



## RESEARCH SERVICES SECTION

# TECHNICAL SUMMARY

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### PROJECT COST:

\$88,000



The STISIM simulator uses three PCs to generate a virtual environment presented on 17-inch monitors.

# The Effectiveness and Safety of Non-Traffic-Related Messages on Changeable Message Signs

## What Was the Need?

Changeable message signs are electronic devices used along roadways to provide drivers with guidance related to traffic conditions and other events. Displayed messages can suggest that drivers take alternate routes in response to congestion, accidents or roadwork zones. CMSs are also used to display time-critical information not related to traffic control, such as Amber alerts regarding child abductions, as well as messages not specific to a time or roadway condition, such as “Don’t Drink and Drive.”

Evidence suggests that CMSs can disrupt traffic flow by causing drivers to slow down. Further, the content of messages displayed on CMSs may not be adequately comprehensible to allow drivers to respond to them appropriately. Finally, using CMSs to display both messages that are time-critical and those that are not may lead drivers to pay less attention to either type of message.

Phase I of a study into these issues, conducted in 2003, measured the effect of the more complex CMS messages Mn/DOT was using at the time. Further study was needed to perform assessments of CMSs with newly developed wording that more clearly conveyed the intended message to drivers.

## What Was Our Goal?

The purpose of Phase II was to evaluate how lowering the complexity and ambiguity of CMS messages would affect driver behavior and traffic flow. By performing the same assessments on Phase II messages that were performed in Phase I, investigators aimed to compare how well the suggested guidance was followed and the degree to which CMSs led drivers to slow down.

In Phase II, investigators also wanted to determine:

- The validity of simulator speed-reduction data in comparison to real-world data
- Driver attitudes toward the utility of CMSs
- The efficacy and efficiency of Mn/DOT’s Regional Transportation Management Center management of CMS deployments

## What Did We Do?

This study assessed the behavior and opinions of 120 licensed drivers from three age groups (18 to 24, 32 to 47 and 55 to 65 years) consisting of 40 participants each. Researchers used a computer-based driving simulator to conduct two experiments on driver responses to CMSs that were directly comparable to experiments in Phase I. They supplemented these findings using a survey to assess whether drivers think it is useful to have traffic-related information presented on CMSs. They then conducted observations at RTMC focusing on the decision-making processes involved when traffic-related CMS messages are deployed.

In the simulation experiments, each participant sat in a driving simulator consisting of an automotive-style seat for the driver facing a bank of three 17-inch CRT monitors, which displayed a virtual environment consisting of a four-lane freeway. Participants drove for approximately 20 miles on the simulated roadway in low-level traffic. In the first experiment, participants encountered a time-critical, site-specific CMS message

*“This study provided valuable information to validate our operating procedures, the way we structured the new messages and the fact that the content of the CMS messages is more important than their location.”*

–**Todd Kramasz**,  
Operations Supervisor,  
Traffic Operations  
Section, Mn/DOT Re-  
gional Transportation  
Management Center

*“The empirical data shows that when you design message content that drivers will more easily understand, they are more likely to respond appropriately.”*

–**Kathleen A. Harder**,  
Senior Research  
Associate, University of  
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This is a typical view of the simulated environment that participants saw on their center display. In this case, a site-specific, time-critical message advises participants to take an exit.

advising them to leave the freeway at a specific exit. In the second experiment, participants encountered a time-critical, non-site-specific CMS displaying an “abducted child” message. Phase II messages were more clearly worded and less complex than those used in Phase I.

## What Did We Learn?

Researchers learned that:

- Clarifying the content of CMS messages led to a correct response from significantly more participants (for site-specific messages, 93.3 percent in Phase II compared with 55.8 percent in Phase I; for non-site-specific alerts, 71.7 percent for the abducted child message in Phase II compared with 8.3 percent for the Amber alert message in Phase I).
- Drivers may reduce speed as they approach CMS messages in free-flow conditions, but are probably less likely to need to reduce speed in the typically lower speeds of congested traffic.
- Real-world data were limited, but consistent with the suggestion that deploying CMS messages can lead to slower driving speeds in real-world driving.
- Drivers thought that using CMS displays to present information about traffic problems and roadway maintenance schedules was very useful, and that display of travel time information was useful. Their responses to safety messages on CMS displays were mixed.
- Current RTMC decision-making processes are sound and efficient: Operators responded to incidents quickly and managed them effectively.

## What's Next?

As new technologies are developed, CMSs will continue to be enhanced, and newer devices will require testing. Apart from studying the effects of CMSs using new technologies, there is a need for a more granular study of various messaging possibilities to identify the safest and most effective ways to inform drivers of roadway conditions and other information. Such studies could yield a knowledge base of driver responses to various CMS messages, leading to an increased level of safety on state and national roads.

*This Technical Summary pertains to Report 2008-27, “The Effectiveness and Safety of Traffic and Non-Traffic Related Messages Presented on Changeable Message Signs—Phase II,” published August 2008. The full report can be accessed at <http://www.lrrb.org/PDF/200827.pdf>.*