Wyoming DOT Connected Vehicle Pilot Deployment Program

RHONDA YOUNG, GONZAGA UNIVERSITY
ITE WESTERN DISTRICT 2018
Wyoming CV Pilot Team
Pilot Project

- Using Connected Vehicle (CV) Technology to enable equipped vehicles to transmit and receive data to other equipped vehicles and roadside infrastructure.
- New York City, Tampa, and Wyoming selected as pilot deployment sites
Wyoming Connected Vehicle Pilot

- Competitive grant opportunity
- About $6 million funded 80% by the USDOT
- Freight focused
- DSRC based
- Intended to reduce the number and severity of crashes while improving mobility on the I-80 corridor
Connected Vehicle Pilot: Next Steps

Phase 1
- Planning
- (09/2015 – 09/2016)

Phase 2
- Deployment
- (10/2016 – Summer 2018)

Phase 3
- Demonstration
- (Fall 2018 – 10/2019)

Concept Development
- System Planning
- Deployment Plan

System Design
- System Build
- System Testing and Acceptance

Real-World Demonstration
- Evaluation
- Maintenance
Wyoming’s I-80 Corridor

Heavy Freight Traffic
- Major E/W freight corridor
- Freight = over half of annual traffic

Severe Weather Conditions
- Roadway elevation
- Heavy winds, heavy snow and fog
- Severe blowing snow and low visibility

Adverse Impacts on Trucks
- Higher than normal incident rates
- Multi-vehicle crashes
- Fatalities

Source: WYDOT (Dec 17, 2015)
Interstate 80 Corridor
Interstate 80 Corridor

On I-80 in Wyoming

- **700** Commercial Vehicle Accidents
- **906** Non-Commercial Vehicle Accidents
- **1,552** Hours Road Closures

1600+ Crashes in 1 Year

- **18** Fatalities
- **271** Injuries
- **1,317** Property Damage

Goal

Reduce crashes and crash severity on I-80.
Pilot Elements

**CV Environment**
- 75 Roadside Units on I-80
- 400 Vehicles with DSRC Connectivity

**V2V Applications**
- Forward Collision Warning
- Distress Notification

**V2I Applications**
- Situational Awareness
- Spot Weather
- Work Zone Warning

**WYDOT’s CV Pilot System**
- Vehicle System
- Back office system
  - Roadside Infrastructure

**Wyoming CV System**
- Spot Weather
- Work Zone Warning

**External Interfaces**
## 5 Focus Areas

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage following speed and distance between vehicles</td>
<td>By alerting trucks to slowing traffic ahead to prevent multiple-vehicle crashes</td>
</tr>
<tr>
<td>Provide custom alerts and advisories</td>
<td>For vehicles that are at risk due to their weight, profile, or traveling speeds due to high-winds or near work zones, including alerting drivers if vehicles are too tall for bridges</td>
</tr>
<tr>
<td>Provide location-based parking information</td>
<td>With a focus on directing drivers to safe parking areas in the event of a road closure</td>
</tr>
<tr>
<td>Allow first responders to be notified of a crash automatically</td>
<td>Based on vehicle metrics, such as airbag deployment</td>
</tr>
<tr>
<td>Use data collected from vehicle’s weather sensors</td>
<td>Such as the status of windshield wipers and if anti-lock brake systems are activated. This information will be used to develop advisories and forecasts for travel to fleet management centers and the general public.</td>
</tr>
</tbody>
</table>
Human-Machine Interface (HMI)

E-Training
In-Cab Display Unit Layout

- Critical Warnings
- Advisory Warnings
- Speed Limit
- Distress Notification Button
- Settings Button
- Vehicle Speed
- Forward Collision Warning

Note: The notifications will remain on the display until the event is over
I-80 Corridor

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

136 Variable Speed Limit Signs
supported by 94 speed sensors

54 Electronic Message Signs

44 Weather Stations

52 Webcams
On-Board Applications
Forward Collision Warning

Slow moving vehicles like Snow Plows or Heavy equipped trucks, or in low visibility conditions

• Impending front-end collision warning
• Data sent to approaching vehicles (from vehicle 1 to vehicle 2)
• Same direction of travel
• All roadway geometries

Host vehicle receives BSM information from remote vehicles.
On-Board Applications
I2V / V2I Situational Awareness (TIM)

- Probe data collected from WYDOT fleet to supplement existing observations
- Downstream road conditions (speed and vehicle restrictions, incidents, parking, road closures etc.) sent via a Traveler Information Message (TIM)
On-Board Applications
I2V / V2I Situational Awareness (SWIS)

- **Spot Weather Impact Warning**: Localized road weather information (fog, ice, etc.)
On-Board Applications
I2V / V2I Situational Awareness (WZW)

- **Work Zone Warning**: Unsafe work zone conditions (obstructions, closures, shifts, etc.)
On-Board Applications

Distress Notification

- Generation and broadcast of distress message (e.g., Mayday)
- CV and RSU within vicinity receive and forward message
On-Board Applications
Distress Notification

- Generation and broadcast of distress message (e.g., Mayday)
- CV and RSU within vicinity receive and forward message
Connected Vehicle Pilot: Integration

WHAT DOES CONNECTIVITY MEAN?

- MORE ACCURATE EN ROUTE ALERTS
- BETTER PRE-TRIP & FORECASTED INFORMATION
- TIMELY NOTIFICATIONS
- FASTER ROADSIDE UPDATES
- IMPROVED INFORMATION SHARING
## Speed and Crash Performance Measures

<table>
<thead>
<tr>
<th>Improved Speed Adherence and Reduced Speed Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. Total vehicles traveling at no more than 5 mph over the posted speed (compare before and after CV Pilot)</td>
</tr>
<tr>
<td>15. Total vehicles traveling within +/- 10 mph of 85th percentile speed (compare before and after CV Pilot)</td>
</tr>
<tr>
<td>16. Speed of applicable connected vehicles are closer to posted speed when compared to non-connected vehicles</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reduced Vehicle Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. Number of connected vehicles involved in a crash</td>
</tr>
<tr>
<td>Initial crashes</td>
</tr>
<tr>
<td>Secondary crashes</td>
</tr>
<tr>
<td>18. Reduction of the number of vehicles involved in a crash (compare a multi-year average before and after CV Pilot)</td>
</tr>
<tr>
<td>19. Reduction of total and truck crash rates within a work zone area (compare a multi-year average before and after CV Pilot)</td>
</tr>
<tr>
<td>20. Reduction of total and truck crash rates along the corridor (compare a multi-year average before and after CV Pilot)</td>
</tr>
<tr>
<td>21. Reduction of critical (fatal or incapacitating) total and truck crash rates in the corridor (compare a multi-year average before and after CV Pilot)</td>
</tr>
</tbody>
</table>
Weather as a Confounding Factor

- Weather is a major confounding factor affecting speed and safety performance measures.
- Not accounting for weather in performance measures would make it difficult to detect differences in baseline and post-deployment data.
  - Short data collection periods for speed performance measures heighten impact of an single extreme or mild winter season.
STAY CONNECTED

Rhonda Young
Professor of Civil Engineering
Gonzaga University
youngr1@Gonzaga.edu

Contact for CV Pilots Program/Site AORs:
- Kate Hartman, Program Manager, Wyoming DOT Site AOR; Kate.hartman@dot.gov

Visit CV Pilot and Pilot Site Websites for more Information:
- CV Pilots Program: http://www.its.dot.gov/pilots
- Wyoming DOT: https://wydotcvp.wyoroad.info/