Wyoming DOT Connected Vehicle Pilot Deployment Program

Overview

U.S. Department of Transportation
Connected Vehicle Pilot Deployment Program Phase I
Kick-off Meeting
09/30/2015
Presentation Outline

- Introduction to the Team
- Problem Definition and Current Capabilities
- Proposed Pilot Overview
- Implementation Approach
- Next Steps
The Team
Phase I Team - Leads

Deepak Gopalakrishna
Project Development Lead
ICF

Vince Garcia
Concept Development Lead
Wyoming DOT

Tony English
Systems Development Lead
TriHydro

Ali Ragan
Outreach and Communications
POC
Wyoming DOT
Phase I Team – Technical Experts

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Weather and Performance Management
McFarland Management

Amanda Anderson
Weather and Connected Vehicles
NCAR

Michael Pack
Data, Connected Vehicles
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Analysis, Modeling and Simulation
University of Wyoming

Dr. Rhonda Young
Analysis, Modeling and Simulation
University of Wyoming

Dr. Gerry Wiener
Weather and CV
NCAR
Overall Team Structure

Phase I
- Led by ICF
- Partners
  - Wyoming DOT
  - Trihydro
  - NCAR
  - Univ of Wyoming
  - CATT Lab
  - McFarland Mgmt

Phase II
- Led by Wyoming DOT
- Partners
  - ICF
  - Trihydro
  - NCAR
  - Univ of Wyoming
  - CATT Lab
  - McFarland Mgmt
  - New Partners
    - DSRC Radio Vendors
    - On-board equipment vendors
    - Data providers
    - Weather Sensor Developers
    - Fleet Operators

Phase III
- Led by Wyoming DOT
- Partners
  - ICF
  - Trihydro
  - NCAR
  - Univ of Wyoming
  - CATT Lab
  - McFarland Mgmt
  - New Partners
    - Fleet Operators

Stakeholders throughout the course of the project.
- Wyoming Trucking Association
- Wyoming Highway Patrol
- Wyoming Workforce Development
- Wyoming Chamber of Commerce
- Freight Operators
- Oil and Gas Industry Representatives
Problem Definition and Current Capabilities

A State Trooper responding to multi-vehicle incident
The Problem

- High profile, multiple vehicle crashes have occurred along Interstate 80 in Wyoming that have resulted in loss of life, extended closures and a direct impact on the nation’s economy.

- Number of truck blowovers were reported related to high wind events in four years: 200

- Road closures in 5 years for adverse weather & average duration for closures in hours: 86 & 8

- Estimated economic cost due each closure: $11.7 Million
The Problem – A challenging mix of weather and road weather conditions

- Blowing Snow
- High-Wind
- Fires
- Visibility

Right over the project corridor
Contributing Factors

- High elevation – highest point along the entire length of transcontinental Interstate 80
- Major truck corridor
- Slow moving trucks cause passenger vehicles to take risks that they would not normally take
- Distances between towns along the corridor range from 50 to 115 miles
- Limited parking and no alternate routes

Along parts of I-80 in southern Wyoming, freight traffic comprises 30 to 55% of the traffic stream. Seasonal truck percentages can be as high as 70%. I-80 annual average daily truck traffic (AADTT) ranges from 4,000 to 6,700 trucks per day.
National Impacts

Origins and Destinations of Westbound Freight on I-80

(Source: FHWA-WY-09/09F Interstate 80 Freight Corridor Analysis)
THE PROBLEM

Some videos from the TMCs

Source: Wyoming Department of Transportation and YouTube, Marci Hugentobler, https://www.youtube.com/watch?v=lxlvxG8zOE
Ongoing Challenges

- Limitations of fixed detection leads to significant gaps in determining road and weather conditions
  - Reduces the effectiveness of strategies like variable speed limits
  - Reduces ability to monitor rapidly changing conditions

- The ability to communicate actionable information to travelers already on the roadway continues to be a challenge
  - Providing key alternatives to truckers (parking, services) while they are on the road
  - Influencing travel decisions of commercial vehicle operators is more difficult than influencing passenger vehicle drivers
Current Capabilities in the Corridor

- Wyoming DOT: A national leader in transportation systems management especially for adverse weather
  - Sophisticated integration of weather and meteorology into operations including on-site meteorologist at TMC
  - Network of roadside systems to provide traveler information
    - RWIS
    - VSL signs
    - Highway Advisory Radios
  - Dedicated backhaul radio system (WyoLink)
  - Citizen reporting lets travelers report conditions to WYDOT
  - Strong ITS and GIS development team

Source: Wyoming DOT
Recent initiatives have focused on improving the way information is collected and shared with the public.

**Road Condition Reporting App**
An FHWA-funded pilot project allows maintenance employees to report road conditions through a tablet mounted in snow plows and other maintenance vehicles.

**CVOP**
A website was designed to give commercial vehicle operators access to forecasted road condition and wind information. Reports are created by WYDOT’s onsite meteorologist.

**Smart TV Display**
Businesses can request custom road-condition websites that show current conditions along with webcam images. The sites are optimized to display on Smart TVs.

Source (all pictures): Wyoming DOT
Current Capabilities in the Corridor

There is a strong demand for information, and the TMC coordinates it all.

- **511 Notify**
  - 33,000 Subscribers

- **Website Hits**
  - 700 Million + web hits

- **Website Visitors**
  - 63,288 per day
  - 15,338,050 for the season

- **511 Phone Calls**
  - 502,505 calls

- **CVOP**
  - 862 registered users

- **Mobile App**
  - In Development
  - Features
    - Pre-trip map
    - Hands Free/Eye Free
    - Location Info
    - Condition and incident reporting

Source: Wyoming DOT
Proposed Pilot Overview
## Pilot Principles

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
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<tr>
<td><strong>Operational</strong></td>
<td>Not an R&amp;D effort. To be used by WYDOT Operations for immediate needs</td>
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<tr>
<td><strong>Scalable and Sustainable</strong></td>
<td>Ability to incorporate new fleets and applications</td>
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<td><strong>Evolutionary</strong></td>
<td>Ability to start with a few applications/services but grow to an eco-system of services</td>
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<td><strong>Replicable</strong></td>
<td>Be a model deployment for rural freight-heavy corridors</td>
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<td><strong>Leveraged</strong></td>
<td>Maximize use of already created federal investments and state initiatives. Do not recreate the wheel</td>
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Source: Wyoming CV Pilot Deployment Team
Pilot Vision

Focusing on the needs of the commercial vehicle operator in the State of Wyoming, the pilot will develop applications that use vehicle to infrastructure and vehicle to vehicle connectivity to 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)
Pilot Components (1/6)

- WYDOT TMC Fleet Management Centers
- Vehicle
- Roadside
- Center
- Wide Area
- 511 Website App CVOP
- Traditional ITS (DMS, HAR) Roadside Equipment with DSRC

Snow Plow Vehicles
Connected Trucks
Truck Telematics
Data

Source: Wyoming CV Pilot Deployment Team
Pilot Components (2/6)

Wyoming DOT Traffic Management Center

Fleet Management Centers

Freight Telematics Data Provider

Vehicle Telematics Data

Source: Wyoming CV Pilot Deployment Team
Pilot Components (3/6)

Center

- PikAlert
- Vehicle Data Translator
- On-Site Meteorology
- RWIS, Traffic Data
- Road Condition Reports
- Alerts and Advisory Generator
- Motorist Information
- Commercial Vehicle Portal
- Roadside and In-Vehicle Dissemination

Source: Wyoming CV Pilot Deployment Team
Use of Pikalert for WYDOT Deployment

- Quality checking and aggregation of incoming mobile data
- Hazard assessments for use in other applications, such as variable speed limits and truck routing
- Develop high wind/blowover hazard product
- EMDSS and MAW functionality may be leveraged for commercial traffic use and WYDOT road maintenance/closures

Source: NCAR
Pilot Components (4/6)

- Roadside
  - Traditional ITS
  - Roadside Equipment

- Wide Area
  - WYDOT Trav. Info
  - Wide Area Travel Advisories

- Center
  - Wyoming DOT Traffic Management Center
  - Various

Motorist Alerts and Advisories
Variable Speed Limits
Closures
Other Services*

Source: Wyoming CV Pilot Deployment Team
Pilot Components (5/6)

Vehicle

Roadside Equipment

Roadside

In-Vehicle Alerts

DSRC

In-Vehicle Alerts

DSRC

Source: Wyoming CV Pilot Deployment Team
Vehicle

Do not pass
Emergency Brake Light
Speed Harmonization

Speed Harmonization

Source: Wyoming CV Pilot Deployment Team
Another View

The WYDOT TMC will receive the data from the vehicles on the corridor. The Vehicle Data Translator coupled with other sources will generate alerts and advisories

3

Integration with existing WYDOT traveler information services ensures great reach

4

5

511 Phone and Web System
Media advisories Integration with Waze

Fleet Management Centers

Source: Wyoming CV Pilot Deployment Team

A combination of vehicles will be equipped or supplemented with on-board equipment. One of the vehicle groups will be WYDOT Snow plows – will provide vehicle, weather, and manually entered road condition data building off the existing road condition tablet. Those vehicles will also broadcast an enhanced safety message via DSRC

1

V2V alerts will provide do not pass notification, situational awareness of incidents, workzones and speed limits between equipped fleets and snow plows

7

Roadside alerts to equipped vehicles include spot weather, dynamic routing, parking services, variable speed limits and other advisories

6

Roadside alerts are sent to message signs, RSEs, and equipped vehicles directly via WyoLink

2

The second groups of fleets that will instrumented will be from Trihyrdo and Dooley Oil. These trucks will report vehicle data back to their centers which will then provide the data back to WYDOT. This allows for scalability as more fleet operators come online

2

Over 150 fleet providers are reached on the corridor. A subset of these will directly transmit the message to their vehicles

The WYDOT TMC will receive the data from the vehicles on the corridor. The Vehicle Data Translator coupled with other sources will generate alerts and advisories

VWOT TMC

On-Site Meteorology

RWIS, Traffic Data

Alerts and Advisory Generator

Commercial Vehicle Portal

Roadside and In-Vehicle Dissemination

Motorist Information

Fleet Management Centers

Communication via WyoLink Radio

Fleet Management Centers

V2V alerts will provide do not pass notification, situational awareness of incidents, workzones and speed limits between equipped fleets and snow plows

Roadside alerts to equipped vehicles include spot weather, dynamic routing, parking services, variable speed limits and other advisories

Source: Wyoming CV Pilot Deployment Team
Proposed CV Applications for Development

- Initially focused on Motorist Alerts and Advisories relating to weather conditions
  - Spot Specific Weather Warnings
  - Variable Speed Limits
  - Speed harmonization

- Create platform for future use based on user needs
  - Work Zone Alerts
  - Truck Restrictions
  - Truck Parking
  - Curve Speed Warnings
  - Route guidance

Also, existing traveler information sources (511, website, CVOP, app) will all be improved to incorporate information from connected vehicles.
Anticipated Impacts

- Reduction in the adverse weather related incidents (including secondary incidents) in the corridor in order to improve safety and reduce incident-related delays

- How
  - Reducing the latency and increase the coverage of road condition reports along the I-80 corridor by gathering data from equipped snow plows and trucks
  - Adding in-vehicle dissemination of advisories to support speed management, detours, parking and presence of maintenance and emergency vehicles
  - Building linkages with fleet management center operations by providing current and forecasted road conditions along I-80
  - Developing local vehicle to vehicle communication of road condition and posted speeds along the I-80 corridor especially in the variable speed limit zones, work zones and around maintenance fleets
Key Risks/Challenges

- DSRC communication not tested yet on I-80 corridor conditions
- Aggressive schedule may limit ability to engage diversity of stakeholders
- Capability of mobile weather sensors and vehicle telematics to accurately portray road weather condition is still nascent in the industry
  - Some parameters are highly accurate, others are of unknown accuracy, and others are not available
- Limited understanding of how best to provide in-vehicle road condition data from a human factors standpoint
- Schedule closely tied to winter seasons
Implementation Approach
Implementation Strategy in Phase I

- **Vendor-Neutral Approach to Phase I**
- **ICF – Lead Contractor**
  - SubConsultants – Trihydro, McFarland Mgmt, University of Wyoming, Univ of Maryland –CATT Lab
  - Partner – Wyoming DOT
- **Strategic Focus Areas**
  - Ensure traceability between documents
  - Understand and support evaluation needs early in ConOps development
  - Develop detailed plan for training needs and obtaining buy-in from truck and snow plow end-users
  - Inventory and leverage federal research investments as much as possible
  - Develop a branding and outreach strategy to support both internal and external marketing needs
  - Develop and cultivate an active stakeholder group in Wyoming around this project.
  - Collaborate and learn from other CVs
  - Engage with vendors and telematics data providers for alternative analysis
  - Deliver on-time
Implementation Strategy in Phase II and Phase III

- Wyoming DOT will be the lead agency for development and deployment in Phase II
- Team roles (ICF and others) will be revisited as part of Phase I implementation planning
- New vendors/partners will be added to the team
  - DSRC Radio providers
  - Weather Data Providers
  - Freight Telematics
  - Fleet Management

- Strategic Focus
  - Develop robust testing and acceptance plan
  - Integrate with existing WyDOT network and systems
  - Support evaluation data needs and participation in RDE
  - Open source development as much as possible
Emphasis on Systems Engineering Management

- Leverage the CVRIA framework for the development of mobile data collection, in vehicle advisories for wind, speed limits, and parking availability using DSRC and cellular communication for V2V and V2I applications

- Use the SET-IT tool to develop the Enterprise, Physical, and Communications View for the CVRIA applications and build the initial draft for the Task 2 Pilot Deployment Concept of Operations (ConOps) document components for system engineering management

- Leverage existing federal research and prototypes
  - PikeAlert
  - MAW
  - INFLO
  - RESCUEME
  - SWIW
Support Evaluation and Performance Measurement

- **Performance Measurement Plan development will occur early in the project concept development**
  - Ensures a project design that focuses on outcome benefits and is prepared to collect the necessary data
  - Closely coordinated with Task 2, Concept of Operations and Task 6, System Requirements

- **Approach**
  - Key performance measures will focus on increasing safety and improving operational efficiencies
    - Surrogate measures will be established, where appropriate
  - Impacts of CV Pilot use-cases; input-output-outcome logic models
  - Modeling and simulation will be utilized to enhance data analysis and performance measurements in the areas of safety, operational efficiencies, and road weather impacts related to freight movement operations
  - Continuous data collection and support to independent evaluation activities
Stakeholder Involvement

- List of Stakeholders
  - Wyoming Trucking Association
  - Trucking companies
  - Truck stops and services
  - Emergency Responders
  - WYDOT employees
    - Telecommunications
    - Maintenance Supervisors and Drivers
    - TMC
    - Wyoming Highway Patrol
  - Wyoming Citizen Panel
  - National Weather Service
  - Representatives from Cities on I-80
  - Oil and Gas industry representatives

- Involvement in Phase I
  - User Needs Development
  - ConOps Review
  - Gathering Commitment for Phase II
Next Steps
Next Steps

- Complete Project Management Plan (PMP) and Systems Engineering Management Plan
- Develop Stakeholder Registry
- Develop internal communications portal for the team and FHWA
- Begin Concept of Operations Development