Connected Vehicle Pilot Deployment Program Phase 3

Operational Capability Showcase Summary – WYDOT

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Intelligent Transportation Systems (ITS) Joint Program Office

Notice

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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 observations and results from the Operational Capability Showcase and lessons learned taken from this presentation. The Operational Capability Showcase consisted of a presentation giving an overview of the pilot and then an on-road demonstration of the connected vehicle devices and applications.

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Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

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1 Introduction

1.1 Project Scope

Wyoming Department of Transportation (WYDOT) is one of the Connected Vehicle (CV) Pilot sites selected to showcase the value of and spur the adoption of CV Technology in the United States. CV Technology is a broad term to describe the applications and the systems that take advantage of dedicated short-range communications (DSRC) between vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) 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 August 2016. The deployment process will happen in Phase 2 (September 2016 – May 2019) followed by demonstration Phase 3 (May 2019 – November 2020).

Outreach efforts will support Phases 2 and 3 by ensuring that the pilot project is promoted within the transportation community and the media, increasing awareness of the project within the public community, and eliciting buy-in for continued investments from a diverse set of stakeholders including the public and state and local decision makers.

1.2 System Overview

Wyoming Department of Transportation (WYDOT) is one of the 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. 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 300 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). In addition, the CV Pilot project will support overall traffic management and traveler information services offered by WYDOT. 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.

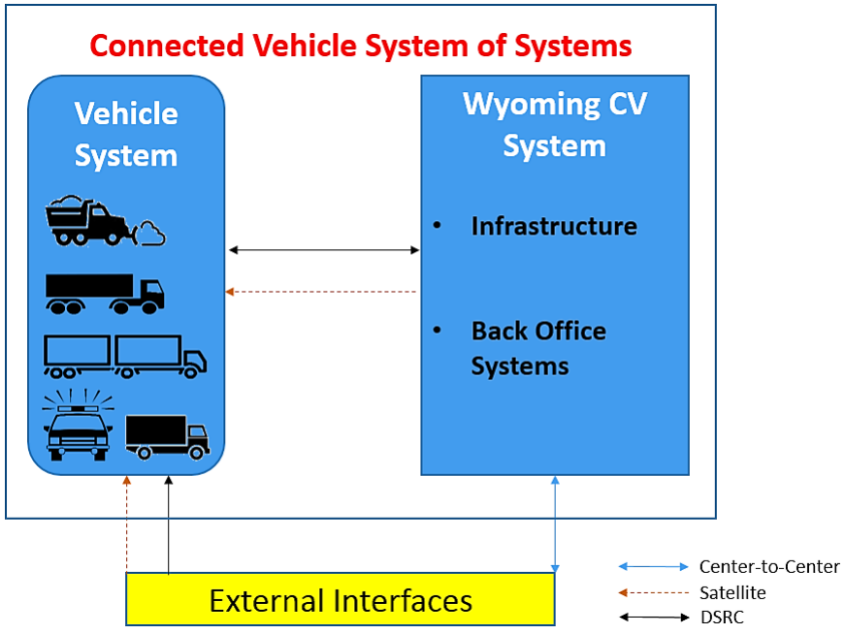


Figure 1-1 Wyoming CV Pilot System of Systems (Source: ICF/Wyoming)

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).

1.3 Purpose of the Operational Capability Showcase

The Operational Capability Showcase invited the media, along with other invited attendees, to learn about the capabilities, intent, and value of this CV pilot. The audience of the Showcase learned about the importance of this project, not just for Wyoming, Wyoming Department of Transportation (WYDOT), or the trucking industry, but for the general public and for future interoperability efforts with other CVs around the country. The Showcase included a discussion about interoperability, to highlight a key goal of the CV Pilots program itself from a national perspective. By attending the Showcase, the audience came away with an understanding of how this pilot will impact WYDOT's TMC, commercial vehicle operators driving on I-80, as well as all other drivers traveling on I-80 and accessing WYDOT's traveling information resources.

The showcase took place at WYDOT's office at 5300 Bishop Boulevard, Cheyenne, WY on Tuesday, October 30, 2018.

1.4 Purpose of the Operational Capability Showcase Summary

The Operational Capability Showcase Summary (OCSS) provides the observations and results from the Operational Capability Showcase. The purpose of this summary is twofold: 1) to provide some

lessons learned for conducting showcases in the future and 2) identify anything that the WYDOT CVP Team should consider as they embark on Phase 3.

1.5 Organization of the Report

The Outreach Plan consists of the following sections:

- Chapter 2 References – This chapter provides reference information of the support documents used.
- Chapter 3 Acronym List – This chapter provides a list of the acronym used in this document.
- Chapter 4 Operational Capability Showcase Activities – This chapter identifies the objective and outcome of the Showcase.
- Chapter 5 Showcase Attendees – This chapter lists the attendees who participated in the Showcase.
- Chapter 6 Operational Capability Showcase Activities – This chapter identifies the key activities occurring in the Showcase.
- Chapter 7 Resources Developed for the Operational Capability Showcase – This chapter lists the various materials that were created in support of the Showcase.
- Chapter 8 Post-Operational Capability Showcase Activities – This chapter identifies a few activities related to the OCS that took place following the Showcase.
- Chapter 9 Lessons Learned – This chapter provides the lessons learned logbook for the OCS.
- Appendix A Showcase Media Advisory – This appendix provides a copy of the Showcase advisory sent to the media partners.
- Appendix B Showcase Press Release – This appendix provides a copy of the press release sent to the media partners after the showcase.
- Appendix C Operational Capability Showcase Presentation Slides – This appendix provides a copy of the presentation slides used during the Showcase.

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.

3 Acronym List

Table 3-1. Acronym List.

Acronym	Definition
BSM	Basic Safety Messages
ConOps	Concept of Operations
CV	Connected Vehicle
DMS	Dynamic Message Sings
DN	Distress Notification
DSRC	Dedicated short-range communications
FCW	Forward Collision Warning
HMI	Human-Machine Interface
I2V	Infrastructure to Vehicle
I-80	Interstate 80
OBU	Onboard Unit
OCS or Showcase	Operational Capability Showcase
OCSP	Operational Capability Showcase Plan
OCSS	Operational Capability Showcase Summary
RSU	Roadside Unit
SA	Situational Awareness
SUV	sport utility vehicles
SWIW	Spot Weather Impact Warning
TIM	traveler information message
TMC	Transportation Management Center
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
VSL	variable speed limits
WYDOT	Wyoming Department of Transportation
WZW	Work Zone Warning

4 Operational Capability Showcase

4.1 Objective of the OCS

The Operational Capability Showcase (OCS or Showcase) illustrated to the media, along with other invited attendees, the capabilities, intent, and value of this pilot. The intent of the Showcase was for the media to grasp the importance of this project, not just for Wyoming, WYDOT, or the trucking industry, but for the general public and for future interoperability efforts with other connected vehicles around the country. The Showcase included a discussion on interoperability, touching on a key goal of the CV Pilots program itself from a national perspective. The media took away from the Showcase an understanding how this pilot will impact WYDOT's Transportation Management Center (TMC) and commercial vehicle operators driving on I-80, as well as all other drivers traveling on I-80 and accessing WYDOT's traveler information resources.

4.2 Outcome of the OCS

The Operational Capability Showcase successfully demonstrated the performance of the CV system. Participants of the showcase saw successful deployment of the five V2V, V2I, and I2V applications that will enable communication with drivers for alerts and advisories through the HMIs, OBUs, and antennas outfitted on the vehicles and the RSUs deployed on the roadways. These applications were: FCW, WZW, DN, SA, and SWIW. The WZW, SA, and SWIW applications involved Traveler Information Messages (TIMs) for I2V capabilities. The FCW and DN applications demonstrated V2V capabilities. TIMs were sent via RSUs and satellite.

During the OCS, the audience was also made aware of the ultimate goal of the CV Pilots, which is to support CV interoperability success and standardization, whereby connected vehicles, devices, infrastructure, and applications can communicate with other parts of the CV system, regardless of when or where the connectivity equipment was built.

5 Showcase Attendees

WYDOT Public Affairs office sent a media advisory to 79 media outlets on October 24, 2018, and a reminder on October 29, 2018. (See Appendix A.) KTWO-TV Casper, Cheyenne - KGWN TV5, and WREN Magazine were the three media outlets who were able to attend the Showcase. While WYDOT's Public Affairs office sent invitations to over 70 media outlets, many media outlets are not within a suitable driving distance to Cheyenne, Wyoming, so it was more difficult to get in-person coverage from the media.

Both KTWO-TV Casper and KGWN TV5 taped portions of the Showcase and conducted interviews with various WYDOT CV Pilot team members and produced segments for the evening news. Links to those segments are provided below:

- October 30th K2 News at 5pm by KTWONews: https://www.youtube.com/watch?v=_9usBc8KBiI&feature=youtu.be&t=189
- WYDOT Connected Vehicles by KGWN TV5: https://www.kgwn.tv/video?vid=499464831

To provide information to those interested media outlets who were unable to attend the Showcase in person, WYDOT Public Affairs released a press release on Wednesday, October 31 (see **Error! Reference source not found.**).

6 Operational Capability Showcase Activities

The timeline and agenda for the showcase is provided in Table 6-1. Additional details about the presentation subject matter, ribbon-cutting event, vehicles involved, and the on-road testing route follow the agenda. All activities detailed in the Operational Capability Showcase Plan document were executed during the Showcase.

Table 6-1. Agenda

Time	Activity
8:30 – 8:35	Welcome by Bryan Cawley, FHWA Wyoming Division Administrator
8:35 – 8:40	Welcome by Pat Lewis, WYDOT Chief Technology Officer
8:40 – 9:00	Project Overview and Update
9:00 – 9:15	Pilot Participant Remarks by John Dooley (Dooley Oil), John Bedessem (Trihydro Corporation), Tom DeHoff (Wyoming District 1 District Engineer)
9:15 – 9:30	Next Steps and Interoperability Discussion
9:30	Ribbon-cutting by WYDOT Executive Staff and USDOT
10:00	1) On-road demonstrations by WYDOT CVP Team 2) Media Recording and Interview time

6.1 Presentation Activity

For the first hour of the Showcase, the WYDOT CV Pilot team provided an overview and update of the project to the Showcase attendees. The intent of these presentations was to give a broad overview of the importance of this pilot for the travelers of I-80 and WYDOT's TMC and discuss the activities that have taken place and the activities to come, as well as discuss the notion of interoperability and integration.

Bryan Cawley, the Division Administrator from FHWA's Wyoming Division Office, kicked off the showcase, highlighting how this pilot would support safety efforts and goals. Pat Lewis, WYDOT's Chief Technology Officer, followed Mr. Cawley and talked about the national and international importance of the CV technology and highlighted the pilot team partners.

Vince Garcia, Ali Ragan, and Tony English provided an overview of pilot, detailing the safety issues occurring on I-80 that were the impetus of this pilot, explained the concept of connected vehicles, and described the impact of the pilot on the TMC, the public, and on the future of interoperability. The presentation leveraged the use of several videos to help explain the pilot, explain the concept and purpose of interoperability, and describe the situations that have been endangering the lives of travelers on I-80. One video was an updated "explainer" video about CV technology which highlighted the

difference between connected and autonomous vehicles. Given the audience attending the showcase, the WYDOT CV Pilot team wanted to take the opportunity to reiterate the difference between connected and autonomous vehicles.

John Dooley from Dooley Oil talked about how Dooley Oil has a "strong safety culture" where by "if our driver is not satisfied or he's afraid to go, we don't let him go." Dooley Oil wanted to participate in this pilot because "any on-time, real-time data that we can get is nothing but beneficial to our company, to our drivers, and to the motoring public."

Jack Bedessem, the President and CEO of Trihydro Corporation, said that it was a "no-brainer" for his company to participate in this pilot, given that Trihydro employees "traveled about 2.5 million miles on the roadways and in over 1,000 different vehicles" last year and that safety is of the utmost importance to these employees.

Tom DeHoff, the District Engineer for Wyoming District 1, highlighted unique relationships the District have with Wyoming Highway Patrol and with the TMC, both which play a crucial role in supporting safety efforts in this corridor and helping this pilot be successful. For this district, Mr. DeHoff hopes this pilot will help reduce the number or severity of crashes with WYDOT's snowplows, of which eight on average are hit every year by passing motorists. Mr. DeHoff also hopes this pilot will reduce the number of crashes and road closures on I-80, it will keep the "WYDOT family and the traveling public safe."

Col. Kebin Haller, WYDOT Highway Patrol Administrator, said that, "because of the higher speeds and the size and weights of [the] commercial vehicles [traveling on I-80], not only is information important to increase our safety, but the timing" of receiving the information is important. The more people we have participating, the more "timely and accurate the information we are sharing."

6.2 Ribbon-cutting Event

After the presentation portion of the showcase, FHWA staff, WYDOT Executive staff and all of the pilot project team members stood between two snow plows and cut the ribbon tied between the two, celebrating the Showcase and ushering forth the on-road demonstration portion of the Showcase, as shown in Figure 6-1.

Figure 6-1. Ribbon Cutting Event.

6.3 Vehicles Involved

The following vehicles were outfitted with HMI, OBUs, and antennas and available for the showcase attendees to view.

- 2 snow plows
- 1 Semi-trailer truck
- 2 WYDOT sport utility vehicles (SUVs)
- 1 WYDOT pickup
- 1 Trihydro pickup

6.4 On-Road Demonstration

This demonstration utilized four vehicles: the two WYDOT SUVs, one WYDOT pickup and one Trihydro pickup.

Showcase attendees were driven from the WYDOT offices to the Archer Complex via I-80 (see Figure 6-2). While driving along I-80, the vehicles received Traveler Information Messages (TIM) for the Work Zone Warning, Spot Weather Impact Warning, and Situational Awareness applications. While the vehicles were driven around the Archer Complex, the team demonstrated the Forward Collision Warning and Distress Notification applications. The vehicles then returned to the WYDOT offices via I-80, where they will receive TIM messages again from the reverse direction.

During the demonstration, the passengers of the three vehicles were able to view the messages on the HMI while the driver of the vehicle explained what was happening. The passengers saw all five applications: Forward Collision Warning, Work Zone Warning, Distress Notification, Situational Awareness, and Spot Weather Impact Warning

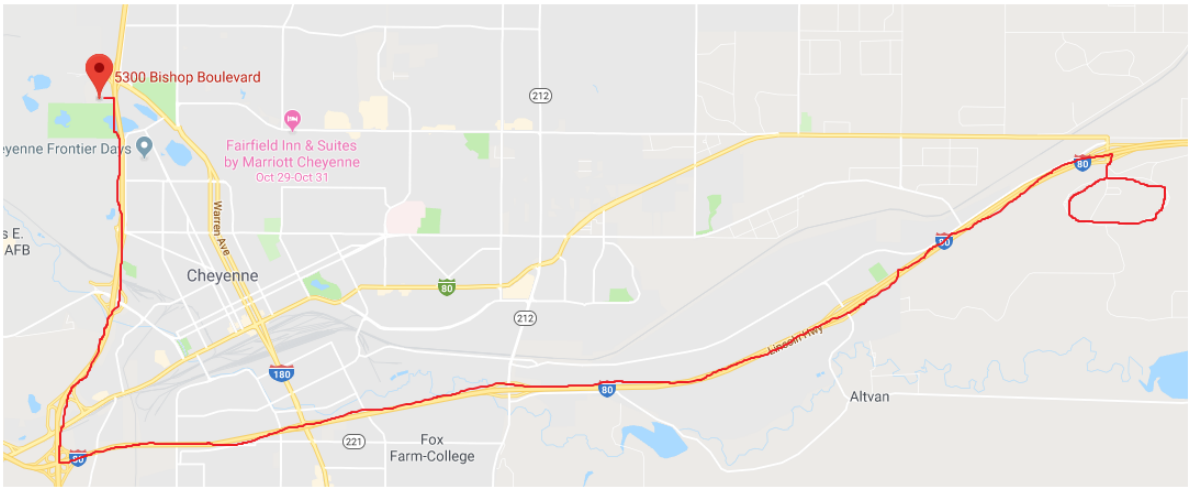


Figure 6-2. On-road demonstration route from WYDOT offices to Archer Complex (Source: Google Maps)

7 Resources Developed for the Operational Capability Showcase

7.1 Presentation

The final slides for the presentation are provided in Appendix B. The presentation introduced the WYDOT CV Pilot team members, gave an overview of the I-80 corridor, explained the concept of connected vehicles (particularly emphasizing the distinction from autonomous vehicles), illustrated the system's data management, security, and privacy considerations, and highlighted the importance of interoperability.

7.2 Videos

The following videos were shown during the OCS and have been posted to the project website (https://wydotcvp.wyoroad.info/).

- Original WYDOT CV Pilot explainer video called "WYDOT CVP Overview": was displayed in the lobby of the auditorium. This video can be found on the project website under the "The Pilot" section, "CVP In Action" subsection.
- New WYDOT CV Pilot explainer video ": was embedded into the presentation. This video can be found on the project website under the "The Pilot" section.
- I-80 multi-vehicle crash video: was embedded into the presentation
- Interoperability testing video created by USDOT from the Phase 2 Interoperability Testing Activity: was embedded into the presentation. This video is available for viewing on the WYDOT CVP project website (https://wydotcvp.wyoroad.info/) and USDOT's website (https://www.its.dot.gov/interoperabilityvideo/index.htm).

7.3 Others

The following posters were on display during the OCS in the lobby of the auditorium:

- Illustration of Forward Collision Warning (FCW)
- Illustration of Situational Awareness (SA)
- Illustration of Distress Notification (DN)
- Illustration of Work Zone Warning (WZW)
- Illustration Spot Weather Impact Warning (SWIW)
- Statistics of crash impacts on I-80
- Illustration of the entire WYDOT CV system

The WYDOT CV Team member were available before and after the OCS Presentation to answer any questions attendees had about the information displayed on the posters.

8 Post-Operational Capability Showcase Activities

8.1 Engagement by the Media

Both KTWO-TV Casper and KGWN TV5 taped portions of the Showcase and conducted interviews with various WYDOT CV Pilot team members and produced segments for the evening news. Links to those segments are provided below and also provided on the project website under the "The Pilot" section, "CVP In Action" subsection:

- October 30th K2 News at 5pm by KTWONews: https://www.youtube.com/watch?v=_9usBc8KBiI&feature=youtu.be&t=189
- WYDOT Connected Vehicles by KGWN TV5: https://www.kgwn.tv/video?vid=499464831

The fact that these segments were shown during evening news lends credence to the importance of this pilot to the local residents and travelers. These video segments thoughtfully explained the concept of connectivity in a non-technical way, hopefully helping their audiences grasp the purpose and impacts of the pilot, particularly the safety aspect. The video segments included interviews with various team members and included clips of the live demonstrations.

8.2 Continued Engagement

To capitalize on the momentum gained by the OCS, WYDOT posted videos and pictures from the OCS to the Wyoming Department of Transportation Facebook page (see Figure 8-1). WYDOT also cross-posted the news clips from KTWO and KGWN on the project website.

USDOT posted a success story about the showcase on the Intelligent Transportation Systems Joint Program Office (ITS JPO) website. The story can be accessed at this link: https://www.its.dot.gov/pilots/wydot_safety_tech.htm.

Figure 8-1. Screenshot of WYDOT's Facebook page with a post celebrating the showcase.

9 Lessons Learned

Observations and lessons learned from the Showcase are listed below in the Lesson Learned Logbook.

ID	Date Identified	Entered By	Subject	Situation	Recommendations & Comments	Follow-Up Needed?
1	11/1/18	WYDOT	OCS	Few attendees	Live stream the presentation via a digital platform so attendees can participate virtually	No
2	11/1/18	WYDOT	OCS	Few attendees	Send invitations to national media outlets, such as journals, magazines, and blogs, that cover transportation or technology topics. Do not limit invitations to local media.	No

Appendix A. Showcase Media Advisories

Media Advisory Press Release about the Showcase

DOT Public Affairs <dot-publicaffairs@wyo.gov>

Wed, Oct 24, 2018, 9:22 AM

to DOT, bcc: me

For immediate release

Oct. 24, 2018

The Wyoming Department of Transportation will demonstrate its new Connected Vehicle technology for the media during a news conference from 8:30 a.m. to noon, on Tuesday, Oct. 30 in the auditorium at WYDOT headquarters, 5300 Bishop Blvd., Cheyenne, WY.

The media will have the opportunity to interview subject matter experts starting at 9:30 a.m.

WYDOT was one of three locations in the nation the U.S. Department of Transportation selected to participate in the Connected Vehicle Pilot Deployment Program.

The event will demonstrate where WYDOT is with the new technology, what it does and how it will make the interstate safer for travelers.

Who: The Wyoming Department of Transportation

What: Connected Vehicle Pilot Deployment Program

Where: Auditorium at WYDOT headquarters, 5300 Bishop Blvd., Cheyenne WY

When: 8:30 a.m. to noon.

Why: Interview WYDOT and U.S. Department of Transportation officials about this cutting-edge technology and how it could help save lives and provide a safer transportation system.

Visit the Connected Vehicle Pilot Deployment Program website for more information.

For additional information about this media advisory, please contact Ali Ragan, WYDOT's Intelligent Transportation Systems project manager.

E-Mail to and from me, in connection with the transaction

of public business, is subject to the Wyoming Public Records

Act and may be disclosed to third parties.

Media Advisory Email Reminder about the Showcase

--------- Forwarded message ---------

From: **DOT Public Affairs** <dot-publicaffairs@wyo.gov>
Date: Monday, October 29, 2018
Subject: REMINDER: WYDOT to demo new safety communication technology for I-80 on Oct. 30
To: DOT Public Affairs <dot-publicaffairs@wyo.gov>

The Wyoming Department of Transportation will demonstrate its new Connected Vehicle technology for the media during a news conference from 8:30 a.m. to noon, on Tuesday, Oct. 30 in the auditorium at WYDOT headquarters, 5300 Bishop Blvd., Cheyenne, WY.

The media will have the opportunity to interview subject matter experts starting at 9:30 a.m.

WYDOT was one of three locations in the nation the U.S. Department of Transportation selected to participate in the Connected Vehicle Pilot Deployment Program.

The event will demonstrate where WYDOT is with the new technology, what it does and how it will make the interstate safer for travelers.

Who: The Wyoming Department of Transportation

What: Connected Vehicle Pilot Deployment Program

Where: Auditorium at WYDOT headquarters, 5300 Bishop Blvd., Cheyenne WY

When: Starts at 8:30 a.m. Demo to follow starting at 9:30 a.m.

Why: Interview WYDOT officials about this cutting-edge technology and how it could help save lives and provide a safer transportation system.

Visit https://wydotcvp.wyoroad.info for more information about the Connected Vehicle Pilot Deployment Program.

For additional information about this media advisory, please contact Ali Ragan, WYDOT's Intelligent Transportation Systems project manager.

E-Mail to and from me, in connection with the transaction
of public business, is subject to the Wyoming Public Records
Act and may be disclosed to third parties.

Media Advisory Press Release Showcase Summary

--------- Forwarded message ---------
From: DOT Public Affairs <dot-publicaffairs@wyo.gov>
Date: Wed, Oct 31, 2018 at 4:20 PM
Subject: WYDOT moves forward with new safety communication technology for vehicles
To: DOT Public Affairs <dot-publicaffairs@wyo.gov>

Editors: Attached is a photo of a ribbon cutting for the Connected Vehicle project.

New technology the Wyoming Department of Transportation is piloting on Interstate 80 could help reduce crashes and make the interstate safer.

WYDOT officials explained during a news conference in Cheyenne on Tuesday, Oct. 30 how new connected vehicle technology will communicate road information and alerts to motorists in near real time.

“The information collected and distributed through connected vehicles will provide better awareness for the entire transportation network,” said Ali Ragan, GIS/ITS project manager. “The goal is to reduce the number of crashes, injuries and road closures on Interstate 80. Wyoming is proud to lead the way in the future of transportation safety.”

WYDOT received a grant from the U.S. Department of Transportation in 2015 to develop and participate in the Connected Vehicle Deployment Program. Wyoming was one of only three locations in the nation to participate. The federal government also selected projects in New York City and Tampa, Florida for the pilot.

WYDOT plans to install onboard communication units on about 100 of the department’s vehicles and about 300 private fleet vehicles. WYDOT is also installing 75 roadside units on and around I-80.

“This technology WYDOT is piloting will help keep the traveling public safer by giving them almost real-time information,” said WYDOT Director Bill Panos. “This cutting-edge technology will improve transportation along the I-80 corridor not only for Wyoming residents but for our commercial truck drivers who transport their goods within the state and across the country.”

During the news conference, WYDOT officials used several vehicles, including a snow plow and a Wyoming Highway Patrol vehicle, to illustrate how the technology communicates with each other during a forward collision warning, a distress notification, a construction zone notification and weather warnings.

Depending on the situation, the technology would either interact vehicle to vehicle, vehicle to roadside unit or roadside to vehicle.

For the vehicle-to-vehicle communications, a vehicle sends out a safety message and a nearby vehicle then receives it, allowing critical information to be shared in near real-time.

For vehicle-to-infrastructure communications, a vehicle that has information on an incident sends it to the roadside unit, which then sends it to WYDOT's Transportation Management Center (TMC). The TMC can also send out alerts based on information collected from connected vehicles and other systems including weather stations and reports from maintenance employees to the road side unit, which is the roadside-to-vehicle communications piece.

"Connected vehicles are not autonomous and require an alert and active driver," Ragan said. "They provide situational awareness, allowing the driver to anticipate and react to changing road and weather conditions as well as traffic hazards."

Visibility issues often become a problem during the winter in Wyoming with high winds that accompany a majority of the snow storms.

Tom DeHoff, District 1 district engineer, and Col. Kebin Haller, of the Wyoming Highway Patrol, both said snow plows and Patrol vehicles are often hit by other vehicles because of poor visibility. Those conditions also contribute to other crashes along the I-80 corridor.

"Our long-term goal is to adopt technology such as the connected vehicle that will help keep our WYDOT family and the traveling public safe," DeHoff said. "I really think this technology will help us out and reduce crashes."

Haller said the timely information motorists will receive will greatly improve safety for everyone.

"The connected vehicle technology will provide our troopers, WYDOT employees and the traveling public more protection on the road," Haller said. "The more people who participate in this project, the more timely and accurate information we can pass along. This new technology will not only help reduce crashes, but those secondary crashes that result after an incident."

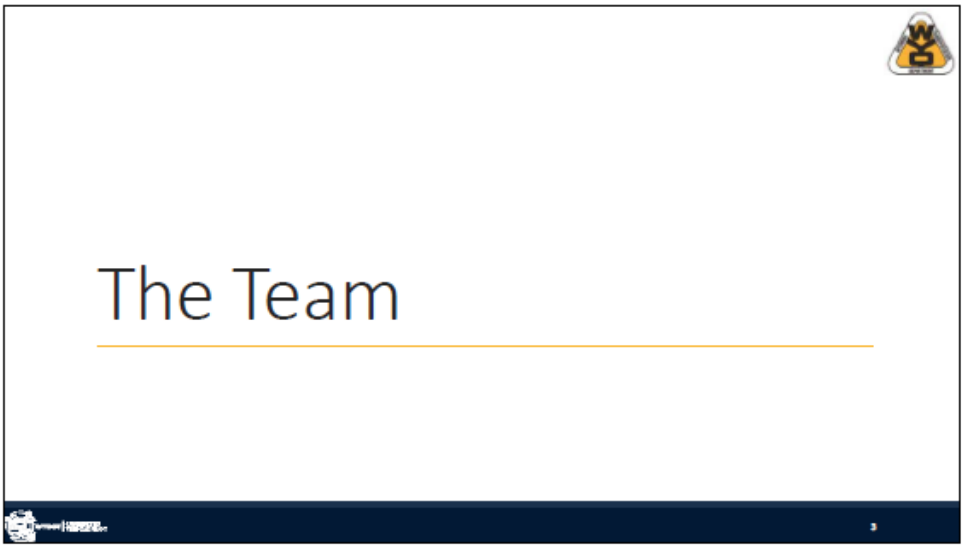
For more information, contact Vince Garcia, WYDOT's GIS/ITS manager, at (307) 777-4231, or Ali Ragan, GIS/ITS project manager, at (307) 777-2985.

Appendix B. Operational Capability Showcase Presentation Slides


Wyoming DOT
Connected Vehicle Pilot
Deployment Program
SAFETY COMMUNICATION
TECHNOLOGY SHOWCASE
OCTOBER 30, 2018


Agenda
Welcome
Project Background
Partner Remarks
Behind the Scenes
Next Steps for Deployment
Ribbon-Cutting
On-Road Demonstrations
I-80 and the Archer Complex
2

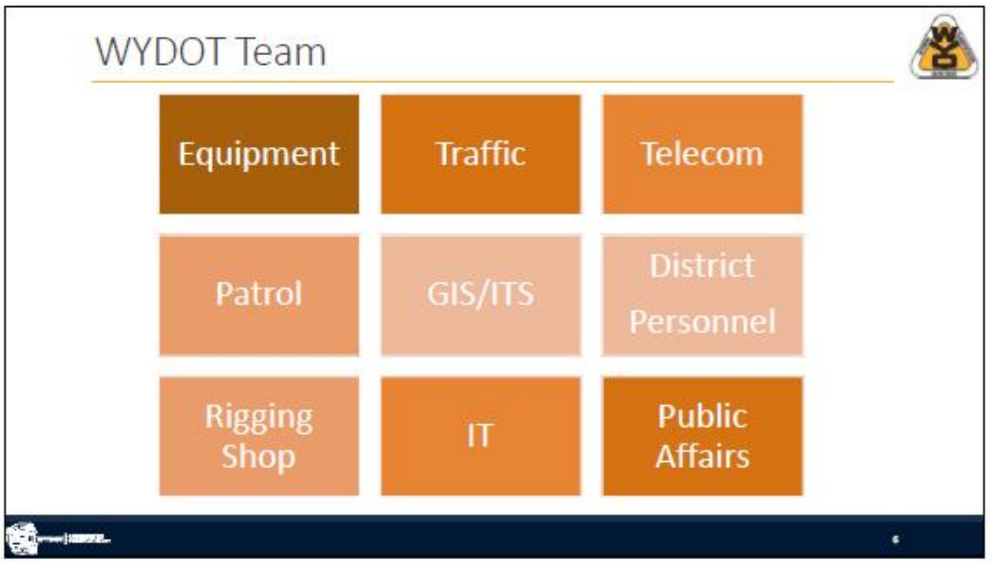
1


The Team
3


Wyoming Based/National Significance
UNIVERSITY OF WYOMING
DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA
Trihydro
WTSC
Wyoming Transportation Safety Coalition
LARAMIE COUNTY
EMERGENCY MANAGEMENT AGENCY
CHEYENNE WYOMING
WYOMING TRANSPORTATION DEPARTMENT
WYOMING HIGHWAY PATROL
WYOMING TRUCKING ASSOCIATION
4

2


Key Technology Partners
NCAR
LEAR CORPORATION
VITAL ASSURANCE
McFARLAND MANAGEMENT, LLC
ICF
Neaera Consulting
Designing for the Future
SiriusXM
5


WYDOT Team
Equipment
Traffic
Telecom
Patrol
GIS/ITS
District Personnel
Rigging Shop
IT
Public Affairs
6

3

Corridor Overview

7

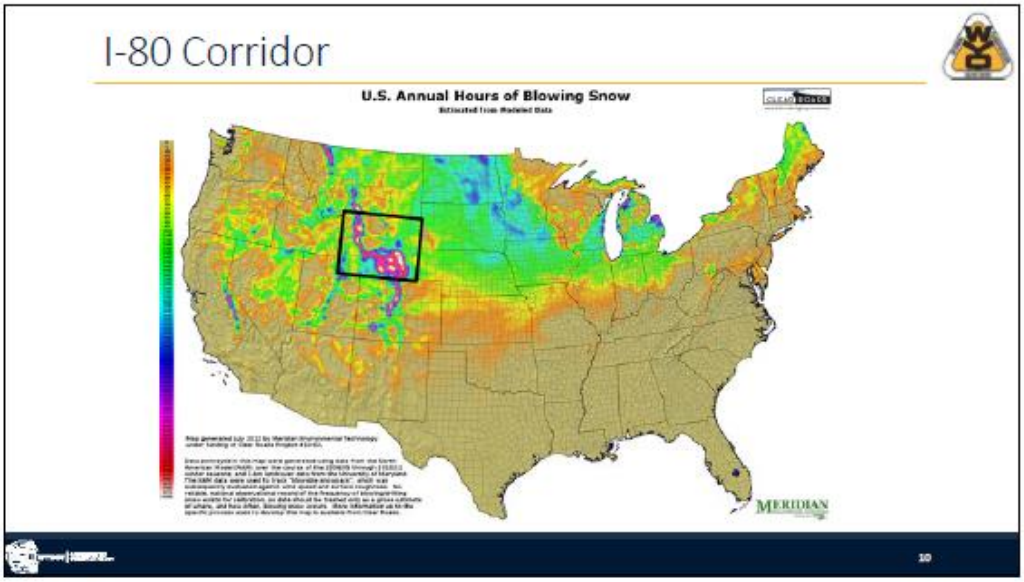
I-80 Corridor

- Runs 402 miles along Wyoming's southern border
- More than 32 million tons of freight per year
- Truck volume is 30-55% of the total traffic stream on an annual basis
  - Seasonal peaks as high as 70%

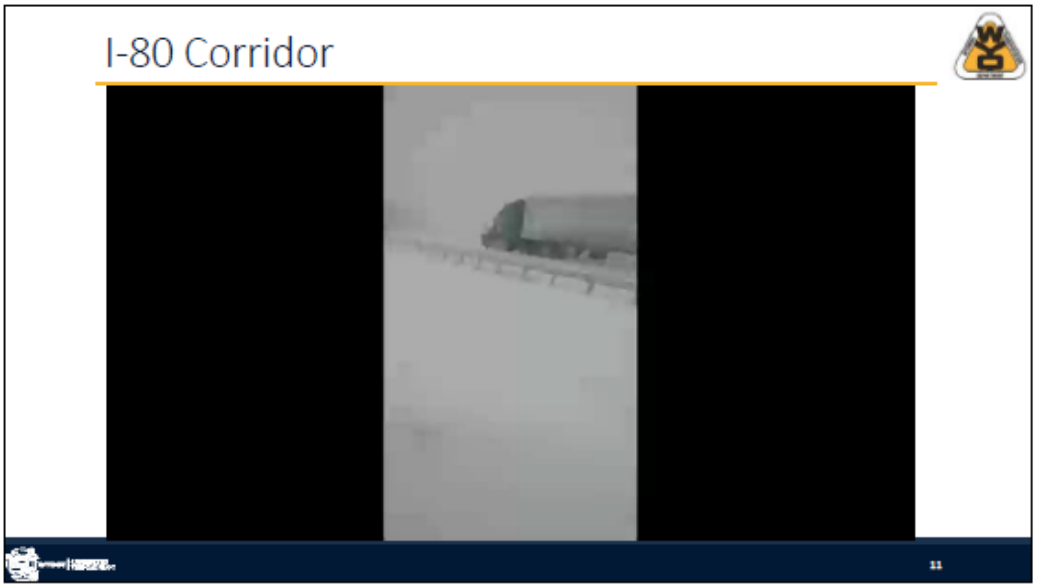
8

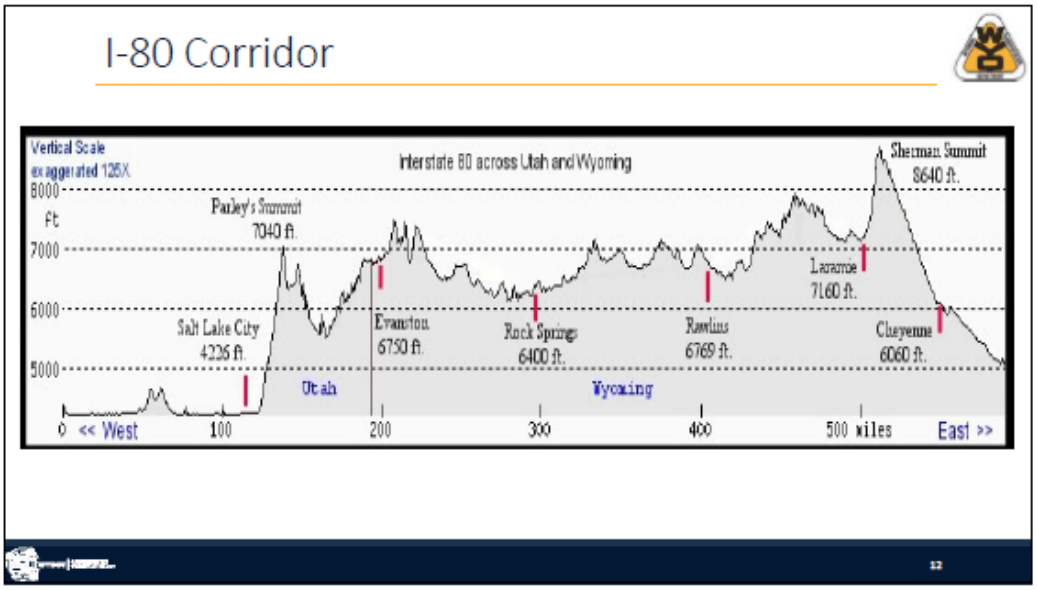
4


I-80 Corridor
National Highway System Routes
FAF Truck Volume/Day


I-80 Corridor
U.S. Annual Hours of Blowing Snow
MERIDIAN

5


I-80 Corridor
11


I-80 Corridor
Vertical Scale
exaggerated 126X
Interstate 80 across Utah and Wyoming
Sherman Summit
8640 ft.
Ft
8000
7000
6000
5000
Pauley's Summit
7040 ft.
Laramie
7160 ft.
Salt Lake City
4226 ft.
Evanston
6750 ft.
Rock Springs
6400 ft.
Rawlins
6769 ft.
Cheyenne
6060 ft.
Utah
Wyoming
0 << West
100
200
300
400
500 miles
East >>
12

6

I-80 Corridor

One of the most heavily instrumented rural corridors in the United States

136 Variable Speed Limit Signs
supported by 94 traffic sensors
54 Electronic Message Signs
44 Weather Stations
52 Webcams

13

WYDOT's Approach

Roadway Design
- Good roadway design
- Select best geometry using powerful modeling tools

Mitigation
- Slope modifications
- Snowfence

Technology
- Intelligent transportation systems
- Connected vehicle technology

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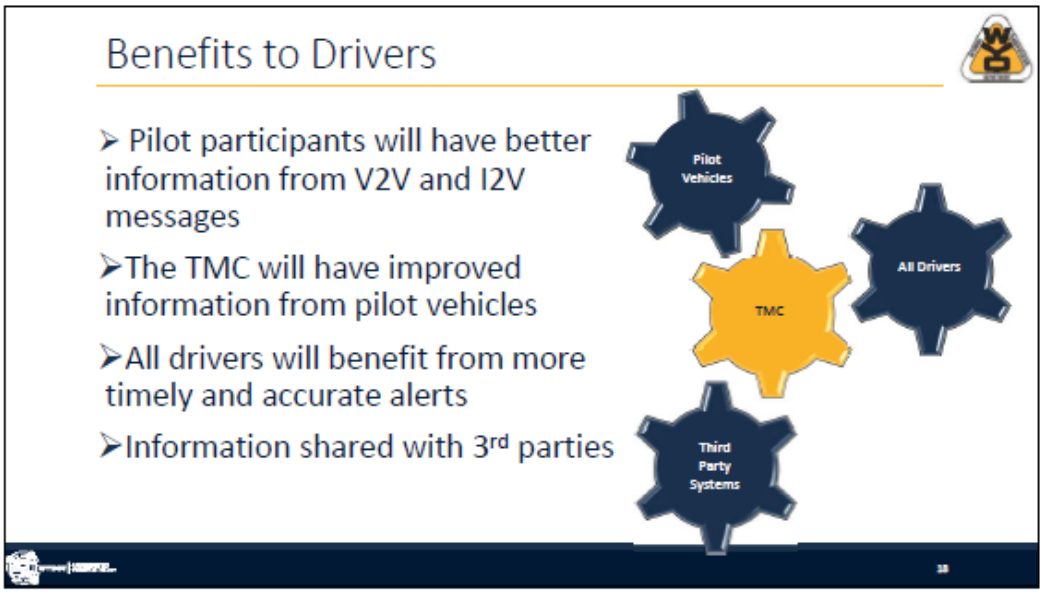
7


Connected Vehicle Pilot
Wyoming
New York City
Tampa, Florida
Image: USDOT
15

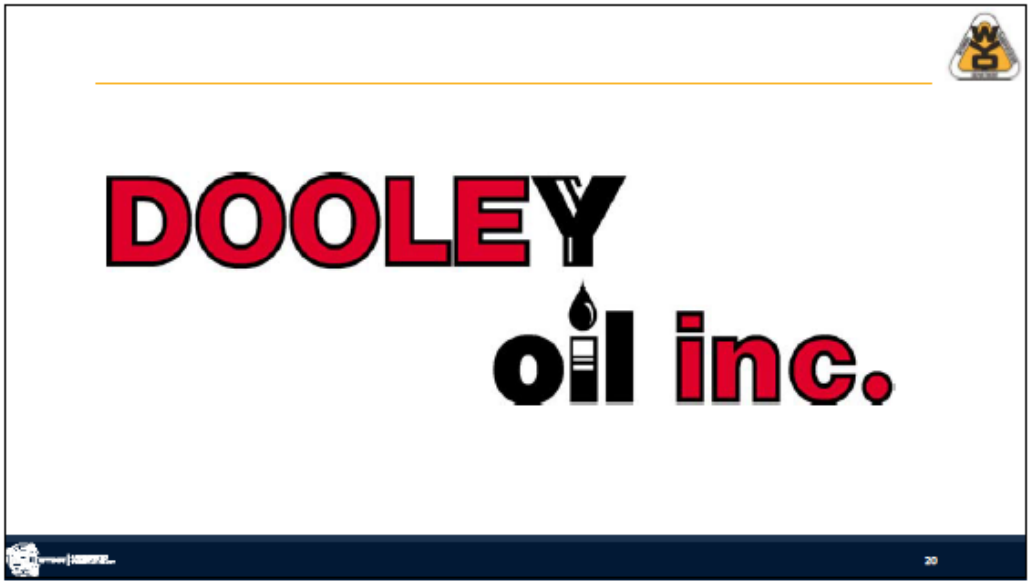

Connected Vehicle Technology
16

8


Benefits to Drivers
Pilot participants will have better information from V2V and I2V messages
The TMC will have improved information from pilot vehicles
All drivers will benefit from more timely and accurate alerts
Information shared with 3rd parties
Pilot Vehicles
TMC
All Drivers
Third Party Systems

9


CV Pilot Partner Remarks
Game changing technology
Safety and efficiency of the transportation system


DOOLEY
oil inc.

10

Trihydro

21

WYDOT Field Personnel

- Tom DeHoff, District Engineer, District 1 in southeast Wyoming
- Representing all districts
- Responsibilities
  - Traffic
  - Construction
  - Equipment
  - Maintenance
  - Contractors

22

11

WYDOT Field Personnel

- Top Priority: Safety of personnel
  - Maintenance: Summer and winter activities
  - Traffic: Striping and other traffic operations
  - Construction: Work zone safety

Every year about
8 snow plows
are hit in spite of flashing lights around the plow to make them visible.

23

WYDOT Field Personnel

- Roadway Safety
  - Fewer crashes and less severe crashes result in fewer deaths and fewer road closures
  - Fewer crashes mean WYDOT employees and other responders remain out of harm's way

24

Wyoming Highway Patrol

- Pleased to participate in pilot
- Timely information will benefit the public
- Parked patrol vehicles will announce position which minimizes risk of a crash

25

I-80 Corridor

26

13

Wyoming Highway Patrol

- Troopers made 24,905 traffic stops on I-80 in Wyoming last year and 106,630 traffic stops statewide.
  - *Each stop puts officer in jeopardy*
  - *CV applications provide patrol officers with more protection on the road*
- Responding to incidents quicker can improve public safety
  - *Distress Notification application can minimize secondary crashes and allow Troopers to respond more quickly to crashes*

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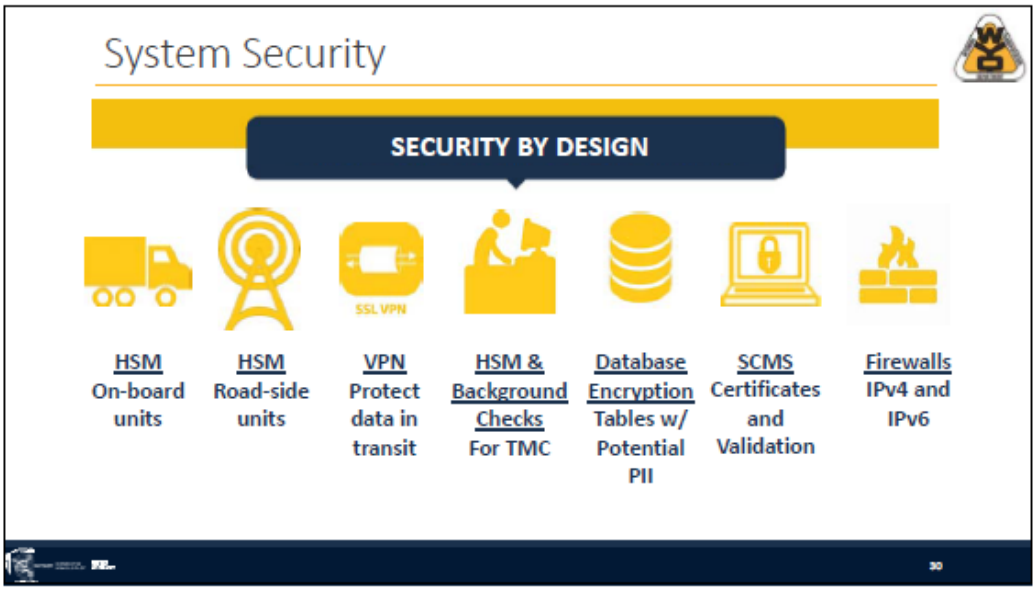
Behind the Scenes

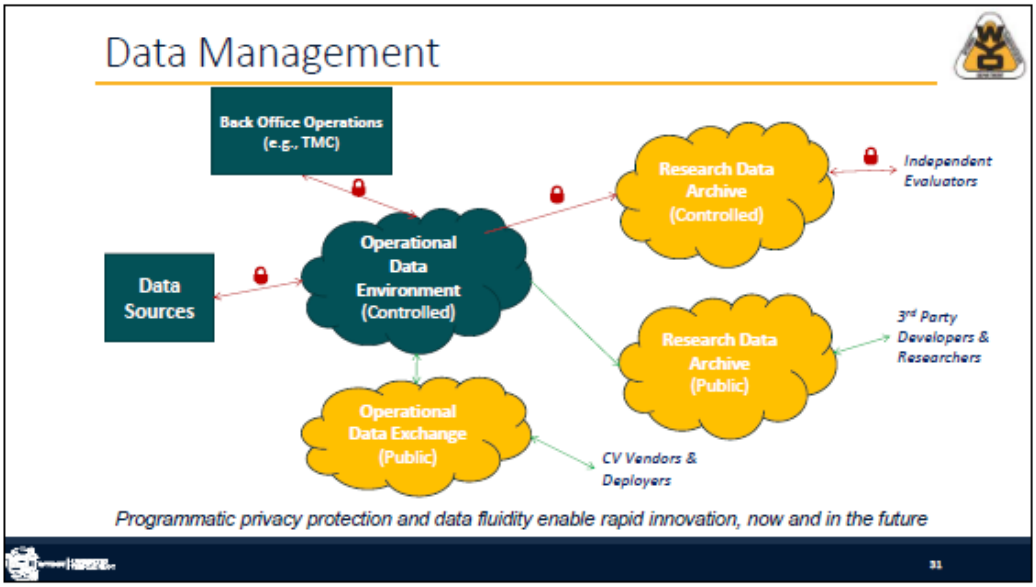
28

14


System Design
Integrate with Existing Systems
Use Standards
Leverage Open Source Software
Agile Development
Acceptance Testing
29


System Security
SECURITY BY DESIGN
SSL VPN
HSM On-board units
HSM Road-side units
VPN Protect data in transit
HSM & Background Checks For TMC
Database Encryption Tables w/ Potential PII
SCMS Certificates and Validation
Firewalls IPv4 and IPv6
30

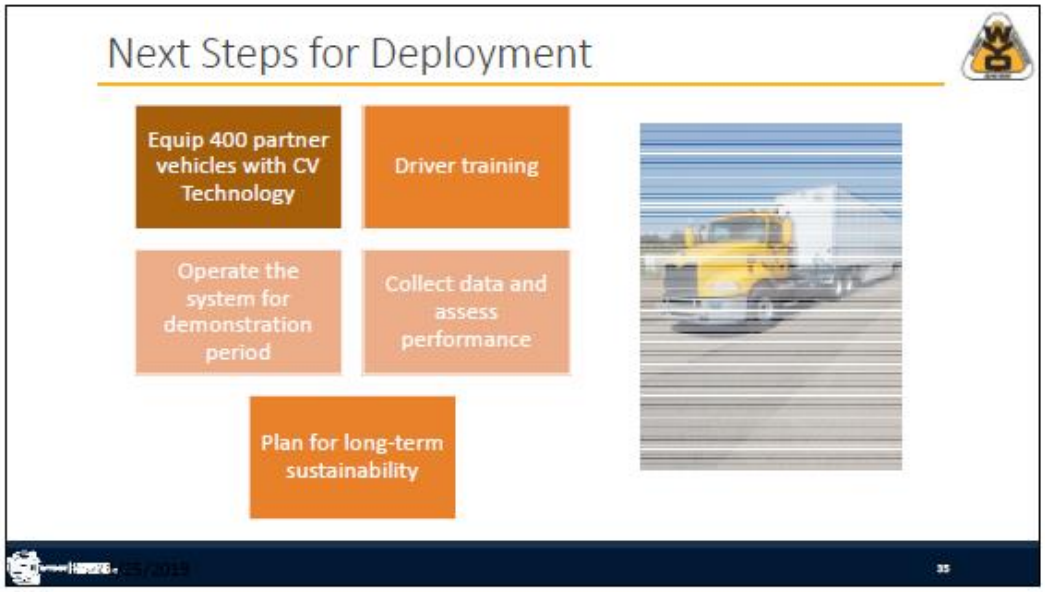
15


Data Management
Back Office Operations (e.g., TMC)
Data Sources
Operational Data Environment (Controlled)
Operational Data Exchange (Public)
Research Data Archive (Controlled)
Research Data Archive (Public)
Independent Evaluators
3rd Party Developers & Researchers
CV Vendors & Deployers
Programmatic privacy protection and data fluidity enable rapid innovation, now and in the future
31


System Interoperability
Future CV Ecosystem
Many vehicles
Many vendors
Many jurisdictions
Messages between vehicles and infrastructure must be seamlessly exchanged and understood by each other
Interoperability of CV Systems is vital to national deployment
32

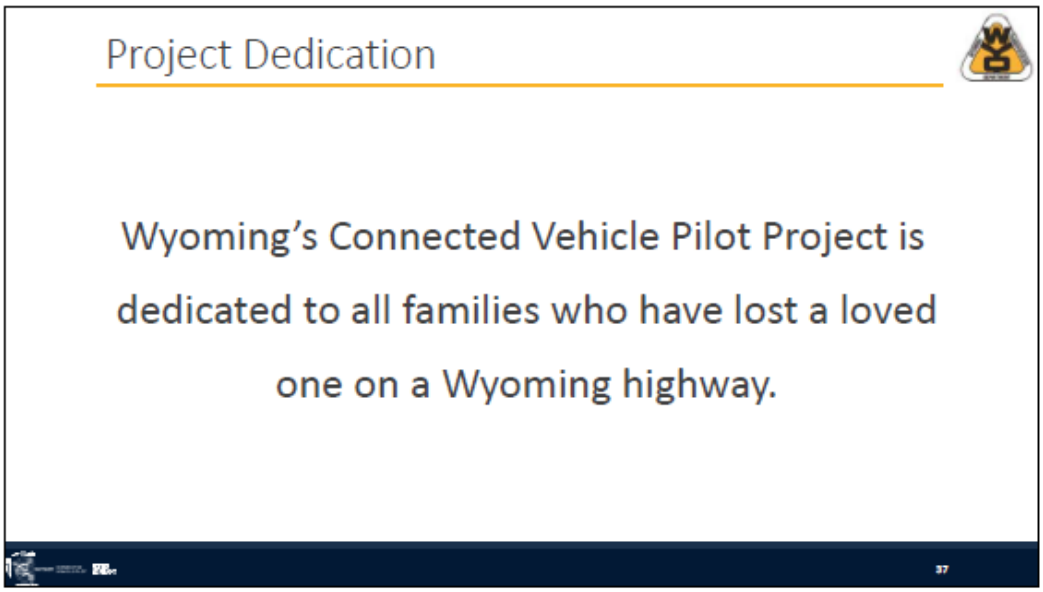
16

17


Next Steps for Deployment
Equip 400 partner vehicles with CV Technology
Driver training
Operate the system for demonstration period
Collect data and assess performance
Plan for long-term sustainability
35


A problem worth solving
Heavy Freight Traffic
1,600+ crashes
1,923 vehicles
$865.3M
Societal Impact
snow and fog
and low
Adverse Impacts on Trucks
• Higher than normal incident rates
• Multi-vehicle crashes
• Fatalities

18


Project Dedication
Wyoming's Connected Vehicle Pilot Project is dedicated to all families who have lost a loved one on a Wyoming highway.
37


Connected Vehicle Pilot
WYOMING DOT CONNECTED VEHICLE PILOT
IMPROVING SAFETY AND TRAVEL RELIABILITY ON I-80 IN WYOMING
visit the Wyoming Connected Vehicle Pilot website
https://wydotcvp.wyoroad.info
email
dot-cvpilot@wyo.gov
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U.S. Department of Transportation
ITS Joint Program Office-HOIT
1200 New Jersey Avenue, SE
Washington, DC 20590

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

FHWA- JPO-18-722

U.S. Department of Transportation