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OFFICE OF TRANSPORTATION
SYSTEM MANAGEMENT

TECHNICAL SUMMARY

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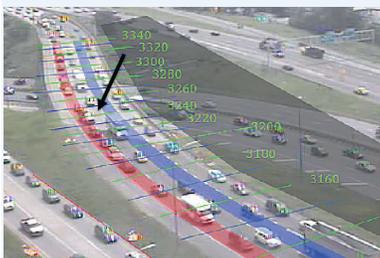
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Principal Investigator:

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PROJECT COST:

\$147,280



To monitor lane changes, researchers used software to analyze vehicle location and distance.

Evaluating the Use of Active Traffic Management Messages for Incident Management

What Was the Need?

To explore effective ways to improve road user safety in Minnesota, MnDOT has been investigating the use of intelligent lane control signs for incident management. Unlike typical variable message signs, these signs are designed to provide detailed information specific to each lane of the highway. They can show drivers in a lane various kinds of active traffic management messages, asking drivers to change lanes or engage in other behaviors. Changing lanes farther upstream from incidents helps to make the incident scene safer for emergency responders on the scene and helps to prevent congestion caused by vehicles being slowed or stopped in a lane blocked by an incident. MnDOT has installed these ATM signs on two corridors along Interstate 94 and I-35W where crash rates have been particularly high.

ATM messages are being used in only a few locations in the United States, and research was needed on their effectiveness for incident management. MnDOT wanted to know in particular if drivers are complying with these signs, and if so, the optimum messaging and timing strategies for ATM messages.

What Was Our Goal?

The goal of this project was to evaluate the effectiveness of ATM messages for influencing driver lane change behavior during congestion due to incidents along westbound I-94 near downtown Minneapolis. The I-94 corridor was chosen for the analysis because the University of Minnesota already had additional instrumentation on the corridor that could be utilized for this study.

What Did We Do?

Researchers collected and analyzed high-resolution video data from westbound I-94's high crash area. To collect data, they relied on surveillance cameras from MnDOT's Regional Transportation Management Center and the Minnesota Traffic Observatory, a unique field laboratory established in 2002 by the University of Minnesota. The Traffic Observatory has video cameras at three locations along the high crash area that can be positioned as needed to track the speeds of individual vehicles. This gave researchers seamless surveillance coverage and a uniquely detailed picture of traffic.

Researchers analyzed this data using statistical modeling techniques to evaluate and quantify the effect of various ATM message strategies on the rate at which drivers changed lanes. To conduct this analysis, they selected 28 of 481 events on record between 2012 and 2014.

What Did We Learn?

Results showed that ATM messages are effective at inducing drivers to select the correct lanes during incidents, and that those drivers who ignore lane change instructions do not disrupt the message effectiveness on other drivers.

This project will help MnDOT remain at the forefront in finding technologies for reducing congestion and increasing safety. Results will play a key role in upcoming MnDOT decisions concerning traffic operations infrastructure.

“This project will help MnDOT determine where to head next when it comes to finding the most cost-effective methods for decreasing congestion and increasing safety during traffic incidents.”

—**Brian Kary,**
MnDOT Freeway
Operations Engineer

“With complete video coverage in a high crash area, the I-94 field laboratory provided a really unique opportunity for collecting detailed data on the responses of drivers to ATM messages.”

—**John Hourdos,**
Director, Minnesota Traffic
Observatory, University of
Minnesota

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ATM signs are lane-specific and provide drivers with more detailed information about road conditions than standard changeable message signs.

Some messages and message combinations were more effective than others. The Use Caution message has a relatively weak effect on lane changes, especially in comparison to stronger messages like the Merge chevron and Lane Closed signs. The Merge chevron seems to be the strongest sign for inducing lane changes upstream of an incident. Most effective was the combination at successive locations of a Lane Closed Ahead message followed by a Merge chevron. ATM messages are even more effective when combined with the visual presence of first responders, whose flashing lights provide a visual confirmation for drivers. This presence is also effective by itself, although not as effective as ATM messages alone.

Researchers also found that the equidistant placement of ATM message signs is not always ideal, depending on road geometry. For example, sign locations can have a weak effect if they occur before a ramp that is situated near a location with frequent incidents. It could be more effective and more economical to locate the intelligent lane control signs based on historical crash locations rather than as a blanket system on a freeway corridor.

Finally, researchers found that with high levels of congestion and stop-and-go traffic, there is a point of diminishing returns where the use of ATM messages is inadvisable since the capacity of all lanes is needed.

What's Next?

MnDOT is currently evaluating strategies for influencing driver lane selection during traffic incidents. This project did not compare the use of ATM messages to the more frequent spacing of simpler variable message signs. However, researchers did observe that variable message signs had a small additional benefit in combination with ATM messages. More frequently spaced variable message signs, which are less expensive than ATM signs, may be comparable in their effectiveness, especially in combination with the visual presence of first responders.

This Technical Summary pertains to Report 2016-04, “Evaluation of the Effectiveness of ATM Messages Used During Incidents,” published January 2016. The full report can be accessed at mndot.gov/research/TS/2016/201604.pdf.