



RESEARCH SERVICES

OFFICE OF POLICY ANALYSIS,
RESEARCH & INNOVATION

TECHNICAL SUMMARY

Technical Liaison:

Cassandra Isackson, Mn/DOT
cassandra.isackson@state.mn.us

Administrative Liaison:

Dan Warzala, Mn/DOT
dan.warzala@state.mn.us

Principal Investigator:

Kathleen Harder, University of Minnesota

PROJECT COST:

\$99,500



The driving simulator console had three 17-inch CRTs, a steering wheel and pedals, and an automobile seat. Speakers behind the CRTs simulated engine noise.

Using Dual-Phase Message Signs to Display Airline Information

Researchers used a driving simulator to compare the use of overhead dual-phase to multiple static changeable message signs for effectiveness in conveying airline information to drivers approaching the Minneapolis-St. Paul Airport by highway, and found that the two methods were equally effective.

What Was the Need?

Changeable Message Signs are electronic traffic signs that can be programmed to display important messages that vary according to current roadway conditions, including the presence of traffic congestion and accidents. CMSs can also be used to display messages that are too long to fit on a single static sign. A “dual-phase” CMS divides a long message into shorter messages displayed sequentially in phases lasting a certain number of seconds.

Conveying a large amount of information is often achieved by displaying static signs at short distances from each other, but the limited length of a highway segment may make this unfeasible. The approach to the Minneapolis-St. Paul International Airport includes a large number of road signs in a relatively short distance. Unfortunately, while these signs inform travelers of where to exit to reach one of two terminals, the signs do not show which airlines are present at these terminals. Travelers who know only the name of their airline may arrive at the wrong terminal and—because the two terminals do not share a roadway within the airport—have to return to the highway to reach the correct terminal.

The Metropolitan Airport Commission and the Minnesota Department of Transportation plan to remedy this problem by displaying airline names on signs, but would like to do so without increasing the already large number of static signs along the highway approaches. Dual-phase CMSs appear to be a promising solution for displaying the nine airline names serviced by the airport’s Lindbergh Terminal (Terminal 1) without the use of multiple signs, but research was needed to demonstrate the effectiveness of these signs in conveying information to drivers and leading them to the right terminal.

What Was Our Goal?

The objective of this study was to conduct a driving simulation experiment to determine whether messages displayed on dual-phase CMSs are as effective in influencing driving behavior as messages displayed on static CMSs.

What Did We Do?

Researchers tested driver responses using a driving simulator consisting of an automobile-styled seat facing a bank of three 17-inch CRT monitors that displayed a virtual six-lane divided highway with a speed limit of 60 mph.

In the experiment, 120 participants were divided into two groups of 60 each; one group was assigned to a scenario using a dual-phase CMS and the other group, a scenario in which two static CMSs were located 500 feet apart. Researchers asked participants to drive as they normally would along the highway to find the airport and the correct terminal for an assigned airline. They then recorded whether drivers had taken the correct exits to their terminals as well as whether CMSs caused them to reduce their driving speeds.

The 60 participants assigned to each scenario included 10 males and 10 females from

“This project provided strong evidence that dual-phase Changeable Message Signs will be just as effective in conveying airline information to travelers approaching the Minneapolis-St. Paul International Airport as successive static signs.”

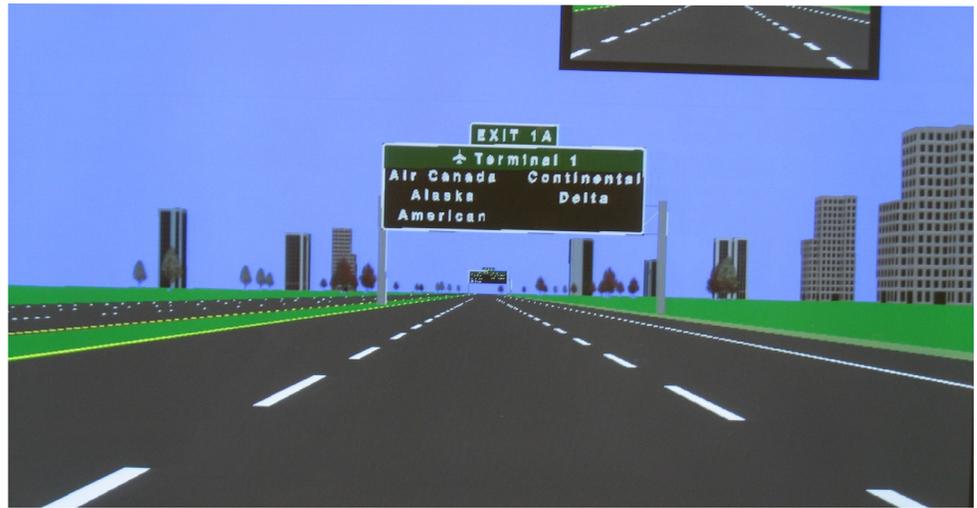
–Kathleen Harder,
Director, University of Minnesota’s Center for Design in Health

“We found that dual-phase messages are far more effective at conveying information than DOTs previously thought. This study could have wide applicability to other areas, such as urban highway segments that are congested with signs.”

–Cassandra Isackson,
Assistant State Traffic Engineer, Mn/DOT Traffic Engineering Section

Produced by CTC & Associates for:

Minnesota Department
of Transportation
Research Services Section
MS 330, First Floor
395 John Ireland Blvd.
St. Paul, MN 55155-1899
(651) 366-3780
www.research.dot.state.mn.us



The first of two signs displaying airlines serviced by Terminal 1 were presented to participants in the static scenario 800 feet after a sign informing them that they were approaching the airport.

each of three age groups: 18 to 24 years, 32 to 47 years and 55 to 65 years. Each participant performed the test twice, using the same scenario each time.

What Did We Learn?

Results showed that the performance of drivers did not vary significantly between dual-phase CMS and static CMS scenarios. In both cases, 89.6 percent of participants took the correct exit. There was also no statistically significant difference in the average speed of the participants in the dual-phase and static CMS scenarios, or in the magnitude of drivers’ speed reduction as they approached signs. About the same number of participants in each group reduced their speed by at least 2 mph in response to the signs.

Researchers concluded that displaying airline information on a dual-phase CMS is as effective at influencing driving behavior as displaying the same information on two successive static CMSs. There was no evidence to suggest that a dual-phase CMS should not be used instead of two static CMSs.

What’s Next?

Because many interstates are running out of room for static signs on segments that run through urban areas, this study can be applied more broadly to these cases. Currently, some static signs on these segments may be placed closer to each other than would be optimally effective in conveying information to travelers, especially older drivers, who are a rapidly increasing percentage of the driving population. More research is needed into the effect that the spacing and quantity of signage has on its effectiveness, and to determine the role of dual-phase CMSs as a remedy for this problem. Mn/DOT currently is engaged in a number of related projects, including the development of a manual of practice for CMSs.