



Final Report

***AMBER, EMERGENCY, AND TRAVEL TIME
MESSAGING GUIDANCE FOR
TRANSPORTATION AGENCIES***

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**U.S. Department of Transportation
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Prepared by



Under contract to
**Battelle
505 King Avenue
Columbus, Ohio 43201**



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List of Acronyms

AMBER	America's Missing: Broadcast Emergency Response
AVI	Automatic Vehicle Identification
CMS	Changeable Message Signs
DMS	Dynamic Message Signs
DOT's	Departments of Transportation
EAS	Emergency Alert System
FHWA	Federal Highway Administration
ITS	Intelligent Transportation Systems
TMC	Transportation Management Center
VMS	Variable Message Signs
VSL	Variable Speed Limit

1 Introduction

1.1 Purpose of Study and Guidelines

Transportation officials constantly strive to achieve safe and efficient movement of people and goods. Many agencies across the nation are pooling their resources and collaborating to achieve these goals not just at the jurisdictional level, but also for entire regions. Best management practices in operations rely on this spirit of cooperation to proactively balance demand and capacity, while recognizing the dynamic and somewhat unpredictable nature of both.

Clearly, intelligent transportation systems (ITS) that harness computing and communications technologies to monitor transportation systems, support traffic management, and provide travel information services all in near real-time are key to successful operations. For example, changeable message signs (CMS) have become an established part of transportation agencies' traffic control "toolkit." While specific capabilities have been upgraded over the years to improve conspicuity, operational control, and cost effectiveness, the essential functionality of CMS has been, and continues to be, to convey timely and important en-route and roadside information to motorists and travelers.

For nearly forty years, transportation agencies have developed various policies regarding the use of the CMS. The Federal Highway Administration (FHWA) has provided policy guidance on several occasions in recent years regarding appropriate uses of CMS.¹ However, this previous guidance has been more focused on acceptable uses, rather than operational guidance. Consequently, operational practices across the nation vary, based on locally identified needs and procedures.

FHWA has undertaken the current study to develop guidance to provide assistance and direction to transportation officials in planning, designing, and providing various types of traveler information messages using CMS. Specifically, these guidelines address messaging for travel time information, emergency or security warnings, and child abduction (AMBER) alerts.

This document reports on the findings of interviews with a number of representatives from State Departments of Transportation (DOT's) and FHWA Division Offices across the country.

1.2 Definitions

For the purposes of these guidelines, a CMS is defined as a sign capable of displaying an electronic message, using multiple lines (and often multiple pages) of messaging. Such messaging can be varied using a pre-set library of messages, tailored to suit particular conditions, or left blank. Typically a CMS is capable of displaying real time information, and is fully controllable by an operator in a transportation management center (TMC).

The term CMS is often used interchangeably with variable message signs (VMS) and dynamic message signs (DMS). VMS and DMS may include other types of signs capable of displaying set messages that are effectively a part of the sign, e.g. a rotating 'drum' type

¹This subject is discussed in detail in section 2.1.

sign, or signs that can vary between a set message (or instruction) and a blank message, e.g. a time-based traffic restriction. A specific variation of VMS/DMS is a variable speed limit (VSL) sign, which displays varying locally defined speed limit information that reflects prevailing traffic conditions.

In this report, “travel time information” refers to a broad range of messaging that may include actual, estimated or predicted travel times and delays. The term “page” is used to refer to the number of screens used to relay one message. This term is interchangeable with “panel,” “phase,” and “scroll.”

These guidelines apply only to the use of CMS, as defined above, and not to VMS, DMS, or VSL.

1.3 Extent of Use of CMS

According to the ITS Deployment Tracking database (2002 Survey Results), accessible on the internet at <http://itsdeployment2.ed.ornl.gov/its2002/default.asp>, the current deployment of CMS is as follows:

- 2744 permanent freeway CMS deployed by 86 agencies in 71 metropolitan areas
- 694 portable freeway CMS deployed by 68 agencies in 60 metropolitan areas

Among the 86 agencies that have permanent and 68 agencies that have portable freeway CMS deployed in metropolitan areas, there is a considerable difference in the scale of CMS deployments. The largest are Virginia DOT with 200 permanent CMS in the Washington D.C. metropolitan area and New Jersey DOT with 50 portable freeway CMS in the New York, NY/Northern New Jersey/Southwestern Connecticut region. The smallest are Ohio DOT, District 12 with 1 permanent CMS in the Cleveland/Akron/Lorain metropolitan area and North Carolina DOT with 1 portable freeway CMS in the Greensboro/Winston-Salem/High Point, NC metro area.

2 Problem Statement

While the absolute number of signs is important from a traffic management standpoint, what is of greater importance for these guidelines is the number of agencies with such deployments in place, or in planning. This is because of the potential for widely varying operational policies and practices to develop, leading to inconsistent approaches to messaging by adjacent agencies when addressing similar (or even the same) situations.

This potential problem of inconsistency is exacerbated by a number of relatively new applications for messaging, e.g. travel time information, emergency or security warnings, and AMBER alerts, for which a new pool of operational experience and best practice is slowly developing in a relatively small number of agencies and locations. FHWA recognizes there is value in capturing lessons learned from around the country to obtain a better understanding of successful and unsuccessful experiences. During the process of interviewing representatives from DOT's, more than one interviewee identified the need and desire for guidelines in these areas. These experiences are the basis for the guidance contained in this document.

2.1 Previous Guidelines

The FHWA has provided policy guidance on the use of CMS as follows:

- January 2001, by sharing a memorandum in response to a question from Pennsylvania (www.fhwa.dot.gov/legregs/directives/policy/pame.htm),
- August 2002, regarding child abduction (AMBER) alert messages displayed on CMS (www.fhwa.dot.gov/legregs/directives/policy/ambermemo.htm),
- March 2003, regarding the posting of security-related messages on CMS (www.fhwa.dot.gov/legregs/directives/policy/securmemo.htm).

These guidance memoranda were intended to assist states in determining what was and what was not appropriate to display on their roadside CMS. Additionally, the TMC Pooled Fund Study (<http://tmcdfs.ops.fhwa.dot.gov>) has conducted a number of projects related to TMC operations; including “Changeable Message Sign Operation & Messaging” that directly relates to the creation of CMS messages.

In the context of AMBER alert messages, it is noted that State DOT’s use the officially established procedures within the State to receive child abduction notices, whether this be through the Emergency Alert System (EAS) or through official law enforcement channels. The development of such procedures is specific to circumstances pertaining to each state, and consequently is not addressed by this document.

2.2 Issues Related to Messaging

There are three primary issues related to messaging that will be addressed by these guidelines:

- The basis for the message, i.e. what condition is occurring? What segment or region is impacted? What outcome or driver response is desired?
- How the content was determined, i.e. how is the message structured to maximize driver comprehension? Is the message aimed at commuters, unfamiliar drivers, or other groups? Is the content automated or put together by a TMC operator? How is the message coordinated with other information dissemination techniques, e.g. 511?
- What policies govern the display of messages, i.e. whose authority is needed to initiate a message? What are the arrangements for posting, updating, and terminating a message? What is the process for inter-agency coordination (especially with non-transportation agencies)? How are messages prioritized during periods when multiple messages are desired? How are 24/7 operations ensured?

3 Context for the Guidelines

3.1 Trends Influencing Use

In the past few years, ITS technologies and their role in operations have matured to such an extent that their value for transportation and non-transportation needs now extends beyond that originally envisioned:

- In cities such as Atlanta, CMS are routinely used to provide travel time information on an upcoming section of freeway and alternative freeway sections. Similarly in Orlando, the iFlorida model deployment will provide motorists with travel time

information between points A and B on alternative routes, thereby presenting motorists with objective information on which to base a decision about which route to choose.

- Immediately following the 9/11 terror attacks, CMS were used to provide travel information related to the emergency in an attempt to steer travelers away from the most affected areas and to provide related news, e.g. airport closures. With the continued (and fluctuating) awareness of homeland security, particularly at the High (orange) threat advisory level, states such as Virginia and Maryland use CMS to provide tip-line contact information.
- Perhaps the single application that has most captured the public attention, however, is the use of CMS to provide information related to stranger-child abductions, otherwise referred to as AMBER Alerts². Given statistics that indicate that 91 percent of stranger abducted children are murdered in the first 24 hours after their abduction (44 percent in the first hour), time is not just of the essence but a matter of life or death. The use of CMS in this way has been credited with the capture of the abductor and successful recovery of the abducted child(ren.)

It is recognized that there are several other applications for CMS messaging such as intermodal/multimodal messages in support of transit, incidents, special events, and work zone closures. However, the purpose of this report is to focus solely on best practices and guidance associated with the three applications listed above.

3.2 Parallel Activities

Apart from the guidelines that are being documented in this report, there are other related activities that are underway in parallel, most notably by the Texas Transportation Institute (TTI) on behalf of FHWA. The TTI work is investigating human factors issues related to the construction of messages for display on CMS, in the same general context as for these guidelines, i.e. travel times, homeland security/emergencies, and AMBER Alerts. Neither of the two efforts is duplicative, as each is investigating different aspects of the subject. To the extent that this study is scanning the state of practice across the nation, and subject to deliverable deadlines, these guidelines are supportive of the TTI effort.

4 Technical Approach

The study is divided into three tasks:

- 1) Literature/Background Review
- 2) “Scan” of the Practice
- 3) Best Practices / Lessons Learned

² AMBER is an acronym for America’s Missing: Broadcast Emergency Response. However, it is named after Amber Hagerman, a nine-year-old from Arlington, Texas, who was abducted and murdered in 1996. In response to community concern following this tragedy, the Association of Radio Managers with the assistance of area law enforcement in Arlington, Texas, created the “Amber Plan.” The Plan uses the Emergency Alert System (EAS), formerly the Emergency Broadcast System, to report serious child abduction cases.

The overall approach is research-based, using published sources and direct interviews. In addition, there is a degree of interaction with the TTI study referenced above.

This report provides a summary of findings from individual states, based on information provided by FHWA Division Office staff, interviews with state DOT representatives with direct operational experiences associated with CMS messaging, and other incidental information derived since the commencement of the study, including:

- National Training Conference on AMBER Alert
- Travel Time Workshop held at the 2003 ITS America Conference

Appendix A summarizes information provided by FHWA Division Office staff and state DOT representatives. In many of the selected states, multiple individuals were selected for interview to ensure that a broad range of application- or location-specific experiences were captured. Typically, the survey instrument was provided to the interviewees ahead of time, and interviews were conducted by telephone. The survey instrument is provided in Appendix B. Interview responses are provided in Appendix C. Appendix D contains a database that lists detail information on the literature sources including the type of document, the title of the document, web site link where its available, source of the document, date published, author, and a brief summary (if available).

5 Scan of the Practice

A scan of the practice was conducted via a series of interviews with representatives from DOT's and Division offices of the FHWA. This section summarizes the results of the interviews. The discussion covers the three focus topics - travel times, homeland security and AMBER Alerts - as well as a section covering general practical concerns. Each topic includes a discussion of sign and message readability; message construction; the differences between messages posted to portable vs. permanent CMS; and any costs and benefits reported from states using CMS.

It should be noted that the sections of this report that deal with homeland security are much more brief than are other sections. In the course of interviews for this research, very few states or jurisdictions reported using CMS for any activity related to homeland security or emergencies of that nature, and those that did use CMS for this purpose used them rarely.

5.1 Travel Times

5.1.1 Process and Operations

Traveler information systems that incorporate as much automation as possible can help agencies optimize the use of valuable resources. The use of CMS for travel times is no exception. The calculation and presentation of travel times is generally automated. In all jurisdictions reporting the use of CMS for travel times, the information is posted during morning and evening peak travel times. The system is generally timed to begin and end at a certain time of day, but some states require a TMC operator to "turn on" and "turn off" the system manually.

CMS display information gathered from a variety of means including loop detectors, video detection systems, automatic vehicle identification (AVI) transponders, and toll tags. An algorithm applied to field devices calculates the distance covered to determine the

estimated travel times from a CMS to specific destination, usually a major intersection and/or interchange, or in the case of toll tags, from one toll plaza to the next downstream toll plaza. While most travel times are calculated automatically, one district reported a program where a pilot car drove the length of a segment, and physically called the travel time into the TMC. This method of gathering travel times was deemed cost prohibitive and too time-intensive. Jurisdictions that have gone from manual calculation to automated report positive feedback.

There are regions that are planning to implement static signs with a CMS insert panel, providing the motorist a static line of text referring to an upcoming intersection, with a live CMS panel that changes according to the automated data being fed to the sign, as illustrated in Figure 1 below.



Figure 1. Static Travel Time Sign

Some states that do not post travel times do provide to the motorist an estimated delay in minutes from one point or origin to destination. This feature tends to be available at the entrance to tunnels. In one jurisdiction, an estimated delay time over 30 minutes will prompt operators at the TMC to enter information regarding alternate routes.

5.1.2 Messaging

Messages are constructed to be as short as possible while still conveying information pertinent to the motorist. To this end, many state DOT's have developed abbreviated message sets using standard wording and letters.

Most interviewees indicated that travel time messages should be kept to one panel, and that accuracy was perhaps the most important element of the message. Several respondents noted that if travel times do not change as per conditions, motorists will fail to trust the information and will ignore the signs.

The elements of travel time messages tend to be consistent from day to day, so the traveler can come to expect to see information on a given segment. A traveler that can anticipate some elements of the message can essentially skip over those elements, taking less time to read the information that changes.

Most interviewees considered it a forgone conclusion that travel time information must be geared toward the local daily commuter. Illinois DOT, for example, has been providing travel times to the public for over 40 years via local media, however the posting of travel times on CMS is relatively new. IDOT's CMS display provides the following information:

estimated travel time on the first line and destination on the second line, as illustrated below:

8 – 10 MINS
TO DOWNTOWN

IDOT is preparing to upgrade the display of travel times on CMS by adding a second destination to the message, allowing for motorists to get information on two destination points.

Georgia has dealt with the perceived restriction of providing travel times by simply adding a mileage indicator along with travel times to a downstream destination. A travel time message into Atlanta may read:

TRAVEL TIME
TO DOWNTOWN / 7 MILES
8 – 10 MINS

The difference to a motorist unfamiliar with the region is significant. With this additional information, even an unfamiliar motorist can derive value from a travel time message by estimating the average speed based on the travel time to a point a certain mileage ahead.

5.1.3 Policies and Practices

Policies and practices refer to the rules applied regarding when to post, update and remove travel time messages.

The policies governing the posting and removal of travel time messages rely mostly on automation. Jurisdictions that post travel times do so at a given time every morning and afternoon. The update of messages is handled automatically via the algorithm that calculates the travel time from data coming in from field devices.

Travel time and delay messages are considered to be valuable information and an efficient use of CMS *in the absence of adverse traffic incidents or events*. In this manner, travel times (or delays) not only give the estimated time between a CMS and a point downstream; the presence of the travel time information gives the implicit message that there are no adverse conditions affecting traffic.

5.2 Homeland Security and Related Emergencies

5.2.1 Process and Operations

The use of CMS for homeland security or other emergencies of this nature is limited. There is a general consensus that CMS have been deployed to provide information regarding traffic conditions to the public, and messages related to homeland security that do not refer to anything traffic-related don't fit this mold. AMBER Alerts are widely recognized as the acceptable exception to this rule; homeland security messages are not generally considered a viable exception.

When CMS are used for homeland security, the number of signs deployed is generally fewer than it is for other purposes. Maryland State Highway Authority, for example,

reports that during the two times CMS were used for this purpose, the Authority tried to use CMS that were at least 5 miles apart.

The paucity of information contained in this report regarding the use of CMS for homeland security and related emergencies can be summed up by the perspective expressed in Washington State. DOT professionals in that state stated that the Washington DOT policy is to use CMS for events on the roadway. Only if an event regarding homeland security had an effect on the roadway; i.e. closed a road or a lane, would that information be appropriate to post on CMS.

5.2.2 Messaging

In Maryland, Virginia and New York, CMS have been used to post a terrorist information tip-line, along with the homeland security threat level color, and motorists asked to call with any terrorist-related information. Virginia has reported using CMS for homeland security twice in the past twelve months, when the national threat level has been raised to orange. Respondents from New York's State DOT report being ordered to post a terrorist information tip-line on their CMS.

Outside of these east coast states, CMS is documented to have been used in only a few instances, such as near urban airports, where CMS were used to advise travelers that there would be vehicle inspections during times of elevated terrorist alerts.

As with the use of CMS for other purposes, there is emphasis on keeping the message as short as possible. Maryland State Highway Authority reports trying to use only one panel for any message relating to homeland security. Mandated by the Governor to post a tip-line after the September 11th attacks, CMS during this time provided motorists a 1-800 number to contact.

5.2.3 Policies and Practices

Policies and practices regarding the use of CMS for homeland security and related emergencies is still new, and information regarding policies and practices is still emerging.

The decision to post a message is in many cases handled by one agency, usually the state police or similar law enforcement agency. Departments of transportation are only the conduit through which homeland security messages are given. Messages are received from state offices of homeland security.

5.3 AMBER Alerts

5.3.1 Process and Operations

Initiation of AMBER Alerts always rest with an emergency management or law enforcement agency such as State Police, or Office of Emergency Management (OEM). Information to post, update and remove alerts often comes via fax to the DOT, or via local methods of using the EAS. Discretion on the part of TMC staff is not a relevant issue; the only free text in an AMBER Alert is the details; e.g. make and model of car, and tag number. Some jurisdictions have a programmed list of preplanned scenarios; templates into which an operator has only to insert the details relevant to the particular situation. Other DOT's receive instruction on how exactly to structure the entire message.

5.3.2 Messaging

There is significant variety in the actual text displayed on CMS during an AMBER Alert. Not only are the variations apparent from state to state, but many states are refining their own policies and display messages differently from one Alert to the next.

The amount of information available to law enforcement, and by extension the DOT, can vary, and therefore make standardization a challenge. The TMC operators at Washington State Department of Transportation, moving ahead on only the information they had, posted the following message:

AMBER ALERT
CALL 911

This was widely seen as a failure, as there was no specific information such as vehicle description or tag number to help locate the vehicle involved, and many motorists were not yet familiar with AMBER Alerts. The jurisdiction's 911 dispatch center was inundated with calls from confused motorists.

While a vehicle description is generally part of the text displayed during an AMBER Alert, there is disagreement regarding the posting of entire vehicle license plate numbers. Some jurisdictions consider that a license plate number is too much information for a motorist to absorb while driving at freeway speeds, and instead prefer to advise motorists to tune to local news radio to obtain more information. Others consider that to post a vehicle description without license plate number may contribute to vigilante behavior on the part of a motorist who sees a vehicle matching the description. (This is a supposition that is not supported by any evidence of actual vigilante behavior.) One respondent at Texas Department of Transportation noted that if a vehicle description is posted without an identifying tag number, it's possible a motorist may report seeing a child who is upset, but not in any danger, inside a vehicle matching the description. In Southern California, emphasis is placed on displaying the *state* of the license plate of a vehicle involved in an AMBER Alert rather than a long string of digits, which Caltrans District 12 considers motorists cannot remember.

The order of information given in different jurisdictions is more similar than dissimilar. Most respondents indicated that three lines are generally used to convey an AMBER Alert, and the order tends to be: general category of information on the top line, vehicle information on the second line, and desired motorist response on the third line. Two pages are most often used to convey all information pertinent to the alert. Examples of wording include:

(Page I)
CHILD ABDUCTION
RED FORD
CALL 911

(Page II)
CHILD ABDUCTION
LIC # ABC 123
CALL 911

One state indicated that they do not use the term “AMBER Alert” on their CMS, for fear that motorists will confuse the text with a change in the national security threat level. This state instead posts “CHILD ABDUCTION” on the first line of CMS during an AMBER Alert.

5.3.3 Policies and Practices

Policies regarding the posting, updating and removal of AMBER Alerts are generally not the domain of DOT's. The role of the DOT in providing AMBER Alerts is widely accepted as supplementary; they take the information, put it out to the public via CMS and instruct motorists to respond accordingly, e.g. call 911 or another abbreviated phone number, or tune to local media for detailed information.

The amount of time an AMBER Alert remains active differs greatly. Some DOT's keep an AMBER Alert on CMS for a set amount of time, usually between 3 and 8 hours. NYSDOT specifies in their policy that alerts be kept on CMS for 8 hours from the time of initiation, and that time be extended whenever an update to the alert is provided. One Caltrans district has a policy providing for the removal of an Alert within one hour if it occurs during rush hour, 4 hours during non-peak. This policy is in direct contrast to the practice of some DOT's of waiting for the managing law enforcement agency to advise the DOT to remove the information.

Caltrans District 7 in Los Angeles adjusted their policy regarding the posting of AMBER Alerts after it was shown that Alerts posted during peak travel hours caused unnecessary congestion. Therefore, the district currently has a policy of not displaying AMBER Alerts during peak hours. After the peak hours are over, any active AMBER Alerts are then posted to CMS.

5.4 General

5.4.1 Sign and Message Readability

Although not the focus of this report, for the purposes of completeness, some attention was given to issues of general readability, including horizontal and vertical locations, design speed, and traffic speed, as well as size and number of characters, and number of pages.

Guidelines regarding sign readability in some states call for a minimum of 900 feet of visibility, which translates to 8.8 seconds of viewing time at 70 mph or 11 seconds at 55 mph. One rule of thumb in practice when using CMS: there should be a minimum exposure time of at least two seconds per line. Arizona State University studied the legibility of various CMS in the Phoenix area and concluded that fiber optic CMS have an average legibility of approximately 835 feet. Subtracting 150 feet due to vehicle cut-off, where the sign is hidden to the driver due to the roof of the vehicle as the vehicle approaches the CMS, this leaves an average reading distance of 685 feet. Thus, motorists have approximately six seconds to comprehend a CMS message at 75 mph, or seven seconds at 65 mph.³

³ Coylar, James and Tim Wolfe, “Displaying Travel Time Messages on Freeway Variable Message Signs in the Phoenix Metropolitan Area.” Paper presented at the 2004 ITS America Annual Meeting.

In the states studied the lines per page range from 2 - 3 lines; characters per line from 16 – 28; and from 10 to 18 inches per character. Most signs are capable of using two pages; some signs can display even four consecutive pages; but many states insist that more than one page is not safe to display to drivers traveling at freeway speeds. Some signs are capable of providing more elaborate presentations: different fonts, flashing, centering, or justifying text right or left.

5.4.2 Message Construction

Message construction refers to standard words and phrases and abbreviations.

There is little variability in the area of message construction. Word and phrase libraries tend to be relatively similar; the notable differences occur in the formality of the message structure. Message construction in some DOT's follows a specific outlined convention, for example:

1. State the problem being addressed
2. Describe the location
3. Define the recommended motorist action or effect

A balance is sought between the impact of these three elements. If one of these elements is overemphasized, the end result is that others may be neglected, or messages become too long or complex. Additionally, consistency in style and order allows the motorist to anticipate the message and allows them to focus on the element line that is of most importance to them. When more than one page is available, messages are still often constructed to fit within one page to maximize readability.

5.4.3 Permanent vs. Portable CMS

Message construction is generally different between permanent and portable CMS. Portable signs are generally smaller and able to handle fewer characters per line. Portable signs tend to accommodate 2 lines of text while freeway signs tend to accommodate 3 lines. At Arizona Department of Transportation (ADOT), for example, freeway CMS are 3-line, 18 characters per line. Portable CMS are 3-line, 10 characters per line. Messages are tailored to be displayed in two pages whenever possible.

The type of information displayed is another difference between the two types of signs. In general, only permanent CMS provide travel times, because portable message signs don't have the capability to handle full travel time messages. Guidelines in many states stress the point that portable CMS are not to be used in place of conventional signs and pavement markings. Portable CMS should be used only when some response or decision by the driver is desired. While AMBER Alert messages are generally posted either on all permanent CMS or within a specified radius, posting of AMBER Alerts on portable CMS tends to be at the discretion of the TMC supervisor on duty.

5.5 Uses and Benefits

5.5.1 Frequency of Use

The frequency of use of CMS is a significant and widely discussed issue. Contradictory attitudes exist regarding CMS frequency of use. On one hand, transportation officials consider that the use of CMS should be rare and retain the ability to get a driver's attention; if there is text on the CMS, there are unusual conditions occurring. On the other hand,

feedback to many DOT's suggests that the traveling public doesn't like to see the signs remain blank, as it gives the impression that the signs are nothing more than a rarely-used expensive toy. Section 6.5.3 elaborates on this point.

5.5.2 Outcomes

Travel time information, when it is accurate and dynamically updated, is well received by the driving public. The posting of this information provides local travelers with the information necessary to choose an alternate route when appropriate, thereby contributing to the effective management of urban congestion.

The overall response to AMBER Alerts is consistently positive nationwide. The public sees the use of CMS for AMBER Alerts as a very valuable use of the equipment. Texas, Georgia and California have all experienced positive outcomes to AMBER Alerts, with California experiencing a high visibility success with the safe return of two female teenagers who had been abducted by a stranger. Many states claim that as of the implementation of an AMBER Alert plan, every alert has resulted in the safe return of the abducted child.

Regarding the use of CMS to alert airport-bound drivers to an increase in security, the general opinions of respondents indicates that the information serves to calm motorists who might otherwise be surprised and angry at the increased wait time getting to the airport.

5.5.3 Feedback on Driver Response and Perceptions

Feedback on the use of CMS for travel times and AMBER Alerts is consistent. The majority of DOT and FHWA respondents report positive feedback on the display of travel times on CMS. Specifically, displaying travel times on CMS has alleviated public concerns that the message signs are never used.

New York representatives indicate that feedback is positive on the issue of the signs always having some message and never staying blank.

Negative feedback reported in the interviews includes public dissatisfaction with blank signs. The motoring public tends to be suspicious of CMS that are rarely, or according to some perception, never used. On the other hand, negative feedback has also been reported when CMS are used for generic messages such as "Drive Safely".

6 Best Practices and Lessons Learned

Drawing on the results of the interviews and literature review, several lessons learned from CMS operations practitioners emerge along with the best practices identified by the study team. These findings, described below, can serve as the basis for guidelines on CMS operations.

6.1 General

- ***Create a sense of urgency in order to convince drivers to comply*** – Experience of DOT's has shown that motorists don't respond as well to information given without a reason, e.g. "right lane closed." Giving the cause of the closure creates a greater sense of urgency and makes the motorist more likely to comply.

- ***Improve interstate coordination*** - Interstate coordination is typically an informal, un-standardized process. Some agencies utilize email to coordinate interstate CMS usage; some have contact numbers and make calls when the need arises. The process by which the controlling agencies communicate with each other should be standardized.
- ***Use paging conservatively*** – If a message requires more than one page, it is an important consideration that there be enough time for the traveler to read it.
- ***Aggressively maintain CMS*** – A CMS that doesn't benefit from regular maintenance, has non-operational bulbs, or a transformer that doesn't work consistently, appears to the public as an expensive toy.
- ***Coordinate the placement and use of CMS along a corridor*** – If more than one CMS is available upstream from an incident, the sign farthest from the incident should be used to provide advance warning, thereby allowing drivers sufficient time to divert from the route. The sign closer to the incident should be used to control traffic flow nearer the incident.
- ***Always work to build credible and useful information*** – The value of CMS's and the messages they display significantly influences their credibility.

6.2 Travel Times

- ***In new deployments, seek feedback from, and educate, the public before travel time messages are instituted*** – The experience of more than one DOT surveyed showed that a campaign of public awareness is critical in order for travel time messages to have an initial positive effect. In regions where the information is new, DOT's should expect that motorists would slow down to read the signs, since they are unfamiliar with the abbreviations used. An effort should be made to expose motorists to travel time messages, including background on how origin/destination pairs are chosen, before the messages are deployed on CMS. Seeking motorists' input on message forms and destinations will improve the ultimate quality of the service, enhancing the likelihood of a positive response when the service is deployed.
- ***Travel times must be dynamic*** – Travel times must reflect reality, or err on the conservative side. Stale travel times, or the same travel time during non-congestion periods could lead to credibility problems.
- ***Travel time messages can be structured to benefit more than the local traveler***- It is widely thought that travel time information is the distinct domain of the local commuter. Best practices in Atlanta illustrate how a simple upgrade to the information given will benefit the unfamiliar traveler without taking anything away from local motorists already used to the system. Simply, CMS signs should give information regarding how many miles ahead the destination is. Distance between sign and destination will allow for unfamiliar motorists to be able to calculate the approximate congestion delay ahead.
- ***Messages for travel time should be considered differently from emergency messages*** – It is important to consider the difference between travel time messages and those that announce an AMBER Alert or major event impacting travel. A well-designed message should be useful, easily understood, concise, and distinguishable from other message types. Also, rules of thumb used in calculating the time necessary for a motorist to read a CMS (approximately 1 second per word, excluding prepositions) can be extended somewhat when it is assumed that

motorists will quickly grow accustomed to reading daily (during weekdays) travel time messages.

- ***Travel times should not be simultaneously provided for both high occupancy vehicle (HOV) and general-purpose lanes on the same sign.*** – Providing a set of travel times for general-purpose lanes and HOV lanes is too much information for the motorist to absorb at once. Where signs have been dedicated for HOV facilities, the potential to provide HOV lane specific information should be explored. Where dedicated HOV lane CMS are not available, it may be possible to give the difference in travel times between the HOV and general-purpose lanes on the CMS over the general-purpose lanes.

6.3 Homeland Security and Related Emergencies

- ***Communicate clearly to the motorist the purpose of posting a message*** – Interviewees at New York State DOT report being asked by the State Office of Security to post a terrorism Tip-line along with the national threat level color. Motorists were confused as to the purpose and meaning of this message, and flooded the tip-line with calls. The message was removed the following day.
- ***Limit CMS use for homeland security to those situations that affect the motorist*** – The posting of an information hotline falls under the category of general information, and is not an appropriate use for CMS.

6.4 AMBER Alerts

- ***Standardize AMBER Alert messages*** – The actual wording of an AMBER Alert varies from state to state. While Texas CMS display “Kidnapped Child” on the first line during an AMBER Alert, others provide the first line “Child Abduction” and still other states write “AMBER Alert”. The recommendation is being made that the term “AMBER Alert” not be used on CMS, as there is no evidence to suggest that the term is widely recognized. In addition, there is a chance that motorists might confuse an AMBER Alert with something related to the color-coded homeland security alert system. Instead, the introductory line on CMS should give specific information, such as “Child Abduction.” The issue of the desired motorist response, e.g. to call 911, to call another abbreviated phone number, or to listen to local media, should be left up to the state agency issuing the alert, as the process differs from state to state and within states. Note: under circumstances where the size of CMS permits, wording such as “AMBER Child Abduction” or “AMBER Abduction” may be an acceptable alternative if the word “AMBER” is desired in the introductory line.
- ***Display license plate numbers*** – There is debate among transportation officials as to whether the posting of license plate numbers is necessary. There is a case to be made that a license plate number is too long for a motorist to absorb; even to read during the short time he or she has to take in the information. However, the arguments for displaying the number are stronger. AMBER Alerts will presumably always result in an increase in call volume to local 911 or police. Providing a description of a vehicle without an accompanying license plate number can be expected to result in a glut of useless calls reporting vehicles that fit the description. In addition, there is the possibility of vigilante behavior should a particularly well meaning but aggressive motorist spot a vehicle that fits the description and is transporting a child.

- ***Know and utilize accurately the purpose of CMS's role in an AMBER Alert*** – Is the purpose to give all pertinent information, or to alert the driver to tune to local radio, a 511 telephone service, etc.? If radio stations are partnered and get information, should that be the primary way to get information about the AMBER emergency?
- ***Where TMC operations are not 24/7, create standard agreements with a local emergency management agency that is 24/7 regarding who can have access to sign operations after hours***– For instance in rural locations, more than one agency should share control of sign operations, so that when a TMC shuts down, a responsible agency can post and remove messages. It is noted that technology exists for broadcasters to activate EAS alerts. For example, every sizeable city must designate two local broadcast stations with the sole responsibility for disseminating a national emergency message from the President. Consequently, there may be opportunities for broadcasters to post and update messages in situations where TMC operations are not 24/7. As with any cooperative efforts of this nature, it is very important to develop policies and procedures that govern the circumstances under which such arrangements would be implemented, and to provide all necessary safeguards.
- ***Messages must be created with time constraints in mind***– CMS on interstates should use one page only; information more than one page in length exceeds the driver's capacity to absorb the information and drive safely.
- ***AMBER Alerts work best at the local level***– Broadcasting alerts within 200 miles of an abduction within the first 3 hours of a kidnapping is considered a helpful guideline for state DOT's. This reflects how far an abductor could travel in the first three hours and keeps alerts local, reducing the likelihood of too many alerts leading to a possible lack of public attention.
- ***Standardize the communication between states***– As the issues related to AMBER Alerts are time critical, some standardization needs to take place in the interstate sharing of data. Agreements are currently relatively informal; and there is no way to chart the effectiveness. It is difficult to ascertain exactly how quickly an AMBER Alert generated in one state is posted to the CMS of an adjoining state.
- ***Explore the role of CMS messaging as part of a comprehensive package of travel information dissemination methods***– Methods such as CMS, Highway Advisory Radio, 511, internet-based systems, etc. are frequently used for disseminating travel information. In this report mention has been made of CMS and 511 that may provide options for greater geographic coverage and alternative means to provide time-critical information.
- ***Convene a meeting or workshop to maintain best practices and consistent policies***– As accumulated knowledge and experience of AMBER Alerts (and potentially other forms of messaging) develop, capturing best practices and maintaining consistent policies will be beneficial. One potential way to facilitate this is to convene a meeting comprising highway officials and local AMBER Alert representatives (including broadcasters.) Such a meeting would share standard operating procedures, and review operating characteristics such as coverage and duration for each alert.

7 Conclusion and Next Steps

CMS is clearly an important device in aiding in the safe and efficient movement of people and goods through the transportation network. CMS is an outstanding example of ITS using computing and communications technologies to support traffic management and provide travel information directly to the audience that needs it most. While CMS have been in use for years, improving technology and a changing climate has necessitated, or provided the opportunity for, greater and more diverse use of CMS. However, there is a balance to be struck between the variety of new uses possible for CMS with practices that are best suited to the use of these devices.

CMS for the use of travel times, homeland security and AMBER Alerts are still, to varying extents, new applications for these devices. The extent of deployment of these applications varies greatly across the nation. More time and more research is needed in order to properly study the effects that these messages have on the traveling public.

Stakeholders in traffic management and traveler information such as ITS America, AASHTO and ITE should be convened to further investigate the feasibility of the suggested guidelines documented in this report. Moreover, the consensus of a group of transportation officials alone cannot be considered the last word on the issues brought forth in this report. More study needs to be undertaken at the level of the average motorist. Transportation officials can only give their own opinions, or at best anecdotal evidence of the elements that work in the display of messages. Research directly with drivers and other members of the traveling public is needed.

As part of ongoing research, FHWA should commission a series of White Papers on issues related to performance monitoring. The transportation industry needs to further study and quantify the performance of CMS messages. A brief list of research questions includes, but is not limited to, the following issues:

- How many AMBER Alerts with successful outcomes are directly attributable to CMS?
- How long can an AMBER Alert be displayed before motorists grow accustomed to the message?
- How useful is travel time information to out-of-town motorists?
- When do motorists consider it is appropriate to use CMS for homeland security?
- How can DOT's convey the sense that CMS signs are operational even when they remain blank for long periods of time?

The value of ITS deployment in Europe should be carefully considered in regards to further research. A scanning tour of Europe in 2001 provided valuable information regarding the use of CMS for travel times in Barcelona and Madrid, Munich, and Berlin. Information from reports such as these should be incorporated into further discussion on the topics.

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