Texas A&M Transportation Institute

Texas Department of Transportation

PROJECT SUMMARY REPORT

0-7119: Develop Standardized Operational Evaluation of Wrong-Way Driving Detection Technologies

Background

From 2010 to 2019, approximately 1700 wrong-way driving (WWD) crashes occurred in Texas on controlled-access highways (e.g., freeways and interstates). On average, about 170 WWD crashes occurred each year, and 10 percent resulted in a fatality. To reduce the number of wrong-way (WW) maneuvers and associated crashes on Texas freeways, the Texas Department of Transportation (TxDOT) purchases, installs, and maintains intelligent transportation systems that can detect WW drivers, alert the WW drivers of their error via signs, and notify the traffic management center (TMC). However, since there is not a TxDOT standard specification for WWD detection systems nor a standardized testing mechanism to assess system performance, TxDOT personnel are often unaware of the benefits and limitations of systems prior to activation in the field. This results in systems not functioning as expected, high false-alarm rates, and increased workload for agency staff. In addition, TxDOT district staff are continually asked to install and test a variety of emerging WWD detection systems.

What the Researchers Did

In the fall of 2021, researchers reviewed previous literature, assessed the current practice in Texas, and identified 17 commercially available off-the-shelf WWD detection systems to determine the state of the practice regarding WWD detection technology. Researchers then developed a standardized testing mechanism to assess performance of WWD detection technologies.

In the fall of 2022, researchers evaluated the WW vehicle detection accuracy, WW vehicle detection latency, sign activation accuracy, email notification accuracy, and short message service notification accuracy of 10 commercially available off-the-shelf WWD detection technologies in a closed-course environment at the Texas A&M RELLIS Campus in Bryan, Texas. Researchers summarized information about the 10 tested WWD detection technologies into two-page documents (front and back) as an easy reference for practitioners.

Researchers also conducted three independent field tests to evaluate the real-world performance of three separate WWD detection technologies. Two of the sites and technologies were in-situ assessments of WWD detection technologies recently deployed by TxDOT. One additional site used technology made available by the manufacturer for a limited-duration field evaluation at a test site arranged by TxDOT

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San Antonio District staff. For each field evaluation, Texas A&M Transportation Institute researchers coordinated with TxDOT staff to obtain the WWD alerts received by TxDOT and analyze each event using the data and video available via the alert.

Based on the findings, researchers developed implementation guidance that TxDOT can use to inform decisions regarding the selection of WWD detection technology. Researchers also prepared language for future technical specifications for WWD detection technology that TxDOT can use.

What They Found

The literature review provided insight into previous evaluations of WWD detection technology, including closed-course and field-testing protocols and performance measures. The literature review also revealed conditions that cause WWD detection technology to produce false alarms as well as items transportation agencies should consider when developing guidance, standards, and specifications for WWD detection technologies. The catalog of WWD detection technologies implemented in Texas showed that TxDOT is actively addressing the WWD issue. However, the catalog also revealed some challenges with deploying and maintaining WWD detection technologies.

Five vendors detected all the WW vehicle runs (100 percent WW vehicle detection accuracy). Two vendors missed one WW vehicle detection (99 percent WW vehicle detection accuracy). Two vendors missed three WW vehicle detections (96 percent WW vehicle detection accuracy). One vendor missed nine WW vehicle detections (89 percent WW vehicle detection accuracy). None of the systems produced false detections during the right-way vehicle runs. The median detection latencies across all WW vehicle tests ranged from 2 to 16 seconds, with the maximum value being 28 seconds. Sign activation accuracy and email notification accuracy closely corresponded to WW vehicle detection accuracy.

The WWD detection equipment field tests conducted as part of this research investigation, while not definitive due to their limited scope, did provide meaningful insight into the practical application of the technologies. All three technologies tested in the field (i.e., radar, optical camera, and thermal camera) proved that they can reliably sense a WW vehicle and that their control systems are capable of quickly providing an alert to TxDOT TMC staff. The field tests also revealed the need for ongoing maintenance of WWD detection technology.

What This Means

Researchers anticipate that the results of this research will be used by practitioners when selecting and installing WWD detection technologies. Implementation of the recommended language for future technical specifications for WWD detection systems will ensure that adopted technologies meet minimum requirements and improve system performance.

For More Information

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