0-6867: Connected Vehicle Wrong-Way Driving Detection and Mitigation Demonstration

Background

Connected vehicles (CVs) and their integration with transportation infrastructure provide new approaches to wrong-way driving (WWD) detection, warning, verification, and intervention that will help practitioners further reduce the occurrence and severity of WWD crashes. This project developed an initial concept for a CV WWD detection and management system. This system would detect WWD vehicles, notify Texas Department of Transportation (TxDOT) and law enforcement personnel, and alert affected travelers.

For this project, the system boundaries were identified as high-speed, controlled-access, freeway-type facilities. These included the main lanes of TxDOT freeways and major toll facilities, as well as their entrance and exit ramps. System boundaries *do not include* frontage roads, cross-street approaches of frontage road intersections or the intersections themselves, or urban roadways operated by municipalities. The system was also not designed for multi-lane, divided highways without access control.

What the Researchers Did

To accomplish the project goal, the research team reviewed the state of the practice of intelligent transportation systems and CV technologies being applied as WWD countermeasures and the WWD crash trends in Texas from 2010 to 2014. The research team also identified the user needs associated with the implementation of a CV WWD detection and management system and preliminary ways to connect with law enforcement. Based on these tasks, the research team developed a concept of operations, functional requirements, and high-level system design for a CV WWD detection and management system.

The research team conducted one-on-one surveys to assess motorist understanding of wrong-way driver warning messages that were designed to be displayed on dynamic message signs (DMSs). The research team also investigated the use of roadside alert (RSA) messages to provide warning to CVs about approaching wrong-way drivers. Researchers developed recommendations regarding the next steps toward the implementation of a CV WWD detection and management system.

What They Found

The motorist survey findings support the use of the two wrong-way driver warning messages shown in Figures 1 and 2. However, there was some evidence that the abbreviation for vehicle may be initially misunderstood. Therefore, the alternative message should only be used for DMSs with 15 characters per line.

Any time one of these messages is displayed on a DMS, the beacons located on the DMS should be activated. If the DMS does not have beacons, the entire message may be flashed. Individual message lines (e.g., WARNING) should never be flashed. The location of the problem (i.e., ahead) and non-specific driving actions (i.e., use caution, watch for the wrong-way driver, and slow down) are inferred from the two recommended messages.

WARNING
WRONG WAY DRIVER
REPORTED

Figure 1. Recommended DMS Message.

WARNING
WRONG WAY VEH
REPORTED

Figure 2. Alternative 15-Character DMS Messages.

Although standard data elements are available for use to generate wrong-way messages that can be broadcast via RSAs, a need exists to conduct human factors studies to determine motorist needs, comprehension, and interpretations of these data elements in a WWD context.

What This Means

The research team recommends the development of a proof-of-concept test bed before implementing a model field deployment of the system on an actual roadway in Texas. The test bed would provide an offline location for the research team and TxDOT to test and fine-tune the system components and operations prior to installing them on the open roadway. The research team would use the lessons learned from the deployment in the test bed environment to determine the design considerations for a model field deployment of the system.