U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program: Wyoming (WYDOT)

ITS Benefits, Costs, and Lessons Learned: 2018 Update Report

Connected Vehicle Pilot – Wyoming

Highlights

- For the Wyoming Pilot, approximately 400 fleet vehicles and commercial trucks that frequently traverse the I-80 corridor will be fit with connected vehicle (CV) technology.
- The cost to design, build, test, operate, and maintain the Wyoming Pilot is estimated to total $5,755,972.
- During the design of their radio communications, the WYDOT Pilot team discovered a major loophole in the 1609.4 standard that is being addressed by the 1609.4 committee.

Introduction

This factsheet is based on past evaluation data contained in the ITS Knowledge Resources database at: www.itskrs.its.dot.gov. The database is maintained by the U.S. DOT's ITS JPO Evaluation Program to support informed decision making regarding ITS investments by tracking the effectiveness of deployed ITS. The factsheet presents benefits, costs and lessons learned from past evaluations of ITS projects.

Connected vehicles are poised to transform our streets, communities, and personal lives. But first, we must tackle deployment challenges head on and provide interested regions with examples of success stories and champions. The U.S. Department of Transportation (USDOT) is taking on this challenge by investing in a regional pilot deployment program that is not only accelerating deployment but also uncovering what barriers remain and how to address them. This program will help ensure that this revolutionary technology can meet its fullest potential in the near future.

In September of 2015, USDOT selected New York City Department of Transportation (NYCDOT), Wyoming Department of Transportation (WYDOT) and Tampa Hillsborough Expressway Authority (THEA) as the recipients of a combined $42 million in federal funding to implement a suite of connected vehicle applications and technologies tailored to meet their region's unique transportation needs. These pilot sites will help connected vehicles make the final leap into real-world deployment so that they can deliver on their promises of increasing safety and improving mobility. Moreover, these sites will lay the groundwork for even more dramatic transformations as other areas follow in their footsteps.

The sites are conducting the pilots in three Phases. Under Phase 1, the sites spent 12 months preparing a comprehensive deployment concept that was suitable for further design, building, testing, and operation. This comprehensive concept included identifying specific performance measures, targets and capabilities associated with performance monitoring and performance management. In Phase 2, the sites embarked on a 20-month phase of activity to design, build and test the nation's most complex and extensive deployment of integrated wireless in-vehicle, mobile device, and roadside technologies. In Phase 3, the tested pilot deployment applications and technologies will be placed into operational practice, where the impact of the deployment on a set of key performance measures will be monitored and reported.

Wyoming Pilot Overview[1]

Wyoming is an important freight corridor that plays a critical role in the movement of goods across the country and between the United States, Canada, and Mexico.

Interstate 80 (I-80) in southern Wyoming, which is above 6000 feet, is a major corridor for east/west freight movement and moves more than 32 million tons of freight per year. During winter seasons when wind speeds and wind gusts exceed 30 mph and 65 mph respectively, crash rates on I-80 have been found to be 3 to 5 times as high as summer crash rates. This resulted in 200 truck blowovers within 4 years and often led to road closures. Wyoming Department of Transportation (WYDOT) CV Pilot site focuses on the needs of the commercial vehicle operator in the State of Wyoming and will develop applications that use vehicle to infrastructure (V2I) and vehicle to vehicle (V2V) connectivity to support a flexible range of services from advisories including roadside alerts, parking notifications and dynamic travel guidance. This WYDOT CV Pilot is expected to reduce the number of blowover incidents and adverse weather related incidents (including secondary incidents) in the corridor in order to improve safety and reduce incident-related delays.

From October 2015 to September 2016, there were more than 1,600 crashes on I-80, resulting in 18 fatalities and 271 injuries. During this same time, roads were closed to all vehicles for over 1,500 hours. The societal impact of these crashes topped $865 million.[2]

WYDOT will develop systems that support the use of CV Technology along the 402 miles of I-80 in Wyoming. Approximately 75 roadside units (RSUs) that can receive and broadcast message using Dedicated Short Range Communication (DSRC) will be deployed along various sections of I-80. WYDOT will equip around 400 vehicles, a combination of fleet vehicles and commercial trucks with on-board units (OBUs). Of the 400 vehicles, at least 150 will be heavy trucks that are expected to be regular users of I-80. In addition, of the 400 equipped-vehicles, 100 WYDOT fleet vehicles, snowplows and highway patrol vehicles, will be equipped with OBUs and mobile weather sensors.

Costs

The CV Pilots were each required to submit a Comprehensive Deployment Plan under Phase 2. In the plan are details about the design approach, procurement, development, integration, testing, and final readiness demonstration. Additional details address the preparation of project plans to secure, operate, and maintain the system and protect privacy. A Cost Summary was also included in the plan to provide insight into the types of costs anticipated for this project. The table below summarizes the projected cost estimates at a high-level, and is intended to provide information and guidance for other deployers regarding the costs allocated for the project (Cost ID: 2017-00386).

Table 1: High Level Costs for the Wyoming Connected Vehicle Pilot Deployment by Task

Phase / Task	Cost
2-A. Program Management	$ 181,634
2-B. System Architecture and Design	$ 469,066
2-C. Data Management Planning	$ 108,585
2-D. Acquisition and Installation Planning	$ 1,487,077
2-E. Application Development	$ 901,075
2-F. Participant and Staff Training	$ 186,678
2-G. Operational Readiness Test and Demonstration Planning	$ 177,177
2-H. Installation and Operational Readiness Testing	$ 171,080
2-I. Maintenance and Operations Planning	$ 154,664
2-J. Stakeholder Outreach	$ 169,699
2-K. Performance Measurement and Independent Eval Support	$ 253,056
2-L. Participation in Standards Development	$ 51,436

Phase / Task	Cost
Phase 2 Total	$4,311,227
3-A. Program Management	$ 150,009
3-B. System Operations and Maintenance	$ 447,823
3-C. Stakeholder Outreach	$ 157,371
3-D. Performance Measurement and Independent Eval Support	$ 447,754
3-E. Post-Pilot Deployment Transition Planning	$ 115,815
3-F. Participation in Standards Development	$ 125,973
Phase 3 Total	$1,444,745
Phase 2 and Phase 3 Total	**$5,755,972**

Lessons Learned

Prevent the need for channel switching (a safety hazard) by designing CV communications to include dual radios in each vehicle (Lesson ID: 2017-00795)

In the area of communications, the CV Pilot sites are using established standards wherever possible, but in many cases, they are trying out standards in the field for the first time, or are implementing messages for which no national or international standards have yet been established. A key component of connected vehicle communication is Dedicated Short Range Communication (DSRC) in the 5.9 GHz band. Within this band are several channels. Channel 172 is the primary channel, carrying safety-related information and WAVE Service Announcements (WSAs) that advertise the availability of other information and services on other channels. The IEEE 1609.4 standard addresses multi-channel operation for Wireless Access in Vehicular Environments (WAVE), and as such is the "official" set of rules for wireless messages by the CV Pilot sites.

The New York and Tampa teams plan to use dual radios in each vehicle: one to listen to channel 172 and the other to listen to other channels for supplementary information such as Traveler Information Messages. The Wyoming team, on the other hand, originally planned to use a single radio, listening to channel 172 most of the time, but switching to other channels to listen for other messages. Such a channel-switching plan is consistent with IEEE 1609.4 specifications. However, the 1609.4 committee and several manufacturers who are looking ahead to implementation of DSRC required by a ruling from the National Highway Traffic Safety Administration (NHTSA) maintain strongly that it is not safe to switch away from Channel 172, because a safety-critical message on that channel might be missed.

The Wyoming team has agreed to re-design its communications design to include dual radios. However, the discovery that a single channel-switching radio is technically compliant to the 1609.4 standard is a major loophole in the standard that must be addressed and corrected by the 1609.4 committee.

References

[1] Connected Vehicle Pilot Deployment Program. Wyoming Pilot. https://www.its.dot.gov/pilots/pilots_wydot.htm. Last Accessed: January 24, 2018.

[2] Wyoming CV Pilot Factsheet. https://www.its.dot.gov/factsheets/pdf/WyomingCVPilot_Factsheet_020817.pdf. Last Accessed: January 24, 2018.