0-6867-01: Connected Vehicle Wrong-Way Driving Detection and Mitigation Demonstration—Phase II

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. In Phase I, the research team reviewed the state of the practice regarding intelligent transportation systems and CV technologies being applied as WWD countermeasures. The research team then identified user needs associated with the implementation of a CV WWD system, assessed motorist understanding of wrong-way driver warning messages posted on dynamic message signs, and ascertained preliminary ways to connect with law enforcement. Phase I culminated in the development of a concept of operations, functional requirements, and high-level system design for CV applications that detect wrong-way vehicles, notify traffic management agencies and law enforcement, and alert affected travelers.

What the Researchers Did

In Phase II, the research team developed a proof-of-concept CV WWD detection and management system at the Texas A&M University Respect, Excellence, Leadership, Loyalty, Integrity, Selfless Service (RELLIS) campus. The purpose of the test bed system was to provide an off-roadway location on a closed-course facility to test and fine-tune the system components and operations prior to installing them on an actual roadway. The research team developed software components to enable the system functionality via two methods: a Lonestar® integrated demonstration version and a standalone version that resides in the field on the roadside units. The use of the Lonestar® demonstration version followed the traditional architecture that has all

components sending and receiving messages through a traffic management center (TMC). The use of a standalone version that resides on the roadside units allowed researchers to show how such a system would operate outside of a TMC region and the future potential for components to communicate directly with each other. The research team also conducted validation testing and hosted a demonstration of the system.

In Phase II, the research team also conducted human factors studies to investigate the in-vehicle information needs of right-way drivers when a WWD event occurs. Researchers conducted a formal task analysis to identify critical stages where right-way drivers could make better decisions if information was provided to them through CV technology. Researchers then used structured interviews and surveys to identify the information needs of right-way drivers, and to evaluate comprehension and preference of message wording and timing.

Research Performed by:
Texas A&M Transportation Institute and Southwest Research Institute

Research Supervisor:
Melisa D. Finley, TTI

Researchers:
Susan T. Chrysler, TTI
Kevin N. Balke, TTI
Hassan Charara, TTI
David H. Florence, TTI
Rajat Rajbhandari, TTI
Cameron R. Mott, SwRI
Purser K. Sturgeon II, SwRI
Darin M. Parish, SwRI

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What They Found

Verification of the Lonestar® system confirmed the reliability and real-time alerting available to right-way (Figure 1) and wrong-way (Figure 2) CVs. Using the Lonestar® system, CV-enabled law enforcement vehicles were able to receive and leverage additional real-time information, and TMC operators gained insight into WWD events as they occurred. The research team also successfully implemented and tested a secondary standalone system.

The findings from the structured interviews showed there is a desire for in-vehicle WWD alerts for multiple right-way vehicle locations. More than 80 percent of participants wanted the in-vehicle alert to contain information about the urgency and problem. Participants indicated that the alert needed to catch right-way drivers' attention and should increase in frequency as they got closer to the wrong-way vehicle. The motorist surveys revealed that wording used on roadside signs cannot simply be put directly into in-vehicle messages because drivers' points of reference are different when considering in-vehicle devices.

What This Means

The research team recommends the installation of a model field deployment on SH 47 (in conjunction with the ongoing development of a smart connected corridor). This real-world application will allow researchers and the Texas Department of Transportation to further prepare for the approaching CV environment and its ability to improve wrong-way detection, more quickly notify public agencies and law enforcement, and alert right-way drivers. Additional human factors research is needed to assess motorist comprehension of in-vehicle messages intended to warn right-way drivers about a WWD event.

Figure 1. In-Vehicle Warning Message for the Right-Way Vehicle Display.

Figure 2. In-Vehicle Warning Message for the Wrong-Way Vehicle Display.

For More Information

Project Manager:
Darrin Jensen, TxDOT, (512) 416-4728

Research Supervisor:
Melisa D. Finley, TTI, (979) 845-7596

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http://library.ctr.utexas.edu.

Research and Technology Implementation Office
Texas Department of Transportation
125 E. 11th Street
Austin, TX 78701-2483

www.txdot.gov
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