
Louisiana Transportation Research Center

Technical Assistance Report 17-01TA-SA

Traffic Safety Messages on Dynamic Message Signs (DMS)

by

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16. Abstract This technical assistance report investigated the existing state of practice across the nation for placing safety campaign messages on dynamic message signs (DMS) and reviewed relevant studies that documented any evidence of effectiveness in influencing driver behavior and providing a public safety benefit. The number of state transportation agencies posting safety messages on DMS has increased over the last few years and messages are typically focused on common dangerous behaviors such as drowsiness, distractions, aggression, alcohol or drug impairment, and unrestrained driving. Several states have started to display their state-specific number of traffic fatalities year-to-date on DMS. Several studies showed that there could be changes in driver behavior by posting safety messages on DMS; some also included small samples of traffic data analysis, which showed some speed changes when the drivers approached active DMS. Overall, the findings from this report support the use of DMS to disseminate highway safety messages. However, more research is needed to validate the perceptions noted in the surveys and more field studies are necessary to confirm long-term impacts of using DMS to convey safety messages about driver behavior and traffic safety.			
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May 2018

ABSTRACT

This technical assistance report investigated the existing state of practice across the nation for placing safety campaign messages on dynamic message signs (DMS) and reviewed relevant studies that documented any evidence of effectiveness in influencing driver behavior and providing a public safety benefit. The number of state transportation agencies posting safety messages on DMS has increased over the last few years and messages are typically focused on common dangerous behaviors such as drowsiness, distractions, aggression, alcohol or drug impairment, and unrestrained driving. Several states have started to display their state-specific number of traffic fatalities year-to-date on DMS. Several studies showed that there could be changes in driver behavior by posting safety messages on DMS; some also included small samples of traffic data analysis, which showed some speed changes when the drivers approached active DMS. Overall, the findings from this report support the use of DMS to disseminate highway safety messages. However, more research is needed to validate the perceptions noted in the surveys and more field studies are necessary to confirm long-term impacts of using DMS to convey safety messages about driver behavior and traffic safety.

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INTRODUCTION

An ongoing conversation among state transportation agencies is whether and how often to display safety messages on DMS. The Federal Highway Administration (FHWA) issued a policy memorandum on February 9, 2006, regarding messages on DMS, which allows driver safety focused messages to be displayed on a DMS. The memorandum recommends that messages should be kept current and relate to a specific campaign and the period of time that a specific message is displayed for a safety campaign should be limited to a few weeks.

More recently, dynamic message signs have been used as part of public campaigns to bring awareness to safe driving behavior and promote roadway safety. Messages are typically focused on five common dangerous behaviors: drowsiness, distractions, aggression, alcohol or drug impairment, and unrestrained driving. More recently, messages displayed have also included the state-specific number of traffic fatalities year-to-date.

The information in this report was collected at the request of the DOTD/Highway Safety Section and the Louisiana Highway Safety Commission to determine both the existing state of practice across the United States for placing safety campaign messages on dynamic message signs (DMS) and any evidence of effectiveness in influencing driver behavior and providing a public safety benefit.

OBJECTIVE AND SCOPE

The objective of this study was to review the literature to determine and document the existing state of practice for placing safety campaign messages on dynamic message signs (DMS) and any evidence of effectiveness in influencing driver behavior and providing a public safety benefit.

EXISTING STATE OF PRACTICE FOR PLACING SAFETY CAMPAIGN MESSAGES ON DMS

More state transportation agencies have started to post safety messages on DMS; however, the efforts differ from state to state. Some agencies post only messages that are part of a national safety/awareness campaign while others seek input from the motoring public about the content of the safety messages they post. Some agencies restrict the days and/or duration that safety messages are posted while others restrict their safety message posts to peak or non-peak travel times. Furthermore, several states have started to post their state-specific total number of traffic fatalities year-to-date in addition to safety messages. The section below provides a summary of DMS safety messaging related efforts found for several states, with the statement that the list provided is not comprehensive. The intention was to provide examples of what other states are doing.

- ***Arizona***
 - Began displaying unconventional safety messages on digital freeway signs (2016)
 - Launched a safety message contest to display winning messages (April 2017)

- ***Delaware***
 - Display safety messages related to distracted driving, speeding, drunken driving, seatbelt use, and fatalities according to statewide strategic safety plan
 - Recently, safety messages are displayed as witticisms to grab drivers' attention
 - An interactive map shows location of DMS and what messages are posted

- ***Florida*** (in Orlando area)
 - Safety messages shown in limited fashion. Campaign limited to 2 hours per day during off-peak hours for maximum duration of 2 weeks. Only six such events allowed per year
 - Safety messages posted to a selected group of DMS chosen by FDOT

- ***Illinois***
 - State Police and Division of Traffic Safety collaborate to create list of safety messages and PSAs for display (postings around holidays)
 - DMS three-phase message set displayed continuously in Chicago area: PSA/Safety messages, travel times, and count of highway-related deaths
 - Illinois tollway safety message contest — displayed three winner's submissions on the tollway overhead signs (2015)

- ***Iowa***
 - “Message Monday” program began as part of Zero Fatalities campaign (August 2013)
 - Display safety messages and current highway fatality count
 - Messages about general highway safety and five specific areas: buckle up, slow down, pay attention, be alert, and drive sober
 - As a public participation strategy, messages are solicited from the motoring public

- ***Massachusetts***
 - Contest held for humorous safety messages to be posted on electronic highway message boards (2014)

- ***Michigan***
 - *Toward Zero Deaths* statewide safety campaign intended to influence driver behavior and improve safety
 - Display the number of traffic fatalities on Michigan roadways year to date once per month, from February through mid-December, on various I, M, and US routes

- ***Missouri***
 - Started with standard safety messages like “BUCKLE UP” on digital message boards (2008)
 - Eventually started posting creative safety messages (April 2014)
 - Messages usually run monthly

- ***Minnesota***
 - “Message Monday” campaign launched as part of Towards Zero Deaths initiative (November 2016)
 - Signs displayed in Twin Cities during off-peak hours

- ***Nebraska***
 - Display “Friday Safety Messages” (weekly safety messages)
 - Display updated highway fatalities for the year
 - Began soliciting humorous messages from the public to post on Fridays (Feb 2017-May 2018)

- ***Nevada***
 - Began displaying statewide traffic fatalities on digital message boards, as well as safe driving tips and reminders as part of Nevada Strategic Highway Safety Plan (May 2013)

- “Click It or Ticket,” and “Over the Limit, Under Arrest”
- **Ohio**
 - Digital message boards rotate messages between: the year-to-date number of traffic fatalities and traffic safety messages such as “Drive Sober or Get Pulled Over” (2015)
- **Pennsylvania**
 - Approved safety messages displayed (prohibited during peak traffic times) during statewide safety campaign periods
 - PennDOT has formal guidance document: “Dynamic Message Sign Operating Standards”
- **Rhode Island**
 - Safety messages are displayed according to NHTSA’s Communications Calendar for safety campaigns
- **Tennessee**
 - Began annual dynamic message sign contest (2015). The latest DMS contest wrapped up in March 2017
 - First DOT in nation to display roadway fatality numbers on DMS
 - Safety messages displayed during off-peak travel times
 - Five highway safety categories: seat belt usage, impaired driving, distracted driving, speeding, and aggressive driving
- **Texas**
 - Started displaying the year-to-date number of traffic fatalities on more than 700 message signs one week every month, typically the third week of each month (August 2012)
 - Traffic safety messages displayed on limited basis with specific targeted campaign (“Click It or Ticket” and “Don’t Drink and Drive”)
 - Austin, TX - Contest for safety messages – winners announced in April 2017. Messages will be displayed on DMS along major roadways
- **Utah**
 - “Message Monday” campaign started as part of Zero Fatalities campaign (Summer 2015)
 - “Fatality Friday” lists the number of fatality-free days in the past week on Utah roads
 - Submission of variable message sign (VMS) messages is accepted from the public

- *Virginia*
 - The safety campaign should be less than two weeks and messages must clearly relate to the applicable campaign
 - Safety message should be limited in duration during daylight hours and should not be displayed during peak travel periods

LITERATURE REVIEW OF RELEVANT STUDIES

After analyzing the state of practice for using DMS to display public safety messages, a literature review was conducted to answer three questions: (1) does any evidence exist about the effectiveness of posting safety messages on DMS to effect driver behavior? (2) if so, can any conclusions be drawn about the effectiveness of posting safety messages on DMS as a behavior change strategy? and (3) were any negative impacts identified during the study of using DMS to promote safety messages?

To find answers to some of these concerns, a report released by the FHWA assessed the usefulness and effectiveness of safety and PSA messages on DMS using a survey-based perceptual study [1]. The surveys were conducted in four cities (Chicago, IL; Houston, TX; Orlando, FL; and Philadelphia, PA) from September 2013 through November 2013 and specifically addressed the types of safety and PSA messages for each city. The findings of the survey showed that most respondents do see the PSA messages on DMS while driving, indicate them as practical and functional if they were encountered often, and some indicate that they are more effective on DMS as compared to other media. The majority of respondents identified those messages with a more threatening connotation as having more impact on their driving behavior. Chicago respondents indicated that they would probably change their driving behaviors for messages with the largest impact on driving such as slowing down for work zones and emergency vehicles. Respondents from Orlando were most likely to change their driving behaviors for all safety and PSA messages, while the majority of Philadelphia respondents were in the “maybe” to “probably” range of changing driving behaviors. For Houston respondents, the messages with more assertive language such as “Drunk driving, over the limit, under arrest” or “100 deaths this year on Texas roads” would most likely change their driving behavior. Certain demographic factors also influenced drivers’ perceptions of these messages. For example, when the surveys were aggregated across all four cities, young male drivers, with lower incomes were less likely to consider the messages effective while older drivers and drivers with a higher education found safety and PSA messages on DMS to be effective. Some of the recommendations of this study are: careful examination of the assertive PSA messages in order to identify the impact on driver behavior, on-road examination of PSA that show monetary fines or crash statistics on driving, and awareness promotion of these messages among the young population.

A more recent study, released in 2016 by the U.S. Department of Transportation, Federal Highway Administration, and Transportation Management Center Pooled Fund Study, assessed the effectiveness and potential benefits of safety messages and PSAs on DMS in

rural areas by surveying frequent and infrequent travelers and truck drivers [2]. Information was collected from travelers in four study corridors—Kansas, Minnesota/Wisconsin, Missouri, and Nevada—to address questions related to safety awareness and PSA messages such as driver awareness, understanding, changes in driving behavior, and traveler opinions. The results showed that approximately 77% of survey respondents were aware of DMS and safety-related messages with infrequent travelers having the highest level of awareness, followed by frequent travelers. Regarding level of understanding, over 79% of respondents were able to correctly interpret the presented messages and 92% of respondents indicated that the messages displayed were understandable. Regarding the behavior changes, approximately 23% of survey respondents reported changing their driving behavior after seeing the messages in the study corridor, while 54% indicated that past safety campaign messages on DMS influenced them to change their driving. The survey data also indicated that a majority of respondents did not slow down to read the DMS messages. The study findings support the use of DMS to display PSA and safety messages in rural areas and majority of respondents think DMS are the best way to communicate these messages.

The Maryland State Highway Administration released a report that evaluated the impact of DMS traffic messages on traffic conditions, congestion, and safety risks [3]. The study investigated the effect of message display, removal, and switching between any two types of messages on traffic speeds over two consecutive five-minute periods for three types of messages: Danger/Warning (Type 1), Informative/Common Road Conditions (Type 2), and Regulatory/Non-Traffic-Related (Type 3). The findings from this analysis indicate that, in general, traffic speed is unaffected by message appearance, removal, or switching messages in the majority of cases. This study also determined the aggregate effects of message display on traffic speeds over 12 two-week periods for these three types of messages. The findings show that Type 1 messages have the largest effect on average traffic speeds. Type 2 messages caused average speeds to fall 4 mph below the overall average for periods with no messages. Type 3 messages had the smallest negative impact on average speed, with most of the cases presenting an increase in average speed when messages were displayed. The results indicate that no congestion is likely to occur due to DMS message display; however, other factors unaccounted for in this study, such as weather, need to be considered for the speed changes observed. The research team also performed a case study on I-95 in Maryland by doing statistical analyses on DMS characteristics, message types, weather conditions, and accidents in the area for a sample of 70 road segments. Analyses on displayed messages showed that among 50 accidents in the DMS impact and impact-adjacent areas, 11 accidents occurred while Type 1 messages were displayed, 22 occurred during displays of Type 2 messages, and 11 during displays of Type 3 messages, indicating that DMS do not have

significant adverse effects on drivers' operation and traffic safety. The findings from this study, focused on Maryland DMS, concluded that DMS can be an accurate, effective, and safe tool for disseminating real-time traffic messages.

A study done by the Virginia Transportation Research Council examined the effect of traffic flow by drivers' reactions to non-traffic messages as well as the impacts of existing message strategies on traffic diversions [4]. The performance measure used for analysis of the impacts of non-traffic messages was speed and it was compared for safety messages posted versus no messages. The analysis time was limited to two non-peak hours on one day when the "BUCKLE UP FOR SAFETY" message was posted. The findings of this study showed minimal impacts on traffic. However, this study investigated only a one-phase message during a short period of time.

Song et al. published a study that evaluated the impacts of DMS messages on highway traffic [5]. This study consisted of three approaches: a traffic data analysis near DMS along I-95 in Rhode Island (for the period June 1-14, 2007 when messages were displayed), a driving simulator test, and a driver questionnaire survey [5]. For the first approach, the messages displayed during the analysis time were all text-only messages and the traffic data were analyzed using 30-minute increments in two stages: initiating stage (30 minutes prior and first 30 minutes after the start of display) and ending stage (30 minutes prior to the end of display and 30 minutes after the end of display). The length of DMS display and the time of the day (rush hours and non-rush hours) as well as the average volume (vehicles per minute), average speed (km/h), and average vehicle range (m) were also employed in this analysis. The traffic data analysis observed speed variations of traffic regardless of the length of DMS display or time of the day, indicating that drivers slow down when approaching active DMS and speed up after they passed the DMS. In terms of average volume and headway distance, no significant difference was observed when comparing an active DMS with an inactive one; however, the headway distance decreased in initiating stage and increased in the ending stage analysis of active DMS. The driving simulation approach analyzed drivers' actual responses to two main factors: message category (danger warning, informative, and regulatory) and message type (graphic-aided message with full text, a graphic-aided message with partial text, and a text-only message). The results of the driving simulation indicated that participants in this experiment responded faster to danger warning messages, followed by informative and regulatory messages, as well as to graphic-aided messages with partial text, followed by full text messages, and graphic-aided messages with full text. The findings of the driver questionnaire surveys indicated that majority of responders would reduce speed when approaching a DMS displaying messages and they preferred text-only messages over

graphic-aided messages and two-frame message with more information over single-frame messages with less information.

Another study, sponsored by the California Department of Transportation, examined the effectiveness of using DMS for displaying safety campaign messages by looking at the public attentiveness on messages displayed, the safety benefits of displaying safety campaign messages, and interruption/slowdown of the traffic flow [6]. The research findings showed that driver inattention to DMS messages did not appear to be a significant problem among California drivers. Regarding the safety benefits, the research suggested that, when the public is familiar with and understands the messages displayed, positive safety effects may be derived from safety campaigns messages. Furthermore, findings showed that safety messages on DMS do not appear to cause major disruptions in overall traffic flow.

The findings from the ENTERPRISE Transportation Pooled Fund Study indicated that most of transportation agencies that have guidelines for prioritizing the DMS message types (only 13 agencies were reviewed in this group) prioritize incidents over safety messages [7]. For example, if the DMS displays safety messages and an incident occurs, this will override the safety message. This pooled fund study documented findings from a review of 17 transportation agencies DMS messaging (all types of messages not just safety) policy/guidelines as well as federal guidelines. The study also documented the findings from an online survey, obtained from 18 transportation agencies, which collected information on current and anticipated DMS messaging requests as well as on the process for accepting/rejecting/prioritizing these requests.

In summary, seven DMS related studies were identified and reviewed for this report. Six of the studies examined the effectiveness of safety messages on DMS on some level so our first question was answered in the affirmative. Regarding the second question, findings indicate that the use of DMS for displaying public safety messages is considered practical and functional. Further, the displaying of public safety messages has proven to have at least some level of positive effect on drivers' behavior. DMS was concluded to be an effective tool for communicating public safety messages, based on these results. Finally, the question about adverse impacts was answered with conclusions that are minimal at best. Of the four studies that looked at the impact of DMS on traffic conditions, there was either no or minimal effect on speed variations.

CONCLUSIONS

The objective of this study was to determine and document the existing state of practice in the U.S. for placing safety campaign messages on DMS and review the literature for any evidence of effectiveness in influencing driver behavior and providing a public safety benefit. The number of transportation agencies posting safety and PSA messages on DMS has increased in recent years, though efforts differ from state to state. Messages displayed are typically focused on behaviors such as drowsiness, distractions, aggression, alcohol or drug impairment, and unrestrained driving. It was found that some states post only messages that are part of a national safety/awareness campaign, while others seek input from the public in the safety messages they post. Some agencies restrict the days and/or duration that safety messages are posted while other restrict their safety message posts to peak or non-peak travel times. Furthermore, several states have started to display the number of traffic fatalities year-to-date on their DMS.

The findings from this literature review support the use of DMS to disseminate safety messages and indicate that DMS do not have significant adverse effects on traffic safety. The studies showed that there could be changes in driver behavior by posting safety messages on DMS. The results gathered from the studies reviewed in this report suggest that posting DMS messages with informative, text-only messages with assertive and cautionary language may be read and processed best.

With almost half of the states in the country regularly posting public safety messages on DMS and 10 of those states going so far as to solicit messages from the public, it is our conclusion that the evidence to support the use of DMS to post public safety messages exists in abundance.

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

DMS	Dynamic Message Signs
DOTD	Louisiana Department of Transportation and Development
FHWA	Federal Highway Administration
LTRC	Louisiana Transportation Research Center
PSA	Public Service Announcements
VMS	Variable Message Signs

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