TDOT Department of Transportation

Research Summary

Investigation on Wrong Way Prevention Technologies and Systems

WHAT WAS THE RESEARCH NEED?

A wrong-way driving (WWD) event occurs when a vehicle enters a high-speed divided highway in the direction opposing the legal traffic flow, causing them to collide with an object or another vehicle or no collision occurs at all. Although this type of event is rare, the damage from WWD accidents is often times more severe because it is more likely to be a head on collision. In order to avoid such events in Tennessee, the research project examined Wrong-Way Driving Prevention Systems (WWPSs) available to prevent such events, creating opportunities for TDOT to test WWPSs and determine the one most appropriate for the state.

WHAT WERE THE RESEARCH OBJECTIVES?

There were five main research objectives for this project:

1. Understanding what WWPS mechanism are available and comparing them.
2. Gathering and analyzing WWD crash data in Tennessee.
3. Surveying WWPS available in the market and conducting product testing.
4. Evaluating and Comparing WWPS performance based on multiple criteria.
5. Recommending the most promising product and developing guidelines for deploying.

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TDOT Lead Staff:
Michelle Nickerson
Traffic Operations Division

Principal Investigator(s):
Dr. Mihalis Golias | Co-PI
Dr. Sabya Mishra | Co-PI
University of Memphis

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WHAT WAS THE RESEARCH APPROACH?

The research team took a 4-step approach for the project.

1. Various wrong-way detection mechanisms and WWPSs deployed in other states were reviewed and evaluated.
2. A descriptive analysis of wrong way crashes in Tennessee was conducted using data from police reports and the Enhanced Tennessee Roadway Information Management System (ETRIMS) crash database.
3. Three WWPSs were acquired and tested in two phases. First, the systems were tested in controlled environment where a test vehicle was driven the wrong way to examine whether the WWPS detects the wrong-way vehicle. Second, the systems were tested in a real-world setting where the WWPSs were deployed to an exit ramp in the Nashville area to determine if the system performs similarly as it did in the controlled environment.
4. Lastly, the results from these tests, along with life cycle cost analysis, were used to perform a multicriteria evaluation to identify the most effective WWPS of the systems tested.

WHAT WERE THE FINDINGS?

The research had three primary findings:

1. Certain types of WWPS components were considerably more effective than others, including thermal detection, radar detection, and blinking LED-enhanced wrong way signs.
2. Tennessee sees an average of 20 wrong-way crashes per year. These accidents most often happen at night and are concentrated in urban areas, such as Nashville and Memphis.
3. Based on results of the WWPSs tested, TraffiCalm had the best overall performance.

IMPLEMENTATION AT TDOT

For TDOT, TraffiCalm is recommended as the most effective WWPS to be deployed in Tennessee after considering accuracy, responsiveness, live-tracking, life-cycle cost, and other relevant elements. TraffiCalm has (1) multiple radars and layers of detection to ensure the WWD driver is detected, (2) a live camera showing the feed, (3) multiple logic units, and (4) optional solar panels so that the system can be a standalone and not rely on external electricity or internet connection, which all contribute to the system's exceptional performance. TraffiCalm also has two advantages over the other WWPSs, including (1) they manufacture and integrate all the components in house with full lifetime technical support, and (2) the system is deployed and fully operational in numerous states across the U.S.

MORE INFORMATION

Find the final report here: https://www.tn.gov/content/dam/tn/tdot/long-range-planning/research/final-reports/res2020-final-reports/RES2020_02_Final_Report_Approved.pdf.

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