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16. Abstract Project

This *Dynamic Message Sign Message Design and Display Manual* was written for use by Texas Department of Transportation (TxDOT) personnel who have responsibility for the operation of and/or message design for large permanent dynamic message signs (DMSs) or portable DMSs. The Manual is designed to help both new and experienced users of DMSs at various levels of the agency including 1) entry-level personnel, 2) personnel very experienced with traffic operations, and 3) managers. It provides very specific information for entry-level personnel, reminders for experienced personnel, and higher-level information for managers regardless of whether they work in one of the Traffic Management Centers (TMCs) in the state.

The *Dynamic Message Sign Message Design and Display Manual* contains the following 22 modules: 1) Introduction, 2) Principles of DMS Operations, 3) DMS Operating Fundamentals, 4) Principles of DMS Message Design, 5) Designing the Base DMS Message for Incidents, 6) Designing the Base DMS Message for Roadwork, 7) Establishing the Maximum Message Length, 8) Dealing with Long Messages, 9) Designing DMS Messages for Incidents, 10) Designing DMS Messages for Roadwork, 11) Quick Reference Guide for Designing DMS Messages, 12) Modifying Messages to Improve Effectiveness, 13) Priorities When Competing Message Needs Arise, 14) Message Design Examples for Incidents: Large DMS, 15) AMBER Alert, 16) Catastrophic Event, 17) High Water and Flood, 18) Ozone, 19) Planned Special Events, 20) Hurricane Evacuation, 21) DMS Operations Policies, and 22) DMS Operations Procedures and Guidelines.

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# DYNAMIC MESSAGE SIGN MESSAGE DESIGN AND DISPLAY MANUAL

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# MODULE 1.  INTRODUCTION

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# MODULE 1. INTRODUCTION

## 1.1 BACKGROUND AND SIGNIFICANCE OF THE DYNAMIC MESSAGE SIGN MESSAGE DESIGN AND DISPLAY MANUAL

This *Dynamic Message Sign Message Design and Display Manual* is designed for use by personnel in the Texas Department of Transportation (TxDOT) who have responsibility for the operation of and/or message design for large permanent dynamic message signs (DMSs) or portable DMSs. The Manual is written to help both new and experienced users of DMSs at various levels of the agency including 1) entry level personnel, 2) personnel very experienced with traffic operations, and 3) managers. It provides very specific information for entry-level personnel, reminders for experienced personnel and higher-level information for managers regardless whether or not they work in one of the Traffic Management Centers (TMCs) in the state.

The design and display of messages on DMSs introduce many challenges to transportation agencies. The following paragraphs briefly summarize some of the relevant issues involved.

Dynamic message signs, previously termed changeable message signs (CMSs) and sometimes referred to as variable message signs (VMSs), are one of the primary links a transportation agency has to the motoring public it serves. Although they have been in existence for more than 40 years in some parts of the U.S., only the recent emphasis and financial support of the Intelligent Transportation System (ITS) legacy has allowed most state transportation departments to purchase them and build the electronic monitoring systems necessary to operate them as a key component in an Advanced Transportation Management System.

Since they represent many motorists' primary concept of ITS, improperly designed messages or operations of DMSs will have negative impacts on the public's perception of ITS in general. It is imperative that TxDOT districts take steps to ensure that the content, format, and application of information on the DMSs under their jurisdictions are of the highest possible quality and consistency statewide. The fact that DMSs are operated by different TMCs in different cities should be transparent to the motorist as they travel from one region of the state to the other.

The design and display of messages on DMSs introduce many challenges. Recommendations to meet these challenges are presented in this Manual. The Manual is patterned after the New Jersey DOT's *Variable Message Sign Operations Manual* (2000) and FHWA's *Guidelines for Changeable Message Sign Messages* (2002). TxDOT's *Dynamic Message Sign Message Design and Display Manual* includes the latest objective data and information that meets the specific needs of TxDOT.

## 1.2 DMS MESSAGE DESIGN PROCESS

The *Dynamic Message Sign Message Design and Display Manual* is written with a focus on 1) the design of effective DMS messages for incident conditions and roadwork, and 2) when and where to display messages. This emphasis is intentional for the following reason. DMS operations require the user to have a good understanding of not only traffic operations but also a working knowledge of how messages are designed. The DMS message design procedure in this Manual, in effect, helps the user to learn more about traffic operations and to understand the strengths, limitations and possible consequences of the messages the operator displays.

Emphasis is given throughout the Manual for effective message designs for DMSs located:

- On the same freeway and relatively close to the incident or roadwork;
- On the same freeway but relatively far from the incident or roadwork; and
- On a different freeway than the incident or roadwork.

The DMS message design process begins with the development of a Base DMS Message using guidelines of acceptable words and message terms for either incident or roadwork events. The Base DMS Message is the sum total of all the information that motorists need on a DMS in order to make a fully informed driving decision (e.g., whether to take an alternative route). In most cases, the Base DMS Message must be shortened because it will exceed the amount of information that motorists can read and comprehend in the short time they have available to read the message, or the message will exceed the amount of information that can physically fit on the DMS.

The maximum length of message that can be displayed on a DMS depends on how far away motorists can adequately view the message and on their perception and information processing capabilities. Viewing distance will be affected by the type of sign used (light-emitting diode [LED], fiber-optic, etc.), the sun position, geometric design, and environmental conditions at the DMS location. Travel speed will affect the amount of information that motorists can read and comprehend.

Guidance is given in the Manual in tables on the maximum number of units of information that can be displayed on a DMS based on type of DMS, travel speed, and sun position. In some cases when portable DMSs are used, it may be necessary to reduce the maximum number of units of information (using tables in the Manual) because of sight distance restrictions to the DMS due to vertical grades or horizontal curves. Additional guidelines are given for sight distance restrictions to the DMS because of fog or heavy rain.

After the maximum number of units of information that should be displayed on a DMS is determined, detailed guidance is provided to shorten the Base DMS Message so that the maximum is not exceeded while keeping the most important information in the message. The process provides for consistency of information and format. Furthermore, the process assures that motorists will be able to read and understand the messages. The underlying objective is to keep messages as complete and concise as possible.

## 1.3 OVERVIEW OF MANUAL MODULES

The *Dynamic Message Sign Message Design and Display Manual* contains the following twenty-two modules and four appendices:

- Module 1. Introduction;
- Module 2. Principles of DMS Operations;
- Module 3. DMS Operating Fundamentals;
- Module 4. Principles of DMS Message Design;
- Module 5. Designing the Base DMS Message for Incidents;
- Module 6. Designing the Base DMS Message for Roadwork;
- Module 7. Establishing the Maximum Message Length;
- Module 8. Dealing with Long Messages;
- Module 9. Designing DMS Messages for Incidents;
- Module 10. Designing DMS Messages for Roadwork;
- Module 11. Quick Reference Guide for Designing DMS Messages;
- Module 12. Modifying Messages to Improve Effectiveness;
- Module 13. Priorities When Competing Message Needs Arise;
- Module 14. Message Design Examples for Incidents: Large DMS;
- Module 15. AMBER Alert;
- Module 16. Catastrophic Event;
- Module 17. High Water and Floods;
- Module 18. Ozone;
- Module 19. Planned Special Events;
- Module 20. Hurricane Evacuation;
- Module 21. DMS Operations Policies;
- Module 22. DMS Operations Procedures and Guidelines;

- Appendix A Message Length Reductions for Vertical Curves;
- Appendix B. Message Length Reductions for Horizontal Curves;
- Appendix C. Message Length Reductions for Rain and Fog; and
- Appendix D. Effects of Large Trucks on DMS Legibility.

As discussed below, Modules 5, 6, 9 and 10 address details of the DMS message design processes for incidents and roadwork. These modules were written in a style to simplify the message design process for the DMS message designer. In addition, the intent was to reduce the amount of information the user has to search within the Manual when messages are designed. As such, the user will find a degree of repetition if Modules 5, 6, 9 and 10 are read from the beginning to the end. The Manual user will recognize the value of the repetition in these modules when messages are actually designed. A summary of the type of material covered in each module is provided below.

## MODULE 1. INTRODUCTION

The first module includes a discussion of the background and significance of the *Dynamic Message Sign Message Design and Display Manual*. The importance of the design of effective DMS messages is discussed and the message design process is summarized.

## MODULE 2. PRINCIPLES OF DMS OPERATIONS

Base principles of DMS operations including the use of DMSs and the importance of maintaining DMS credibility are presented in the second module.

## MODULE 3. DMS OPERATING FUNDAMENTALS

Module 3 contains a discussion of the five basic considerations when operating DMSs. These are: 1) determine the purpose for using a DMS, 2) determine which DMS is (are) appropriate to use, 3) determine what to display on the DMS, 4) determine how long to display the message, and 5) resolve any message signing conflicts that exist.

## MODULE 4. PRINCIPLES OF DMS MESSAGE DESIGN

Basic principles for designing DMS messages are presented in Module 4. It contains an overview of issues for message design, discussion of selecting the audience for the message and definitions and message design considerations. Details are given for the first step in the DMS message design process: the design of the Base DMS Message needed to satisfy motorist information needs when the DMS is used to advise motorists of an accident or roadwork. Meanings of words and phrases based on human factors research are also given. The module also includes classification, definition, and discussion of six types of diversion routes that might apply in a diversion situation.

## MODULE 5. DESIGNING THE BASIC DMS MESSAGE FOR INCIDENTS

Module 5 is devoted to presentation of the details, including message elements and words or terms, for designing the Base DMS Message when the sign is used to advise motorists of incidents. It includes detailed guidelines for 1) lane-closure (blockage) incidents, 2) incidents that block all the lanes, and 3) incidents that require closing the freeway. The guidelines are addressed for DMSs located on 1) the same freeway and relatively close to the incident or closure, 2) the same freeway but relatively far from the incident or closure, and 3) a different freeway than the incident or closure.

The user of the Manual will find a degree of repetition in this module. The repetition is necessary in order to allow the user to reference successive pages when designing a message for the specific DMS location relative to the incident (i.e., relatively near, relatively far, on a different freeway) rather than shuffling through several sections of the Manual.

## MODULE 6. DESIGNING THE BASIC DMS MESSAGE FOR ROADWORK

Module 6 is similar to Module 5 with the exception it addresses the design of the Base DMS Message when the sign is used to advise motorists of roadwork.
Also, similar to Module 5, the Manual user will find a degree of repetition in this module. The repetition is necessary in order to allow the user to reference successive pages when designing a message for the specific DMS location relative to the roadwork (i.e., relatively near, relatively far, on a different freeway) rather than shuffling through several sections of the Manual.

## MODULE 7. ESTABLISHING THE MAXIMUM MESSAGE LENGTH

Guidelines for the maximum DMS message length in terms of the maximum number of units of information that can be displayed are given in Module 7 based on DMS type, travel speed, and sun position. Guidelines for reducing this maximum on LED DMSs due to adverse vertical grades, horizontal curves, rain, or fog are also presented. A discussion and data concerning the number of motorists who may fail to read the DMS message because of the presence of trucks in the traffic stream are also given.

## MODULE 8. DEALING WITH LONG MESSAGES

In most cases, the Base DMS Message designed in Modules 5 and 6 and reduced in length based on data in Module 7 will exceed the amount of information that motorists can read and comprehend in the short time they have available to read the message, or will exceed the amount of information that can physically fit on the DMS. Module 8 contains guidelines for several ways to reduce the message length and units of information. It includes guidelines on using abbreviations, deleting “dead” words, reformatting the message and combining message elements. Guidelines for splitting a message onto two phases when the message is too long to fit on one phase are also presented.

## MODULE 9. DESIGNING DMS MESSAGES FOR INCIDENTS

A detailed step-by-step procedure for designing DMS messages for incidents is provided in Module 9. It includes detailed procedures for 1) lane-closure (blockage) incidents, 2) incidents that block all the lanes, and 3) incidents that require closing the freeway. The procedures are given for DMSs located on 1) the same freeway and relatively close to the incident or closure, 2) the same freeway but relatively far from the incident or closure, and 3) a different freeway than the incident or closure.

## MODULE 10. DESIGNING DMS MESSAGES FOR ROADWORK

Module 10 is similar to Module 9, with the exception that it addresses designing DMS messages when the sign is used to advise motorists of roadwork.

## MODULE 11. QUICK REFERENCE GUIDE FOR DESIGNING DMS MESSAGES

The objective of Module 11 is to provide a quick reference guide for designing and selecting DMS messages. It is intended for TMC supervisory personnel and for DMS operators who have considerable experience with using the guidelines in Modules 9 and 10.

## MODULE 12. MODIFYING MESSAGES TO IMPROVE EFFECTIVENESS

Module 12 is a quick reference guide illustrating how messages that violate good and sound principles for effective design can be improved. The Module includes examples of both incident and roadwork messages.

## MODULE 13. PRIORITIES WHEN COMPETING MESSAGE NEEDS ARISE

Occasionally, two or more events occur simultaneously that require a decision as to which event should be displayed on the DMS. Module 13 contains a set of tables to help the DMS operator establish signing priority.

## MODULE 14. MESSAGE DESIGN EXAMPLES FOR INCIDENTS: LARGE DMS

Two examples are given that illustrate how Module 9 is used to design DMS messages for large DMSs when incidents occur that close all the lanes of a freeway.

## MODULE 15. AMBER ALERT

Federal and the state of Texas policies are discussed as well as the importance of statewide coordination of AMBER alert DMS messages. Recommended information elements that should be included in an AMBER alert message and recommended message design for a variety of scenarios are presented.

## MODULE 16. CATASTROPHIC EVENT

Brief discussions of the National Incident Management System, Texas Office of Homeland Security, Governor's Division of Emergency Management, and State Operations Center are presented. Federal policy on displaying DMS messages for emergencies and security is also presented. Recommendations are given for effect DMS message design during catastrophic events.

## MODULE 17. HIGH WATER AND FLOODS

Driver information needs and recommended DMS message design are given for situations when 1) high water is on the freeway but drivers are still able to pass through and 2) the freeway is flooded and drivers are not able to continue on the freeway.

## MODULE 18. OZONE

Module 18 contains DMS design recommendations for ozone alerts on the day prior to an ozone action day and the day of the ozone action day.

## MODULE 19. PLANNED SPECIAL EVENTS

Module 19 contains a listing and discussion of the categories of planned special events. Typical DMS messages for drivers who are traveling to the event and those not traveling to the event but are impacted by the event traffic are shown.

## MODULE 20. HURRICANE EVACUATION

A brief discussion is presented concerning the focus group studies that were conducted as part of Study 0-4023. Given that following the focus group studies, Hurricane Rita impacted the Texas Gulf Coast and resulted in mass evacuation from major cities, it was deemed desirable to take advantage of the plight and evacuation experiences. A recommendation was made that Module 20 be completed after the results of further study in Project 0=4296 become available.

## MODULE 21. DMS OPERATIONS POLICIES

Module 21 is divided into two major parts. The first part contains summaries of available DMS operations policies and guidelines at the federal level. In part two, guidelines are presented to assist TxDOT in developing statewide and regional policies for the operation of DMSs. Twenty-four candidate policy issues are presented. The following information is given for each of the issues: a) an explanation of the policy, b) a policy statement example that TxDOT can use in developing a policy, and c) a discussion of justification and/or considerations that may influence TxDOT's decision to elect to include the statement in its policies.

## MODULE 22. DMS OPERATIONS PROCEDURES AND GUIDELINES

Module 22 contains a listing and discussions of items that TxDOT may want to include in a manual on DMS operations procedures and guidelines.

## APPENDIX A. MESSAGE LENGTH REDUCTIONS FOR VERTICAL CURVES

The theory and procedure for determining the sight distance to a DMS when there are restrictions because of a vertical curve are presented in Appendix A. Four examples using the procedure in Appendix A are also included.

## APPENDIX B. MESSAGE LENGTH REDUCTIONS FOR HORIZONTAL CURVES

The theory and procedure for determining the sight distance to a DMS when there are restrictions because of a horizontal curve are presented in Appendix B. Two examples using the procedure in Appendix B are also included.

## APPENDIX C. MESSAGE LENGTH REDUCTIONS FOR RAIN AND FOG

The theory and procedure for determining the sight distance to a DMS when there are visual restrictions because of a heavy rain or fog are presented in Appendix C. An example illustrating the procedure is included.

## APPENDIX D. EFFECTS OF LARGE TRUCKS ON DMS LEGIBILITY

The theory and procedure for determining the effects of large trucks on DMS legibility are presented in Appendix D. Two examples illustrating the procedure are included.

# MODULE 2. PRINCIPLES OF DMS OPERATIONS

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# MODULE 2. PRINCIPLES OF DMS OPERATIONS

## 2.1 INTRODUCTION

Road signs exist to communicate information to motorists. Static guide signs are permanent and are limited to presenting information that is largely "geographically linked." Dynamic message signs can present up-to-the-moment traffic information.

DMSs are programmable traffic control devices that can usually display any combination of characters to present messages to motorists. These signs are either permanent in which case they are usually installed above or on the side of the roadway, or transportable, in which case they are attached to a trailer or mounted directly on a truck and driven to a desired location. Portable DMSs are much smaller than permanent DMSs and are often used in highway work zones, when major accidents or natural disasters occur, or for special events (e.g., sport events).

**DMSs are used to manage traffic by displaying:**
- **Early warning messages**
- **Advisory messages**
- **Alternative route messages**

Dynamic message signs perform a critical role on freeways by furnishing motorists with real-time information that advises them of a problem and in some cases, a suggested course of action. Dynamic message signs improve motorist safety and reduce traffic congestion and delay. They are used to manage traffic by displaying early warning, advisory and alternative route messages.

### EARLY WARNING MESSAGES

Early warning messages give motorists advance notice of slow traffic and queuing ahead and are effective in reducing secondary accidents. When used in freeway work zones, early warning messages also give notice of new detours, changes in detour route, changes in lane patterns, special speed control measures, etc.

### ADVISORY MESSAGES

Advisory messages provide motorists with useful information about a specific problem along their route. This information allows motorists to change their speed or path, as the situation dictates, in advance of the problem area, or motorists may elect to voluntarily take an alternative route to their destination.

### ALTERNATIVE ROUTE MESSAGES

Alternative route messages influence motorists to travel to their chosen destination using different routes than originally intended. The alternative route is one designated by the transportation agency. In cases when the freeway is physically closed as a result of construction, accident, or natural disaster, motorists are notified that an alternative route must be used.

## 2.2 IMPORTANCE OF MAINTAINING DMS CREDIBILITY

**WHAT MOTORISTS EXPECT FROM DMSs:**
- **Up-to-the-minute information**
- **Reliable information**
- **Accurate information**
- **Relevant information**

To be effective, DMSs must provide timely, reliable, accurate and relevant information and they must be operated properly. An important consideration in properly operating a DMS system is to **maintain credibility**. Regardless of how well a message is designed, there is a risk of motorists distrusting the signing system if the messages are not changed at the correct times and updated to reflect current traffic conditions. Each time the information displayed is disproved, the credibility of the system decreases. Eventually motorists ignore the messages and the DMS system is in jeopardy.

**RULE 1 - Never display specific traffic information before it has been verified.**

The first rule of good DMS operation is that specific traffic information (e.g., accident) should not be displayed before it has been verified. For example, does the DMS operator know there was an accident? Does he/she know where it occurred? Does he/she know how many lanes are closed? Does he/she know if a specific route for diversion can handle the capacity?

**RULE 2 - There are at least six ways to lose the motorists' confidence in the DMS:**
***Display information that is***
- **Inaccurate**
- **Not current**
- **Irrelevant**
- **Obvious**
- **Trivial**

***and/or display***
- **Erroneous numbers (e.g., incorrect speeds, travel times, etc.)**

It is the responsibility of the DMS operator to ensure that the motorists respect the DMSs and continue to have confidence in them. There are at least six ways to <u>reduce</u> message credibility:

- **Inaccurate** information (e.g., no accident is observed when traffic passes by the location where an incident was displayed on a DMS).

- Information is **not current** (e.g., the message is the same each morning when motorists pass the sign).

- Information is **irrelevant** to essentially all motorists using that facility.

- Information is **obvious** by inspection, hence, is redundant (e.g., displaying *HEAVY CONGESTION* when motorists are driving bumper to bumper in peak traffic).

- Information is **trivial** (e.g.,*DRIVE CAREFULLY*, *SUPPORT YOUR LOCAL RED CROSS*, time, and temperature). If trivial information is displayed, many motorists, particularly commuters, will ignore the messages that have no direct impact on their trips and, consequently, they will begin to ignore the DMS. When an important message is displayed that will impact their trip, the motorists may not read the message.

- Displaying **erroneous numbers** such as traffic speeds and time to reach a destination can be easily checked and disproved. The DMS operator should never display these values unless they can be accurately predicted. However, delay time is more difficult to disprove by motorists.

# MODULE 3. DMS OPERATING FUNDAMENTALS

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# MODULE 3. DMS OPERATING FUNDAMENTALS

## 3.1 BASIC CONSIDERATIONS FOR OPERATING DMSs

It is important to remember that DMSs are tools to help manage traffic on a roadway system. Just as a carpenter carefully selects a tool and then uses that tool to accomplish a particular construction task, one must determine when and how to use DMSs to best accomplish traffic management tasks.

The operation of DMSs involves five basic considerations presented in logical order:

1. Determine the purpose for using a DMS;
2. Determine the appropriate DMS to use;
3. Determine what to display on the DMS;
4. Determine how long to display the message; and
5. Resolve any message signing conflicts that exist.

Within each of these, several factors and issues need to be addressed. It is important to realize that these factors often change over the duration of an incident or other event. These changes require the operator to revisit the situation and possibly modify how the DMS is being used. This process can be illustrated as shown in Figure 3.1.

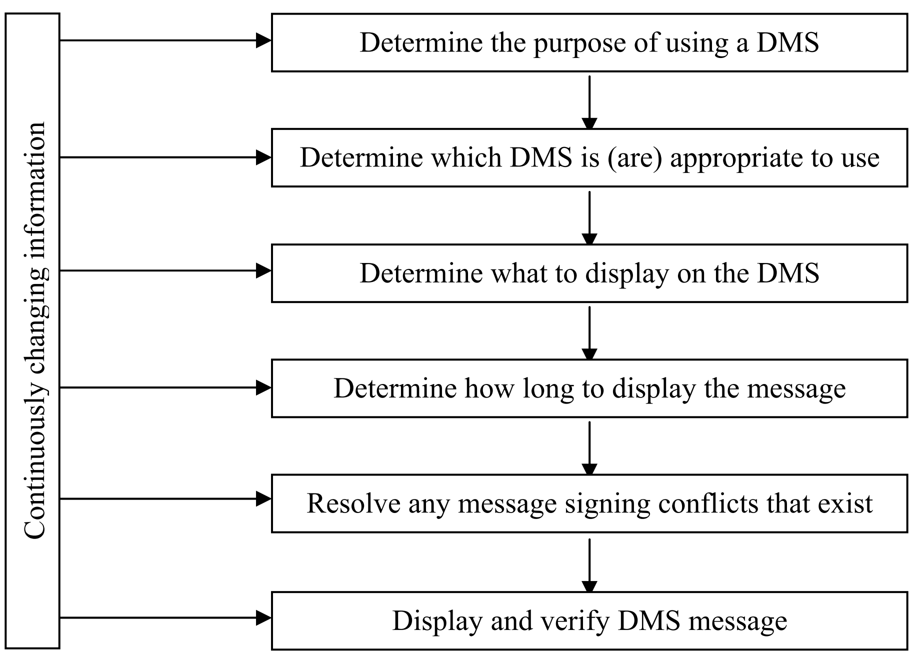


**Figure 3.1 DMS Operating Process**

## DETERMINE THE PURPOSE FOR USING A DMS

DMSs should always be used with a specific purpose or objective in mind. To determine this purpose, the DMS operator must fully understand six things:

1. What is the problem I am trying to address?
2. What verified information do I have?
3. Who is the audience that I am trying to reach with the DMS message?
4. What type of motorist response is required?
5. Where should the response take place?
6. What degree of response is required?

### What Is the Problem I Am Trying to Address?

The DMS operator must consider not only the basic type of problem (i.e., accident, work zone lane closure, etc.) that exists, but also the following:

- Location of problem (position within the roadway right-of-way as well as its relation to other freeways and major traffic generators);

- Scope (number and types of agencies that will likely need to be involved, whether police officers will be required to direct traffic at the scene or on a detour, whether a major incident response team will be activated);

- Potential duration of the situation; and

- Extent of impacts (number of lanes affected, location where lanes are affected, nearby ramps that are blocked or constrained by the traffic queue, etc.).

### What Verified Information Do I Have?

Credibility is very important in DMS operations. Although it is desirable to select and design messages based on complete and perfect information, situations often occur where an operator receives only limited information about a problem (particularly early in the timeline of an event). Furthermore, the information may be from an unknown or untrained source (i.e., a motorist) or may conflict with other information the operator has been received. As a result, a DMS operator must decide what information can be used, and how it can be best used to operate the DMS.

***Verified*** information is that which is obtained directly by the DMS operator via closed circuit television or other visual means, or is provided by approved personnel of selected agencies. Law enforcement officers, emergency response personnel, or transportation agency courtesy patrol personnel are examples of individuals who can generally provide verified information.

***Unverified*** information, on the other hand, is not obtained directly by the DMS operator or received from the sources above. Most common examples of unverified information are calls received from motorists about incidents that they have encountered. Unconfirmed commercial radio reports are another source of unverified information.

DMS operators should only use verified information to operate DMSs. Motorists and other sources of unverified information will often provide inaccuracies about locations and effects that, if presented to the public and found to be false, degrade the credibility of the DMS system and the operating agency. *However, unverified information can be useful to the operator in identifying information items that may need to be explored further.* For example, calls from one or more motorists that an incident has cleared may prompt the DMS operator to check a closed circuit television camera or contact the appropriate enforcement agency to verify that the incident has indeed cleared.

If recommendations are to be made about a specific diversion route to use around a problem, the DMS operator must also have information about current conditions on that route. If the operator cannot obtain such information, the DMS should not recommend a specific route. The only exception to this is when the freeway has been completely closed and police officers are directing traffic along a designated detour route.

**Who Is the Audience for the DMS Message?**

A component of establishing an objective for a DMS message is to decide who the audience will be for the message. The audience is the group of motorists that the DMS operator wants to respond to the message in some manner. In some cases, this may be all of the motorists who pass the DMS. In other cases, the message is intended for only some of the motorists (e.g., those who are traveling all the way downtown). Depending on the situation, it may be necessary to identify the intended audience as part of the DMS message itself. In other situations, the intended audience is implied.

**What Type of Motorist Response Is Required?**

The operator of a DMS must first decide what he or she wants motorists to do in response to the message placed on a sign or group of signs. Messages will be most effective when they encourage some type of response from the motorist, such as to:

- Reduce speed,
- Move out of a blocked or closed lane, and/or
- Take an alternative route.

**Where Should the Response Take Place?**

The location where responses are desired will depend on 1) type of response desired, 2) the layout of the roadway system, 3) the type and severity of problem being addressed and 4) the availability of existing guide signs or those installed by TxDOT in response to a major incident. It is important to realize that the desired motorist response to a particular problem may differ depending on where in the roadway system the motorists are at that particular time. For example, the desired response for a motorist traveling immediately upstream of a full freeway closure might be to follow the designated traffic control devices off of the freeway, along the designated alternative route, and back to the freeway. For motorists approaching on an intersecting freeway farther upstream of the closure, however, the desired response might simply be to not exit onto the closed freeway, and find their own alternative route to their ultimate destination. In general, the more severe the problem and the longer it is expected to last, the farther upstream messages can be displayed on DMSs.

**What Degree of Motorist Response Is Required?**

The DMS operator must continuously monitor traffic conditions and motorist response to the DMS messages. Suggested alternative routes must provide improved travel to motorists compared to remaining on the freeway. Remember, the messages on the DMSs can be changed when conditions on the alternative route(s) no longer are better than the freeway.

## DETERMINE THE APPROPRIATE DMS TO USE

**Proximity of DMSs to Problem**

Next, the operator must determine which DMS or DMS group within the overall DMS system should be used to address a particular situation or problem. DMS operators should have a fairly good idea of current locations of permanent DMSs or be able to quickly determine their location from maps or computerized databases. These signs should be located where it is most advantageous to provide information to motorists. For advance warning of future lane closures and special events, the messages displayed are typically of a general warning nature and can be displayed on DMSs over a fairly wide area. When signing for a current incident or work zone lane closure, however, the DMS operator must be careful to make sure that the DMSs selected will reach the appropriate audience for the message to be displayed. Two simple questions should be asked when determining which DMS should be activated:

- Is the expected duration of the incident or lane closure longer than the expected travel time from that DMS to the incident or lane closure?

- Are there a significant number of motorists traveling past the DMS who are destined for the incident or lane closure location?

If the answer to either of these questions is “no,” the DMS is probably not appropriate to activate for that situation.

**Characteristics of the DMS Hardware**

The characteristics of the DMS have an effect on how far away the DMS can be read and, consequently, how much information can be presented to motorists. This information is generally determined prior to TMC operations of the DMS. Some of the characteristics of a DMS that affect legibility and message length include the type of sign (LED, fiberoptic, etc.), the number of lines available, and the number of characters on each line.

In locations where permanent DMS have not been installed or in situations where the amount of information that needs to be presented exceeds the motorists’ processing capabilities from a single sign, it may be necessary to deploy portable DMSs to provide the necessary information to motorists. The operator must consider the time needed to deploy these devices in determining whether they are appropriate for a given situation. These DMSs should also be deployed far enough away from other DMS, existing static signing, and complex roadway geometry such as weaving areas. The DMS operator must ensure that motorists are not overloaded with information when choosing where to place the portable DMS.

### Roadway, Traffic, and Environmental Characteristics in the Vicinity of the DMS

The DMS operator also needs to be familiar with the actual site characteristics in the vicinity of the DMS. These characteristics dictate the amount of information that can be displayed. Among the items of interest are the following:

- The operating speed of traffic on the roadway;
- The presence and design characteristics of any vertical curves affecting sight distance;
- The presence of horizontal curves and obstructions such as trees, bridge abutments, or construction vehicles that constrain sight distance to the DMS around the curve;
- The location of the DMS relative to the position of the sun (for daytime conditions);
- The presence, number, and information on static guide signs in the vicinity; and
- Whether or not rain or fog is present to degrade visibility to the sign.

## DETERMINE WHAT TO DISPLAY ON THE DMS

### Basic Information Needs and DMS Message

DMSs are a transportation agency's direct link to the motoring public. Displaying well-designed messages on DMSs is key to effectively managing traffic and to maintaining credibility with motorists. The vast majority of this Manual is devoted to proper design of DMS messages.

Proper design begins with understanding the basic information needs of motorists. Motorists need several different types of information in order to make their driving decisions. These elements include the following:

- The type of problem (incident or road work descriptor),
- Location of the problem,
- The lanes that are affected (closure description),
- Location of the lane closure,
- The effect on travel,
- The audience for the message,
- Proper response or driving action by motorists, and
- A reason to follow the recommended driving action.

Unfortunately, motorists are not equipped to perceive, process, and remember a large amount of information at one time. Consequently, the job of the DMS operator is to decide what information is most important and how to present that information on a DMS in a way that maximizes motorist understanding and encourages them to take appropriate actions.

## Diversion Routes

Motorists must not be diverted to arbitrary routes. The practice in some TxDOT districts is to divert traffic to another freeway rather than an arterial alternative route when diversion is required unless the primary freeway is closed. It is important that the suggested freeway diversion route result in a significant time savings compared to remaining on the primary freeway. In addition, it must be a route that motorists can travel on without getting lost. Therefore, before recommended diversion routes are displayed on a DMS, the DMS operator must know the following about the route:

- Current traffic conditions,
- Current traffic capacity constraints, and
- Guide sign information.

When motorists are advised by the DMS message to divert and take a specific highway or route, it is essential that the destination names and routes used in the message are the same as those displayed on the existing guide signs. Inconsistency between the DMS message and the existing guide signs will lead to motorist confusion and cause some to take incorrect routes. Therefore, the DMS operator must have full knowledge of the wording and route markers on the existing guide signs before diversion messages directing motorists to a specific highway or route are used in a DMS message.

## DMS Operator Message Options

The design of a safe, effective DMS message requires consideration of a number of different factors and interactions between factors. This design process is complex, as is shown in the following modules, and can take a significant amount of time to utilize properly. Fortunately, many situations require a message or group of messages that are identical to those used in other past situations or that have been developed in advance for a particular event. In other situations, a DMS message or message group can utilize a general template and modify an item or two prior to display on the DMS(s). Finally, an extremely complicated or unusual situation may necessitate following the complete design process in order to determine the best DMS message to display. Basic considerations under each of these approaches are discussed below.

### *Selecting a Message from a Message Library*

In the simplest case, a DMS operator may be able to select a proper message from an existing message library on the DMS operating system. The agency would have a predefined scenario prepared (following the proper message design process) for a given type of problem, location, severity (such as how many and which lanes are blocked or closed), and time of day. If a problem develops that fits the scenario, the DMS operator can simply call up a message from the library and display it on the appropriate sign(s). This approach only requires that the DMS operator be able to verify that all of the information to be displayed on the DMS is correct (which lane or lanes are blocked, the location of the problem, etc.).

### *Modifying a Message from a Message Library*

Another type of DMS message that may be included in message libraries is one that requires some modification by the operator prior to displaying it on a sign. The modification may be needed to display the correct location of a problem to motorists, the lane(s) that are affected, the action that should be taken, etc.

Modified messages present special challenges in DMS operations. They require DMS operators to make sometimes complex decisions about message elements that need to be changed, whether a change in overall message format is required (e.g., if the location name is fairly long), the proper term to use for a location, etc. Consequently, the potential for errors to creep into modified messages can increase during periods of high operator workload. DMS operators need to pay special attention to ensure that they review such messages prior to posting on a DMS.

### *Creating a New Message*

If a message in the library does not properly address the particular situation of interest or cannot be modified to address the situation, a new message must be created. Principles and procedures illustrated elsewhere in this Manual should be followed to formulate the message. This requires the highest level of reasoning and decision making from the DMS operator. Those operators who have responsibility for creating new messages must have adequate training in the message design process.

## DETERMINE HOW LONG TO DISPLAY THE MESSAGE

After messages have been selected and conflicts resolved, the DMS operator must decide how long to display the message on the sign. For advance warning of upcoming work activity or special events, the message can be shown for several hours or even days prior to the event. However, it is more difficult to determine an appropriate duration for incidents. If the operator has responsibility for only a limited number of DMSs and the incident occurs during off-peak periods when demand for attention is lower, it may be acceptable to set an extremely long duration on the message and simply turn the message off when the incident clears. This means that the operator must constantly monitor the incident and then remember to deactivate the signs at its conclusion.

During periods of high operator workload or if the operator has a large number of DMSs to operate, it may be necessary to estimate the expected duration of the incident and set the message display time to that duration. This may require the operator to periodically adjust the time setting if the expected duration changes as more information about the incident is obtained. The advantage of such a procedure is that it ensures against an operator forgetting that a message is being displayed long after an incident is cleared. Failure to deactivate messages that are no longer relevant can degrade the agency's credibility with the motoring public.

## RESOLVE ANY MESSAGE SIGNING CONFLICTS THAT EXIST

After determining which message or messages are appropriate for the situation, the fourth step in the process is to resolve any conflicts that may exist within the DMS system. For example, it is possible that two incidents may occur in adjacent sections of roadway. These incidents may each warrant several DMS messages in the vicinity, some on the same signs. In these cases, the operator must prioritize messages at each DMS and display the message that is most appropriate. Details on how to make these prioritization decisions are provided in *MODULE 13 Priorities When Competing Message Needs Arise*.

The most common types of possible message conflicts are as follows:

- Two events (incidents and/or road work) occur concurrently on the same freeway as the DMS,
- One event (incident or roadwork) occurs on the same freeway as the DMS and a second event occurs concurrently on an intersecting freeway,
- One event (incident or roadwork) occurs on the same freeway as the DMS and a second event occurs concurrently on a connecting freeway in another state, and
- One event (incident or roadwork) occurs on an intersecting freeway to the DMS and a second event occurs concurrently on a connecting freeway in another state.

Generally speaking, events on Texas freeways that are more current, more severe, and impact a greater number of motorists passing the DMS will have higher priority.

**DISPLAY AND VERIFY DMS MESSAGE**

Once the operator is satisfied with the accuracy of the information available, the information in the message and the message format, the selected message can be displayed. After the DMS message is activated, it is important that the operator validate that the correct message is displayed on the DMSs. It would be desirable to be able to validate the message by viewing the messages via the closed circuit television (CCTV) system and electronically. If CCTVs are not positioned such that the messages can be viewed, the operator will have to rely solely upon electronic validation from the software/computer system. The implication is that DMSs should be part of a coordinated ITS system and each component must reliably work together.

# MODULE 4. PRINCIPLES OF DMS MESSAGE DESIGN

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# MODULE 4.  PRINCIPLES OF DMS MESSAGE DESIGN

## 4.1 OVERVIEW OF ISSUES

Dynamic message signs are one of the primary links a transportation agency has to the motoring public it serves. Since the signs represent the primary concept of ITS to motorists, improperly designed or operated DMS messages will have a negative impact on the perception of the public about ITS in general.  The design and display of messages on DMSs introduce many challenges to transportation agencies.  The following paragraphs briefly summarize some of the relevant issues involved.

***DMSs are the direct link with the motoring public*****—**DMSs can be an effective tool for communicating with motorists.  However, displaying messages that are too long for motorists to read at prevailing highway speeds or that are too complex or inappropriately designed leading to motorist confusion, can adversely affect both traffic flow and the transportation agency's credibility.

***Efforts must be made to ensure that DMS messages are standardized and consistently applied throughout the state or region*****—**The messages displayed must be "transparent" to travelers in the state or region.  Therefore, messages need to be presented in a consistent manner and order based on motorists' expectancies.

***Only a few seconds are available to communicate a message*****—**At prevailing highway speeds, the DMS message must be presented to motorists in about 8 seconds or less.  This translates to a message with a maximum of eight words--Uninformed transportation personnel sometimes display messages that are too long for motorists, particularly slower readers such as the elderly, to read while driving at prevailing speeds.

***Available exposure time controls the maximum length of message that should be displayed*****—** Results of research indicates that reading times for DMSs are higher than those for static guide signs.  The distinguishing factor is that motorists can scan guide signs for relevant information, whereas they must read the entire message displayed on DMSs in order to understand the message.  Exposure time is directly related to message legibility distance and driving speed.  For a specific type and design of DMS, the available message exposure time dictates the maximum length of message that can be displayed for a given highway operating speed.

***In many signing situations, some of the basic information needed by motorists must be omitted from the DMS message*****—**Key DMS objectives include maximizing information transfer to motorists, providing explicit advice, eliciting specific motorist response, and inducing motorist confidence.  One major challenge is that this must be accomplished within a short time phase. DMS operators must strive to satisfy basic motorist information needs that allow more informed driving decisions to be made during incidents and roadwork.  However, in most cases these basic needs exceed the number of units of information that a motorist can read and comprehend at prevailing driving speeds.  Therefore, some of the information in the basic message must be omitted in order to meet the maximum number of units of information that can be processed by motorists. Tradeoffs must be made as to what elements of the message should be omitted.

In many signing situations DMS legibility distance constraints dictate the need to reduce the amount of information that is needed to fully communicate with motorists—The length of message that can be displayed on a DMS at a location also depends on how far away the motorists can adequately view the message and the prevailing speed of vehicles.  At some locations, geometric features obscure the visibility of the DMS.  At times, trucks in the traffic stream may obscure the motorist's view of the DMS.  Environmental conditions such as rain and fog deteriorate the amount of light that is coming from the DMS, thus reducing the distance at which motorists can read the message.  The DMS message length must be reduced to compensate for the reduced legibility distance.

***Measures must be taken when developing DMS messages to enhance motorist understanding of messages***—Research and experience have allowed the author of this Manual to determine which words and word combinations are understood by most motorists.  In developing messages, factors that enhance understanding of messages include the following:

1. Simplicity of words,
2. Brevity,
3. Standardized order of words,
4. Standardized order of message lines, and
5. Using understood abbreviations when abbreviations are needed.

# 4.2 SELECTING AN AUDIENCE FOR THE DMS MESSAGE

**UNFAMILIAR MOTORISTS WILL HAVE DIFFICULTY IN UNDERSTANDING:**

- **Local street and highway names; and**
- **Abbreviations for local landmarks, bridges, and entertainment and recreational facilities.**

The DMS message designer must know the intended audience for the message that will be displayed. Research has found that in some cases commuters and visitors have different informational needs. The visitor has very limited information about a city other than interstate route numbers, whereas, commuters understand most of the intersecting and parallel streets. Thus, messages that incorporate local street or highway names that are understood by commuters, may not be understood by unfamiliar motorists. Also, abbreviations used for landmarks, bridges, and entertainment and recreational facilities may not be well understood by unfamiliar motorists even though they may be understood by local motorists.

**Certain local names of facilities, landmarks, bridges, and entertainment and recreational facilities in selected Texas cities are not well-understood by motorists from other Texas cities.**

Research has also found differences among cities in Texas of motorist understanding of terms and abbreviations. For example, motorists in Houston are familiar with the term *BLTWY 8*, whereas, motorists in Austin, Dallas, El Paso, Fort Worth, and San Antonio are not.

# 4.3 DEFINITIONS AND MESSAGE DESIGN CONSIDERATIONS

## DEVELOPING EFFECTIVE DMS MESSAGES

To be effective, a DMS must communicate a meaningful message that can be read and understood by motorists within a very short time period (constrained by the sight distance characteristics of the location and design features of the DMS). Extensive human factors and traffic operations research has been conducted, most of it by the author of this Manual and his colleagues, to develop fundamental principles and guidelines for DMS message design. The principles and guidelines are based on a solid understanding of motorist physical and information-processing capabilities and are valid *so long as they are consistently and properly applied*.

## MESSAGE CONTENT

Message ***content*** refers to specific information displayed on a DMS, essentially, what is wrong ahead and what the motorist should do about it are the key elements.

If DMSs are to be read and believed by motorists, the content of the message must provide information relative to their needs. Above all, they want to know if something "ahead" has occurred on the roadway which would change their plans.

> **DEFINITIONS FOR MESSAGE "__________"**
>
> **CONTENT: specific information displayed.**
> **LENGTH: number of words or number of characters and spaces.**
> **LOAD: number of units of information in message.**
> **INFORMATIONAL UNIT: the answer to a question a motorist might ask.**
> **FORMAT: order of the units of information.**

A DMS message should present "advice." This appears at the end of the brief message. It may be *REDUCE SPEED*, *EXIT AND TAKE OTHER ROUTES* or some other advice.

Motorists will ignore advice unless a reason is offered for taking it. The "reason" in most cases is the problem (*ACCIDENT*, *LEFT 2 LANES CLOSED*, etc.). Motorists expect this information to appear first in a DMS message. Motorists also would like to know where the problem has occurred. This is given on the second line. If the incident occurs far away, it may not affect them because they planned to exit long before then.

## MESSAGE LENGTH

***Length*** refers to either the number of words or the number of characters and spaces in a DMS message. With DMS line capacity less than optimal, it becomes necessary to count the characters in a message to determine if the message will fit. If the message does not fit, look for abbreviations to use and/or eliminate redundant words. It may at times be necessary to display the message in two phases.

The maximum length of a DMS message is controlled in part by ***reading time***—the time the motorist has available to read the message. Reading time is affected by 1) the time that the motorist is within the legibility zone of the DMS message, and 2) by the amount of activity in the traffic stream which the motorist must attend to (e.g., reading signs, adjusting vehicle speed, lane positioning, etc.). The entire message must be short enough to allow motorists to glance at the sign and read and comprehend the message while attending to the complex driving situation.

**It takes unfamiliar motorists longer to read a DMS message than familiar motorists who see the sign regularly.**

**Familiar motorists need more time to read unusual messages.**

Message familiarity enhances motorist reading time. When information displayed on a DMS applies to unfamiliar drivers or when the information being presented to commuters is unusual, longer reading times will be required than for information posted frequently and seen repeatedly by commuting traffic. Obviously, site-specific characteristics and normal DMS operating procedures dictate what information is usual and what is not, and so this factor varies from location to location.

Another important consideration in designing DMS messages is the need for motorists to time-share their attention to the roadway, to traffic, and to reading signs. Adults can read quite fast while sitting at home reading a newspaper or novel or while in stopped traffic reading a sign or billboard. However, motorists cannot always devote full attention to sign reading. They must share their attention between information necessary for the task of driving and the information on signs. Because of this time-sharing, it will take longer to read a sign than if the motorists could devote all of their attention to the sign.

Another important consideration is that motorists must read the entire message on a DMS. In contrast, they do not have to read the entire guide sign to obtain relevant information about guidance. Therefore, it takes a motorist longer to read a DMS message than to read the message on a guide sign.

**AVOID MESSAGES LONGER THAN:**
- **8 words at 55 mph**
- **7 words at 65 mph**
- **6 words at 70 mph**

In a driving situation, the motorist has a limited amount of time to read a message on a sign. He/she can start reading a sign when the words become legible at the ***legibility distance*** of the sign. About 85 percent of motorists can begin reading a message on LED DMSs with 18-inch characters—commonly used in Texas—at about 650 feet in front of the sign. Research strongly suggests that motorists can read an 8-word message (excluding prepositions such as *TO* and *AT*) in 8 seconds, or one word/second. Based on the known legibility distance of DMSs, this translates to a maximum message length of 8 words while the motorist is traveling at 55 mph, 7 words at 65 mph, and 6 words at 70 mph. Longer messages should be avoided because motorists will often reduce their speeds in order to read the message.

**DMS messages that are too long for motorists to read while traveling at normal speeds will result in some motorists slowing to read the message.**

When the complexity of the driving situation increases due to extremes in geometrics, heavier traffic volumes, increased traffic conflicts (e.g., merging, lane changing), or climatological conditions, motorists will attend to those information needs they feel are most important to them and to their safety.

These demands on the motorist will result in less time available to read the DMS message.

**REDUCE MESSAGE LENGTH WHEN:**
- **Motorist work load is increased due to extreme geometrics, very heavy traffic, merging, heavy lane changing, or adverse climatological conditions.**
- **Conditions change during the day that affects motorist visibility to the DMS (e.g., sun in eyes).**

In addition, lighting and environmental conditions change. For example, during part of the day the sun may not affect the legibility of the DMS. However, if the sun shines directly in the eyes of the motorist, then the legibility distance for the motorist can be greatly reduced. It may be necessary to reduce the length of the message to account for the reduced visibility.

**Always look for ways to reduce message length without losing the intent of the message.**

**See Module 8 - DEALING WITH LONG MESSAGES**

The DMS message designer should always look for ways to reduce the message length without losing the intent of the message. Reducing message length can sometimes be accomplished by using alternative phrases that are understandable by motorists and have the same meaning as the original. Also, there may be redundancy or unimportant information in the message which can be omitted. For situations such as these, refer to *Module 8 – DEALING WITH LONG MESSAGES.*

## MESSAGE LOAD AND UNIT OF INFORMATION

The term ***load*** refers to the units of information in the total message. A ***unit of information (informational unit)*** refers to the answer to a question a motorist might ask. Stated another way, a unit of information is each data item in a message that a motorist could use to make a decision. Each answer is one unit of information. The message in the following table has four units of information and serves to illustrate the concept of units of information.

**UNIT OF INFORMATION**

| Question | | Answer | | Unit of Info |
|---|---|---|---|---|
| 1. What happened? | ⇨ | ACCIDENT | ⇨ | 1 unit |
| 2. Where? | ⇨ | PAST ROWLAND | ⇨ | 1 unit |
| 3. Who is advisory for? | ⇨ | FAIR PARK | ⇨ | 1 unit |
| 4. What is advised? | ⇨ | USE FITZHUGH | ⇨ | 1 unit |

A unit of information typically is one to three words, but at times can be up to four words.

Since motorists can process a limited amount of information, the amount of information that should be displayed on a DMS is also limited. Research and operational experience indicate that no more than four units of information should be in a message when the traffic operating speeds are 35 mph or more. No more than five units of information should be displayed when the operating speeds are less than 35 mph. In addition, no more than three units of information should be displayed on a one message phase.

Normally, only one unit of information appears on each line of the DMS. However, a unit of information may be displayed on more than one line. A sign line, however, should not contain more than two units of information.

| |
|---|
| **ENTIRE MESSAGE:**<br>• **No more than 4 units of information for operating speeds of 35 mph or more.**<br>• **No more than 5 units of information for operating speeds less than 35 mph**<br><br>**LENGTH OF MESSAGE PHASE:**<br>• **No more than 3 units of information.**<br><br>**LENGTH OF MESSAGE LINE:**<br>• **No more than 2 units of information.** |

When a DMS message meeting all informational requirements of the motorist exceeds the maximum number of units of information that should be displayed on a single sign, tradeoffs must be made to determine what elements of the messages should be omitted. If it is deemed necessary by the agency to display all of the required information, two DMSs will be needed. Guidelines to reduce the number of units of information are given in *Section 8.2 – Approaches to Reducing Message Length on page 8-5.*

## MESSAGE FORMAT

Message ***formatting*** refers to the order and arrangement of the units of information on a DMS. The DMS message must contain the proper information in the expected order to allow motorists to easily read and interpret the information and make rational decisions based on that information.

Placement of message elements on the wrong line or in the wrong sequence will result in driver confusion and will increase message reading times. Conversely, consistent formatting of information enhances motorist expectations and reduces the time required to read and understand messages. Examples of acceptable and unacceptable format approaches are shown below.

| |
|---|
| **ROADWORK**<br>**ON I-10 EAST**<br>**AT PATERSON** |

*Acceptable*

| |
|---|
| ~~**I-10 EAST**~~<br>~~**AT PATERSON**~~<br>~~**ROADWORK**~~ |

*Not Acceptable*

# 4.4 BASE DMS MESSAGE TO SATISFY MOTORIST INFORMATION NEEDS

## GENERAL CONCEPT OF BASE DMS MESSAGE

The ***Base DMS Message*** is the sum total of all the information that motorists need on the DMS in order to make a fully informed driving decision (e.g., whether to take an alternative route). In most cases, the Base DMS Message will exceed the maximum amount of informational units that should be displayed on a DMS. Therefore, the Base DMS Message must be reduced in length and content to allow motorists to read, understand and react to the message.

> **THE BASE DMS MESSAGE:**
> - **Is the sum total of all the information that motorists need to make a fully informed driving decision;**
> - **Will normally exceed the maximum amount of informational units that should be displayed; and**
> - **Must normally be reduced in length and content.**

The message elements that make up the Base DMS Message include: 1) ***Incident/ Roadwork Descriptor*** (situation description), 2) ***Incident/Roadwork Location,*** 3) ***Lanes Closed***; 4) ***Closure Descriptor,*** 5) ***Closure Location,*** 6) ***Effect on Travel*** (e.g., major delay), 7) ***Audience for Action,*** 8) ***Action,*** and 9) ***Good Reason for Following the Action***.

> **BASE DMS MESSAGE ELEMENTS:**
> - **Incident/Roadwork Descriptor (situation description),**
> - **Incident/Roadwork Location,**
> - **Lanes Closed,**
> - **Closure Descriptor,**
> - **Closure Location,**
> - **Effect on Travel (e.g., major delay),**
> - **Audience for Action (when the action is for a specific group of motorists),**
> - **Action (tells motorists what to do), and**
> - **One Good Reason for Following Action (usually implied by other message elements).**

## INCIDENT/ROADWORK DESCRIPTOR

The ***Incident/Roadwork Descriptor*** informs the motorist of the unusual situation. When an accident or roadwork blocks part of the roadway, motorists want advance warning.

## INCIDENT/ROADWORK LOCATION

The ***Incident/Roadwork Location*** informs the motorist about the location of the unusual situation and thus must directly follow the Incident/Roadwork Descriptor. Knowing the location helps the motorist to make judgments as to the distance he/she could be affected. In addition, it also provides basic information as to the location downstream where the motorist can return to the freeway.

If the incident or roadwork is on the same freeway as the DMS, there is no need to display the freeway route number or name; this is understood by motorists. However, when displaying information about an incident that has occurred on an intersecting freeway the route number or name must be displayed.

> **WHEN INCIDENT/ROADWORK IS ON SAME FREEWAY AS THE DMS:**
> - **No need to display route number or name**

When a majority of motorists are commuters, the incident/roadwork location should be referenced to the nearest cross street or exit ramp. Commuters are highly familiar with cross-street names and exit ramp names (or numbers). When there are no cross-streets or exit ramps in the vicinity of the incident, a prominent landmark (airport, factory, etc.) may be substituted.

When a majority of motorists would be unfamiliar with the names of local cross-streets, the incident/roadwork location should be described in distances to the nearest half-mile. Where numbers are used for exit ramps, the incident location can be referenced to the exit ramp number.

**FOR COMMUTERS:**
**Reference location of problem to street names, exit names, exit numbers, or landmarks.**

**FOR UNFAMILIAR MOTORISTS:**
**Reference location of problem by distance or exit numbers.**

| ACCIDENT<br>AT ROWLAND | ACCIDENT<br>AT EXIT 12 | ACCIDENT<br>1 MILE |
|---|---|---|
| *For familiar motorists* | *For familiar and unfamiliar motorists* | *For unfamiliar motorists* |

When a lane is closed, it is advisable to display the location where the lane closure begins and where it ends. This information is useful to the motorist in assessing where to return to the freeway if he/she decides to avoid the congestion. An example follows.

**Displaying the location where a lane closure begins and where it ends helps motorists.**

**LEFT LANE CLOSED**
**FROM EXIT 12**
**TO EXIT 14**

*Showing limits of lane closure*

The terms *ST*, *RD* and *AVE* are used with the names of streets, roads and avenues, respectively. These terms are not required and could be omitted. However, these terms must be used for streets and avenues with the same numeric names in the region (e.g., *7TH ST* vs. *7TH AVE*). An example follows.

***ST*, *RD* and *AVE* are not required and could be omitted.**

**They must be used for streets and avenues with the same numeric names (e.g., *7TH ST, 7TH AVE*).**

| ACCIDENT<br>AT ROWLAND | ACCIDENT<br>AT 7TH AVE |
|---|---|
| *AVE not required* | *AVE required* |

## LANES CLOSED

The ***Lanes Closed*** message element gives specific information about which lanes or exit ramps are closed or blocked. It helps the motorist prepare to change into the open lanes or to prepare to use another exit ramp.

## CLOSURE DESCRIPTOR

The ***Closure Descriptor*** message element is used in place of the *Incident/Roadwork Descriptor* when all lanes on the facility or exit ramp are closed.

## CLOSURE LOCATION

The location of a freeway closure will be at an exit ramp that will normally be different than the actual incident location. The ***Closure Location*** message element specifically states the location where the freeway is closed and would be used in place of the *Incident/Roadwork Location*.

## EFFECT ON TRAVEL

The ***Effect on Travel*** message element informs the motorist of the severity of the situation (i.e., delay or travel time) and helps the motorist make informed decisions about whether diversion is appropriate. In addition, it can imply the expected arrival time (in general terms) to the motorist's destination.

### Delay

Motorists interpret *DELAY* (shown in minutes) as being relative to their normal expected travel time to traverse the freeway and arrive at their destination. *DELAY* implies that it will take that much longer than usual. *DELAY* does not mean that the motorist will be held up in traffic at one location for that long or that it will take that long to remove an incident.

***(number) MIN DELAY*** **means that the motorist can expect his/her trip to be that much longer than usual.**

***AVOID (number) MIN DELAY*** **gives the advantage of the stated diversion route over the existing route.**

***SAVE (number) MIN*** **also gives the advantage of the stated diversion route over the primary route.**

Delay information can be displayed in terms of "X Minutes Delay," "Avoid X Minutes Delay," or "Save X Minutes." If the delay is expressed in the first form, it refers to travel time on the primary route and should appear in the DMS message immediately after the *Incident/Roadwork Descriptor* and the *Incident/Roadwork Location* (if displayed). If delay is expressed in terms of "Avoid X Minutes Delay" or "Save X Minutes," the reference is to an advantage of using the alternative route and should appear after the *Action* message element that mentions the alternative route. The following examples illustrate the different ways that delay information could be displayed.

| | | |
|---|---|---|
| **ACCIDENT<br>AT EXIT 12** | **ACCIDENT<br>AT EXIT 12** | **ACCIDENT<br>AT EXIT 12** |
| **20 MIN DELAY<br>USE I-410** | **USE I-410<br>AVOID 20 MIN DELAY** | **USE I-410<br>SAVE 20 MIN** |
| *Example of<br>“X MIN DELAY”* | *Example of<br>“AVOID X MIN DELAY”* | *Example of<br>“SAVE X MIN”* |

To be useful to the motorist, it is best to display specific delay times. However, when displaying a value (number) the DMS operator must have full confidence in the delay values selected. This is a number that motorists can sometimes check. Confidence in the DMS system can be adversely affected if the numbers are incorrect.

As an alternative to displaying a specific delay value, it is safer to display generic information such as *MAJOR DELAY* or *MINOR DELAY*.

> **THE GENERIC TERMS:**
> ***MAJOR DELAY* means to the average motorist in Texas a delay of 45 minutes or more.**
>
> ***HEAVY DELAY* means to the average motorist in Texas a delay of 25 to 45 minutes.**

Results of studies conducted implied that the average Texas motorist interprets *MAJOR DELAY* as meaning the delay is at least 45 minutes. *HEAVY DELAY* was interpreted to mean that the delay is at least 25 minutes. A majority of motorists understood *MAJOR DELAY* to be more severe than *HEAVY DELAY*.

Sometimes the *Effect on Travel* element can be combined with the *Incident/Roadwork Descriptor*. In the case of delay, the message *MAJOR ACCIDENT* has specific meaning to motorists. Motorists in Texas would interpret *MAJOR ACCIDENT* to mean that they can expect delays of 45 minutes or more.

### Travel Time

Another form of an *Effect on Travel* element is travel time. However, travel time should not be displayed as part of an incident or roadwork message because motorists prefer other types of information that is deemed more important to them.

Travel time is very useful to motorists because it gives them some indication as to the potential arrival time to their destination. Also, travel times can be displayed during the off-peak periods and has the added advantage that a message will be displayed on the DMS more frequently rather than having a sign blank in the absence of an incident.

When used, the posted travel times are calculated from speed measurements at two successive detector stations or are measured directly with automated vehicle identification equipment. Although the travel time information is historical in nature, it is fairly recent. Because of rapidly changing traffic conditions, it is difficult to post travel time information manually. It is more efficient to display travel times automatically using system software.

Although display of travel times is advantageous, the following possible credibility issues have created concerns for some TMC managers:

- Display of historic travel times; and
- Daily repetition of the same travel times displayed to commuters.

First, current technology does not allow TMCs to accurately predict travel times, thus recent historical travel times are displayed. Motorists can easily measure their own travel times and dispute incorrectly posted travel times. If "10 minutes" is displayed on a CMS and it takes motorists 15 minutes, credibility may be weakened. To circumvent this concern, TransStar in Houston displayed the time of day of the most recent calculation of travel times in the format below.

**TRAVEL TIME**
**TO I-610**
**20 MIN AT 8:20**

**Travel time RANGE is a good alternative.**

An approach used by TransGuide in San Antonio is to display a range of the estimated travel time. The DMS operator gives motorists the important information they need about potential arrival times while maintaining motorist credibility and support of the DMS system. An example of a message showing a range of travel time is shown below.

**TRAVEL TIME**
**TO DOWNTOWN**
**8-12 MINS**

The results of studies conducted in 2000 for TxDOT indicated that displaying recent historical travel times may not be a credibility issue provided that the differences in expected and actual travel times are not significantly different.

The second concern with displaying travel time on a regular basis is the possibility that commuter drivers may see the same travel times posted daily if traffic conditions do not change from day to day, may begin to ignore the CMS at later dates, and thus may not read the sign when important incident information is presented. To date, no research has been conducted to validate or disprove this concern.

## AUDIENCE FOR ACTION

> **WHEN THE ACTION APPLIES TO:**
> - **ALL MOTORISTS – *Audience for Action* message element is NOT used.**
> - **A SEGMENT OF MOTORISTS – *Audience for Action* message element is used.**

The ***Audience for Action*** message element is used when the *Action* message element applies to a specific group of motorists rather than all of the motorists traveling past the DMS. It alerts a specific group of motorists that the action part of the message applies to them. When the *Audience for Action* applies to all motorists on the highway at the location of the DMS, then the statement is not displayed. When the *Action* applies to only a segment of the motorists, then the *Audience for Action* message element should be used to avoid confusion as to whom the *Action* applies.

> **An *Audience for Action* message element must always be accompanied by an *Action* message element.**

Motorists expect when they see an *Audience for Action* message element on the DMS, they will also see an *Action* message element. An *Audience for Action* message element must always be accompanied with an *Action* statement.

| Message Phase 1 | | Message Phase 2 | |
|---|---|---|---|
| **MAJOR ACCIDENT**<br>**PAST ROWLAND** | *(Problem)*<br>*(Location)* | **USE**<br>**OTHER ROUTES** | *(Action)* |

*Action message element applies to all drivers passing CMS*

| Message Phase 1 | | Message Phase 2 | |
|---|---|---|---|
| **MAJOR ACCIDENT**<br>**PAST ROWLAND** | *(Problem)*<br>*(Location)* | **GALVESTON**<br>**USE I-610** | *(Audience)*<br>*(Action)* |

*Action message element applies to a specific group of drivers (Philadelphia traffic)*

> **Generally, the word *TRAFFIC* after a destination name is not necessary.**

Generally, the word *TRAFFIC* after a destination is not necessary. The reader of a sign can only be a motorist who is a part of the traffic stream, so *FAIR PARK, TAKE NEXT EXIT* can only mean *FAIR PARK TRAFFIC, TAKE NEXT EXIT*. The primary exception to this message design principle is when the location of the incident--either in terms of the cross street, miles ahead, or simply *AHEAD*--is not displayed, it is frequently necessary to display *TRAFFIC* after the destination. The following examples are presented:

| ACCIDENT<br>PAST I-30<br>- - - - - -<br>FAIR PARK<br>USE FITZHUGH | ACCIDENT<br>FAIR PARK TRAFFIC<br>USE FITZHUGH |
|---|---|
| *"TRAFFIC" not required* | *"TRAFFIC" required* |

If *TRAFFIC* were omitted from the second message, motorists could interpret the message to mean that an accident occurred near Fair Park.

**Names used for <u>cities</u> must be identical to those appearing on existing static signs.**

City destinations appearing on a DMS must be consistent with existing signing practices. Nicknames should be avoided. For example, *SAN ANTONIO* should be used rather than the term *ALAMO CITY*.

**Names used for <u>major generators</u> must be specific and address the exact place where the activity takes place.**

Many cities have large areas known locally by a single name, but which house smaller areas of wider general knowledge. Caution should be used when signing for these areas so that the name displayed is consistent with the name used by motorists. If the audience includes non-local, unfamiliar motorists, the more general, lesser known destination would be confusing if the activity was being held at a specific, more widely known destination.

## ACTION

The ***Action*** message element is necessary because it tells the motorist what to do. It is best that every incident management DMS message have an action statement. Omitting the *Action* leaves the motorist with a great deal of uncertainty as to the best course of action.

## GOOD REASON FOR FOLLOWING THE ACTION

When a motorist is advised to take an alternative route, he/she must be confident that it is the correct decision and that doing so will result in significant savings in time. Therefore, the motorist should be given a *Good Reason for Following the Action*. In most cases, the good reason is implied through the *Incident* or *Roadwork Descriptor*, *Lanes Affected*, and *Effect on Travel* elements of the message and need not be displayed separately. However, in other situations, a specific *Good Reason for Following the Action* message element is needed.

# 4.5 WORD AND PHRASE MEANINGS AND CRITERIA

## SELECTING FROM ALTERNATIVE WORDS AND PHRASES

### Use, Take and Follow

The *Action* message element requires an action verb. In general, the three verbs *USE*, *TAKE* and *FOLLOW* are synonymous and no strong preference has been found. The verb *USE* has been employed more often because it is slightly shorter. There are, however, small differences in meaning which make one verb preferable to another when used in a particular DMS message.

**_USE_: A route that will carry motorists to the destination.**
**_TAKE_: Directive to begin the first "leg" of route.**
**_FOLLOW_: Motorist will be guided by other signs along the route.**
**_EXIT_: Sometimes used as a verb.**
**_GO_: Not used.**

The verb *USE* should be selected whenever the advisory in the DMS message is to employ a route that will carry the motorist to his/her destination. The destination could be a major generator or a point of return to the freeway.

The verb *TAKE* should be selected whenever the advisory is a directive to begin taking the first highway or "leg" of a route.

The verb *FOLLOW* carries the additional connotation that the motorist will be guided by other signs along the route. *FOLLOW* should never be used when guidance is not available.

The verb *EXIT* may also be used as a verb in action message statements that are displayed on a freeway. When *EXIT* is employed as a verb, it should usually be followed by the name of the cross-street or highway associated with the exit ramp.

The verb *GO* is not used in DMS messages for route guidance, but may be used in highway advisory radio messages. It connotes initiation of action, but would be out of place in situations where *USE* or *TAKE* is appropriate.

**MAJOR ACCIDENT**
**AT EXIT 12**
**USE I-410**

*Example of "USE"*

**BEST ROUTE**
**TO GALVESTON**
**TAKE NEXT EXIT**

*Example of "TAKE"*

**MAJOR ACCIDENT**
**AT ROWLAND**

*Phase 1*

**EXIT AT BASEL**
**FOLLOW DETOUR**

*Phase 2*

*Example of "FOLLOW"*

**Construction vs. Roadwork**

Although the relative interpretations of the words *CONSTRUCTION* and *ROADWORK* were not studied in Texas, results from studies in New Jersey indicated that *ROADWORK* can be substituted for the longer word *CONSTRUCTION*. Human factors studies in New Jersey indicated that 59 percent of the motorists surveyed interpreted the words *CONSTRUCTION* and *ROADWORK* to have the same meaning. The other 41 percent stated that the meanings differ. To these 41 percent, *CONSTRUCTION* implied larger-scale, longer-term work such as building bridges.

**_ROADWORK_ may be substituted for the longer word _CONSTRUCTION_.**

There are two disadvantages to displaying the word *CONSTRUCTION*. First, it is a longer and more complex word than *ROADWORK* and, therefore, will take longer for motorists to read. Second, the word *CONSTRUCTION* will not fit on an eight-character line of a portable sign and, therefore, must either be abbreviated with *CONST* or replaced with the word *ROADWORK.*

Results of human factors studies showed that approximately 85 percent of the motorists surveyed in six major cities in Texas understood the abbreviation *CONST* to mean *CONSTRUCTION*.

**Exit vs. Ramp**

When referring to an off ramp on DMSs located on a freeway, the word *EXIT* should be used. The word *RAMP* should not be used because it has different meanings among motorists.

Results of human factors studies indicated that 41 percent of the Texas motorists surveyed believed that the two terms have different meanings. Interpretations included: 1) the term *EXIT* is for when the motorist gets off the freeway, and *RAMP* is for when the motorist gets on; and 2) the term *EXIT* means a motorist can leave the freeway, and *RAMP* means the motorist will go to a freeway-to-freeway connector.

**A Dash vs. Thru**

The dash may be substituted for the term *THRU* to indicate a set of inclusive days (e.g., *TUE – THURS* to indicate Tuesday thru Thursday). Eighty-five percent of the motorists surveyed in Texas correctly stated the days of the week when the dash was used; 92 percent of the motorists surveyed in New Jersey correctly stated the days of the week.

**Nite vs. Night**

The term *NITE* may be used in place of *NIGHT*. Although the term was not specifically studied in Texas, results of human factors studies conducted in New Jersey showed most motorists in that state understand the term *NITE* as a substitute for *NIGHT*.

**For 1 Week**

Frequently roadwork is performed over a 1-week period (i.e., 7 consecutive days). Although the term *FOR 1 WEEK* takes less DMS space, it should not be used to indicate the 7-day work period. The results of human factor studies in Texas revealed that the term *FOR 1 WEEK* was ambiguous as to whether the roadwork begins the date the message was viewed, the next day, or from the beginning of the current or next week.

### Weekend

Oftentimes, major lane or roadway closures are necessary on the weekend. Although it is desirable to present the inclusive days and hours (e.g., *FRI 6 PM – MON 5 AM*), the portable DMS is limited to eight characters per line. If a term such as *NEXT WEEKEND* can be used rather than days and hours, then the message can be made much shorter in length.

The message term *WEEKEND* should be used only if the work is to start on Saturday morning and end by Sunday evening at midnight. The term should not be used in Texas if either the roadwork begins on Friday evening or ends on Monday morning. The results of human factors studies in Texas indicated that 62 percent of the motorists would believe the work would begin on Saturday morning and 69 percent would believe the work would end on Sunday evening.

## WORDS AND TERMS WITH LOW MOTORIST UNDERSTANDING

The recommendations that follow are based on results of human factors studies conducted in Texas and New Jersey.

### Calendar Dates

It is desirable to notify motorists of upcoming roadwork or of a special event that will impact traffic. In the past, calendar dates have been used (e.g., *OCT 10 – OCT 12*) to indicate when the roadwork or special event activity begins and/or ends. However, results of human factors studies showed that Texas motorists have difficulty in corresponding calendar dates with specific days of the week.

Therefore, use days of the week (e.g., *TUE – THUR*) rather than calendar dates (*OCT 10 – OCT 12*). The use of days of the week is preferred over calendar dates.

Results of human factors studies showed that 85 and 93 percent gave the correct days of the week when Message 1 was shown. In contrast, only 21 percent and 11 percent of the drivers surveyed in Texas and New Jersey were able to give correct days of the week when calendar dates were displayed even though the days were during the next week (see Message 2).

| | |
|---|---|
| **ROAD CLOSED**<br>**TUES - THUR** | ~~**ROAD CLOSED**~~<br>~~**[OCT 10 - OCT 12]**~~ |
| *Message 1*<br>*Acceptable* | *Message 2*<br>*Unacceptable* |

**Lane Shift, Traffic Shifts, Lanes Change and New Traffic Pattern**

There are several terms that have sometimes been used in work zones to indicate a temporary alignment change (i.e., all lanes shift left or right). The following terms should not be used:

- LANES SHIFT;
- TRAFFIC SHIFTS;
- LANES CHANGE; and
- NEW TRAFFIC PATTERN.

Instead, the following term should be used:

- LANES SHIFT/STAY IN LANE.

The recommendation is based on human factors studies conducted in New Jersey. The results of New Jersey studies revealed that a large majority of the motorists surveyed believed that they would have to merge with traffic in another lane when the terms *LANE SHIFT* (53 percent), *TRAFFIC SHIFTS* (52 percent), *LANE CHANGES* (73 percent), or *NEW TRAFFIC PATTERN* (42 percent) was displayed. Therefore, these terms would encourage undesirable lane changing. Most of the motorists surveyed (81 percent) understood that they would not have to merge to another lane when the term *LANES SHIFT/STAY IN LANE* was used.

# 4.6 DIVERSION/DETOUR ROUTE DESCRIPTIONS FOR INCIDENT AND ROADWORK SITUATIONS

## INTRODUCTION

The *Action* message element that involves traffic diversion is influenced by the type of diversion route that will be used by motorists to travel around the incident. Six diversion route types have been identified for use in this Manual—Types 1 through 6. Based on current practice, only Types 2, 5, and 6 apply to Texas. Type 2 is a diversion route to another freeway, Type 5 is a diversion route documented in an Incident Emergency Route Plan, and Type 6 is a detour route used in a Traffic Control Plan for a roadway closure during construction or maintenance operations.

Although only three diversion route types apply to Texas, all six are described in the following Section of the Manual for information purposes.

## DIVERSION/DETOUR ROUTE TYPES

### Type 1 Diversion Route

Type 1 is the simplest form of diversion route. The diversion route has a major road (e.g., frontage road, arterial, etc.) that is basically parallel and close to the primary freeway and offers opportunities for motorists to either turn toward the freeway and reenter downstream of the incident; or head directly to the major destination.

Some form of surveillance (electronic or human) exists on the diversion route and sends information about traffic conditions to the traffic management center (TMC). Therefore, the DMS operator has knowledge of the traffic conditions on both the primary freeway and the diversion route.

Guide signs and/or trailblazers to the freeway or major destination **may not be** present. However, commuters most likely know the crossroads that will allow them to drive back to the freeway once they pass the incident or know the route to the major destination. Police and/or traffic control personnel are not guiding traffic along the diversion route.

The Type 1 diversion route is generally applicable when:

- Lanes are blocked due to an incident;
- Lanes are closed due to an incident;
- Freeway is totally blocked due to an incident;
- Freeway is closed due to an incident;
- Lanes are closed due to roadwork; or
- Freeway is closed due to roadwork.

**Type 2 Diversion Route**

The Type 2 diversion route has one or more primary major roads (e.g., other freeways, arterials, etc.) that offer opportunities for motorists to either 1) exit the primary freeway and reenter downstream of the incident, or 2) head directly to the major destination.

Some form of surveillance (electronic or human) exists on the diversion route and sends information about traffic conditions to the TMC. Therefore, the DMS operator has knowledge of the traffic conditions on both the primary freeway and the diversion route.

Existing static guide signs and/or trailblazers to the primary freeway or to the major destination **are** present. Police and/or traffic control personnel are not guiding traffic along the diversion route.

The Type 2 diversion route is generally applicable when:

- Lanes are blocked due to an incident;
- Lanes are closed due to an incident;
- Freeway is totally blocked due to an incident;
- Freeway is closed due to an incident;
- Lanes are closed due to roadwork; or
- Freeway is closed due to roadwork.

**Type 3 Diversion Route**

The Type 3 diversion route has one or more primary major roads (e.g., arterials, other freeways, etc.) that offer opportunities for motorists to either turn toward the freeway and reenter downstream of the incident or head directly to the major destination.

Some form of surveillance (electronic or human) exists on the diversion route and sends information about traffic conditions to the TMC. Therefore, the DMS operator has knowledge of the traffic conditions on both the primary freeway and the diversion route.

Static guide signs and/or trailblazers to the freeway or to the major destination **are not** present. Police and/or traffic control personnel are guiding traffic along the diversion route.

The Type 3 diversion route is generally applicable when

- Freeway is closed due to an incident.

**Type 4 Diversion Route**

The Type 4 diversion route has one or more primary major roads (e.g., arterials, other freeways, etc.) that offer opportunities for motorists to either turn toward the freeway and reenter downstream of the incident or head directly to the major destination.

Some form of surveillance (electronic or human) exists on the diversion route and sends information about traffic conditions to the TMC. Therefore, the DMS operator has knowledge of the traffic conditions on both the primary freeway and the diversion route.

Existing static guide signs and/or trailblazers to the freeway or to the major destination **are** present.  In addition, police and/or traffic control personnel are guiding traffic along the diversion route.

The Type 4 diversion route is generally applicable when:

- Freeway is closed due to an incident.

**Type 5 Diversion Route: Incident Emergency Route Plan**

The Type 5 diversion route has one or more primary major roads (e.g., arterials, other freeways, etc.) that offer opportunities for motorists to either turn toward the freeway and reenter downstream of the incident; or head directly to the major destination.

Existing static guide signs and/or trailblazers to the freeway or to the major destination may not be present.  Diversion/detour signs are installed after the incident occurs.  In addition, police and/or traffic control personnel are guiding traffic along the diversion route.

The Type 5 Diversion Route is applicable when:

- Freeway is closed due to an incident.

**Type 6 Detour Route: Traffic Control Plan for Roadwork Closure**

The Type 6 detour route is a route that has been established and contains the full complement of traffic control devices specified in the traffic control plan for the major roadwork project.

The Type 6 detour route is applicable when:

- Freeway is closed due to roadwork.

**Summary of Diversion/Detour Route Types**

A summary of the characteristics for diversion/detour route types is shown in Table 4.1.  The applicable incident or roadwork situation for the various diversion/detour route types based on the location of the DMS relative to the incident/roadwork location is given in Table 4.2.

| Table 4.1 Characteristics of Diversion/Detour Routes | | | | | | |
|---|---|---|---|---|---|---|
| **Characteristics** | **Diversion/Detour Route** | | | | | |
| | **Type 1** | **Type 2** | **Type 3** | **Type 4** | **Type 5** | **Type 6** |
| Electronic and/or human surveillance are required on diversion route | X | X | X | X | | |
| Existing guide signs and/or trailblazers to freeway or destination on diversion route | | X | | X | | |
| Police and/or traffic control personnel at critical decision points on diversion route | | | X | X | X | |
| Incident Emergency Route Plan signing | | | | | X | |
| Roadwork Traffic Control Plan traffic control devices | | | | | | X |

| Table 4.2 Incident/Roadwork Situation, DMS Location and Diversion/Detour Route Type | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Incident/Roadwork** | **DMS Location** | **Diversion/Detour Route** | | | | | |
| | | **Type 1** | **Type 2** | **Type 3** | **Type 4** | **Type 5** | **Type 6** |
| Incident Lane Blockage | Same freeway & near incident | X | X | | | | |
| | Same freeway & far upstream of incident | X | X | | | | |
| | Different freeway | X | X | | | | |
| Incident Lane Closure | Same freeway & near incident | X | X | | | | |
| | Same freeway & far upstream of incident | X | X | | | | |
| | Different freeway | X | X | | | | |
| Incident Total Freeway Blockage | Same freeway & near incident | X | X | | | | |
| | Same freeway & far upstream of incident | X | X | | | | |
| | Different freeway | X | X | | | | |
| Incident Total Freeway Closure | Same freeway & near incident | X | X | X | X | X | |
| | Same freeway & far upstream of incident | X | X | X | X | X | |
| | Different freeway | X | X | | | | |
| Roadwork Lane Closure | Same freeway & near incident | X | X | | | | |
| | Same freeway & far upstream of incident | X | X | | | | |
| | Different freeway | X | X | | | | |
| Roadwork Total Freeway Closure | Same freeway & near incident | | | | | | X |
| | Same freeway & far upstream of incident | | | | | | X |
| | Different freeway | X | X | | | | |
| Connector Ramp Closure: Incident on Intersecting Freeway | Upstream of connector ramp | X | X | | | X | |
| Connector Ramp Closure: Roadwork on Intersecting Freeway | Upstream of connector ramp | X | X | | | | X |

# 4.7 DYNAMIC FEATURES ON DMSs

## INTRODUCTION

DMSs are capable of using dynamic features to display messages. Results of research indicate that the use of the following dynamic features should be avoided:

> **AVOID:**
> - **Flashing an entire one-phase message,**
> - **Flashing one line of a one-phase message, and**
> - **Alternating text on one line of a three-line DMS while keeping the other two lines of text the same.**

- Flashing an entire one-phase message;

| |
|---|
| **MAJOR ACCIDENT**<br>**AT ROWLAND**<br>**LEFT 2 LANES CLOSED** |

*flashing*

- Flashing one line of a one-phase message;

| |
|---|
| **MAJOR ACCIDENT** ← *flashing*<br>**AT ROWLAND**<br>**LEFT 2 LANES CLOSED** |

- Alternating text on one line of a three-line DMS while keeping the other two lines of text the same.

| | |
|---|---|
| **ACCIDENT**<br>**AT ROWLAND**<br>**LEFT 2 LANES**<br>**CLOSED** | **ACCIDENT**<br>**AT ROWLAND**<br>**TUNE TO 530 AM** ← *alternating* |

## FLASHING AN ENTIRE ONE-PHASE MESSAGE

Results of research conducted in Texas for TxDOT indicate that flashing a one-phase 3-unit message on a DMS has no significant effect upon motorist comprehension of the information being presented. Furthermore, driver preferences are fairly evenly split between flashing the message or not (i.e., a static message). However, the data show that flashing the message increases the amount of time required to read and comprehend the message. In this particular study, the fact that the message contained only 3 units of information allowed most subjects to correctly comprehend the message. However, this would not be expected to be the case if more information were presented.

Given that there does not appear to be strong driver preference for flashing one-phase messages and that such a practice does increase reading times, it is recommended that flashing messages not be used as part of DMS operations. However, if personnel in a TMC choose to use flashing one-phase messages, it is strongly recommended that the message themselves be limited to 3 units of information or less to account for the increased reading and comprehension times.

## FLASHING ONE LINE OF A ONE-PHASE MESSAGE

Results of research conducted in Texas for TxDOT indicate that flashing one line of a one-phase, 3-unit message on a DMS does reduce the ability of motorists to remember parts of the message that are not flashing. The data further indicate that reading times are significantly increased when a line is flashed. Driver preferences are fairly evenly split between flashing the message line or not (i.e., a static message). In this particular study, the fact that the message contained only 3 units of information allowed most subject drivers to correctly comprehend the message. However, this would not be expected to be the case if more information were presented.

Given that there does not appear to be strong driver preference for flashing one line of a one-phase message and that such a practice reduces overall motorist comprehension and increases reading time, it is recommend that this technique not be used as part of DMS operations.

## ALTERNATING TEXT ON ONE LINE OF A THREE-LINE DMS WHILE KEEPING THE OTHER TWO LINES OF TEXT THE SAME

Results of research conducted in Texas for TxDOT indicate that on three-line DMSs including redundant information by repeating the top two lines on both phases of a two-phase message while changing the bottom line does not reduce the ability of motorists to remember parts of the message. However, total message reading times are significantly increased when the sign message includes redundant information. Driver preferences are fairly evenly split between having and not having redundant information in both phases.

Given these findings, it is recommended that redundant information on a two-phase, four-unit DMS message should not be displayed such that two lines are kept the same and a third line is changed.

# MODULE 5. DESIGNING THE BASE DMS MESSAGE FOR INCIDENTS

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# MODULE 5. DESIGNING THE BASE DMS MESSAGE FOR INCIDENTS

## 5.1 BASE DMS MESSAGE FOR LANE-CLOSURE (BLOCKAGE) INCIDENTS

### BASE DMS MESSAGE ELEMENTS

The Base DMS Message for lane-closure incidents includes the following elements: 1) ***Incident Descriptor*** (situation description), 2) ***Incident Location,*** 3) ***Lanes Closed,*** 4) ***Effect on Travel*** (e.g., major delay), 5) ***Audience for Action,*** 6) ***Action,*** and 7) ***Good Reason for Following the Action***.

**BASE DMS MESSAGE ELEMENTS**
- **Incident Descriptor (situation description),**
- **Incident Location,**
- **Lanes Closed,**
- **Effect on Travel (e.g., major delay),**
- **Audience for Action (when the action is for a specific group of motorists),**
- **Action (tells motorists what to do), and**
- **Good Reason for Following the Action statement (usually implied by other message elements).**

## DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE INCIDENT

### Incident Descriptor

Warnings of hazardous incidents should be displayed under all traffic conditions in peak or off-peak periods. Minor off-the-roadway incidents such as grass cutting, stalled vehicles on the shoulder, etc. should not be displayed.

Terms for the *Incident Descriptor* message element are shown in Table 5.1

**Table 5.1 *INCIDENT DESCRIPTORS***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO INCIDENT**

| **Large Signs** | **Portable Signs** |
|---|---|
| ACCIDENT | ACCIDENT |
| ACCIDENT AHEAD | ACCIDENT | AHEAD |
| MAJOR ACCIDENT | MAJOR | ACCIDENT |
| MINOR ACCIDENT | MINOR | ACCIDENT |
| TRUCK ACCIDENT | TRUCK | ACCIDENT |
| STALLED VEHICLE | STALLED | VEHICLE |
| VEHICLE FIRE | VEHICLE | FIRE |
| FUEL SPILL | FUEL | SPILL |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

A general message phrase, such as *ACCIDENT,* is preferred and reduces the need for a large library of messages for every conceivable incident. Also, credibility is weakened when overly precise messages are not verified. For example, the terms *MAJOR ACCIDENT* or *TRUCK ACCIDENT* is preferred to more exact descriptions such as *VEHICLE OVERTURNED*. Some motorists will voluntarily divert in response to either of the terms.

The message phrase *MAJOR ACCIDENT* implies to motorists a more serious accident that may block more than one lane and will result in extensive delay. To the average Texas motorist, it implies a delay of more than 45 minutes.

***MAJOR ACCIDENT* means delays of 45 minutes or more to the average Texas motorist.**

## Incident Location

General principles for the message element *Incident Location* can be found beginning on page 4-8.

Terms for the *Incident Location* message element are shown in Table 5.2.

**Table 5.2 TERMS FOR *INCIDENT LOCATION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| 1 MILE *(AHEAD)* | 1 MILE *(AHEAD)* |
| *[number]* MILES *(AHEAD)* | *[number]* MILES *(AHEAD)* |
| AHEAD | AHEAD |
| AT *[highway, street name]* | AT \| *[highway, street name]* |
| AT *[exit ramp name]* EXIT | AT \| *[exit ramp name]* \| EXIT |
| BEFORE *[highway, street name]* | BEFORE \| *[highway, street name]* |
| BEFORE *[exit ramp name]* EXIT | BEFORE \| *[exit ramp name]* \| EXIT |
| PAST *[highway, street name]* | PAST \| *[highway, street name]* |
| PAST *[exit ramp name]* EXIT | PAST \| *[exit ramp name]* \| EXIT |
| ON LEFT SHOULDER | ON LEFT \| SHOULDER |
| ON RIGHT SHOULDER | ON RIGHT \| SHOULDER |
| ON MAIN LANES | ON \| MAIN LNS |
| OVER *[highway, street name]* | OVER \| *[highway, street name]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

When the DMS is located on the same freeway as the incident and relatively close to and upstream of the incident, the DMS message can encourage motorists to leave the closed lane(s) and move into the open lanes by informing them which specific lanes are closed. This helps the movement of vehicles through the restricted area.

Terms for the *Lanes Closed* message element for these cases are shown in Table 5.3.

**Table 5.3 TERMS FOR *LANES CLOSED***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |
| CENTER LANE CLOSED | CENTER \| LANE \| CLOSED |
| CENTER LANES CLOSED | CENTER \| LANES \| CLOSED |
| CENTER *[number]* LANES CLOSED | CENTER \| *[number]* LANES \| CLOSED |
| LEFT LANE CLOSED | LEFT \| LANE \| CLOSED |
| LEFT *[number]* LANES CLOSED | LEFT \| *[number]* LANES \| CLOSED |
| RIGHT LANE CLOSED | RIGHT \| LANE \| CLOSED |
| RIGHT *[number]* LANES CLOSED | RIGHT \| *[number]* LANES \| CLOSED |
| FREEWAY CLOSED | FREEWAY \| CLOSED |
| EXIT TO *[highway, street name]* CLOSED | EXIT TO \| *[highway, street name]* \| CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

Terms for the *Effect on Travel* message element when lane-blocking incidents occur are shown in Table 5.4.

**Table 5.4 TERMS FOR *EFFECT ON TRAVEL***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO INCIDENT**

| **Large Signs** | **Portable Signs** |
|---|---|
| EXPECT DELAY | EXPECT \| DELAY |
| EXPECT MAJOR DELAY | EXPECT \| MAJOR \| DELAY |
| EXPECT MINOR DELAY | EXPECT \| MINOR \| DELAY |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Action

General principles for the message element *Action* statements can be found beginning on page 4-14.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists are not advised to take an alternative route,
- Motorists are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion), or
- Motorists are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4, Type 5 and Type 6 diversion routes are not applicable)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, motorists should not be encouraged to divert to another route because it would result in greater travel time than if the motorists were to remain on the primary freeway. However, it is still important to tell motorists what they need to do.

Terms for the *Action* message element when lane-blocking incidents occur under this situation are shown in Table 5.5.

**Table 5.5 TERMS FOR *ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO INCIDENT**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-***
***NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| BE PREPARED TO STOP | BE \| REPARED \| TO STOP |
| USE CAUTION | USE \| CAUTION |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A "Soft" Diversion *Action* message element might be displayed for a variety of reasons including:

- There are no suitable alternative routes that can be recommended because traffic conditions on the most logical routes would not result in travel time savings to motorists if they diverted from the primary freeway;
- The DMS operator is unaware of the traffic conditions on the most logical alternative routes because surveillance does not exist on these routes,
- It is important to display an *Action* before the DMS operator has had a chance to assess the full impact of the incident, and/or
- It is important to display an *Action* before the police have arrived and establish positive diversion routes.

Terms for the *Action* message element when lane-blocking incidents occur under this situation are shown in Table 5.6.

**Table 5.6 TERMS FOR *ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO INCIDENT**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| Large Signs | Portable Signs |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

There are times when the DMS operator is aware of an acceptable alternative freeway route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 5-7.

**Table 5.7 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| Large Signs | Portable Signs |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE [*freeway] [cardinal direction]* | USE \| [*freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Terms for the *Audience for Action* message element are shown in Table 5.8.

**Table 5.8 TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[highway, street name] [cardinal direction]* TRAFFIC | *[highway, street name] [cardinal direction]* \| TRAFFIC |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for displaying to motorists the message element *Good Reason for Following the Action* are given on page 4-14.

When *MAJOR ACCIDENT* or *TRUCK ACCIDENT* are displayed, the reason for following the suggested action is implied and there is no need to display the reason. However, when the incident descriptors *ACCIDENT* or *MINOR ACCIDENT* are displayed, then a reason should displayed. Also, when it is important to convince motorists to use an alternative route, it is oftentimes advantageous to display *BEST ROUTE TO [destination]*.

The terms shown in Table 5.9 are acceptable to display.

**Table 5.9 TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO INCIDENT**

| **Large Signs** | **Portable Signs** |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE INCIDENT

### Incident Descriptor

Warnings of hazardous incidents should be displayed under all traffic conditions in peak or off-peak periods. Minor off-the-roadway incidents such as grass cutting, stalled vehicles on the shoulder, etc., should not be displayed.

Terms for the *Incident Descriptor* message element are shown in Table 5.10.

**Table 5.10 *INCIDENT DESCRIPTORS***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| ACCIDENT | ACCIDENT |
| ACCIDENT AHEAD | ACCIDENT \| AHEAD |
| MAJOR ACCIDENT | MAJOR \| ACCIDENT |
| MINOR ACCIDENT | MINOR \| ACCIDENT |
| TRUCK ACCIDENT | TRUCK \| ACCIDENT |
| STALLED VEHICLE | STALLED \| VEHICLE |
| VEHICLE FIRE | VEHICLE \| FIRE |
| FUEL SPILL | FUEL \| SPILL |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

A general message phrase, such as *ACCIDENT,* is preferred and reduces the need for a large library of messages for every conceivable incident. Also, credibility is weakened when overly precise messages are not verified. For example, the terms *MAJOR ACCIDENT* or *TRUCK ACCIDENT* is preferred to more exact descriptions such as *VEHICLE OVERTURNED*. Some motorists will voluntarily divert in response to either of the terms.

The message phrase *MAJOR ACCIDENT* implies to motorists a more serious accident that may block more than one lane and will result in extensive delay. To the average Texas motorist, it implies a delay of more than 45 minutes.

***MAJOR ACCIDENT* means delays of 45 minutes or more to the average Texas motorist.**

## Incident Location

General principles for the message element *Incident Location* can be found beginning on page 4-8.

Terms for the *Incident Location* message element are shown in Table 5.11.

**Table 5.11 TERMS FOR *INCIDENT LOCATION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| 1 MILE *(AHEAD)* | 1 MILE *(AHEAD)* |
| *[number]* MILES *(AHEAD)* | *[number]* MILES *(AHEAD)* |
| AHEAD | AHEAD |
| AT *[highway, street name]* | AT \| *[highway, street name]* |
| AT *[exit ramp name]* EXIT | AT \| *[exit ramp name]* \| EXIT |
| BEFORE *[highway, street name]* | BEFORE \| *[highway, street name]* |
| BEFORE *[exit ramp name]* EXIT | BEFORE \| *[exit ramp name]* \| EXIT |
| PAST *[highway, street name]* | PAST \| *[highway, street name]* |
| PAST *[exit ramp name]* EXIT | PAST \| *[exit ramp name]* \| EXIT |
| ON LEFT SHOULDER | ON LEFT \| SHOULDER |
| ON RIGHT SHOULDER | ON RIGHT \| SHOULDER |
| ON MAIN LANES | ON \| MAIN LNS |
| OVER *[highway, street name]* | OVER \| *[highway, street name]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

Situations arise when the DMS is on the same freeway and upstream of the incident but at a location far enough upstream of the incident where it is not advisable to encourage lane changing. It is best to move traffic in all the lanes. Therefore, there is no traffic flow advantage to inform motorists the specific lanes that are closed. However, it is important to notify motorists the number of lanes closed so that they can make earlier decisions about whether to take alternative routes.

Terms for *Lanes Closed* message element for these cases are shown in Table 5.12.

**Table 5.12 TERMS FOR *LANES CLOSED***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |
| 1 LANE CLOSED | 1 LANE \| CLOSED |
| *[number]* LANES CLOSED | *[number]* LANES \| CLOSED |
| 1 LANE OPEN | 1 LANE \| OPEN |
| *[number]* LANES OPEN | *[number]* LANES \| OPEN |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

Terms for the *Effect on Travel* message element when lane-blocking incidents occur are shown in Table 5.13.

**Table 5.13 TERMS FOR *EFFECT ON TRAVEL***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| EXPECT DELAY | EXPECT \| DELAY |
| EXPECT MAJOR DELAY | EXPECT \| MAJOR \| DELAY |
| EXPECT MINOR DELAY | EXPECT \| MINOR \| DELAY |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS

## Action

General principles for the message element *Action* can be found beginning on page 4-14.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists are not advised to take an alternative route,
- Motorists are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion), or
- Motorists are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4, Type 5 and Type 6 diversion routes are not applicable)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, motorists should not be encouraged to divert to another route because it would result in greater travel time than if the motorists were to remain on the primary freeway. However, it is still important to tell motorists what they need to do.

Terms for the *Action* message element when lane-blocking incidents occur under this situation are shown in Table 5.14.

**Table 5.14 TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| BE PREPARED TO STOP | BE \| REPARED \| TO STOP |
| USE CAUTION | USE \| CAUTION |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

***Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)***

A "Soft" Diversion *Action* message element might be displayed for a variety of reasons including:

- There are no suitable alternative routes that can be recommended because traffic conditions on the most logical routes would not result in travel time savings to motorists if they diverted from the primary freeway,
- The DMS operator is unaware of the traffic conditions on the most logical alternative routes because surveillance does not exist on these routes,
- It is important to display an *Action* before the DMS operator has had a chance to assess the full impact of the incident, and/or
- It is important to display an *Action* before the police have arrived and establish positive diversion routes.

Terms for the *Action* message element when lane-blocking incidents occur under this situation are shown in Table 5.15.

**Table 5.15 TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| **Large Signs** | **Portable Signs** |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

There are times when the DMS operator is aware of an acceptable alternative freeway route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 5-16.

**Table 5.16 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE [*freeway] [cardinal direction]* | USE \| [*freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Terms for *Audience for Action* message element are shown in Table 5.17.

**Table 5.17 TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**

| **Large Signs** | **Portable Signs** |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[highway, street name] [cardinal direction]* TRAFFIC | *[highway, street name] [cardinal direction]* \| TRAFFIC |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for displaying the message element *Good Reason for Following the Action* are given on page 4-14.

When *MAJOR ACCIDENT* or *TRUCK ACCIDENT* are displayed, the reason for following the suggested action is implied, and there is no need to display the reason. However, when the incident descriptors *ACCIDENT* or *MINOR ACCIDENT* are displayed, then a reason needs to be displayed. Also, when it is important to convince motorists to use an alternative route, it is oftentimes advantageous to display *BEST ROUTE TO [destination]*.

The terms shown in Table 5.18 are acceptable to display.

**Table 5.18 TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## DMS ON DIFFERENT FREEWAY THAN THE INCIDENT

The DMS operational guidelines in this section of the Manual apply when the DMS is on a different freeway than the incident, but the incident still can have an affect on motorists who are passing the DMS. For example, westbound I-10 motorists who intend to exit the freeway and enter northbound I-45 to travel toward Dallas could be affected by incidents that occur on northbound I-45 north of the I-10/I-45 interchange. Messages displayed on DMSs on westbound I-10 concerning incidents on northbound I-45 can be helpful to those motorists heading toward Dallas.

The major difference between the messages displayed on DMSs located on a different freeway than the incident in comparison to the messages on DMSs located on the same freeway as the incident but far upstream of the incident is in the diversion information provided.

## Incident Descriptor

Warnings of hazardous incidents should be displayed under all traffic conditions in peak or off-peak periods. Minor off-the-roadway incidents such as grass cutting, stalled vehicles on the shoulder, etc. should not be displayed.

Terms for the *Incident Descriptor* message element are shown in Table 5.19

**Table 5.19 *INCIDENT DESCRIPTORS***
**DMS ON DIFFERENT FREEWAY THAN INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| ACCIDENT | ACCIDENT |
| MAJOR ACCIDENT | MAJOR \| ACCIDENT |
| MINOR ACCIDENT | MINOR \| ACCIDENT |
| TRUCK ACCIDENT | TRUCK \| ACCIDENT |
| STALLED VEHICLE | STALLED VEHICLE |
| VEHICLE FIRE | VEHICLE FIRE |
| FUEL SPILL | FUEL SPILL |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

A general message phrase, such as *ACCIDENT,* is preferred and reduces the need for a large library of messages for every conceivable incident. Also, credibility is weakened when overly precise messages are not verified. For example, the terms *MAJOR ACCIDENT* or *TRUCK ACCIDENT* is preferred to more exact descriptions such as *VEHICLE OVERTURNED*. Some motorists will voluntarily divert in response to either of the terms.

**_MAJOR ACCIDENT_ means delays of 45 minutes or more to the average Texas motorist.**

The message phrase *MAJOR ACCIDENT* implies to motorists a more serious accident that may block more than one lane and will result in extensive delay. To the average Texas motorist, it implies a delay of more than 45 minutes.

## Incident Location

General principles for the message element *Incident Location* can be found beginning on page 4-8.

Terms for the *Incident Location* message element are shown in Table 5.20.

**Table 5.20 TERMS FOR *INCIDENT LOCATION***
**DMS ON DIFFERENT FREEWAY THAN INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| AT *[highway, street name]** | AT \| *[highway, street name]** |
| AT *[exit ramp name]* EXIT* | AT \| *[exit ramp name]* \| EXIT* |
| BEFORE *[highway, street name]** | BEFORE \| *[highway, street name]** |
| BEFORE *[exit ramp name]* EXIT* | BEFORE \| *[exit ramp name]* \| EXIT* |
| PAST *[highway, street name]** | PAST \| *[highway, street name]** |
| PAST *[exit ramp name]* EXIT* | PAST \| *[exit ramp name]* \| EXIT* |
| OVER *[highway, street name]** | OVER \| *[highway, street name]** |

* Insert "**ON *[route number, highway name or street name][cardinal direction]***" in front of the Incident Location**.**
"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

When the incident occurs downstream of the DMS but on a different highway, it is not necessary to inform motorists the specific lanes that are closed.  What is important to the motorist is knowledge of the number of lanes that are closed.

Terms for the *Lanes Closed* message element are shown in Table 5.21.

**Table 5.21  TERMS FOR *LANES CLOSED***
**DMS ON DIFFERENT FREEWAY THAN INCIDENT**

| **Large Signs** | **Portable Signs** |
|---|---|
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |
| 1 LANE CLOSED | 1 LANE \| CLOSED |
| *[number]* LANES CLOSED | *[number]* LANES \| CLOSED |
| 1 LANE OPEN | 1 LANE \| OPEN |
| *[number]* LANES OPEN | *[number]* LANES \| OPEN |

"|"  Indicates that the next portion of the message will be displayed on the next line(s) of DMS

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

Terms for the *Effect on Travel* message element when lane-blocking incidents occur are shown in Table 5.22.

**Table 5.22 TERMS FOR *EFFECT ON TRAVEL***
**DMS ON DIFFERENT FREEWAY THAN INCIDENT**

| **Large Signs** | **Portable Signs** |
| --- | --- |
| EXPECT DELAY | EXPECT \| DELAY |
| EXPECT MAJOR DELAY | EXPECT \| MAJOR \| DELAY |
| EXPECT MINOR DELAY | EXPECT \| MINOR \| DELAY |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### Action

General principles for the message element *Action* can be found beginning on page 4-14.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists who will turn onto the affected freeway are not advised to take an alternative route,
- Motorists who will turn onto the affected freeway are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion), or
- Motorists who will turn onto the affected freeway are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4, Type 5 and Type 6 diversion routes are not applicable)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

#### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, motorists should not be encouraged to divert to another route because it would result in greater travel time than if the motorists were to remain on the primary freeway. However, it is still important to tell motorists what they need to do.

Terms for the *Action* message element when lane-blocking incidents occur under this situation are shown in Table 5.23.

**Table 5.23 TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN INCIDENT**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| BE PREPARED TO STOP | BE \| PREPARED \| TO STOP |
| USE CAUTION | USE \| CAUTION |
| STAY ON *[route number][cardinal direction]* | STAY ON \| *[route number][cardinal direction]* |
| STAY ON *[highway, street name][cardinal direction]* | STAY ON \| *[highway, street name][cardinal direction]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

***Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)***

A “Soft” Diversion *Action* message element might be displayed for a variety of reasons including:

- There are no suitable alternative routes that can be recommended because traffic conditions on the most logical routes would not result in travel time savings to motorists if they diverted from the primary freeway,
- The DMS operator is unaware of the traffic conditions on the most logical alternative routes because surveillance does not exist on these routes,
- It is important to display an *Action* before the DMS operator has had a chance to assess the full impact of the incident, and/or
- It is important to display an *Action* before the police have arrived and establish positive diversion routes.

Terms for the *Action* message element when lane-blocking incidents occur under this situation are shown in Table 5.24.

**Table 5.24 TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN INCIDENT**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| **Large Signs** | **Portable Signs** |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

“|” Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

There are times when the DMS operator is aware of an acceptable alternative freeway route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 5-25.

**Table 5.25 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE [*freeway] [cardinal direction]* | USE \| [*freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Terms for the *Audience for Action* message element are shown in Table 5.26.

**Table 5.26 TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON DIFFERENT FREEWAY THAN INCIDENT**

| **Large Signs** | **Portable Signs** |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[highway, street name] [cardinal direction]* TRAFFIC | *[highway, street name] [cardinal direction]* \| TRAFFIC |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for displaying the message element *Good Reason for Following the Action* are given on page 4-14.

When *MAJOR ACCIDENT* or *TRUCK ACCIDENT* are displayed, the reason for following the suggested action is implied, and there is no need to display the reason. However, when the incident descriptors *ACCIDENT* or *MINOR ACCIDENT* are displayed, then a reason needs to be displayed. Also, when it is important to convince motorists to use an alternative route, it is oftentimes advantageous to display *BEST ROUTE TO [destination]*.

The terms shown in Table 5.27 below are acceptable to display.

**Table 5.27 TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON DIFFERENT FREEWAY THAN INCIDENT**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## 5.2 BASE DMS MESSAGE FOR INCIDENTS THAT REQUIRE CLOSING THE FREEWAY

When the police and/or traffic control personnel arrive, the freeway is *closed* and traffic is diverted to an alternative route. The freeway closure (the location where traffic is diverted from the freeway) is in most cases at a different location than the incident. Under these conditions, the guidelines in this section of the Manual should be used.

### BASE DMS MESSAGE ELEMENTS

The Base DMS Message for incidents that block all lanes of the freeway includes the following elements: 1) ***Incident Descriptor*** (situation description), 2) ***Incident Location,*** 3) ***Lanes Closed,*** 4) ***Closure Location,*** 5) ***Effect on Travel*** (implied), 6) ***Audience for Action*** (implied), 7) ***Action,*** and 8) ***Good Reason for Following the Action*** (implied).

**BASE DMS MESSAGE ELEMENTS: CLOSURE**

- **Incident Descriptor (situation description);**
- **Incident Location,**
- **Lanes Closed,**
- **Closure Location,**
- **Effect on Travel (implied by other message elements)**
- **Audience for Action (implied by other message elements),**
- **Action (tells motorists what to do), and**
- **Good Reason for Following the Action statement (implied by other message elements).**

## DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE CLOSURE

Warnings of road closures due to incidents should be displayed under all traffic conditions in peak or off-peak periods.

Terms for the *Incident Descriptor* message element are shown in Table 5.28.

**Table 5.28 *INCIDENT DESCRIPTORS***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| ACCIDENT | ACCIDENT |
| MAJOR ACCIDENT | MAJOR \| ACCIDENT |
| TRUCK ACCIDENT | TRUCK \| ACCIDENT |
| VEHICLE FIRE | VEHICLE \| FIRE |
| FUEL SPILL | FUEL \| SPILL |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

A general message phrase, such as *ACCIDENT,* is preferred and reduces the need for a large library of messages for every conceivable incident. Also, credibility is weakened when overly precise messages are not verified. For example, the terms *MAJOR ACCIDENT* or *TRUCK ACCIDENT* is preferred to more exact descriptions such as *VEHICLE OVERTURNED*. Some motorists will voluntarily divert in response to either of the terms.

The message phrase *MAJOR ACCIDENT* implies to motorists a more serious accident that may block more than one lane and will result in extensive delay. To the average Texas motorist, it implies a delay of more than 45 minutes.

***MAJOR ACCIDENT* means delays of 45 minutes or more to the average Texas motorist.**

## Incident Location

General principles for the message element *Incident Location* can be found beginning on page 4-8.

Terms for the *Incident Location* message element are shown in Table 5.29.

**Table 5.29 TERMS FOR *INCIDENT LOCATION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| 1 MILE *(AHEAD)* | 1 MILE *(AHEAD)* |
| *[number]* MILES *(AHEAD)* | *[number]* MILES *(AHEAD)* |
| AHEAD | AHEAD |
| AT *[highway, street name]* | AT \| *[highway, street name]* |
| AT *[exit ramp name]* EXIT | AT \| *[exit ramp name]* \| EXIT |
| BEFORE *[highway, street name]* | BEFORE \| *[highway, street name]* |
| BEFORE *[exit ramp name]* EXIT | BEFORE \| *[exit ramp name]* \| EXIT |
| PAST *[highway, street name]* | PAST \| *[highway, street name]* |
| PAST *[exit ramp name]* EXIT | PAST \| *[exit ramp name]* \| EXIT |
| ON MAIN LANES | ON \| MAIN LNS |
| OVER *[highway, street name]* | OVER \| *[highway, street name]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

When the DMS is located on the same freeway as the incident and relatively close to and upstream from the freeway, the DMS message should be used to encourage motorists to leave the freeway and find alternative routes.

Terms for the *Lanes Closed* message element are shown in Table 5.30.

**Table 5.30 TERMS FOR *LANES CLOSED***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Closure Location

General principles for the message element *Closure Location* can be found beginning on page 4-10.

Terms for the *Closure Location* message element are shown in Table 5.31.

**Table 5.31  TERMS FOR *CLOSURE LOCATION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| 1 MILE *(AHEAD)* | 1 MILE *(AHEAD)* |
| *[number]* MILES *(AHEAD)* | *[number]* MILES *(AHEAD)* |
| AHEAD | AHEAD |
| AT *[highway, street name]* | AT \| *[highway, street name]* |
| AT *[exit ramp name]* EXIT | AT \| *[exit ramp name]* \| EXIT |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

There is no need to include the *Effect on Travel* message element because the effects are implied from other message elements such as the *Lanes Closed* (i.e., *ALL LANES CLOSED*) message element.

| **Table 5.32 TERMS FOR *EFFECT ON TRAVEL*<br>DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE** |
|---|
| (Not necessary to display because it is implied by other message elements) |

## Action

General principles for the message element *Action* can be found beginning on page 4-14.

The *Action* message element displayed to motorists will be dictated by one of the following:

- Motorists are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion),
- Motorists are advised by the DMS message to take a specific Type 2 freeway diversion route *( Type 1, Type 3, Type 4 diversion routes are not applicable)*, or
- Motorists are advised by the DMS message to take a specific Type 5 diversion route *(Type 6 diversion route is not applicable.)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A "Soft" Diversion *Action* message element might be displayed prior to the arrival and positioning of the police or traffic control personnel and/or the traffic control devices along the planned diversion route.

Terms for the *Action* message element when lane-blocking incidents occur under this situation are shown in Table 5.33.

**Table 5.33 TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN INCIDENT**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| Large Signs | Portable Signs |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

An *Action* message element with diversion to a specific Type 2 freeway diversion route might be displayed prior to the arrival and positioning of the police or traffic control personnel and/or the traffic control devices along the planned diversion route.

Acceptable terms for the *Action* message element for this situation is given in Table 5.34.

**Table 5.34 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE *[freeway] [cardinal direction]* | USE \| *[freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 5 Diversion Route*

After the arrival of the police and the TxDOT Incident Response Team, traffic control devices are placed along the route in accordance with the Incident Emergency Route Plan. The Plan may also include positioning of police or traffic control personnel at critical points. The DMS operator is aware of the established diversion route(s).

Terms for the *Action* message element for this situation are given in Table 5.35.

**Table 5.35 ACCEPTABLE TERMS FOR *ACTION***
**VMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE A SPECIFIC TYPE 5 DIVERSION ROUTE***

<table>
<tr><th>Large Signs</th><th>Portable Signs</th></tr>
<tr><td>EXIT AND FOLLOW DETOUR</td><td>EXIT AND | FOLLOW | DETOUR</td></tr>
<tr><td>EXIT AND FOLLOW SIGNS</td><td>EXIT AND | FOLLOW | SIGNS</td></tr>
<tr><td>FOLLOW DETOUR</td><td>FOLLOW | DETOUR</td></tr>
<tr><td>FOLLOW SIGNS</td><td>FOLLOW | SIGNS</td></tr>
<tr><td>EXIT AT *[highway, street name] [cardinal direction]* |<br>FOLLOW DETOUR</td><td>EXIT | AT | *[highway, street name] [cardinal direction]* |<br>FOLLOW | DETOUR</td></tr>
<tr><td>EXIT AT *[highway, street name] [cardinal direction]* |<br>FOLLOW SIGNS</td><td>EXIT | AT | *[highway, street name] [cardinal direction]* |<br>FOLLOW | SIGNS</td></tr>
<tr><td>EXIT AT *[route number] [cardinal direction]* |<br>FOLLOW DETOUR</td><td>EXIT | AT *[route number] [cardinal direction]* |<br>FOLLOW | DETOUR</td></tr>
<tr><td>EXIT AT *[route number] [cardinal direction]* |<br>FOLLOW SIGNS</td><td>EXIT | AT *[route number] [cardinal direction]* |<br>FOLLOW | SIGNS</td></tr>
<tr><td>TAKE *[exit ramp name*] EXIT*]* |<br>FOLLOW DETOUR</td><td>TAKE | *[exit ramp name*] | EXIT |<br>FOLLOW | DETOUR</td></tr>
<tr><td>TAKE *[exit ramp name*] EXIT |<br>FOLLOW SIGNS</td><td>TAKE | *[exit ramp name*] | EXIT |<br>FOLLOW | SIGNS</td></tr>
<tr><td>TAKE *[highway, street name] [cardinal direction]* |<br>FOLLOW DETOUR</td><td>TAKE | *[highway, street name] [cardinal direction]* |<br>FOLLOW | DETOUR</td></tr>
<tr><td>TAKE *[highway, street name] [cardinal direction]* |<br>FOLLOW SIGNS</td><td>TAKE | *[highway, street name] [cardinal direction]* |<br>FOLLOW | SIGNS</td></tr>
<tr><td>TAKE *[route number] [cardinal direction]* |<br>FOLLOW DETOUR</td><td>TAKE *[route number] [cardinal direction]* |<br>FOLLOW | DETOUR</td></tr>
<tr><td>TAKE *[route number] [cardinal direction]* |<br>FOLLOW SIGNS</td><td>TAKE *[route number] [cardinal direction]* |<br>FOLLOW | SIGNS</td></tr>
</table>

"|" Indicates that the next portion of the message will be displayed on the next line(s) of VMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Terms for the *Audience for Action* message element are shown in Table 5.36.

**Table 5.36 TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[highway, street name] [cardinal direction]* TRAFFIC | *[highway, street name] [cardinal direction]* \| TRAFFIC |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for displaying the message element *Good Reason for Following the Action* are given on page 4-14.

As a rule, when the freeway is closed and *ALL LANES CLOSED* or *FREEWAY CLOSED* is displayed, the reason for following the suggested action is implied, and there is no need to display the reason. However, when a recommended diversion route may be perceived by motorists as not being the most logical route, then a *Good Reason for Following the Action* should be displayed.

The terms shown in Table 5.37 below are acceptable to display.

**Table 5.37 ACCEPTABLE TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE CLOSURE

### Incident Descriptor

Warnings of road closures due to incidents should be displayed under all traffic conditions in peak or off-peak periods.

Terms for the *Incident Descriptor* message element are shown in Table 5.38.

**Table 5.38** ***INCIDENT DESCRIPTORS***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| ACCIDENT | ACCIDENT |
| MAJOR ACCIDENT | MAJOR \| ACCIDENT |
| TRUCK ACCIDENT | TRUCK \| ACCIDENT |
| VEHICLE FIRE | VEHICLE \| FIRE |
| FUEL SPILL | FUEL \| SPILL |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

A general message phrase, such as *ACCIDENT,* is preferred and reduces the need for a large library of messages for every conceivable incident. Also, credibility is weakened when overly precise messages are not verified. For example, the terms *MAJOR ACCIDENT* or *TRUCK ACCIDENT* is preferred to more exact descriptions such as *VEHICLE OVERTURNED*. Some motorists will voluntarily divert in response to either of the terms.

The message phrase *MAJOR ACCIDENT* implies to motorists a more serious accident that may block more than one lane and will result in extensive delay. To the average Texas motorist, it implies a delay of more than 45 minutes.

***MAJOR ACCIDENT* means delays of 45 minutes or more to the average Texas motorist.**

## Incident Location

General principles for the message element *Incident Location* can be found beginning on page 4-8.

Terms to use for the *Incident Location* are shown in Table 5.39.

**Table 5.39  TERMS FOR *INCIDENT LOCATION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| *[number]* MILES *(AHEAD)* | *[number]* MILES *(AHEAD)* |
| AHEAD | AHEAD |
| AT *[highway, street name]* | AT \| *[highway, street name]* |
| AT *[exit ramp name]* EXIT | AT \| *[exit ramp name]* \| EXIT |
| BEFORE *[highway, street name]* | BEFORE \| *[highway, street name]* |
| BEFORE *[exit ramp name]* EXIT | BEFORE \| *[exit ramp name]* \| EXIT |
| PAST *[highway, street name]* | PAST \| *[highway, street name]* |
| PAST *[exit ramp name]* EXIT | PAST \| *[exit ramp name]* \| EXIT |
| ON MAIN LANES | ON \| MAIN LNS |
| OVER *[highway, street name]* | OVER \| *[highway, street name]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

When the DMS is located on the same freeway as the incident and relatively close to and upstream of the incident, the DMS message should be used to encourage motorists to leave the freeway and find alternative routes.

Terms for the *Lanes Closed* message element are shown in Table 5.40.

**Table 5.40 TERMS FOR *LANES CLOSED***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Closure Location

General principles for the message element *Closure Location* can be found beginning on page 4-10.

Terms for the *Closure Location* message element are shown in Table 5.41.

**Table 5.41 TERMS FOR *CLOSURE LOCATION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| *[number]* MILES *(AHEAD)* | *[number]* MILES *(AHEAD)* |
| AHEAD | AHEAD |
| AT *[highway, street name]* | AT \| *[highway, street name]* |
| AT *[exit ramp name]* EXIT | AT \| *[exit ramp name]* \| EXIT |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

There is no need to include the *Effect on Travel* message element because the effects are implied from other message elements such as the *Lanes Closed* (i.e., *ALL LANES CLOSED*) message element.

| **Table 5.42 ACCEPTABLE TERMS FOR *EFFECT ON TRAVEL*<br>DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE** |
| --- |
| (Not necessary to display because it is implied by other message elements) |

## Action

General principles for the message element *Action* can be found beginning on page 4-13.

The *Action* message element displayed to motorists will be dictated by one of the following:

- Motorists are not advised to take an alternative route,
- Motorists are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion),
- Motorists are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4 diversion routes are not applicable.)*, or
- Motorists are advised by the DMS message to take a specific Type 5 diversion route *(Type 6 diversion route is not applicable)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, motorists should not be encouraged to divert to another route because it would result in greater travel time than if the motorists were to remain on the primary freeway. However, it is still important to tell motorists what they need to do.

Terms for the *Action* message element in this situation are shown in Table 5.43.

**Table 5.43 TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| BE PREPARED TO STOP | BE \| PREPARED \| TO \|STOP |
| USE CAUTION | USE \| CAUTION |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A "Soft" Diversion *Action* message element might be displayed for a variety of reasons including:

- There are no suitable freeway alternative routes that can be recommended, and/or.
- It is important to display an *Action* before the DMS operator has had a chance to assess the full impact of the incident.

Terms for the *Action* message element in this situation are shown in Table 5.44.

**Table 5.44 TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| **Large Signs** | **Portable Signs** |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

An *Action* message element with diversion to a specific Type 2 freeway diversion route might be displayed if an alternative freeway is available that will result in savings in travel time

Acceptable terms for the *Action* message element for this situation are given in Table 5.45.

**Table 5.45 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE *[freeway] [cardinal direction]* | USE \| *[freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 5 Diversion Route*

After the arrival of the police and the TxDOT Incident Response Team, traffic control devices are placed along the route in accordance with the Incident Emergency Route Plan. The Plan may also include positioning of police or traffic control personnel at critical points. The DMS operator is aware of the established diversion route(s).

Terms for the *Action* message element for this situation are given in Table 5.46.

**Table 5.46 TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE A SPECIFIC TYPE 5 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AT *[highway, street name] [cardinal direction]* \| FOLLOW DETOUR | EXIT \| AT \| *[highway, street name] [cardinal direction]* \| FOLLOW \| DETOUR |
| EXIT AT *[highway, street name] [cardinal direction]* \| FOLLOW SIGNS | EXIT \| AT \| *[highway, street name] [cardinal direction]* \| FOLLOW \| SIGNS |
| EXIT AT *[route number] [cardinal direction]* \| FOLLOW DETOUR | EXIT \| AT *[route number] [cardinal direction]* \| FOLLOW \| DETOUR |
| EXIT AT *[route number] [cardinal direction]* \| FOLLOW SIGNS | EXIT \| AT *[route number] [cardinal direction]* \| FOLLOW \| SIGNS |
| TAKE *[exit ramp name*] EXIT*]* \| FOLLOW DETOUR | TAKE \| *[exit ramp name*] \| EXIT \| FOLLOW \| DETOUR |
| TAKE *[exit ramp name*] EXIT \| FOLLOW SIGNS | TAKE \| *[exit ramp name*] \| EXIT \| FOLLOW \| SIGNS |
| TAKE *[highway, street name] [cardinal direction]* \| FOLLOW DETOUR | TAKE \| *[highway, street name] [cardinal direction]* \| FOLLOW \| DETOUR |
| TAKE *[highway, street name] [cardinal direction]* \| FOLLOW SIGNS | TAKE \| *[highway, street name] [cardinal direction]* \| FOLLOW \| SIGNS |
| TAKE *[route number] [cardinal direction]* \| FOLLOW DETOUR | TAKE *[route number] [cardinal direction]* \| FOLLOW \| DETOUR |
| TAKE *[route number] [cardinal direction]* \| FOLLOW SIGNS | TAKE *[route number] [cardinal direction]* \| FOLLOW \| SIGNS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Terms for the *Audience for Action* message element are shown in Table 5.47.

**Table 5.47 TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[highway, street name] [cardinal direction]* TRAFFIC | *[highway, street name] [cardinal direction]* \| TRAFFIC |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for displaying the message element *Good Reason for Following the Action* are given on page 4-14.

As a rule, when the freeway is closed and *ALL LANES CLOSED* or *FREEWAY CLOSED* is displayed, the reason for following the suggested action is implied, and there is no need to display the reason. However, when a recommended diversion route may be perceived by motorists as not being the most logical route, then a *Good Reason for Following the Action* should be displayed.

Terms shown in Table 5.48 below are acceptable to display.

**Table 5.48 TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## DMS ON DIFFERENT FREEWAY THAN THE CLOSURE

The DMS operational guidelines in this section of the Manual apply when the DMS is on a different freeway than the incident, but the incident still can have an affect on motorists who are passing the DMS. For example, westbound I-10 motorists who intend to exit the freeway and enter northbound I-45 to travel toward Dallas could be affected by incidents that occur on northbound I-45 north of the I-10/I-45 interchange. Messages displayed on DMSs on westbound I-10 concerning incidents on northbound I-45 can be helpful to those motorists heading toward Dallas.

The major difference between the messages displayed on DMSs located on a different freeway than the closure in comparison to the messages on DMSs located on the same freeway as the closure but far upstream of the closure is in the diversion information provided.

## Incident Descriptor

Warnings of road closures due to incidents should be displayed under all traffic conditions in peak or off-peak periods.

Terms for the *Incident Descriptor* message element are shown in Table 5.49.

**Table 5.49 *INCIDENT DESCRIPTORS***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| | |
|---|---|
| ACCIDENT | ACCIDENT |
| MAJOR ACCIDENT | MAJOR \| ACCIDENT |
| TRUCK ACCIDENT | TRUCK \| ACCIDENT |
| VEHICLE FIRE | VEHICLE \| FIRE |
| FUEL SPILL | FUEL \| SPILL |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

A general message phrase, such as *ACCIDENT,* is preferred and reduces the need for a large library of messages for every conceivable incident. Also, credibility is weakened when overly precise messages are not verified. For example, the terms *MAJOR ACCIDENT* or *TRUCK ACCIDENT* is preferred to more exact descriptions such as *VEHICLE OVERTURNED*. Some motorists will voluntarily divert in response to either of the terms.

The message phrase *MAJOR ACCIDENT* implies to motorists a more serious accident that may block more than one lane and will result in extensive delay. To the average Texas motorist, it implies a delay of more than 45 minutes.

***MAJOR ACCIDENT* means delays of 45 minutes or more to the average Texas motorist.**

## Incident Location

General principles for the message element *Incident Location* can be found beginning on page 4-8.

Terms for the *Incident Location* message element are shown in Table 5.50.

**Table 5.50 TERMS FOR *INCIDENT LOCATION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| AT *[highway, street name]** | AT \| *[highway, street name]** |
| AT *[exit ramp name]* EXIT* | AT \| *[exit ramp name]* \| EXIT* |
| BEFORE *[highway, street name]** | BEFORE \| *[highway, street name]** |
| BEFORE *[exit ramp name]* EXIT* | BEFORE \| *[exit ramp name]* \| EXIT* |
| PAST *[highway, street name]** | PAST \| *[highway, street name]** |
| PAST *[exit ramp name]* EXIT* | PAST \| *[exit ramp name]* \| EXIT* |
| OVER *[highway, street name]** | OVER \| *[highway, street name]** |

* Insert **"ON *[route number, highway name or street name][cardinal direction]*"** in front of the Incident Location.
"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

When the DMS is located on a different freeway than the incident, it is oftentimes advantageous to advise motorists of the freeway closure. Acceptable terms for the *Lanes Closed* message element are shown in Table 5.51.

**Table 5.51 TERMS *FOR LANES CLOSED***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| **Large Signs** | **Portable Signs** |
| --- | --- |
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Closure Location

General principles for the message element *Closure Location* can be found beginning on page 4-10.

Acceptable terms for the *Closure Location* message element are shown in Table 5.52.

**Table 5.52 TERMS FOR *CLOSURE LOCATION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| AT *[highway, street name]** | AT \| *[highway, street name]** |
| AT *[exit ramp name]* EXIT* | AT \| *[exit ramp name]* \| EXIT* |

* Insert **"ON *[route number, highway name or street name][cardinal direction]"*** in front of the Incident Location**.**
"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

There is no need to include the *Effect on Travel* message element because the effects are implied from other message elements such as *Lanes Closed* (i.e., *ALL LANES CLOSED*) message element.

| **Table 5.53  TERMS FOR *EFFECT ON TRAVEL*<br>DMS ON DIFFERENT FREEWAY THAN CLOSURE** |
| --- |
| (Not necessary to display because it is implied by other message elements) |

## Action

General principles for *Action* message element can be found beginning on page 4-13.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists who will turn onto the affected freeway are not advised to take an alternative route,
- Motorists who will turn onto the affected freeway are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion), or
- Motorists who will turn onto the affected freeway are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4, Type 5 and Type 6 diversion routes are not applicable.)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, it may be best for the motorists to stay on the current freeway rather than turning onto the freeway that is affected by the closure.

Acceptable terms for the *Action* message element in this situation are shown in Table 5.54.

**Table 5.54 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE- NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| BE PREPARED TO STOP | BE \| PREPARED \| TO STOP |
| USE CAUTION | USE CAUTION |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

***Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)***

A “Soft” Diversion *Action* message element might be displayed for a variety of reasons including:

- The DMS operator is unaware of the traffic conditions on the most logical alternative routes because surveillance does not exist on these routes,
- It is important to display an *Action* before the DMS operator has had a chance to assess the full impact of the incident, and/or
- It is important to display an *Action* before the police have arrived and establish positive diversion routes.

Terms for the *Action* message element in this situation are shown in Table 5.55.

**Table 5.55 TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| **Large Signs** | **Portable Signs** |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

“|” Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

There are times when the DMS operator is aware of an acceptable alternative freeway route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 5.56.

**Table 5.56 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| Large Signs | Portable Signs |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE *[freeway] [cardinal direction]* | USE \| *[freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Terms for the *Audience for Action* message element are shown in Table 5.57.

**Table 5.57 TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[highway, street name] [cardinal direction]* TRAFFIC | *[highway, street name] [cardinal direction]* \| TRAFFIC |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for displaying the message element *Good Reason for Following the Action* are given on page 4-14.

As a rule, when the freeway is closed and *ALL LANES CLOSED* or *FREEWAY CLOSED* is displayed, the reason for following the suggested action is implied, and there is no need to display the reason. However, when a recommended diversion route may be perceived by motorists as not being the most logical route, then a *Good Reason for Following the Action* should be displayed.

Terms shown in Table 5.58 below are acceptable to display.

**Table 5.58 TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID | DELAY |
| AVOID MAJOR DELAY | AVOID | MAJOR | DELAY |
| SAVE *[number]* MINUTES | SAVE | *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST | ROUTE TO | *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

# 5.3 BASE DMS MESSAGE FOR INCIDENTS ON AN INTERSECTING FREEWAY THAT REQUIRE CLOSING THE CONNECTOR RAMP

## BASE DMS MESSAGE ELEMENTS

The Base DMS Message for closure of a freeway-to-freeway connector during incidents includes the following: 1) ***Incident Descriptor,*** 2) ***Incident Location,*** 3) ***Lanes Closed,*** 4) ***Ramp Closure Descriptor,*** 5) ***Audience for Action,*** 6) ***Action,*** and 7) ***Good Reason for Following the Action***.

**BASE DMS MESSAGE ELEMENTS**

- **Incident Descriptor (situation description),**
- **Incident Location,**
- **Lanes Closed,**
- **Ramp Closure Descriptor,**
- **Audience for Action (when the action is for a specific group of motorists),**
- **Action (tells motorists what to do), and**
- **Good Reason for Following the Action statement (usually implied by other message elements)**

## DMS UPSTREAM OF THE CONNECTOR RAMP CLOSURE

### Incident Descriptor

Acceptable terms for the *Incident Descriptor* message element are given in Table 5.59.

**Table 5.59 ACCEPTABLE *INCIDENT DESCRIPTORS***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| MAJOR ACCIDENT | MAJOR \| ACCIDENT |
| TRUCK ACCIDENT | TRUCK \| ACCIDENT |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

A general message phrase, such as *ACCIDENT,* is preferred and reduces the need for a large library of messages for every conceivable incident. Also, credibility is weakened when overly precise messages are not verified. For example, the terms *MAJOR ACCIDENT* or *TRUCK ACCIDENT* is preferred to more exact descriptions such as *VEHICLE OVERTURNED.* Some motorists will voluntarily divert in response to either of the terms.

The message phrase *MAJOR ACCIDENT* implies to motorists a more serious accident that may block more than one lane and will result in extensive delay. To the average Texas motorist, it implies a delay of more than 45 minutes.

***MAJOR ACCIDENT* means delays of 45 minutes or more to the average Texas motorist.**

## Incident Location

General principles for the message element *Incident Location* can be found beginning on page 4-8.

Acceptable terms for the *Incident Location* message element are shown in Table 5.60.

**Table 5.60 ACCEPTABLE TERMS FOR *INCIDENT LOCATION* DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| AT *[highway, street name]** | AT \| *[highway, street name]** |
| AT *[exit ramp name]* EXIT* | AT \| *[exit ramp name]* \| EXIT* |
| BEFORE *[highway, street name]** | BEFORE \| *[highway, street name]** |
| BEFORE *[exit ramp name]* EXIT* | BEFORE \| *[exit ramp name]* \| EXIT* |
| PAST *[highway, street name]** | PAST \| *[highway, street name]** |
| PAST *[exit ramp name]* EXIT* | PAST \| *[exit ramp name]* \| EXIT* |
| OVER *[highway, street name]** | OVER \| *[highway, street name]** |

* Insert "**ON *[route number, highway name or street name][cardinal direction]***" in front of the Incident Location**.**

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

Acceptable terms for the *Lanes Closed* message element are shown in Table 5.61.

**Table 5.61 ACCEPTABLE TERMS FOR *LANES CLOSED***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Ramp Closure Descriptor

Acceptable terms for the *Ramp Closure Descriptor* message element are shown in Table 5.62.

**Table 5.62 ACCEPTABLE TERMS FOR *RAMP CLOSURE DESCRIPTORS***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| RAMP CLOSED \| TO [*intersecting fwy number] [card. direction]* | RAMP \| CLOSED \| TO [*intersecting fwy number] [card. direction]* |
| RAMP CLOSED \| TO *[intersecting freeway name]* FREEWAY | |
| [*intersecting fwy number] CLOSED* | [*intersecting fwy number]* \| CLOSED |
| [*intersecting fwy number] [card. direction] CLOSED* | [*intersecting fwy number] [card. direction]* CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s).

## Action

General principles for the message element *Action* can be found beginning on page 4-13.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists who will turn onto the affected freeway are not advised to take an alternative route,
- Motorists are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion),
- Motorists who will turn onto the affected ramp are advised by the DMS message to take a specific Type 1 or Type 2 diversion route *(Type 3, Type 4 and Type 6 diversion routes are not applicable.)*, or
- Motorists who will turn onto the affected ramp are advised by the DMS message to take the Type 5 diversion (detour) route.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, it may be best for the motorists to stay on the current freeway rather than turning onto the freeway that is affected by the closure.

Acceptable terms for the *Action* message element in this situation are shown in Table 5.63.

**Table 5.63 ACCEPTABLE TERMS FOR *ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-***
***NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| BE PREPARED TO STOP | BE \| PREPARED \| TO STOP |
| USE CAUTION | USE \| CAUTION |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A "Soft" Diversion *Action* message element might be displayed when it is not possible for the DMS operator to specify a specific route the motorist should use.

Acceptable terms for the *Action* message element in this situation are shown in Table 5.64.

**Table 5.64 ACCEPTABLE TERMS FOR *ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| Large Signs | Portable Signs |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

There are times when the DMS operator is aware of an acceptable alternative route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 5.65.

**Table 5.65 ACCEPTABLE TERMS FOR *ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE *[freeway] [cardinal direction]* | USE \| *[freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 5 Diversion Route*

There are times when the Incident Emergency Route Plan has been implemented. Guide signs, trailblazers, and police and/or traffic control personnel are guiding motorists at critical locations along the route.

Acceptable terms for the *Action* message element when this condition exists are shown in Table 5.66.

**Table 5.66 ACCEPTABLE TERMS FOR *ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE THE TYPE 5 DIVERSION (DETOUR) ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AT *[highway, street name] [cardinal direction]* \| FOLLOW DETOUR | EXIT \| AT \| *[highway, street name] [cardinal direction]* \| FOLLOW \| DETOUR |
| EXIT AT *[highway, street name] [cardinal direction]* \| FOLLOW SIGNS | EXIT \| AT \| *[highway, street name] [cardinal direction]* \| FOLLOW \| SIGNS |
| EXIT AT *[route number] [cardinal direction]* \| FOLLOW DETOUR | EXIT \| AT *[route number] [cardinal direction]* \| FOLLOW \| DETOUR |
| EXIT AT *[route number] [cardinal direction]* \| FOLLOW SIGNS | EXIT \| AT *[route number] [cardinal direction]* \| FOLLOW \| SIGNS |
| TAKE *[exit ramp name]* EXIT \| FOLLOW DETOUR | TAKE \| *[exit ramp name]* \| EXIT FOLLOW DETOUR |
| TAKE *[exit ramp name]* EXIT \| FOLLOW SIGNS | TAKE \| *[exit ramp name]* \| EXIT FOLLOW SIGNS |
| TAKE *[highway, street name] [cardinal direction]* \| FOLLOW DETOUR | TAKE \| *[highway, street name] [cardinal direction]* \| FOLLOW \| DETOUR |
| TAKE *[highway, street name] [cardinal direction]* \| FOLLOW SIGNS | TAKE \| *[highway, street name] [cardinal direction]* \| FOLLOW SIGNS |
| TAKE *[route number] [cardinal direction]* \| FOLLOW DETOUR | TAKE *[route number] [cardinal direction]* \| FOLLOW \| DETOUR |
| TAKE *[route number] [cardinal direction]* \| FOLLOW SIGNS | TAKE *[route number] [cardinal direction]* \| FOLLOW \| SIGNS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Acceptable terms for the *Audience for Action* message element are shown in Table 5.67.

**Table 5.67 ACCEPTABLE TERMS FOR *AUDIENCE FOR ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following Action

General guidelines for displaying the message element *Good Reason for Following the Action* are given on page 4-14.

The terms shown in Table 5.68 are acceptable to display.

**Table 5.68 ACCEPTABLE TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION* CLOSURE DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

# MODULE 6. DESIGNING THE BASE DMS MESSAGE FOR ROADWORK

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# MODULE 6. DESIGNING THE BASE DMS MESSAGE FOR ROADWORK

## 6.1 BASE DMS MESSAGE FOR LANE CLOSURES DURING ROADWORK

This section of the Manual applies to roadwork that requires closure of some of the lanes of the freeway while other lanes are open to traffic. When the roadwork requires closure of all the lanes on the freeway, *Section 6.2 Base DMS Message for Roadwork That Requires Closing the Freeway* should be used to develop the Base DMS Message.

### BASE DMS MESSAGE ELEMENTS

The Base DMS Message for roadwork includes the following: 1) ***Roadwork Descriptor*** (situation description), 2) ***Roadwork Location,*** 3) ***Lanes Closed,*** 4) ***Effect on Travel*** (e.g., major delay), 5) ***Audience for Action,*** 6) ***Action,*** and 7) ***Good Reason for Following the Action***.

**BASE DMS MESSAGE ELEMENTS**

- **Roadwork Descriptor (situation description),**
- **Roadwork Location,**
- **Lanes Closed,**
- **Effect on Travel (e.g., major delay),**
- **Audience for Action (when the action is for a specific group of motorists),**
- **Action (tells motorists what to do), and**
- **Good Reason for Following the Action statement (usually implied by other message elements).**

## DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE ROADWORK

### Roadwork Descriptor

Warnings of lane closures due to roadwork should be displayed under all traffic conditions in peak or off-peak periods. Minor off-the-roadway work such as grass mowing should not be displayed.

Acceptable terms for the *Roadwork Descriptor* message element are given in Table 6.1.

**Table 6.1 ACCEPTABLE *ROADWORK DESCRIPTORS***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| CONSTRUCTION* | CONST or ROADWORK* |
| ROADWORK | ROADWORK |

* The word *CONSTRUCTION* will not fit on an eight-character line of a portable DMS. Therefore, the word must either be abbreviated or replaced with the word *ROADWORK*.

The word *ROADWORK* may be substituted for the longer word *CONSTRUCTION*. Motorist interpretations of both words are described on page 4-16. In addition, *CONST* is an acceptable abbreviation for *CONSTRUCTION*.

## Roadwork Location

General principles for the message element *Roadwork Location* can be found under *Lanes Closed* on page 4-10.

Acceptable terms to use for the *Roadwork Location* message element are shown in Table 6.2. Note that portable DMSs cannot be used when it is desirable to inform motorists about the length of the closure for the roadwork (e.g., *2 LANES CLOSED FROM EXIT 42 TO EXIT 43*).

**Table 6.2 ACCEPTABLE TERMS FOR *ROADWORK LOCATION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO ROADWORK**

**Large Signs**

1 MILE *(AHEAD)*
*[number]* MILES *(AHEAD)*
AHEAD
AT *[highway, street name]*
AT *[exit ramp name]* EXIT
BEFORE *[highway, street name]*
BEFORE *[exit ramp name]* EXIT
PAST *[highway, street name]*
PAST *[exit ramp name]* EXIT
OVER *[highway, street name]*
FROM *[highway, street name]* |
TO *[highway, street name]*
FROM *[highway, street name]* |
TO *[exit ramp name]* EXIT
FROM *[exit ramp name]* EXIT
TO *[highway, street name]*
FROM *[exit ramp name]* EXIT |
TO *[exit ramp name]* EXIT

**Portable Signs**

1 MILE *(AHEAD)*
*[number]* MILES *(AHEAD)*
AHEAD
AT | *[highway, street name]*
AT | *[exit ramp name]* | EXIT
BEFORE | *[highway, street name]*
BEFORE | *[exit ramp name]* | EXIT
PAST | *[highway, street name]*
PAST | *[exit ramp name]* | EXIT
OVER | *[highway, street name]*

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

When the DMS is located on the same freeway as the roadwork and relatively close to and upstream of the lane closure, the DMS message can encourage motorists to leave the closed lane(s) and move into the open lanes by informing them of which specific lanes are closed. This helps the movement of vehicles through the restricted lane closure area.

Acceptable terms for the *Lanes Closed* message element for these cases are shown in Table 6.3.

**Table 6.3 ACCEPTABLE TERMS FOR *LANES CLOSED***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO ROADWORK**

| **Large Signs** | **Portable Signs** |
|---|---|
| CENTER LANE CLOSED | CENTER \| LANE \| CLOSED |
| CENTER LANES CLOSED | CENTER \| LANES \| CLOSED |
| CENTER *[number]* LANES CLOSED | CENTER \| *[number]* LANES\| CLOSED |
| LEFT LANE CLOSED | LEFT \| LANE \| CLOSED |
| LEFT *[number]* LANES CLOSED | LEFT \| *[number]* LANES \| CLOSED |
| RIGHT LANE CLOSED | RIGHT \| LANE \| CLOSED |
| RIGHT *[number]* LANES CLOSED | RIGHT \| *[number]* LANES \| CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

Acceptable terms for the *Effect on Travel* message element are shown in Table 6.4.

**Table 6.4  ACCEPTABLE TERMS FOR *EFFECT ON TRAVEL***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO ROADWORK**

| **Large Signs** | **Portable Signs** |
|---|---|
| EXPECT DELAY | EXPECT \| DELAY |
| EXPECT MAJOR DELAY | EXPECT \| MAJOR \| DELAY |
| EXPECT MINOR DELAY | EXPECT \| MINOR \|DELAY |

"|"  Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Action

General principles for the message element *Action* can be found beginning on page 4-13.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists are not advised to take an alternative route,
- Motorists are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion), or
- Motorists are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4, Type 5 and Type 6 diversion routes are not applicable)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, motorists should not be encouraged to divert to another route because it would result in greater travel time than if the motorists were to remain on the primary freeway. However, it is still important to tell motorists what they need to do.

Acceptable terms for the *Action* when lane-blocking incidents occur under this situation are shown in Table 6.5.

**Table 6.5 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO ROADWORK**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-***
***NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| BE PREPARED TO STOP | BE \| PREPARED \| TO STOP |
| USE CAUTION | USE \| CAUTION |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A "Soft" Diversion *Action* message element might be displayed for a variety of reasons including:

- There are no suitable alternative routes that can be recommended because traffic conditions on the most logical routes would not result in travel time savings to motorists if they diverted from the primary freeway,

- The DMS operator is unaware of the traffic conditions on the most logical alternative routes because surveillance does not exist on these routes, and/or

- No specific alternative route has been selected by the work crew where police, traffic control personnel and/or traffic control devices are available to provide positive guidance to motorists.

Acceptable terms for the *Action* when lane-blocking incidents occur under these situations are shown in Table 6.6.

**Table 6.6 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO ROADWORK**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| Large Signs | Portable Signs |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

There are times when the DMS operator is aware of an acceptable alternative route and has real-time information about the conditions on the alternative route. Guide signs or trailblazers may or may not be present. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 6.7.

**Table 6.7 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO ROADWORK**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE *[freeway] [cardinal direction]* | USE \| *[freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Acceptable terms for the *Audience for Action* message element are shown in Table 6.8.

**Table 6.8 ACCEPTABLE TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO ROADWORK**

| **Large Signs** | **Portable Signs** |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for a displaying the message element *Good Reason for Following the Action* are given on page 4-14.

The terms shown in Table 6.9 are acceptable to display.

**Table 6.9 ACCEPTABLE TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE ROADWORK

### Roadwork Descriptor

Warnings of lane closures due to roadwork should be displayed under all traffic conditions in peak or off-peak periods. Minor off-the-roadway work such as grass mowing should not be displayed.

Acceptable terms for the *Roadwork Descriptor* message element are given in Table 6.10.

**Table 6.10 ACCEPTABLE *ROADWORK DESCRIPTORS***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| CONSTRUCTION* | CONST or ROADWORK* |
| ROADWORK | ROADWORK |

* The word *CONSTRUCTION* will not fit on an eight-character line of a portable DMS. Therefore, the word must either be abbreviated or replaced with the word *ROADWORK*.

The word *ROADWORK* may be substituted for the longer word *CONSTRUCTION*. Motorist interpretations of both words are described on page 4-14. In addition, *CONST* is an acceptable abbreviation for *CONSTRUCTION*.

## Roadwork Location

General principles for the message element *Roadwork Location* can be found under *Lanes Closed* on page 4-10.

Acceptable terms for the *Roadwork Location* message element are shown in Table 6.11.

**Table 6.11 ACCEPTABLE TERMS FOR *ROADWORK LOCATION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| *[number]* MILES *(AHEAD)* | *[number]* MILES *(AHEAD)* |
| AHEAD | AHEAD |
| AT *[highway, street name]* | AT \| *[highway, street name]* |
| AT *[exit ramp name]* EXIT | AT \| *[exit ramp name]* \| EXIT |
| BEFORE *[highway, street name]* | BEFORE \| *[highway, street name]* |
| BEFORE *[exit ramp name]* EXIT | BEFORE \| *[exit ramp name]* \| EXIT |
| PAST *[highway, street name]* | PAST \| *[highway, street name]* |
| PAST *[exit ramp name]* EXIT | PAST \| *[exit ramp name]* \| EXIT |
| OVER *[highway, street name]* | OVER \| *[highway, street name]* |
| FROM *[highway, street name]* \| TO *[highway, street name]* | |
| FROM *[highway, street name]* \| TO *[exit ramp name]* EXIT | |
| FROM *[highway, street name]* \| | |
| FROM *[exit ramp name]* EXIT TO *[highway, street name]* | |
| FROM *[exit ramp name]* EXIT \| | |
| FROM *[exit ramp name]* EXIT \| TO *[exit ramp name]* EXIT | |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

Situations arise when the DMS is on the same freeway and upstream of the roadwork but at a location far enough upstream of the lane closure where it is not advisable to encourage lane changing. It is best to move traffic in all the lanes. Therefore, there is no traffic flow advantage to inform motorists the specific lanes that are closed. However, it is important to notify motorists the number of lanes closed so that they can make earlier decisions about whether to take alternative routes.

Acceptable terms for the *Lanes Closed* message element for these cases are shown in Table 6.12.

**Table 6.12 ACCEPTABLE TERMS FOR *LANES CLOSED***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| 1 LANE CLOSED | 1 LANE \| CLOSED |
| *[number]* LANES CLOSED | *[number]* LANES \| CLOSED |
| 1 LANE OPEN | 1 LANE \| OPEN |
| *[number]* LANES OPEN | *[number]* LANES \| OPEN |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

Acceptable terms for the *Effect on Travel* message element are shown in Table 6.13.

**Table 6.13 ACCEPTABLE TERMS FOR *EFFECT ON TRAVEL***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM ROADWORK**

| **Large Signs** | **Portable Signs** |
|---|---|
| EXPECT DELAY | EXPECT DELAY |
| EXPECT MAJOR DELAY | EXPECT \| MAJOR \| DELAY |
| EXPECT MINOR DELAY | EXPECT \| MINOR \| DELAY |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Action

General principles for the message element *Action* can be found beginning on page 4-13.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists are not advised to take an alternative route,
- Motorists are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as “soft” diversion), or
- Motorists are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4, Type 5 and Type 6 diversion routes are not applicable)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route.  The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, motorists should not be encouraged to divert to another route because it would result in greater travel time than if the motorists were to remain on the primary freeway. However, it is still important to tell motorists what they need to do.

Acceptable terms for the *Action* message element in this situation are shown in Table 6.14.

**Table 6.14  ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM ROADWORK**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-***
***NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| PREPARE TO STOP | PREPARE \| TO \| STOP |
| USE CAUTION | USE  \| CAUTION |

“|”  Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A "Soft" Diversion *Action* message element might be displayed for a variety of reasons including:

- There are no suitable alternative routes that can be recommended because traffic conditions on the most logical routes would not result in travel time savings to motorists if they diverted from the primary freeway,
- The DMS operator is unaware of the traffic conditions on the most logical alternative routes because surveillance does not exist on these routes, and/or
- No specific alternative route has been selected by the work crew where police, traffic control personnel and/or traffic control devices are available to provide positive guidance to motorists.

Acceptable terms for the *Action* message element in these situations are shown in Table 6.15.

**Table 6.15 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM ROADWORK**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| **Large Signs** | **Portable Signs** |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### ***Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route***

There are times when the DMS operator is aware of an acceptable freeway alternative route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 6.16.

**Table 6.16 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM ROADWORK**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE *[freeway] [cardinal direction]* | USE \| *[freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Acceptable terms for the *Audience for Action* message element are shown in Table 6.17.

**Table 6.17 ACCEPTABLE TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for a displaying the message element *Good Reason for Following the Action* are given on page 4-14.

The terms shown in Table 6.18 are acceptable to display.

**Table 6.18 ACCEPTABLE TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## DMS ON DIFFERENT FREEWAY THAN THE ROADWORK

The DMS operational guidelines in this section of the Manual apply when the DMS is on a different freeway than the incident, but the incident still can have an affect on motorists who are passing the DMS. For example, westbound I-10 motorists who intend to exit the freeway and enter northbound I-45 to travel toward Dallas could be affected by incidents that occur on northbound I-45 north of the I-10/I-45 interchange. Messages displayed on DMSs on westbound I-10 concerning incidents on northbound I-45 can be helpful to those motorists heading toward Dallas.

The major difference between the messages displayed on DMSs located on a different freeway than the roadwork in comparison to the messages on DMSs located on the same freeway as the work but far upstream of the work is in the diversion information provided.

### Roadwork Descriptor

Warnings of lane closures due to roadwork should be displayed under all traffic conditions in peak or off-peak periods. Minor off-the-roadway work such as grass mowing should not be displayed.

Acceptable terms for the *Roadwork Descriptor* message elements are given in Table 6.19.

**Table 6.19 ACCEPTABLE *ROADWORK DESCRIPTORS***
**DMS ON DIFFERENT FREEWAY THAN ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| CONSTRUCTION* | CONST or ROADWORK* |
| ROADWORK | ROADWORK |

* The word *CONSTRUCTION* will not fit on an eight-character line of a portable DMS. Therefore, the word must either be abbreviated or replaced with the word *ROADWORK*.

The word *ROADWORK* may be substituted for the longer word *CONSTRUCTION*. Motorist interpretations of both words are described on page 4-16. In addition, *CONST* is an acceptable abbreviation for *CONSTRUCTION*.

## Roadwork Location

General principles for the message element *Roadwork Location* can be found under *Lanes Closed* on page 4-10.

Acceptable terms for the *Roadwork Location* message element are shown in Table 6.20.

**Table 6.20 ACCEPTABLE TERMS FOR *ROADWORK LOCATION***
**DMS ON DIFFERENT FREEWAY THAN ROADWORK**

**Large Signs**

AT *[highway, street name]**
AT EXIT *[exit ramp number]**
BEFORE *[highway, street name]**
BEFORE *[exit ramp name]* EXIT*
PAST *[highway, street name]**
PAST *[exit ramp name]* EXIT*
OVER *[highway, street name]**

**Portable Signs**

AT | *[highway, street name]**
AT EXIT *[exit ramp number]**
BEFORE | *[highway, street name]**
BEFORE | *[exit ramp name]* | EXIT*
PAST | *[highway, street name]**
PAST | *[exit ramp name]* | EXIT*
OVER | *[highway, street name]**

* Insert "**ON *[route number, highway name or street name][cardinal direction]***" in front of the Roadwork Location.
"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

**Lanes Closed**

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

It is not important to inform motorists on another freeway about the specific lanes that are closed. However, it is important to notify motorists about the number of lanes closed so that they can make earlier decisions about whether to take alternative routes.

Acceptable terms for the *Lanes Closed* message element are shown in Table 6.21.

**Table 6.21 ACCEPTABLE TERMS FOR *LANES CLOSED***
**DMS ON DIFFERENT FREEWAY THAN ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| 1 LANE CLOSED | 1 LANE \| CLOSED |
| *[number]* LANES CLOSED | *[number]* LANES \| CLOSED |
| 1 LANE OPEN | 1 LANE \| OPEN |
| *[number]* LANES OPEN | *[number]* LANES \| OPEN |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

Acceptable terms for the *Effect on Travel* message element are shown in Table 6.22.

**Table 6.22 ACCEPTABLE TERMS FOR *EFFECT ON TRAVEL***
**DMS ON DIFFERENT FREEWAY THAN ROADWORK**

| **Large Signs** | **Portable Signs** |
| --- | --- |
| EXPECT DELAY | EXPECT \| DELAY |
| EXPECT MAJOR DELAY | EXPECT \| MAJOR \| DELAY |
| EXPECT MINOR DELAY | EXPECT \| MINOR \| DELAY |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Action

General principles for the message element *Action* can be found beginning on page 4-14.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists who will turn onto the affected freeway are not advised to take an alternative route,
- Motorists who will turn onto the affected freeway are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion), or
- Motorists who will turn onto the affected freeway are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4, Type 5 and Type 6 diversion routes are not applicable)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, it may be best for the motorists to stay on the current freeway rather than turning onto the freeway that is affected by the roadwork.

Acceptable terms for the *Action* when lane closures are on another freeway under this situation are shown in Table 6.23.

**Table 6.23 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN ROADWORK**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-***
***NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| BE PREPARED TO STOP | BE \| PREPARED \| TO STOP |
| USE CAUTION | USE \| CAUTION |
| STAY ON *[highway, street name] [cardinal direction]* | STAY ON \| *[highway, street name] [cardinal direction]* |
| STAY ON *[route number] [cardinal direction]* | STAY \| ON *[route number] [cardinal direction]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A "Soft" Diversion *Action* message element might be displayed for a variety of reasons including:

- There are no suitable alternative routes that can be recommended because traffic conditions on the most logical routes would not result in travel time savings to motorists if they diverted from the primary freeway,
- The DMS operator is unaware of the traffic conditions on the most logical alternative routes because surveillance does not exist on these routes, and/or
- No specific alternative route has been selected by the work crew where police, traffic control personnel and/or traffic control devices are available to provide positive guidance to motorists.

Acceptable terms for the *Action* message element in this situation are shown in Table 6.24.

**Table 6.24 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN ROADWORK**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| **Large Signs** | **Portable Signs** |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

There are times when the DMS operator is aware of an acceptable alternative freeway route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 6.25.

**Table 6.25 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN ROADWORK**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| Large Signs | Portable Signs |
|---|---|
| EXIT AND USE [*freeway*] [*cardinal direction*] | EXIT \| AND USE \| [*freeway*] [*cardinal direction*] |
| USE [*freeway*] [*cardinal direction*] | USE \| [*freeway*] [*cardinal direction*] |
| TUNE RADIO TO [*number*] AM | TUNE \| RADIO \| TO [*number*] AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Acceptable terms for the *Audience for Action* message element are shown in Table 6.26.

**Table 6.26 ACCEPTABLE TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON DIFFERENT FREEWAY THAN ROADWORK**

| **Large Signs** | **Portable Signs** |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for a displaying the message element *Good Reason for Following the Action* are given on page 4-14.

The terms shown in Table 6.27 are acceptable to display.

**Table 6.27 ACCEPTABLE TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION* DMS ON DIFFERENT FREEWAY THAN ROADWORK**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

# 6.2 BASE DMS MESSAGE FOR ROADWORK THAT REQUIRES CLOSING THE FREEWAY

When construction or maintenance roadwork requires closure of the entire freeway, a traffic control plan is implemented. The traffic control plan includes installation of traffic control devices to divert traffic off the primary freeway and to give positive guidance to the motorists along the diversion route and then back to the primary freeway. The closure of the primary freeway will take place at an exit ramp upstream of the roadwork.

## BASE DMS MESSAGE ELEMENTS

The Base DMS Message for roadwork that requiring a total freeway closure usually includes the following: 1) ***Roadwork Descriptor*** (situation description), 2) ***Closure Location,*** 3) ***Lanes Closed,*** 4) ***Effect on Travel*** (e.g., major delay), 5) ***Audience for Action,*** 6) ***Action,*** and 7) ***Good Reason for Following the Action***.

**BASE DMS MESSAGE ELEMENTS:**
- **Roadwork Descriptor (situation description),**
- **Closure Location,**
- **Lanes Closed,**
- **Effect on Travel (e.g., major delay),**
- **Audience for Action (when the action is for a specified group of motorists),**
- **Action (tells motorists what to do), and**
- **Good Reason for Following the Action statement (usually implied by other message elements.**

## DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE CLOSURE

### Base DMS Message Elements

In contrast to other situations, the Base Message when the DMS is located upstream on the same freeway and near the freeway closure will only include the following four elements: 1) ***Roadwork Descriptor,*** 2) ***Closure Location,*** 3) ***Lanes Closed,*** and 4) ***Action***.

**BASE DMS MESSAGE ELEMENTS FOR DMS NEAR CLOSURE:**
- **Roadwork Descriptor,**
- **Closure Location,**
- **Lanes Closed, and**
- **Action.**

The *Effect on Travel*, *Audience for Action* and *Good Reason for Following the Action* are implied by the *Lanes Closed* and diversion *Action* message elements and are not displayed on the DMS that is near the freeway closure location.

**Roadwork Descriptor**

Warnings of freeway closures due to roadwork should be displayed under all traffic conditions in peak or off-peak periods.

Acceptable terms for the *Roadwork Descriptor* message element are given in Table 6.28.

**Table 6.28 ACCEPTABLE *ROADWORK DESCRIPTORS***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| CONSTRUCTION* | CONST or ROADWORK* |
| ROADWORK | ROADWORK |

* The word *CONSTRUCTION* will not fit on an eight-character line of a portable DMS. Therefore, the word must either be abbreviated or replaced with the word *ROADWORK*.

The word *ROADWORK* may be substituted for the longer word *CONSTRUCTION*. Motorist interpretations of both words are described on page 4-16. In addition, *CONST* is an acceptable abbreviation for *CONSTRUCTION*.

## Closure Location

General principles for the message element *Closure Location* can be found beginning on page 4-10.

Acceptable terms to use for the *Closure Location* message element are shown in Table 6.29. Note that portable DMSs cannot be used when it is desirable to inform motorists the length of the closure for the roadwork (e.g., *FREEWAY CLOSED FROM MCCART TO WESTCREEK*).

**Table 6.29 ACCEPTABLE TERMS FOR *CLOSURE LOCATION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| 1 MILE *(AHEAD)* | 1 MILE *(AHEAD)* |
| *[number]* MILES *(AHEAD)* | *[number]* MILES *(AHEAD)* |
| AHEAD | AHEAD |
| AT *[highway, street name]* | AT \| *[highway, street name]* |
| AT *[exit ramp name]* EXIT | AT \| *[exit ramp name]* \| EXIT |
| FROM *[highway, street name]* \| TO *[highway, street name]* | |
| FROM *[highway, street name]* \| TO *[exit ramp name]* EXIT | |
| FROM *[exit ramp name]* EXIT TO *[highway, street name]* | |
| FROM *[exit ramp name]* EXIT \| TO *[exit ramp name]* EXIT | |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

Acceptable terms for the *Lanes Closed* message element are shown in Table 6.30.

**Table 6.30 ACCEPTABLE TERMS FOR *LANES CLOSED***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

The *Effect on Travel* is implied to motorists by the *Lanes Closed* and *Action* message elements and is not required in the message.

| **Table 6.31 ACCEPTABLE TERMS FOR *EFFECT ON TRAVEL*<br>DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE** |
|---|
| (Not necessary to display because it is implied by other message elements) |

## Action

General principles for the message element *Action* can be found beginning on page 4-14.

Because a Type 6 diversion (detour) route has been set up, acceptable terms for the *Action* message element are shown in Table 6.32.

**Table 6.32 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE A SPECIFIC TYPE 6 DIVERSION (DETOUR) ROUTE***

| Large Signs | Portable Signs |
|---|---|
| EXIT AND FOLLOW DETOUR | EXIT AND \| FOLLOW \| DETOUR |
| EXIT AND FOLLOW SIGNS | EXIT AND \| FOLLOW \| SIGNS |
| FOLLOW DETOUR | FOLLOW \| DETOUR |
| FOLLOW SIGNS | FOLLOW \| SIGNS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

The *Audience for Action* is implied to motorists by the *Lanes Closed* and *Action* message elements to mean all traffic passing the DMS and is not required in the message.

| **Table 6.33 ACCEPTABLE TERMS FOR *AUDIENCE FOR ACTION*<br>DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE** |
|---|
| (Not necessary to display because it is implied by other message elements) |

## Good Reason for Following the Action

General guidelines for a displaying the message element *Good Reason for Following the Action* are given on page 4-14.

The *Good Reason for Following the Action* is implied to motorists by the *Lanes Closed* and *Action* message elements and is not required in the message.

| Table 6.34 ACCEPTABLE TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION* DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE |
|---|
| (Not necessary to display because it is implied by other message elements) |

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE CLOSURE

### Roadwork Descriptor

Warnings of freeway closures due to roadwork should be displayed under all traffic conditions in peak or off-peak periods.

Acceptable terms for the *Roadwork Descriptor* message element are given in Table 6.35.

**Table 6.35 ACCEPTABLE *ROADWORK DESCRIPTORS***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| CONSTRUCTION* | CONST or ROADWORK* |
| ROADWORK | ROADWORK |

* The word *CONSTRUCTION* will not fit on an eight-character line of a portable DMS. Therefore, the word must either be abbreviated or replaced with the word *ROADWORK*.

The word *ROADWORK* may be substituted for the longer word *CONSTRUCTION*. Motorist interpretations of both words are described on page 4-16. In addition, *CONST* is an acceptable abbreviation for *CONSTRUCTION*.

## Closure Location

General principles for the message element *Closure Location* can be found beginning on page 4-10.

Acceptable terms for the *Closure Location* message element are shown in Table 6.36. Note that portable DMSs cannot be used when it is desirable to inform motorists the length of the closure for the roadwork (e.g., *FREEWAY CLOSED FROM MCCART TO WESTCREEK*).

**Table 6.36 ACCEPTABLE TERMS FOR *CLOSURE LOCATION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| *[number]* MILES *(AHEAD)* | *[number]* MILES *(AHEAD)* |
| AT *[highway, street name]* | AT \| *[highway, street name]* |
| AT *[exit ramp name]* EXIT | AT \| *[exit ramp name]* \| EXIT |
| FROM *[highway, street name]* \| TO *[highway, street name]* | |
| FROM *[highway, street name]* \| TO *[exit ramp name]* EXIT | |
| FROM *[exit ramp name]* EXIT TO *[highway, street name]* | |
| FROM *[exit ramp name]* EXIT \| TO *[exit ramp name]* EXIT | |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

Acceptable terms for the *Lanes Closed* message element are shown in Table 6.37.

**Table 6.37 ACCEPTABLE TERMS FOR *LANES CLOSED***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

**Effect on Travel**

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

The *Effect on Travel* is implied to motorists by the *Lanes Closed* and *Action* message elements and is not required in the message.

| **Table 6.38 ACCEPTABLE TERMS FOR *EFFECT ON TRAVEL*<br>DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE** |
| --- |
| (Not necessary to display because it is implied by other message elements) |

## Action

General principles for the message element *Action* can be found beginning on page 4-13.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists are not advised to take an alternative route,
- Motorists are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion),
- Motorists are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4 and Type 5 diversion routes are not applicable)*, or
- Motorists are advised by the DMS to take the specific Type 6 diversion (detour) route.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

In some cases, it may be best for the motorists to stay on the current freeway rather than turning onto the freeway that is affected by the roadwork.

Acceptable terms for the *Action* message element when lane closures are on another freeway under this situation are shown in Table 6.39.

**Table 6.39 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-NO DIVERSION ACTION***

| **Large Signs** | **Portable Signs** |
|---|---|
| BE PREPARED TO STOP | BE \| PREPARED \| TO STOP |
| USE CAUTION | USE \| CAUTION |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A “Soft” Diversion *Action* message element might be displayed when it is advantageous for motorists to leave the freeway far upstream of the closure rather than exiting at the detour location where severe congestion may be present.

Acceptable terms for the *Action* message element in this situation are shown in Table 6.40.

**Table 6.40 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| Large Signs | Portable Signs |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

“|” Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### ***Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route***

There are times when the DMS operator is aware of an acceptable alternative freeway route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 6.41.

**Table 6.41 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE *[freeway] [cardinal direction]* | USE \| *[freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 6 Diversion Route*

There are times when it is best to send the motorists at the DMS location to the diversion (detour) route that has been set up downstream.

Acceptable terms for the *Action* message element when this condition exists are shown in Table 6.42.

**Table 6.42 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE THE TYPE 6 DIVERSION (DETOUR) ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AT *[highway, street name] [cardinal direction]* \| FOLLOW DETOUR | EXIT \| AT \| *[highway, street name] [cardinal direction]* \| FOLLOW \| DETOUR |
| EXIT AT *[highway, street name] [cardinal direction]* \| FOLLOW SIGNS | EXIT \| AT \| *[highway, street name] [cardinal direction]* \| FOLLOW \| SIGNS |
| EXIT AT *[route number] [cardinal direction]* \| FOLLOW DETOUR | EXIT \| AT *[route number] [cardinal direction]* \| FOLLOW \| DETOUR |
| EXIT AT *[route number] [cardinal direction]* \| FOLLOW SIGNS | EXIT \| AT *[route number] [cardinal direction]* \| FOLLOW \| SIGNS |
| TAKE *[exit ramp name*] EXIT \| FOLLOW DETOUR | TAKE \| *[exit ramp name*] \| EXIT \| FOLLOW \| DETOUR |
| TAKE *[exit ramp name*] EXIT \| FOLLOW SIGNS | TAKE \| *[exit ramp name*] \| EXIT \| FOLLOW \| SIGNS |
| TAKE *[highway, street name] [cardinal direction]* \| FOLLOW DETOUR | TAKE \| *[highway, street name] [cardinal direction]* \| FOLLOW \| DETOUR |
| TAKE *[highway, street name] [cardinal direction]* \| FOLLOW SIGNS | TAKE \| *[highway, street name] [cardinal direction]* \| FOLLOW \| SIGNS |
| TAKE *[route number] [cardinal direction]* \| FOLLOW DETOUR | TAKE *[route number] [cardinal direction]* \| FOLLOW \| DETOUR |
| TAKE *[route number] [cardinal direction]* \| FOLLOW SIGNS | TAKE *[route number] [cardinal direction]* \| FOLLOW \| SIGNS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Acceptable terms for the *Audience for Action* message element are shown in Table 6.43.

**Table 6.43 ACCEPTABLE TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for a displaying the message element *Good Reason for Following the Action* are given on page 4-14.

As a rule, when the freeway is closed and *ALL LANES CLOSED* or *FREEWAY CLOSED* is displayed, the reason for following the suggested action is implied, and there is no need to display the reason. However, when a recommended diversion route may be perceived by motorists as not being the most logical route, then a *Good Reason for Following the Action* should be displayed.

The terms shown in Table 6.44 below are acceptable to display.

**Table 6.44 ACCEPTABLE TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## DMS ON DIFFERENT FREEWAY THAN THE ROADWORK AND CLOSURE

The DMS operational guidelines in this section of the Manual apply when the DMS is on a different freeway than the incident, but the incident still can have an affect on motorists who are passing the DMS. For example, westbound I-10 motorists who intend to exit the freeway and enter northbound I-45 to travel toward Dallas could be affected by incidents that occur on northbound I-45 north of the I-10/I-45 interchange. Messages displayed on DMSs on westbound I-10 concerning incidents on northbound I-45 can be helpful to those motorists heading toward Dallas.

The major difference between the messages displayed on DMSs located on a different freeway than the closure in comparison to the messages on DMSs located on the same freeway as the closure but far upstream of the work is in the diversion information provided.

## Roadwork Descriptor

Warnings of freeway closures due to roadwork should be displayed under all traffic conditions in peak or off-peak periods.

Acceptable terms for the *Roadwork Descriptor* message element are given in Table 6.45.

**Table 6.45 ACCEPTABLE *ROADWORK DESCRIPTORS***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| CONSTRUCTION* | CONST or ROADWORK* |
| ROADWORK | ROADWORK |

* The word *CONSTRUCTION* will not fit on an eight-character line of a portable DMS. Therefore, the word must either be abbreviated or replaced with the word *ROADWORK*.

The word *ROADWORK* may be substituted for the longer word *CONSTRUCTION*. Motorist interpretations of both words are described on page 4-16. In addition, *CONST* is an acceptable abbreviation for *CONSTRUCTION*.

## Closure Location

General principles for the message element *Closure Location* can be found beginning on page 4-10.

Acceptable terms for the *Closure Location* message element are shown in Table 6.46. Note that portable DMSs cannot be used when it is desirable to inform motorists the length of the closure for the roadwork (e.g., *FREEWAY CLOSED FROM MCCART TO WESTCREEK*).

**Table 6.46 ACCEPTABLE TERMS FOR *CLOSURE LOCATION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| AT *[highway, street name]** | AT \| *[highway, street name]** |
| AT *[exit ramp name]* EXIT* | AT \| *[exit ramp name]* \| EXIT* |
| FROM *[highway, street name]* \| TO *[highway, street name]** | |
| FROM *[highway, street name]* \| TO *[exit ramp name]* EXIT* | |
| FROM *[exit ramp name]* EXIT TO *[highway, street name]** | |
| FROM *[exit ramp name]* EXIT \| TO *[exit ramp name]* EXIT* | |

* Insert "**ON *[route number, highway or street name] [cardinal direction]*** in front of **Closure Location**.
"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Lanes Closed

General principles for the message element *Lanes Closed* can be found beginning on page 4-10.

Acceptable terms for the *Lanes Closed* message element are shown in Table 6.47.

**Table 6.47 ACCEPTABLE TERMS FOR *LANES CLOSED***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| ALL LANES CLOSED | ALL \| LANES \| CLOSED |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Effect on Travel

General principles for the message element *Effect on Travel* can be found beginning on page 4-10.

The *Effect on Travel* is implied to motorists by the *Lanes Closed* and *Action* message elements and is not required in the message.

| Table 6.48 ACCEPTABLE TERMS FOR *EFFECT ON TRAVEL* DMS ON DIFFERENT FREEWAY THAN CLOSURE |
|---|
| (Not necessary to display because it is implied by other message elements) |

## Action

General principles for the message element *Action* can be found beginning on page 4-13.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists who will turn onto the affected freeway are not advised to take an alternative route,
- Motorists who will turn onto the affected freeway are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion), or
- Motorists who will turn onto the affected freeway are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4, Type 5 and Type 6 diversion routes are not applicable)*.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Not Advised to Take an Alternative Route – No Diversion Action Message*

There may be situations when it is better for the motorists intending to turn onto the freeway with the closure to stay on the existing freeway.

Acceptable terms for the *Action* message element when closures occur under this situation are shown in Table 6.49.

**Table 6.49 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**
***MOTORISTS ARE NOT ADVISED TO TAKE AN ALTERNATIVE ROUTE-***
***NO DIVERSION ACTION***

| Large Signs | Portable Signs |
|---|---|
| BE PREPARED TO STOP | BE \| PREPARED \| TO STOP |
| USE CAUTION | USE \| CAUTION |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A "Soft" Diversion *Action* message element might be displayed when it is advantageous for motorists to leave the existing freeway rather than turning onto the freeway with the closure and exiting at the detour location where severe congestion may be present.

Acceptable terms for the *Action* message element in this situation are shown in Table 6.50.

**Table 6.50  ACCEPTABLE TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| Large Signs | Portable Signs |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTE |

"|"  Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

There are times when the DMS operator is aware of an acceptable alternative freeway route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 6.51.

**Table 6.51 ACCEPTABLE TERMS FOR *ACTION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE *[freeway] [cardinal direction]* | USE \| *[freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Acceptable terms for the *Audience for Action* message element are shown in Table 6.52.

**Table 6.52 ACCEPTABLE TERMS FOR *AUDIENCE FOR ACTION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for a displaying the message element *Good Reason for Following the Action* are given on page 4-14.

As a rule, when the freeway is closed and *ALL LANES CLOSED* or *FREEWAY CLOSED* is displayed, the reason for following the suggested action is implied, and there is no need to display the reason. However, when a recommended diversion route may be perceived by motorists as not being the most logical route, then a *Good Reason for Following the Action* should be displayed.

The terms shown in Table 6.53 below are acceptable to display.

**Table 6.53 ACCEPTABLE TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS ON DIFFERENT FREEWAY THAN CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

# 6.3 BASE DMS MESSAGE FOR ROADWORK ON AN INTERSECTING FREEWAY THAT REQUIRES CLOSING THE CONNECTOR RAMP

## BASE DMS MESSAGE ELEMENTS

The Base DMS Message for closure of a freeway-to-freeway connector during roadwork includes the following: 1) ***Roadwork Descriptor (situation description),*** 2) ***Closure Location,*** 3) ***Lanes Closed,*** 4) ***Ramp Closure Descriptor,*** 5) ***Audience for Action,*** 6) ***Action,*** and 7) ***Good Reason for Following the Action***.

**BASE DMS MESSAGE ELEMENTS**

- **Roadwork Descriptor (situation description),**
- **Closure Location,**
- **Lanes Closed,**
- **Ramp Closure Descriptor,**
- **Audience for Action (when the action is for a specific group of motorists),**
- **Action (tells motorists what to do), and**
- **Good Reason for Following the Action statement (usually implied by other message elements).**

## DMS UPSTREAM OF THE CONNECTOR RAMP CLOSURE

### Roadwork Descriptor

Acceptable terms for the *Roadwork Descriptor* message element are given in Table 6.54.

**Table 6.54 ACCEPTABLE *ROADWORK DESCRIPTORS***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| Large Signs | Portable Signs |
|---|---|
| CONSTRUCTION* | CONST or ROADWORK* |
| ROADWORK | ROADWORK |

* The word *CONSTRUCTION* will not fit on an eight-character line of a portable DMS. Therefore, the word must either be abbreviated or replaced with the word *ROADWORK*.

The word *ROADWORK* may be substituted for the longer word *CONSTRUCTION*. Motorist interpretations of both words are described on page 4-16. In addition, *CONST* is an acceptable abbreviation for *CONSTRUCTION*.

## Closure Location

General principles for the message element *Closure Location* can be found beginning on page 4-10.

Acceptable terms for the *Closure Location* message element are shown in Table 6.55. Note that portable DMSs cannot be used when it is desirable to inform motorists the length of the closure for the roadwork (e.g., *I-20 EAST CLOSED FROM MCCART TO WESTCREEK*).

**Table 6.55 ACCEPTABLE TERMS FOR *CLOSURE LOCATION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| AT *[highway, street name]** | AT \| *[highway, street name]** |
| AT *[exit ramp name]* EXIT* | AT \| *[exit ramp name]* \| EXIT* |
| FROM *[highway, street name]* \| TO *[highway, street name]** | |
| FROM *[highway, street name]* \| TO *[exit ramp name]* EXIT* | |
| FROM *[exit ramp name]* EXIT TO *[highway, street name]** | |
| FROM *[exit ramp name]* EXIT \| TO *[exit ramp name]* EXIT* | |
| TO *[landmark]** | |

* Insert "**ON *[route number, highway or street name] [cardinal direction]***" in front of **Closure Location**.
"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Ramp Closure Descriptor

Acceptable terms for the *Ramp Closure Descriptor* Message Element are shown in Table 6.56.

**Table 6.56  ACCEPTABLE TERMS FOR *RAMP CLOSURE DESCRIPTORS***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| RAMP CLOSED \| TO [*intersecting fwy number] [card. direction])* | RAMP \| CLOSED \| TO [*intersecting fwy number] [card. direction]* |
| RAMP CLOSED \| TO *[intersecting freeway name]* FREEWAY | |
| [*intersecting fwy number] CLOSED* | [*intersecting fwy number]* \| CLOSED |
| [*intersecting fwy number] [card. direction]) CLOSED* | [*intersecting fwy number] [card. direction])* CLOSED |

"|"  Indicates that the next portion of the message will be displayed on the next line(s).

## Action

General principles for the message element *Action* can be found beginning on page 4-13.

The *Action* message element displayed to motorists will be dictated by whether:

- Motorists are advised to take other routes but the specific route is not specified in the DMS message (sometimes referred to as "soft" diversion),
- Motorists who will turn onto the affected ramp are advised by the DMS message to take a specific Type 2 freeway diversion route *(Type 1, Type 3, Type 4 and Type 6 diversion routes are not applicable)*, or
- Motorists who will turn onto the affected ramp are advised by the DMS message to take the Type 5 diversion (detour) route.

Each TxDOT district has an established policy that defines when motorists can be advised to take a specific alternative route. The DMS operator should review this policy before diversion messages are displayed.

### *Motorists Are Advised to Take Other Routes but the Specific Route Is Not Specified in the DMS Message (Soft Diversion)*

A "Soft" Diversion *Action* message element might be displayed when it is not possible for the DMS operator to specify a specific route the motorist should use.

Acceptable terms for the *Action* message element in this situation are shown in Table 6.57.

**Table 6.57 ACCEPTABLE TERMS FOR *ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE AN ALTERNATIVE ROUTE-SOFT DIVERSION***

| Large Signs | Portable Signs |
|---|---|
| USE OTHER ROUTES | USE \| OTHER \| ROUTES |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 2 Freeway Diversion Route*

There are times when the DMS operator is aware of an acceptable alternative freeway route and has real-time information about the conditions on the alternative route. Police or traffic control personnel are not positioned at critical decision points along the diversion route.

Acceptable terms for the *Action* message element when these conditions exist are shown in Table 6.58.

**Table 6.58 ACCEPTABLE TERMS FOR *ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE A TYPE 2 DIVERSION ROUTE***

| **Large Signs** | **Portable Signs** |
|---|---|
| EXIT AND USE *[freeway] [cardinal direction]* | EXIT \| AND USE \| *[freeway] [cardinal direction]* |
| USE *[freeway] [cardinal direction]* | USE \| *[freeway] [cardinal direction]* |
| TUNE RADIO TO *[number]* AM | TUNE \| RADIO \| TO *[number]* AM |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

### *Motorists Are Advised to Take a Specific Type 6 Diversion Route*

There are times when the Incident Emergency Route Plan has been implemented. Thus guide signs, trailblazers, and police and/or traffic control personnel are guiding motorists at critical locations along the route.

Acceptable terms for the *Action* message element when this condition exists are shown in Table 6.59.

**Table 6.59 ACCEPTABLE TERMS FOR *ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**
***MOTORISTS ARE ADVISED TO TAKE THE TYPE 6 DIVERSION (DETOUR) ROUTE***

| | |
|---|---|
| **Large Signs** | **Portable Signs** |
| EXIT AT *[highway, street name] [cardinal direction]* \| FOLLOW DETOUR | EXIT \| AT \| *[highway, street name] [cardinal direction]* \| FOLLOW \| DETOUR |
| EXIT AT *[highway, street name] [cardinal direction]* \| FOLLOW SIGNS | EXIT \| AT \| *[highway, street name] [cardinal direction]* \| FOLLOW \| SIGNS |
| EXIT AT *[route number] [cardinal direction]* \| FOLLOW DETOUR | EXIT \| AT *[route number] [cardinal direction]* \| FOLLOW \| DETOUR |
| EXIT AT *[route number] [cardinal direction]* \| FOLLOW SIGNS | EXIT \| AT *[route number] [cardinal direction]* \| FOLLOW \| SIGNS |
| TAKE *[exit ramp name*] EXIT \| FOLLOW DETOUR | TAKE \| *[exit ramp name*] \| EXIT \| FOLLOW \| DETOUR |
| TAKE *[exit ramp name*] EXIT \| FOLLOW SIGNS | TAKE \| *[exit ramp name*] \| EXIT \| FOLLOW \| SIGNS |
| TAKE *[highway, street name] [cardinal direction]* \| FOLLOW DETOUR | TAKE \| *[highway, street name] [cardinal direction]* \| FOLLOW \| DETOUR |
| TAKE *[highway, street name] [cardinal direction]* \| FOLLOW SIGNS | TAKE \| *[highway, street name] [cardinal direction]* \| FOLLOW \| SIGNS |
| TAKE *[route number] [cardinal direction]* \| FOLLOW DETOUR | TAKE *[route number] [cardinal direction]* \| FOLLOW \| DETOUR |
| TAKE *[route number] [cardinal direction]* \| FOLLOW SIGNS | TAKE *[route number] [cardinal direction]* \| FOLLOW \| SIGNS |

"|" Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Audience for Action

General principles for the message element *Audience for Action* can be found beginning on page 4-13.

Acceptable terms for the *Audience for Action* message element are shown in Table 6.60.

**Table 6.60  ACCEPTABLE TERMS FOR *AUDIENCE FOR ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| *[highway, street name] [cardinal direction]* | *[highway, street name] [cardinal direction]* |
| *[route number] [cardinal direction]* | *[route number] [cardinal direction]* |
| *[name of city or state]* | *[name of city or state]* |
| *[name of event, tourist attraction]* | *[name of event, tourist attraction]* |
| *[name of stadium, park, etc.]* | *[name of stadium, park, etc.]* |
| TO *[highway, street name][cardinal direction]* | TO *[highway, street name][cardinal direction]* |
| TO *[route number] [cardinal direction]* | TO *[route number] [cardinal direction]* |
| TO *[name of city or state]* | TO *[name of city or state]* |
| TO *[name of event, tourist attraction]* | TO *[name of event, tourist attraction]* |
| TO *[name of stadium, park, etc.]* | TO *[name of stadium, park, etc.]* |
| ALL TRAFFIC | ALL \| TRAFFIC |
| ALL TRUCKS | ALL \| TRUCKS |

"|"  Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

## Good Reason for Following the Action

General guidelines for a displaying the message element *Good Reason for Following the Action* are given on page 4-14.

The terms shown in Table 6.61 are acceptable to display.

**Table 6.61  ACCEPTABLE TERMS FOR *GOOD REASON FOR FOLLOWING THE ACTION***
**DMS UPSTREAM OF CONNECTOR RAMP CLOSURE**

| **Large Signs** | **Portable Signs** |
|---|---|
| AVOID DELAY | AVOID \| DELAY |
| AVOID MAJOR DELAY | AVOID \| MAJOR \| DELAY |
| SAVE *[number]* MINUTES | SAVE \| *[number]* MIN |
| BEST ROUTE TO *[destination]* | BEST \| ROUTE TO \| *[destination]* |

"|"  Indicates that the next portion of the message will be displayed on the next line(s) of DMS.

# MODULE 7. ESTABLISHING THE MAXIMUM MESSAGE LENGTH

## TABLE OF CONTENTS

# MODULE 7. ESTABLISHING THE MAXIMUM MESSAGE LENGTH

## 7.1 MESSAGE LENGTH AND DMS VIEWING DISTANCE REQUIREMENTS

**Available viewing distance to the DMS (coupled with traveling speed) dictates the amount of time the motorist has to read the sign.**

**Any obstruction that comes between the motorist and the DMS within this viewing distance will hinder the motorist from reading the entire message.**

The maximum length of message that can be displayed on a DMS at a location depends not only on the perception and information processing capabilities of motorists, but also on how far away they can adequately view the message. Stated another way, available viewing distance (coupled with the speed that the motorist is traveling) dictates the amount of time that the motorist has available to read a DMS. The viewing distance from a motorist to a DMS viewed straight on that is necessary to read a message of a given length (in terms of units of information presented) is illustrated in Figure 7.1. Any obstruction that comes between the motorist and the sign within this viewing distance will hinder the motorist from reading the entire message. At higher speeds, distances as great as 800 feet are needed for messages that contain 4 units of information.

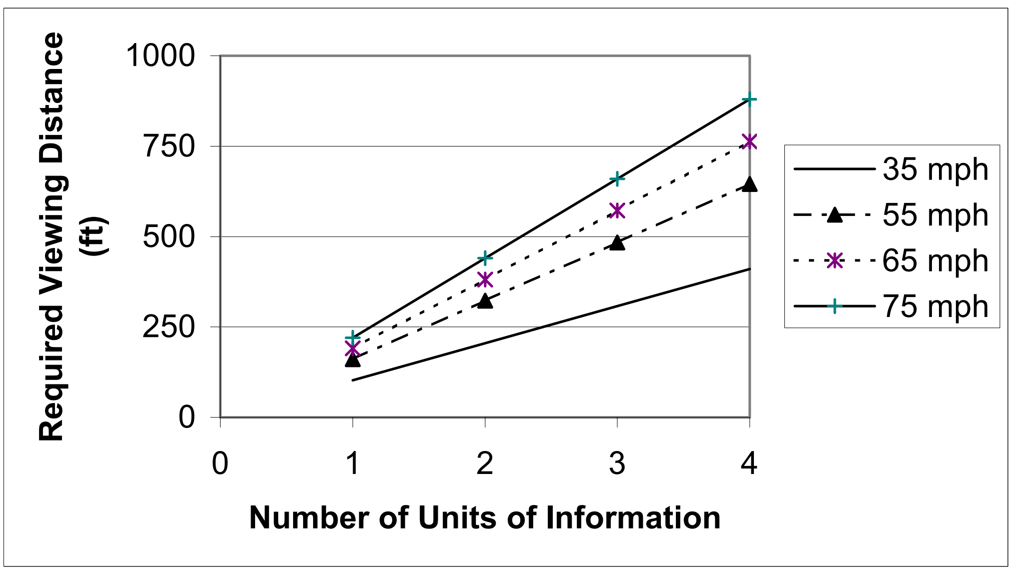


**Figure 7.1 Required Viewing Distances to a DMS**

The values in Figure 7.1 are for DMSs mounted directly over the travel lanes. However, for DMSs positioned off to the side of the roadway (either permanent-mounted or portable), additional sight distance is required to ensure that the message is read entirely while still within the driver's field of vision (assumed to be 10° right or left of head-on viewing). The distances that should be added to the values in Figure 7.1 for a given lateral offset between the motorist and the center of the DMS are shown in Figure 7.2. Note that the additional sight distance required can be quite significant for larger offsets, adding 300 feet or more to the necessary sight distance between the motorist and the DMS.

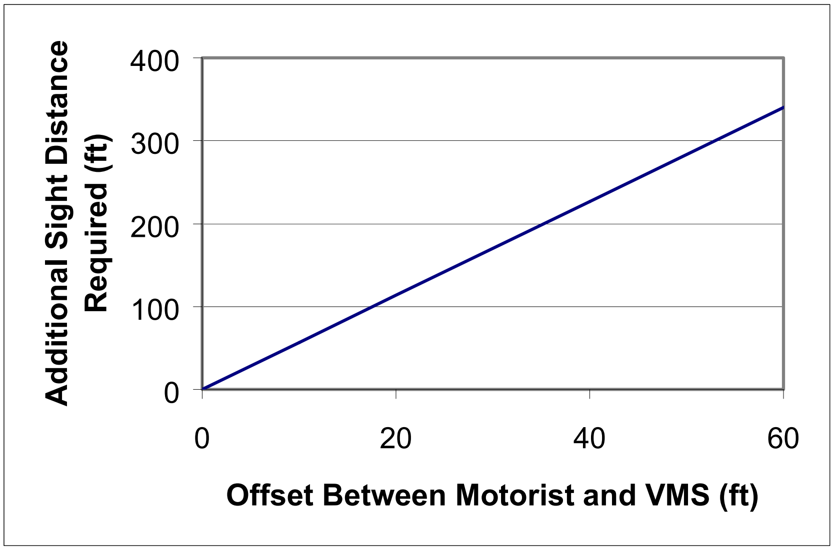


**Figure 7.2 Additional Sight Distance Required For Lateral DMS Offset**

> **THE LEGIBILITY DISTANCE TO A DMS MAY BE LESS THAN EXPECTED BECAUSE OF:**
>
> - **Lighting conditions,**
> - **Sun position,**
> - **Vertical curvature,**
> - **Horizontal curvature,**
> - **Spot obstructions,**
> - **Rain or fog, and**
> - **Trucks in the traffic stream.**
>
> **THERFORE, THE MAXIMUM ALLOWABLE NUMBER OF UNITS OF INFORMATION MAY HAVE TO BE REDUCED.**

The maximum distance at which a motorist can first correctly identify letters and words on a DMS is termed the legibility distance of the sign. In some situations, a motorist may not be able to utilize the maximum possible legibility distance (and thus, viewing time) from a DMS. Lighting conditions (day vs. night and position of the sun) can reduce the legibility distance to the DMS. Roadway geometric features such as vertical or horizontal curvature (around sight obstructions) can restrict a motorist's sight distance to a DMS. Spot obstructions such as overpasses and sign bridges can also restrict DMS viewing distances, particularly for signs mounted over the travel lanes. A number of environmental factors or conditions also impact DMS visibility. Rain and fog (and even snow) all scatter and block light rays from a DMS as that light travels through the atmosphere. Finally, the presence of a significant number of trucks on the roadway will likewise limit the ability of motorists to adequately view a DMS positioned on the side of the roadway.

Just as factors such as reduced lane widths and sharp grades reduce the ideal traffic-carrying capacity of a roadway, one or more of these conditions can constrain the available DMS viewing distances to values lower than what are ideal. This means that there may not always be enough viewing time for a motorist to read a DMS message providing 4 units of information (5 units on lower speed roadways), and so shorter messages may have to be used.

Adjustments that may need to be made to the Base Maximum Message Length assumed to be available for a particular type of DMS are described in the following sections for five major conditions:

- Day and night operations,
- Vertical curves,
- Horizontal curves,
- Presence of a large proportion of trucks, and
- Presence of rain or fog.

## 7.2 MAXIMUM DMS LEGIBILITY DISTANCES FOR DAY AND NIGHT OPERATIONS

The maximum distance at which a motorist can first correctly identify letters and words on a DMS is termed the legibility distance of the sign. This distance depends on the design characteristics of the sign. Key design parameters are the type of display technology (light-emitting, light-reflecting, etc.), height and width of the characters, the stroke width of the characters, and the type of font displayed. Legibility distances proposed for use in DMS message design (based on results of several studies) are presented in Table 7.1. These distances represent standard font (all uppercase), 18-inch character heights, 13-inch (approximate) character widths, and about 2.5-inch stroke (pixel) widths. Smaller characters would yield shorter distances.

The legibility distances shown in Table 7.1 affect the maximum number of units of information that should be displayed on a DMS which will allow motorists to read and comprehend the message at prevailing highway operating speeds. Based on these distances, the maximum number of informational units that motorists can actually read and comprehend in a DMS message is summarized in Table 7.2. These numbers establish the Base Maximum Message Length.

**Table 7.1 Suggested DMS Legibility Distances for Use in Message Design (ft)**

| Condition | Light-Emitting Diode[A] | Fiberoptic | Incandescent Bulb | Reflective Disk |
|---|---|---|---|---|
| Mid-Day | 800 | 700 | 700 | 700 |
| Washout | 800 | 700 | 700 | 400 |
| Backlight | 600 | 400 | 400 | 200 |
| Nighttime | 600 | 600 | 600 | 350 |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs

**Table 7.2 Maximum Number of Units of Information in DMS Message (Base Maximum Message Length)**

| Condition | Light-Emitting Diode[A] | | | Fiberoptic | | | Incandescent Bulb | | | Reflective Disk | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0-35 mph | 36-55 mph | 56-70 mph | 0-35 mph | 36-55 mph | 56-70 mph | 0-35 mph | 36-55 mph | 56-70 mph | 0-35 mph | 36-55 mph | 56-70 mph |
| Mid-Day | 5 units | 4 units | 4 units | 5 units | 4 units | 3 units | 5 units | 4 units | 3 units | 5 units | 4 units | 3 units |
| Washout | 5 units | 4 units | 4 units | 5 units | 4 units | 3 units | 5 units | 4 units | 3 units | 4 units | 3 units | 2 units |
| Backlight | 4 units | 4 units | 3 units | 4 units | 3 units | 2 units | 4 units | 3 units | 2 units | 2 units | 1 unit | 1 unit |
| Nighttime | 4 units | 4 units | 3 units | 4 units | 3 units | 3 units | 4 units | 3 units | 3 units | 3 units | 2 units | 1 unit |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs

# 7.3 UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES - LED DMSs

## INTRODUCTION

Generally speaking, permanent DMSs mounted above the travel lanes are not affected by the presence of crest vertical curves. Vertical curvature is established based on safe stopping sight distances to a rather small (i.e., 6-inch) object located on the roadway, based on the design speed of the roadway. The high (20 to 25 ft) typical mounting heights of permanent DMSs provide viewing distances over the curve which usually exceed the visual capabilities of the signs themselves. However, this is often not the case for portable DMS positioned on the shoulder of the roadway. Furthermore, conditions where actual operating speeds are higher than the design speed of the vertical curve can sometimes provide less viewing time than is normally assumed to exist.

A procedure for determining the potential influence of the vertical curve on the maximum number of information units that should be displayed on a DMS is given in Appendix A.

## REDUCTIONS FOR VERTICAL CURVE DESIGN SPEEDS 45 MPH AND ABOVE

No reductions in the number of units of information are required for LED DMSs. Therefore, use the Base Maximum Message Length shown in Table 7.2 for the traffic operating speed on the highway.

## REDUCTIONS FOR VERTICAL CURVE DESIGN SPEEDS BELOW 45 MPH

Vertical curve design speeds lower than 45 mph require that the number of informational units be reduced to account for the lower legibility. The number of units that must be subtracted from the Base Maximum Message Length shown in Table 7.2 when LED signs are used are given in Tables 7.3 and 7.4 for PERMANENT DMSs with mounting heights of 20 and 25 feet and offsets of 0, 20 and 60 feet. The number of units that must be subtracted from the Base Maximum Message Length shown in Table 7.2 when LED signs are used are given in Tables 7.5 and 7.6 for PORTABLE DMSs with mounting heights of 7 and 10 feet and offsets of 20 and 60 feet.

## EXAMPLES

### Example 1

*Question*

A permanent LED DMS mounted 20 feet above the roadway is located to the right of a six-lane urban arterial. The sign is positioned such that the offset from the DMS to the motorist in the left lane is approximately 60 feet. It is located at the downstream end of a 600-foot crest vertical curve that is designed for 35 mph. Does the Base Maximum Message Length have to be reduced in this situation?

***Answer***

Yes. Using Table 7.3 for a 60-foot offset and 35 mph operating speed, the Base Maximum Message Length must be reduced by 3 units in all viewing conditions (mid-day, washout, backlight, and nighttime).

**Example 2**

***Question***

A portable LED DMS that is 7 feet high is located in the middle of a 20-foot median on a four-lane freeway with a 6-foot inside paved shoulder. The sign is placed on the downstream end of a 1200-foot crest vertical curve. The design speed of the curve is 60 mph. Does the curve constrain the amount of information that can be presented on the DMS?

***Answer***

Since the design speed of the curve is greater than 45 mph, a sight distance restriction is not expected for the portable DMS. No reduction in Base Maximum Message Length is necessary.

**Table 7.3 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Vertical Curve PERMANENT LED DMS[A] Mounting Height: 20 feet**

| Condition | Vertical Curve Design Speed | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Overhead | | | 20-foot Offset | | | 60-foot Offset | | |
| | 30 mph | 35 mph | 40 mph | 30 mph | 35 mph | 40 mph | 30 mph | 35 mph | 40 mph |
| Mid-Day | 1 unit | 0 unit | 0 unit | 2 units | 0 unit | 0 unit | 5 units | 3 units | 1 unit |
| Washout | 1 unit | 0 unit | 0 unit | 2 units | 0 unit | 0 unit | 5 units | 3 units | 1 unit |
| Backlight | 0 unit | 0 unit | 0 unit | 1 unit | 0 unit | 0 unit | 4 units | 3 units | 1 unit |
| Nighttime | 0 unit | 0 unit | 0 unit | 1 unit | 0 unit | 0 unit | 4 units | 3 units | 1 unit |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.

**Table 7.4 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Vertical Curve PERMANENT LED DMS[A] Mounting Height: 25 feet**

| Condition | Vertical Curve Design Speed | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Overhead | | | 20-foot Offset | | | 60-foot Offset | | |
| | 30 mph | 35 mph | 40 mph | 30 mph | 35 mph | 40 mph | 30 mph | 35 mph | 40 mph |
| Mid-Day | 0 unit | 0 unit | 0 unit | 2 units | 1 unit | 0 unit | 5 units | 4 units | 1 unit |
| Washout | 0 unit | 0 unit | 0 unit | 2 units | 1 unit | 0 unit | 5 units | 4 units | 1 unit |
| Backlight | 0 unit | 0 unit | 0 unit | 1 unit | 0 unit | 0 unit | 4 units | 3 units | 1 unit |
| Nighttime | 0 unit | 0 unit | 0 unit | 1 unit | 0 unit | 0 unit | 4 units | 3 units | 1 unit |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.

**Table 7.5 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Vertical Curve PORTABLE LED DMS[A] Mounting Height: 7 feet**

| Condition | Vertical Curve Design Speed | | | | | |
|---|---|---|---|---|---|---|
| | 20-foot Offset | | | 60-foot Offset | | |
| | 30 mph | 35 mph | 40 mph | 30 mph | 35 mph | 40 mph |
| Mid-Day | 3 units | 2 units | 1 unit | 5 units | 5 units | 3 units |
| Washout | 3 units | 2 units | 1 unit | 5 units | 5 units | 3 units |
| Backlight | 2 units | 1 unit | 1 unit | 4 units | 4 units | 2 units |
| Nighttime | 2 units | 1 unit | 1 unit | 4 units | 4 units | 2 units |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.

**Table 7.6 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Vertical Curve PORTABLE LED DMS[A] Mounting Height: 10 feet**

| Condition | Vertical Curve Design Speed | | | | | |
|---|---|---|---|---|---|---|
| | 20-foot Offset | | | 60-foot Offset | | |
| | 30 mph | 35 mph | 40 mph | 30 mph | 35 mph | 40 mph |
| Mid-Day | 2 units | 2 units | 1 unit | 5 units | 4 units | 3 units |
| Washout | 2 units | 2 units | 1 unit | 5 units | 4 units | 3 units |
| Backlight | 1 unit | 1 unit | 0 unit | 4 units | 3 units | 2 units |
| Nighttime | 1 unit | 1 unit | 0 unit | 4 units | 3 units | 2 units |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.

# 7.4 UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs

## INTRODUCTION

Whereas vertical curvature design is based on stopping sight distance, design criteria for horizontal curvature is based on driver comfort and the friction between the tires and the roadway. With respect to DMS visibility and viewing time, horizontal curvature generally does not impact permanent DMSs mounted over travel lanes. Likewise, permanent DMS mounted adjacent to the travel lanes (in the median or off to the right) will extend above most obstructions that may exist on the roadside and so are not affected by any horizontal curvature (although certain spot obstructions such as overhead signs or luminaires may be more problematic to DMS viewing on horizontal curves).

However, the situation is different for portable DMSs placed on the side of the road within the curve (on the right side of a right-hand curve, on the left side of a left-hand curve). If an object (construction vehicle, tree, etc.) is located close to the edge of a roadway on the same side as the DMS, a driver in the closest lane may not be able to see around the object and fully read and comprehend the message. The detailed process to assess whether an obstruction may constrain the reading time of a portable DMS around a horizontal curve is described in Appendix B.

## REDUCTIONS FOR HORIZONTAL CURVES FOR PERMANENT DMSs

No reduction is necessary for permanent DMSs.

## REDUCTIONS FOR HORIZONTAL CURVES FOR PORTABLE DMSs

Tables 7.7 through 7.9 give the number of units of information that must be subtracted from the Basic Maximum Message Length when LED signs are used and the portable DMS is offset 2 feet. Similar numbers to subtract when the portable DMS is offset 10 feet are given in Tables 7.10 through 7.12.

## EXAMPLES

### Example 1

***Question***

A portable LED DMS is to be placed 2 feet from the edge of travel lanes on a rural highway upstream of a work zone toward the end of a long (2500 ft) horizontal curve. Traffic speeds on the roadway average 65 mph. A bridge overpass abutment is located upstream of the DMS along the curve as well. The abutment is 50 feet from the edge of the travel lane. The curve radius is 1500 feet. The DMS will not be in washout or backlighted conditions during the day, and will not have overhead lighting present at night. Does the Base Maximum Message Length have to be reduced in this situation?

***Answer***

For the characteristics identified, go to Table 7.9. A curve radius of 1500 feet and obstruction offset of 50 feet does not require a reduction in Base Maximum Message Length for either the backlight overhead or nighttime viewing conditions. However, it does require a 1 unit reduction for mid-day and washout.

**Example 2**

***Question***

A portable DMS is to be used to assist in providing trailblazer information along a detour route for a section of freeway. The sign will be placed 10 feet from the travel lanes. The diversion route is an urban arterial with vehicle operating speeds about 40 mph. The operating agency is contemplating the location of the sign towards the end of the 750-foot horizontal curve with curve radius of 500 feet. A brick wall located 20 feet from the roadway is used to separate the roadway from the adjacent neighborhood. Does the curve constrain the amount of information that can be presented on the DMS?

***Answer***

For the characteristics identified, go to Table 7.11. A curve radius of 500 feet and obstruction offset of 20 feet does require the Base Maximum Message Length to be reduced by 4 units in the mid-day and washout viewing conditions, and reduced by 3 units under backlight and nighttime viewing conditions. In effect, not enough sight distance is available at this location to provide any information on a portable DMS. An alternative location for the DMS should be found.

**Table 7.7 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Horizontal Curve**
**PORTABLE LED DMS[A]**
**Offset: 2 feet**

**Traffic Operating Speeds: 0-35 mph**

| Curve Radii (ft) | Mid-Day and Washout: Offset of Sight Obstruction from Edge of Travel Lanes (feet) | | | | | | | Backlight and Nighttime: Offset of Sight Obstruction from Edge of Travel Lanes (feet) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 20 | 50 | 100 | 150 | 200 | 250 | 10 | 20 | 50 | 100 | 150 | 200 | 250 |
| 250 | 4 units | 4 units | 2 units | 1 unit | 1 unit | 1 unit | | 3 units | 3 units | 1 unit | | | | |
| 500 | 4 units | 3 units | 1 unit | 1 unit | | | | 3 units | 2 units | | | | | |
| 750 | 4 units | 2 units | 1 unit | 1 unit | | | | 3 units | 2 units | | | | | |
| 1000 | 3 units | 2 units | 1 unit | | | | | 2 units | 1 unit | | | | | |
| 1250 | 3 units | 2 units | 1 unit | | | | | 2 units | 1 unit | | | | | |
| 1500 | 3 units | 1 unit | 1 unit | | | | | 2 units | 1 unit | | | | | |
| 1750 | 3 units | 1 unit | | | | | | 2 units | 1 unit | | | | | |
| 2000 | 3 units | 1 unit | | | | | | 2 units | 1 unit | | | | | |
| 2250 | 2 units | 1 unit | | | | | | 1 unit | | | | | | |
| 2500 | 2 units | 1 unit | | | | | | 1 unit | | | | | | |
| 2750 | 2 units | 1 unit | | | | | | 1 unit | | | | | | |
| 3000 | 2 units | 1 unit | | | | | | 1unit | | | | | | |
| 4000 | 1 unit | 1 unit | | | | | | | | | | | | |
| 5000 | 1 unit | | | | | | | | | | | | | |
| 7500 | 1 unit | | | | | | | | | | | | | |
| 10000 | 1 unit | | | | | | | | | | | | | |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.

**Table 7.8 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Horizontal Curve**
**PORTABLE LED DMS[A]**
**Offset: 2 feet**

**Traffic Operating Speeds: 36-55 mph**

| Curve Radii (ft) | Mid-Day and Washout: Offset of Sight Obstruction from Edge of Travel Lanes (feet) | | | | | | | Backlight and Nighttime: Offset of Sight Obstruction from Edge of Travel Lanes (feet) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 20 | 50 | 100 | 150 | 200 | 250 | 10 | 20 | 50 | 100 | 150 | 200 | 250 |
| 250 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 500 | 3 units | 3 units | 2 units | 1 unit | | | | 3 units | 3 units | 2 units | 1 unit | | | |
| 750 | 3 units | 3 units | 1 unit | | | | | 3 units | 3 units | 1 unit | | | | |
| 1000 | 3 units | 2 units | 1 unit | | | | | 3 units | 2 units | 1 unit | | | | |
| 1250 | 3 units | 2 units | | | | | | 3 units | 2 units | | | | | |
| 1500 | 3 units | 2 units | | | | | | 3 units | 2 units | | | | | |
| 1750 | 3 units | 2 units | | | | | | 3 units | 2 units | | | | | |
| 2000 | 3 units | 1 unit | | | | | | 3 units | 1 unit | | | | | |
| 2250 | 3 units | 1 unit | | | | | | 3 units | 1 unit | | | | | |
| 2500 | 2 units | 1 unit | | | | | | 2 units | 1 unit | | | | | |
| 2750 | 2 units | 1 unit | | | | | | 2 units | 1 unit | | | | | |
| 3000 | 2 units | 1 unit | | | | | | 2units | 1 unit | | | | | |
| 4000 | 2 units | | | | | | | 2 units | | | | | | |
| 5000 | 2 units | | | | | | | 2 units | | | | | | |
| 7500 | 1 unit | | | | | | | 1 unit | | | | | | |
| 10000 | 1 unit | | | | | | | | | | | | | |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.
N/A Adequate sight distance not available for any message.

**Table 7.9 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Horizontal Curve**
**PORTABLE LED DMS[A]**
**Offset: 2 feet**

**Traffic Operating Speeds: 56-70 mph**

| Curve Radii (ft) | Mid-Day and Washout: Offset of Sight Obstruction from Edge of Travel Lanes (feet) | | | | | | | Backlight and Nighttime: Offset of Sight Obstruction from Edge of Travel Lanes (feet) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 20 | 50 | 100 | 150 | 200 | 250 | 10 | 20 | 50 | 100 | 150 | 200 | 250 |
| 250 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 500 | N/A | N/A | N/A | N/A | N/A | | | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 750 | 3 units | 3 units | 2 units | 1 unit | | | | 2 units | 1 unit | | | | | |
| 1000 | 3 units | 3 units | 2 units | | | | | 1 unit | 1 unit | | | | | |
| 1250 | 3 units | 3 units | 1 unit | | | | | 1 unit | 1 unit | | | | | |
| 1500 | 3 units | 2 units | 1 unit | | | | | 1 unit | | | | | | |
| 1750 | 3 units | 2 units | 1 unit | | | | | 1 unit | | | | | | |
| 2000 | 3 units | 2 units | | | | | | 1 unit | | | | | | |
| 2250 | 3 units | 2 units | | | | | | 1 unit | | | | | | |
| 2500 | 3 units | 2 units | | | | | | 1 unit | | | | | | |
| 2750 | 3 units | 2 units | | | | | | 1 unit | | | | | | |
| 3000 | 3 units | 2 units | | | | | | 1 unit | | | | | | |
| 4000 | 2 units | 1 unit | | | | | | | | | | | | |
| 5000 | 2 units | | | | | | | | | | | | | |
| 7500 | 2 units | | | | | | | | | | | | | |
| 10000 | 2 units | | | | | | | | | | | | | |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.
N/A Adequate sight distance not available for any message.

**Table 7.10 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Horizontal Curve**
**PORTABLE LED DMS[A]**
**Offset: 10 feet**

**Traffic Operating Speeds: 0-35 mph**

| Curve Radii (ft) | Mid-Day and Washout: Offset of Sight Obstruction from Edge of Travel Lanes (feet) | | | | | | | Backlight and Nighttime: Offset of Sight Obstruction from Edge of Travel Lanes (feet) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 20 | 50 | 100 | 150 | 200 | 250 | 10 | 20 | 50 | 100 | 150 | 200 | 250 |
| 250 | 5 units | 4 units | 2 units | 1 unit | 1 unit | | | 4 units | 3 units | 1 unit | | | | |
| 500 | 5 units | 3 units | 1 unit | | | | | 4 units | 2 units | | | | | |
| 750 | 5 units | 3 units | 1 unit | | | | | 4 units | 2 units | | | | | |
| 1000 | 5 units | 3 units | 1 unit | | | | | 4 units | 2 units | | | | | |
| 1250 | 5 units | 2 units | | | | | | 4 units | 1 unit | | | | | |
| 1500 | 5 units | 2 units | | | | | | 4 units | 1 unit | | | | | |
| 1750 | 5 units | 2 units | | | | | | 4 units | 1 unit | | | | | |
| 2000 | 5 units | 1 unit | | | | | | 4 units | | | | | | |
| 2250 | 5 units | 1 unit | | | | | | 4 units | | | | | | |
| 2500 | 5 units | 1 unit | | | | | | 4 units | | | | | | |
| 2750 | 5 units | 1 unit | | | | | | 4 units | | | | | | |
| 3000 | 5 units | 1 unit | | | | | | 4 units | | | | | | |
| 4000 | 5 units | 1 unit | | | | | | 4 units | | | | | | |
| 5000 | 5 units | | | | | | | 4 units | | | | | | |
| 7500 | 5 units | | | | | | | 4 units | | | | | | |
| 10000 | 5 units | | | | | | | 4 units | | | | | | |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.

**Table 7.11 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Horizontal Curve**
**PORTABLE LED DMS[A]**
**Offset: 10 feet**

**Traffic Operating Speeds: 36-55 mph**

| **Curve Radii (ft)** | **Mid-Day and Washout** | | | | | | | **Backlight and Nighttime** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Offset of Sight Obstruction from Edge of Travel Lanes (feet)** | | | | | | | **Offset of Sight Obstruction from Edge of Travel Lanes (feet)** | | | | | | |
| | 10 | 20 | 50 | 100 | 150 | 200 | 250 | 10 | 20 | 50 | 100 | 150 | 200 | 250 |
| 250 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 500 | 5 units | 4 units | 3 units | 2 units | 1 unit | 1 unit | | 5 units | 3 units | 2 units | 1 unit | | | |
| 750 | 5 units | 4 units | 2 units | 1 unit | 1 unit | | | 5 units | 3 units | | | | | |
| 1000 | 5 units | 4 units | 2 units | 1 unit | | | | 5 units | 3 units | | | | | |
| 1250 | 5 units | 3 units | 1 unit | | | | | 5 units | 2 units | | | | | |
| 1500 | 5 units | 3 units | 1 unit | | | | | 5 units | 2 units | | | | | |
| 1750 | 5 units | 3 units | 1 unit | | | | | 5 units | 2 units | | | | | |
| 2000 | 5 units | 3 units | 1 unit | | | | | 5 units | 2 units | | | | | |
| 2250 | 5 units | 3 units | 1 unit | | | | | 5 units | 2 units | | | | | |
| 2500 | 5 units | 3 units | 1 unit | | | | | 5 units | 2 units | | | | | |
| 2750 | 5 units | 2 units | | | | | | 5 units | 1 unit | | | | | |
| 3000 | 5 units | 2 units | | | | | | 5 units | 1 unit | | | | | |
| 4000 | 5 units | 2 units | | | | | | 5 units | | | | | | |
| 5000 | 5 units | 1 unit | | | | | | 5 units | | | | | | |
| 7500 | 5 units | 1 unit | | | | | | 5 units | | | | | | |
| 10000 | 5 units | 1 unit | | | | | | 5 units | | | | | | |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.
N/A Adequate sight distance not available for any message.

**Table 7.12 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Horizontal Curve**
**PORTABLE LED DMS[A]**
**Offset: 10 feet**

**Traffic Operating Speeds: 56-70 mph**

| **Curve Radii (ft)** | **Mid-Day and Washout** | | | | | | | **Backlight and Nighttime** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Offset of Sight Obstruction from Edge of Travel Lanes (feet)** | | | | | | | **Offset of Sight Obstruction from Edge of Travel Lanes (feet)** | | | | | | |
| | 10 | 20 | 50 | 100 | 150 | 200 | 250 | 10 | 20 | 50 | 100 | 150 | 200 | 250 |
| 250 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 500 | N/A | N/A | N/A | N/A | N/A | 1 unit | | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 750 | 5 units | 4 units | 3 units | 2 units | 1 unit | | | 4 units | 3 units | 2 units | 1 unit | | | |
| 1000 | 5 units | 4 units | 3 units | 1 unit | 1 unit | | | 4 units | 3 units | 2 units | | | | |
| 1250 | 5 units | 4 units | 2 units | 1 unit | 1 unit | | | 4 units | 3 units | 1 unit | | | | |
| 1500 | 5 units | 4 units | 2 units | 1 unit | | | | 4 units | 3 units | 1 unit | | | | |
| 1750 | 5 units | 4 units | 2 units | 1 unit | | | | 4 units | 3 units | 1 unit | | | | |
| 2000 | 5 units | 3 units | 1 unit | 1 unit | | | | 4 units | 2 units | | | | | |
| 2250 | 5 units | 3 units | 1 unit | | | | | 4 units | 2 units | | | | | |
| 2500 | 5 units | 3 units | 1 unit | | | | | 4 units | 2 units | | | | | |
| 2750 | 5 units | 3 units | 1 unit | | | | | 4 units | 2 units | | | | | |
| 3000 | 5 units | 3 units | 1 unit | | | | | 4 units | 2 units | | | | | |
| 4000 | 5 units | 3 units | 1 unit | | | | | 4 units | 2 units | | | | | |
| 5000 | 5 units | 2 units | | | | | | 4 units | 1 unit | | | | | |
| 7500 | 5 units | 2 units | | | | | | 4 units | 1 unit | | | | | |
| 10000 | 5 units | 1 unit | | | | | | 4 units | | | | | | |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.
N/A Adequate sight distance not available for any message.

# 7.5 UNITS OF INFORMATION REDUCTIONS FOR RAIN AND FOG

Rain and fog are additional factors that can influence the amount of information that can be presented on a DMS. Both conditions deteriorate the amount of light that is coming from the DMS (either direct illumination from the light pixels on the DMS or reflected by the DMS from other light sources such as the sun, overhead lighting, or automobile headlights). This reduces the contrast between the sign legend and its background. If the contrast becomes too low, motorists cannot read the DMS message.

For light-emitting DMSs, contrast ratios are at their minimums on bright, sunny days because the sun increases the background luminance of the signs. Under cloudy conditions, the luminance of the legend will be much greater than the background and can create very large contrast ratios. Unfortunately, data on typical DMS background luminance or contrast ratios on cloudy, rainy, or foggy days are not available (in actuality, there may not be a true "typical" cloudy day anyway). Conversely, contrast ratios for light-reflecting DMSs decrease as external lighting levels decrease, becoming zero (or nearly so) as the amount of light falling on the sign reaches zero. A procedure for determining the effects of rain and fog on the number of units of information that can be displayed is given in Appendix C.

Because the majority of DMSs are light-emitting technologies, the following section is provided for those signs. The DMS operator should apply the detailed procedure in Appendix C for consideration of light-reflecting DMS.

**REDUCTIONS FOR RAIN**

The effect of rainfall on desired DMS message lengths is believed to be relatively insignificant under most operating conditions. The exception to this situation is when rainfall intensities exceed 2 inches per hour. Under these conditions, the DMS operator should reduce the units of information on a portable LED DMS by one if the operating speed on the roadway exceeds 55 mph. Portable LED DMSs generally utilize fewer numbers of LEDs per pixel and so typically generate lower character luminance levels than permanent DMSs. The higher character luminance levels of permanent LED DMSs now in use is believed to provide significant contrast even under heavy rain.

**REDUCTIONS FOR FOG**

The effect of fog is more significant. The reductions in the base number of information units that can be displayed on a portable LED DMS under daytime conditions under various operating speed and DMS offset scenarios are presented in Table 7.13. As noted previously, reductions for permanent LED DMSs are not suggested due to their much higher character luminance values (and thus much higher contrast ratios).

**EXAMPLE**

***Question***

A portable LED DMS is being used in the median of a divided rural highway (offset between DMS and right lane motorist is 60 feet). A heavy fog is present that limits visibility to approximately 0.5 mile. Does this condition require a reduction in the Base Maximum Message Length?

***Answer***

Using Table 7.13 for a 60-foot offset and an assumed traffic speed of greater than 56 mph (since it is a rural highway) and a 0.5-mi visibility, no reduction is necessary. If the fog had been thicker and reduced visibility to 0.25 mile, then the Base Maximum Message Length would have to be reduced by 2 units.

**Table 7.13 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Effects of Fog in Daytime Conditions PORTABLE LED[A] DMS**

| Visibility Range in Fog | No Offset | | | 20-ft Offset | | | 60-ft Offset | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0-35 mph | 36-55 mph | 56-70 mph | 0-35 mph | 36-55 mph | 56-70 mph | 0-35 mph | 36-55 mph | 56-70 mph |
| 0.5 mi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.25 mi | 0 | 0 | 1 unit | 0 | 1 unit | 1 unit | 2 units | 2 units | 2 units |
| 0.1 mi | 2 units | 2 units | 2 units | 3 units | 3 units | 3 units | 5 units[B] | 4 units[B] | 4 units[B] |

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.
[B] Adequate sight distance not available for any message under this viewing condition.

# 7.6 UNITS OF INFORMATION REDUCTIONS WHEN LARGE TRUCKS ARE PRESENT

## INTRODUCTION

Large trucks can be a major cause of sight obstructions to DMSs. Motorists in vehicles travelling closely behind or adjacent to a truck may be limited in the amount of time they have to read a DMS. If they follow too closely, they may not be able to see the DMS at all. This can occur in some instances for permanent overhead DMSs as well. However, the majority of concerns relating to trucks pertain to portable DMSs located off to the side of the travel lanes.

Evaluating truck obstructions of DMSs requires a slightly different analysis approach than that used for horizontal and vertical curvature. This is because a motorist has the ability to adjust his or her speed slightly relative to that of a truck and find a travel position that allows for adequate viewing. However, as the number of trucks on the roadway increases, the amount of roadway space that a motorist can travel in with an unobstructed view decreases. If the number of vehicles traveling on the facility approaches or exceeds the number that can "fit" into the unobstructed viewing spaces, then some motorists will not be able to read all of a DMS message. Depending on the specific message being presented, this can begin to create operational problems on the facility.

## EFFECT OF LARGE TRUCKS ON DMS VIEWING

A detailed procedure to assess the impact of large trucks on DMS viewing time is given in Appendix D. This procedure computes the amount of roadway space available for adequate DMS viewing and compares it to the amount of traffic on the roadway that needs to use that space. In this section, this analysis is simplified to a series of tables designed to assist the operator in determining the influence of large trucks on the ability of motorists in the overall traffic stream to adequately read a DMS message containing the maximum base number of information units.

Tables 7.14 through 7.17 present the estimated percentage of motorists on the roadway who would likely be able to read an entire DMS message that consists of the maximum base number of units of information. Separate tables are provided for four major roadway cross-sections (two-lane, two-way highway; four-lane roadway; six-lane roadway; and eight-lane roadway). The numbers represent average conditions for messages on high-quality LED DMSs. Assumptions have been made regarding the distribution of large trucks across the various travel lanes in a given direction. These assumptions are noted at the bottom of the tables. The percentages also assume that all truck drivers will be able to adequately see the DMS (since they sit higher than a typical automobile).

The tables illustrate how quickly viewing conditions can degrade as truck volumes increase. The point of the tables is not to define a specific threshold between acceptable and unacceptable viewing conditions for DMSs. Rather, the information contained in the tables should be used in deciding when less information should be presented on a DMS, or where a redundant DMS may be needed. If redundant DMS are used, consideration should also be given to placing them on the left side of the roadway (the percentages in the tables assume the DMS is placed on the right side of the roadway 10 feet from the travel lanes).

**Table 7.14 Percent of Motorists Able to Fully Read a DMS Message with Maximum Base Number of Units (Two-Lane, Two-Way Highway)**

| Percent Trucks | Operating Speed Range | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0-35 mph | | | 36-55 mph | | | 56-70 mph | | |
| | 500 vph | 1000 vph | 1500 vph | 500 vph | 1000 vph | 1500 vph | 500 vph | 1000 vph | 1500 vph |
| 5 | 95 | 95 | 90 | 100 | 95 | 95 | 100 | 95 | 90 |
| 10 | 95 | 90 | 85 | 95 | 90 | 85 | 95 | 90 | 80 |
| 20 | 90 | 80 | 70 | 90 | 85 | 75 | 90 | 85 | 70 |
| 30 | 90 | 75 | 65 | 90 | 80 | 65 | 90 | 80 | 60 |
| 50 | 85 | 70 | 55 | 85 | 75 | 60 | 90 | 75 | 50* |

* Under these conditions, only truck drivers are assumed to be able to see the DMS.
vph = vehicles per hour.

**Table 7.15 Percent of Motorists Able to Fully Read a DMS Message with Maximum Base Number of Units (Four-Lane Roadway: Two Lanes in Each Direction)**

| Percent Trucks | Operating Speed Range | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0-35 mph | | | 36-55 mph | | | 56-70 mph | | |
| | 1000 vph | 2000 vph | 3000 vph | 1000 vph | 2000 vph | 3000 vph | 1000 vph | 2000 vph | 3000 vph |
| 5 | 95 | 90 | 85 | 95 | 90 | 85 | 95 | 90 | 80 |
| 10 | 90 | 80 | 70 | 90 | 80 | 70 | 90 | 80 | 65 |
| 20 | 80 | 65 | 45 | 80 | 65 | 45 | 85 | 65 | 40 |
| 30 | 75 | 50 | 30* | 75 | 55 | 30 | 75 | 55 | 30* |
| 50 | 70 | 50* | 50* | 70 | 50* | 50* | 75 | 50* | 50* |

Note: Assumes an 85%/15% split of truck traffic in shoulder and median travel lanes.
* Under these conditions, only truck drivers are assumed to be able to see the DMS.
vph = vehicles per hour

**Table 7.16 Percent of Motorists Able to Fully Read a DMS Message with Maximum Base Number of Units (Six-Lane Roadway: Three Lanes in Each Direction)**

| Percent Trucks | Operating Speed Range | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0-35 mph | | | 36-55 mph | | | 56-70 mph | | |
| | 2000 vph | 4000 vph | 6000 vph | 2000 vph | 4000 vph | 6000 vph | 2000 vph | 4000 vph | 6000 vph |
| 5 | 90 | 75 | 65 | 90 | 80 | 65 | 90 | 80 | 65 |
| 10 | 80 | 55 | 35 | 80 | 60 | 35 | 80 | 60 | 40 |
| 20 | 60 | 25 | 20* | 65 | 25 | 20* | 65 | 25 | 20* |
| 30 | 50 | 30* | 30* | 50 | 30* | 30* | 50 | 30* | 30* |
| 50 | 50* | 50* | 50* | 50* | 50* | 50* | 50* | 50* | 50* |

Note: Assumes an 85%/15%/0% split of truck traffic in shoulder, center, and median travel lanes, respectively.
* Under these conditions, only truck drivers are assumed to be able to see the DMS.
vph = vehicles per hour.

**Table 7.17 Percent of Motorists Able to Fully Read a DMS Message with Maximum Base Number of Units (Eight-Lane Roadway: Four Lanes in Each Direction)**

| Percent Trucks | Operating Speed Range | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0-35 mph | | | 36-55 mph | | | 56-70 mph | | |
| | 2000 vph | 4000 vph | 6000 vph | 2000 vph | 4000 vph | 6000 vph | 2000 vph | 4000 vph | 6000 vph |
| 5 | 90 | 80 | 70 | 90 | 80 | 70 | 90 | 80 | 70 |
| 10 | 80 | 60 | 45 | 80 | 65 | 45 | 80 | 65 | 45 |
| 20 | 65 | 35 | 20* | 70 | 35 | 20* | 65 | 35 | 20* |
| 30 | 60 | 30* | 30* | 60 | 30* | 30* | 55 | 30* | 30* |
| 50 | 50* | 50* | 50* | 50* | 50* | 50* | 50* | 50* | 50* |

Note: Assumes a 70%/20%/10%/0% split of truck traffic in shoulder, right center, left center, and median travel lanes, respectively.
* Under these conditions, only truck drivers are assumed to be able to see the DMS.
vph = vehicles per hour.

# MODULE 8. DEALING WITH LONG MESSAGES

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# MODULE 8.  DEALING WITH LONG MESSAGES

After the DMS message designer selects the necessary elements of the Base DMS Message, in many cases the message will be too long.  That is, it may exceed the number of message units that motorists can read and understand while traveling at the prevailing freeway speeds, or it may exceed the physical limitations of the DMS itself.  Guidelines and helpful hints for reducing the length of messages are presented in this section of the Manual.

## 8.1  SPLITTING MESSAGES

When a DMS message is too long to fit on one phase, it can be split and displayed on multiple phases that are shown sequentially.  The DMS is best formatted into a horizontal rectangular space consisting of two lines on one message phase and two lines on the second phase.  On large overhead signs, each line typically has two words (or three if within line capacity).  On portable DMSs, each line typically has one word when abbreviations are not used.

When it is necessary to divide a message and display it on multiple phases, the five principles below must be used.

**MESSAGE SPLITTING PRINCIPLES:**

- **No more than two phases should be used;**
- **Each phase must be understood by itself;**
- **Compatible units of information should be displayed on the same phase;**
- **A message line should not contain portions of two different units of information; and**
- **No more than three units of information should be displayed on a single phase at high freeway speeds.**

### 1.  NO MORE THAN TWO PHASES SHOULD BE USED

Research has shown that for the typical three- or four-line DMSs, motorists have difficulty in reading messages displayed on more than two phases.

### 2.  EACH PHASE MUST BE UNDERSTOOD BY ITSELF

Each message phase must be understood by itself because either phase may be read first by the passing motorist. Typically, the problem and location appear on the first phase and the advisory and attention statement (if needed) on the second phase.  The following two examples help illustrate Principle 2.

**Example of an UNACCEPTABLE MESSAGE SPLIT with a phase that is not understood by itself**

| Phase 1 | Phase 2 |
|---|---|
| ~~MAJOR ACCIDENT~~<br>~~AT I-10~~<br>~~GALVESTON TRAFFIC~~ | ~~USE~~<br>~~I-610 EAST~~ |

In Phase 1, the message *MAJOR ACCIDENT/ AT I-10/ GALVESTON TRAFFIC* is not understood by itself. This is because the *Audience* (*GALVESTON TRAFFIC*) is not compatible with the *Incident Descriptor* and *Incident Location* message elements. The *Audience* message element should be combined with the *Action* (*USE I-610 EAST*) so that the two terms *GALVESTON* and *USE I-610 EAST* are on the same message phase as shown below.

**Example of an ACCEPTABLE MESSAGE SPLIT with each phase understood by itself**

| | |
|---|---|
| **MAJOR ACCIDENT**<br>**AT I-10** | **GALVESTON**<br>**USE I-610 EAST** |
| *Phase 1* | *Phase 2* |

## 3. COMPATIBLE UNITS OF INFORMATION SHOULD BE DISPLAYED ON THE SAME PHASE

Compatible units of information should be displayed on the same phase. The previous examples shown for Principle 2 also help to illustrate Principle 3. The *Incident Descriptor (MAJOR ACCIDENT)* and the *Incident Location (AT I-10)* message elements are compatible and can be displayed on the same phase. Also, the *Audience* (*GALVESTON)* and *Action* (*USE I-610 EAST)* message elements are compatible and can be displayed on the same phase. In contrast, the *Audience* (*GALVESTON)* message element is not compatible with the *Incident Descriptor (MAJOR ACCIDENT)* and the *Incident Location (USE I-610 EAST)*.

Additional illustrations of the violation of Principle 3 and the corrected message are shown in the examples below. The first example (UNACCEPTABLE MESSAGE SPLIT) shows two *Action* message elements that are split. One action is on the first phase and the second action on the second phase. The two *Action* message elements should be displayed on the same message phase as shown in the second example (ACCEPTABLE MESSAGE SPLIT).

**Example of an UNACCEPTABLE MESSAGE SPLIT with phase that is not compatible**

| | |
|---|---|
| **~~MAJOR ACCIDENT~~**<br>**~~AT RIVER DR~~**<br>**~~EXIT AT RT 20~~** | **~~USE~~**<br>**~~OTHER ROUTES~~** |
| *Phase 1* | *Phase 2* |

**Example of an ACCEPTABLE MESSAGE SPLIT with each phase compatible**

| | |
|---|---|
| **MAJOR ACCIDENT**<br>**AT RIVER DR** | **EXIT AT RT-20**<br>**USE**<br>**OTHER ROUTES** |
| *Phase 1* | *Phase 2* |

*(Note: The above message is used for illustrative purposes. It is common practice in TxDOT Districts not to suggest specific ramps, highways, or streets to motorists other than freeways.)*

## 4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION

Sometimes, two interrelated units of information are too long for each to fit on one line when it is desirable to display both in the same message phase. The temptation, at times, is to "squeeze" both units of information on the same phase by splitting each unit and displaying portions of each unit on the same line. This should be avoided because it confuses motorists and increases reading time. An example of an unacceptable message split is shown below. Note the unacceptable splitting and combining of portions of the two message units of information in Phase 2 (i.e., combining DRIVE and *USE* on the second line of Phase 2 from the two units of information *EXIT AT RIVER DRIVE* and *USE OTHER ROUTES*).

**Example of an UNACCEPTABLE SPLITTING AND COMBINING PORTIONS OF TWO MESSAGE UNITS**

| **MAJOR ACCIDENT<br>AT RT-20** | ~~**EXIT AT RIVER<br>DRIVE USE<br>OTHER ROUTES**~~ |
|---|---|
| *Phase 1* | *Phase 2* |

*(Note: The above message is used for illustrative purposes. It is common practice in TxDOT Districts not to suggest specific ramps, highways, or streets to motorists other than freeways.)*

In most cases, the unacceptable message can be corrected by using better terms in the message phase or by using abbreviations. In the example above, the unacceptable message can be corrected by using abbreviations as shown in the acceptable message below.

**Example of an ACCEPTABLE MESSAGE SPLIT**

| **MAJOR ACCIDENT<br>AT RT-20** | **EXIT AT RIVER DR<br>USE<br>OTHER ROUTES** |
|---|---|
| *Phase 1* | *Phase 2* |

## 5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS

Research has shown that, at typical freeway speeds, no more than three units of information should be displayed on a single message phase. Phase 2 in the example below has the following four units of information that motorists destined to Dallas and to I-35 East (two *Audiences*) must read in order to make a diversion decision:

- Unit 1 – *BEST ROUTE TO;*
- Unit 2 – *DALLAS;*
- Unit 3 – *I-35 E*; and
- Unit 4 – *USE I-30*.

The four-unit message phase is too complex for motorists to read and understand while traveling at high freeway speeds.

**Example of an UNACCEPTABLE MESSAGE PHASE with four units of information (Phase 2)**

| | |
|---|---|
| **3 LANES CLOSED<br>AT US-377** | **~~BEST ROUTE TO~~<br>~~DALLAS/ I-35 E~~<br>~~USE I-30~~** |
| *Phase 1* | *Phase 2* |

One alternative solution is to direct the *Action* message element to only one of the two *Audiences*. The decision would need to be made whether it is best to advise motorists destined to Dallas or destined to I-35 East. In the acceptable message below, the *Action* is directed to the Dallas-bound motorists.

**Example of an ACCEPTABLE MESSAGE PHASE with three units of information (Phase 2)**

| | |
|---|---|
| **3 LANES CLOSED<br>AT US-377** | **BEST ROUTE TO<br>DALLAS<br>USE I-30** |
| *Phase 1* | *Phase 2* |

# 8.2 APPROACHES TO REDUCING MESSAGE LENGTH

Always look for ways to reduce the message length without losing the intent of the message by:

- Deleting "dead" words, and/or
- Reformatting the message.

**MESSAGE LENGTH CAN BE REDUCED BY:**
- **Omitting "dead" words; and/or**
- **Reformatting the message.**

**MESSAGE LENGTH CAN ALSO BE REDUCED BY**
- **Using abbreviations.**

## DELETING "DEAD" WORDS

"Dead" words should be deleted whenever possible. "Dead" words are ones that 99 percent of local motorists would assume without being told.

### Street, Avenue or Boulevard

One example of a "dead" word is the use of "street," "avenue," or "boulevard" following a familiar arterial name. These words are not required and could be omitted. There are exceptions to this principle that are discussed on page 4-9.

### Ahead

Another "dead" word is "ahead." It is not necessary to tell motorists that an incident or roadwork is "ahead" when the DMS is on the same freeway as the event because it will be understood by motorists that the event is ahead.

## FORMATTING MESSAGES

The order of information is dependent upon whether:

- An *Incident Descriptor* or *Roadwork Descriptor* message element is part of the message; or
- The *Incident Descriptor* or *Roadwork Descriptor* message element is replaced by or combined with a *Lanes Closed* message element.

(See *Module 12 Modifying Messages to Improve Effectiveness* for reformatting examples.)

### Messages WITH Incident Descriptor Message Element

The format order for messages that contain an *Incident Descriptor* message element (e.g., *ACCIDENT)* is summarized in Table 8.1 for the cases when lane-closure (blockage) incidents occur or when incidents occur that require closing the freeway.

**Table 8.1 Format Order When *Incident Descriptor* Message Element is Used for Incidents**

| Message Elements for Lane Closure Incidents | Message Elements for Freeway Closure Incidents |
|---|---|
| 1. Incident Descriptor<br>2. Incident Location<br>3. Lanes Closed (Blocked)<br>4. Audience for Action (if needed)<br>5. Action<br>6. Good Reason for Following Action[A] | 1. Incident Descriptor<br>2. Incident Location<br>3. Lanes Closed (Blocked)<br>4. Audience for Action (if needed)<br>5. Action |

[A] When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

When the message is split into two phases, then the combinations of formatting shown in Table 8.2 should be used:

**Table 8.2 Format Order for Two-Phase Messages When *Incident Descriptor* Message Element is Used for Incidents**

| Message Phase 1 | Message Phase 2 |
|---|---|
| 1. Incident Descriptor<br>2. Incident Location | 3. Lanes Closed (Blocked)<br>4. Action |
| 1. Incident Descriptor<br>2. Incident Location | 3. Audience for Action<br>4. Action |
| 1. Incident Descriptor<br>2. Incident Location<br>3. Lanes Closed (Blocked) | 4. Audience for Action<br>5. Action |
| 1. Incident Descriptor<br>2. Incident Location | 3. Audience for Action<br>4. Action<br>5. Good Reason for Following Action[A] |

[A] When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

## Messages WITH Roadwork Descriptor Message Element

The format order for messages that contain a *Roadwork Descriptor* message element (e.g., *ROADWORK)* is summarized in Table 8.3 for the cases when lane closures occur due to roadwork and when the roadwork requires closing the freeway.

**Table 8.3 Format Order When *Roadwork Descriptor* Message Element is Used for Roadwork**

| Message Elements for Lane Closures | Message Elements for Freeway Closures |
|---|---|
| 1. Roadwork Descriptor<br>2. Lane Closure Location<br>3. Lanes Closed<br>4. Audience for Action (if needed)<br>5. Action<br>6. Good Reason for Following Action[A] | 1. Roadwork Descriptor<br>2. Closure Location<br>3. Lanes Closed<br>4. Audience for Action (if needed)<br>5. Action |

[A] When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

When the message is split into two phases, then the combinations of formatting shown in Table 8.4 should be used.

**Table 8.4 Format Order for Two-Phase Messages When *Roadwork Descriptor* Message Element is Used for Roadwork**

| Message Phase 1 | Message Phase 2 |
|---|---|
| 1. Roadwork Descriptor<br>2. Lane Closure Location | 3. Lanes Closed<br>4. Action |
| 1. Roadwork Descriptor<br>2. Lane Closure Location | 3. Audience for Action<br>4. Action |
| 1. Roadwork Descriptor<br>2. Lane Closure Location<br>3. Lanes Closed | 4. Audience for Action<br>5. Action |
| 1. Roadwork Descriptor<br>2. Lane Closure Location | 3. Audience for Action<br>4. Action<br>5. Good Reason for Following Action[A] |

[A] When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

## Messages WITHOUT Incident Descriptor Message Element

The format order for messages in which the *Incident Descriptor* message element is replaced by or combined with a *Lanes Closed* message element is shown in Table 8.5.

**Table 8.5 Format Order When *Incident Descriptor* Message Element is Replaced By or Combined With the *Lanes Closed* Message Element for Incidents**

| Message Elements for Lane Closure Incidents | Message Elements for Freeway Closure Incidents |
|---|---|
| 1. Lanes Closed (Blocked)<br>2. Lane Closure (Blockage) Location<br>3. Audience for Action (if needed)<br>4. Action<br>5. Good Reason for Following Action[A] | 1. Freeway Closure (Blocked)<br>2. Location of Closure<br>3. Audience for Action (if needed)<br>4. Action<br>5. Good Reason for Following Action[A] |

[A] When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

When the message is split into two phases, then the combinations of formatting shown in Table 8.6 should be used.

**Table 8.6 Format Order for Two-Phase Messages When *Incident Descriptor* Message Element is Replaced By or Combined With the *Lanes Closed* Message Element for Incidents**

| Message Phase 1 | Message Phase 2 |
|---|---|
| 1. Lanes Closed (Blocked)<br>2. Lane Closure (Blockage) Location | 3. Audience for Action<br>4. Action |
| 1. Lanes Closed (Blocked)<br>2. Lane Closure (Blockage) Location | 3. Audience for Action<br>4. Action<br>5. Good Reason for Following Action[A] |
| 1. Freeway Closed (Blocked)<br>2. Location of Closure | 3. Audience for Action<br>4. Action |

[A] When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

## Messages WITHOUT Roadwork Descriptor Message Element

The format order for messages in which the *Roadwork Descriptor* message element is replaced by or combined with a *Lanes Closed* message element is shown in Table 8.7.

**Table 8.7 Format Order When *Incident Descriptor* Message Element is Replaced By or Combined With the *Lanes Closed* Message Element for Roadwork**

| Message Elements for Lane Closures | Message Elements for Freeway Closures |
|---|---|
| 1. Lanes Closed<br>2. Lane Closure Location<br>3. Audience for Action (if needed)<br>4. Action<br>5. Good Reason for Following Action[A] | 1. Freeway Closed<br>2. Closure Location<br>3. Audience for Action (if needed)<br>4. Action |

[A] When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

When the message is split into two phases, then the combinations of formatting shown in Table 8.8 should be used.

**Table 8.8 Format Order for Two-Phase Messages When *Roadwork Descriptor* Message Element is Replaced By or Combined With the *Lanes Closed* Message Element for Roadwork**

| Message Phase 1 | Message Phase 2 |
|---|---|
| 1. Lanes Closed<br>2. Lane Closure Location | 3. Audience for Action<br>4. Action |
| 1. Lanes Closed<br>2. Lane Closure Location | 3. Audience for Action<br>4. Action<br>5. Good Reason for Following Action[A] |
| 1. Freeway Closed<br>2. Closure Location | 3. Audience for Action<br>4. Action |

[A] When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

## USING ABBREVIATIONS

### Acceptable Abbreviations

Table 8.9 shows the message words and terms with abbreviations that were understood by 85 percent or more of either Texas drivers tested in 1997 and 2000, or drivers in a study conducted in 1983 by Dudek and his colleagues. These abbreviations are acceptable for use on DMSs for Texas drivers.

### Unacceptable Abbreviations

Results of human factors studies revealed a group of abbreviations that were not understood by 85 percent or more of the drivers tested in Texas, and are therefore unacceptable for use on DMSs in Texas. A list of these abbreviations is shown in Table 8.10.

**Table 8.9 ACCEPTABLE Abbreviation Terms For Texas Drivers**

| Word or Phrase | ACCEPTABLE Abbreviation Term | Word or Phrase | ACCEPTABLE Abbreviation Term |
|---|---|---|---|
| Access | NO ACCS | Lower Level | LOWR LVL MAINT |
| Access Road | ACCES RD | Maintenance | MAINT WORK |
| Accident At | ACCDT AT | Major | MAJ ACCIDENT |
| Ahead | [*incident, distance ,etc.]* AHD | Major Accident | MAJ ACCDT |
| Aquarium | [*name*] AQRM | Mile(s) | [*number*] MI |
| Avenue | AVE | Minor | MNR ACCIDENT |
| Blocked | LANE BLKD | Minor Accident | MNR ACCDT |
| | FREEWAY BLKD | Minute(s) | [*number*] MIN |
| Boulevard | [*name*] BLVD | Monday | MON |
| Bridge | [*name*] BRDG | National Park | [*name*] NATL PRK |
| Center | CNTR | North | N |
| | CNTR LANE | | |
| | ARTS CNTR | Oversized | OVRSZ LOAD |
| | ARTS CTR | Parking | PKING |
| Center Lane | CNTR LN | Parking Lot | PRK LOT |
| Chemical Spill | CHEM SPILL | | PKING LOT |
| Closed | EXPRESSWAY CLSD | Prepare | PREP TO STOP |
| | FREEWAY CLSD | Pavement | WET PVMT |
| | LANE CLSD | Quality | AIR QLTY |
| | LN CLSD | Right | RGT |
| Construction | CONST | | KEEP RGT |
| Downtown | TO DWNTN | | MERGE RGT |
| East | E | | RGT LANE |
| Emergency | EMER | Right Lane | RGT LN |
| Emergency Vehicle | EMER VEHICLE | Road | [*name*] RD |
| | EMER VEH | Route | BEST RTE |
| Exit | NEXT EXT | | TO RT [*number*] |
| Express Lanes | EXP LANES | Saturday | SAT |
| | EXP LNS | Service Road | SERV ROAD |
| Expressway | [*name*] EXPWY | | SERV RD |
| Freeway | [*name*] FWY | Shoulder | ON SHLDR |
| | [*name*] FRWY | | SOFT SHLDR |
| Freeway Blocked | FWY BLKD | Slippery | SLIP |
| Freeway Closed | FWY CLSD | South | S |
| Friday | FRI | Speed | SPD LIMIT |
| Hazardous | HAZ DRIVING | Street | ST |
| | | Sunday | SUN |
| Highway | HWY | Thursday | THURS |
| | HWY [*number*] | Traffic | TRAF |
| | [*name*] HWY | Traffic Clear | TRAF CLR |
| Information | INFO | Travelers | TRVLRS |
| Interstate | I-[*number*] | Truck Stop | TRK STOP |
| | IH-[*number*] | Tuesday | TUES |
| Lane | CENTER LN | Turnpike | TO TRNPK |
| | LEFT LN | | [*name*] TRNPK |
| | RIGHT LN | Vehicle | STALLED VEH |
| Left | LFT | Upper | UPR LEVEL |
| | KEEP LFT | Upper Level | UPR LVL |
| | LFT LANE | Warning | WARN |
| | MERGE LFT | Wednesday | WED |
| Left Lane | LFT LN | Weight | WT LIMIT |
| Level | LOWER LVL | West | W |
| | UPPER LVL | | |

| Table 8.10 UNACCEPTABLE Abbreviation Terms | | |
|---|---|---|
| **Word/Phrase** | **Abbreviation Tested** | **Recommended Alternatives** |
| Alternate Route | ALT RT | OTHER RTE |
| Detour Route | DETOUR RT | DETOUR RTE |
| Feeder Road | FEED RD | FEEDER RD |
| Frontage Road | FRNTG RD | FRONTAGE RD |
| High Occupancy Vehicle Lane | HOV LANE | Investigate other terms |
| Interchange 14 | INTCH 14 | Use full word: INTERCHANGE 14 |
| Incident at | INCDT AT | ACCDT AT |
| | INCID AT | ACCDT AT |
| Major Congestion | MAJ CONG | MAJ CONGESTION |
| Road Work | RD WK | ROADWORK |
| Vicinity of | VIC OF | BEFORE, PAST, AT |
| Eastbound Traffic | EB TRAFFIC | *[route]* E |
| Northbound Traffic | NB TRAFFIC | *[route]* N |
| Southbound Traffic | SB TRAFFIC | *[route]* S |
| Westbound Traffic | WB TRAFFIC | *[route]* W |
| *[route]* Eastbound | *[route]* SB | *[route]* E |
| *[route]* Northbound | *[route]* EB | *[route]* N |
| *[route]* Southbound | *[route]* NB | *[route]* S |
| *[route]*Westbound | *[route]* WB | *[route]* W |

# 8.3 REDUCING MESSAGE UNITS OF INFORMATION

**UNITS OF INFORMATION CAN BE REDUCED BY:**
- **Omitting unimportant information;**
- **Omitting redundant information; and/or**
- **Combining Base DMS Message elements.**

DMS messages should be as short as possible. Therefore, the message designer should look for ways to reduce long messages or Base DMS Messages that exceed the maximum number of information units that can be displayed for the given situation. Units of information can be reduced without losing information content or the important information required by motorists to make decision by:

- Omitting unimportant information;
- Omitting redundant information; and/or
- Combining Base DMS Message elements.

**REFORMATTING THE MESSAGE**

The message designer can sometimes be reduce units of information in a message by reformatting the message. At times it is possible to use alternative phrases that are understandable by motorists and have the same meaning as the original. The following example illustrates how message length can be reduced by reformatting.

The Original Message:

**ROAD CLOSED AHEAD**
**DUE TO CONSTRUCTION**
**FOLLOW DETOUR ROUTE**

Can Be Shortened To:

**ROAD CLOSED**
**1 MILE**
**FOLLOW DETOUR**

With Better Results.

In the above, the most important message elements are the road is closed and the location of the closure. The reason *DUE TO CONSTRUCTION* is not necessary to display and can be omitted. In addition, the word *AHEAD* can be omitted because it is obvious to motorists by simply stating *ROAD CLOSED.*

# 8.4 REDUCING UNITS OF INFORMATION FROM THE BASE DMS MESSAGE

**THE NUMBER OF UNITS OF INFORMATION CONTAINED IN A BASE DMS MESSAGE CAN BE REDUCED BY:**
- **First applying the Initial Reduction Approaches;**
- **Then applying the Priority Reduction Principles.**

In most cases a Base DMS Message required for the incident or roadwork situation will contain more units of information than is acceptable to display for the prevailing freeway speed. Therefore, the number of units of information must be reduced. The DMS message designer should first use the *Initial Reduction Approaches* that are discussed in the section that follows. After these approaches are applied, then the message designer should follow the principles set discussed in *Priority Reduction Principles* on page 8-20.

## INITIAL REDUCTION APPROACHES

The first step that the message designer should take to reduce the units of information of the Base DMS Message to an acceptable level is to apply the approaches discussed in this section. Approaches to reducing the number of units of information for both incidents and roadwork are presented in the sections that follow.

### Reducing Redundancy in Incident and Roadwork Messages

#### *Omitting Reference to Same Freeway as Incident/Roadwork and DMS*

**INCIDENT AND ROADWORK MESSAGES CAN BE REDUCED BY:**
- **Omitting reference to same freeway as incident/ roadwork and DMS.**

It is not necessary nor is it desirable to make reference to the freeway if the DMS is on the same freeway as the incident/roadwork. For example, if a major accident occurs on northbound I-276 just past I-80 which blocks all the lanes, reference to *ON I-276 NORTH* should be omitted since this information is evident to motorists and increases the units of information and the length of the message.

**Table 8.11 Example of Omitting Reference to Same Freeway as Incident/Roadwork and DMS**

| Message Elements | | Revised Message Elements |
|---|---|---|
| Incident on Same Freeway (US-75 North) as DMS (US-75 North) | | |
| *Incident Descriptor* | **MAJOR ACCIDENT**<br>**ON US-75 NORTH** | **MAJOR ACCIDENT**<br>**PAST I-635** |
| *Location* | **PAST I-635** | |
| *Lanes Closed* | **ALL LANES CLOSED** | **ALL LANES CLOSED** |

## Combining Message Elements for Incident Messages

### *Combining Incident Descriptor, Location and Lanes Closed Message Elements*

**INCIDENT MESSAGES CAN BE REDUCED BY:**
- **Combining *Incident Descriptor*, *Incident Location*, and *Lanes Closed* message elements.**

In an effort to reduce the length of DMS messages, it is sometimes necessary and, in most cases, useful to combine the *Incident Descriptor*, *Incident Location*, and *Lanes Closed* message elements. For example, when a major accident occurs that blocks all of the lanes, the term *FREEWAY BLOCKED* can be used in place of the longer combination of *MAJOR ACCIDENT* and *ALL LANES BLOCKED*. Examples of combining *Incident Descriptor*, *Incident Location* and *Lanes Closed* message elements are shown in Table 8.12.

**Table 8.12 Examples of Combining *Incident Descriptor*, *Incident Location* and *Lanes Closed* Message Elements**

| Message Elements | | Revised Message Elements |
|---|---|---|
| Incident on Same Freeway (US-75 North) as DMS (US-75 North) | | |
| *Incident Descriptor* | **MAJOR ACCIDENT** | **FREEWAY CLOSED** |
| *Location* | **AT ARAPAHO RD** | **AT ARAPAHO RD** |
| *Lanes Closed* | **ALL LANES CLOSED** | |
| Incident on Another Freeway (I-635 West) than DMS (US-75 North) | | |
| *Incident Descriptor* | **MAJOR ACCIDENT** | **I-635 WEST CLOSED** |
| *Location* | **ON I-635 WEST**<br>**AT HILLSIDE RD** | **AT HILLSIDE RD** |
| *Lanes Closed* | **ALL LANES CLOSED** | |
| Closed Roadway Due to Incident on Same Freeway (US-75 North) as DMS (US-75 North) | | |
| *Incident Descriptor* | **TRUCK ACCIDENT** | **FREEWAY CLOSED** |
| *Location* | **PAST ARAPAHO RD** | |
| *Lanes Closed* | **ALL LANES CLOSED** | |
| *Location of Closure* | **AT ARAPAHO RD** | |
| *Audience for Action* | **US-75 NORTH TRAFFIC** | |
| *Action* | **EXIT AT ARAPAHO RD**<br>**FOLLOW DETOUR** | **EXIT AT ARAPAHO**<br>**FOLLOW DETOUR** |
| Closed Exit Ramp at Major Interchange (I-635) on Same Freeway (US-75 North) as DMS (US-75 North) | | |
| *Incident Descriptor* | **MAJOR ACCIDENT** | **RAMP CLOSED** |
| *Location* | **ON I-635 WEST RAMP** | |
| *Lanes Closed* | **RAMP CLOSED** | |
| *Location of Closure* | **TO I-635 WEST** | **TO I-635 WEST** |
| *Audience for Action* | **I-635 WEST TRAFFIC** | |
| *Action* | **EXIT FORREST LANE**<br>**FOLLOW DETOUR** | **EXIT AT FORREST LANE**<br>**FOLLOW DETOUR** |

### *Combining Location of Closure Message Element and Action Message Element*

> **WHEN THE FREEWAY IS CLOSED, INCIDENT MESSAGES CAN BE REDUCED FURTHER BY:**
> - **Combining *Location of Closure* message element and *Action* message element.**

When the freeway is closed and a detour route set in place with signs, police, and/or traffic control personnel, and the DMS is on the same freeway and close to the closure, then the *Location of Closure* message element becomes unnecessary to display because it will be contained in the *Action* message element. One of the examples in Table 8.12 is repeated here to illustrate the concept. In the table below, the *Location of Closure* (*PAST ARAPAHO RD*) is combined with the *Action* (*EXIT AT ARAPAHO RD/ FOLLOW DETOUR*) and should be omitted because it is redundant.

**Table 8.13 Example of Combining *Location of Closure* Message Element With *Action* Message Element**

| Message Elements | | Revised Message Elements |
|---|---|---|
| Closed Roadway Due to Incident on Same Freeway (US-75 North) as DMS (US-75 North) | | |
| *Incident Descriptor* | **TRUCK ACCIDENT** | **FREEWAY CLOSED** |
| *Location* | **PAST ARAPAHO RD** | |
| *Lanes Closed* | **ALL LANES CLOSED** | |
| *Location of Closure* | **AT ARAPAHO RD** | |
| *Audience for Action* | **US-75 NORTH TRAFFIC** | |
| *Action* | **EXIT AT ARAPAHO RD**<br>**FOLLOW DETOUR** | **EXIT AT ARAPAHO RD**<br>**FOLLOW DETOUR** |

## Combining Message Elements for Roadwork Messages

### *Combining Roadwork Descriptor Message Element with Lanes Closed Message Element*

| ROADWORK MESSAGES CAN BE REDUCED BY: |
|---|
| • Combining ***Roadwork Descriptor*** message element with ***Lanes Closed*** message element; or |
| • Combining ***Roadwork Descriptor***, ***Closure Location***, and ***Lanes Closed*** message elements. |

When motorists are about to encounter roadwork on the freeway, it is more important for them to know that lanes are closed and, more specifically, which lanes are closed rather than be given information on a DMS that roadwork is taking place on the freeway. The information about the roadwork will ordinarily be displayed on static signs as part of the work zone traffic control plan, and displaying the information on a DMS is redundant and takes up space for more relevant information. For example, if roadwork requires closure of the two left freeway lanes, the *Roadwork Descriptor (ROADWORK)* can be omitted on the first line of the DMS and replaced with the *Lanes Closed* message element *2 LEFT LANES CLOSED*.

Examples of how the *Roadwork Descriptor* message element can be replaced with the *Lanes Closed* message element are shown in Table 8.14.

**Table 8.14 Examples of Combining *Roadwork Descriptor* Message Element with *Lanes Closed* Message Element**

| Message Elements | | Revised Message Elements |
|---|---|---|
| <u>Roadwork on Same Freeway (US-75 North) as DMS (US-75 North)</u> | | |
| *Roadwork Descriptor* | **ROADWORK** | **LEFT 2 LANES CLOSED** |
| *Lane Closure Location* | **PAST ARAPAHO RD** | **PAST ARAPAHO RD** |
| *Lanes Closed* | **LEFT 2 LANES CLOSED** | |
| <u>Closed Roadway Due to Roadwork on Same Freeway (US-75 North) as DMS (US-75 North)</u> | | |
| *Roadwork Descriptor* | **ROADWORK** | **FREEWAY CLOSED** |
| *Lane Closure Location* | **PAST ARAPAHO RD** | |
| *Lanes Closed* | **ALL LANES CLOSED** | |
| *Location of Closure* | **AT ARAPAHO RD** | |
| *Audience for Action* | **US-75 NORTH TRAFFIC** | |
| *Action* | **EXIT AT ARAPAHO RD** | **EXIT AT ARAPAHO RD** |
| | **FOLLOW DETOUR** | **FOLLOW DETOUR** |

### *Combining Roadwork Descriptor, Closure Location and Lanes Closed Message Elements*

When the DMS gives information about roadwork closures on an intersecting freeway that many motorists will use to get to their destinations, it is oftentimes desirable and necessary to combine the *Roadwork Descriptor*, *Closure Location*, and *Lanes Closed* message elements. An example is shown in Table 8.15.

**Table 8.15 Example of Combining *Roadwork Descriptor*, *Closure Location* and *Lanes Closed* Message Elements**

| Message Elements | | Revised Message Elements |
|---|---|---|
| Roadwork on Different Highway (I-635 West) than DMS (US-75 North) | | |
| *Roadwork Descriptor* | **ROADWORK** | **I-635 WEST CLOSED** |
| *Closure Location* | **ON I-635 WEST** | |
| | **FROM HILLCREST RD** | **FROM HILLCREST** |
| | **TO PRESTON RD** | **TO PRESTON** |
| *Lanes Closed* | **ALL LANES CLOSED** | |

### *Combining Location of Closure Message Element and Action Message Element*

**WHEN THE FREEWAY IS CLOSED, ROADWORK MESSAGES CAN BE REDUCED FURTHER BY:**
- **Combining *Location of Closure* message element and *Action* message element.**

When the freeway is closed and a detour route set in place with signs, police and/or traffic control personnel, and the DMS is on the same freeway and close to the closure, then the *Location of Closure* message element becomes unnecessary to display because it will be contained in the *Action* message element. One of the examples in Table 8.14 is repeated here to illustrate the concept. In the table below, the *Location of Closure (PAST ARAPAHO RD)* is combined with the *Action* (*EXIT AT ARAPAHO RD/ FOLLOW DETOUR)* and should be omitted because it is redundant.

**Table 8.16 Example of Combining *Location of Closure* Message Element and *Action* Message Element**

| Message Component and Message | | Revised Message |
|---|---|---|
| Closed Roadway Due to Roadwork on Same Freeway as DMS | | |
| *Roadwork Descriptor* | **ROADWORK** | **FREEWAY CLOSED** |
| *Lane Closure Location* | **PAST ARAPAHO RD** | |
| *Lanes Closed* | **ALL LANES CLOSED** | |
| *Location of Closure* | **AT ARAPAHO RD** | |
| *Audience for Action* | **US-75 NORTH TRAFFIC** | |
| *Action* | **EXIT AT ARAPHO RD** | **EXIT AT ARAPAHO** |
| | **FOLLOW DETOUR** | **FOLLOW DETOUR** |

## SECONDARY REDUCTION APPROACH

### Reducing the Number of Destinations in the Action Message Element

After the Initial Reduction Approaches have been applied to the Base DMS Message, it may still be possible to reduce the number of informational units, if required, when the *Action* message element contains more than two *Audiences*. A decision will have to be made by the message designer concerning which of the two *Audiences* should be addressed in the message. The second *Audienc*e must then be omitted from the *Action* message element. In the example shown in Table 8.17, a Base DMS Message with eight units of information was reduced to the message shown on the left side.

**Table 8.17 Example of Reducing Number of Destinations in the *Action* Message Element**

| Reduced Message After Applying Initial Reduction Approaches | | Revised Message | |
|---|---|---|---|
| Roadwork on Same Highway (I-20 East) as DMS (I-20 East) | | | |
| **I-20<br>CLOSED** | **BEST ROUTE TO<br>DALLAS/ I-35 E<br>USE I-30** | **I-20<br>CLOSED** | **BEST ROUTE TO<br>DALLAS<br>USE I-30** |
| *Phase 1* | *Phase 2* | *Phase 1* | *Phase 2* |

The reduced message on the left side has the following five units of information:

- *I-20 CLOSED* 1 unit
- *BEST ROUTE TO* 1 unit
- *DALLAS/ I-35 E* 2 units
- *USE I-30* 1 unit

Five units of information exceed the maximum number of units that motorists can read and comprehend while traveling at high freeway speeds. The message must therefore be reduced to four units of information shown on the right side. In the revised message, the destination *I-35 E* is omitted in preference to *DALLAS*, resulting in an acceptable four-unit message.

## PRIORITY REDUCTION PRINCIPLES

After the Initial Reduction Approaches and the Secondary Reduction Approach are applied and the Base DMS Message still has more units of information than should be displayed to motorists at the prevailing freeway speed, then the Priority Reduction Principles discussed in this section should be applied.

There is a priority of information that motorists need in order to make driving decisions when incidents occur or lanes are closed due to roadwork. The information needed by motorists in order of priority for incidents and roadwork is shown in Tables 8.18 and 8.19.

**Table 8.18 Information Order of Priority for Incidents**

| Message Elements For Lane Closure Incidents | Message Elements for Freeway Closure Incidents |
|---|---|
| 1. Lane Closure (Blockage | 1. Freeway Closure (Blocked) |
| 2. Lane Closure Location | 2. Location of Closure |
| 3. Diversion Action | 3. Diversion Action |
| 4. Audience for Action (if needed) | 4. Audience for Action (if needed) |

**Table 8.19 Information Order of Priority for Roadwork**

| Message Elements For Lane Closure for Roadwork | Message Elements for Freeway Closure for Roadwork |
|---|---|
| 1. Lane Closure (Blockage) | 1. Freeway Closure (Blocked) |
| 2. Lane Closure Location | 2. Location of Closure |
| 3. Action Concerning Speed Reductions | 3. Action Concerning Speed Reductions |
| 4. Diversion Action | 4. Diversion Action |
| 5. Audience for Action (if needed) | 5. Audience for Action (if needed) |

Although *the Incident Descriptor* and the *Roadwork Descriptor* are useful to motorists, these message elements can be replaced with the *Lanes Closed* message element.

When the number of information units exceeds the maximum that should be displayed under prevailing speeds and the Initial Reduction Approaches and the Secondary Reduction Approach have been applied, then the message designer must begin eliminating informational units. **This is done by eliminating units of information starting with the lowest priority.**

# MODULE 9. DESIGNING DMS MESSAGES FOR INCIDENTS

## TABLE OF CONTENTS

# MODULE 9. DESIGNING DMS MESSAGES FOR INCIDENTS

## 9.1 LANE CLOSURE (BLOCKAGE) INCIDENTS

### DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE INCIDENT

Use the procedure outlined in this section of the Manual when an incident occurs that blocks one or more lanes of traffic and the DMS is located on the same freeway and relatively close to the incident. When a major incident occurs that blocks all of the lanes, use Section *9.2 INCIDENTS THAT REQUIRE CLOSING THE FREEWAY*, page 9-19.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| **Maximum Number of Units of Information Allowed in DMS Message** | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section *7.3 UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section *7.4 UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Base DMS Message to Satisfy Motorist Information Needs**

Step 12– Select *Incident Descriptor* Message Element from Table 5.1, page 5-2.

Step 13 – Select *Incident Location* Message Element from Table 5.2, page 5-3.

Step 14 – Select *Lanes Closed* Message Element from Table 5.3, page 5-4.

Step 15 – Establish Whether the *Effect on Travel* Message Element Is Implied by the *Lanes Closed* Message Element.

If "no" Continue to Step 16.
If "yes" Go Directly to Step 17.

Note: Statements in the *Lanes Closed* message element such as *RIGHT 3 LANES CLOSED* imply to motorists that, depending upon the time of day, they will experience delay or major delay. Thus, an *Effect on Travel* message element does not have to be included in the Base DMS Message.

Step 16 – Select *Effect on Travel* Message Element from Table 5.4, page 5-5.

Step 17 – Establish Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 18.
If "yes" Go Directly to Step 19.

Step 18 – Select No Diversion *Action* Message Element from Table 5.5, page 5-6 or Omit *Action* Message Element.

GO TO Step 27.

Step 19 – Establish Whether "Soft" Diversion Should be Recommended.

If "no" Go Directly to Step 21.
If "yes" Continue to Step 20.

Step 20 – Select "Soft" Diversion *Action* Message Element from Table 5.6, page 5-7.

GO TO Step 22.

Step 21 – Select Type 2 Freeway Diversion Route *Action* Message Element from Table 5.7, page 5-8. *(TxDOT practice is to divert traffic only to another freeway.)*

Step 22 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 24.
If "yes" Continue to Step 23.

Step 23 – Select *Audience for Action* Message Element from Table 5.8, page 5-9.

Step 24 – Establish Whether a *Good Reason for Following Action* Is Implied in *Lanes Closed* and *Incident Location* Message Elements.

If "no"   Go Directly to Step 26.
If "yes"  Continue to Step 25.

Step 25 – Examine Whether the Diversion Route Will Be Perceived By Motorists as Being a Most Logical Route.

If "no"   Continue to Step 26.
If "yes"  Go Directly to Step 27.

Step 26 – Select a *Good Reason for Following Action* Message Element from Table 5.9, page 5-10.

---

**Reduce the Number of Message Units If Necessary**

Step 27 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no"   Go Directly to Step 34.
If "yes"  Continue to Step 28.

Step 28 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* Beginning on page 8-15.

Step 29 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Maximum Allowable from Step 11.

If "no"   Go Directly to Step 34.
If "yes"  Continue to Step 30.

Step 30 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no"   Go Directly to Step 33.
If "yes"  Continue to Step 31.

Step 31 – Omit All but One *Audience for Action*

Step 32 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no"   Go Directly to Step 34.
If "yes"  Continue to Step 33.

Step 33 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 34 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 35 – Determine Whether the DMS Has 4 Lines.

If “no”   Continue to Step 36.
If “yes”  Go Directly to Step 37.

Step 36 – Determine Whether the DMS Has 3 Lines.

If “no”   MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If “yes”  Continue to Step 37.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 37 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If “no”   Continue to Step 38.
If “yes”  Go Directly to Step 39.

Step 38 – Split Message Into 2 Phases According to Guidelines in Section *8.1* - *SPLITTING MESSAGES* on page 8-1.

Step 39 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If “no”   Continue to Step 40.
If “yes”  Go Directly to Step 41.

Step 40 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 41 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If “no”   Go Directly to Step 43.
If “yes”  Continue to Step 42.

Step 42 – Separate Message Elements According to Guidelines in Item *4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 43 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 47.
If "yes" Continue to Step 44.

Step 44 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 45 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 46.
If "yes" Go Directly to Step 47.

Step 46 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 47 – Review Message for Inconsistencies and Incompatibility.

Step 48 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE INCIDENT

Use the procedure outlined in this section of the Manual when an incident occurs that blocks one or more lanes of traffic and the DMS is on the same freeway but relatively far from the incident. When a major incident occurs that blocks all of the lanes, use Section *9.2 INCIDENTS THAT REQUIRE CLOSING THE FREEWAY*, page 9-19.

---

### Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| **Maximum Number of Units of Information Allowed in DMS Message** | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

### Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section *7.3 UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section *7.4 UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Base DMS Message to Satisfy Motorist Information Needs**

Step 12– Select *Incident Descriptor* Message Element from Table 5.10, page 5-11.

Step 13 – Select *Incident Location* Message Element from Table 5.11, page 5-12.

Step 14 – Select *Lanes Closed* Message Element from Table 5.12, page 5-13.

Step 15 – Establish Whether the *Effect on Travel* Message Element Is Implied by the *Lanes Closed* Message Element.

If "no" Continue to Step 16.
If "yes" Go Directly to Step 17.

<u>Note</u>: Statements in the *Lanes Closed* message element such as *RIGHT 3 LANES CLOSED* imply to motorists that, depending upon the time of day, they will experience delay or major

delay. Thus, an *Effect on Travel* message element does not have to be included in the Base DMS Message.

Step 16 – Select *Effect on Travel* Message Element from Table 5.13, page 5-14.

Step 17 – Establish Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 18.
If "yes" Go Directly to Step 19.

Step 18 – Select No Diversion *Action* Message Element from Table 5.14, page 5-15 or Omit *Action* Message Element.

GO TO Step 27.

Step 19 – Establish Whether "Soft" Diversion Should Be Recommended.

If "no" Go Directly to Step 21.
If "yes" Continue to Step 20.

Step 20 – Select "Soft" Diversion *Action* Message Element from Table 5.15, page 5-16.

GO TO Step 22.

Step 21 – Select Type 2 Diversion Route *Action* Message Element from Table 5.16, page 5-17. *(TxDOT practice is to divert traffic only to another freeway.)*

Step 22 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 24.
If "yes" Continue to Step 23.

Step 23 – Select *Audience for Action* Message Element from Table 5.17, page 5-18.

Step 24 – Establish Whether a *Good Reason for Following Action* Is Implied *in Lanes Closed* and *Incident Location* Message Elements.

If "no" Go Directly to Step 26.
If "yes" Continue to Step 25.

Step 25 – Examine Whether the Diversion Route Will Be Perceived By Motorists as Being a Most Logical Route.

If "no" Continue to Step 26.
If "yes" Go Directly to Step 27.

Step 26 – Select a *Good Reason for Following Action* Message Element from Table 5.18, page 5-19.

**Reduce the Number of Message Units If Necessary**

Step 27 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 28.

Step 28 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* Beginning on page 8-15.

Step 29 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 30.

Step 30 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 33.
If "yes" Continue to Step 31.

Step 31 – Omit All but One *Audience for Action*.

Step 32 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 33.

Step 33 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

**Format the Message**

Step 34 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

**Adjust Message to Fit on Existing DMS**

Step 35 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 36.
If "yes" Go Directly to Step 37.

Step 36 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 37.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 37 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 38.
If "yes" Go Directly to Step 39.

Step 38 – Split Message Into 2 Phases According to Guidelines in Section *8.1* - *SPLITTING MESSAGES* on page 8-1.

Step 39 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 40.
If "yes" Go Directly to Step 41.

Step 40 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 41 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 43.
If "yes" Continue to Step 42.

Step 42 – Separate Message Elements According to Guidelines in Item *4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 43 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 47.
If "yes" Continue to Step 44.

Step 44 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 45 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 46.
If "yes" Go Directly to Step 47.

Step 46 – Omit Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 47 – Review Message for Inconsistencies and Incompatibility.

Step 48 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

## DMS ON DIFFERENT FREEWAY THAN THE INCIDENT

Use the procedure outlined in this section of the Manual when an incident occurs that blocks one or more lanes of traffic and the DMS is located on a different freeway than the incident. When a major incident occurs that blocks all of the lanes, use Section *9.2 INCIDENTS THAT REQUIRE CLOSING THE FREEWAY*, page 9-19.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| **Maximum Number of Units of Information Allowed in DMS Message** | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section *7.3 UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section *7.4 UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

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**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

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**Define the Base DMS Message to Satisfy Motorist Information Needs**

Step 12– Select *Incident Descriptor* Message Element from Table 5.19, page 5-21.

Step 13 – Select *Incident Location* Message Element from Table 5.20, page 5-22.

Step 14 – Select *Lanes Closed* Message Element from Table 5.21, page 5-23.

Step 15 – Establish Whether the *Effect on Travel* Message Element Is Implied by the *Lanes Closed* Message Element.

If "no" Continue to Step 16.
If "yes" Go Directly to Step 17.

Note: Statements in the *Lanes Closed* message element such as *RIGHT 3 LANES CLOSED* imply to motorists that, depending upon the time of day, they will experience delay or major

delay. Thus, an *Effect on Travel* message element does not have to be included in the Base DMS Message.

Step 16 – Select *Effect on Travel* Message Element from Table 5.22, page 5-24.

Step 17 – Establish Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 18.
If "yes" Go Directly to Step 19.

Step 18 – Select No Diversion *Action* Message Element from Table 5.23, page 5-25 or Omit *Action* Message Element.

GO TO Step 27.

Step 19 – Establish Whether "Soft" Diversion Should Be Recommended.

If "no" Go Directly to Step 21.
If "yes" Continue to Step 20.

Step 20 – Select "Soft" Diversion *Action* Message Element from Table 5.24, page 5-26.

GO TO Step 22.

Step 21 – Select Type 2 Diversion Route *Action* Message Element from Table 5.25, page 5-27. *(TxDOT practice is to divert traffic only to another freeway.)*

Step 22 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 24.
If "yes" Continue to Step 23.

Step 23 – Select *Audience for Action* Message Element from Table 5.26, page 5-28.

Step 24 – Establish Whether a *Good Reason for Following Action* Is Implied *in Lanes Closed* and *Incident Location* Message Elements.

If "no" Go Directly to Step 26.
If "yes" Continue to Step 25.

Step 25 – Examine Whether the Diversion Route Will Be Perceived By Motorists as Being a Most Logical Route.

If "no" Continue to Step 26.
If "yes" Go Directly to Step 27.

Step 26 – Select a *Good Reason for Following Action* Message Element from Table 5.27, page 5-29.

**Reduce the Number of Message Units If Necessary**

Step 27 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Maximum Allowable from Step 11.

If “no”   Go Directly to Step 34.
If “yes”  Continue to Step 28.

Step 28 – Omit *Incident Descriptor* Message Element According to the Guidelines in the Section on *Combining Message Elements for Incident Messages* Beginning on page 8-15.

Step 29 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Maximum Allowable from Step 11.

If “no”   Go Directly to Step 34.
If “yes”  Continue to Step 30.

Step 30 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If “no”   Go Directly to Step 33.
If “yes”  Continue to Step 31.

Step 31 – Omit All but One *Audience for Action*.

Step 32 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If “no”   Go Directly to Step 34.
If “yes”  Continue to Step 33.

Step 33 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

**Format the Message**

Step 34 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

**Adjust Message to Fit on Existing DMS**

Step 35 – Determine Whether the DMS Has 4 Lines.

If “no”   Continue to Step 36.
If “yes”  Go Directly to Step 37.

Step 36 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 37.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 37 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 38.
If "yes" Go Directly to Step 39.

Step 38 – Split Message Into 2 Phases According to Guidelines in Section *8.1 - SPLITTING MESSAGES* on page 8-1.

Step 39 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 40.
If "yes" Go Directly to Step 41.

Step 40 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 41 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 43.
If "yes" Continue to Step 42.

Step 42 – Separate Message Elements According to Guidelines in Item *4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 43 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 47.
If "yes" Continue to Step 44.

Step 44 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 45 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 46.
If "yes" Go Directly to Step 47.

Step 46 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 47 – Review Message for Inconsistencies and Incompatibility.

Step 48 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

# 9.2 INCIDENTS THAT REQUIRE CLOSING THE FREEWAY

## DMS ON THE SAME FREEWAY AND RELATIVELY CLOSE TO THE CLOSURE

Use the procedure outlined in this section of the Manual when an incident occurs that blocks all lanes of traffic and requires closing the freeway using signs, police or traffic control personnel. The procedure is for situations when the DMS is on the same freeway and relatively close to the closure.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| **Maximum Number of Units of Information Allowed in DMS Message** | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section *7.3 UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section *7.4 UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Base DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Incident Descriptor* Message Element from Table 5.28, page 5-31.

Step 13 – Select *Incident Location* Message Element from Table 5.29, page 5-32.

Step 14 – Select *Lanes Closed* Message Element from Table 5.30, page 5-33.

Step 15 – Select *Closure Location* Message Element from Table 5.31, page 5-34.

Step 16 – Determine Whether Diversion Traffic Control Is in Place on the Selected Diversion Route (i.e., police, traffic control personnel and/or guide signs/trailblazers providing positive guidance).

If "no" Continue to Step 17.
If "yes" Go Directly to Step 20.

Step 17. – Establish Whether "Soft" Diversion Should Be Recommended.

If "no" Go Directly to Step 19.
If "yes" Continue to Step 18.

Step 18. – Select "Soft" Diversion *Action* Message Element from Table 5.33, page 5-36.

GO TO Step 21.

Step 19. – Select Type 2, Freeway Diversion Route *Action* Message Element from Table 5.34, page 5-37.

GO TO Step 21.

Step 20 – Select Type 5 Diversion Route *Action* Message Element from Table 5.35, page 5-38.

Step 21 – Establish Whether *Action* Message Element Is for a Select Group of Motorists.

If "no" Go Directly to Step 23.
If "yes" Continue to Step 22.

Step 22 – Select *Audience for Action* Message Element from Table 5.36, page 5-39.

Step 23 – Examine Whether the Diversion Route Will Be Perceived By Motorists as Being a Most Logical Route.

If "no" Continue to Step 24.
If "yes" Go Directly to Step 25.

Step 24 – Select a *Good Reason for Following Action* Message Element from Table 5.37, page 5-40.

---

**Reduce the Number of Message Units if Necessary**

Step 25 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 26.

Step 26 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* beginning on page 8-15.

Step 27 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 28.

Step 28 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 31.
If "yes" Continue to Step 29.

Step 29 – Omit All but One *Audience for Action*

Step 30 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 31.

Step 31 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 32 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 33 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 34.
If "yes" Go Directly to Step 35.

Step 34 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 35.

**Adjust Message to Fit on 3 Lines or Less**

Step 35 – Determine Whether the Message can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 36.
If "yes" Go Directly to Step 37.

Step 36 – Split Message Into 2 Phases According to Guidelines in Section *8.1 - SPLITTING MESSAGES* on page 8-1.

Step 37 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 38.
If "yes" Go Directly to Step 39.

Step 38 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 39 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 41.
If "yes" Continue to Step 40.

Step 40 – Separate Message Elements According to Guidelines in Item *4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 41 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 45.
If "yes" Continue to Step 42.

Step 42 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 43 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 44.
If "yes" Go Directly to Step 45.

Step 44 – Omit Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

## Finalize DMS Message

Step 45 – Review Message for Inconsistencies and Incompatibility.

Step 46 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

## Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE CLOSURE

The steps discussed below should be used to create a new DMS message when an incident occurs that blocks all lanes and requires closing the freeway using static signs, police or traffic control personnel. The procedure is for situations when the DMS is on the same freeway but relatively far from the closure.

---

### Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| **Maximum Number of Units of Information Allowed in DMS Message** | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

### Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section *7.3 UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section *7.4 UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Base DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Incident Descriptor* Message Element from Table 5.38, page 5-41.

Step 13 – Select *Incident Location* Message Element from Table 5.39, page 5-42.

Step 14 – Select *Lanes Closed* Message Element from Table 5.40, page 5-43.

Step 15 – Select *Closure Location* Element from Table 5.41, page 5-44.

Step 16 – Establish Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 17.
If "yes" Go Directly to Step 18.

Step 17 – Select No Diversion *Action* Message Element from Table 5.43, page 5-46, or Omit *Action* Message Element

GO TO Step 27.

Step 18 – Establish Whether "Soft" Diversion Should Be Recommended.

If "no"   Go Directly to Step 20.
If "yes"  Continue to Step 19.

Step 19 – Select "Soft" Diversion *Action* Message Element from Table 5.44, page 5-47.

GO TO Step 23.

Step 20 – Determine Whether Diversion Traffic Control is in Place on the Selected Alternative Route (i.e., police, traffic control personnel and/or guide signs/trailblazers providing positive guidance).

If "no"   Continue to Step 21.
If "yes"  Go Directly to Step 22.

Step 21 – Select Type 2 Freeway Diversion Route *Action* Message Element from Table 5.45, page 5-48.

GO TO Step 23.

Step 22 – Select Type 5 Diversion Route *Action* Message Element from Table 5.46, page 5-49.

Step 23 – Establish Whether *Action* Message Element Is for a Select Group of Motorists.

If "no"   Go Directly to Step 25.
If "yes"  Continue to Step 24.

Step 24 – Select *Audience for Action* Message Element from Table 5.47, page 5-50.

Step 25 – Examine Whether the Diversion Route Will Be Perceived By Motorists as Being a Most Logical Route.

If "no"   Continue to Step 26.
If "yes"  Go Directly to Step 27.

Step 26 – Select a *Good Reason for Following Action* Message Element from Table 5.48, page 5-51.

---

**Reduce the Number of Message Units If Necessary**

Step 27 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 28.

Step 28 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* Beginning on page 8-15.

Step 29 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 30.

Step 30 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Continue to Step 31.
If "yes" Go Directly to Step 33.

Step 31 – Omit All but One *Audience for Action*

Step 32 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Continue to Step 33.
If "yes" Go Directly to Step 34.

Step 33 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 34 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 35 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 36.
If "yes" Go Directly to Step 37.

Step 36 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 37.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 37 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 38.
If "yes" Go Directly to Step 39.

Step 38 – Split Message Into 2 Phases According to Guidelines in Section *8.1 - SPLITTING MESSAGES* on page 8-1.

Step 39 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 40.
If "yes" Go Directly to Step 41.

Step 40 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 41 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 43.
If "yes" Continue to Step 42.

Step 42 – Separate Message Elements According to Guidelines in Item *4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 43 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 47.
If "yes" Continue to Step 44.

Step 44 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 45 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 46.
If "yes" Go Directly to Step 47.

Step 46 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 47 – Review Message for Inconsistencies and Incompatibility.

Step 48 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

## DMS ON DIFFERENT FREEWAY THAN THE CLOSURE

The steps discussed below should be used to create a new DMS message when an incident occurs that blocks all lanes and requires closing the freeway using static signs, police or traffic control personnel. The procedure is for situations when the DMS is on a different freeway than the closure.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| **Maximum Number of Units of Information Allowed in DMS Message** | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section *7.3 UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section *7.4 UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Base DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Incident Descriptor* Message Element from Table 5.49, page 5-53.

Step 13 – Select *Incident Location* Message Element from Table 5.50, page 5-54.

Step 14 – Select *Lanes Closed* Message Element from Table 5.51, page 5-55.

Step 15 – Select *Closure Location* Message Element from Table 5.52, page 5-56.

Step 16 – Determine Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 17.
If "yes" Go Directly to Step 18.

Step 17 – Select No Diversion *Action* Message Element from Table 5.54, page 5-58 or Omit *Action* Message Element.

GO TO Step 25.

Step 18 – Establish Whether "Soft" Diversion Should Be Recommended.

If "no" Go Directly to Step 20.
If "yes" Continue to Step 19.

Step 19 – Select "Soft" Diversion *Action* Message Element from Table 5.55, page 5-59.

GO TO Step 21.

Step 20 – Select Type 2 Freeway Diversion Route *Action* Message Element from Table 5.56, page 5-60.

Step 21 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 23.
If "yes" Continue to Step 22.

Step 22 – Select *Audience for Action* Message Element from Table 5.57, page 5-61.

Step 23 – Examine Whether the Diversion Route May Be Perceived by Motorists as Being a Most Logical Route.

If "no" Continue to Step 24.
If "yes" Go Directly to Step 25.

Step 24 – Select a *Good Reason for Following Action* Message Element from Table 5.58, page 5-62.

---

**Reduce the Number of Message Units If Necessary**

Step 25 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 26.

Step 26 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* beginning on page 8-15.

Step 27 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 28.

Step 28 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 30.
If "yes" Continue to Step 29.

Step 29 – Omit All but One *Audience for Action*

Step 30 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 31.

Step 31 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 32 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 33 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 34.
If "yes" Go Directly to Step 35.

Step 34 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 35.

**Adjust Message to Fit on 3 Lines or Less**

Step 35 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 36.
If "yes" Go Directly to Step 39.

Step 36 – Split Message Into 2 Phases According to Guidelines in Section *8.1* - *SPLITTING MESSAGES* on page 8-1.

Step 37 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 38.
If "yes" Go Directly to Step 39.

Step 38 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 39 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 41.
If "yes" Continue to Step 40.

Step 40 – Separate Message Elements According to Guidelines in Item *4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 41 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 45.
If "yes" Continue to Step 42.

Step 42 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 43 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 44.
If "yes" Go Directly to Step 45.

Step 44 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

**Finalize DMS Message**

Step 45 – Review Message for Inconsistencies and Incompatibility.

Step 46 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

# 9.3 INCIDENTS ON AN INTERSECTING FREEWAY THAT REQUIRE CLOSING THE CONNECTOR RAMP

## DMS UPSTREAM OF THE CONNECTOR RAMP CLOSURE

Use the procedure outlined in this section of the Manual when an incident occurs on an intersecting freeway and the connector ramp from the DMS freeway to the intersecting freeway is closed.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| Maximum Number of Units of Information Allowed in DMS Message | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section *7.3 UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section *7.4 UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Base DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Incident Descriptor* Message Element from Table 5.59, page 5-64.

Step 13 – Select *Incident Location* Message Element from Table 5.60, page 5-65.

Step 14 – Select *Lanes Closed* Message Element from Table 5.61, page 5-66.

Step 15 – Select *Ramp Closure Descriptor* Message Element from Table 5.62, page 5-67.

Step 16 – Determine Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 17.
If "yes" Go Directly to Step 18.

Step 17 – Select No Diversion *Action* Message Element from Table 5.63, page 5-68 or Omit *Action* Message Element.

GO TO Step 27.

Step 18 – Establish Whether "Soft" Diversion Should Be Recommended.

If "no" Go Directly to Step 20.
If "yes" Continue to Step 19.

Step 19 – Select "Soft" Diversion *Action* Message Element from Table 5.64, page 5-69.

GO TO Step 23.

Step 20 – Determine Whether Diversion Traffic Control Is in Place on the Selected Alternative Route (i.e., police, traffic control personnel and/or guide signs/trailblazers providing guidance).

If "no" Continue to Step 21.
If "yes" Go Directly to Step 22.

Step 21 – Select Type 2 Freeway Diversion Route *Action* Message Element from Table 5.65, page 5-70.

GO TO Step 23.

Step 22 – Select Type 5 Diversion Route *Action* Message Element from Table 5.66, page 5-71.

Step 23 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 25.
If "yes" Continue to Step 24.

Step 24 – Select *Audience for Action* Message Element from Table 5.67, page 5-72.

Step 25 – Examine Whether the Diversion Route May Be Perceived by Motorists as Being a Most Logical Route.

If "no" Continue to Step 26.
If "yes" Go Directly to Step 27.

Step 26 – Select a *Good Reason for Following Action* Message Element from Table 5.68, page 5-73.

---

**Reduce the Number of Message Units If Necessary**

Step 27 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 28.

Step 28 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* Beginning on page 8-15.

Step 29 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 30.

Step 30 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 33.
If "yes" Continue to Step 31.

Step 31 – Omit All but One *Audience for Action*

Step 32 – Examine Whether the Number of Units of Information in the Base Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 33.

Step 33 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 34 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 35 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 36.
If "yes" Go Directly to Step 37.

Step 36 – Determine Whether the DMS Has 3 Lines.

If “no” MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If “yes” Continue to Step 37.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 37 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If “no” Continue to Step 38.
If “yes” Go Directly to Step 41.

Step 38 – Split Message Into 2 Phases According to Guidelines in Section *8.1 - SPLITTING MESSAGES* on page 8-1.

Step 39 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If “no” Continue to Step 40.
If “yes” Go Directly to Step 41.

Step 40 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 41 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If “no” Go Directly to Step 43.
If “yes” Continue to Step 42.

Step 42 – Separate Message Elements According to Guidelines in Item *4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 43 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If “no” Go Directly to Step 47.
If “yes” Continue to Step 44.

Step 44 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 45 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 46.
If "yes" Go Directly to Step 47.

Step 46 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 47 – Review Message for Inconsistencies and Incompatibility.

Step 48 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

# MODULE 10. DESIGNING DMS MESSAGES FOR ROADWORK

## TABLE OF CONTENTS

# MODULE 10. DESIGNING DMS MESSAGES FOR ROADWORK

## 10.1 LANE CLOSURE DURING ROADWORK

The DMS message design process described in this section of the Manual applies to roadwork that requires closure of some of the lanes of the freeway while other lanes are open to traffic. When the roadwork requires closure of all the lanes on the freeway, Section *10.2 ROADWORK THAT REQUIRES CLOSING THE FREEWAY* on page 10-19 should be used.

### DMS ON THE SAME FREEWAY AND RELATIVELY CLOSE TO THE ROADWORK

The steps discussed below should be used to create a new DMS message when it is necessary to close one or more lanes while other lanes are open to traffic and the DMS is located on the same freeway and relatively close to the roadwork.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| Maximum Number of Units of Information Allowed in DMS Message | | | |
|---|---|---|---|
| Condition | Light-Emitting Diode DMS | | |
| | 0-35 mph | 36-55 mph | 56-70 mph |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section 7.3 *UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section 7.4 *UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Basic DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Roadwork Descriptor* Message Element from Table 6.1, page 6-2.

Step 13 – Select *Roadwork Location* Message Element from Table 6.2, page 6-3.

Step 14 – Select *Lanes Closed* Message Element from Table 6.3, page 6-4.

Step 15 – Establish Whether *Effect on Travel* Message Element Is implied by the *Lanes Closed* Message Element.

If "no" Continue to Step 16.
If "yes" Go Directly to Step 17.

Note: Statements in the *Lanes Closed* message element such as *RIGHT 3 LANES CLOSED* imply to motorists that, depending upon the time of day, they will experience delay or major delay. Thus, an *Effect on Travel* message element does not have to be included in the Basic DMS Message.

Step 16 – Select *Effect on Travel* Message Element from Table 6.4, page 6-5.

Step 17 – Establish Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 18.
If "yes" Go Directly to Step 19.

Step 18 – Select No Diversion *Action* Message Element from Table 6.5, page 6-6 or Omit *Action* Message Element.

GO TO Step 27.

Step 19 – Establish Whether "Soft" Diversion Should Be Recommended.

If "no" Go Directly to Step 21.
If "yes" Continue to Step 20.

Step 20 – Select "Soft" Diversion *Action* Message Element from Table 6.6, page 6-7.

GO TO Step 22.

Step 21 – Select Type 2 Freeway Diversion Route *Action* Message Element from Table 6.7, page 6-8.

Step 22 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 24.
If "yes" Continue to Step 23.

Step 23 – Select *Audience for Action* Message Element from Table 6.8, page 6-9.

Step 24 – Establish Whether a *Good Reason for Following Action* Is Implied in *Lanes Closed and Roadwork Location* Message Elements.

If "no" Go Directly to Step 26.
If "yes" Continue to Step 25.

Step 25 – Determine Whether Motorists Will Be Advised to Take a Route That May Be Perceived by Them as Not Being Logical.

If "no" Go Directly to Step 27.
If "yes" Continue to Step 26.

Step 26 – Select a *Good Reason for Following Action* Message Element from Table 6.9, page 6-10.

---

**Reduce the Number of Message Units If Necessary**

Step 27 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 28.

Step 28 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* beginning on page 8-15.

Step 29 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 30.

Step 30 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 31.

Step 31 – Omit All but One *Audience for Action*.

Step 32 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 33.

Step 33 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 34 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 35 – Determine Whether the DMS Has 4 Lines.

If “no” Continue to Step 36.
If “yes” Go Directly to Step 37.

Step 36 – Determine Whether the DMS Has 3 Lines.

If “no” MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If “yes” Continue to Step 37.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 37 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If “no” Continue to Step 38.
If “yes” Go Directly to Step 39.

Step 38 – Split Message Into 2 Phases According to Guidelines in *Section 8.1 - SPLITTING MESSAGES* on page 8-1.

Step 39 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If “no” Continue to Step 40.
If “yes” Go Directly to Step 41.

Step 40 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 41 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If “no” Go Directly to Step 43.
If “yes” Continue to Step 42.

Step 42 – Separate Message Elements According to Guidelines in *Item 4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 43 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 47.
If "yes" Continue to Step 44.

Step 44 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 45 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 46.
If "yes" Go Directly to Step 47.

Step 46 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 47 – Review Message for Inconsistencies and Incompatibility.

Step 48 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE ROADWORK

The steps discussed below should be used to create a new DMS message when it is necessary to close one or more lanes while other lanes are open to traffic and the DMS is on the same freeway but relatively far from the roadwork.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| Maximum Number of Units of Information Allowed in DMS Message | | | |
|---|---|---|---|
| Condition | Light-Emitting Diode DMS | | |
| | 0-35 mph | 36-55 mph | 56-70 mph |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section 7.3 *UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section 7.4 *UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

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**Define the Basic DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Roadwork Descriptor* Message Element from Table 6.10, page 6-11.

Step 13 – Select *Roadwork Location* Message Element from Table 6.11, page 6-12.

Step 14 – Select *Lanes Closed* Message Element from Table 6.12, page 6-13.

Step 15 – Establish Whether *Effect on Travel* Message Element Is Implied by the *Lanes Closed* Message Element.

If "no" Continue to Step 16.
If "yes" Go Directly to Step 17.

Note: Statements in the *Lanes Closed* message element such as *RIGHT 3 LANES CLOSED* imply to motorists that, depending upon the time of day, they will experience delay or major

delay. Thus, an *Effect on Travel* message element does not have to be included in the Basic DMS Message.

Step 16 – Select *Effect on Travel* Message Element from Table 6.13, page 6-14.

Step 17 – Establish Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 18.
If "yes" Go Directly to Step 19.

Step 18 – Select No Diversion *Action* Message Element from Table 6.14, page 6-15 or Omit *Action* Message Element.

GO TO Step 27.

Step 19 – Establish Whether "Soft" Diversion Should Be Recommended.

If "no" Go Directly to Step 21.
If "yes" Continue to Step 20.

Step 20 – Select "Soft" Diversion *Action* Message Element from Table 6.15, page 6-16.

GO TO Step 22.

Step 21 – Select Type 2 Freeway Diversion Route *Action* Message Element from Table 6.16, page 6-17.

Step 22 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 24.
If "yes" Continue to Step 23.

Step 23 – Select *Audience for Action* Message Element from Table 6.17, page 6-18.

Step 24 – Establish Whether a *Good Reason for Following Action* Is Implied in *Lanes Closed and Roadwork Location* Message Elements.

If "no" Go Directly to Step 26.
If "yes" Continue to Step 25.

Step 25 – Determine Whether Motorists Will Be Advised to Take a Route That May Be Perceived by Them as Not Being Logical.

If "no" Go Directly to Step 27.
If "yes" Continue to Step 26.

Step 26 – Select a *Good Reason for Following Action* Message Element from Table 6.18, page 6-29.

## Reduce the Number of Message Units If Necessary

Step 27 – Examine Whether the Number of Units of Information in the Basic Message Is Greater than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 28.

Step 28 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* Beginning on page 8-15.

Step 29 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 30.

Step 30 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 31.

Step 31 – Omit All but One *Audience for Action*.

Step 32 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 33.

Step 33 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

## Format the Message

Step 34 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

## Adjust Message to Fit on Existing DMS

Step 35 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 36
If "yes" Go Directly to Step 37.

Step 36 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 37.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 37 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 38.
If "yes" Go Directly to Step 39.

Step 38 – Split Message Into 2 Phases According to Guidelines in *Section 8.1 - SPLITTING MESSAGES* on page 8-1.

Step 39 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 40.
If "yes" Go Directly to Step 41.

Step 40 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 41 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 43.
If "yes" Continue to Step 42.

Step 42 – Separate Message Elements According to Guidelines in *Item 4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 43 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 47.
If "yes" Continue to Step 44.

Step 44 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 45 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 46.
If "yes" Go Directly to Step 47.

Step 46 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 47 – Review Message for Inconsistencies and Incompatibility.

Step 48 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

## DMS ON DIFFERENT FREEWAY THAN THE ROADWORK

The steps discussed below should be used to create a new DMS message when it is necessary to close one or more lanes while other lanes are open to traffic and the DMS is located on a different freeway than the roadwork.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| Maximum Number of Units of Information Allowed in DMS Message | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section 7.3 *UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section 7.4 *UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Basic DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Roadwork Descriptor* Message Element from Table 6.19, page 6-20.

Step 13 – Select *Roadwork Location* Message Element from Table 6.20, page 6-21.

Step 14 – Select *Lanes Closed* Message Element from Table 6.21, page 6-22.

Step 15 – Establish Whether *Effect on Travel* Message Element Is Implied by the *Lanes Closed* Message Element.

If "no" Continue to Step 16.
If "yes" Go Directly to Step 17.

Note: Statements in the *Lanes Closed* message element such as *RIGHT 3 LANES CLOSED* imply to motorists that, depending upon the time of day, they will experience delay or major

delay. Thus, an *Effect on Travel* message element does not have to be included in the Basic DMS Message.

Step 16 – Select *Effect on Travel* Message Element from Table 6.22, page 6-23.

Step 17 – Establish Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 18.
If "yes" Go Directly to Step 19.

Step 18 – Select No Diversion *Action* Message Element from Table 6.23, page 6-24 or Omit *Action* Message Element.

GO TO Step 27.

Step 19 – Establish Whether "Soft" Diversion Should Be Recommended.

If "no" Go Directly to Step 21.
If "yes" Continue to Step 20.

Step 20 – Select "Soft" Diversion *Action* Message Element from Table 6.24, page 6-25.

GO TO Step 22.

Step 21 – Select Type 1 or Type 2 Diversion Route *Action* Message Element from Table 6.25, page 6-26.

Step 22 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 24.
If "yes" Continue to Step 23.

Step 23 – Select *Audience for Action* Message Element from Table 6.26, page 6-27.

Step 24 – Establish Whether a *Good Reason for Following Action* Is Implied in *Lanes Closed and Roadwork Location* Message Elements.

If "no" Go Directly to Step 26.
If "yes" Continue to Step 25.

Step 25 – Determine Whether Motorists Will Be Advised to Take a Route That May be Perceived by Them as Not Being Logical.

If "no" Go Directly to Step 27.
If "yes" Continue to Step 26.

Step 26 – Select a *Good Reason for Following Action* Message Element from Table 6.27, page 6-28.

**Reduce the Number of Message Units If Necessary**

Step 27 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 28.

Step 28 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* beginning on page 8-15.

Step 29 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 30.

Step 30 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 31.

Step 31 – Omit All but One *Audience for Action*.

Step 32 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 34.
If "yes" Continue to Step 33.

Step 33 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

**Format the Message**

Step 34 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

**Adjust Message to Fit on Existing DMS**

Step 35 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 36
If "yes" Go Directly to Step 37.

Step 36 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 37.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 37 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 38.
If "yes" Go Directly to Step 39.

Step 38 – Split Message Into 2 Phases According to Guidelines in *Section 8.1 - SPLITTING MESSAGES* on page 8-1.

Step 39 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 40.
If "yes" Go Directly to Step 41.

Step 40 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 41 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 43.
If "yes" Continue to Step 42.

Step 42 – Separate Message Elements According to Guidelines in *Item 4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 43 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 47.
If "yes" Continue to Step 44.

Step 44 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 45 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 46.
If "yes" Go Directly to Step 47.

Step 46 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 47 – Review Message for Inconsistencies and Incompatibility.

Step 48 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

# 10.2 ROADWORK THAT REQUIRES CLOSING THE FREEWAY

When construction or maintenance roadwork requires closure of the entire freeway, a traffic control plan is implemented. The traffic control plan includes installation of traffic control devices to divert traffic off the primary freeway and to give positive guidance to the motorists along the diversion route and then back to the primary freeway. The closure of the primary freeway will take place at an exit ramp upstream of the roadwork.

## DMS ON THE SAME FREEWAY AND RELATIVELY CLOSE TO THE CLOSURE

Use the procedure outlined in this section of the Manual when roadwork requires closure of all the traffic lanes and the DMS is located on the same freeway and relatively close to the closure.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| Maximum Number of Units of Information Allowed in DMS Message | | | |
|---|---|---|---|
| Condition | Light-Emitting Diode DMS | | |
| | 0-35 mph | 36-55 mph | 56-70 mph |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section 7.3 *UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS Because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines Section 7.4 *UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message..

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**Define the Basic DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Roadwork Descriptor* Message Element from Table 6.28, page 6-31.

Step 13 – Select *Closure Location* Message Element from Table 6.29, page 6-32.

Step 14 – Select *Lanes Closed* Message Element from Table 6.30, page 6-33.

Step 15 – Select Type 6 Diversion (Detour) Route *Action* Message Element from Table 6.32, page 6-35.

---

**Reduce the Number of Message Units If Necessary**

Step 16 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 20.
If "yes" Continue to Step 17.

Step 17 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* beginning on page 8-15.

Step 18 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 20.
If "yes" Continue to Step 19.

Step 19 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 20 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 21 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 22.
If "yes" Go Directly to Step 23.

Step 22 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 23.

**Adjust Message to Fit on 3 Lines or Less**

Step 23 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 24.
If "yes" Go Directly to Step 25.

Step 24 – Split Message Into 2 Phases According to Guidelines in *Section 8.1 - SPLITTING MESSAGES* on page 8-1.

Step 25 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 26.
If "yes" Go Directly to Step 27.

Step 26 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 27 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 29.
If "yes" Continue to Step 28.

Step 28 – Separate Message Elements According to Guidelines in *Item 4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 29 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 33.
If "yes" Continue to Step 30.

Step 30 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 31 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 32.
If "yes" Go Directly to Step 33.

Step 32 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

## Finalize DMS Message

Step 33 – Review Message for Inconsistencies and Incompatibility.

Step 34 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

## Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE CLOSURE

Use the procedure outlined in this section of the Manual when roadwork requires closure of all the traffic lanes and the DMS is located on the same freeway but relatively far from the closure.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| Maximum Number of Units of Information Allowed in DMS Message | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section 7.3 *UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section 7.4 *UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Basic DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Roadwork Descriptor* Message Element from Table 6.35, page 6-38.

Step 13 – Select *Closure Location* Message Element from Table 6.36, page 6-39.

Step 14 – Select *Lanes Closed* Message Element from Table 6.37, page 6-40.

Step 15 – Establish Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 16.
If "yes" Go Directly to Step 17.

Step 16 – Select No Diversion *Action* Message Element from Table 6.39, page 6-42.

GO TO Step 26.

Step 17 – Establish Whether "Soft" Diversion *Action* Should Be Recommended.

If "no" Go Directly to Step 19.
If "yes" Continue to Step 18.

Step 18 – Select "Soft" Diversion *Action* Message Element from Table 6.40, page 6-43.

GO TO Step 22.

Step 19 – Establish Whether Type 6 Diversion (Detour) Route *Action* Should Be Recommended.

If "no" Continue to Step 20.
If "yes" Go Directly to Step 21.

Step 20 – Select Type 2 Freeway Diversion Route *Action* Message Element from Table 6.41, page 6-44.

GO TO Step 22.

Step 21 – Select Type 6 Diversion (Detour) Route *Action* Message Element from Table 6.42, page 6-45.

Step 22 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 24.
If "yes" Continue to Step 23.

Step 23 – Select *Audience for Action* Message Element from Table 6.43, page 6-46.

Step 24 – Determine Whether Motorists Will Be Advised to Take a Route That May Be Perceived by Them as Not Being Logical.

If "no" Go Directly to Step 26.
If "yes" Continue to Step 25.

Step 25 – Select a *Good Reason for Following Action* Message Element from Table 6.44 page 6-47.

---

**Reduce the Number of Message Units If Necessary**

Step 26 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 33.
If "yes" Continue to Step 27.

Step 27 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* beginning on page 8-15.

Step 28 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 33.
If "yes" Continue to Step 29.

Step 29 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 31.
If "yes" Continue to Step 30.

Step 30 – Omit All but One *Audience for Action*

Step 32 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 33.
If "yes" Continue to Step 32.

Step 32 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 33 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 34 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 35.
If "yes" Go Directly to Step 36.

Step 35 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 36.

**Adjust Message to Fit on 3 Lines or Less**

Step 36 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 37.
If "yes" Go Directly to Step 38.

Step 37 – Split Message Into 2 Phases According to Guidelines in *Section 8.1 - SPLITTING MESSAGES* on page 8-1.

Step 38 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 39.
If "yes" Go Directly to Step 40.

Step 39 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 40 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 42.
If "yes" Continue to Step 41.

Step 41 – Separate Message Elements According to Guidelines in *Item 4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 42 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 46.
If "yes" Continue to Step 43.

Step 43 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 44 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 45.
If "yes" Go Directly to Step 46.

Step 45 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

## Finalize DMS Message

Step 46 – Review Message for Inconsistencies and Incompatibility.

Step 47 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

## Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

## DMS ON DIFFERENT FREEWAY THAN THE ROADWORK AND CLOSURE

Use the procedure outlined in this section of the Manual when roadwork requires closure of all the traffic lanes and the DMS is located on a different freeway than the closure.

---

### Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| Maximum Number of Units of Information Allowed in DMS Message | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

### Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section 7.3 *UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section 7.4 *UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.
If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use This Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Basic DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Roadwork Descriptor* Message Element from Table 6.45, page 6-49.

Step 13 – Select *Closure Location* Message Element from Table 6.46, page 6-50.

Step 14 – Select *Lanes Closed* Message Element from Table 6.47, page 6-51.

Step 15 – Establish Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 16.
If "yes" Go Directly to Step 17.

Step 16 – Select No Diversion *Action* Message Element from Table 6.49, page 6-53.

GO TO Step 24.

Step 17 – Establish Whether "Soft" Diversion *Action* Should Be Recommended.

If "no" Go Directly to Step 19.
If "yes" Continue to Step 18.

Step 18 – Select "Soft" Diversion *Action* Message Element from Table 6.50, page 6-54.

GO TO Step 20.

Step 19 – Select Type 2 Freeway Diversion Route *Action* Message Element from Table 6.51, page 6-55.

Step 20 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 22.
If "yes" Continue to Step 21.

Step 21 – Select *Audience for Action* Message Element from Table 6.52, page 6-56.

Step 22 – Determine Whether Motorists Will Be Advised to Take a Route That May Be Perceived by Them as Not Being Logical.

If "no" Go Directly to Step 24.
If "yes" Continue to Step 23.

Step 23 – Select a *Good Reason for Following Action* Message Element from Table 6.53, page 6-57.

---

**Reduce the Number of Message Units If Necessary**

Step 24 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 31.
If "yes" Continue to Step 25.

Step 25 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* beginning on page 8-15.

Step 26 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 31.
If "yes" Continue to Step 27.

Step 27 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 29.
If "yes" Continue to Step 28.

Step 28 – Omit All but One *Audience for Action*.

Step 29 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 31.
If "yes" Continue to Step 30.

Step 30 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 31 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 32 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 33.
If "yes" Go Directly to Step 34.

Step 33 – Determine Whether the DMS Has 3 Lines.

If "no" MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If "yes" Continue to Step 34.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 34 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If "no" Continue to Step 35.
If "yes" Go Directly to Step 36.

Step 35 – Split Message Into 2 Phases According to Guidelines in *Section 8.1* - *SPLITTING MESSAGES* on page 8-1.

Step 36 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If "no" Continue to Step 37.
If "yes" Go Directly to Step 38.

Step 37 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 38 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If "no" Go Directly to Step 40.
If "yes" Continue to Step 39.

Step 39 – Separate Message Elements According to Guidelines in *Item 4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 40 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If "no" Go Directly to Step 44.
If "yes" Continue to Step 41.

Step 41 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 42 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 43.
If "yes" Go Directly to Step 44.

Step 43 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 44 – Review Message for Inconsistencies and Incompatibility.

Step 45 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

# 10.3 ROADWORK ON AN INTERSECTING FREEWAY THAT REQUIRES CLOSING THE CONNECTOR RAMP

## DMS UPSTREAM OF THE CONNECTOR RAMP CLOSURE

Use the procedure outlined in this section of the Manual when roadwork occurs on an intersecting freeway and the connector ramp from the DMS freeway to the intersecting freeway is closed.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

Step 1 – Determine Freeway Operating Speeds.

Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5. For LED DMSs, these maximum values are as follows:

| **Maximum Number of Units of Information Allowed in DMS Message** | | | |
|---|---|---|---|
| **Condition** | **Light-Emitting Diode DMS** | | |
| | **0-35 mph** | **36-55 mph** | **56-70 mph** |
| Mid-Day | 5 units | 4 units | 4 units |
| Sun Washout | 5 units | 4 units | 4 units |
| Sun Backlight | 4 units | 4 units | 3 units |
| Nighttime | 4 units | 4 units | 3 units |

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section 7.3 *UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.

If "no" Go Directly to Step 5.
If "yes" Continue to Step 4.

Step 4 – Identify the Reduction in the Number of Message Units of Information to Compensate for Lower Legibility to the DMS because of the Vertical Curve Using Tables 7.3 through 7.6 on pages 7-8 and 7-9.

Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section 7.4 *UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.

If "no" Go Directly to Step 7.
If "yes" Continue to Step 6.

Step 6 – Identify the Reduction in the Number of Units of Information to Compensate for Lower Legibility to the DMS Because of the Horizontal Curve Using Tables 7.7 through 7.12 on pages 7-12 through 7-17.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

Step 7 – Determine Whether Rainfall Near the DMS Exceeds 2 Inches per Hour.

If "no" Go Directly to Step 9.
If "yes" Continue to Step 8.

Step 8 – The Reduction in the Number of Units of Information to Compensate for Rain Is 1.

Step 9 – Determine Whether Fog Exists Near the DMS.

If "no" Go Directly to Step 11.
If "yes" Continue to Step 10.

Step 10 – Identify the Reduction in the Number of Units of Information to Compensate for Fog Using Table 7.13 on page 7-19.

---

**Finalize the Maximum Allowable Units of Information in the Message**

Step 11 – Select the Largest Reduction in the Number of Units of Information from Among the Effects of a Vertical Curve (Step 4), a Horizontal Curve (Step 6), Rain (Step 8), or Fog (Step 10), and Use ThIs Number to Subtract from the Maximum Allowable Number of Units of Information in the Message Shown in Table 7.2 on page 7-5. The new number after the subtraction represents the final Maximum Allowable Units of Information in the message.

---

**Define the Basic DMS Message to Satisfy Motorist Information Needs**

Step 12 – Select *Roadwork Descriptor* Message Element from Table 6.54, page 6-59.

Step 13 – Select *Closure Location* Message Element from Table 6.55, page 6-60.

Step 14 – Select *Ramp Closure Descriptor* Message Element from Table 6.56, page 6-61.

Step 15 – Determine Whether Diversion Action Should Be Recommended.

If "no" Continue to Step 16.
If "yes" Go Directly to Step 17.

Step 16 – Establish Whether "Soft" Diversion Should Be Recommended.

If "no" Go Directly to Step 18.
If "yes" Continue to Step 17.

Step 17 – Select "Soft" Diversion *Action* Message Element from Table 6.57, page 6-62.

GO TO Step 21.

Step 18 – Establish Whether Detour Route Has Been Established as Part of the Traffic Control Plan.

If "no" Continue to Step 19.
If "yes" Go Directly to Step 20.

Step 19 – Select Type 2 Freeway Diversion Route *Action* Message Element from Table 6.58, page 6-63.

GO TO Step 21.

Step 20 – Select Type 6 Diversion Route *Action* Message Element from Table 6.59, page 6-64.

Step 21 – Establish Whether *Action* Message Is for a Select Group of Motorists.

If "no" Go Directly to Step 25.
If "yes" Continue to Step 24.

Step 22 – Select *Audience for Action* Message Element from Table 6.60, page 6-65.

Step 23 – Examine Whether the Diversion Route May Be Perceived by Motorists as Being a Most Logical Route.

If "no" Continue to Step 24.
If "yes" Go Directly to Step 25.

Step 24 – Select a *Good Reason for Following Action* Message Element from Table 6.61, page 6-66.

**Reduce the Number of Message Units If Necessary**

Step 25 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 26.

Step 26 – Omit *Incident Descriptor* Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* Beginning on page 8-15.

Step 27 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 28.

Step 28 – Examine Whether the Message Contains More Than One *Audience for Action* (Destination) Message Element.

If "no" Go Directly to Step 31.
If "yes" Continue to Step 29.

Step 29 – Omit All but One *Audience for Action*

Step 30 – Examine Whether the Number of Units of Information in the Basic Message Is Greater Than the Maximum Allowable from Step 11.

If "no" Go Directly to Step 32.
If "yes" Continue to Step 31.

Step 31 – Omit Other Information According to Guidelines in the Section on *PRIORITY REDUCTION PRINCIPLES* on page 8-20.

---

**Format the Message**

Step 32 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.

---

**Adjust Message to Fit on Existing DMS**

Step 33 – Determine Whether the DMS Has 4 Lines.

If "no" Continue to Step 34.
If "yes" Go Directly to Step 35.

Step 34 – Determine Whether the DMS Has 3 Lines.

If “no” MESSAGE CANNOT BE DESIGNED USING THIS PROCEDURE.
If “yes” Continue to Step 35.

---

**Adjust Message to Fit on 3 Lines or Less**

Step 35 – Determine Whether the Message Can Be Displayed on 3 Lines or Less.

If “no” Continue to Step 36.
If “yes” Go Directly to Step 39.

Step 36 – Split Message Into 2 Phases According to Guidelines in *Section 8.1 - SPLITTING MESSAGES* on page 8-1.

Step 37 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.

If “no” Continue to Step 38.
If “yes” Go Directly to Step 39.

Step 38 – Omit Information to Reduce Phase to 3 Decision-Relevant Units According to Guidelines in Item *5. NO MORE THAN THREE UNITS OF INFORMATION SHOULD BE DISPLAYED ON A SINGLE PHASE AT HIGH FREEWAY SPEEDS* on page 8-3.

Step 39 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.

If “no” Go Directly to Step 41.
If “yes” Continue to Step 40.

Step 40 – Separate Message Elements According to Guidelines in Item *4. A MESSAGE LINE SHOULD NOT CONTAIN PORTIONS OF TWO DIFFERENT UNITS OF INFORMATION* on page 8-3.

Step 41 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.

If “no” Go Directly to Step 45.
If “yes” Continue to Step 42.

Step 42 – Apply Abbreviations to Selected Words According to Guidelines in the Section on *USING ABBREVIATIONS*, page 8-10.

Step 43 – Examine Whether the Application of Abbreviation Guidelines Adequately Reduced the Length of the Message Lines and the Entire Message Can Fit in the Available DMS Space.

If "no" Continue to Step 44.
If "yes" Go Directly to Step 45.

Step 44 – Omit Information According to Guidelines in the Sections on *PRIORITY REDUCTION PRINCIPLES* on page 8-20 and *FORMATTING MESSAGES* on page 8-6.

---

**Finalize DMS Message**

Step 45 – Review Message for Inconsistencies and Incompatibility.

Step 46 – Make Additional Adjustments if Necessary.

***You now should have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

he final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

# MODULE 11. QUICK REFERENCE GUIDE FOR DESIGNING DMS MESSAGES

## TABLE OF CONTENTS

# MODULE 11. QUICK REFERENCE GUIDE FOR DESIGNING DMS MESSAGES

## 11.1 INTRODUCTION

Details of the DMS message design process for incidents and roadwork were presented in Modules 9 and 10. The objective of Module 11 is to provide a quick reference guide for designing messages. It is intended for supervisory personnel and for DMS operators who have considerable experience with using the guidelines in Modules 9 and 10.

As one examines the large number of alternative terms that are available for each of the DMS message elements in Modules 5 and 6, it becomes apparent that there are numerous combinations of messages that can be used—too numerous to list each combination. Therefore, only typical example messages are shown in Module 11 to illustrate specific principles of message design.

This Module applies only to DMS messages for situations where a maximum of 4 units of information can be displayed.

# 11.2 LANE CLOSURE (BLOCKAGE) INCIDENTS

## DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE INCIDENT

**Table 11.1 DMS Message Examples for Lane Closure (Blockage) Incidents**
**DMS Close to Incident[A]**

| **Message Characteristics Highlights** | **Large DMS** | | **Portable DMS[B]** | |
|---|---|---|---|---|
| | **Phase 1** | **Phase 2** | **Phase 1** | **Phase 2** |
| • *"ACCIDENT" for Incident Descriptor message element.*<br>• *Incident (Blockage) Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | ACCIDENT<br>AT ROWLAND DR<br>RIGHT LANE CLOSED | | ACCIDENT<br>AT<br>ROWLAND | RIGHT<br>LANE<br>CLOSED |
| • *"MAJOR ACCIDENT" for Incident Descriptor message element.*<br>• *No Action message element* | MAJOR ACCIDENT<br>AT ROWLAND<br>RIGHT 3 LANES CLOSED | | | |
| • *"TRUCK ACCIDENT" for Incident Descriptor message element.*<br>• *No Action message element* | TRUCK ACCIDENT<br>AT ROWLAND<br>RIGHT 3 LANES CLOSED | | | |
| • *Highway name (number) for Incident (Blockage) Location message element.*<br>• *No Action message element.* | ACCIDENT<br>PAST I-610<br>RIGHT 2 LANES CLOSED | | ACCIDENT<br>PAST<br>I-610 | RIGHT 2<br>LANES<br>CLOSED |
| • *Replacing Incident Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>PAST I-610 | | | |
| • *Action message element.*<br>• *No diversion.* | ACCIDENT<br>PAST ROWLAND | RIGHT 2 LANES CLOSED<br>BE PREPARED TO STOP | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>PAST ROWLAND | BE PREPARED<br>TO STOP | | |
| | RIGHT 2 LANES CLOSED<br>PAST ROWLAND<br>BE PREPARED TO STOP | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"Soft" diversion.* | ACCIDENT<br>BEFORE ROWLAND | RIGHT 2 LANES CLOSED<br>USE OTHER ROUTES | | |
| • *"Soft" diversion.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>BEFORE ROWLAND | USE<br>OTHER ROUTES | | |
| | RIGHT 2 LANES CLOSED<br>BEFORE ROWLAND<br>USE OTHER ROUTES | | | |
| • *Diversion to Type 2 Freeway Diversion Route.* | ACCIDENT<br>AT ROWLAND | RIGHT 2 LANES CLOSED<br>USE I-45 NORTH | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>AT ROWLAND | USE<br>I-45 NORTH | | |
| | RIGHT 2 LANES CLOSED<br>AT ROWLAND<br>USE I-45 NORTH | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>AT ROWLAND | USE I-45 NORTH<br>AVOID MAJOR DELAY | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Implied good reason for following Action message element (MAJOR ACCIDENT).*<br>• *No Lanes Closed message element.* | MAJOR ACCIDENT<br>AT ROWLAND | USE<br>I-45 NORTH | | |
| | MAJOR ACCIDENT<br>AT ROWLAND<br>USE I-45 NORTH | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (TRUCK ACCIDENT).*<br>• *No Lanes Closed message element.* | TRUCK ACCIDENT<br>AT ROWLAND | UTOPIA<br>USE I-45 NORTH | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM INCIDENT

**Table 11.2 DMS Message Examples for Lane Closure (Blockage) Incidents**
**DMS Relatively Far from Incident[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ACCIDENT" for Incident Descriptor message element.*<br>• *Incident (Blockage) Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | ACCIDENT<br>AT ROWLAND DR<br>1 LANE CLOSED | | ACCIDENT<br>AT<br>ROWLAND | RIGHT<br>LANE<br>CLOSED |
| • *"MAJOR ACCIDENT" for Incident Descriptor message element.* | MAJOR ACCIDENT<br>AT ROWLAND<br>3 LANES CLOSED | | | |
| • *"TRUCK ACCIDENT" for Incident Descriptor message element.* | TRUCK ACCIDENT<br>AT ROWLAND<br>3 LANES CLOSED | | | |
| • *Distance for Incident (Blockage) Location message element.*<br>• *No Action message element.* | ACCIDENT<br>1 MILE<br>2 LANES CLOSED | | ACCIDENT<br>1 MILE | 2 LANES<br>CLOSED |
| • *Highway name (number) for Incident (Blockage) Location message element.*<br>• *No Action message element.* | ACCIDENT<br>PAST I-610<br>2 LANES CLOSED | | ACCIDENT<br>PAST<br>I-610 | 2 LANES<br>CLOSED |
| • *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>PAST I-610 | | | |
| • *Action message element.*<br>• *No diversion.* | ACCIDENT<br>PAST ROWLAND | 2 LANES CLOSED<br>BE PREPARED TO STOP | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>PAST ROWLAND | BE PREPARED<br>TO STOP | | |
| | 2 LANES CLOSED<br>PAST ROWLAND<br>BE PREPARED TO STOP | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"Soft" diversion.* | ACCIDENT<br>BEFORE ROWLAND | 2 LANES CLOSED<br>USE OTHER ROUTES | | |
| • *"Soft" diversion.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>BEFORE ROWLAND | USE<br>OTHER ROUTES | | |
| | 2 LANES CLOSED<br>BEFORE ROWLAND<br>USE OTHER ROUTES | | | |
| • *Diversion to Type 2 Freeway Diversion Route.* | MAJOR ACCIDENT<br>AT ROWLAND | 2 LANES CLOSED<br>USE I-45 NORTH | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>AT ROWLAND | USE<br>I-45 NORTH | | |
| | 2 LANES CLOSED<br>AT ROWLAND<br>USE I-45 NORTH | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>AT ROWLAND | USE I-45 NORTH<br>AVOID MAJOR DELAY | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Implied good reason for following Action message element (MAJOR ACCIDENT).*<br>• *No Lanes Closed message element.* | MAJOR ACCIDENT<br>AT ROWLAND | USE<br>I-45 NORTH | | |
| | MAJOR ACCIDENT<br>AT ROWLAND<br>USE I-10 EAST | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (TRUCK ACCIDENT).*<br>• *No Lanes Closed message element.* | TRUCK ACCIDENT<br>AT BELTON RD | UTOPIA<br>USE I-30 EAST | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

## DMS ON DIFFERENT FREEWAY THAN INCIDENT

**Table 11.3 DMS Message Examples for Lane Closure (Blockage) Incidents DMS on Different Freeway than Incident[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ACCIDENT" for Incident Descriptor message element.*<br>• *Incident (Blockage) Location message element.*<br>• *No Lanes Closed message element.*<br>• *No Action message element.* | ACCIDENT<br>ON I-20 EAST<br>AT BELTON | | | |
| • *"MAJOR ACCIDENT for Incident Descriptor message element.* | MAJOR ACCIDENT<br>ON I-20 EAST<br>BEFORE BELTON | | | |
| • *"TRUCK ACCIDENT for Incident Descriptor message element.* | TRUCK ACCIDENT<br>ON I-20 EAST<br>BEFORE BELTON | | | |
| • *Highway name (number) for Incident (Blockage) Location message element.*<br>• *No Action message element.* | ACCIDENT<br>ON I-20 EAST<br>BEFORE I-635 | | | |
| • *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>ON I-20 EAST<br>BEFORE I-635 | | | |
| • *Action message element.*<br>• *No diversion.* | (Does not apply in this case.) | | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | (Does not apply in this case.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *“Soft” diversion.* | ACCIDENT<br>ON I-20 EAST<br>BEFORE BELTON | USE<br>OTHER ROUTES | | |
| • *“Soft” diversion.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2LANES CLOSED<br>ON I-20 EAST<br>BEFORE BELTON | USE<br>OTHER ROUTES | | |
| • *Diversion to Type 2 Freeway Diversion Route.* | ACCIDENT<br>ON I-20 EAST<br>BEFORE BELTON | USE<br>I-30 EAST | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>ON I-20 EAST<br>BEFORE BELTON | USE<br>I-30 EAST | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | (Requires a five-unit message.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Implied good reason for following Action message element (MAJOR ACCIDENT).*<br>• *No Lanes Closed message element.* | MAJOR ACCIDENT<br>ON I-20 EAST<br>BEFORE BELTON | USE<br>I-30 EAST | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (TRUCK ACCIDENT).*<br>• *No Lanes Closed message element.* | (Requires a five-unit message.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

# 11.3 INCIDENTS THAT REQUIRE CLOSING THE FREEWAY

## DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE CLOSURE

**Table 11.4 DMS Message Examples for Incidents that Require Closing the Freeway**
**DMS Close to Incident[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ACCIDENT" for Incident Descriptor message element.*<br>• *Incident (Blockage) Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | (Does not apply in this case.) | | | |
| • *"MAJOR ACCIDENT" for Incident Descriptor message element.*<br>• *Lanes Closed message element.*<br>• *Closure Location message element.*<br>• *No Action message element.* | MAJOR ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | | | |
| • *"TRUCK ACCIDENT" for Incident Descriptor message element.* | TRUCK ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | | | |
| • *Highway name (number) for Closure Location message element.*<br>• *No Action message element.* | MAJOR ACCIDENT<br>PAST I-610<br>ALL LANES CLOSED | | | |
| • *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>PAST I-610 | | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>AT RIVER RD | BE PREPARED<br>TO STOP | | |
| | FREEWAY CLOSED<br>AT RIVER RD<br>BE PREPARED TO STOP | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *Action message element.*<br>• *No diversion.* | MAJOR ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | BE PREPARED<br>TO STOP | | |
| • *"Soft" diversion.* | MAJOR ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | USE<br>OTHER ROUTES | | |
| • *"Soft" diversion.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>AT RIVER RD | USE<br>OTHER ROUTES | | |
| | FREEWAY CLOSED<br>AT RIVER RD<br>USE OTHER ROUTES | | | |
| • *Diversion to Type 2 Freeway Diversion Route.* | MAJOR ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | USE<br>I-10 WEST | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>AT RIVER RD | USE<br>I-10 WEST | | |
| | FREEWAY CLOSED<br>AT RIVER RD<br>USE I-10 WEST | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | (Good reason is implied by<br>ALL LANES CLOSED<br>in above message.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Implied good reason for following Action message element (MAJOR ACCIDENT).*<br>• *No Lanes Closed message element.* | MAJOR ACCIDENT<br>AT RIVER RD | USE<br>I-10 WEST | | |
| | MAJOR ACCIDENT<br>AT RIVER RD<br>USE I-10 WEST | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (TRUCK ACCIDENT).*<br>• *No Lanes Closed message element.* | TRUCK ACCIDENT<br>AT BELTON RD | UTOPIA<br>USE I-30 EAST | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.*<br>• *Implied good reason for following Action message element (ALL LANES CLOSED).* | FREEWAY CLOSED<br>AT BELTON RD | USE<br>I-30 EAST | | |
| | FREEWAY CLOSED<br>AT BELTON RD<br>USE I-30 EAST | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.*<br>• *Implied good reason for following Action message element (ALL LANES CLOSED).* | FREEWAY CLOSED<br>AT BELTON RD | UTOPIA<br>USE I-30 EAST | | |
| • *Diversion to Type 5 Diversion Route.* | MAJOR ACCIDENT<br>ALL LANES CLOSED | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| • *Diversion to Type 5 Diversion Route.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| | FREEWAY CLOSED<br>EXIT AT RIVER RD<br>FOLLOW DETOUR | | | |
| • *Diversion to Type 5 Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Combining Incident Descriptor and Lanes Closed message elements..* | (Good reason is implied by<br>FREEWAY CLOSED<br>in above message.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | **Phase 1** | **Phase 2** | **Phase 1** | **Phase 2** |
| • *Diversion to Type 5 Diversion Route.*<br>• *Implied good reason for following Action message element (MAJOR ACCIDENT).*<br>• *No Lanes Closed message element.* | MAJOR ACCIDENT<br>AT KENT | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| • *Diversion to Type 5 Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (TRUCK ACCIDENT).*<br>• *No Lanes Closed message element.* | TRUCK ACCIDENT<br>AT KENT | UTOPIA<br>EXIT AT RIVER RD | | |
| • *Diversion to Type 5 Diversion Route.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.*<br>• *Implied good reason for following Action message element (ALL LANES CLOSED).* | FREEWAY CLOSED | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| | FREEWAY CLOSED<br>EXIT AT RIVER RD<br>FOLLOW DETOUR | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM CLOSURE

**Table 11.5 DMS Message Examples for Incidents that Require Closing the Freeway**
**DMS Relatively Far from Incident[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ACCIDENT" for Incident Descriptor message element.*<br>• *Incident (Blockage) Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | (Does not apply in this case.) | | | |
| • *"MAJOR ACCIDENT" for Incident Descriptor message element.*<br>• *Lanes Closed message element.*<br>• *Closure Location message element.*<br>• *No Action message element.* | MAJOR ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | | | |
| • *"TRUCK ACCIDENT" for Incident Descriptor message element.* | TRUCK ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | | | |
| • *Highway name (number) for Closure Location message element.*<br>• *No Action message element.* | MAJOR ACCIDENT<br>PAST I-610<br>ALL LANES CLOSED | | | |
| • *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>PAST I-610 | | | |
| • *Action message element.*<br>• *No diversion.* | MAJOR ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | BE PREPARED<br>TO STOP | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>AT RIVER RD | BE PREPARED<br>TO STOP | | |
| | FREEWAY CLOSED<br>AT RIVER RD<br>BE PREPARED TO STOP | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"Soft" diversion.* | MAJOR ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | USE<br>OTHER ROUTES | | |
| • *"Soft" diversion.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>AT RIVER RD | USE<br>OTHER ROUTES | | |
| | FREEWAY CLOSED<br>AT RIVER RD<br>USE OTHER ROUTES | | | |
| • *Diversion to Type 2 Freeway Diversion Route.* | MAJOR ACCIDENT<br>AT RIVER RD<br>ALL LANES CLOSED | USE<br>I-10 WEST | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>AT RIVER RD | USE<br>I-10 WEST | | |
| | FREEWAY CLOSED<br>AT RIVER RD<br>USE I-10 WEST | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | (Good reason is implied by<br>FREEWAY CLOSED<br>in above message.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Implied good reason for following Action message element (MAJOR ACCIDENT).*<br>• *No Lanes Closed message element.* | MAJOR ACCIDENT<br>AT ROWLAND | USE<br>I-10 WEST | | |
| | MAJOR ACCIDENT<br>AT RIVER RD<br>USE I-10 WESTTH | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (TRUCK ACCIDENT).*<br>• *No Lanes Closed message element.* | TRUCK ACCIDENT<br>AT BELTON RD | UTOPIA<br>USE I-30 EAST | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.*<br>• *Implied good reason for following Action message element (ALL LANES CLOSED).* | FREEWAY CLOSED<br>AT BELTON RD | USE<br>I-30 EAST | | |
| | FREEWAY CLOSED<br>AT BELTON RD<br>USE I-30 EAST | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.*<br>• *Implied good reason for following Action message element (ALL LANES CLOSED).* | FREEWAY CLOSED<br>AT BETLTON RD | UTOPIA<br>USE I-30 EAST | | |
| • *Diversion to Type 5 Diversion Route.* | MAJOR ACCIDENT<br>ALL LANES CLOSED | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| • *Diversion to Type 5 Diversion Route.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| | FREEWAY CLOSED<br>EXIT AT RIVER RD<br>FOLLOW DETOUR | | | |
| • *Diversion to Type 5 Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | (Good reason is implied by<br>FREEWAY CLOSED<br>in above message.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *Diversion to Type 5 Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.* | (Good reason is implied by FREEWAY CLOSED in above message.) | | | |
| • *Diversion to Type 5 Diversion Route.*<br>• *Implied good reason for following Action message element (MAJOR ACCIDENT).*<br>• *No Lanes Closed message element.* | MAJOR ACCIDENT<br>AT ROWLAND | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| • *Diversion to Type 5 Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (TRUCK ACCIDENT).*<br>• *No Lanes Closed message element.* | TRUCK ACCIDENT<br>AT ROWLAND | UTOPIA<br>EXIT AT RIVER RD | | |
| • *Diversion to Type 5 Diversion Route.*<br>• *Combining Incident Descriptor and Lanes Closed message elements.*<br>• *Implied good reason for following Action message element (ALL LANES CLOSED).* | FREEWAY CLOSED | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| | FREEWAY CLOSED<br>EXIT AT RIVER RD<br>FOLLOW DETOUR | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

## DMS ON DIFFERENT FREEWAY THAN CLOSURE

**Table 11.6 DMS Message Examples for Incidents that Require Closing the Freeway
DMS on Different Freeway than Incident[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ACCIDENT" for Incident Descriptor message element.*<br>• *Incident (Blockage) Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | (Does not apply in this case.) | | | |
| • *"MAJOR ACCIDENT" for Incident Descriptor message element.*<br>• *Incident (Blockage) Location message element.*<br>• *No Lanes Closed message element.*<br>• *No Action message element.* | MAJOR ACCIDENT<br>ON I-20 EAST<br>BEFORE BELTON | | | |
| • *"TRUCK ACCIDENT" for Incident Descriptor message element.* | TRUCK ACCIDENT<br>ON I-20 EAST<br>BEFORE BELTON | | | |
| • *Highway name (number) for Closure Location message element.*<br>• *No Action message element.* | MAJOR ACCIDENT<br>ON I-20 EAST<br>PAST I-635 | | | |
| • *Combining Incident Descriptor and Closure Location message elements.* | I-20 EAST CLOSED<br>PAST I-635 | | | |
| • *Action message element.*<br>• *No diversion.* | (Does not apply in this case.) | | | |
| • *Action message element.*<br>• *No diversion*<br>• *Combining Incident Descriptor and Closure Location message elements.* | (Does not apply in this case.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"Soft" diversion.* | MAJOR ACCIDENT<br>ON I-20 EAST<br>PAST BELTON | USE<br>OTHER ROUTES | | |
| • *"Soft" diversion.*<br>• *Combining Incident Descriptor and Closure Location message elements.* | I-20 EAST CLOSED<br>PAST BELTON<br>USE OTHER ROUTES | | | |
| • *Diversion to Type 2 Freeway Diversion Route.* | MAJOR ACCIDENT<br>ON I-20 EAST<br>PAST BELTON | USE<br>I-30 EAST | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Combining Incident Descriptor and Closure Location message elements.* | I-20 EAST CLOSED<br>PAST BELTON<br>USE I-30 EAST | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Combining Incident Descriptor and Closure Location message elements.* | (Good reason is implied by<br>FREEWAY CLOSED<br>in above message.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Implied good reason for following Action message element (MAJOR ACCIDENT).*<br>• *No Lanes Closed message element.* | MAJOR ACCIDENT<br>ON I-20 WEST<br>PAST BELTON | USE<br>I-30 EAST | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (TRUCK ACCIDENT).*<br>• *No Lanes Closed message element.* | (Requires a five-unit message.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | **Phase 1** | **Phase 2** | **Phase 1** | **Phase 2** |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Combining Incident Descriptor and Closure Location message elements.*<br>• *Implied good reason for following Action message element (ALL LANES CLOSED).* | I-20 EAST CLOSED<br>PAST BELTON<br>USE 30 EAST | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Combining Incident Descriptor and Closure Location message elements.*<br>• *Implied good reason for following Action message element (ALL LANES CLOSED).* | I-20 EAST CLOSED<br>PAST BELTON | UTOPIA<br>USE I-30 EAST | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

# 11.4 LANE CLOSURES DURING ROADWORK

## DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE ROADWORK

**Table 11.7 DMS Message Examples for Lane Closures during Roadwork**
**DMS Close to Lane Closure[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ROADWORK" for Roadwork Descriptor message element.*<br>• *Lane Closure Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | ROADWORK<br>AT ROWLAND DR<br>RIGHT LANE CLOSED | | ROADWORK<br>AT<br>ROWLAND | RIGHT<br>LANE<br>CLOSED |
| • *Highway name (number) for Lane Closure Location message element.*<br>• *No Action message element.* | ROADWORK<br>PAST I-635<br>RIGHT 2 LANES CLOSED | | ROADWORK<br>PAST<br>I-635 | RIGHT 2<br>LANES<br>CLOSED |
| • *Replacing Roadwork Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>PAST I-635 | | | |
| • *Displaying the limits of the Lane Closure Location message element.*<br>• *Replacing Roadwork Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>FROM SPENCE<br>TO ROWLAND | | | |
| • *Action message element.*<br>• *No diversion.* | ROADWORK<br>PAST ROWLAND | RIGHT 2 LANES CLOSED<br>BE PREPARED TO STOP | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Replacing Lane Closure Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>PAST ROWLAND | BE PREPARED<br>TO STOP | | |
| | RIGHT 2 LANES CLOSED<br>PAST ROWLAND<br>BE PREPARED TO STOP | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"Soft" diversion.* | ROADWORK<br>BEFORE ROWLAND | RIGHT 2 LANES CLOSED<br>USE OTHER ROUTES | | |
| • *"Soft" diversion.*<br>• *Replacing Lane Closure Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>BEFORE ROWLAND | USE<br>OTHER ROUTES | | |
| | RIGHT 2 LANES CLOSED<br>BEFORE ROWLAND<br>USE OTHER ROUTES | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>AT ROWLAND | USE<br>I-45 NORTH | | |
| | RIGHT 2 LANES CLOSED<br>AT ROWLAND<br>USE I-45 NORTH | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>AT ROWLAND | USE I-45 NORTH<br>AVOID MAJOR DELAY | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (2 lanes closed).*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | RIGHT 2 LANES CLOSED<br>AT ROWLAND | UTOPIA<br>USE I-45 NORTH | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE ROADWORK

**Table 11.8 DMS Message Examples for Lane Closures during Roadwork**
**DMS Far Upstream of Lane Closure[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ROADWORK" for Roadwork Descriptor message element.*<br>• *Lane Closure Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | ROADWORK<br>AT ROWLAND DR<br>1 LANE CLOSED | | ROADWORK<br>AT<br>ROWLAND | 1 LANE<br>CLOSED |
| • *Highway name (number) for Lane Closure Location message element.*<br>• *No Action message element.* | ROADWORK<br>PAST I-635<br>2 LANES CLOSED | | ACCIDENT<br>PAST<br>I-635 | 2 LANES<br>CLOSED |
| • *Replacing Roadwork Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>PAST I-635 | | | |
| • *Displaying the limits of the Lane Closure Location message element.*<br>• *Replacing Roadwork Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>FROM SPENCE<br>TO ROWLAND | | | |
| • *Action message element.*<br>• *No diversion.* | ROADWORK<br>PAST ROWLAND | 2 LANES CLOSED<br>BE PREPARED TO STOP | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Replacing Lane Closure Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>PAST ROWLAND | BE PREPARED<br>TO STOP | | |
| | 2 LANES CLOSED<br>PAST ROWLAND<br>BE PREPARED TO STOP | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | **Phase 1** | **Phase 2** | **Phase 1** | **Phase 2** |
| • *"Soft" diversion.* | ROADWORK<br>BEFORE ROWLAND | 2 LANES CLOSED<br>USE OTHER ROUTES | | |
| • *"Soft" diversion.*<br>• *Replacing Lane Closure Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>BEFORE ROWLAND | USE<br>OTHER ROUTES | | |
| | 2 LANES CLOSED<br>BEFORE ROWLAND<br>USE OTHER ROUTES | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>AT ROWLAND | USE<br>I-45 NORTH | | |
| | 2 LANES CLOSED<br>AT ROWLAND<br>USE I-45 NORTH | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>AT ROWLAND | USE I-45 NORTH<br>AVOID MAJOR DELAY | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (2 lanes closed).*<br>• *Replacing Incident Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>AT ROWLAND | UTOPIA<br>USE I-45 NORTH | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

## DMS ON DIFFERENT FREEWAY THAN THE ROADWORK

**Table 11.9 DMS Message Examples for Lane Closures during Roadwork DMS on Different Freeway Than Lane Closure[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ROADWORK" for Roadwork Descriptor message element.*<br>• *Lane Closure Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | (Cannot be properly formatted on a three-line sign.) | | | |
| • *"ROADWORK" for Roadwork Descriptor message element.*<br>• *Lane Closure Location message element.*<br>• *No Action message element.* | ROADWORK<br>ON I-20 EAST<br>BEFORE BELTON | | | |
| • *Highway name (number) for Lane Closure Location message element.*<br>• *No Action message element.* | ROADWORK<br>ON I-20 EAST<br>BEFORE I-635 | | | |
| • *Replacing Roadwork Descriptor message element with Lanes Closed message element.* | 2 LANES CLOSED<br>ON I-20 EAST<br>BEFORE I-635 | | | |
| • *Displaying the limits of the Lane Closure Location message element.*<br>• *Replacing Roadwork Descriptor message element with Lanes Closed message element.* | (Cannot be properly formatted on a three-line sign.) | | | |
| • *Action message element.*<br>• *No diversion.* | (Does not apply in this case.) | | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Replacing Lane Closure Descriptor message element with Lanes Closed message element.* | (Does not apply in this case.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS Phase 1 | Large DMS Phase 2 | Portable DMS[B] Phase 1 | Portable DMS[B] Phase 2 |
|---|---|---|---|---|
| • *"Soft" diversion.* | (Requires a five-unit message.) | | | |
| • *"Soft" diversion.* • *Replacing Lane Closure Descriptor message element with Lanes Closed message element.* | (Cannot be properly formatted on a three-line sign.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.* • *Replacing Incident Descriptor message element with Lanes Closed message element.* | (Cannot be properly formatted on a three-line sign.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.* • *Good reason for following Action message element.* • *Replacing Incident Descriptor message element with Lanes Closed message element.* | (Requires a five-unit message.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.* • *Diversion message for specific audience.* • *Implied good reason for following Action message element (2 lanes closed).* • *Replacing Incident Descriptor message element with Lanes Closed message element.* | (Requires a five-unit message.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

# 11.5 ROADWORK REQUIRING TOTAL FREEWAY CLOSURE

## DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE CLOSURE

**Table 11.10 DMS Message Examples for Roadwork Requiring Total Freeway Closure**
**DMS Close to Closure[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ROADWORK" for Roadwork Descriptor message element.*<br>• *Lane Closure Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | ROADWORK<br>AT RIVER RD<br>ALL LANES CLOSED | | ROADWORK<br>AT<br>RIVER RD | ALL<br>LANES<br>CLOSED |
| • *Highway name (number) for Lane Closure Location message element.*<br>• *No Action message element.* | ROADWORK<br>PAST I-635<br>ALL LANES CLOSED | | ROADWORK<br>NEAR<br>I-287 | ALL<br>LANES<br>CLOSED |
| • *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>PAST I-635 | | | |
| • *Combining Roadwork Descriptor and Lanes Closed message elements.*<br>• *Replacing Roadwork Descriptor message element with Lanes Closed message element.* | FREEWAY CLOSED<br>FROM SPENCE<br>TO RIVER RD | | | |
| • *Action message element.* | ROADWORK<br>ALL LANES CLOSED | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| • *Action message element.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>EXIT AT RIVER RD<br>FOLLOW DETOUR | | | |
| • *Action message element.*<br>• *No diversion.* | (Does not apply in this case.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | **Phase 1** | **Phase 2** | **Phase 1** | **Phase 2** |
| • *"Soft" diversion.* | (Does not apply in this case.) | | | |
| • *"Soft" diversion.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | (Does not apply in this case.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | (Does not apply in this case.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | (Does not apply in this case.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (2 lanes closed).*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | (Does not apply in this case.) | | | |
| • *Diversion to Type 6 Detour Route.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>EXIT AT RIVER RD<br>FOLLOW DETOUR | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

## DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE CLOSURE

**Table 11.11 DMS Message Examples for Roadwork Requiring Total Freeway Closure**
**DMS Far from Closure[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ROADWORK" for Roadwork Descriptor message element.*<br>• *Lane Closure Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | ROADWORK<br>AT RIVER RD<br>ALL LANES CLOSED | | ROADWORK<br>AT<br>RIVER RD | ALL<br>LANES<br>CLOSED |
| • *Highway name (number) for Lane Closure Location message element.*<br>• *No Action message element.* | ROADWORK<br>PAST I-610<br>ALL LANES CLOSED | | ROADWORK<br>PAST<br>I-635 | ALL<br>LANES<br>CLOSED |
| • *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>PAST I-610 | | | |
| • *Combining Roadwork Descriptor and Lanes Closed message elements.*<br>• *Replacing Roadwork Descriptor message element with Lanes Closed message element.* | FREEWAY CLOSED<br>FROM SPENCE<br>TO RIVER RD | | | |
| • *Action message element.* | ROADWORK<br>ALL LANES CLOSED | EXIT AT RIVER RD<br>FOLLOW DETOUR | | |
| • *Action message element.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>EXIT AT RIVER RD<br>FOLLOW DETOUR | | | |
| • *Action message element.*<br>• *No diversion.* | (Does not apply in this case.) | | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | (Does not apply in this case.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"Soft" diversion.* | ROADWORK<br>BEFORE RIVER RD | ALL LANES CLOSED<br>USE OTHER ROUTES | | |
| • *"Soft" diversion.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>BEFORE RIVER RD | USE<br>OTHER ROUTES | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>AT RIVER RD | USE<br>I-10 WEST | | |
| | FREEWAY CLOSED<br>AT RIVER RD<br>USE I-10 WEST | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>AT RIVER RD | USE I-10 WEST<br>AVOID MAJOR DELAY | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (FREEWAY CLOSED).*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>AT RIVER RD | UTOPIA<br>USE I-10 WEST | | |
| • *Diversion to Type 6 Detour Route.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | FREEWAY CLOSED<br>EXIT AT RIVER RD<br>FOLLOW DETOUR | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

## DMS ON DIFFERENT FREEWAY THAN THE ROADWORK AND CLOSURE

**Table 11.12 DMS Message Examples for Roadwork Requiring Total Freeway Closure DMS on Different Highway[A]**

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"ROADWORK" for Roadwork Descriptor message element.*<br>• *Lane Closure Location message element.*<br>• *Lanes Closed message element.*<br>• *No Action message element.* | (Cannot be properly formatted on a three-line sign.) | | | |
| • *Highway name (number) for Lane Closure Location message element.*<br>• *No Action message element.* | (Cannot be properly formatted on a three-line sign.) | | | |
| • *Combining Roadwork Descriptor and Lanes Closed message elements.* | I-20 EAST CLOSED<br>PAST I-635 | | | |
| • *Combining Roadwork Descriptor and Lanes Closed message elements.*<br>• *Replacing Roadwork Descriptor message element with Lanes Closed message element.* | I-20 EAST CLOSED<br>FROM SPENCE<br>TO ROWLAND | | | |
| • *Action message element.* | (Requires a five-unit message.) | | | |
| • *Action message element.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | (Does not apply in this case.) | | | |
| • *Action message element.*<br>• *No diversion.* | (Does not apply in this case.) | | | |
| • *Action message element.*<br>• *No diversion.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | (Does not apply in this case.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

| Message Characteristics Highlights | Large DMS | | Portable DMS[B] | |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| • *"Soft" diversion.* | (Requires a five-unit message.) | | | |
| • *"Soft" diversion.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | I-20 EAST CLOSED<br>PAST BELTON<br>USE OTHER ROUTES | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | I-20 EAST CLOSED<br>PAST BELTON<br>USE I-30 EAST | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Good reason for following Action message element.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | (Cannot be properly formatted on a three-line sign.) | | | |
| • *Diversion to Type 2 Freeway Diversion Route.*<br>• *Diversion message for specific audience.*<br>• *Implied good reason for following Action message element (FREEWAY CLOSED).*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | I-20 EAST CLOSED<br>PAST BELTON | UTOPIA<br>USE I-30 EAST | | |
| • *Diversion to Type 6 Detour Route.*<br>• *Combining Roadwork Descriptor and Lanes Closed message elements.* | (Does not apply in this case.) | | | |

[A] Large DMS: 3 lines, 20 characters per line; Portable DMS: 3 lines, 8 characters per line. All messages are for operating speeds above 35 mph and thus are limited to 4 units of information.

[B] Blank cells indicate that the message cannot be displayed on a portable DMS.

# MODULE 12. MODIFYING MESSAGES TO IMPROVE EFFECTIVENESS

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# MODULE 12. MODIFYING MESSAGES TO IMPROVE EFFECTIVENESS

## 12.1 INTRODUCTION

Module 12 contains recommended improvements to several poorly designed DMS messages that the author has observed in different parts of the United States. Notes that highlight the reasons for the recommended changes to the observed messages are also provided.

It should be noted that in the examples given the freeway and highway numbers and names have been changed from the original.

## EXAMPLES OF IMPROVED MESSAGES FOR INCIDENTS

**Table 12.1 Incident Messages**

| Old Message | | Recommended Message* | | Notes |
|---|---|---|---|---|
| **First Phase** | **Second Phase** | **First Phase** | **Second Phase** | |
| ACCIDENT AHEAD<br>USE CAUTION | | ACCIDENT<br>AT [location] | | • It is best to give the location of the incident. Knowledge of the incident location is useful to motorists to make diversion and other driving decisions.<br>• ***AHEAD*** is redundant and need not be displayed because it is understood by motorists that the accident is ahead on the freeway. |
| ACCIDENT AHEAD<br>21ST STREET<br>USE CAUTION | | ACCIDENT<br>AT 21ST STREET<br>LEFT 2 LANES CLOSED | | • ***AT*** should be displayed before the location of the incident.<br>• Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay.<br>• Knowledge of which lanes are closed is useful to motorists to determine which lanes they should use to travel past the incident.<br>• ***AHEAD*** is redundant and need not be displayed because it is understood by motorists that the accident is ahead on the freeway. |
| ACCIDENT AHEAD<br>I-84<br>EXPECT DELAYS | | ACCIDENT<br>AT [*location*]<br>LEFT 2 LANES CLOSED | | • It is best to give the location of the incident rather than the information that the accident is on I-84. If the DMS is on I-84, it will be understood by motorists that the accident is on I-84 and it need not be displayed.<br>• Knowledge of the incident location is useful to motorists to make diversion and other driving decisions.<br>• Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay.<br>• Knowledge of which lanes are closed is useful to motorists to determine which lanes they should use to travel past the incident.<br>• ***AHEAD*** is redundant and need not be displayed because it is understood by motorists that the accident is ahead on I-84. |

* Assumes 3- or 4-line, 20 character per line DMS.

| Old Message | | Recommended Message* | | Notes |
|---|---|---|---|---|
| **First Phase** | **Second Phase** | **First Phase** | **Second Phase** | |
| ACCIDENT AHEAD<br>RIGHT LANES<br>USE CAUTION | | ACCIDENT<br>AT [location]<br>RIGHT 2 LANES CLOSED | | ● It is best to give the location of the incident rather than the information that the accident is ahead. Knowledge of the incident location is useful to motorists to make diversion and other driving decisions.<br>● Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay.<br>● ***AHEAD*** is redundant and need not be displayed because it is understood by motorists that the accident is ahead. |
| ACCIDENT AHEAD<br>ONE RIGHT LANE<br>OPEN | ACCIDENT AHEAD<br>BROOK BRIDGE<br>EXPECT DELAYS | ACCIDENT<br>AT BROOK BRIDGE<br>LEFT 2 LANES CLOSED | | ● The current message has five units of information and can be reduced to three units.<br>● Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay.<br>● Knowledge of which lanes are closed is useful to motorists to determine which lanes they should use to travel past the incident.<br>● ***AHEAD*** is redundant and need not be displayed because it is understood by motorists that the accident is ahead on the freeway. |
| ACCIDENT AHEAD<br>REDUCE SPEED<br>MERGE LEFT | RIGHT LANE<br>CLOSED AHEAD<br>DRIVE CAREFULLY | ACCIDENT<br>AT [*location*]<br>RIGHT LANE CLOSED | | ● The current message has five units of information and can be reduced to three units.<br>● It is best to give the location of the accident. Knowledge of the accident location is useful to motorists to make diversion and other driving decisions.<br>● Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay.<br>● ***AHEAD*** is redundant and need not be displayed because it is understood by motorists that the accident is ahead on the freeway.<br>● ***MERGE LEFT*** is redundant to ***RIGHT LANE CLOSED*** and can be omitted. |

| Old Message | | Recommended Message* | | Notes |
|---|---|---|---|---|
| **First Phase** | **Second Phase** | **First Phase** | **Second Phase** | |
| ALL LANES<br>CLOSED AHEAD<br>KEEP RIGHT | | FREEWAY CLOSED<br>EXIT AT[location]<br>FOLLOW DETOUR | | • ***FREEWAY CLOSED*** is used rather than ***ALL LANES CLOSED*** because it is shorter and means the same thing to motorists.<br>• Telling motorists where to exit is useful.<br>• Telling motorists to follow a detour that is set up because of the closure gives motorists the assurance that they will have positive guidance along the alternative route. |
| ACCIDENT<br>IH-84 EAST<br>AT ROWLAND | USE<br>ALTERNATE<br>ROUTES | ACCIDENT<br>AT ROWLAND<br>USE OTHER ROUTES | | • If the DMS is located on I-84 East, the accident is understood to be on I-84 East and it need not be displayed.<br>• ***OTHER*** is used rather than ***ALTERNATE*** because it is shorter and easier to read and will be understood by motorists. |
| | | ACCIDENT<br>ON I-84 EAST<br>AT ROWLAND | USE<br>OTHER<br>ROUTES | • If the DMS is located on a cross freeway to I-84 East, then ***ON I-84 EAST*** must be displayed.<br>• ***I-84*** should be used rather than ***IH-84***. Human factors research by TTI revealed that motorists do not understand "IH." |
| IH-84 EAST<br>ACCIDENT<br>AT ROWLAND | USE<br>ALTERNATE<br>ROUTES | ACCIDENT<br>AT ROWLAND<br>USE OTHER ROUTES | | • If the DMS is located on I-84 EAST, the accident is understood to be on I-84 EAST and it need not be displayed.<br>• The problem ***ACCIDENT*** should always be on the top line.<br>• ***OTHER*** is used rather than ***ALTERNATE*** because it is shorter and easier to read and will be understood by motorists. |
| IH-84 EAST<br>ACCIDENT<br>DOWNTOWN | TWO RIGHT<br>LANES<br>CLOSED | ACCIDENT<br>PAST DOWNTOWN<br>RIGHT 2 LANES CLOSED | | • If the DMS is located on I-84 East, the accident is understood to be on I-84 East and it need not be displayed.<br>• The problem ***ACCIDENT*** should always be on the top line.<br>• ***2*** should be used rather than ***TWO*** because it is shorter and more easily read by motorists.<br>• ***PAST*** is displayed in front of ***DOWNTOWN*** to reduce possibility of confusion as to the location of the accident. |

| Old Message | | Recommended Message* | | Notes |
|---|---|---|---|---|
| First Phase | Second Phase | First Phase | Second Phase | |
| IH-84 EB AT<br>ROWLAND<br>MAJOR ACCIDENT | | MAJOR ACCIDENT<br>AT ROWLAND<br>2 LANES CLOSED | | • The incident should be displayed on the top line followed by the location.<br>• The word ***AT*** should be separated from the first unit of information and be placed with the location of the incident (second unit of information). A message line should not contain portions of two different units of information.<br>• Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay.<br>• Human factors research conducted by TTI revealed that a large majority of Texas motorists do not understand the meaning of the abbreviation ***EB***. |
| IH-84 EAST<br>CLOSED AT<br>ROWLAND | USE<br>ALTERNATE<br>ROUTES | FREEWAY CLOSED<br>AT ROWLAND<br>USE OTHER ROUTES | | • ***FREEWAY*** is used rather than ***I-84 EAST*** because it is shorter and easier to read and is well understood to mean the freeway on which the motorist is traveling.<br>• The word ***CLOSED*** from the first unit of information should be separated from the word ***AT*** from the second unit of information. A message line should not contain portions of two different units of information.<br>• ***OTHER*** is used rather than ***ALTERNATE*** because it is shorter and easier to read. |
| IH-84 EB AT<br>ROWLAND<br>ACCIDENT | LEFT 2 LANES<br>CLOSED<br>EXPECT DELAY | ACCIDENT<br>AT ROWLAND<br>LEFT 2 LANES CLOSED | | • If the DMS is located on I-84 EAST, the accident is understood to be on I-84 EAST and it need not be displayed.<br>• The word ***AT*** should be separated from the first unit of information and be placed with the location of the incident (second unit of information). A message line should not contain portions of two different units of information.<br>• Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay.<br>• ***AHEAD*** is redundant and need not be displayed because it is understood by motorists that the accident is ahead on I-84.<br>• The abbreviation ***EB*** should not be used. Recent human factors studies conducted by TTI indicated that a large percentage of Texas motorists would not understand the abbreviation ***EB***.<br>• When two lanes are closed due to an accident, most motorists will ***EXPECT DELAYS***. Thus, it can be omitted. |

| Old Message | | Recommended Message* | | Notes |
|---|---|---|---|---|
| First Phase | Second Phase | First Phase | Second Phase | |
| IH-84 EB AT<br>ROWLAND<br>FREEWAY CLOSED | AVOID DELAY<br>USE<br>ALTERNATE ROUTES | FREEWAY CLOSED<br>AT ROWLAND<br>USE OTHER ROUTES | | • The current message has five units of information and can be reduced to three units.<br>• The incident should be displayed on the top line followed by the incident location.<br>• Human factors research conducted by TTI revealed that a large majority of Texas motorists do not understand the meaning of the abbreviation ***EB***.<br>• ***OTHER*** is used rather than ***ALTERNATE*** because it is shorter and easier to read and will be understood by motorists |
| FREEWAY CLOSED<br>AT ROWLAND<br>MAJOR ACCIDENT | ALL TRAFFIC<br>EXIT<br>ROWLAND | FREEWAY CLOSED<br>EXIT AT ROWLAND<br>USE SERVICE RD | | • The current message has five units of information and can be reduced to four units.<br>• ***FREEWAY CLOSED*** is used rather than ***MAJOR ACCIDENT*** because it represents the immediate problem the motorists will face.<br>• If the freeway is closed, the motorists will understand that ***ALL TRAFFIC*** must exit. The recommendation is to tell the motorists that they should ***EXIT AT WASHINGTON*** and then ***USE SERVICE ROAD*** to bypass the incident. |
| MAJOR ACCIDENT<br>AT ROWLAND<br>ON MAIN LANES | AVOID DELAY<br>USE<br>ALTERNATE ROUTE | MAJOR ACCIDENT<br>AT ROWLAND<br>USE OTHER ROUTES | | • Information that the accident is ***ON MAIN LANES*** will be understood by motorists and it need not be displayed.<br>• ***OTHER*** is used rather than ***ALTERNATE*** because it is shorter and easier to read.<br>• The motorist would assume that if told to use other routes the motorist would avoid delay. Thus ***AVOID DELAY*** need not be displayed. |
| MAJOR ACCIDENT AT<br>ROWLAND<br>CLEARED AT 5:10 | LEFT 2 LANES<br>CLOSED<br>EXPECT DELAY | MAJOR ACCIDENT<br>AT ROWALAND<br>CLEARED AT 5:10 | | • Conflicting information is given in the current message. The first message phase states that the accident was cleared at 5:10; the second phase states that two lanes are closed. The recommended message is based on the assumption that the former is true. |

## EXAMPLES OF IMPROVED MESSAGES FOR ROADWORK

**Table 12.2 Roadwork Messages**

| Old Message | | Recommended Message* | | Notes |
|---|---|---|---|---|
| **First Phase** | **Second Phase** | **First Phase** | **Second Phase** | |
| LEFT LANE<br>CLOSED AHEAD<br>EXPECT DELAY | | LEFT LANE CLOSED<br>AT [location]<br>EXPECT DELAY | | • It is best to give the location of the lane closure. Knowledge of the lane closure location is useful to motorists to make diversion and other driving decisions.<br>• ***AHEAD*** is redundant and need not be displayed because it is understood by motorists that the lane closure is ahead on the freeway. |
| RIGHT TWO LANES<br>CLOSED<br>KEEP LEFT | | RIGHT 2 LANES CLOSED<br>AT [location] | | • It is best to give the location of the lane closure. Knowledge of the lane closure location is useful to motorists to make diversion and other driving decisions.<br>• ***2*** should be used rather than ***TWO*** because it is shorter and more easily read by motorists.<br>• ***KEEP LEFT*** is redundant and need not be displayed. |
| IH 84 REDUCED<br>TO ONE LANE<br>AHEAD | RIVERSIDE TO<br>WOODWARD<br>EXPECT DELAY | 2 LANES CLOSED<br>FROM RIVERSIDE<br>TO WOODWARD | | • The current message has five units of information and can be reduced to three units.<br>• If the DMS is located on I-84, the lanes closures are understood to be on I-84 and it need not be displayed.<br>• Giving the limits of the lane closures as was done in the current message is an excellent means of informing motorists the extent of the closure and where they may return to the freeway should they decide to divert. |
| LANE CLOSURES<br>BEGIN TUESDAY<br>8 P.M. - 6 A.M. | LANE CLOSURES<br>TUES - THURS<br>8 P.M. - 6 A.M. | 1 LANE CLOSED<br>TUES - THURS<br>8 PM - 6 AM | | • The current message has two phases with only the middle line changing information between phases. Motorists may not notice the subtle change of only the middle line. The message can be reduced to a simple one-phase, three-unit message.<br>• ***TUES - THURS*** is more descriptive than ***BEGIN TUESDAY***. However, including it in the message would result in a five-unit message. |

* Assumes 3- or 4-line, 20 character per line DMS.

| Current Message | | Recommended Message* | | Notes |
|---|---|---|---|---|
| **First Phase** | **Second Phase** | **First Phase** | **Second Phase** | |
| LEFT TWO LANES<br>CLOSED AT ROWLAND<br>CONSIDER DETOUR | | LEFT 2 LANES CLOSED<br>AT ROWLAND<br>USE OTHER ROUTES | | • The word ***CLOSED*** in the first unit of information should be separated from the second unit of information and be placed with the problem (first unit of information). A message line should not contain portions of two different units of information.<br>• ***2*** should be used rather than ***TWO*** because it is shorter and more easily read by motorists.<br>• ***USE OTHER ROUTES*** is used rather than ***CONSIDER DETOUR***. DETOUR implies to motorists that positive guidance will be provided along a route in the form of trailblazers for motorists to follow around the incident and/or police control. |
| RIGHT TWO<br>LANES CLOSED<br>DOWNTOWN | | RIGHT 2 LANES<br>CLOSED<br>PAST DOWNTOWN | | • ***2*** should be used rather than ***TWO*** because it is shorter and more easily read by motorists.<br>• ***PAST*** is displayed in front of ***DOWNTOWN*** to reduce possibility of confusion as to the location of the lane closure. |
| CAUTION<br>INTERSTATE 84<br>EASTBOUND | RIGHT THREE<br>LANES CLOSED<br>AHEAD | 3 RIGHT LANES<br>CLOSED<br>AT [location] | | • This current message has five units of information that can be reduced to three units.<br>• If the DMS is located on I-84 East, the lane closures are understood to be on I-84 East and it need not be displayed.<br>• ***3*** should be used rather than ***THREE*** because it is shorter and more easily read by motorists.<br>• It is best to give the location of the lane closure. Knowledge of the lane closure location is useful to motorists to make diversion and other driving decisions.<br>• The long word ***INTERSTATE*** should not be used; instead, use ***I-***. |
| IH-84<br>EASTBOUND | RIGHT<br>THREE LANES<br>CLOSED | 3 RIGHT LANES<br>CLOSED<br>AT [location] | | • If the DMS is located on I-84 EAST, the lane closures are understood to be on I-84 EAST and it need not be displayed.<br>• ***3*** should be used rather than ***THREE*** because it is shorter and more easily read by motorists.<br>• It is best to give the location of the lane closure. Knowledge of the lane closure location is useful to motorists to make diversion and other driving decisions. |

| Current Message | | Recommended Message* | | Notes |
|---|---|---|---|---|
| **First Phase** | **Second Phase** | **First Phase** | **Second Phase** | |
| IH-84 EAST<br>DOWNTOWN<br>ROAD WORK | THRU TRAFFIC<br>USE LEFT<br>TWO LANES | ROADWORK<br>PAST DOWNTOWN | THRU TRAFFIC<br>USE<br>LEFT 2 LANES | • The problem, ***ROADWORK*** should be displayed on the first line.<br>• If the DMS is located on I-84 East, the roadwork is understood to be on I-84 East and it need not be displayed.<br>• ***2*** should be used rather than ***TWO*** because it is shorter and more easily read by motorists.<br>• The second message phase is reformatted slightly to enhance readability. |
| IH-84 EAST<br>ROAD WORK | AT<br>ROWLAND<br>ON RAMP | ROADWORK<br>AT ROWLAND<br>2 LANES CLOSED | | • The problem, ***ROADWORK*** should be displayed on the first line.<br>• Since the DMS is located on I-84 East, the roadwork is understood to be on I-84 East and it need not be displayed.<br>• ***2*** should be used rather than ***TWO*** because it is shorter and more easily read by motorists.<br>• The message should include the number of lanes that are closed. |
| US-65 SB EXIT<br>RAMP CLOSED<br>UNTIL DEC 1998 | DETOUR<br>US-59 NORTH<br>TO MUNSON | RAMP TO US-65 S<br>CLOSED | USE<br>US-65 NORTH<br>TO MUNSON | • The current message has six units of information and must be reduced to a maximum of four units. This is accomplished by omitting the least relevant unit of information, namely, ***UNTIL DEC 1998***. About six days prior to the opening of the ramp, the DMS can display the day of the week when the ramp will be open, if the agency desires.<br>• The abbreviation ***SB*** should not be used. Recent human factors studies conducted by TTI indicated that a large majority of motorists do not understand the meaning of the abbreviation ***SB***. |

# MODULE 13. PRIORITIES WHEN COMPETING MESSAGE NEEDS ARISE

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# MODULE 13. PRIORITIES WHEN COMPETING MESSAGE NEEDS ARISE

## 13.1 INTRODUCTION

Sometimes the DMS operator is faced with competing message needs when two or more events take place at the same time. For example, the DMS may contain a message about a downstream accident when a second accident occurs on the freeway. The DMS operator must decide which of the two accidents should be presented on the DMS because it is neither possible nor advisable to display information about two accidents. This Module is intended to provide information to help the DMS operator resolve the most common types of competing message needs that might arise.

## 13.2 BASIC MESSAGE PRIORITIES

There are a number of different combinations of events that can take place on the primary freeway, on intersecting freeways, and on freeways in an adjoining state. In general, the following priority principles shall apply:

- Messages about downstream lane closures (blockages) or full closures (blockages) on the primary freeway receive priority over events on downstream intersecting freeways or on freeways in other states, and

- Messages about lane closures (blockages) or full closures (blockages) on downstream intersecting freeways receive priority over events on freeways in other states.

## 13.3 COMMON TYPES OF COMPETING MESSAGE NEEDS

Competing DMS message needs for incidents that occur downstream of the DMS can be classified according to whether:

- Two events occur concurrently on the same freeway,

- One event occurs on the primary freeway and the second occurs concurrently on an intersecting freeway,

- One event occurs on the primary freeway and the second occurs concurrently on a connecting freeway in another state,

- Two events occur concurrently on an intersecting freeway, or

- One event occurs on an intersecting freeway and the second occurs concurrently on a connecting freeway in another state.

## 13.4 RESOLUTION OF COMMON TYPES OF COMPETING MESSAGE NEEDS

This section provides guidance to the DMS operator about the priority of information display when two concurrent events occur on the freeway(s) for each of the classifications given in Section 13.3.

**THE DMS MESSAGE PRIORITIES ASSUME:**

- **Motorists who travel past the DMS will be adversely affected by the incidents, and**
- **A high majority of motorists normally remain on the primary freeway rather than turning onto an intersecting freeway.**

In establishing the priorities in this section, it is assumed that incidents that occur on the freeways have a good chance of adversely affecting a large percentage of motorists on the freeways. For example, a major incident on an intersecting freeway may possibly have an adverse affect on motorists who will turn off the primary freeway onto the intersecting freeway. However, if the major incident is downstream (e.g., 10 miles) of the interchange, then the likelihood that the incident would affect motorists turning onto the intersecting freeway would greatly diminish. The DMS operator should consult with the TMC manager when the operator is uncertain about possible adverse affects to motorists on the primary freeway.

## TWO EVENTS OCCUR CONCURRENTLY ON THE SAME FREEWAY

### Major Accident with Another Event

The priorities of messages when a major accident occurs on the same freeway concurrently with another event are summarized in Tables 13.1 and 13.2.

**Table 13.1 Message Priority for Major Accidents That Occur UPSTREAM of Another Event**

| Major Accident Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream major accident |
| • Construction project | Upstream major accident |
| • Construction project with temporary lane closure(s) | Upstream major accident |
| • Disabled vehicle blocking a lane | Upstream major accident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream major accident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream major accident |
| • Maintenance operations with lane closure(s) | Upstream major accident |
| • Maintenance operations requiring total freeway closure | Upstream major accident |
| • Special event exit | Upstream major accident |
| • Adjoining state accident (Major) | Upstream major accident |
| • Adjoining state maintenance operations requiring total freeway closure | Upstream major accident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream major accident |

**Table 13.2 Message Priority for Major Accidents That Occur DOWNSTREAM of Another Event**

| Major Accident Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream major accident |
| • Construction project with temporary lane closure(s) | Downstream major accident |
| • Disabled vehicle blocking a lane | Downstream major accident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream major accident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Downstream major accident |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream major accident |

**Minor Accident with Another Event**

The priorities of messages when a minor accident occurs on the same freeway concurrently with another event are summarized in Tables 13.3 and 13.4.

**Table 13.3 Message Priority for Minor Accidents That Occur UPSTREAM of Another Event**

| Minor Accident Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream minor accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Upstream minor accident |
| • Construction project with temporary lane closure(s) | Upstream minor accident |
| • Disabled vehicle blocking a lane | Upstream minor accident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream minor accident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream minor accident |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream minor accident |
| • Adjoining state: Accident (Major) | Upstream minor accident |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream minor accident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream minor accident |

**Table 13.4 Message Priority for Minor Accidents That Occur DOWNSTREAM of Another Event**

| Minor Accident Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream minor accident |
| • Construction project with temporary lane closure(s) | Downstream minor accident |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Downstream minor accident |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream minor accident |

## Construction with Another Event

The priorities of messages when construction is on the same freeway concurrently with another event are summarized in Tables 13.5 and 13.6.

**Table 13.5 Message Priority for Construction UPSTREAM of Another Event**

| Construction Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Downstream minor accident |
| • Construction project | Upstream construction |
| • Construction project with temporary lane closure(s) | Downstream construction |
| • Disabled vehicle blocking a lane | Downstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Downstream maintenance |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Downstream special event exit |
| • Adjoining state: Accident (Major) | Adjoining state major accident |
| • Adjoining state: Maintenance operations requiring total freeway closure | Adjoining state maintenance |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Adjoining state incident |

**Table 13.6 Message Priority for Construction DOWNSTREAM of Another Event**

| Construction Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Upstream construction |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream special event exit |

### Construction with Temporary Lane Closure(s) with Another Event

The priorities of messages when a temporary lane closure in a construction project occurs on the same freeway concurrently with another event are summarized in Tables 13.7 and 13.8.

**Table 13.7  Message Priority for Construction with Temporary Lane Closure(s) UPSTREAM of Another Event**

| Construction with Temporary Lane Closure(s) Upstream of | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Downstream minor accident |
| • Construction project | Upstream construction |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Downstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream construction |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream construction |
| • Adjoining state: Accident (Major) | Upstream construction |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream construction |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream construction |

**Table 13.8  Message Priority for Construction with Temporary Lane Closure(s) DOWNSTREAM of Another Event**

| Construction with Temporary Lane Closure(s) Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream construction |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream special event exit |

## Disabled Vehicle with Another Event

The priorities of messages when a lane-blocking disabled vehicle is on the same freeway concurrently with another event are summarized in Tables 13.9 and 13.10.

**Table 13.9 Message Priority for Disabled Vehicles That Occur UPSTREAM of Another Event**

| Disabled Vehicle Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Upstream disabled vehicle |
| • Construction project | Upstream disabled vehicle |
| • Construction project with temporary lane closure(s) | Upstream disabled vehicle |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream disabled vehicle |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream disabled vehicle |
| • Adjoining state: Accident (Major) | Upstream disabled vehicle |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream disabled vehicle |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream disabled vehicle |

**Table 13.10 Message Priority for Disabled Vehicles That Occur DOWNSTREAM of Another Event**

| Disabled Vehicle Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream disabled vehicle |
| • Construction project with temporary lane closure(s) | Downstream disabled vehicle |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream disabled vehicle |

## Incident (Load Spill, Debris, etc.) Requiring a Lane Closure with Another Event

The priorities of messages when an incident (load spill, debris, etc.) requiring a lane closure occurs on the same freeway concurrently with another event are summarized in Tables 13.11 and 13.12.

**Table 13.11 Message Priority for Incidents Requiring Lane Closures That Occur UPSTREAM of Another Event**

| Incident Requiring Lane Closure Occurs Upstream of: | Give Message Priority to: |
|---|---|
| ● Accident (Major) | Downstream major accident |
| ● Accident (Minor) | Upstream incident |
| ● Construction project | Upstream incident |
| ● Construction project with temporary lane closure(s) | Upstream incident |
| ● Disabled vehicle blocking a lane | Upstream incident |
| ● Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| ● Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| ● Maintenance operations with lane closure(s) | Upstream incident |
| ● Maintenance operations requiring total freeway closure | Downstream maintenance |
| ● Special event exit | Upstream incident |
| ● Adjoining state: Accident (Major) | Upstream incident |
| ● Adjoining state: Maintenance operations requiring total freeway closure | Upstream incident |
| ● Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |

**Table 13.12 Message Priority for Incidents Requiring Lane Closures That Occur DOWNSTREAM of Another Event**

| Incident Requiring Lane Closure Occurs Downstream of: | Give Message Priority to: |
|---|---|
| ● Accident (Major) | Upstream major accident |
| ● Accident (Minor) | Upstream minor accident |
| ● Construction project | Downstream incident |
| ● Construction project with temporary lane closure(s) | Downstream incident |
| ● Disabled vehicle blocking a lane | Upstream disabled vehicle |
| ● Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| ● Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| ● Maintenance operations with lane closure(s) | Upstream maintenance |
| ● Maintenance operations requiring total freeway closure | Upstream maintenance |
| ● Special event exit | Downstream incident |

### Incidents (Load Spill, Debris, etc.) Requiring Total Freeway Closures with Another Event

The priorities of messages when an incident (load spill, debris, etc.) requiring total freeway closure occurs on the same freeway concurrently with another event are summarized in Tables 13.13 and 13.14.

**Table 13.13 Message Priority for Incidents Requiring Total Freeway Closures That Occur UPSTREAM of Another Event**

| Incident Requiring Total Freeway Closure Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream incident |
| • Accident (Minor) | Upstream incident |
| • Construction project | Upstream incident |
| • Construction project with temporary lane closure(s) | Upstream incident |
| • Disabled vehicle blocking a lane | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream incident |
| • Maintenance operations requiring total freeway closure | Upstream incident |
| • Special event exit | Upstream incident |
| • Adjoining state accident (Major) | Upstream incident |
| • Adjoining state maintenance operations requiring total freeway closure | Upstream incident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |

**Table 13.14 Message Priority for Incidents Requiring Total Freeway Closures That Occur DOWNSTREAM of Another Event**

| Incident Requiring Total Freeway Closure Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Downstream incident |
| • Construction project | Downstream incident |
| • Construction project with temporary lane closure(s) | Downstream incident |
| • Disabled vehicle blocking a lane | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Downstream incident |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream incident |

## Maintenance Operations with Lane Closure(s) with Another Event

The priorities of messages when maintenance operations with lane closure(s) take place on the same freeway concurrently with another event are summarized in Tables 13.15 and 13.16.

**Table 13.15 Message Priority for Maintenance Operations with Lane Closure(s) UPSTREAM of Another Event**

| Maintenance Operations with Lane Closure(s) Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Downstream minor accident |
| • Construction project | Upstream maintenance |
| • Construction project with temporary lane closure(s) | Upstream maintenance |
| • Disabled vehicle blocking a lane | Upstream maintenance |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream maintenance |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream maintenance |
| • Adjoining state: Accident (Major) | Upstream maintenance |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream maintenance |

**Table 13.16 Message Priority for Maintenance Operations with Lane Closure(s) DOWNSTREAM of Another Event**

| Maintenance Operations with Lane Closure(s) Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream maintenance |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream special event exit |

### Maintenance Operations Requiring Total Freeway Closures with Another Event

The priorities of messages when maintenance operations requiring total freeway closure take place on the same freeway concurrently with another event are summarized in Tables 13.17 and 13.18.

**Table 13.17 Message Priority for Maintenance Operations Requiring Total Freeway Closures That Occur UPSTREAM of Another Event**

| Maintenance Operations Requiring Total Freeway Closure Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream maintenance |
| • Accident (Minor) | Upstream maintenance |
| • Construction project | Upstream maintenance |
| • Construction project with temporary lane closure(s) | Upstream maintenance |
| • Disabled vehicle blocking a lane | Upstream maintenance |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream maintenance |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream maintenance |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream maintenance |
| • Adjoining state accident (Major) | Upstream maintenance |
| • Adjoining state maintenance operations requiring total freeway closure | Upstream maintenance |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream maintenance |

**Table 13.18 Message Priority for Maintenance Operations Requiring Total Freeway Closures That Occur DOWNSTREAM of Another Event**

| Maintenance Operations Requiring Total Freeway Closure Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Downstream maintenance |
| • Construction project | Downstream maintenance |
| • Construction project with temporary lane closure(s) | Downstream maintenance |
| • Disabled vehicle blocking a lane | Downstream maintenance |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream maintenance |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Downstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream maintenance |

## Special Event Exit with Another Event

The priorities of messages when special event traffic uses the same freeway concurrently with another event are summarized in Tables 13.19 and 13.20.

**Table 13.19 Message Priority for Special Event Exit UPSTREAM of Another Event**

| Special Event Exit Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Downstream minor accident |
| • Construction project | Upstream special event exit |
| • Construction project with temporary lane closure(s) | Upstream special event exit |
| • Disabled vehicle blocking a lane | Downstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream special event exit |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream special event exit |
| • Adjoining state: Accident (Major) | Upstream special event exit |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream special event exit |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream special event exit |

**Table 13.20 Message Priority for Special Event Exit DOWNSTREAM of Another Event**

| Special Event Exit) Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream special event exit |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream special event exit |

## ONE EVENT OCCURS ON THE PRIMARY FREEWAY AND THE SECOND OCCURS CONCURRENTLY ON AN INTERSECTING FREEWAY

The DMS message priorities when an event occurs on the primary freeway and a second event occurs concurrently on an intersecting freeway will be dictated by the following:

- Whether the intersecting freeway is upstream or downstream of the event that occurs on the primary freeway, and

- The distances the events on the primary freeway and the intersecting freeway are from the DMS.

Message priorities for incidents that occur on the primary freeway upstream of an intersecting freeway that also experiences an incident have been established and are summarized in the tables that follow.

**USE THE TABLES BELOW:**
- **When an incident occurs concurrently on the primary freeway and on an intersecting freeway that is <u>downstream</u> of the primary freeway incident.**

**CONSULT THE TMC MANAGER:**
- **When an incident occurs concurrently on the primary freeway and on an intersecting freeway that is <u>upstream</u> of the primary freeway incident.**

Because of the wide variety of issues involved, it is not possible to specify a single set of priorities for incidents that occur on the primary freeway downstream of an intersecting freeway that concurrently experiences an incident. Message priority in these latter cases will be dictated by the relative location that the incidents are from the DMS and the likelihood that the incidents will affect motorists who read the DMS message. Priority will be set separately for each case. The DMS operator should consult the TMC manager whenever concurrent events occur on both the primary freeway and on an upstream intersecting freeway.

## Major Accident on the Primary Freeway with Another Event on an Intersecting Freeway

The priorities of messages when a major accident occurs on the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.21.

**Table 13.21 Message Priority for Major Accidents That Occur on the Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Major Accident Occurs on Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | PF major accident |
| • Accident (Minor) | PF major accident |
| • Construction project | PF major accident |
| • Construction project with temporary lane closure(s) | PF major accident |
| • Disabled vehicle blocking a lane | PF major accident |
| • Incident (Load spill, debris, etc.) requiring lane closure | PF major accident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | PF major accident |
| • Maintenance operations with lane closure(s) | PF major accident |
| • Maintenance operations requiring total freeway closure | PF major accident |
| • Special event exit | PF major accident |
| • Adjoining state accident (Major) | PF major accident |
| • Adjoining state maintenance operations requiring total freeway closure | PF major accident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | PF major accident |

[A] PF = Primary Freeway.

## Minor Accident on the Primary Freeway with Another Event on an Intersecting Freeway

The priorities of messages when a minor accident occurs on the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.22.

**Table 13.22 Message Priority for Minor Accidents That Occur on the Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Minor Accident Occurs on Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | PF minor accident |
| • Accident (Minor) | PF minor accident |
| • Construction project | PF minor accident |
| • Construction project with temporary lane closure(s) | PF minor accident |
| • Disabled vehicle blocking a lane | PF minor accident |
| • Incident (Load spill, debris, etc.) requiring lane closure | PF minor accident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | PF minor accident |
| • Maintenance operations with lane closure(s) | PF minor accident |
| • Maintenance operations requiring total freeway closure | PF minor accident |
| • Special event exit | PF minor accident |
| • Adjoining state accident (Major) | PF minor accident |
| • Adjoining state maintenance operations requiring total freeway closure | PF minor accident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | PF minor accident |

[A] PF = Primary Freeway.

## Construction on the Primary Freeway with Another Event on an Intersecting Freeway

The priorities of messages when construction occurs on the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.23.

**Table 13.23 Message Priority for Construction on the Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Construction on Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | *Check with TMC manager* |
| • Accident (Minor) | *Check with TMC manager* |
| • Construction project | PF construction |
| • Construction project with temporary lane closure(s) | *Check with TMC manager* |
| • Disabled vehicle blocking a lane | *Check with TMC manager* |
| • Incident (Load spill, debris, etc.) requiring lane closure | *Check with TMC manager* |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | *Check with TMC manager* |
| • Maintenance operations with lane closure(s) | *Check with TMC manager* |
| • Maintenance operations requiring total freeway closure | *Check with TMC manager* |
| • Special event exit | *Check with TMC manager* |
| • Adjoining state accident (Major) | AS major accident |
| • Adjoining state maintenance operations requiring total freeway closure | AS maintenance |
| • Adjoining state load spill requiring total freeway closure | AS incident |

[A] PF = Primary Freeway; AS = Adjoining State.

## Construction with Temporary Lane Closure(s) on the Primary Freeway with Another Event on an Intersecting Freeway

The priorities of messages when construction with a temporary lane closure occurs on the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.24.

**Table 13.24 Message Priority for Construction with Temporary Lane Closure(s) on the Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Construction with a Temporary Lane Closure on the Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | PF construction |
| • Accident (Minor) | PF construction |
| • Construction project | PF construction |
| • Construction project with temporary lane closure(s) | PF construction |
| • Disabled vehicle blocking a lane | PF construction |
| • Incident (Load spill, debris, etc.) requiring lane closure | PF construction |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | PF construction |
| • Maintenance operations with lane closure(s) | PF construction |
| • Maintenance operations requiring total freeway closure | PF construction |
| • Special event exit | PF construction |
| • Adjoining state accident (Major) | PF construction |
| • Adjoining state maintenance operations requiring total freeway closure | PF construction |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | PF construction |

[A] PF = Primary Freeway.

### Disabled Vehicle on the Primary Freeway with Another Event on an Intersecting Freeway

The priorities of messages when a lane-blocking incident occurs on the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.25.

**Table 13.25 Message Priority for Disabled Vehicles on the Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Disabled Vehicle on the Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | PF disabled vehicle |
| • Accident (Minor) | PF disabled vehicle |
| • Construction project | PF disabled vehicle |
| • Construction project with temporary lane closure(s) | PF disabled vehicle |
| • Disabled vehicle blocking a lane | PF disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | PF disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | PF disabled vehicle |
| • Maintenance operations with lane closure(s) | PF disabled vehicle |
| • Maintenance operations requiring total freeway closure | PF disabled vehicle |
| • Special event exit | PF disabled vehicle |
| • Adjoining state accident (Major) | PF disabled vehicle |
| • Adjoining state maintenance operations requiring total freeway closure | PF disabled vehicle |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | PF disabled vehicle |

[A] PF = Primary Freeway.

## Incident (Load Spill, Debris, etc.) Requiring a Lane Closure on the Primary Freeway with Another Event on an Intersecting Freeway

The priorities of messages when an incident (load spill, debris, etc.) requiring a lane occurs on the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.26.

**Table 13.26 Message Priority for Incidents Requiring Lane Closures on Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Incidents Requiring Lane Closure on Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | PF incident |
| • Accident (Minor) | PF incident |
| • Construction project | PF incident |
| • Construction project with temporary lane closure(s) | PF incident |
| • Disabled vehicle blocking a lane | PF incident |
| • Incident (Load spill, debris, etc.) requiring lane closure | PF incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | PF incident |
| • Maintenance operations with lane closure(s) | PF incident |
| • Maintenance operations requiring total freeway closure | PF incident |
| • Special event exit | PF incident |
| • Adjoining state accident (Major) | PF incident |
| • Adjoining state maintenance operations requiring total freeway closure | PF incident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | PF incident |

[A] PF = Primary Freeway.

**Incident (Load Spill, Debris, etc.) Requiring Total Closure of the Primary Freeway with Another Event on an Intersecting Freeway**

The priorities of messages when an incident (load spill, debris, etc.) occurs requiring total closure of the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.27.

**Table 13.27 Message Priority for Incidents Requiring Total Closure of Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Incidents Requiring Total Closure of Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | PF incident |
| • Accident (Minor) | PF incident |
| • Construction project | PF incident |
| • Construction project with temporary lane closure(s) | PF incident |
| • Disabled vehicle blocking a lane | PF incident |
| • Incident (Load spill, debris, etc.) requiring lane closure | PF incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | PF incident |
| • Maintenance operations with lane closure(s) | PF incident |
| • Maintenance operations requiring total freeway closure | PF incident |
| • Special event exit | PF incident |
| • Adjoining state accident (Major) | PF incident |
| • Adjoining state maintenance operations requiring total freeway closure | PF incident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | PF incident |

[A] PF = Primary Freeway.

## Maintenance Operations Requiring a Lane Closure on the Primary Freeway with Another Event on an Intersecting Freeway

The priorities of messages when maintenance operations requiring a lane closure take place on the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.28.

**Table 13.28 Message Priority for Maintenance Operations Requiring Lane Closures on Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Maintenance Operations Requiring Lane Closure on Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | PF maintenance |
| • Accident (Minor) | PF maintenance |
| • Construction project | PF maintenance |
| • Construction project with temporary lane closure(s) | PF maintenance |
| • Disabled vehicle blocking a lane | PF maintenance |
| • Incident (Load spill, debris, etc.) requiring lane closure | PF maintenance |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | PF maintenance |
| • Maintenance operations with lane closure(s) | PF maintenance |
| • Maintenance operations requiring total freeway closure | PF maintenance |
| • Special event exit | PF maintenance |
| • Adjoining state accident (Major) | PF maintenance |
| • Adjoining state maintenance operations requiring total freeway closure | PF maintenance |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | PF maintenance |

[A] PF = Primary Freeway.

### Maintenance Operations Requiring Total Closure of the Primary Freeway with Another Event on an Intersecting Freeway

The priorities of messages when maintenance operations requiring total closure take place on the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.29.

**Table 13.29 Message Priority for Maintenance Operations Requiring Total Closure of Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Maintenance Operations Requiring Total Closure of Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | PF maintenance |
| • Accident (Minor) | PF maintenance |
| • Construction project | PF maintenance |
| • Construction project with temporary lane closure(s) | PF maintenance |
| • Disabled vehicle blocking a lane | PF maintenance |
| • Incident (Load spill, debris, etc.) requiring lane closure | PF maintenance |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | PF maintenance |
| • Maintenance operations with lane closure(s) | PF maintenance |
| • Maintenance operations requiring total freeway closure | PF maintenance |
| • Special event exit | PF maintenance |
| • Adjoining state accident (Major) | PF maintenance |
| • Adjoining state maintenance operations requiring total freeway closure | PF maintenance |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | PF maintenance |

[A] PF = Primary Freeway.

## Special Event Exit on the Primary Freeway with Another Event on an Intersecting Freeway

The priorities of messages when maintenance operations requiring total closure take place on the primary freeway concurrently with another event on an intersecting freeway that is UPSTREAM of the primary freeway incident are summarized in Table 13.30.

**Table 13.30 Message Priority for Special Event Exit on the Primary Freeway UPSTREAM of an Intersecting Freeway Experiencing Another Event**

| Special Event Exit on Primary Freeway Upstream of an Intersecting Freeway Experiencing the Following Event: | Give Message Priority to:[A] |
|---|---|
| • Accident (Major) | PF special event exit |
| • Accident (Minor) | PF special event exit |
| • Construction project | PF special event exit |
| • Construction project with temporary lane closure(s) | PF special event exit |
| • Disabled vehicle blocking a lane | PF special event exit |
| • Incident (Load spill, debris, etc.) requiring lane closure | PF special event exit |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | PF special event exit |
| • Maintenance operations with lane closure(s) | PF special event exit |
| • Maintenance operations requiring total freeway closure | PF special event exit |
| • Special event exit | PF special event exit |
| • Adjoining state accident (Major) | PF special event exit |
| • Adjoining state maintenance operations requiring total freeway closure | PF special event exit |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | PF special event exit |

[A] PF = Primary Freeway.

## ONE EVENT OCCURS ON THE PRIMARY FREEWAY AND THE SECOND OCCURS CONCURRENTLY ON A CONNECTING FREEWAY IN ANOTHER STATE

Whenever there is a need to display a message for an event on the primary freeway in Texas, it should receive priority over any request for messages to inform motorists of major incidents on a connecting freeway in another state.

## TWO EVENTS OCCUR CONCURRENTLY ON AN INTERSECTING FREEWAY

### Major Accident with Another Event

The priorities of messages when a major accident occurs on the same intersecting freeway concurrently with another event are summarized in Tables 13.31 and 13.32.

**Table 13.31 Message Priority for Major Accidents That Occur UPSTREAM of Another Event**

| Major Accident Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream major accident |
| • Construction project | Upstream major accident |
| • Construction project with temporary lane closure(s) | Upstream major accident |
| • Disabled vehicle blocking a lane | Upstream major accident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream major accident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream major accident |
| • Maintenance operations with lane closure(s) | Upstream major accident |
| • Maintenance operations requiring total freeway closure | Upstream major accident |
| • Special event exit | Upstream major accident |
| • Adjoining state accident (Major) | Upstream major accident |
| • Adjoining state maintenance operations requiring total freeway closure | Upstream major accident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream major accident |

**Table 13.32 Message Priority for Major Accidents That Occur DOWNSTREAM of Another Event**

| Major Accident Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream major accident |
| • Construction project with temporary lane closure(s) | Downstream major accident |
| • Disabled vehicle blocking a lane | Downstream major accident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream major accident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Downstream major accident |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream major accident |

### Minor Accident with Another Event

The priorities of messages when a minor accident occurs on the same intersecting freeway concurrently with another event are summarized in Tables 13.33 and 13.34.

**Table 13.33 Message Priority for Minor Accidents That Occur UPSTREAM of Another Event**

| Minor Accident Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream minor accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Upstream minor accident |
| • Construction project with temporary lane closure(s) | Upstream minor accident |
| • Disabled vehicle blocking a lane | Upstream minor accident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream minor accident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream minor accident |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream minor accident |
| • Adjoining state: Accident (Major) | Upstream minor accident |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream minor accident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream minor accident |

**Table 13.34 Message Priority for Minor Accidents That Occur DOWNSTREAM of Another Event**

| Minor Accident Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream minor accident |
| • Construction project with temporary lane closure(s) | Downstream minor accident |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Downstream minor accident |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream minor accident |

### Construction with Another Event

The priorities of messages when construction is on the same intersecting freeway concurrently with another event are summarized in Tables 13.35 and 13.36.

**Table 13.35 Message Priority for Construction UPSTREAM of Another Event**

| Construction Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Downstream minor accident |
| • Construction project | Upstream construction |
| • Construction project with temporary lane closure(s) | Downstream construction |
| • Disabled vehicle blocking a lane | Downstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Downstream maintenance |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Downstream special event exit |
| • Adjoining state: Accident (Major) | Adjoining state major accident |
| • Adjoining state: Maintenance operations requiring total freeway closure | Adjoining state maintenance |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Adjoining state incident |

**Table 13.36 Message Priority for Construction DOWNSTREAM of Another Event**

| Construction Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Upstream construction |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream special event exit |

### Construction with Temporary Lane Closure(s) with Another Event

The priorities of messages when a temporary lane closure in a construction project occurs on the same intersecting freeway concurrently with another event are summarized in Tables 13.37 and 13.38.

**Table 13.37 Message Priority for Construction with Temporary Lane Closure(s) UPSTREAM of Another Event**

| Construction with Temporary Lane Closure(s) Upstream of | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Downstream minor accident |
| • Construction project | Upstream construction |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Downstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream construction |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream construction |
| • Adjoining state: Accident (Major) | Upstream construction |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream construction |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream construction |

**Table 13.38 Message Priority for Construction with Temporary Lane Closure(s) DOWNSTREAM of Another Event**

| Construction with Temporary Lane Closure(s) Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream construction |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream special event exit |

## Disabled Vehicle with Another Event

The priorities of messages when a lane-blocking disabled vehicle is on the same intersecting freeway concurrently with another event are summarized in Tables 13.39 and 13.40.

**Table 13.39 Message Priority for Disabled Vehicles That Occur UPSTREAM of Another Event**

| Disabled Vehicle Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Upstream disabled vehicle |
| • Construction project | Upstream disabled vehicle |
| • Construction project with temporary lane closure(s) | Upstream disabled vehicle |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream disabled vehicle |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream disabled vehicle |
| • Adjoining state: Accident (Major) | Upstream disabled vehicle |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream disabled vehicle |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream disabled vehicle |

**Table 13.40 Message Priority for Disabled Vehicles That Occur DOWNSTREAM of Another Event**

| Disabled Vehicle Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream disabled vehicle |
| • Construction project with temporary lane closure(s) | Downstream disabled vehicle |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream disabled vehicle |

## Incident (Load Spill, Debris, etc.) Requiring a Lane Closure with Another Event

The priorities of messages when an incident (load spill, debris, etc.) requiring a lane closure occurs on the same intersecting freeway concurrently with another event are summarized in Tables 13.41 and 13.42.

**Table 13.41 Message Priority for Incidents Requiring Lane Closures That Occur UPSTREAM of Another Event**

| Incident Requiring Lane Closure Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Upstream incident |
| • Construction project | Upstream incident |
| • Construction project with temporary lane closure(s) | Upstream incident |
| • Disabled vehicle blocking a lane | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream disabled vehicle |
| • Maintenance operations requiring total freeway closure | Upstream incident |
| • Special event exit | Upstream incident |
| • Adjoining state: Accident (Major) | Upstream incident |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream incident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |

**Table 13.42 Message Priority for Incidents Requiring Lane Closures That Occur DOWNSTREAM of Another Event**

| Incident Requiring Lane Closure Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream incident |
| • Construction project with temporary lane closure(s) | Downstream incident |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream incident |

### Incidents (Load Spill, Debris, etc.) Requiring Total Freeway Closure with Another Event

The priorities of messages when an incident (load spill, debris, etc.) requiring total freeway closure occurs on the same intersecting freeway concurrently with another event are summarized in Tables 13.43 and 13.44.

**Table 13.43 Message Priority for Incidents Requiring Total Freeway Closures That Occur UPSTREAM of Another Event**

| Incident Requiring Total Freeway Closure Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream incident |
| • Accident (Minor) | Upstream incident |
| • Construction project | Upstream incident |
| • Construction project with temporary lane closure(s) | Upstream incident |
| • Disabled vehicle blocking a lane | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream incident |
| • Maintenance operations requiring total freeway closure | Upstream incident |
| • Special event exit | Upstream incident |
| • Adjoining state accident (Major) | Upstream incident |
| • Adjoining state maintenance operations requiring total freeway closure | Upstream incident |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |

**Table 13.44 Message Priority for Incidents Requiring Total Freeway Closures That Occur DOWNSTREAM of Another Event**

| Incident Requiring Total Freeway Closure Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Downstream incident |
| • Construction project | Downstream incident |
| • Construction project with temporary lane closure(s) | Downstream incident |
| • Disabled vehicle blocking a lane | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Downstream incident |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream incident |

### Maintenance Operations with Lane Closure(s) with Another Event

The priorities of messages when maintenance operations with lane closure(s) take place on the same intersecting freeway concurrently with another event are summarized in Tables 13.45 and 13.46.

**Table 13.45 Message Priority for Maintenance Operations with Lane Closure(s) UPSTREAM of Another Event**

| Maintenance Operations with Lane Closure(s) Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Downstream minor accident |
| • Construction project | Upstream maintenance |
| • Construction project with temporary lane closure(s) | Upstream maintenance |
| • Disabled vehicle blocking a lane | Upstream maintenance |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream maintenance |
| • Adjoining state: Accident (Major) | Upstream maintenance |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream maintenance |

**Table 13.46 Message Priority for Maintenance Operations with Lane Closure(s) DOWNSTREAM of Another Event**

| Maintenance Operations with Lane Closure(s) Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream maintenance |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream special event exit |

### Maintenance Operations Requiring Total Freeway Closure with Another Event

The priorities of messages when maintenance operations requiring total freeway closure take place on the same intersecting freeway concurrently with another event are summarized in Tables 13.47 and 13.48.

**Table 13.47 Message Priority for Maintenance Operations Requiring Total Freeway Closures That Occur UPSTREAM of Another Event**

| Maintenance Operations Requiring Total Freeway Closure Occurs Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream maintenance |
| • Accident (Minor) | Upstream maintenance |
| • Construction project | Upstream maintenance |
| • Construction project with temporary lane closure(s) | Upstream maintenance |
| • Disabled vehicle blocking a lane | Upstream maintenance |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream maintenance |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream maintenance |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream maintenance |
| • Adjoining state accident (Major) | Upstream maintenance |
| • Adjoining state maintenance operations requiring total freeway closure | Upstream maintenance |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream maintenance |

**Table 13.48 Message Priority for Maintenance Operations Requiring Total Freeway Closures That Occur DOWNSTREAM of Another Event**

| Maintenance Operations Requiring Total Freeway Closure Occurs Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Downstream maintenance |
| • Construction project | Downstream maintenance |
| • Construction project with temporary lane closure(s) | Downstream maintenance |
| • Disabled vehicle blocking a lane | Downstream maintenance |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream maintenance |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Downstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Downstream maintenance |

## Special Event Exit with Another Event

The priorities of messages when special event traffic uses the same intersecting freeway concurrently with another event are summarized in Tables 13.49 and 13.50.

**Table 13.49 Message Priority for Special Event Exit UPSTREAM of Another Event**

| Special Event Exit Upstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Downstream major accident |
| • Accident (Minor) | Downstream minor accident |
| • Construction project | Upstream special event exit |
| • Construction project with temporary lane closure(s) | Upstream special event exit |
| • Disabled vehicle blocking a lane | Downstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Downstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Downstream incident |
| • Maintenance operations with lane closure(s) | Upstream special event exit |
| • Maintenance operations requiring total freeway closure | Downstream maintenance |
| • Special event exit | Upstream special event exit |
| • Adjoining state: Accident (Major) | Upstream special event exit |
| • Adjoining state: Maintenance operations requiring total freeway closure | Upstream special event exit |
| • Adjoining state incident (Load spill, debris, etc.) requiring total freeway closure | Upstream special event exit |

**Table 13.50 Message Priority for Special Event Exit DOWNSTREAM of Another Event**

| Special Event Exit) Downstream of: | Give Message Priority to: |
|---|---|
| • Accident (Major) | Upstream major accident |
| • Accident (Minor) | Upstream minor accident |
| • Construction project | Downstream special event exit |
| • Construction project with temporary lane closure(s) | Upstream construction |
| • Disabled vehicle blocking a lane | Upstream disabled vehicle |
| • Incident (Load spill, debris, etc.) requiring lane closure | Upstream incident |
| • Incident (Load spill, debris, etc.) requiring total freeway closure | Upstream incident |
| • Maintenance operations with lane closure(s) | Upstream maintenance |
| • Maintenance operations requiring total freeway closure | Upstream maintenance |
| • Special event exit | Upstream special event exit |

## ONE EVENT OCCURS ON AN INTERSECTING FREEWAY AND THE SECOND OCCURS CONCURRENTLY ON A CONNECTING FREEWAY IN ANOTHER STATE

Whenever there is a need to display a message for an event on an intersecting freeway in Texas, it should receive priority over any request for messages to inform motorists of major incidents on a connecting freeway in another state.

# MODULE 14. MESSAGE DESIGN EXAMPLES FOR INCIDENTS: LARGE DMSs

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# MODULE 14. DMS MESSAGE DESIGN EXAMPLES FOR INCIDENTS: LARGE DMSs

## 14.1 OBJECTIVES AND SUMMARY

The objectives of Module 14 are to illustrate the:

- DMS message design process that is detailed in Module 9 for incidents, and
- Application of several design principles for messages displayed on large DMSs.

## 14.2 INCIDENT EXAMPLES: ALL LANES ARE CLOSED

After their arrival, the police will close the freeway and in cooperation with the Emergency Incident Response Team will set up a diversion (detour) route. The location of the crash, DMSs, and diversion (detour) route are shown in Figure 14.1.

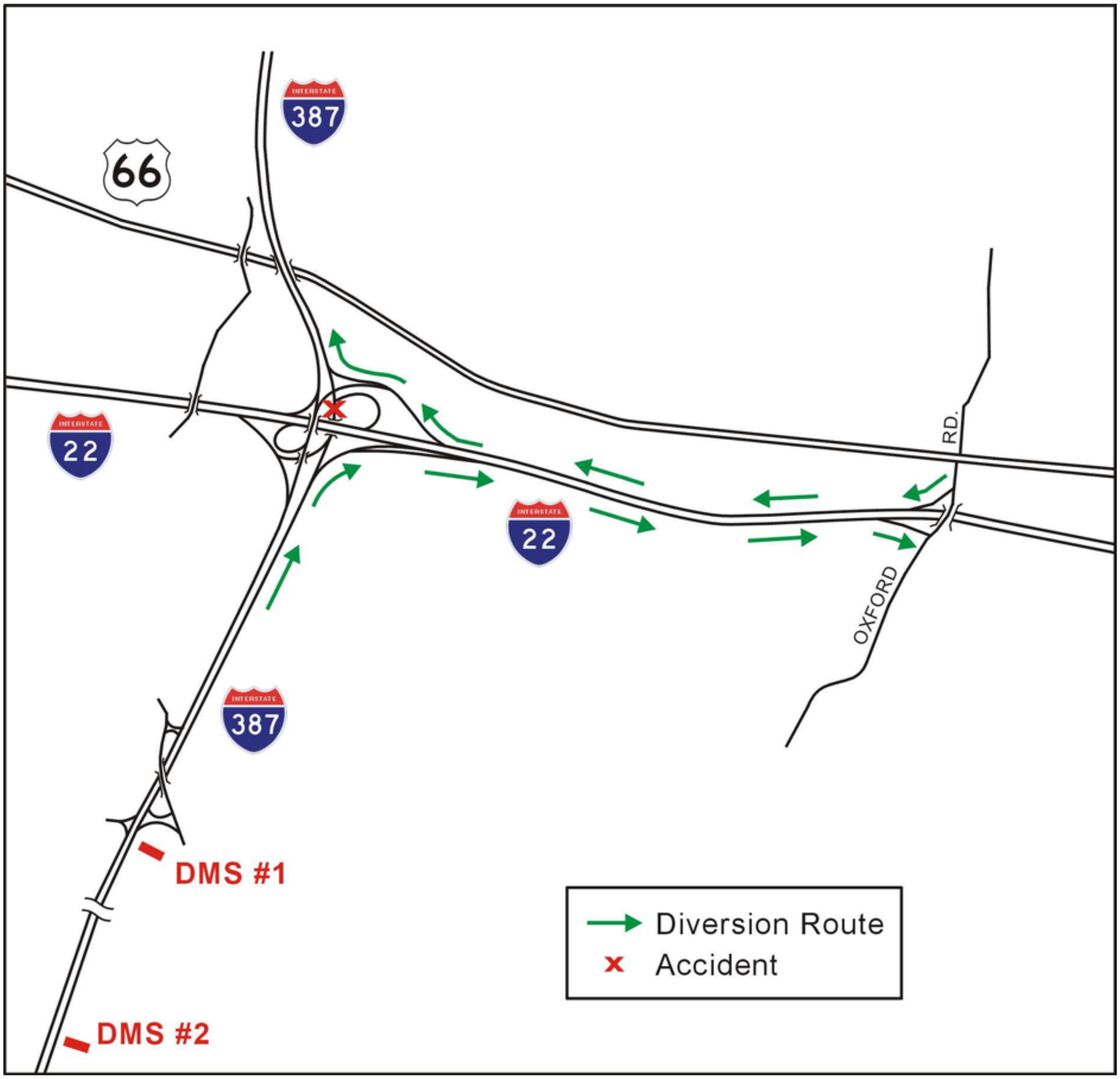


**Figure 14.1 Locations of Crash, Dynamic Message Signs, and Diversion (Detour) Route**

## DEFINE SITUATION

### Analyze Incident and Incident Scene Characteristics

1. **What happened?**
   TMC personnel confirm that a major three-vehicle crash occurred. There appears to be a fatality.

   The DMS operator in the TMC pans the closed circuit television cameras to view the crash scene.

2. **Where?**
   On I-387 northbound just past I-22.

3. **What lanes (how many) lanes are affected?**
   All lanes are closed.

4. **What is the current time?**
   It is now 10:15 a.m.

5. **How long do you expect the incident to block the lanes?**
   The nature of the crash with a fatality indicates that the crash will block all the lanes for 3 hours (until 1:00 p.m.).

6. **What is the effect on traffic?**
   Even though the incident will not block lanes during an off-peak traffic period, congestion will be severe because the northbound freeway will be closed for 3 hours.

7. **Are the police on the scene to direct traffic or close the freeway?**
   Yes, the police have arrived and are directing traffic off the freeway at I-22.

8. **Did the Emergency Incident Response Team arrive at the scene and implement the preplanned traffic control plan including detour signs and trailblazers along the preplanned diversion (detour) route?**
   Yes, the Team arrived and implemented the preplanned traffic control plan.

## DESIGN MESSAGE FOR DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO THE INCIDENT (DMS #1)

### Identify DMS Characteristics

1. **Where is the DMS located in relation to the incident/closure?**
The DMS is on the same freeway as the incident and upstream and relatively close to the incident. In addition, the DMS is located upstream of the exit to the primary diversion route.

2. **What type of DMS is being used?**
The sign is an LED DMS.

3. **How many lines and characters per line on the DMS?**
The overhead DMS has three lines, 20 characters per line.

### Review Conditions at the DMS Location

1. **What is the traffic operating speed at the DMS location?**
Speeds have reduced to about 30 mph at the DMS location.

2. **Are there any geometric features (vertical or horizontal curves) which will adversely affect the motorists' sight distance to the DMS?**
Previous field inspections revealed that there are no geometric features that will adversely affect the motorists' sight distance to the DMS.

3. **What are the current natural lighting conditions?**
It is a bright sunlit day.

4. **Is there rain or fog at the DMS location? If so, what are the degrees of each?**
There is no rain or fog.

### Identify Diversion Route Characteristics

1. **Is a primary diversion route available?**
The DMS operator has determined that a primary diversion route was previously identified and documented by the TxDOT district. Agreements are in place between the TxDOT district and the local agencies. Predetermined action plans have been published for diversion, including types and locations of signs (both static and DMSs) and locations of police officers to facilitate traffic movement during the freeway closure.

   The established primary diversion route for I-387 North is as follows:

   - I-22 East ramp onto I-22 East;
   - Exit right for Oxford Road;
   - Turn left onto Oxford Road;
   - Cross over I-22;
   - Turn left onto entrance ramp to I-22 West;
   - Continue straight for I-387;

- Bear right for I-387 North;
- Use entrance ramp to I-387 North.

2. **Is the primary diversion route complex for motorists?**
   The DMS operator concludes that the primary diversion route is complex. Therefore, it is necessary for police or traffic control personnel to direct traffic at critical locations along the diversion route, or that guide signs be available along the route to provide positive guidance to motorists before the primary diversion route is given in the DMS message.

3. **Are police or traffic control personnel directing traffic at critical locations along the diversion route, or are guide signs available along the route to provide positive guidance to motorists?**
   Yes.

4. **Will a diversion message be displayed? If so, what type?**
   Because of the nature, severity, and potential duration of the incident, the Emergency Incident Management Team installed detour signing along the designated route. In addition, police are stationed at the established traffic control locations. A Type 5 diversion (detour) route is in place.

**Set Objectives**

Based on the information in the previous sections, the DMS operator establishes the following objectives to achieve with the DMS:

- Inform northbound I-387 motorists of freeway closure and location of closure, and
- Inform northbound I-387 motorists that they will detour at I-22 around the incident.

Because the incident is blocking all the lanes of the freeway, the freeway is closed, and the DMS is on the same freeway and relatively close to the incident, the steps given in Section *9.3 INCIDENTS THAT REQUIRE CLOSING THE FREEWAY* on page 9-19 will be used to define the Base DMS Message.

Even though the incident blocks all of the lanes at a location just past I-22, the primary situation that confronts northbound I-387 motorists is that the normal route is closed at I-22. Therefore, motorists must exit at I-22 and they can follow the detour to return to I-387 North.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

**Step 1 – Determine Freeway Operating Speed at the DMS Location.**
The freeway operating speed at the DMS location was determined to be 30 mph.

**Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5.**
Based on the sun's position, it is initially determined from Table 7.2 that a maximum of five units of information can be displayed on the DMS.

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

**Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in Section 7.3 *UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.**
An examination of the data in Section 7.3 indicates that no reductions from the initial maximum allowable five units of information need to be made because no vertical curve geometric sight distance restriction exists. Therefore, go directly to Step 5.

**Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section 7.4 *UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.**
An examination of the data in Section 7.4 indicates that no reductions from the initial maximum allowable five units of information need to be made because of no horizontal curve geometric sight distance restriction exists. Therefore, go directly to Step 7.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

**Step 7 – Determine Whether Rainfall near the DMS Exceeds 2 Inches per Hour.**
There is no rainfall. Therefore, go directly to Step 9.

**Step 9 – Determine Whether Fog Exists near the DMS.**
No fog. Therefore, go directly to Step 11.

---

**Finalize the Maximum Allowable Units of Information in the Message**

**Step 11 – Based on Steps 1 through 10, Finalize the Maximum Allowable Number of Units of Information in the Message.**
There are no reductions to the maximum allowable units of information found in Table 7.2. Therefore, it is allowable to use up to five units of information on the DMS.

---

**Define Base DMS Message to Satisfy Motorist Information Needs**

**Step 12 - Select *Incident Descriptor* Message Element from Table 5.28, page 5-31.**
*Incident Descriptor:* **MAJOR ACCIDENT**

**Step 13 - Select *Incident Location* Message Element from Table 5.29, page 5-32.**
*Incident Location:* **PAST I-22**

**Step 14 -Select *Lanes Closed* Message Element from Table 5.30, page 5-33.**
*Lanes Closed:* **ALL LANES CLOSED**

**Step 15 – Select *Closure Location* Message Element from Table 5.31, page 5-34.**

*Closure Location:* **AT I-22**

**Step 16 -Determine Whether Diversion Traffic Control is in Place.**

"Yes." Therefore, go directly to Step 20.

**Step 20 – Select Type 5 Diversion (Detour) Route *Action* Message Element from Table 5.35, page 5-38.**

*Action:* **EXIT AT I-22**
**FOLLOW DETOUR**

**Step 21 – Establish Whether *Action* Message Element Is for a Select Group of Motorists.**

"No," the *Action* message element applies to all motorists passing the DMS. Therefore, go directly to Step 23.

**Step 23 – Examine Whether the Diversion Route Will Be Perceived by Motorists as Being a Most Logical Route.**

"Yes," the detour route set up with signs and trailblazers is expected by motorists and will provide positive guidance throughout. Therefore, go directly to Step 25.

**Summary**

In summary, the following Base DMS Message is suggested:

| | |
|---|---|
| *Incident Descriptor:* | **MAJOR ACCIDENT** *(1 unit)* |
| *Incident Location:* | **PAST I-22** *(1 unit)* |
| *Lanes Closed:* | **ALL LANES CLOSED** *(1 unit)* |
| *Closure Location:* | **AT I-22** *(1 unit)* |
| *Action:* | **EXIT AT I-22** *(1 unit)* |
| | **FOLLOW DETOUR** *(1 unit)* |

The Base DMS Message contains six units of information.

***Notes:***

- An *Audience for Action* message element ***I-387 NORTH TRAFFIC*** is not needed because it is understood that the *Action* applies to all northbound I-387 traffic.
- A *Good Reason for Following the Action* message element is not needed because the motorists should know that motorists must leave the freeway when it is closed.

## Reduce the Number of Message Units If Necessary

**Step 25 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Maximum Allowable from Step 11.**
The Base Message requires six units of information, one more than the maximum of five units identified in Step 11. Therefore, continue to Step 26.

**Step 26 – Omit Incident Descriptor Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* Beginning on page 8-15.**
Using the guidelines beginning on page 8-15, the Base DMS Message is revised to read:

**FREEWAY CLOSED** *(1 unit)*
**EXIT AT I-22** *(1 unit)*
**FOLLOW DETOUR** *(1 unit)*

The term ***FREEWAY CLOSED*** is used rather than ***ALL LANES CLOSED*** because it is shorter and means the same thing to motorists.

**Step 27 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Allowable from Step 11.**
"No," the message has been reduced to three units of information; the maximum allowable is five units. Therefore, go directly to Step 32.

## Format the Message

**Step 32 – Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.**
The message format is consistent with the guidelines on page 8-6. Therefore, continue to Step 33.

## Adjust Message to Fit on Existing DMS

**Step 33 – Determine Whether the DMS Has 4 Lines.**
"Yes," the DMS that will be used to display the message has three lines. Therefore, go directly to Step 35.

## Adjust Message to Fit on 3 Lines or Less

**Step 35 – Determine Whether the Current DMS Message Can Be Displayed on 3 Lines or Less.**
"Yes," the current message can be displayed on three lines. Therefore, go directly to Step 37.

**Step 37 – Examine Whether There Are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases.**
"Yes," the message contains only three units of information. Therefore, go directly to Step 39.

**Step 39 – Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.**
"No," the message elements are not split. Therefore, go directly to Step 41.

**Step 41 – Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.**
"No," the message is small enough to fit on the available DMS space. Therefore, go directly to Step 45.

---

**Finalize DMS Message**

**Step 45 – Review Message for Inconsistencies and Incompatibility.**
An examination of the DMS message indicates that there are no inconsistencies in the message. The motorist should understand the entire message. Therefore the message can be accepted as final and can be displayed or stored in a message file.

**Step 46 – Make Additional Adjustments if Necessary.**
No adjustments are necessary. The following represents the final message:

**FREEWAY CLOSED**
**EXIT AT I-22**
**FOLLOW DETOUR**

**Summary**

**Table 14.1 Comparison of DMS #1 Base DMS Message to Satisfy Motorist Information Needs and Final Message for Incident #1 after Police Arrive**

| Base DMS Message Elements | Base DMS Message to Satisfy Motorist Information Needs | Final Message |
|---|---|---|
| *Incident Descriptor* | MAJOR ACCIDENT | FREEWAY CLOSED |
| *Incident Location* | PAST I-22 | |
| *Lanes Closed* | ALL LANES CLOSED | |
| *Closure Location* | AT I-22 | |
| *Action* | EXIT AT I-22 | EXIT AT I-22 |
| | FOLLOW DETOUR | FOLLOW DETOUR |
| | *(6 Units of Information)* | *(3 Units of Information)* |

***You now have an acceptable message ready to display or to store in the DMS message library.***

---

**Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message**

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or, consequently, the percentage who will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

## DESIGN MESSAGE FOR DMS ON SAME FREEWAY BUT RELATIVELY FAR FROM THE INCIDENT (DMS #2)

### Identify DMS Characteristics

1. **Where is the DMS located in relation to the incident/closure?**
   The DMS is located on the same freeway as the incident and upstream and relatively far from the incident. In addition, the DMS is located upstream of the exit to the primary diversion route.

2. **What type of DMS is being used?**
   The sign is an LED DMS.

3. **How many lines and characters per line on the DMS?**
   The overhead DMS has three lines, 20 characters per line.

### Review Conditions at the DMS Location

1. **What is the traffic operating speed at the DMS location?**
   The operating speed at the DMS is about 60 mph at the DMS location.

2. **Are there any geometric features (vertical or horizontal curves) which will adversely affect the motorists' sight distance to the DMS?**
   Previous field inspections revealed that there are no geometric features that will adversely affect the motorists' sight distance to the DMS.

3. **What are the current natural lighting conditions?**
   It is a bright sunlit day.

4. **Is there rain or fog at the DMS location? If so, what are the degrees of each?**
   There is no rain or fog.

### Identify Diversion Route Characteristics

1. **Is a primary diversion route available?**
   Although a primary diversion route has been identified for motorists viewing DMS #1, DMS #2 is very far upstream of the freeway closure. It is desirable that motorists began to exit from the freeway as soon as possible upstream of the closure in order to minimize the congestion and delays on the freeway. However, no suitable single diversion route is available for motorists viewing DMS #2.

2. **Is the primary diversion route complex for motorists?**
   (Not Applicable)

3. **Are police or traffic control personnel directing traffic at critical locations along the diversion route, or are guide signs available along the route to provide positive guidance to motorists.**
   (Not Applicable)

**4. Will a diversion message be displayed? If so, what type?**
Because of the nature, severity, and potential duration of the incident, it is desirable to display a diversion message. The situation dictates that a "soft" diversion message can be displayed. The DMS operator decides to display a message with "soft" diversion.

**Set Objectives**

Based on the information in the previous sections, the DMS operator establishes the following objectives to achieve with the DMS:

- Inform northbound I-387 motorists of freeway closure and location of closure, and
- Recommend that northbound I-387 motorists located south of I-22 interchange to use alternative routes.

Because the incident is blocking all the lanes of the freeway, the freeway is closed and the DMS is on the same freeway but relatively far from the incident, the steps given in Section *10.3 INCIDENTS THAT REQUIRE CLOSING THE FREEWAY* on page 10-38 will be used to define the Base DMS Message.

Even though the incident blocks all of the lanes at a location just past I-22, the primary situation that confronts northbound I-387 motorists is that the normal route is closed at I-22.

---

**Establish Initial Maximum Allowable Number of Units of Information in the Message Based on DMS Type and Freeway Operating Speeds**

**Step 1 – Determine Freeway Operating Speed at the DMS Location.**
The freeway operating speed at the DMS location was determined to be 60 mph.

**Step 2 – Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-5.**
Based on the sun's position, it is initially determined from Table 7.2 that a maximum allowable of four units of information can be displayed on the DMS.

---

**Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to the DMS**

**Step 3 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Vertical Curve Using the Guidelines in *SECTION 7.3 UNITS OF INFORMATION REDUCTIONS FOR VERTICAL CURVES – LED DMSs* on page 7-6.**
An examination of the data in Section 7.3 indicates that no reductions from the initial maximum allowable four units of information need to be made because no vertical curve geometric sight distance restriction exists. Therefore, go directly to Step 5.

**Step 5 – Determine Whether There Are Sight Distance Restrictions to the DMS Because of a Horizontal Curve Using the Guidelines in Section 7.*4 UNITS OF INFORMATION REDUCTIONS FOR HORIZONTAL CURVES – LED DMSs* on page 7-10.**

An examination of the data in Section 7.4 indicates that no reductions from the initial maximum allowable four units of information need to be made because of no horizontal curve geometric sight distance restriction exists. Therefore, go directly to Step 7.

---

**Assess Whether the Message Must Be Reduced Because of Local Environmental Sight Distance Restrictions to the DMS Due to Rain or Fog**

**Step 7 – Determine Whether Rainfall near the DMS Exceeds 2 Inches per Hour.**

There is no rainfall. Therefore, go directly to Step 9.

**Step 9. Determine Whether Fog Exists near the DMS.**

No fog. Therefore, go directly to Step 11.

---

**Finalize the Maximum Allowable Units of Information in the Message**

**Step 11 – Based on Steps 1 through 10, Finalize the Maximum Allowable Number of Units of Information in the Message.**

There are no reductions to the maximum allowable units of information found in Table 7.2. Therefore, it is allowable to use up to four units of information on the DMS.

---

**Define Base DMS Message to Satisfy Motorist Information Needs**

**Step 12 - Select *Incident Descriptor* Message Element from Table 5.38, page 5-41.**

*Incident Descriptor:* **MAJOR ACCIDENT**

**Step 13 - Select *Incident Location* Message Element from Table 5.39, page 5-42.**

*Closure Location:* **PAST I-22**

**Step 14 -Select *Lanes Closed* Message Element from Table 5.40, page 5-43.**

*Lanes Closed:* **ALL LANES CLOSED**

**Step 15 - Select *Closure Location* Message Element from Table 5.41, page 5-44.**

*Closure Location:* **AT I-22**

**Step 16 – Establish Whether Diversion *Action* Should Be Recommended.**

"Yes." The anticipated very congested traffic downstream justifies advising motorists at this DMS location to divert. Therefore, continue to Step 18.

**Step 18 – Establish Whether "Soft" Diversion Should Be Recommended.**

"Yes." There are no suitable alternative routes that can be specified for the motorists at the DMS location. However, it is appropriate (and desirable) to use a "soft" diversion message element. Therefore, continue to Step 19.

**Step 19 - Select "Soft" Diversion *Action* Message Element from Table 5.44, page 5-47.**

*Action:* **USE OTHER ROUTES**

Go to Step 23.

**Step 23 – Establish Whether *Action* Message Element Is for a Select Group of Motorists.**

"No," the *Action* message element applies to all motorists passing the DMS. Therefore, go directly to Step 25.

**Step 25 – Examine Whether the Diversion Route Will Be Perceived by Motorists as Being a Most Logical Route.**

No specific route will be given since a "soft" diversion will be displayed. This step does not apply in this case. Therefore, go directly to Step 27.

**Summary**

In summary, the following Base DMS Message is suggested:

| | |
|---|---|
| *Incident Descriptor:* | **MAJOR ACCIDENT** *(1 unit)* |
| *Incident Location* | **PAST I-22** *(1 unit)* |
| *Lanes Closed* | **ALL LANES CLOSED** *(1 unit)* |
| *Closure Location* | **AT I-22** *(1 unit)* |
| *Action* | **USE OTHER ROUTES** *(1 unit)* |

The Base DMS Message contains five units of information.

***Notes:***

- An *Audience for Action* message element ***I-387 NORTH TRAFFIC*** is not needed because it is understood that the *Action* applies to all northbound I-387 traffic.
- A *One Good Reason for Following the Action Statement* message element is not needed because the motorists should know that motorists must leave the freeway when it is closed.

---

**Reduce the Number of Message Units If Necessary**

**Step 27 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Maximum Allowable from Step 11.**

The Base Message requires five units of information, one more than the maximum of four units identified in Step 11. Therefore, continue to Step 28.

**Step 28 – Omit Incident Descriptor Message Element According to Guidelines in the Section on *Combining Message Elements for Incident Messages* Beginning on page 8-15.**

Using the guidelines beginning on page 8-15, the Base DMS Message is revised to read:

**FREEWAY CLOSED** *(1 unit)*
**AT I-22** *(1 unit)*
**USE OTHER ROUTES** *(1 unit)*

The term ***FREEWAY CLOSED*** is used rather than ***ALL LANES CLOSED*** because it is shorter and means the same thing to motorists.

**Step 29 – Examine Whether the Number of Units of Information in the Base Message Is Greater than the Allowable from Step 11.**
"No," the message has been reduced to three units of information; the maximum allowable is four units. Therefore, go directly to Step 34.

---

**Format the Message**

**Step 34 - Format the Message According to Guidelines in the Section on *FORMATTING MESSAGES* on page 8-6.**
The message format is consistent with the guidelines on page 8-6. Therefore, continue to Step 35.

---

**Adjust Message to Fit on Existing DMS**

**Step 35 - Determine Whether the DMS Has 4 Lines.**
"Yes", the DMS that will be used to display the message has three lines. Therefore, go directly to Step 37.

---

**Adjust Message to Fit on 3 Lines or Less**

**Step 37 - Determine Whether the Message Can Be Displayed on 3 Lines or Less.**
"Yes," the message has 3 lines. Therefore, go directly to Step 39.

**Step 39 - Examine Whether 3 or Fewer Decision-Relevant Units of Information Are Displayed on Each of the Phases.**
"Yes," the one-phase message has three units of information. Therefore, go directly to Step 41.

**Step 41 - Examine Whether Message Elements Are Split in Such a Way That a Part of One Message Element Is on the Same Line as a Part of a Second Message Element.**
"No." A review of the DMS message reveals that the message elements are separated such that part of one message element is not on the same line as part of a second message element. Therefore, go directly to Step 43.

**Step 43 - Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available DMS Space.**
"No," since the DMS has space for 20 characters on each line, no message line exceeds the space on the sign. Therefore, go directly to Step 47.

## Finalize DMS Message

**Step 47 - Review Message for Inconsistencies and Incompatibility.**

An examination of the DMS message indicates that there are no inconsistencies in the message. The motorist should understand the entire message. Therefore the message can be accepted as final and can be displayed or stored in a message file.

**Step 48 - Make Additional Adjustments if Necessary.**

No adjustments are necessary. The following represents the final message:

**FREEWAY CLOSED**
**AT I-22**
**USE OTHER ROUTES**

## Summary

**Table 14.2 Comparison of DMS #2 Base DMS Message to Satisfy Motorist Information Needs and Final Message For Incident #1 after Police Arrive**

| Base DMS Message Elements | Base DMS Message to Satisfy Motorist Information Needs | Final Message |
|---|---|---|
| *Incident Descriptor* | MAJOR ACCIDENT | FREEWAY CLOSED |
| *Incident Location* | PAST I-22 | |
| *Lanes Closed* | ALL LANES CLOSED | |
| *Closure Location* | AT I-22 | AT I-22 |
| *Action* | USE OTHER ROUTES | USE OTHER ROUTES |
| | *(5 Units of Information)* | *(3 Units of Information)* |

***You now have an acceptable message ready to display or to store in the DMS message library.***

## Assess Effects of Large Trucks on the Ability of Motorists to View the DMS Message

The final step in the process is to assess the effects of large trucks in the traffic stream on the ability of motorists to see the DMS and read the message. Tables 7.14 through 7.17 on pages 7-21 and 7-22 should be studied to determine the percentage of motorists who will be able to see the DMS message (or consequently, the percentage that will not be able to see the DMS message because their visibility to the sign is blocked by large trucks). This information will help the DMS operator and the TMC manager to determine the potential effectiveness in communicating the message to the motorists in the traffic stream.

# MODULE 15. AMBER ALERT

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# MODULE 15. AMBER ALERT

## 15.1 BACKGROUND, PROGRAMS, AND POLICIES

AMBER (America's Missing: Broadcast Emergency Response) alert is a notification program to help locate missing children believed to have been abducted. The Emergency Alert System (formerly known as the Emergency Broadcast System) is used to alert the public via television and radio in the event of an AMBER alert. America's AMBER Plan Program is a voluntary program.

In August 2002, the California Department of Transportation began using DMSs to provide AMBER alert information. Since then, virtually every state and most local transportation agencies that own and operate DMSs have become actively involved in responding when AMBER alerts are issued. AMBER alert messages displayed on DMSs are receiving positive reactions from the public.

### FEDERAL AMBER PLAN PROGRAM AND POLICIES

FHWA recognized the value of the AMBER Plan Program and fully supports state and local governments' choice to implement this program. A Memorandum "AMBER Alert Use of Changeable Message Sign (CMS)" dated August 16, 2002 (http://www.fhwa.dot.gov/legsregs/directives/policy/ambermemo.htm) was prepared to clarify FHWA policy on the use of CMSs to display child abduction messages as part of an AMBER Plan Program. Parts of the Memorandum that relate to policies and guidelines are presented below. (Note, FHWA uses the term *changeable message signs* (CMSs) in its policies.)

> *"If public agencies decide to display AMBER Alert or child abduction messages on a CMS [changeable message sign], FHWA has determined that this application is acceptable only if (A) it is part of a well-established local AMBER Plan Program, and (B) public agencies have developed a formal policy that governs the operation and messages that are displayed on CMS.*
>
> *(A) A local AMBER Plan Program would include written criteria for issuing and calling off an AMBER Alert, procedures on issues to coordinate with local agencies and other interests, and conforms to the recommendations of the national program. Specific criteria for issuing an Alert and the associated procedures may include:*
>
> 1. *Confirmation that a child has been abducted,*
> 2. *Belief that the circumstances surrounding the abduction indicate that the child is in danger of serious bodily harm or death, and*
> 3. *Enough descriptive information about the child, abductor, and/or suspect's vehicle to believe an immediate broadcast alert will help.*

*(B) The formal public agency policy and procedures relating to displaying AMBER Alert or child abduction messages on CMS must address the following issues:*

1. *The criteria under which CMS will be used for AMBER Alerts.*
2. *Clear identification of the law enforcement agency responsible for issuing the alert (e.g., State police, local police department, etc.).*
3. *Agencies, interests, and persons to be contacted and information to be disseminated to initiate or call off an AMBER Alert.*
4. *Specific recognition that traffic messages, such as lane closures, fog alerts, detours, etc., are the highest priority, and circumstances under which the AMBER Alert message could or could not be displayed.*
5. *Length of time to display the message (should be of short duration, typically a few hours). (Note: 4 and 5 should be defined in cooperation with the responsible law enforcement agency based on the specific circumstances of the abduction.)*
6. *Geographic area over which the information is to be displayed (should be limited to a reasonable search distance that is reachable within a few hours).*
7. *Circumstances that would cause the discontinuation of use of the CMS if the AMBER Alert message creates an adverse traffic impact such as queues, markedly slowing of traffic, etc.*
8. *Format and content of the messages to be displayed. Agencies should follow the recommended national CMS practices related to the development, use of text, manner in which messages should be displayed, and how CMS are operated."*

FHWA noted in the Memorandum that CMSs are not always the most effective or safest method to disseminate information related to child abductions and clarified its policy on the use of DMS for displaying AMBER alert messages. Since the CMS can convey only a limited amount of information to motorists, when there is a need to provide more extensive information to motorists, it is critical that other types of traveler information services (e.g., 511 travel information telephone services, highway advisory radio (HAR), web sites, commercial radio) be used, and that the messages displayed on a CMS supplement these other services.

## TEXAS AMBER ALERT NETWORK AND POLICIES

The Texas Amber Alert Network was activated by Governor Rick Perry to "ensure that every available resource is used to return abducted children safely to their loved ones." (http://www.governor.state.tx.us/divisions/press/initiatives/amber) The Texas Department of Public Safety is in charge of the statewide system, but any Texas law enforcement agency has the ability to activate this network of resources when needed. When the system is activated, media outlets receive notification of an abducted child and TxDOT displays AMBER alert information on DMSs. To activate the network, the law enforcement agency with jurisdiction must determine that the case meets the following criteria:

- The child is 17 years of age or younger.
- The local law enforcement agency believes that the child has been abducted, that is, unwillingly taken from his/her environment without permission from the child's parent or legal guardian who commits an act of murder or attempted murder during the time of the abduction.
- The local law enforcement agency believes that the missing child is in immediate danger of serious bodily harm or death.
- The local law enforcement agency confirms that an investigation has taken place that verifies the abduction and has eliminated alternative explanations for the missing child.
- Sufficient information is available to disseminate to the public that could assist in locating the child, the suspect, or the vehicle used in the abduction.
- Upon verification of the activation request, the Governor's Division of Emergency Management determines the circumference of the search area and issues the alert. Alerts are distributed to:
  - √ TxDOT's Traffic Management Center (for messages on highway signs),
  - √ National Weather Service's Texas Warning System (for broadcast on radio and television stations),
  - √ Law enforcement agencies,
  - √ Texas Missing Persons Clearinghouse, and
  - √ Texas Office of the Governor.

### TXDOT AMBER ALERT COORDINATION

It is important that AMBER alert messages are designed and displayed on DMSs uniformly across the state. In TxDOT, Traffic Engineering (TE) is responsible for the format used for the messages so that they meet MUTCD requirements and provide complete information. AMBER alert messages are displayed after the Department of Public Safety (DPS) in Austin provides information to TxDOT about the event. Authorization for AMBER alert comes from DPS Austin. DPS contacts the TxDOT AMBER alert coordinator who then contacts the Districts.

## 15.2 MESSAGE ELEMENTS

### PRIORITY OF INFORMATION

Results of research indicated that drivers in Texas place the following order of importance on the elements of an AMBER alert message:

1. Situation descriptor
2. Vehicle description
3. License plate number
4. Telephone number (to dial)
5. Tune to radio (local station or HAR)

**The priority order of motorist information needs for an AMBER alert message is:**
- **Situation descriptor**
- **Vehicle description**
- **License plate number**
- **Telephone number (to dial)**
- **Tune to radio (local station or HAR)**

## SITUATION DESCRIPTOR

The situation descriptor specifies the event and should always be displayed on the top line of the DMS. Ninety-six percent of drivers sampled in Texas selected the situation descriptor as the most important part of an AMBER alert message.

TxDOT uses the situation descriptor *KIDNAPPED CHILD*. Currently, no strong research evidence exists to change this practice, but there is indication that the term *AMBER ALERT* should be considered in the future. Greater numbers of drivers are becoming familiar with the term because of its common use by broadcast and print media.

> **The situation descriptor term *KIDNAPPED CHILD* should be displayed on the top line.**
>
> **The term *AMBER ALERT* may be a more acceptable term in the future.**
>
> **The term *MISSING CHILD* should not be used.**

Results of a recent study in Texas showed that 32 percent of the subjects in the study chose *AMBER ALERT* as the preferred descriptor, whereas 22 percent selected *ABDUCTED CHILD* and 15 percent chose *KIDNAPPED CHILD*.

The term *MISSING CHILD* should not be used because it has the connotation that a child may not be in a dangerous situation. For example, *MISSING CHILD* could imply that the child was taken by a family member and is not in a dangerous situation.

## VEHICLE DESCRIPTION

When a vehicle description is displayed as part of the message, it should contain the color, make, and vehicle type if it is different from an automobile (e.g., pickup, van, etc.). The year of the vehicle is optional. Many motorists are not able to identify the differences among vehicle model years.

> **When the vehicle description and the license plate number are both known, the vehicle description should be displayed on the second line and the license plate number displayed on the third line.**
>
> **A vehicle description should never be displayed unless the license plate number is also displayed.**

The vehicle description should never be displayed unless the license plate number is also displayed.

## LICENSE PLATE NUMBER

When used in a message, the license plate number should be displayed in the style shown below.

**LIC # ABC-123**

Use “#” preceding the number and a dash between the sets of numbers (letters). A license plate number should always be displayed whenever a vehicle descriptor is in the message.

> **The symbol “#” should be placed before the license plate number.**

**A license plate number is equivalent to three units of information.**

**When a license plate number is used in the message, the message far exceeds the maximum number of units of information that motorists can read and recall.**

**The majority of motorists will not be able to read and recall the entire license plate number.**

It should be recognized that a license plate number is equivalent to three units of information. (See *Message Load and Unit of Information* on page 4-6 of the *Manual* for a definition and description of "units of information.") Thus, a message containing the situation descriptor, vehicle descriptor, and a license plate number has six units of information. Guidelines given on page 4-6 of the *Manual* specify that when freeway operating speeds are greater than 35 mph, no more than four units of information should be displayed in a message. In addition, no more than three units of information should be displayed on one phase (frame). The message containing the situation descriptor, vehicle descriptor, and a license plate number violates proven guidelines and exceeds the information processing capabilities of most drivers. Therefore, it should be expected that motorists will not be able to recall the entire license plate number.

Almost all motorists recognize the abbreviation *LIC* for license plate. In addition, about 75 percent will recall the first three digits of the license plate number, and only about 40 percent will also recall the last three digits.

When the vehicle has an out-of-state license plate number, the specific state should be shown using the standard two-digit abbreviation for the state. The state abbreviation should be placed in front of the license number in the style shown below.

**MA LIC # DE4-567**

Many motorists will have difficulty remembering the abbreviation for some of the states and therefore, may not recognize the state where the vehicle is registered. Regardless of the inability of motorists to identify the abbreviations for some of the states, surveyed motorists feel it is important to know that the vehicle is from out-of-state.

It is not advisable or necessary to use an abbreviation for "Texas." In the absence of a state abbreviation, motorists will assume that the vehicle has a Texas license plate.

## TELEPHONE NUMBER

Motorists surveyed in Texas indicated that a contact telephone number was the next most important information to include in a DMS message after the situation descriptor, vehicle description, and vehicle license plate number. In the absence of a specific telephone number to call, motorists are most likely to dial *911* if they believe they have seen the sought-after vehicle or child.

If a telephone number is included in an AMBER alert message, it should be short. Typical 10-digit telephone numbers are equivalent to three units of information. Thus, by including a 10-digit number, the message will exceed the maximum units of information specified in the guidelines given on page 4-6 in the *Manual*. The result is that the large majority of motorists will not recall the number.

> **A typical 10-digit telephone numbers is equivalent to three units of information.**
>
> **When a 10-digit telephone number is used in the message, the message will exceed the maximum number of units of information that motorists can read and recall.**
>
> **When used, telephone numbers should be short and easy to remember.**

The national traveler information number *511* is a good example of a short number that can be easily remembered by motorists. If a simple three-digit number is not available for use for Amber Alerts, other options include acquiring and using a telephone number with words that can be easily remembered (e.g., *FIND A CHILD*).

When a telephone number is displayed, the preferred action word preceding the number is *CALL* rather than *DIAL*. An example of an easily remembered telephone number is shown below.

**CALL 1 FIND A CHILD**

## TUNE TO RADIO

Motorists surveyed in Texas indicated that knowing a radio (HAR) station to tune to was by far the least important information in comparison to the four message elements discussed above.

When advice is given for motorists to tune to the radio, it is important to post the specific radio station number and whether the station is AM or FM. Examples of appropriate message elements are shown below.

> **When advice is given to tune to the radio, the frequency and the abbreviation *AM* or *FM* should be included.**

**TUNE TO 530 AM**
**TUNE RADIO TO 530 AM**

# 15.3 MESSAGES

The specific message displayed will be influenced by the specific information that the DMS operator has concerning the child abduction and the information transfer media that will be used to inform motorists.

### ISSUES WITH MESSAGES CONTAINING A VEHICLE DESCRIPTOR AND/OR A LICENSE PLATE NUMBER

As discussed in Section 15.2, motorists want information about the vehicle description and the license plate number. However, messages containing the vehicle descriptor and/or license plate number far exceed the reading and understanding capabilities of the majority of motorists. Therefore, it should be expected that most motorists will not be able to read and recall all the information displayed on the DMS, particularly the entire license plate number and/or the entire telephone number.

Messages that are too long or too complex to read and understand are undesirable because drivers may fail to read the messages that require changes in driving actions on their part or that may affect safety. However, AMBER alert messages are not designed to enhance driving behavior or safety, but are designed to provide secondary information (i.e., kidnapped child). Given the very positive reaction by the public and public officials to displaying AMBER alert messages on DMSs, it seems logical that the vehicle description and license plate number—stated as important by motorists—should be displayed if the information is available to the DMS operator, even though all of the information may not be assimilated by motorists. It is likely that as motorists pass more than one DMS containing the AMBER alert message, they will "pick up" more information.

Thus, TxDOT may elect to display AMBER alert messages that exceed the maximum number of units of information. However, if drivers begin to reduce speed to read the messages, then TxDOT should rescind this practice in favor of messages with fewer units of information.

### SCENARIOS AND MESSAGES

The recommended messages for a number of scenarios are given in the sections that follow.

#### Message Scenario 1

***Known***

- Vehicle description
- Vehicle license plate

***Available***

- Telephone number to call
- HAR station broadcasting AMBER alert message

Message style options for the conditions above are shown below.

**KIDNAPPED CHILD**
***BLUE TRAILBLAZER***
**LIC #** ***ABC-123***

*Style Option 1*

**KIDNAPPED CHILD**
***BLUE CHEV SUV***
**LIC #** ***ABC-123***

*Style Option 2*

NOTE: Each of the messages above contains six units of information, which violates guidelines with respect to the maximum number of four units of information that should be displayed in a message. Each message also exceeds the maximum number of three units of information that should be displayed in a phase. The majority of motorists will not be able to read and recall the entire message.

**Message Scenario 2**

***Known***
- Vehicle license plate

***Available***
- Telephone number to call
- HAR station broadcasting AMBER alert message

***Unknown***
- Vehicle description

The message for the conditions above is shown below.

**KIDNAPPED CHILD**
**LIC #** ***ABC-123***
**TUNE TO** ***530 AM***

NOTE: The message contains five units of information, which violates guidelines with respect to the maximum number of four units of information that should be displayed in a message. In addition, the message exceeds the maximum number of three units of information that should be displayed in a phase. The majority of motorists will not be able to read and recall the entire message, particularly the license plate number.

**Message Scenario 3**

***Known***
- Vehicle description

***Available***
- Telephone number to call
- HAR station broadcasting AMBER alert message

***Unknown***
- Vehicle license plate

The message options for the conditions above are shown below.

| |
|---|
| **KIDNAPPED CHILD**<br>**CALL *1 FIND A CHILD*** |

*Option 1*

| |
|---|
| **KIDNAPPED CHILD**<br>**TUNE TO *530 AM*** |

*Option 2*

**Message Scenario 4**

***Known***
- Vehicle description

***Not Available***
- Telephone number to call
- HAR station broadcasting AMBER alert message

***Unknown***
- Vehicle license plate

For this scenario, an AMBER alert message **should not** be displayed.

# MODULE 16. CATASTROPHIC EVENT

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# MODULE 16. CATASTROPHIC EVENT

## 16.1 BACKGROUND, PROGRAMS, AND POLICIES

### NATIONAL INCIDENT MANAGEMENT SYSTEM – INCIDENT COMMAND SYSTEM

Homeland Security Presidential Directive (HSPD-5), Management of Domestic Incidents, requires all federal departments and agencies to adopt the National Incident Management System (NIMS) and to use it in domestic incident management. The NIMS provides a consistent nationwide approach for federal, state, territorial, tribal, and local governments to work effectively and efficiently together to prepare for, prevent, respond to, and recover from domestic incidents, regardless of cause, size, or complexity. On March 1, 2004, the Department of Homeland Security (DHS) issued the NIMS to provide a comprehensive national approach to incident management, applicable to all jurisdictional levels and across functional disciplines.

### THE TEXAS OFFICE OF HOMELAND SECURITY

The Texas Office of Homeland Security is an element of the governor's staff that provides policy guidance for state homeland security programs and coordinates development and monitors implementation of the state homeland security strategy. The Office of Homeland Security coordinates state homeland security programs with local governments, regional organizations, and federal agencies. The Director of the Office of Homeland Security also serves as the Director of the Governor's Division of Emergency Management (GDEM).

### THE GOVERNOR'S DIVISION OF EMERGENCY MANAGEMENT

The Division of Emergency Management is also an element of the governor's office. Chapter 418 of the Government Code assigns the division specific responsibilities for carrying out a comprehensive all-hazard emergency management program for the state and for assisting cities, counties and state agencies in implementing their own emergency management programs. The GDEM, like other state agencies, is also responsible for supporting development and implementation of the Governor's Homeland Security Strategy.

### THE STATE OPERATIONS CENTER

The State Operations Center (SOC) is operated by the GDEM and serves as the state warning point. It uses an extensive suite of communications to receive and disseminate warning of threats to regional warning points and to state and local officials; monitors emergency situations throughout the state and provides information on these events to federal, state, and local officials; and coordinates state assistance to local governments that are dealing with emergencies.

## TEXAS SECURITY ANALYSIS AND ALERT CENTER

The Texas Security Analysis and Alert Center (TSAAC) is a 24-hour centralized intelligence collection, analysis, and dissemination organization. Information is obtained from law enforcement agencies, other elements of state and local government, other organizations, and industry. TSAAC also receives reports from the public of suspicious activity possibly related to terrorism. Staffed by highly trained and experienced Department of Public Safety personnel and using sophisticated technology, The TSAAC is capable of collecting, analyzing, and disseminating leads to local, state, and federal agencies to aid with the investigation of terrorism. The TSAAC is collocated with the SOC, and there is continuous coordination between the two elements.

## FEDERAL HIGHWAY ADMINISTRATION POLICY ON EMERGENCY OR SECURITY ALERT MESSAGES

In support of the activities of the above agencies, FHWA has determined that the display of emergency or security alert messages on DMSs is acceptable if public agencies have developed policies and procedures that govern the messages that are displayed on DMSs and their operation. The public agency policy and procedures relating to displaying emergency or security alert messages on DMSs must address the issues listed below. (Note, FHWA uses the term *changeable message signs* (CMSs) in its policy.)
(See http://www.fhwa.dot.gov/legsregs/directives/policy/securmemo.htm.)

*"1. The criteria under which CMS will be used for emergency or security alert messages, including the necessary coordination with public safety or security agencies. Formal policies among critical stakeholders (such as law enforcement, security, transportation, and public safety) can be used to establish these agreed upon criteria.*

*2. Protocols or hierarchy for prioritizing messages and determining which messages are to be displayed.*

*3. Geographic area over which the information is to be displayed, to be determined in cooperation with public safety and security agencies.*

*4. Identification of the circumstances under which transportation-related messages, such as lane closures, fog alerts, detours, or other messages that may be needed because of dangerous travel conditions in the immediate vicinity, would preempt emergency or security alert messages.*

*5. The criteria that would cause the discontinuation of use of the CMS if the emergency or security alert message creates an adverse traffic impact such as queues, markedly slowing traffic, etc.*

*6. Methodology for developing and displaying messages that are appropriate for CMS display including but not limited to standard message sets. Agencies*

> *should follow the recommended national CMS practices related to the development, use of text, manner in which messages should be displayed, human factors related to understandability of the messages, and how CMS are operated."*

The guidelines in Section 16.2 below are intended to assist in meeting item 6 of the above FHWA policy. Local knowledge of the transportation system and geography are required to establish policy on the remaining five items

## 16.2 MESSAGES

When a major catastrophe such as a terrorist attack strikes a city, there may initially be much confusion as to the exact nature and extent of the event. Local, state, and regional emergency management groups will implement emergency management plans based on the best available information. The traffic management component of the plans will normally involve:

- Closing access to the city (area) and
- Evacuation of the city (area).

The traffic control plan will involve displaying DMS messages in the TxDOT district in which the catastrophe occurs and in adjacent districts.

### CLOSING ACCESS TO THE CITY (AREA)

The traffic management plan will involve closing all of the roads including freeways to the city (area) and possibly reversing the flow of traffic on high occupancy or managed lanes. Thus, the emphasis of the DMS messages should be to let drivers know the roads that are closed and information about detours, rather than information about the catastrophic event. DMS messages for closing access to the city (area) are displayed after the police or other traffic control personnel are in place to close the freeway. The design of the messages is similar (but not exactly the same) to those used for roadway closures during incidents and roadwork.

#### DMS Relatively Close to the Event

An example of a message for DMS located relatively close to the affected area within a city is shown below.

| |
|---|
| **I (*XX*) NORTH CLOSED**<br>**AT (*Location*)** |

Note that for incidents and roadwork freeway closures, the third line of the DMS message includes terms to advise drivers to exit and follow a detour or to use another route. Advising drivers to exit and follow a detour is inappropriate because detour signing will most likely not be in place. Advising drivers to use another route gives them the false impression that they can

reach their destination by other routes.
When information about the closure is also being disseminating by HAR, the message shown below should be used.

| |
|---|
| **I (*XX*) NORTH CLOSED**<br>**AT (*Location*)**<br>**TUNE TO *530 AM*** |

### DMS Far from the Event

When the DMS is located far from the event, it is sufficient to use one of the messages shown below.

| |
|---|
| **(*City or Location*)**<br>**CLOSED TO**<br>**ALL TRAFFIC** |

*Option 1*

| |
|---|
| **ALL ROADS TO**<br>**(*City or Location*)**<br>**CLOSED** |

*Option 2*

## EVACUATION OF THE CITY (AREA)

During the evacuation, only messages that address incidents and congestion should be displayed in the outbound direction, with two exceptions. First, travel time messages are acceptable. Second, when the HOV lane is open to all outbound traffic, then the message shown below is appropriate.

| |
|---|
| **HOV LANES OPEN**<br>**TO ALL TRAFFIC** |

# MODULE 17. HIGH WATER AND FLOODS

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# MODULE 17. HIGH WATER AND FLOODS

## 17.1 INTRODUCTION

High water sometimes collects on or flows across the freeway during heavy rainstorms. In some cases drivers can safely pass through the water, and in other cases the water is too high for drivers to pass through. In summary, the following possible conditions exist:

- Water on the freeway but passable or
- Water on the freeway and impassible (flooded).

Surveys of Texas drivers indicate a need to have information displayed on DMSs for both of the above conditions.

**DRIVER INFORMATION NEEDS**

DMS message design and display for high water and floods are based on the results of focus group studies and human factors laboratory studies conducted in 2004 and 2005 in six cities in Texas, namely Arlington, Austin, El Paso, Houston, Laredo, and San Antonio. The guidelines are based on the combined results from the six cities; differences among cities are noted when they appeared to be significant.

When high water is on the freeway but drivers are still able to pass through, Texas drivers want to:

- Be alerted about the high water,
- Know the location of the high water, and
- Be confident that they can pass through and do not have to exit the freeway.

When the freeway becomes flooded and drivers are not able to pass through, the freeway will be closed to traffic. Under flood conditions Texas drivers want to:

- Be alerted about the freeway closure;
- Know the location of the closure; and
- Be informed as to which exit ramps to take.

The majority Texas drivers (69 percent) stated that it is more important to know about the closure than the fact that the freeway is flooded.

# 17.2 MESSAGES FOR WATER ON THE FREEWAY BUT PASSABLE

## MESSAGE FORMAT AND MESSAGE ELEMENTS

The following message format should be used:

- Water Descriptor message element *(top line)*,
- Water Location message element *(middle line)*, and
- Action message element *(bottom line)*.

The acceptable message format for a message is illustrated below.

| |
|---|
| **WATER ON FREEWAY**<br>**(*Water Location*)**<br>**(*Action*)** |

### Water Descriptor

There was no clear choice by the drivers in the Texas studies as to what term should be used to describe water on the road that is still passable. However, 56 percent of the drivers selected *WATER ON ROAD (FREEWAY)* or *WATER AHEAD*. A variety of other descriptors were each selected by 7 percent or less of the drivers. The terms *HIGH WATER* and *FLOODED* were selected by only 5 percent of the drivers and thus should not be used as the descriptor for the situation.

### Water Location

The *Water Location* message element will differ depending upon whether the water is

- Downstream of a crossing highway or street,
- Between the exit and entrance ramps, or
- Upstream of the exit ramp.

#### *Water Downstream of Crossing Highway or Street*

The acceptable message element for the cases when the water is downstream of a crossing highway or street is shown below.

**PAST *[highway, street name]***

A very large majority of Texas drivers (95 percent) interpret the term *PAST [highway, street name]* to mean a location downstream of the specific crossing highway or street. For example, the descriptor *PAST ROWLAND ST* is interpreted as a location downstream of Rowland Street.

### *Water between Exit and Entrance Ramps*

Acceptable *Water Location* message elements when the water is between the exit and entrance ramps are shown below.

**AT *[highway, street name]***
**PAST *[exit ramp name]* EXIT**

A large majority (82 percent) of Texas drivers interpret the term *AT [highway, street name]* to mean a location between the exit ramp and entrance ramps. For example, the descriptor *AT ROWLAND ST* is interpreted as a location downstream of the Rowland Street exit ramp but upstream of the Rowland Street entrance ramp. However, 16 percent of drivers interpret the descriptor to mean that the water is upstream of the Rowland Street exit ramp. Thus, the term *PAST [exit ramp name] EXIT* may be the better of the two options.

### *Water Upstream of Exit Ramp*

When the water is upstream of an exit ramp, the *Water Location* message element shown below should be used.

**BEFORE *[exit ramp name]* EXIT**

*BEFORE [exit ramp name] EXIT* is preferred to *BEFORE [highway, street name]*. A significant percentage of Texas drivers (24%) will improperly conclude that the *BEFORE [highway, street name]* format means that the water is between the exit ramp and the crossing highway or street so that the exit is available for use.

## Action

Texas drivers indicated the *Action* message elements shown below are sufficient to inform them that they can proceed on the freeway and do not have to exit because of the high water.

**BE PREPARED TO STOP**
**USE CAUTION**

# 17.3 MESSAGES FOR FREEWAY FLOOD CONDITIONS

## MESSAGE FORMAT AND MESSAGE ELEMENTS

The following message format should be used when the message is displayed with one phase:

- Freeway Closure Descriptor message element *(top line)*,
- Closure Location message element *(middle line)*, and
- Action message element *(bottom line)*.

The acceptable format for a one-phase message is illustrated below.

| |
|---|
| **I (*XX*) (*NORTH*) CLOSED**<br>**(*Closure Location*)**<br>**(*Action*)** |

The following message format should be used when the message is displayed on two phases:

- Freeway Closure Descriptor message element *(phase 1, top line)*,
- Closure Location message element *(phase 1 middle line)*, and
- Action message element *(phase 2 top and middle lines)*.

The acceptable format for a two-phase message is illustrated below.

| Phase 1 | Phase 2 |
|---|---|
| **I (*XX*) (*NORTH*) CLOSED**<br>**(*Closure Location*)** | ***(ACTION)***<br>***(ACTION)*** |

### Freeway Closure Descriptor

The acceptable freeway *Closure Descriptor* message element is shown below.

**I *XX [cardinal direction]* CLOSED**

The interstate number designation of the freeway that is flooded and the direction of travel should always be the first terms on the first line in the message. The term *I 45 NORTH CLOSED* is preferred over *FREEWAY CLOSED* because it gives drivers specific information as to whether the freeway they are on is closed or whether some other freeway that may be along their route to specific destinations is closed.

Overall, the majority of the Texas drivers prefer the term *I-XX* (68 percent) rather than *IH-XX* (32 percent) for the interstate number designation. A very large majority of the drivers in Arlington (81 percent), El Paso (100 percent), and Houston (81 percent) prefer the term *I-XX*. Drivers in Austin, Laredo, and San Antonio were generally evenly split with respect to preference

## Closure Location

Acceptable terms for the *Closure Location* message element are shown below.

***[number]* MILES *[AHEAD]***
**AT *[highway, street name]***

## Action

### *DMS on Same Freeway and Relatively Close to the Flood*

Acceptable terms for the *Action* message element for a one-phase message are shown below.

**USE OTHER ROUTES** (soft diversion)
**TAKE NEXT EXIT**
**TAKE NEXT *X* EXITS**
**EXIT AT *[highway, street name] [cardinal direction]***
**EXIT AT *[route number] [cardinal direction]***
**TAKE *[exit ramp name]* EXIT**
**USE *[highway, street name] [cardinal direction]***
**USE *[route number] [cardinal direction]***

Acceptable terms for the *Action* message element for a two-phase message are shown below.

**EXIT AND**
    **FOLLOW DETOUR**
**EXIT AND**
    **FOLLOW SIGNS**
**EXIT AT *[highway, street name] [cardinal direction]***
    **FOLLOW DETOUR**
**EXIT AT *[highway, street name] [cardinal direction]***
    **FOLLOW SIGNS**
**EXIT AT *[route number] [cardinal direction]***
    **FOLLOW DETOUR**
**EXIT AT *[route number] [cardinal direction]***
    **FOLLOW SIGNS**
**TAKE *[exit ramp name]* EXIT**
    **FOLLOW DETOUR**
**TAKE *[exit ramp name]* EXIT**
    **FOLLOW SIGNS**
**TAKE *[highway, street name] [cardinal direction]***
    **FOLLOW DETOUR**
**TAKE *[highway, street name] [cardinal direction]***
    **FOLLOW SIGNS**
**TAKE *[route number] [cardinal direction]***
    **FOLLOW DETOUR**
**TAKE *[route number] [cardinal direction]***
    **FOLLOW SIGNS**

### *DMS on Same Freeway but Relatively Far from the Flood*

When the DMS is relatively far upstream from the flood, it is desirable to have drivers take exits far upstream of the flood to minimize freeway congestion. Detour signs are not generally installed at these far upstream ramps or on the arterial streets. Acceptable terms for the *Action* message element for a one-phase message are shown below.

**USE OTHER ROUTES** (soft diversion)
**TAKE NEXT EXIT**
**TAKE NEXT *X* EXITS**
**EXIT AT *[highway, street name] [cardinal direction]***
**EXIT AT *[route number] [cardinal direction]***
**TAKE *[exit ramp name]* EXIT**
**USE *[highway, street name] [cardinal direction]***
**USE *[route number] [cardinal direction]***

# MODULE 18. OZONE

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# MODULE 18. OZONE

## 18.1 INTRODUCTION

Hot, humid, and stagnant weather conditions contribute to the formation of ground-level ozone—a major component of smog. People exposed to elevated levels of ozone may experience a variety of symptoms. The most common symptom is a feeling of irritation in the eyes, nose, and throat. Some people also experience shortness of breath, chest pain, and wheezing. Very young people and people with pre-existing lung disease, such as asthma, may be more seriously affected.

Besides the adverse effects of ozone pollution, high levels of ground-level ozone can violate federal air quality standards. Violating these standards can lead to a variety of sanctions.

Ozone action days are declared on hot, sunny, still days when conditions are most favorable for the accumulation of unhealthy levels of ground-level ozone. Forecasters at the Texas Commission on Environmental Quality make their forecasts a day in advance. Ozone action days are forecasted for many of Texas' larger urban areas which may use different terms for the event. For example, in San Antonio, the term *air quality health alert* is used.

## 18.2 OZONE MESSAGES

Messages are generally displayed on DMSs both the day prior to and the day of the Ozone Action Day. Messages displayed the day before the ozone action day provide drivers with advanced notice and give them an opportunity to plan for other modes of transportation, although it is not clear how many drivers change modes.

### DAY PRIOR TO OZONE ACTION DAY

Acceptable messages and formats are illustrated below.

| | |
|---|---|
| **OZONE ACTION DAY<br>TOMORROW** | **RIDE THE BUS (FREE)<br>SHARE A RIDE** |
| *Phase 1* | *Phase 2* |

*Option 1*

| | |
|---|---|
| **OZONE ACTION DAY<br>TOMORROW** | **REDUCE TRIPS<br>WORK AT HOME** |
| *Phase 1* | *Phase 2* |

*Option 2*

## DAY OF OZONE ACTION DAY

An acceptable message and format is illustrated below.

| | |
|---|---|
| **OZONE ACTION DAY**<br>**TODAY** | **REDUCE TRIPS**<br>**WALK TO LUNCH** |
| *Phase 1* | *Phase 2* |

# MODULE 19.  PLANNED SPECIAL EVENTS

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# MODULE 19. PLANNED SPECIAL EVENTS

## 19.1 INTRODUCTION

Results of research have shown that one of the most effective uses of DMSs is for planned special events. A very large majority of drivers respond to DMS messages when information directs them to the best route to an event. For example, results of field studies conducted by TTI showed that up to 90 percent of the drivers destined to a planned special event diverted to an alternative route that was suggested on DMSs.

### IMPACT AND OPERATIONAL STRATEGIES OF PLANNED SPECIAL EVENTS

A planned special event impacts the transportation system by generating an increase in travel demand over and above the normal traffic demand. Operations strategies for a planned special event include: 1) mitigating the travel demand impacts of the event and 2) ensuring the transportation system operates as efficiently as possible on the day-of-event. Successful operational strategies include: travel demand management, transit service and information, and pre-trip traveler information. Freeway DMSs can play important roles for the first two strategies.

Two distinct groups of travelers are affected during a planned special event that is located near the freeway:

- Drivers traveling to the event and
- Drivers not traveling to the event.

### Categories of Planned Special Events

Information for this section of Module 19 was obtained in large part from the *Managing Traffic for Planned Special Events Handbook* that was prepared for FHWA by Dunn Engineering Associates. The full text of the *Handbook* can be found at http://tmcpfs.ops.fhwa.dot.gov/cfprojects/new_detail.cfm?id=59&new=2.

There are five categories of planned special events, namely:

- Discrete/recurring event at a permanent venue,
- Continuous event,
- Street use event,
- Regional/multi-venue event, and
- Rural event.

A discrete/recurring event at a permanent venue occurs on a regular basis and it has a specific starting time and predictable ending time. Events classified under this category have predictable peak arrival and departure rates relative to other categories of planned special events. These events generate high peak travel demand rates because of patron urgency to arrive at the venue by a specific event start time.  Moreover, these events end abruptly upon game time expiration or the conclusion of a final song, which creates high peak departure rates.  Information displayed on DMSs can benefit drivers both traveling to the event and those traveling on the freeway and roads that are impacted by the event traffic.

A continuous event occurs over a single or multiple days.  Unlike a discrete/recurring event at a permanent venue, continuous events do not exhibit sharp peak arrival and peak departure rates. Event patrons typically arrive and depart throughout the event day.  Aside from conventions and state/county fairs, many continuous events take place at a temporary venue, park, or other large open space.  As a result, roadway and parking capacity issues may arise in the immediate area surrounding a temporary venue which can be addressed with a management strategy that involves displaying messages on DMSs.  DMSs are also helpful to drivers who are not traveling to the event at times when ensuing congestion sets in due to increased travel demand for the event.

A street use event occurs on a street requiring temporary closure.  These events generally occur in a city or town central business district; however, race events or motorcycle rallies may necessitate temporary closure of arterial streets or limited-access highways.  A street use event significantly impacts businesses and neighborhoods adjacent to the event site from the perspective of parking and access.  A street use event requires closure of a segment(s) of the roadway network and causes background and event traffic to divert onto alternative routes, thus increasing traffic demand on other streets in the roadway network.  DMS messages of advance notification of the street closures can help encourage drivers to avoid the venue area on the day of the event.

A regional/multi-venue event refers to multiple planned special events that occur within a region at or near the same time.  The collection of events may have different starting times and differ in classification category.  For instance, a major metropolitan area may have two or more adjacent fixed venues or venues utilizing the same freeway corridor.  Multiple venues may occasionally host events on the same day.  Stakeholders managing all planned special events within a region emphasize coordination of event times to reduce peak parking demand and impact on transportation system operations.  Information displayed on DMSs can benefit both drivers traveling to one of the events and those traveling on the freeway and roads that are impacted by the event traffic.

Rural events encompass any discrete/recurring event or continuous event occurring in a rural area.  Planned special events occurring in rural areas deserve a stand-alone classification category for several reasons.  First, there is a need for stakeholders to assume new and/or expanded roles. Second, there may be limited road capacity to access the event venue and potentially limited parking capacity at the venue.  Third, there may be fewer alternative routes to accommodate event and background traffic.  Again, information displayed on DMSs can benefit both drivers traveling to one of the events and those traveling on the freeway and roads that are impacted by the event traffic.

## SETTING PRIORITIES FOR PLANNED SPECIAL EVENT MESSAGES

DMS messages informing drivers of incidents, roadwork involving lane closures, or traffic events that impact safety always take precedence over messages designed to manage traffic during planned special events. Also, policies should be established by TxDOT as to whether DMS signing priority should be placed on drivers heading to the venue or other drivers on the freeway who are not heading to the event but could be impacted by the additional travel demand.

## INFORMATION ON DMSs TO ACCOMPLISH OPERATIONAL STRATEGIES

### Drivers Traveling to the Event

The two most likely scenarios for using DMSs for a planned special event are to:

- Inform drivers of the direct route to the event or
- Divert drivers to an alternative route.

#### *Best Signing Strategy*

Freeway drivers traveling to a planned special event want to know where to exit or which route to take to reach the event. They are particularly concerned with knowing the availability and location of parking—desirably parking close to the venue. Although important, parking information should not be displayed on DMSs on the freeway.

The best signing strategy is to inform drivers of the exit(s) or arterial that should be used to reach the event and to use well-designed and well-located static trailblazers to direct drivers to the venue and parking areas. When trailblazers are not installed, then it is important that police or traffic control personnel be stationed at the signalized intersections and the entrances to parking facilities/areas to direct traffic.

Drivers expect to see an *Audience for Action* message element on the top line in the message. (Refer to page 4-13 for a more detailed discussion of *Audience for Action*.) In the case of a planned special event, the *Audience for Action* is the destination. FAIRPARK, for example is a special event destination in Dallas.

#### *Information on DMSs: Inform Drivers of Direct Route to Event*

The more common traffic management strategy is to inform drivers of the exits to take or routes to use to reach the event. It is not possible to show in the *Manual* the wide variety of DMS messages that might be used. Examples of typical messages are shown below.

| Example 1 | Example 2 |
|---|---|
| **FAIR PARK**<br>**TAKE NEXT 2 EXITS** | **FAIR PARK**<br>**EXIT AT 2ND AVE** |

*Example 1*  *Example 2*

### *Information on DMSs: Divert Event Traffic to an Alternative Route*

In some situations, drivers are diverted to an alternative route. When this traffic management strategy is used, the alternative route must provide a significant travel time savings. It is essential that the traffic conditions on both the primary and diversion routes be monitored to ensure that the drivers are not being diverted to an alternative route that does not provide significant time savings. One advantage of DMSs is that the messages can be displayed when it is desirable to divert drivers to the alternative route and can be turned off whenever it no longer applies (i.e., the alternative route no longer provides significant time savings).

In addition to the messages shown above to inform drivers of the direct route to the planned special event, DMS messages that would illicit greater response to divert to an alternative route are shown below.

| FAIR PARK<br>TAKE FITZHUGH<br>AVOID MAJOR DELAY | FAIR PARK<br>TAKE FITZHUGH<br>SAVE 20 MIN | FAIR PARK<br>TAKE FITZHUGH<br>AVOID 20 MIN DELAY |
|---|---|---|
| *Example 1* | *Example 2* | *Example 3* |

**FAIR PARK**
**BEST ROUTE**
**USE FITZHUGH AVE**

*Example 4*

### *Static Trailblazer Signs*

Normally, as soon as drivers leave the freeway, they must maneuver through a major signalized intersection. They will be searching for information about the:

- Destination name,
- Turning movements, and
- Lane assignments.

Because of the relatively high exit speed and the high information load at the intersection due to high traffic volumes and the short time available to make critical decisions as soon as they leave the freeway, good trailblazer signing at the ramp/service road (or street) junction is exceptionally important. Drivers must be “pulled through” the intersection with a trailblazer assembly that is easily recognizable. The first trailblazer sign or sign assembly must contain the destination name, the turning movement to reach the venue, and the lane assignment in preparation for the turning movement. The destination name on the trailblazer must be the same as that used on the DMS.

Trailblazers should be located at every point where drivers may become confused. It is important to remember that many drivers will be taking the route for the first time. A general rule of thumb is that a trailblazer is needed at major intersections where drivers have to make a decision. Where a wide major road (particularly another freeway) passes over or under the alternative route, trailblazers are recommended both in advance of and just beyond the interchange.

Examples of well-designed trailblazer signs for a special event, proper locations, and other requirements are given in Report FHWA/TX-92/1232-10, *Guidelines on the Selection and Design of Messages for Changeable Message Signs*.

### Drivers Not Traveling to the Event

Drivers not traveling to the event could be adversely affected by increased travel demand, which sometime results in congestion. Thus, it may be advantageous to provide advance notification of the event.

As previously noted, DMS message priority on the day of the special event should be given to incidents, roadwork involving lane closures, and traffic events that impact safety as opposed to management of the special event traffic.

## POLICY FOR DISPLAYING DMS MESSAGES

TxDOT currently does not have an established statewide policy for displaying messages on DMSs during planned special events. The Houston District has developed a set of requirements for displaying messages on DMSs during special events and for displaying information for shuttle services. These are shown in Figures 19-1 and 19-2.

**TEXAS DEPARTMENT OF TRANSPORTATION**
**HOUSTON DISTRICT**
**SPECIAL EVENT SIGNING REQUIREMENTS**

A. Policy

Pursuant to policy 22.10.22.15, concerning the use of state highway right-of-way, the Department, using the State's Intelligent Transportation System, may assist with signing to inform the public of a special event which is open to the general public.

B. Application

To obtain assistance for signing for a special event, a person or entity must file an application with the Freeway Operations Supervisor, Transportation Management Systems, and the Department's Transportation Management Center, not fewer than 14 calendar days prior to the initial date of signing. The application shall be in the form prescribed by the Department and shall at a minimum include:

a. date of the event, beginning and ending;
b. hours of operation;
c. event information, what the event is benefiting, number of people anticipated to attend;
d. exact location of the event, including diagrams of the access, parking areas and relationship to adjacent state right-of-way;
e. if applicable, a letter from any and all law enforcement agencies that will be assisting with traffic control;
f. if applicable, a letter of permission from the owner of the property being utilized for the event;
g. a detailed traffic control and Dynamic Message Sign (DMS) plan, stamped by a licensed Professional Engineer (P.E.), incorporating the requirements of the Texas Manual on Uniform Traffic Control Devices, including but not limited to:
   1. diagram of site and relationship of DMS to event access, stamped by a P.E. licensed to work in the state of Texas;
   2. location(s) of applicable DMS;
   3. dates and hours of operation for each DMS to be utilized;
   4. applicable message text for each DMS.

C. Criteria

a. a minimum of 5,000 people must be projected to attend the event;
b. the event location must be adjacent to the state's right-of-way or must be shown to have significant impact on the right-of-way.

**Figure 19-1. Houston District Special Event Signing Requirements.**

**TEXAS DEPARTMENT OF TRANSPORTATION**
**HOUSTON DISTRICT**
**SHUTTLE SIGNING REQUIREMENTS**

A. Policy

The Department may assist with signing to advise the traveling public of remote shuttle parking locations during special events if there are not ample parking spaces available or if such actions are necessary to alleviate traffic congestion on the State roadway system in and around the event.

B. Request

1. Who may submit?
   Any individual, private entity, or government entity may submit a request for assistance with shuttle signing for a special event that is offering shuttle service. If in an incorporated area the event must be approved by the local government entity.
2. Requirements
   A request for assistance with shuttle parking signing must be submitted in writing to the Freeway Operations Supervisor, Transportation Management Systems, a minimum of twenty-one (21) days prior to the event and must contain the following information:
   a. municipalities impacted by the event;
   b. date for the event;
   c. event information, what the event is benefiting, number of people anticipated to attend, number of people expected to utilize the shuttle service;
   d. exact location of the shuttle parking area(s), the event, distance from the shuttle parking area to the event location, including diagrams of the shuttle route, event location and shuttle parking location(s);
   e. dates/hours of operations for the shuttle;
   f. number of shuttle vehicles that will be utilized, type of vehicles used, number of people each shuttle is capable of transporting at one time, and frequency of operation;
   g. if applicable, a permit or letter of permission from each of the local jurisdictions affected by the event;
   h. h. if applicable, a letter of permission from the owner of the property being utilized for the event;

   a detailed traffic control and Dynamic Message Sign (DMS) plan, stamped by a licensed Professional Engineer (P.E.), incorporating the requirements of the Texas Manual on Uniform Traffic Control Devices (MUTCD).
3. Criteria
   a. shuttle parking area must be adjacent to the State's right-of-way;
   b. a minimum of 20,000 people must be projected to attend the event;
   c. a minimum of 10% of the patrons must be projected to utilize the shuttle service;
   d. a minimum of four (4) shuttle vehicles are required;
   e. shuttle must operate on a scheduled basis;
   f. the shuttle parking area must be a minimum two (2) miles from the actual event.

It is recommended that a post event report be submitted containing updated information for the current year's event. This information will be used to meet criteria for future events.

**Figure 19-2. Houston District Shuttle Signing Requirements.**

# MODULE 20.  HURRICANE EVACUATION

Issues relating to hurricane evacuation were addressed as part of the focus group studies conducted as part of Project 0-4023 in early 2004 in Amarillo, Arlington, El Paso, Houston, Laredo, and San Antonio.  One of the weaknesses of the study was that none of the focus group participants had been in a situation where they had to evacuate because of a hurricane and had a difficult time imagining themselves in this type of emergency.  Thus, the results of the studies are suspect and the researchers did not have full confidence to translate the results into meaningful motorist information needs and to design effective DMS messages.

Hurricane Rita in September 2005 impacted the Texas Gulf Coast and resulted in mass evacuation from major cities such as Houston and Galveston.  It was deemed desirable to take advantage of the plight and evacuation experiences of some of the citizens who could provide more meaningful responses to queries about driver information needs.  A task was added to Project 0-4296 Development of Guidelines for Hurricane Evacuation Signing and Markings to conduct focus group studies and to support TxDOT in developing messages for DMSs and portable changeable message signs.

It is recommended that Module 20 be completed after the results from Project 0-4296 are available and DMS messages are designed.

# MODULE 21. DMS OPERATIONS POLICIES

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# MODULE 21. DMS OPERATIONS POLICIES

## 21.1 INTRODUCTION

This module is divided into two parts. The first part contains summaries of available DMS operations policies and guidelines at the federal level. In part two, guidelines are presented to assist TxDOT in developing statewide and regional policies for the operation of DMSs. A list of supporting references is included at the end of the module. (Note "region" as used in this *Manual* refers to an area encompassing more than one state, in contrast to the division of state DOTs into regions within a state.)

A distinction is made in this *Manual* between DMS operations a) policies and b) procedures and guidelines. *DMS operations policies* contain the guiding principles that are considered to be prudent and that influence the actions taken by the managers of TMCs in the operation of DMSs. An example is a policy on whether the DMSs should be blank when there are no incidents or roadwork on the freeway. *DMS operations procedures and guidelines* outline and describe the day-to-day operation of DMSs (e.g., the content and format of DMS messages). A list of items that TxDOT should consider in developing procedures and guidelines for the operation of DMSs is presented in *Module 22 DMS Operations Procedures and Guidelines*.

## 21.2 FEDERAL POLICIES

There are no written DMS operations policies at the national level. However, policies, standards, and guidance are embodied in the MUTCD *(1)* and in four FHWA Policy Memorandums. In addition, another Memorandum describes FHWA's recommendation for displaying travel time on DMSs**.** (Note, FHWA uses the term *changeable message signs* (CMSs) in its policies.) The first Policy Memorandum "Use of Changeable Message Sign (CMS)" (http://www.fhwa.dot.gov/legsres/directives/policy/pame.htm) dated January 19, 2001 supports the use of CMSs as a traffic control device to safely and efficiently manage traffic by informing drivers of roadway conditions and required actions to perform. The primary sections addressing CMSs in the MUTCD are *Section 2A.07 Changeable Message Signs*, *Section 2E.21 Changeable Message Signs*, and *Section 6F.52 Portable Changeable Message Signs*. Parts of the January 19, 2001 Memorandum that relate to policies and guidelines are presented below *(2)*.

> *" . . . Section 2A.07 of the Manual on Uniform Traffic Control Devices (MUTCD) requires that a CMS shall conform to the principles established in the MUTCD related to the use of signs within the right-of-way of all classes of public highways, and to the extent practical, the design and applications prescribed in Sections 6F.02 and 6F.52. Section 2E.21 of the MUTCD specifies that 'Changeable message signs shall display pertinent traffic operational and guidance information only, not advertising'. "*

> *"The FHWA supports the use of a CMS as a traffic control device to safely and efficiently manage traffic by informing motorists of roadway conditions and*

*required actions to perform. The appropriate use of a CMS and other types of real-time displays should be limited to managing travel, controlling and diverting traffic, identifying current and anticipated roadway conditions, or regulating access to specific lanes or the entire roadway."*

*" . . . The use of a CMS for the display of general public information or other nonessential messages is discouraged. Only essential messages should be displayed on a CMS. As per MUTCD Section 1A.01 'Guide and information signs are solely for the purpose of traffic control and are not an advertising medium'."*

*"The content of a CMS message should be based on requiring the motorist to take an action. However, operational, road condition, and driver safety focused messages are acceptable to be displayed on a CMS. If driver safety focused messages are to be displayed on a CMS, they should be kept current and relate to a safety campaign. The period of time that a specific message is displayed for a safety campaign should be limited to a few weeks . . ."*

The second Memorandum, "Click it or Ticket Signs" dated March 6, 2002, addresses whether the safety campaign message "CLICK IT OR TICKET" is in conformance with the MUTCD. (http://mutcd.fhwa.dot.gov/res-memorandum_clickit.htm) The following statements are contained in the Memorandum (3):

*"The display of safety messages associated with a safety campaign is allowable under the current MUTCD, as long as it conforms to sign design, location, and spacing requirements and does not block other regulatory, guide and/or warning signs. We have determined that the "Click it or Ticket" signs meet the design requirements and are in conformance with the Manual based on the following analysis.*

*The Millennium Edition of the MUTCD does not specifically address safety message signs; however, there are provisions in Section 1A.03 and Section 2B.51 that allow an agency to develop its own regulatory and warning message signs, as long as they follow the basic guidelines on color, appearance, etc. Section 2B.51 of the Manual also includes the seat belt symbol.*

*The Federal Highway Administration (FHWA) supports the use of a Changeable Message Sign (CMS) as a traffic control device to safely and efficiently inform motorists of roadway conditions and required actions to perform. The FHWA issued a policy memorandum on CMS January 19, 2001 (copy attached). That policy gives general guidance and allows driver safety messages to be displayed on a CMS including those associated with a safety campaign. The "Click it or Ticket" sign design for a safety campaign conforms to the information in this memorandum."*

The third Memorandum, "AMBER Alert Use of Changeable Message Sign (CMS)" (http://www.fhwa.dot.gov/legsregs/directives/policy/ambermemo.htm), dated August 16, 2002, was prepared to clarify FHWA policy on the use of CMSs to display child abduction messages as part of an AMBER (America's Missing: Broadcast Emergency Response) Plan Program. Parts of the Memorandum that relate to policies and guidelines were presented in the Section on *Federal Amber Plan Program Policies* on page 15-1 *(4)*.

The fourth Memorandum, "Use of Changeable Message Sign (CMS) for Emergency Security" (http://www.fhwa.dot.gov/legsregs/directives/policy/securmemo.htm), dated March 21, 2003, contains a documentation of FHWA policy for use of CMSs for emergency security. The part of the Memorandum that addresses FHWA policy should a public agency decide to display emergency or security alert messages on CMSs was presented in the section on *Federal Highway Administration Policy on Emergency or Security Alert Messages on page 16-2 (5)*.

A Memorandum dated July 16, 2004 notes that FHWA strongly recommends the display of travel time information in CMSs whenever possible. A part of the Memorandum is presented below (http://www.i95coalition.org/PDF/Calendar/travel time-memo-ver3.pdf) *(6)*.

> *"…(The) goal should be to have travel time information as the default information available to motorists throughout the day. A "dark" or blank CMS is a transportation investment that is not being fully utilized. We should be asking why is it dark and what will it take to get travel time posted on an ongoing basis. Furthermore, no new CMS should be installed in a major metropolitan area or along a heavily traveled route unless the operating agency and the jurisdiction have the capability to display travel time messages."*

## 21.3 REGIONAL POLICIES

Some state DOTs coordinate their DMS operations with other operating agencies in a region through a variety of formal and informal mechanisms such as committees or coalitions. One of the objectives of a coalition is to coordinate across jurisdictional boundaries the display of timely and accurate information to drivers in major freeway corridors when major incidents occur or during construction. To accomplish this, the roles and responsibilities of the agencies affected by incidents or construction of significant proportion are defined based on the nature of their interaction with the event. These roles and responsibilities are defined in oral or written agreements.

It is likely that agencies in a regional coalition may have different DMS operations policies. Individual states in the coalition should generally operate in accordance with state policies, and the regional coalition should attempt to ensure, to the extent possible, that the partnership policies on DMS operations comply with key elements of the state policies.

# 21.4 POTENTIAL TXDOT OPERATIONS POLICY STATEMENTS FOR PERMANENT DMSS

## INTRODUCTION

The sections that follow are intended to provide guidance to TxDOT in developing statewide or regional policies for the operation of DMSs. Twenty-four candidate policy issues are presented. Table 3-1 is a summary of suggested policy issues that should be considered at state and regional levels. Certainly, TxDOT may not wish to establish policy on each of these issues. Table 3-1 is intended to remind TxDOT of several possible policy issues that it may want to consider.

To assist TxDOT in developing a policy, the following information is given for each of the issues listed in Table 3-1: a) an explanation of the policy, b) a policy statement example that TxDOT can use in developing the policy, and c) justification and/or considerations that may influence TxDOT's decision to elect to include the statement in its policies, along with supporting references where available. The policy issues and statements were abstracted from the New Jersey DOT *Variable Message Sign Operations Manual* (*7*) and from documents that the author was able to obtain from a small number of state DOTs. It should be noted that TxDOT may prefer to change the wording in the policy statements to fit its own specific needs.

**Table 3-1. Possible DMS Operations Policy Issues.**

| State | Region[A] |
|---|---|
| 1. Responsibility for operation of DMSs | 1. Responsibility for operation of DMSs |
| 2. Operation of DMSs by other state DOT personnel | 2. Operation of DMSs by other state DOT personnel |
| 3. Operation of DMSs by law enforcement personnel | 3. Operation of DMSs by law enforcement personnel |
| 4. General operations | 4. General operations |
| 5. Blank signs | 5. |
| 6. Messages during peak periods | 6. |
| 7. Display of upcoming roadwork | 7. |
| 8. Display of upcoming special events | 8. |
| 9. Display of travel times | 9. |
| 10. Traffic diversion (general) | 10. Traffic diversion (general) |
| 11. Traffic diversion to roadways not under jurisdiction of TxDOT | 11. Traffic diversion to roadways not under jurisdiction of TxDOT |
| 12. Advance notice of roadwork involving lane closures | 12. |
| 13. Special events | 13. Special events |
| 14. Regulatory speed messages | 14. |
| 15. Adverse weather, environmental, and roadway conditions | 15. |
| 16. Limits of DMS influence for incidents | 16. Limits of DMS influence for incidents |
| 17. Advertising | 17. |
| 18. Public service announcements | 18. |
| 19. Driver safety campaigns | 19. |
| 20. Display of AMBER alerts | 20. Display of AMBER alerts |
| 21. Displaying information for other states | 21. Displaying information for other states |
| 22. Intermodal information | 22. Intermodal information |
| 23. Operation with lane control signals | 23. |
| 24. Test messages | 24. |

[A] The language in the Policy Statement Examples may have to be changed to accommodate cooperative interstate activities.

# 1. RESPONSIBILITY FOR OPERATION OF DMSs

**Policy**

The policy statement is to establish final responsibility for the operation of DMSs on roadways under the jurisdiction of TxDOT and to establish responsibility for daily operations of the DMSs.

**Policy Statement Example**

**General**

> TxDOT personnel have responsibility for the operation of DMSs on roadways under the jurisdiction of TxDOT. The [*fill in*] office (*or position title*) has final responsibility for the operation of all DMSs on roadways under the jurisdiction of TxDOT. [*Add the contact name(s) for general questions about the DMSs and overall responsibility.*]
>
> The [*Name of Center*] Traffic Management Center manager [*telephone number*] the [*Name of Center*] Traffic Management Center manager [*telephone number*], and the [*Name of Center*] Traffic Management Center manager [*telephone number*] have the responsibility for the daily operations of the DMSs on Texas state highways in [*list regions, areas, etc.*] respectively.

**Justification and/or Considerations**

It is advisable that clear lines of responsibility for operation of DMSs be established statewide and at the TMC levels.

# 2. OPERATION OF DMSs BY OTHER STATE DOT PERSONNEL

**Policy**

When a TMC does not operate 24 hours, 7 days a week, there may be situations that justify having other TxDOT personnel operate one or more of the DMSs during off hours either from the sign site or from another TMC. The situations that might arise when the TMC is not operational include events that result in unexpected congestion or impact safety such as: a) incidents, b) emergency roadwork, c) spilled loads, d) special events, e) severe weather or adverse pavement conditions, and f) heavy weekend/holiday traffic.

**Policy Statement Example**

> Authorized TxDOT district personnel may operate DMSs located in their respective districts during TMC off hours for emergency situations that may impact safety or traffic operations. The emergency situations may include the following: a) crashes, b) emergency roadwork, c) spilled loads, d) special events, e) severe weather or adverse pavement conditions, and f) heavy weekend/holiday

> traffic. The authorized district personnel shall only display messages contained in a message library developed by the TMC manager.

**Justification and/or Considerations**

Although it may not be practical for a TMC to operate the TMC 24/7, failure to display messages on DMSs when unexpected traffic congestion or events that may impact safety occur contributes to the erosion of the public's trust in the system. Therefore, it may be desirable to have authorized non-TMC personnel operate DMSs from the sign site or from a remote location during off hours.

The personnel must be trained to ensure that proper messages are displayed for the given traffic or highway situations. In addition, it is recommended that non-TMC personnel not be allowed to design messages. Rather, the TMC manager should provide a list of acceptable messages that are preprogrammed into the controller at the sign site or reside at the remote DMS system database.

## 3. OPERATION OF DMSs BY LAW ENFORCEMENT PERSONNEL

**Policy**

When the TMC does not operate 24 hours, 7 days a week, there may be situations when it is desirable to have law enforcement personnel operate one or more of the DMSs during off hours. The situations that may arise include: a) incidents, b) spilled loads, and c) severe weather or adverse pavement conditions. Operation of the DMSs may be at the sign site or from a remote location if the law enforcement agency is provided with the necessary equipment.

**Policy Statement Example**

> Control of DMSs during TMC off hours can be arranged with the [*State, city, county, etc.*] law enforcement agency provided that appropriate agreements are developed. Authorized law enforcement personnel may operate DMSs identified by the manager of the [*Name of Center*] TMC for emergency situations during TMC off hours. Messages may be displayed for the following situations: a) incidents, b) spilled loads, and c) severe weather or adverse pavement conditions. Law enforcement personnel shall only display messages contained in a message library developed by the TMC manager.

**Justification and/or Considerations**

Although it may not be practical for a TMC to operate the TMC 24/7, failure to display messages on DMSs when unexpected traffic congestion or events occur that may impact safety contributes to the erosion of the public's trust in the system. Therefore, it may be desirable to have authorized law enforcement personnel operate DMSs from the sign site during off hours.

The law enforcement personnel must be trained to ensure that proper messages are displayed for the given traffic or highway situations. In addition, it is recommended that the law enforcement personnel not be allowed to design messages; but rather, the TMC manager should provide a list of acceptable preprogrammed messages.

## 4. GENERAL OPERATIONS

### Policy

A policy statement is included to emphasize the type of messages that are allowable on DMSs within the state.

### Policy Statement Example

> Only real-time information about incidents and roadwork and about traffic, roadway, environmental, or pavement conditions that could have an effect on driver safety and traffic efficiency shall be displayed on the DMSs, with the exception that the following may occasionally be displayed: a) advance notification of roadwork requiring lane closures as described in Policy Statement 7 and b) advance notification of special events that will adversely affect travel either because of the added traffic generated or the requirement to close streets or highways (e.g., parades, street auto races, etc.) as described in Policy Statement 8. Messages associated with AMBER alerts described in Policy Statement 19 are permitted. (*The following statement can be added if TxDOT allows messages for safety campaigns.*) Occasional messages associated with driver safety campaigns described in Policy Statement 20 are permitted. Incidents include crashes, disabled vehicles, debris, or utility line breaks.

### Justification and/or Considerations

It is advisable to have a policy statement that succinctly addresses the use of the DMSs.

## 5. BLANK SIGNS

### Policy

The policy statement is to keep the DMS in a blank mode during the peak and off-peak periods in the absence of incidents and roadwork and current traffic, roadway, environmental, or pavement conditions that could have an effect on driver safety and traffic efficiency.

### Policy Statement Example

> DMSs will be in blank mode during the peak and off-peak periods when traffic, roadway, environmental, or pavement conditions do not warrant the display of a

message, or messages of advance notification of roadwork requiring lane closures (Policy Statement *7. Display of Upcoming Roadwork*), or special events (Policy Statement *8. Display of Upcoming Special Events*) are not being displayed. (*A phrase can be added if the state allows messages for safety campaigns and AMBER alerts.*)

**Justification and/or Considerations**

Once a DMS system is installed, a question always arises concerning when messages should be displayed. There are two schools of thought:

1. Display messages only when unusual conditions exist on the freeway; or
2. Always display messages regardless of whether unusual conditions exist on the freeway. Or, as a minimum, always display a message during the peak periods and only when unusual conditions exist during the off-peak periods.

The first of the above approaches is advantageous because of human factors principles and because of difficulties in designing messages when incidents actually occur during the peak periods. The second approach of always displaying a message leads to violation of the following two important human factors principles for DMS operations:

- Don't tell drivers something they already know; and
- For more effective systems, use the DMSs only when some response by drivers is required (i.e., change in speed, path, or route).

In the absence of incidents during the peak periods, more often than not, bottleneck locations and the subsequent locations and durations of congestion can almost be predicted. Consequently, the same congestion information will most likely be displayed almost daily. The display of repetitive information will result in many drivers failing to read the DMS even when important information is given. Some TMCs are even considering the use of flashing beacons on DMSs to attract the attention of motorists when incident, roadwork, etc. messages are displayed. To circumvent any possible adverse public reaction to seeing blank signs, the public could be educated through the media that the signs will be activated only when unusual freeway conditions exist. When so advised, drivers should be alert whenever a message is displayed on a DMS because they know that it will likely affect them. Messages should be displayed when some action is required of the driver. (*8*)

Another consideration with respect to displaying messages for recurring congestion is that one simply runs out of descriptors for the various possible levels of congestion. For example, if descriptors such as *HEAVY CONGESTION* or *MAJOR DELAY* are used to describe recurrent congestion, then descriptors are not available for the more severe congestion when incidents occur during the peak period.

Results of a survey reported by Dudek (*9*) in 1997 showed that 20 of 26 (77 percent) of transportation agencies responding had a policy of displaying messages only when unusual conditions were present on the facility and leaving the DMS blank during other times.

In contrast, because of delayed construction schedules, DMSs were installed for the INFORM Project on Long Island more than 18 months before the system became operational. Adverse public reaction to having expensive DMSs sitting idle for several months prompted New York to adopt a policy of displaying some type of message on the freeway DMSs at all times (*10*).

## 6. MESSAGES DURING PEAK PERIODS

### Policy

The policy statement is to prohibit display information about recurring congestion on DMSs during peak periods in absence of incidents.

### Policy Statement Example

> During daily peak traffic periods, DMS messages shall be used to advise motorists of unusual conditions (e.g., crashes, lane blockages, etc.) and congestion descriptors (e.g., *CONGESTION NEXT 2* MILES) shall not be used to advise motorists of normal daily recurrent peak period traffic congestion conditions.

### Justification and/or Considerations

(See *Justification and/or Considerations* presented previously for *5. Blank Signs*.)

## 7. DISPLAY OF TRAVEL TIMES

### Policy

Some TxDOT districts have the capability to measure or estimate travel times between sensor stations and to automatically display travel time information on DMSs. The policy is to allow travel time messages to be displayed during peak and off-peak periods in the absence of incidents, roadwork, or other conditions that may adversely affect driver safety or travel efficiency.

### Policy Statement Example

> Travel time information may be displayed if travel times can be measured or calculated using the electronic sensor equipment on the freeway and in the TMC, and if the information can be displayed and updated on the DMS automatically by the system computers. (*Note: Experience with displaying travel time information indicates that manual operation, particularly when a large number of DMSs are operated, is extremely difficult for DMS operators. Displaying travel time manually introduces a tremendous amount of workload to the DMS operators, particularly when an incident occurs on the freeway*.)

**Justification and/or Considerations**

Display of travel time information helps to reduce the amount of time that the DMSs are blank in the absence of incidents or roadwork. Travel time is generally calculated from speed measurements taken at loop detector stations or measured directly with automated vehicle identification (AVI) sensors.

It is important to recognize that the data available from these sources are estimated travel times of current conditions (loop detectors) or the travel times of the vehicles that recently traveled between two AVI sensor stations. In essence it is historical travel time. The process of accurately predicting the travel times of drivers viewing the DMS is not currently available. Recent human factors laboratory studies by Dudek et al. (*12*) suggest that the historical travel times obtained from loop or AVI sensors is acceptable to use in DMS messages. (Refer to the section on *Travel Time* beginning on page 4-11.)

## 8. DISPLAY OF UPCOMING ROADWORK

**Policy**

The policy statement is to allow display of DMS messages of upcoming roadwork that could impact the efficiency of drivers' trips because of lane closures or other activities in the work zone. In addition, the number of days in advance of the roadwork during which a message can be displayed is established.

**Policy Statement Example**

> Traffic-related information that provides advance notice of upcoming roadwork may be displayed, but should be replaced by current information whenever applicable. The upcoming roadwork may be on a freeway that could possibly affect the drivers' trips (e.g., the same freeway as the DMS, downstream intersecting freeway, etc.). The advance notification should not be given more than 7 days prior to the roadwork. Calendar dates should not be used in the message.

**Justification and/or Considerations**

When there is a concern about adverse public reaction when DMSs are left in a blank mode in the absence of incidents, roadwork, or other conditions that may adversely affect the driver's safety or travel efficiency, periodic display of relevant upcoming roadwork reduces the amount of blank time on the DMS.

Results of human factors studies in New Jersey (*11*) and Texas (*12*) indicate that the majority of drivers cannot relate calendar days (e.g., *SEP 25-SEP 28*) displayed on signs with actual workdays. Consequently, calendar dates should not be displayed on DMSs. Days of the week (e.g., *TUES-FRI*) should be displayed instead. Therefore, advance notification of roadwork should not be displayed more than one week prior to the roadwork in order to avoid the need to display calendar days.

## 9. DISPLAY OF UPCOMING SPECIAL EVENTS THAT ADVERSELY AFFECT TRAVEL

### Policy

The policy statement is to allow display of information about upcoming special events that will adversely affect travel by generating major traffic or by requiring street or highway closures (e.g., parades, street auto races, etc.). In addition, the number of days in advance of the event during which a message can be displayed is established.

### Policy Statement Example

> Traffic-related information that provides advance notice of upcoming special events that will adversely affect travel by generating major traffic or by requiring street or highway closures (e.g., parades, street auto races, etc.) may be displayed. The advance notification should not be given more than 7 days prior to the special event. Calendar dates should not be used in the message.

### Justification and/or Considerations

(See *Justification and/or Considerations* for *7. Upcoming Roadwork*.)

## 10. TRAFFIC DIVERSION (GENERAL)

### Policy

The policy statement is to ensure that positive guidance in the form of signs and/or law enforcement or traffic control personnel are placed at critical locations along the alternative route when the DMS messages direct drivers to divert to a specific alternative route.

### Policy Statement Example

> When incidents occur that do not require the full closure of the roadway and it is desirable to divert traffic from the freeway, DMS messages shall not divert motorists to specific alternative routes unless positive guidance is available along the alternative route in the form of a) guide signs and/or trailblazers to the major destination or b) law enforcement or traffic control personnel positioned at critical locations along the alternative route to control and guide traffic. Furthermore, both of the following conditions must be met:

- The DMS operator has current and continuously updated knowledge of the traffic conditions on the alternative route; and
- The alternative route will result in a significant savings in time for the diverted motorists.

**Justification and/or Considerations**

It is important that motorists are not diverted from the freeway to routes that do not provide positive guidance. Motorists are more willing to divert to an alternative route before they enter the freeway. They are less willing to divert after they are on the freeway because the average motorist enjoys the "security" of not getting lost while on the freeway and is reluctant to drive on unfamiliar routes if he/she were to divert (*13*). Results of studies reported in 1979 showed that the average motorist at that time indicated a propensity to divert when the delay on the freeway was 20 minutes or more (*14*, *15*).

## 11. TRAFFIC DIVERSION TO ROADWAYS NOT UNDER THE JURISDICTION OF TXDOT

**Policy**

The policy statement is intended to ensure that DMS diversion messages do not advise freeway drivers to use specific local streets that are not under the jurisdiction of TxDOT without prior approvals and agreements with the local agency.

**Policy Statement Example**

> DMS messages giving specific alternative routes may be displayed when the route is another state route. Specific messages recommending that motorists divert to specific roadways and/or local streets that are not within the jurisdiction of TxDOT are not permitted unless severe conditions exist and the appropriate agencies are involved. Messages supporting preplanned diversion routes established via written agreements with the local transportation agency are permitted at all times. "Soft" diversion messages (i.e., *USE OTHER ROUTES*) may be displayed when conditions warrant.

**Justification and/or Considerations**

It is important that institutional cooperation be maintained between TxDOT and local agencies.

## 12. ADVANCE NOTICE OF ROADWORK INVOLVING LANE CLOSURES

### Policy

The policy statement is to allow display of advance notice of roadwork involving lane closures that could impact the safety and efficiency of travel, and to prohibit the use of calendar days in the advance notice message.

### Policy Statement Example

> Displaying advance notice of roadwork or other potential impacts to a roadway on DMSs is acceptable. TxDOT Standard Plan TCP (6-1) – 98A states that "Static signs or changeable message signs stating the duration of ramp or freeway closure shall be placed a minimum of seven (7) calendar days in advance of actual closure." However, starting from six days prior to the closure, the advance notice shall be displayed in terms of days of the week. Calendar dates shall not be displayed. Messages that impact the safety and operations of the roadway shall have priority over advance notice messages.

### Justification and/or Considerations

Giving advance notice of roadway activities that may impact motorists' travel helps them in planning future trips and travel paths. Results of research conducted in Texas (*12*) and New Jersey (*11*) have shown that motorists cannot translate calendar dates to specific days of the week; thus, calendar dates should not be displayed. To adequately sign using the days of the week, it is important that the motorists are not confused as to whether the message applies to the current week or the following week. Thus, the message should not be displayed more than six days before the event takes place.

Advance notice messages have much lower priority than messages that impact the safety and operations of the roadway.

## 13. PLANNED SPECIAL EVENTS

Possible applications of DMSs during planned special events are as follows:

- Accommodate through drivers on the freeway when their travel is adversely affected by high-impact special events; and/or
- Manage traffic destined to the special event.

**Policy Alternative #1**

The policy statement is to allow the display of DMS messages to inform through drivers on the freeway when their travel is adversely affected by high-impact special events.

**Policy Statement Example**

> DMS messages may be displayed to inform through drivers on the freeway of adverse traffic conditions created as a result of special event traffic or conditions, or to reroute through drivers.

**Justification and/or Considerations**

Special events are traffic-related events on highways that involve closing lanes (e.g., bicycle races) or occur off the freeway system but may adversely influence freeway traffic and flows. Informing through freeway drivers of unexpected congestion, delays, lane closures, or detours resulting from the special event is a legitimate use for the DMSs and is in concert with Policy Statement 1.

**Policy Alternative #2**

The policy statement is to allow DMSs messages to be displayed to manage traffic destined to high-impact special events.

**Policy Statement Example**

> DMSs may be used to accommodate motorists traveling to special events (e.g., sporting event) when the anticipated traffic flow rates to the event exceed [*number*] vph. The messages may be used to direct motorists from the primary route to an alternative route that will eventually lead to a parking area. Trailblazers shall be used on the alternative route to direct motorists to the special event parking areas. Traffic conditions on the primary route and alternative route must be monitored. Messages intended to elicit diversion shall only be displayed when there is a significant savings in travel time for the motorists destined to the event, or when the motorists are being directed to parking areas with available parking spaces. The message shall be blanked alternately whenever the alternative route does not provide a significant travel time saving.
>
> DMSs may also be used to inform drivers of intermodal facilities and transportation opportunities to accommodate visitors to the special event. (See Policy Statement *22. Intermodal Information.*)

**Justification and/or Considerations**

Research has shown that one of the most effective uses of DMSs is for special events (*16, 17*). A large majority of motorists respond to DMS messages when the information directs them to a faster route to the special event. The alternative route must provide a significant travel time saving. Also, motorists are concerned with specific directions to parking areas; therefore, trailblazers on the alternative route should guide drivers to parking areas. Signing guidelines for special events are given in the *Manual on Real-Time Motorist Information Displays* (*8*).

One advantage of DMSs is that messages can be displayed when it is desirable to divert motorists to the alternative route and can be turned off when they no longer apply. It is essential that TxDOT personnel monitor traffic conditions on both the primary and secondary routes to ensure that motorists are not being diverted to an alternative route that does not provide significant time saving.

For some special events, intermodal transportation travel is emphasized for a number of reasons, including very limited parking or no parking at all at the special event site. DMSs are useful in informing motorists if ;parking is not available and the need to park at facilities such as park-and-ride shuttle lots. Directions to the park-and-ride shuttle lots can be given as well.

## 14. REGULATORY SPEED MESSAGES

**Policy**

The policy is to ensure that DMSs are not used as an exclusive speed limit regulatory sign.

**Policy Statement Example**

> The DMS message can be displayed to supplement existing static speed limit signs. The DMS message is not enforceable and shall not be used in place of a static sign. However, the DMS can be used to display advisory speed limits without static advisory speed limit signs.

**Justification and/or Considerations**

For certain conditions such as in freeway work zones there is a need to lower the speed limit below the normal posted speed limit. DMSs may be used to emphasize the change in speed limit that has been established using actual regulatory speed limit signs in that section.

Regulatory messages on current types of DMSs are not recognized or standardized in the MUTCD (*1*), nor do they have any legal status with respect to any information that they display. (*Note: FHWA is considering a change in the MUTCD that would allow a DMS sign to be used as the sole sign to post regulatory messages such as speed limits without the need for a static sign (18).*)

## 15. ADVERSE WEATHER, ENVIRONMENTAL, AND ROADWAY CONDITIONS

**Policy**

The policy allows display of adverse weather, environmental, roadway condition messages on DMSs.

**Policy Statement Example**

> DMSs may be used to display adverse weather, environmental, or roadway conditions downstream that may impact driver visibility and safety (e.g., fog, major snow storms, sand storms, icy roadway, high cross winds, broken pavement, etc.) or advise motorists of specific regulations due to the weather or roadway conditions (e.g., tire chains required).
>
> Messages, when used, are restricted to a specific location and a specific DMS. The roadway condition must be in the vicinity of the sign in use. General weather, environmental, or roadway condition information (*ICY ROAD CONDITIONS AHEAD*) is not permitted.

**Justification and/or Considerations**

> Informing motorists of adverse conditions helps to prepare them to take action (e.g., reduce speed).

## 16. LIMITS OF DMS INFLUENCE FOR INCIDENTS

**Policy**

This policy statement establishes the limits of the DMS message influence with respect to distance downstream of the DMS.

**Policy Statement Example**

> The following constitutes the policy for displaying incident messages on DMSs.
>
> - Messages should be displayed for all verified <u>major</u> incidents (e.g., multi-vehicle crash affected several lanes, truck overturn, etc.) that occur on the freeway up to [*number*] miles downstream of the DMS. The message should include the location of the incident (or closure) and the number of lanes closed.
>
> - Information concerning verified <u>minor</u> incidents and lane closures should be displayed for incidents occurring up to [*number*] miles from the DMS,

provided that information about the location and the number of lanes closed can also be given.

- Information concerning verified lane-blocking incidents that occur on an intersecting freeway may be displayed on DMSs that are located upstream of the interchange with that freeway depending on the location, severity, and duration of the incident.

- DMSs located on freeways leading to other states may display messages concerning verified major incidents (e.g., all lanes closed, truck overturn, etc.) on connecting freeways within the following states [*names of states*] depending on the location, severity, and duration of the incident.

**Justification and/or Considerations**

There is sometimes uncertainty by TMC supervisors concerning whether a DMS should be activated to display a message when an incident occurs that, in the supervisor's opinion, may not be close to the DMS.

## 17. ADVERTISING

**Policy**

The policy prohibits the display of advertisements or advertisement type messages on DMSs.

**Policy Statement Example**

> DMS messages advertising any product, service, campaign or political party are prohibited. Messages for special events should be designed such that advertising is not embedded in the messages (e.g., messages such as *GARTH BROOKS CONCERT* should not be displayed).

**Justification and/or Considerations**

Commercial advertisements on DMSs are prohibited by federal regulations (see Section 2E.21 in MUTCD). The illegality is also emphasized in two memoranda—one written in 1995 by Jerry L. Malone, Chief Counsel, FHWA (*19*) and the other written in 2001 by Christine M. Johnson, Program Manager, Operations and Director, ITS Joint Program Office, FHWA (http://www.fhwa.dot.gov/legsres/directives/policy/pame.htm) (*2*).

Oftentimes, special events have a significant impact on motorists—those attending the special event and those using the same primary freeway to pass by the special event location. Messages for special events can be well designed without including the private company or person sponsoring or performing at the event. For example, if Garth Brooks was performing at a facility at Fair Park, rather than displaying *GARTH BROOKS CONCERT*, the facility at which the concert will be performed (*FAIR PARK*) can be used.

## 18. PUBLIC SERVICE ANNOUNCEMENTS

**Policy Alternative #1**

The policy prohibits display of public service announcements on DMSs.

**Policy Statement Example**

> Messages designed to relay a public service announcement (e.g., ridesharing, enforcement actions, telephone hotlines, potential transit strike notices, etc.) are not permitted on DMSs, nor are messages designed to increase public awareness of a specific topic not associated with traffic or transportation.

**Justification and/or Considerations**

Public service announcements (PSAs) do not provide drivers with real-time safety or travel efficiency information. PSAs provide motorists with information that can be more effectively disseminated through other methods such as media campaigns or pamphlets. These and other methods would benefit a greater majority of the motoring public since it would not be limited to only those that travel on freeways with DMSs.

One argument in support of this policy is the concern that motorists who continually travel a specific route will become accustomed to the public service sign message and then begin to ignore the DMSs. Subsequent messages indicating lane closures, detours, etc., that directly affect motorists' travels may then tend to be unnoticed. Since DMSs are provided for the purpose of informing the motorists of unexpected conditions, the signs should be left blank and unused until conditions warrant their use. When use of the signs for real-time information is infrequent, it may be desirable to display other information that may affect the motorists' travel (e.g., existing or planned roadwork on the specific facility or on other intersecting freeways, expressways or toll roads, or travel time information).

A second argument in support of this policy is the potential negative response by the public when PSAs are displayed. In the past, Caltrans personnel in the TMC in Los Angeles displayed public service messages on freeway DMSs. Although these messages were transportation-related (e.g., *NEXT TIME TRY AMTRAK TO LAS VEGAS*; *RELIEVE CONGESTION–RIDESHARE*; etc.) they did not relate to the operation of the freeway system. Public reaction to the use of DMSs in this manner was quite negative. There was a belief among the traffic operations professionals that such use led to a public disregard of messages on the DMSs, thus making the signs less effective when traffic operational messages were displayed. The practice has been discontinued; DMSs are now used only for messages pertaining to unusual real-time traffic flow conditions *(20)*.

**Policy Alternative #2**

The policy allows display of public service announcements on DMSs.

**Policy Statement Example**

> Public service announcements (PSAs) may be displayed on a limited and short-term basis. DMSs should only be used only randomly and sparingly for PSAs so that the primary purpose of the signs will not be degraded. PSAs shall not be displayed in urban areas during the peak periods, and the total duration of the display should not exceed [*number*] hours per day or more than [*number*] days per month at any permanent DMS location.
>
> PSAs shall not be displayed prior to the approval of the [*title*]. The text for PSA messages must be approved by the [*title*].

**Justification and/or Considerations**

Normally, DMSs will only be used for PSAs that are directly related to transportation (e.g., carpool information, transit information, etc.). If the DMSs are used on a regular basis for non-critical messages and PSAs, motorists may begin ignoring the signs and miss urgent messages. The concept is that the signs are blank unless there is something urgent to relay to motorists.

## 19. DISPLAY OF AMBER ALERTS

**Policy**

The policy allows DMS messages to be displayed for child abduction (AMBER) alerts. The policy statement below is an interim policy established by Caltrans *(21)*.

**Policy Statement Example**

> DMS messages may be displayed for AMBER alerts. Only credible real-time information, where it is crucial to the safety of the victim to disseminate the information to the public in the near term, will be displayed on these DMS signs. Law enforcement activates an Amber alert when circumstances meet the following criteria: the missing child is of a pre-determined age; the law enforcement agency believes the child has been kidnapped; and the agency believes the missing child is under threat of serious bodily harm or death.
>
> TxDOT will consult with the investigating agency prior to requesting any DMS sign activations. TxDOT will only respond to AMBER alert requests from the Texas Department of Public Safety. The TMC staff and Texas Department of Public Safety staff shall jointly agree upon the most appropriate DMS message content(s). TMC staff shall also consult with Texas Department of Public Safety staff regarding the length of time to display messages (initially 2-3 hours) and

extent of roadway system to display the messages (i.e., radius and/or directions and specific routes).

TMC personnel should discuss with the requester the limitations on message content, the number of signs that can be deployed within a given time period, conflicts with other necessary sign messages etc. There is a concern that messages that are too general in describing vehicles might result in inappropriate vigilantism. The preferred response is to display a radio frequency (thus referring the public elsewhere for details) - Highway advisory radios (HAR) or appropriate commercial radio. Alternatively, a license plate number (or partial number) might be displayed along with a vehicle description. The display of any contact phone number is discouraged.

Nothing in this policy suggests a requirement to preempt true motorist safety messages, e.g. unexpected "end of queue" motorist alerts, severe weather advisories (fog, smoke), road closure and detour information etc. It may be necessary to turn off an AMBER alert sign that creates a traffic hazard.

**Justification and/or Considerations**

The AMBER Plan Program is a voluntary program through which emergency alerts are issued to notify the public about abductions of children. The FHWA has determined that the use of DMSs for this application is acceptable only if the criteria presented in the FHWA Memorandum "AMBER Alert Use of Changeable Message Sign (DMS)" dated August 16, 2002 are satisfied (http://www.fhwa.dot.gov/legsregs/directives/policy/ambermemo.htm). A summary of the criteria was presented earlier in this *Manual* starting on page 15-1.

The AMBER Plan Program encourages the most effective methods to communicate with the public on behalf of abducted children. The FHWA notes that DMSs are not always the most effective or safest method to disseminate information related to child abductions. Only a limited amount of information can be conveyed on a DMS. When there is a need to provide extensive information to motorists, FHWA states that it is critical that other types of traveler information media (e.g., 511, HAR, web sites, commercial radio) be used or that the messages on a DMS supplement these other media.

## 20. DRIVER SAFETY CAMPAIGNS

Although a safety campaign message is a form of public service announcement, it is addressed separately because some states permit safety campaign DMS messages and not other types of public service announcements.

**Policy**

The policy allows display of traffic safety messages associated with safety campaigns.

**Policy Statement Example**

> Public service announcements (PSAs) related to traffic/driver safety issues shall be displayed on DMSs only as a supplement to local or statewide traffic/driver safety media campaigns on the same topic. The PSAs shall not be displayed in urban areas during peak traffic periods, and the total duration of the display should not exceed [*number*] hours per day or more than [*number*] days per month at any permanent DMS location.

**Justification and/or Considerations**

> (See Justification and/or Considerations for 17. Public Service Announcements, above.)

## 21. DISPLAYING MESSAGES FOR OTHER STATES

**Policy**

The policy allows messages to be displayed on DMSs when major incidents or roadwork occur in an adjoining state.

**Policy Statement Example**

> DMSs may be used to display messages relating to major incidents and major construction for other agencies. The priority for displaying messages shall remain in the control of TxDOT. If another agency's message is preempted by TxDOT for higher priority needs, TxDOT shall notify the other agency.

**Justification and/or Considerations**

Many states in high-volume corridors have recognized the importance of providing motorists who travel from one state to another or through several states with information about major incidents in the adjacent state. The I-95 Corridor Coalition and the Gary-Chicago-Milwaukee ITS Priority Corridor are examples of multi-state cooperative agreements to apply ITS technologies toward solutions of regional problems. Also, agreements are sometimes reached between adjacent states that are not in a high-volume corridor.

## 22. INTERMODAL INFORMATION

**Policy**

The policy is designed to allow DMS messages to be displayed for inter-modal travel.

**Policy Statement Example**

> DMSs may be used to display messages to inform motorists of conditions to assist them with inter-modal travel. For example, DMSs may display messages to inform motorists a) of the availability of parking at Park-and-Ride facilities, b) of the availability of parking at the [*name*] Airport, c) whether AMTRAK trains are running on schedule, or d) about delays in departures of the [*name*] Ferry System. This information is of a lower priority than information concerning roadway incidents and other situations that affect motorist safety. The priority for displaying messages shall remain in the control of TxDOT.

**Justification and/or Considerations**

In high-density corridors, travel options are highly interrelated. Information about parking lot availability, ferry system departure delays, etc. can affect freeway driver real-time decisions about which exit ramps to use and so are appropriate information units to present in DMS messages.

## 23. OPERATION WITH LANE CONTROL SIGNALS

**Policy**

The policy requires that a message should be displayed on the relevant DMS whenever lane-use control signals (LCS) display red or yellow symbols.

**Policy Statement Example**

> DMS should always be used whenever lane-use control signals are activated to display either red or yellow symbols.

**Justification and/or Considerations**

At least one state DOT has a similar written policy.

Truly effective freeway LCS symbols should convey a clear message and elicit a consistent response from all motorists if they are to be useful tools for managing traffic during incidents. This should be true whether drivers have been educated about their use or if they are seeing them for the first time. Results of studies in the late 1950s by Forbes et al. (*22*), in the late 1970s by Dudek et al. (*13*), and more recently in the 1990s by Ullman (*23*) and Wohlschlaeger et al. (*24*) indicated that the majority of drivers tested understand the meaning of the green arrow and red X. However, the interpretations indicate that the yellow X is ambiguous, particularly when it is displayed with a red X in an adjacent lane. Wohlschlaeger et al. found that a higher percentage of drivers understood the downward slanted yellow arrow than the yellow X and that it produced the least variation and confusion.

Results of studies by Dudek et al. (*12*) reported in 2000 showed that only 36 percent of the motorists tested responded that they did not need any additional information beyond what was provided by the LCS and an *ACCIDENT AHEAD* message displayed on a DMS. Fourteen percent stated that they would like to see which lanes were closed (which would be redundant with the LCS). Meanwhile, 50 percent of the drivers stated that other information would be useful. Information about the approximate distance to the crash was cited as needed information by 14 percent of the drivers. Finally, smaller proportions of drivers indicated a preference for expected travel times, magnitudes of delays, average speeds downstream, or general caution information. The results suggest that it is possible to rely on the LCS to indicate which lanes are blocked or closed and to utilize the DMS to provide other key information (what is the problem, how far downstream the problem is located, etc.).

## 24. TEST MESSAGES

### Policy

The policy establishes the appropriate DMS messages that can be displayed during system testing or for special studies.

### Policy Statement Example

> It is sometimes necessary to display messages on a DMS to assure correct operations, to "burn-in" a new sign, or for special studies. Acceptable test messages should either state *TEST-MESSAGE*, display a portion of the alphabet, a sequence of numbers, or a non-message test pattern such as moving columns or rows, etc. (*Note: SIGN UNDER TEST may be a suitable option to TEST-MESSAGE.*) Other test messages shall be reviewed and approved by [*name of office or title of person*] before they are displayed.

### Justification and/or Considerations

It is vital that drivers are not misinformed with typical traffic control messages displayed for the purposes of system testing.

## REFERENCES

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4. Paniati, J.F. FHWA Policy Memorandum: AMBER Alert Use of Changeable Message Sign (DMS). August 16, 2002. http://www.fhwa.dot.gov/legsregs/directives/policy/ambermemo.htm .

5. Paniati, J.F. FHWA Policy Memorandum: Use of Changeable Message Sign (DMS) for Emergency Security. March 21, 2003. http://www.fhwa.dot.gov/legsregs/directives/policy/securmemo.htm .

6. Paniati, J.F. / Lindley J.. Memorandum, Information and Action: Dynamic Message Sign (DMS) Recommended Practice and Guidance. July 16, 2004. http://www.i95coalition.org/PDF/Calendar/traveltime-memo-ver3.pdf .

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19. Malone, J. L. Memorandum to D. Judycki and T. Ptak. Re: Legal Opinion on the Erection of Billboards on the Right-Of-Way of an Interstate Highway by a State. December 19, 1995.

20. Roper, D., formerly Deputy District Director, Operations, California Department of Transportation. Telephone conversation on March 21, 2002.

21. Use of DMS Signs for Child Abduction (AMBER) Alert Messages. Interim Policy, California Department of Transportation, Division of Traffic Operations. August 8, 2002.

22. Forbes, T.W., E. Gervais, and T. Allen. Effectiveness of Symbols for Lane Control Signals. In *Bulletin 244*, HRB, National Research Council, Washington, D.C., 1959, pp 16-29.

23. Ullman, G.L. Motorist Interpretation of MUTCD Freeway Lane Control Signals. In *Transportation Research Record 1403*, Transportation Research Board, National Research Council, Washington, D.C., 1993, pp. 49-56.

24. Wohlschlaeger, S.D., G.L. Ullman, and C.L. Dudek. Motorist Interpretation of Yellow X and Yellow Diagonal Arrow in Freeway Lane Control Signal Array. In *Transportation Research Record 1495*, Transportation Research Board, National Research Council, Washington, D.C., 1995, pp. 9-16.

# MODULE 22. DMS OPERATIONS PROCEDURES AND GUIDELINES

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# MODULE 22. DMS OPERATIONS PROCEDURES AND GUIDELINES

## 22.1 INTRODUCTION

*Module 21 DMS Operations Policies* contained guidelines to assist TxDOT in developing statewide or regional policies for the operation of DMSs. Module 22 contains a listing and discussions of items that TxDOT may want to include in a document that contains DMS operations procedures and guidelines. The procedures and guidelines would establish the day-to-day operation of the DMSs. The operations guidelines are influenced by the policies established by TxDOT. TMC managers should consider developing an operations procedures and guidelines manual that includes the items listed below. The operations procedures and guidelines manual will be a very useful document for staff working in the TMC.

1. Responsibility for operation of DMS system
2. Days and hours of operation
3. DMS operators
4. Responsibilities of DMS operators
5. Authority to design messages
6. Authority to display messages
7. Authority to display messages during off TMC hours
8. Requests for DMS messages from agency persons outside of TMC
9. Requests for DMS messages from other agencies
10. Documentation of DMS usage
11. Verifying the incident prior to displaying message
12. Verifying the message via closed circuit television
13. Message libraries vs. developing messages as the need arises
14. Automated display of messages
15. Automatic shutoff of DMS messages
16. Grouping operations of more than one DMS
17. Use of DMSs during construction
18. Use of DMSs during non-incident related conditions
19. Operation of DMSs with lane control signals
20. Use of DMS messages as part of the freeway management system operational strategies (along with ramp meters and traffic intersection signals)
21. Information needed about incident and alternative route before message is displayed
22. Priority of message types
23. Priority when two events (incidents, roadwork, etc.) are on the freeway at the same time
24. Format of messages
25. Maximum number of units of information in messages for each DMS
26. Reducing message size when lighting conditions change
27. Reducing the number of units of information in messages to account for their effects on drivers' ability to read messages
28. Messages displayed prior to identification of specifics of an incident
29. Acceptable message words/terms for

- Incident/roadwork descriptor
- Incident/roadwork location
- Closure descriptor
- Location of closure
- Effect on travel
- Audience for action
- Action

30. Acceptable abbreviation terms
31. Use of one-phase and two-phase messages
32. Use and criteria for flashing messages
33. Use and criteria for flashing a message line
34. Flashing beacons on DMSs
35. Messages after an incident is removed from the freeway lanes before congestion clears
36. Messages after incident is removed from freeway lanes after congestion clears
37. Location and positioning of DMSs
38. On-site control of DMSs
39. Coordination with other agencies
40. Display of congestion information during and immediately following incidents
41. Display of “all clear” messages after an incident has been removed from the freeway lanes
42. DMS messages to support HAR
43. Messages for truck and hazardous cargo restrictions
44. Use of graphics in messages

Information previously given in Modules 1 through 9 in this *Manual* should be helpful in formulating procedures and guidelines for many of the issues listed above. The sections that follow in this below address those issues in the list that were not here-to-for addressed in the *Manual*.

## 22.2 DAYS AND HOURS OF OPERATION

The TMC operating hours must be established. If the TMC is not staffed 24/7, credibility could be compromised if the DMSs are not operating when major events that result in severe congestion occur (crashes, holiday traffic, etc.). Thus, the TMC manager should make arrangements to ensure that messages are displayed on appropriate DMSs during off hours.

## 22.3 DMS OPERATORS

The DMS operators are often the critical link between TxDOT and the motorists. They are the ones who ultimately control and monitor what is displayed on DMSs. No matter how automated the DMS message posting practices, proper DMS operation requires well-trained individuals to operate the system. Some of the desirable skills needed by operators are as follows:

- Common sense,
- Ability to make decisions under stress,
- Ability to understand and follow written and oral procedures,
- Writing and verbal abilities,
- People skills,
- Computer skills,
- General knowledge of transportation,
- Familiarity with local and statewide roadway network,
- Technical knowledge, and
- Basic knowledge of electronics.

Recruitment and retention of qualified operators is a challenge, particularly when the TMC operates 24/7. Thus, TMC managers should establish practices concerning DMS operator

- Recruiting,
- Hiring,
- Training,
- Retaining, and
- Performance.

## 22.4 RESPONSIBILITIES OF DMS OPERATORS

The TMC manager should consider preparing written responsibilities of DMS operators, procedures with respect to operator shifts, and responsibilities of DMS operators at the beginning and end of each shift. These help the DMS operators to understand their responsibilities, provide clarity to work schedules, and maintain operational consistency among the operators.

Useful resources for developing responsibilities of DMS operators are listed below.

1. Arizona Department of Transportation, Transportation Technology Group. Traffic Operations Center (TOC) Operations Manual. January 2002.

2. Baxter, D.H. *Guidelines for TMC Transportation Management Operations Technician Staff Development*, Report FHWA-OP-03-071, Traffic Management Center Pooled-Fund Study, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C., August 2005.
   Also at: http://tmcpfs.ops.fhwa.dot.gov/cfprojects/new_detail.cfm?id=26&new=2

3. Ray, J.B., Jr., T.M. Whaley, D.R. Stocks, and D.J. Folds. *TMC Operator Requirements and Position Descriptions*. Traffic Management Center Pooled-Fund Study, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C., October 2002. http://tmcpfs.ops.fhwa.dot.gov/cfprojects/new_detail.cfm?id=55&new=2

Below is an operator's mission statement contained in the Arizona DOT Traffic Operations Center Manual.

*"The operator's primary mission is to assure the safety of the motoring public. The operator must understand the system, be able to make sound decisions, and quickly implement the proper procedures for routine and emergency actions. This is accomplished through a thorough understanding and working knowledge of TOC policies and procedures. Timely and accurate responses to all reports of incidents and requests for information, services, or ADOT equipment is required at all times.*

*The operator must provide quality information in a prompt and courteous manner to the public, public agencies, and ADOT personnel. When a situation arises that the operator cannot resolve, the TOC Supervisor or designee will be advised immediately and a proper response will provided as rapidly as possible.*

*The Traffic Management System (TMS) is a computerized system designed to assist with management of traffic occurrences. The system cannot react to emergencies without input from the operator. The TMS must be monitored continuously to enable the operator to give timely and accurate notification to the proper agencies."*

Below are statements of procedures established by the Arizona DOT.

*"There are three shifts: a) morning shift (6 AM to 2 PM), b) evening shift (2 PM to 10 PM), and c) graveyard shift (10 PM to 6 AM). Each operator and shift supervisor works 8 hours a day, five days a week. At the end of each shift, each operator will:*

- √ Discuss any ongoing incidents or issues with the operator going off-shift.
- √ Access and read E-mail.
- √ Scan all monitors to determine traffic conditions and verify the status of any incident.
- √ Review closed incidents for previous 24 hours on the Operator Workstation (OW).
- √ Review Highway Condition Reporting System (HCRS) status. Check for any incidents that are being worked by other districts.
- √ Check HCRS entries for quality

*At the end of each shift, every operator will:*

- √ Verify that the OW incident logs are completely up-to-date.
- √ Advise the incoming operator of any pending issues.
- √ Leave the work area in a clean and orderly condition.
- √ Make sure all customer inquiries received during their shift have been handled.

*All operators may be assigned additional duties as necessary by the Operations Supervisor."*

## 22.5 AUTHORITY TO DESIGN MESSAGES

Results of interviews with state DOT representatives revealed that DMS operators at some TMCs have the authority to design messages and to display the messages they design without TMC supervisor approval of the messages. This practice is more likely to occur at TMCs that operate a small number of DMSs or where software has not been developed to a level that will suggest messages for display based on minimal input by the operator or present the operator with a standardized message template.

Allowing operators to design messages without supervision can have serious negative credibility consequences because there is no assurance that the messages will adhere to sound design principles. Also, this practice can increase the likelihood of inconsistent messages among the many operators. Therefore, TMC supervisors should regularly review and critique any messages created by operators and provide feedback to the operator on ways to improve consistency and credibility of the messages.

## 22.6 DOCUMENTATION OF DMS USAGE

It is important to document DMS benefits as operational needs increase and resources dwindle. Continuous recordkeeping of DMS use during incidents, roadwork, inclement weather, special events, etc., is one measure of the benefits of the DMS system. Documentation of when DMS messages are displayed is important to evaluate the effectiveness of the messages in the library and DMS locations. The logs are also important for possible tort defense.

DMS benefits may be quantified in order to arrive at benefit/cost ratios. For example, when an incident occurs, a DMS message upstream of the incident can inform motorists to exit and take an alternative route, thus preventing them from standing in a traffic jam. Knowing the time of the incident, the time the message is displayed, the number and percentage of vehicles diverted, and the conditions on the freeway and alternate route, one can determine an estimated cost savings resulting from the use of the DMS.

## 22.7 GROUPING OPERATIONS OF MORE THAN ONE DMS

Some transportation agencies use an automation technique referred to as grouping. Grouping allows the TMC manager to place a certain number of signs into a group and associate a specific message with each sign in that group. Then, when a single command is given by the DMS operator to activate that group, the messages on all the DMSs in the group change appropriately. This further simplifies system operations and helps keep incomplete or conflicting information from being displayed. An example of automatic grouping of messages which was used by the Houston District is shown in Figure 22-1.

INCIDENT ON U.S. 59 NORTHBOUND NORTH OF IH-610 NORTH LOOP

Sign #1  On U.S. 59 Northbound at Collingsworth

| | |
|---|---|
| U.S. 59 NORTH<br>ACCIDENT<br>AHEAD | AVOID DELAY<br>USE HARDY TOLL<br>EXIT IH 10 WEST |

Sign #2  On IH-610 North Loop Eastbound at Fulton

| | |
|---|---|
| U.S. 59 NORTH<br>ACCIDENT<br>AHEAD | AVOID DELAY<br>USE HARDY<br>TOLL ROAD |

Sign #3  On IH-610 North Loop Eastbound at North Main

| | |
|---|---|
| U.S. 59 NORTH<br>ACCIDENT<br>AHEAD | AVOID DELAY<br>USE HARDY TOLL<br>OR IH 45 N |

Sign #4  On IH-610 North Loop Westbound at Jensen

U.S. 59 NORTH<br>ALTERNATE ROUTE<br>EXIT HARDY TOLL

Sign #5  On IH-610 North Loop Westbound at Lockwood

| | |
|---|---|
| U.S. 59 NORTH<br>ACCIDENT<br>AHEAD | AVOID DELAY<br>USE HARDY<br>TOLL ROAD |

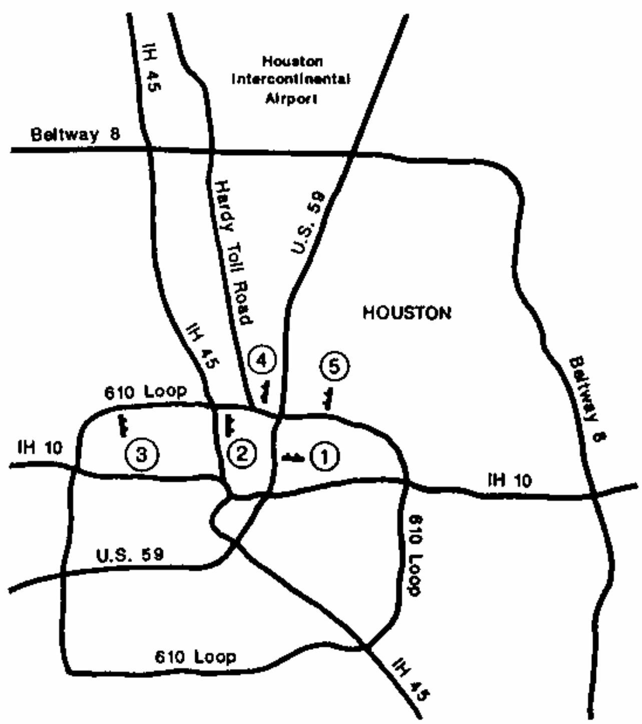



**Figure 22-1.  Example of Automatic DMS Grouping – Houston TranStar).**

# APPENDIX A. MESSAGE LENGTH REDUCTIONS FOR VERTICAL CURVES

## A.1 THEORY

Vertical curve designs are based on providing adequate stopping sight distance to a small object located in the travel lane for a motorist traveling at the design speed of the curve. The AASHTO *Policy on Geometric Design of Highways and Streets* recommends using a parabolic vertical curve to connect two intersecting grade lines. Near worst-case conditions are assumed for driver perception-reaction time, pavement friction, driver eye and roadway object heights, and other factors that influence a driver's ability to safely stop a vehicle. Basic geometry is then used to define the relationship between the length of curve required to provide a given sight distance (when the sight distance is less than the length of the curve):

$$L = \frac{AS^2}{100\left(\sqrt{2h_1} + \sqrt{2h_2}\right)^2} \qquad (1)$$

where,

$L$ = length of parabolic curve (ft)
$A$ = algebraic difference in grades (%)
$S$ = required stopping sight distance (ft)
$h_1$= driver eye height (ft)
$h_2$= roadway object eye height (ft)

The above equation can be rearranged to describe the sight distance available as a function of the length of curve provided, as shown below:

$$S = 10\left(\sqrt{2h_1} + \sqrt{2h_2}\right)\sqrt{\frac{L}{A}}$$

Written in this manner, it is possible to assess how different object heights influence the available sight distance (or "reading" distance) for a given curve (defined by its length $L$ and grade difference $A$). More importantly, the available sight distance of an object at any height above the roadway can be related to the stopping sight distance ($S_{ssd}$) used for vertical curve design purposes using the simple ratio shown below (with the second subscript in the numerator denoting the new object height). Note that the constant, $L$, and $A$ drop out of the equation:

$$\frac{S_1}{S_{ssd}} = \frac{\sqrt{2h_{11}} + \sqrt{2h_{21}}}{\sqrt{2h_{1ssd}} + \sqrt{2h_{2ssd}}} \tag{2}$$

For $S_{ssd}$ design purposes, an object height ($h_{2ssd}$) of 0.5 ft is commonly assumed. DMSs, on the other hand, are located considerably higher above the road and so will have a greater sight (reading) distance available. The driver eye height assumed for calculations is the same ($h_{11} = h_{1ssd}$) regardless of the object being considered (current guidelines use a driver eye height of 3.5 ft. Labeling $h_{21}$ as the height of a DMS ($h_{DMS}$) and the other variables with their assumed values yields the following relationship:

$$\frac{S_{DMS}}{S_{ssd}} = \frac{\sqrt{7} + \sqrt{2h_{DMS}}}{\sqrt{7} + \sqrt{1}} \tag{3}$$

This ratio can then easily be solved for different DMS mounting heights to determine the available reading distance to the sign in relation to the stopping sight distance provided by that vertical curve. Figure A.1 presents a plot of the relationship between DMS height above the road and this sight distance ratio. As an example, a portable DMS located 7 ft above the roadway on a crest vertical curve would yield a sight distance that is approximately 1.7 times that of the stopping sight distance provided by that curve. Likewise, a permanent overhead-mounted DMS located 26 ft above the roadway (a fairly common mounting height) provides a relative sight distance to the sign that is about 2.7 times the stopping sight distance.

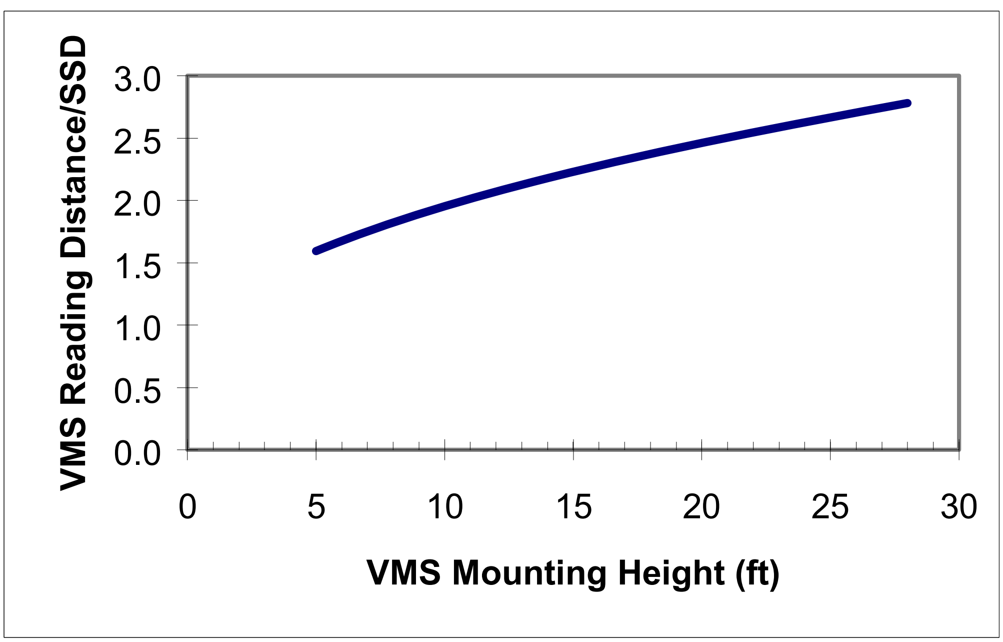



**Figure A.1  Ratio of DMS Reading Distance to Stopping Sight Distance**

The relationship depicted in Figure A.1 can then be used with design information about the vertical curve to estimate the available reading distance to the sign. The analyst either uses the curve design criteria directly (*L* and *A*) to compute $S_{ssd}$ or uses the stated design speed of the curve to estimate $S_{ssd}$ from tables already provided in most state roadway design manuals or from AASHTO policy.

In most cases, permanent overhead DMSs generally have adequate available reading distances to allow typical-length messages to be used. Conditions where this may not be the case include situations where actual operating speeds on the facility exceed the design speed of the curve or situations where a considerable lateral offset exists between the driver's eye and the center of the DMS. To illustrate this point, Figure A.2 presents a plot of the actual available reading distance to a DMS mounted 26 ft above the roadway on vertical curves with design speeds ranging from 25 to 70 mph. Also plotted on Figure A.2 are the required reading distances for a message presenting 4 units of information (as defined by Dudek and Huchingson) to the driver (current guidelines recommend this as an upper limit for presentation) on a DMS that has a lateral offset from the driver of 30, 65, and 100 ft. According to guidelines, such a message would require 8 seconds of reading time to properly perceive and interpret the information. Two points should be evident from this figure. First, conditions where required reading distance to a DMS may exceed the available reading distance of that DMS are more likely to occur at lower design speeds. The second point to note is that a significant lateral offset between the driver and the DMS can significantly increase the required reading distance to the sign and create message constraints even up to fairly high design speeds. It should be intuitive that these constraints will be even more significant for portable DMSs that are typically lower in height.

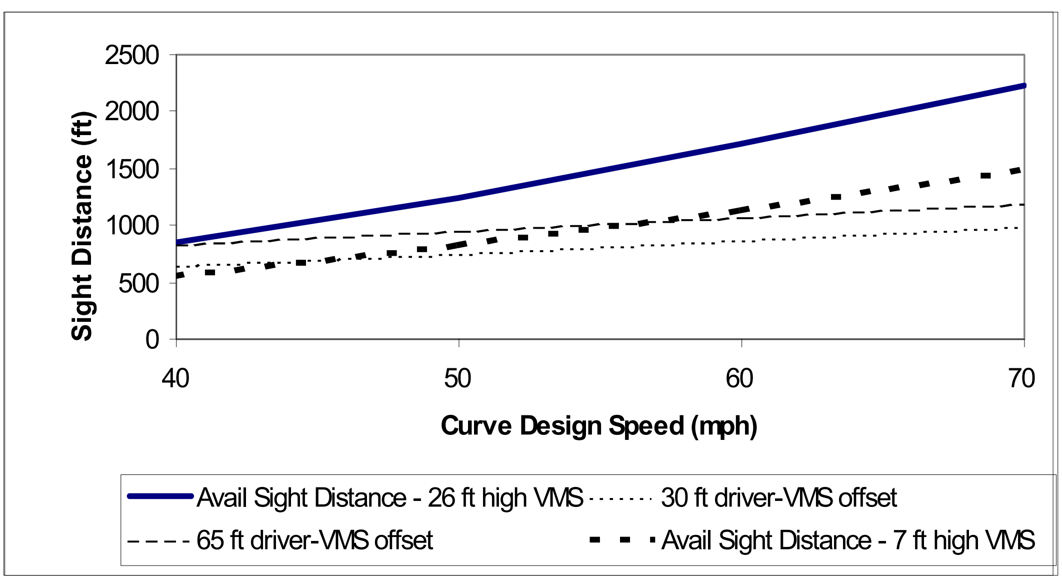



**Figure A.2  Available versus Required Reading Distance to a DMS on a Vertical Curve for a Four-Unit Message (26 ft DMS Mounting Height)**

# A.2 PROCEDURE

Generally speaking, permanent DMSs mounted above the travel lanes are not affected by the presence of crest vertical curves. Vertical curvature is established based on safe stopping sight distances to a rather small (i.e., 6 inch) object located in the roadway, based on the design speed of the roadway. The high (20 to 25 ft) typical mounting heights of permanent DMSs provide viewing distances over the curve that usually exceed the visual capabilities of the signs themselves. However, this is often not the case for portable DMSs positioned on the shoulder of the roadway. Furthermore, conditions where actual operating speeds are higher than the design speed of the vertical curve can sometimes provide less viewing time than are normally assumed to exist.

To assess the potential influence of the vertical curve, the DMS message designer requires the following information for the DMS of interest:

- Maximum sign viewing offset (ft), which is the sum of
  - The number of lanes a driver must look across to view the sign, and
  - The actual sign offset distance from the edge of the travel lanes,
- Sign mounting height (ft),
- Design speed of the curve (mph),
- Curve length (ft), and
- Expected operating speed on the curve (mph).

Tables A.1 and A.2 are provided to help evaluate whether a vertical curve is constricting the viewing of a permanent or portable DMS, respectively. The DMS message designer selects the appropriate table and finds the actual design speed of the curve, DMS mounting height, and sign viewing offset (the message designer should extrapolate if actual mounting heights and viewing offsets are not found in the table). The selected cell defines the available viewing travel distance that a motorist has available to read a message on the sign. This distance is then compared to the length of the vertical curve. If the curve is longer than the available viewing distance, the message designer computes the available viewing time over the curve (if the curve is shorter, there will not be a viewing constraint due to the vertical curve). Available viewing time is defined by equation 4:

$$\text{Viewing Time} = \left( \frac{\text{Viewing Distance}}{\text{Operating Speed} \bullet 1.467} \right) \tag{4}$$

In this equation, viewing time is in seconds, viewing distance is in feet, and operating speed in miles per hour (the 1.467 is a multiplier to convert the units to seconds). The available viewing time can then simply be divided by 2 to compute the number of units of information that can be read and processed by motorists.

**Table A.1 Available Permanent DMS Viewing Distance over Vertical Curves**

| Vertical Curve Design Speed (mph) | Available Viewing Distance While Traveling (ft) | | | | | |
|---|---|---|---|---|---|---|
| | DMS Mounting Height = 20 ft | | | DMS Mounting Height = 25 ft | | |
| | DMS Over Lanes | DMS Viewing Offset:20 ft | DMS Viewing Offset: 60 ft | DMS Over Lanes | DMS Viewing Offset: 20 ft | DMS Viewing Offset: 60 ft |
| 30 | 490 | 305 | 80 | 530 | 345 | 120 |
| 35 | 620 | 435 | 210 | 670 | 485 | 260 |
| 40 | 800 | 615 | 390 | 870 | 685 | 460 |
| 45 | 980 | 795 | 570 | 1060 | 875 | 650 |
| 50 | 1170 | 985 | 760 | 1260 | 1075 | 850 |
| 55 | 1350 | 1165 | 940 | 1460 | 1275 | 1050 |
| 60 | 1600 | 1415 | 1190 | 1730 | 1545 | 1320 |
| 65 | 1780 | 1595 | 1370 | 1930 | 1745 | 1520 |
| 70 | 2090 | 1905 | 1680 | 2260 | 2075 | 1850 |
| 75 | 2300 | 2115 | 1890 | 2490 | 2305 | 2080 |

**Table A.2 Available Portable DMS Viewing Distance over Vertical Curves**

| Vertical Curve Design Speed (mph) | Available Viewing Distance While Traveling (ft) | | | |
|---|---|---|---|---|
| | DMS Mounting Height = 7 ft | | DMS Mounting Height = 10 ft | |
| | DMS Viewing Offset:20 ft | DMS Viewing Offset: 60 ft | DMS Viewing Offset: 20 ft | DMS Viewing Offset: 60 ft |
| 30 | 235 | 5 | 275 | 45 |
| 35 | 325 | 95 | 375 | 145 |
| 40 | 375 | 145 | 515 | 285 |
| 45 | 585 | 355 | 665 | 435 |
| 50 | 715 | 485 | 815 | 585 |
| 55 | 845 | 615 | 955 | 725 |
| 60 | 1025 | 795 | 1155 | 925 |
| 65 | 1155 | 925 | 1295 | 1065 |
| 70 | 1375 | 1145 | 1545 | 1315 |
| 75 | 1525 | 1295 | 1705 | 1475 |

For simplicity, the DMS offsets from Table A.1 or A.2 should be selected to represent worst-case viewing conditions. That is, it should reflect the lateral distance from a motorist traveling in the lane farthest from the DMS to the middle of the DMS sign (including adjacent travel lanes, shoulder, actual DMS offset from the edge of pavement, and one-half of the width of the DMS itself).

The following examples illustrate how the tables are used to estimate reading times for permanent and portable over crest vertical curves.

# A.3 EXAMPLE 1

A 3-line, 15-character DMS (26 ft wide mounted 20 ft above the travel lanes) is located in the middle of a 20-ft median on a four-lane freeway with a 6-ft inside paved shoulder. The sign is located on the downstream end of a 1200-ft crest vertical curve. The design speed of the curve is 60 mph, as is the average operating speed of traffic on that facility. Does the curve constrain the amount of information that can be presented on the DMS?

**DMS VIEWING OFFSET**

Worst-case viewing conditions are from the right shoulder lane. Assuming that the driver is located one-third of a lane in from the lane line, the viewing offset is the sum of that one-third of a lane, the other travel lane to the left, the 6-ft paved shoulder, and one-half of the median.

Viewing offset = 12/3 + 12 + 6 + 10 = 32 ft

Since this is not shown in Table A.1, one must interpolate between the 20- and 60-ft offset distances. Using a 60 mph design speed, the available reading distance for a DMS mounted 20 ft above the roadway is 1415 ft at a 20-ft viewing offset and 1190 ft at a 60-ft viewing offset. Linear interpolation indicates the available reading distance at a 32-ft offset to be approximately 1350 ft. This is less than the curve length, so is assumed to be the available viewing distance to the sign. Therefore,

$$\text{Viewing Time} = \left( \frac{1350 \text{ ft}}{60 \text{ mph} \bullet 1.47} \right) = 15 \text{ seconds}$$

This indicates that there is enough viewing distance for 7 or 8 units of information to be viewed by motorists. Since this exceeds both the 4 units of information typically assumed as the limit of driver information processing capability from a DMS and the typical legibility distance of the DMS itself, the vertical curve <u>does not</u> constrain DMS readability in this example.

# A.4 EXAMPLE 2

In this example, a 3-line, 15-character DMS (also 26 ft wide mounted 20 ft above the roadway) is located to the right of a six-lane urban arterial. The sign is positioned such that the center of the sign is 15 ft from the edge of pavement. It is located at the downstream end of a 600-ft crest vertical curve that is designed for 35 mph. However, average operating speeds on this facility are currently closer to 45 mph. Does the curve constrain the amount of information that can be presented on the DMS?

Worst-case viewing conditions are from the left lane. Assuming the driver is located one-third of a lane in from the lane line, the viewing offset is the sum of the driver lateral position in the left lane, the other two travel lanes to the right, and the remaining distance to the middle of the sign.

Viewing offset = 12 + 24 + 15 = 51 ft

Since this is not shown in Table A.1, one must interpolate between the 20- and 60-ft distances. Using a 35 mph design speed, the available reading distance for a DMS mounted 20 ft above the roadway is 435 ft at a 20-ft viewing offset and 290 ft at a 60-ft viewing offset. Linear interpolation indicates the available reading distance at a 51-ft offset to be approximately 320 ft. This is less than the curve length of 600 ft, and so is assumed to be the available viewing distance to the sign. Therefore,

$$\text{Viewing Time} = \left(\frac{320\text{ ft}}{45\text{ mph} \bullet 1.47}\right) = 5\text{ seconds}$$

Dividing this value by 2 indicates that the sign can be seen only far enough to read and process two to three units of information. Consequently, the vertical curve <u>does</u> constrain DMS readability in this example.

# A.5 EXAMPLE 3

Example 3 characteristics are identical to Example 1, except that a portable DMS with a 7-ft mounting height is used.

DMS offset = 32 ft

Using a 60 mph design speed, the available viewing distance for a DMS mounted 7 ft above the roadway is 1025 ft at a 20-ft viewing offset and 795 ft at a 60-ft viewing offset. Linear interpolation indicates the available reading distance at a 32-ft offset to be approximately 960 ft. This is less than the 1200-ft curve length, so is assumed to be the available viewing distance to the sign. Therefore,

$$\text{Viewing Time} = \left( \frac{960\ \text{ft}}{60\ \text{mph} \bullet 1.47} \right) = 11\ \text{seconds}$$

This corresponds to 5 or 6 units of DMS information (11 seconds divided by 2). Since this exceeds the 4 units of information typically assumed as the limit of driver information processing capability from a DMS, the vertical curve <u>does not</u> constrain DMS readability in this example.

## A.6 EXAMPLE 4

The details for this example remain the same as in Example 2. However, a 3-line, 8-character DMS 7 ft above the roadway is located to the right of a six-lane urban arterial. The sign is positioned such that the center of the sign is 15 ft from the edge of pavement. It is located at the downstream end of a 600-ft vertical crest curve that is designed for 35 mph. However, average operating speeds on that facility are currently closer to 45 mph. Does the curve constrain the amount of information that can be presented on the DMS?

Viewing offset = 51 ft

Since this is not shown in Table A.2, one must interpolate between the 20- and 60-ft distances. Using a 35 mph design speed, the available reading distance for a DMS mounted 7 ft above the roadway is 325 ft at a 20-ft viewing offset and 95 ft at a 60-ft viewing offset. Linear interpolation indicates the available reading distance at a 47-ft offset to be approximately 170 ft. This is less than the curve length of 600 ft, so is assumed to be the available viewing distance to the sign. Therefore,

$$\text{Viewing Time} = \left( \frac{170\ \text{ft}}{45\ \text{mph} \bullet 1.47} \right) = 2.5\ \text{seconds}$$

This time would allow a driver to process approximately 1 unit of information. Since this is much less than the 4 units of information typically assumed as the limit of driver information processing capability from a DMS, the vertical curve <u>does</u> constrain DMS readability in this example. More importantly, such a low available viewing time indicates a significant problem with placing a portable DMS at this proposed location. In this situation, the message designer should find a better placement location, such as before the start of the curve itself.

# APPENDIX B. MESSAGE LENGTH REDUCTIONS FOR HORIZONTAL CURVES

Design criteria for horizontal curvature is based on driver comfort and the friction between the tires and the roadway. With respect to DMS visibility and viewing time, horizontal curves generally do not impact permanent DMSs mounted over travel lanes. Likewise, permanent DMSs mounted adjacent to the travel lanes (in the median or off to the right) will extend above most obstructions that may exist on the roadside and so will not be affected by horizontal curves (although certain spot obstructions such as overhead signs or luminaires may be more problematic to DMS viewing on horizontal curves).

The situation is different for portable DMSs placed on the side of the road within the curve (on the right side of a right-hand curve, on the left side of a left-hand curve). If an object (construction vehicle, tree, etc.) is located close to the edge of a roadway on the same side as the DMS, a driver in the closest lane may not be able to see around the object and fully read and comprehend the message. The following sections describe the analysis theory and then present a process to follow to assess whether an obstruction may constrain the reading time of a portable DMS around a horizontal curve. The procedure is approximate in that it does not consider the effects of spiral curves sometimes used in horizontal curve design, and so provides slightly conservative results.

## B.1 THEORY

Although horizontal curves are generally not a problem for permanently mounted overhead DMSs, they can often cause sight distance problems for portable DMSs located to the side of the road because of roadside obstructions blocking the driver's view around the curve. Figure B.1 illustrates the analysis of the roadside obstruction situation graphically, as depicted in AASHTO policy. The worst-case condition for this situation occurs for the driver traveling in the far right lane. Key variables defining sight distance are the radius of the curve, *R,* and the offset of the sight obstruction from the travel path of the vehicle, *M,* as indicated by the following equation (other key variables noted in Figure B.1 are also defined below):

$$M = R\left(1 - \cos\frac{S}{2R}\right) \qquad (1)$$

where,

$M$ = distance from inside travel lane to obstruction (ft)
$S$ = sight distance around curve (ft)
$R$ = curve radius (ft)
$s$ = offset between edge of far right shoulder lane and the DMS (ft)
$L$ = lane width (ft)

2 = ½ angle subtended by a sight distance chord around obstruction
*N* = angle between end of the sight distance chord and location of the DMS

Unlike the vertical curve analysis, DMS mounting height does not enter into consideration of horizontal curve reading distance calculations. However, lateral placement of the sign relative to the roadway has a key impact upon the available sight distance to the sign. The effect of this placement is to reduce the length of the travel arc around the curve to where the DMS intersects the chord defining the sight distance around the obstruction (see Figure B.1).

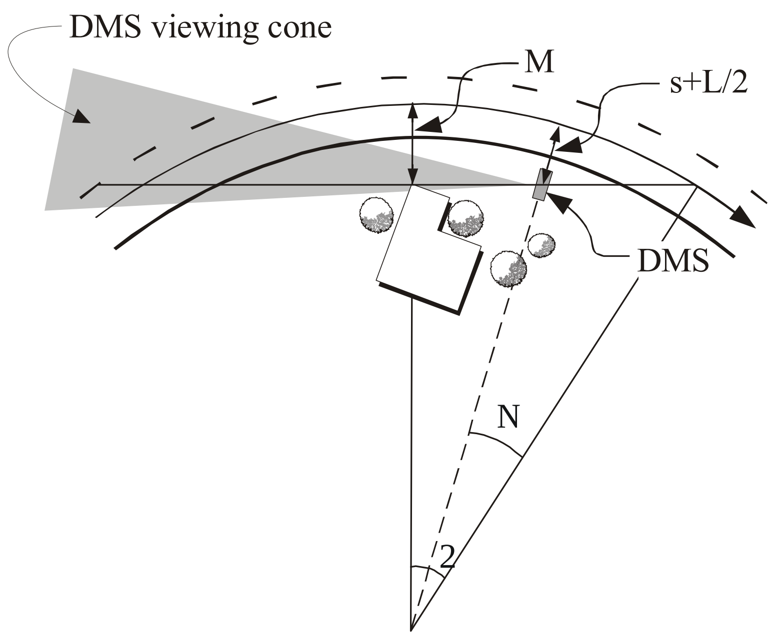



**Figure B.1 Geometry of Horizontal Curve Sight Obstruction to a DMS**

To analyze the effective sight distance to the sign in this situation, the above equation must first be rewritten and solved for the normal sight distance around the curve, as defined below (note that the trigonometric relationships are calculated in terms of radians and not degrees):

$$S = 2R\cos^{-1}\left(1 - \frac{M}{R}\right) \qquad (2)$$

The travel distance around the curve to the location of the DMS off of the side of the road can be computed by determining the angle ϕ in Figure B.1. This can be accomplished using the mathematical relationships between *M, R,* $s + L/2$ (with $s$ = sign offset and $L$ = lane width), θ, and ϕ:

$$\frac{R-M}{R-s-\frac{L}{2}} = \cos(\theta - \phi) \tag{6}$$

By rearranging this equation and substituting $\cos^{-1}(1 - M/R)$ for $\theta$, a solution for $\phi$ is obtained that is strictly dependent on *M, R, s,* and *L:*

$$\phi = \cos^{-1}\left(1-\frac{M}{R}\right) - \cos^{-1}\left(\frac{R-M}{R-s-\frac{L}{2}}\right) \tag{7}$$

The travel distance along the curve bisected by the angle $\phi$ is simply $R\phi$, where $\phi$ is defined in terms of radians instead of degrees. Subtracting this value from the original sight distance ($S$) yields the following relationship:

$$\textit{Available Sight Distance} = R\left[\cos^{-1}\left(1-\frac{M}{R}\right) + \frac{1}{2}\cos^{-1}\left(\frac{R-M}{R-s-\frac{L}{2}}\right)\right] \tag{8}$$

The available sight distance around the horizontal curve can then be compared to the required reading distance of the DMS for a driver traveling at a given speed. Figure B.2 provides an example of the calculated reading distances to a DMS located 3 ft from the edge of the travel lane around a horizontal curve where an obstruction is present (similar figures could be calculated for different DMS offsets).

Assuming that the analyst wants to display a message requiring 8 seconds to read on a facility with operating speeds of 70 mph, a minimum of 820 ft reading distance is necessary. From Figure B.2, this requires a minimum curve radius of approximately 1300 ft if the obstruction is located 80 ft from the travel lane, and more than 2950 ft if the obstruction is located only 10 m (30 ft) from the travel lane. Depending on the design characteristics of the curve (i.e., AASHTO policy allows curve radii near these values, depending on superelevation rates used), it is possible that this reading distance would not be available within the curve. The analyst would then have to choose between moving the obstruction farther away from the curve (if it a portable object such as a construction vehicle) or reducing the message length by reducing the units of information on the DMS.

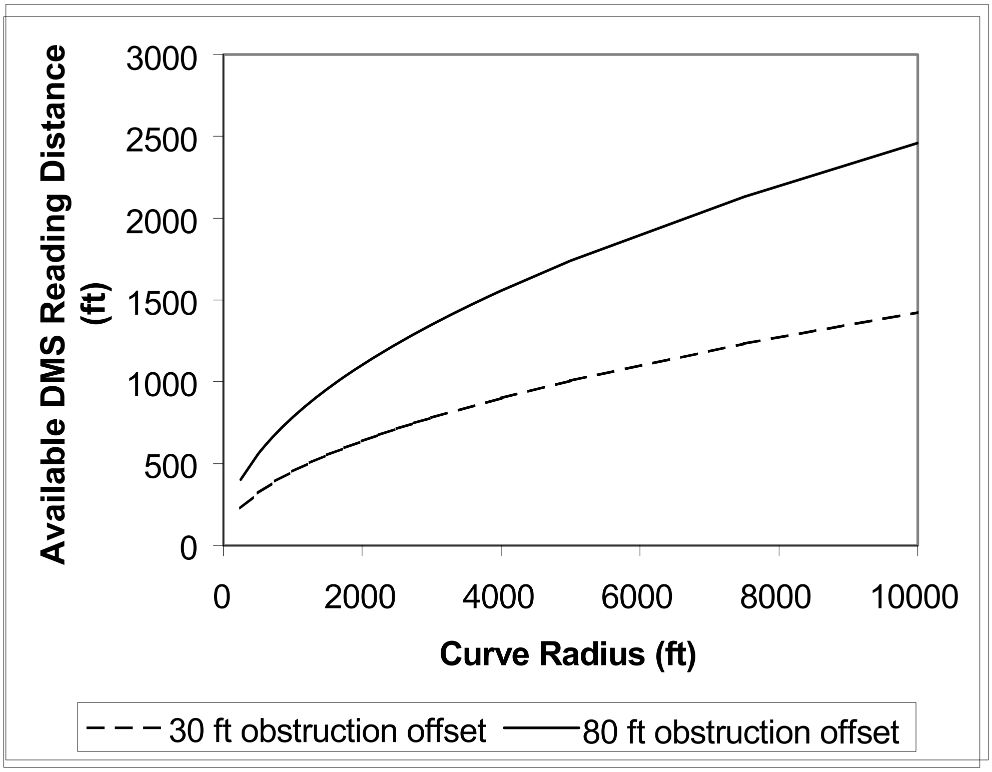



**Figure B.2 Example of Available Reading Distance around a Horizontal Curve (DMS Offset 3 ft from Edge of Travel Lanes)**

# B.2 PROCEDURE

To determine whether a potential horizontal curve sight distance restriction to a portable DMS exists, the message designer must have the following information at hand:

- Radius of the curve (ft),
- Length of the curve (ft),
- Distance of DMS to edge of the travel lane (ft),
- Distance of a potential sight obstruction from the edge of the travel lane (ft), and
- Expected operating speed of vehicles traversing the curve (mph).

Although horizontal curve design typically starts with a design speed, many curves use radii longer than the minimum required. Consequently, more detailed geometric information (curve radii and length of curve) is needed to evaluate possible horizontal curve sight restrictions.

Using the above information about the curve, Table B.1 or B.2 is used to determine the possible restricted viewing distance around a sight obstruction on the curve. If the appropriate sign offset, curve radius, and/or sight obstruction offset is not listed, the viewing distance value must be interpolated. This distance is then compared to the length of the horizontal curve and to the estimated distance between the DMS and the sight obstruction. If both exceed the value determined in Table B.1 or B.2, then the sign may be obstructed. The estimated viewing distance is then converted to a corresponding viewing time using equation 1. Finally, the available viewing time is used to estimate the number of units of information that can be presented to motorists on the DMS at that location.

The following examples illustrate the procedure.

## B.3 EXAMPLE 1

A portable DMS is placed 2 ft from the edge of travel lanes on a rural highway upstream of a work zone toward the end of a long (2500 ft) horizontal curve. Traffic speeds on the roadway average 65 mph. A bridge overpass abutment is located upstream of the DMS along the curve as well. The abutment is 50 ft from the edge of the travel lane, and the curve radius is 1500 ft. Is the viewing distance of the DMS constrained by the bridge abutment?

Using Table B.1 for the 2-ft DMS offset, the available viewing distance around the curve for an obstruction located 50 ft from the roadway is 750 ft. The length of the curve is longer than this value, and so the analysis proceeds to the computation of available viewing time. A motorist traveling 65 mph around the curve will have the following available time:

$$\text{Viewing Time} = \left( \frac{750\text{ feet}}{65\text{ mph} \bullet 1.47} \right) = 8\text{ seconds}$$

This time allows 4 units of information of information to be presented on the DMS. This is considered the maximum amount of information that a motorist can perceive and process while driving. Therefore, the horizontal curve does not constrict the amount of information that can be presented on the DMS.

## B.4 EXAMPLE 2

A portable DMS is to be used to assist in providing trailblazer information along a detour route for a section of freeway that has been closed. The sign will be placed 10 ft from the travel lanes. The diversion route is an urban arterial with vehicle operating speeds of about 40 mph. The operating agency is contemplating the location of the sign toward the end of the 750-ft horizontal curve with curve radius of 500 ft. A brick wall located 20 ft from the roadway is used to separate the roadway from the adjacent neighborhood. Does the curve constrain the amount of information that can be presented on the DMS?

Using Table B.2, the available viewing distance for an obstruction 20 ft from the roadway is 250 ft. This is less than the length of horizontal curve.

**Table B.1 Available DMS Reading Distances around a Horizontal Curve: 2-ft DMS Offset**

| Curve Radii (ft) | Edge of Travel Lane to Obstruction (ft) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **10** | **20** | **50** | **100** | **150** | **200** | **250** |
| 250 | 100 | 180 | 310 | 460 | 580 | 680 | 790 |
| 500 | 150 | 250 | 430 | 630 | 790 | 920 | 1040 |
| 750 | 180 | 310 | 530 | 770 | 950 | 1110 | 1250 |
| 1000 | 200 | 360 | 610 | 890 | 1100 | 1280 | 1440 |
| 1250 | 230 | 400 | 680 | 990 | 1220 | 1420 | 1600 |
| 1500 | 250 | 440 | 750 | 1080 | 1340 | 1550 | 1750 |
| 1750 | 270 | 470 | 800 | 1170 | 1440 | 1670 | 1880 |
| 2000 | 290 | 500 | 860 | 1250 | 1540 | 1790 | 2010 |
| 2250 | 310 | 530 | 910 | 1320 | 1630 | 1890 | 2130 |
| 2500 | 320 | 560 | 960 | 1390 | 1720 | 2000 | 2240 |
| 2750 | 340 | 590 | 1010 | 1460 | 1800 | 2090 | 2350 |
| 3000 | 360 | 620 | 1050 | 1520 | 1880 | 2180 | 2450 |
| 4000 | 410 | 710 | 1210 | 1760 | 2170 | 2520 | 2820 |
| 5000 | 460 | 790 | 1360 | 1960 | 2420 | 2810 | 3150 |
| 7500 | 560 | 970 | 1660 | 2400 | 2970 | 3440 | 3850 |
| 10000 | 650 | 1120 | 1920 | 2770 | 3420 | 3970 | 4450 |

| Table B.2 Available DMS Reading Distances around a Horizontal Curve: 10-ft DMS Offset | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Curve Radii (ft)** | **Edge of Travel Lane to Obstruction (ft)** | | | | | | |
| | **10** | **20** | **50** | **100** | **150** | **200** | **250** |
| 250 | N/A | 150 | 300 | 450 | 570 | 680 | 780 |
| 500 | N/A | 210 | 410 | 620 | 780 | 920 | 1040 |
| 750 | N/A | 250 | 510 | 750 | 940 | 110 | 1250 |
| 1000 | N/A | 290 | 580 | 870 | 1080 | 1270 | 1430 |
| 1250 | N/A | 330 | 650 | 970 | 1210 | 1410 | 1590 |
| | | | | | | | 1730 |
| 1500 | N/A | 360 | 710 | 1060 | 1320 | 1540 | 1870 |
| 1750 | N/A | 380 | 770 | 1140 | 1420 | 1660 | 1990 |
| 2000 | N/A | 410 | 820 | 1220 | 1520 | 1770 | 2110 |
| 2250 | N/A | 440 | 870 | 1290 | 1610 | 1880 | 2220 |
| 2500 | N/A | 460 | 920 | 1360 | 1700 | 1980 | 2330 |
| | | | | | | | 2430 |
| 2750 | N/A | 480 | 960 | 1430 | 1780 | 2070 | 2800 |
| 3000 | N/A | 500 | 1000 | 1490 | 1860 | 2160 | 3130 |
| 4000 | N/A | 580 | 1160 | 1720 | 2140 | 2490 | 3820 |
| 5000 | N/A | 650 | 1290 | 1920 | 2390 | 2780 | 4410 |
| 7500 | N/A | 790 | 1580 | 2350 | 2920 | 3400 | |
| 10000 | N/A | 920 | 1830 | 2710 | 3370 | 3930 | |

N/A Reading sight distance not available for any message.

The available viewing time to the DMS along this curve will be

$$\text{Viewing Time} = \left( \frac{250\text{ feet}}{40\text{ mph} \bullet 1.47} \right) = 4\text{ seconds}$$

This is only enough time to present 2 units of information to drivers on the DMS. The operating agency will need to make sure that the message displayed on this DMS contains only 2 units of information, or else select another location for the DMS.

# APPENDIX C. MESSAGE LENGTH REDUCTIONS FOR RAIN AND FOG

Rain and fog can influence the amount of information that can be presented on a DMS. Both conditions deteriorate the amount of light that comes from the DMS (either direct illumination from the light pixels on the DMS or reflected by the DMS from other light sources such as the sun, overhead lighting, or automobile headlights). This reduces the contrast between the sign legend and its background. If the contrast becomes too low, motorists cannot read the DMS message.

For LED DMSs, contrast ratios are at their minimums on bright, sunny days because the sun increases the background luminance of the signs. Under cloudy conditions, the luminance of the legend will be much greater than the background and create very large contrast ratios. Unfortunately, data on typical DMS background luminance or contrast ratios on cloudy, rainy, or foggy days are not available (in actuality, there may not be a true "typical" cloudy day anyway). Conversely, contrast ratios for light-reflecting DMSs decrease as external lighting levels decrease, becoming zero (or nearly so) as the amount of light falling on the sign reaches zero. Consequently, it is the light-reflecting technologies for which this section is most appropriate.

## C.1 THEORY

### EFFECT OF RAINFALL ON LEGIBILITY

Light traveling through rainfall in the atmosphere is attenuated, which causes a reduction in the apparent luminance and contrast of an object. Mathematically, the influence of rain (which affects the light transmissivity of the atmosphere) can be described in terms of its effect on the apparent illumination of an object using Allard's law, established in the 1870s:

$$E = I\,\frac{t^d}{d^2}$$

where,

$E$ = apparent illumination at some distance from the object
$I$ = light intensity of the object at its source
$t$ = transmissivity coefficient of the medium over which light is traveling
$d$ = distance from the object to the point where illumination is being measured

The difficulty in applying this relationship to the interpretation of rainfall effects is in relating it to a factor that can be easily measured and is readily available. Intuitively, light attenuation should be related to rainfall intensity. Empirical observations have suggested this to be the case. In one instance, researchers estimated that a 1-in/hr rainfall rate reduces visibility by about 30 percent and a 2-in/hr rainfall rate reduces visibility by about 50 percent. Often, a coefficient of atmospheric extinction term (*s*) is used instead of the transmissivity coefficient to describe the optical extinction phenomenon caused by rainfall. These two coefficients are related in the following simple manner:

$$t = e^{-s}$$

A relationship, originally developed by Atlas, expresses the atmospheric extinction coefficient as a function of rainfall intensity:

$$s = \frac{5.85\, R^{\,0.63}}{10{,}000}$$

where,

*s* = atmospheric extinction coefficient
*R* = rainfall intensity (in/hr)

These relationships can then be combined in order to estimate the influence of rainfall on the apparent illuminance of an object. To illustrate, Figure C.1 presents the relative reduction in the illuminance of a DMS as a function of the distance to that object for various rainfall intensity rates.

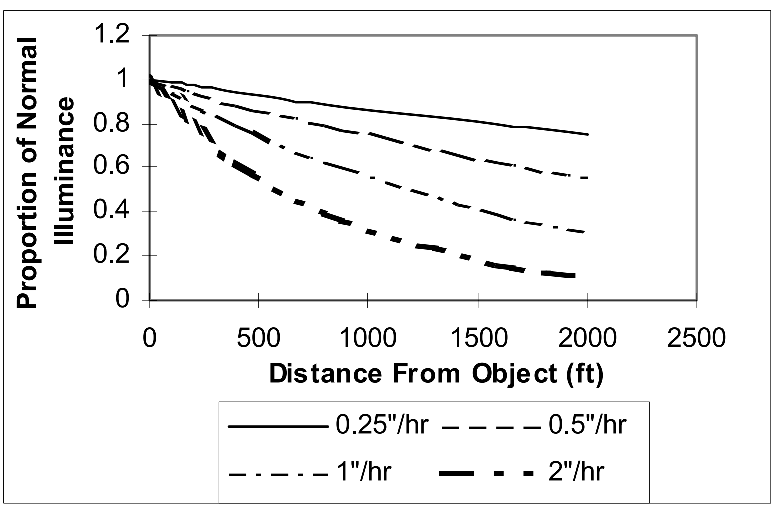



**Figure C.1  Effect of Rainfall on the Apparent Illuminance of a DMS**

The reduction in illuminance from a DMS due to rainfall may or may not impact its legibility, depending on the design characteristics of the sign. As will be discussed more thoroughly in a later section of this Appendix, there is a fairly wide range of luminance values (which are inherently related to sign illuminance) and contrast ratios that provide fairly consistent performance in terms of message legibility. In adverse weather conditions, a given rainfall rate may or may not have an impact upon legibility, depending on the luminance level normally provided by the sign. If the rainfall rate is excessive enough to reduce the apparent sign luminance below minimum requirements, a degradation in legibility will occur. On the other hand, if the reduction in sign luminance caused by the rain still provides adequate contrast, no significant change in legibility would be expected. Since the occurrence of rain in the daytime typically reduces ambient lighting levels (as compared to bright sunlight), a reduced DMS luminance would not automatically reduce contrast levels below minimum acceptable thresholds. The effect of rain at night would be to also reduce sign luminance values, but again contrast levels are already so great that the reduction would need to be extremely severe in order to adversely affect legibility. In fact, it could be envisioned that rainfall could actually be somewhat beneficial to nighttime legibility if the normal DMS luminance levels were at or slightly above optimum levels and were approaching irradiation conditions.

A final note is required in this section. The mathematical model above does not take into consideration the potential for light scatter due to water on the windshield, which might simulate irradiation conditions, nor does the model account for the periodic obscuring of the sign as the windshield wipers pass over the driver's line of sight. Such influences are vehicle and driver dependent and beyond representation in any reasonable model.

## EFFECT OF FOG ON LEGIBILITY

Allard's law can also be used to theorize the effect of fog on DMS legibility. Again, however, the difficulty comes in relating the transmissivity coefficient to an easily measurable and interpretable factor describing fog intensity or density. Unlike rainfall intensity, researchers found no relationship in the literature to relate fog characteristics to an atmospheric extinction or transmissivity coefficient. Several fog warning systems that are in place worldwide utilize fog detection equipment that measures changes in atmospheric transmissivity over some distance. However, these systems are designed to determine when fog is present (and to enact appropriate warning devices), not to relate how the fog affects visibility and legibility.

Rather than attempt to work directly with Allard's law, researchers looked for alternative approaches to relate DMS legibility to fog characteristics. Researchers were able to identify a relationship that relates the apparent contrast of an object to its "normal" contrast as a function of the visibility range of the atmosphere. This relationship, as expressed by Duntley, is as follows :

$$C_{apparent} = C_{inherent}\, e^{\frac{-3.912\, V}{R}}$$

where,

| | | |
|---|---|---|
| $C_{apparent}$ | = | apparent contrast of object viewed as some distance under given degraded atmospheric visibility conditions |
| $C_{inherent}$ | = | inherent contrast of object under perfect visibility conditions |
| $V$ | = | atmospheric visibility range |
| $R$ | = | distance at which object is being viewed |

The National Weather Service describes atmospheric visibility ranges as part of its normal operations, and so atmospheric visibility is a factor that is easily accessible. Duntley's relationship can be used to generate a plot describing the relative reduction in contrast as a function of viewing distance and atmospheric visibility ranges. This is shown in Figure C.2.

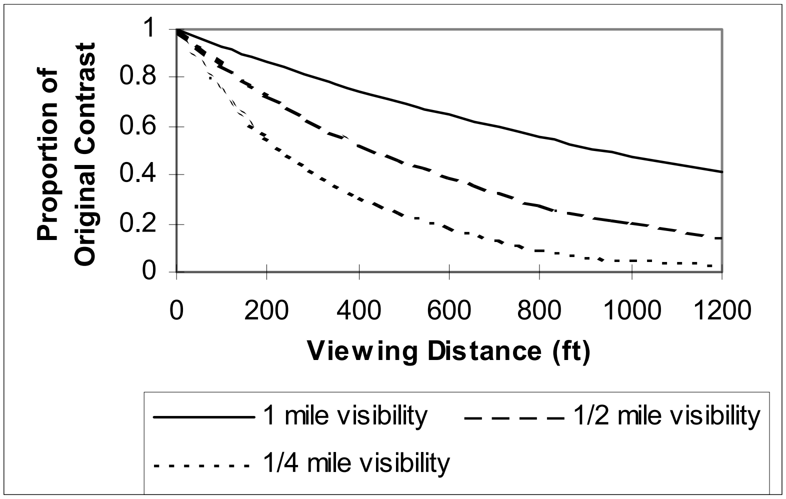



**Figure C.2  Effect of Fog on DMS Contrast Levels**

Figure C.2 illustrates the dramatic effect that fog will have upon DMS legibility during daytime conditions. For example, fog that limits atmospheric visibility to 0.5 mile will reduce the apparent contrast of a DMS message viewed at 800 ft by nearly 50 percent. If the fog is heavier (i.e., 0.25 mile visibility), contrast levels of the DMS viewed at 800 ft will be reduced by 90 percent.

As with rainfall impacts upon DMS legibility, reductions in legibility caused by fog are dependent upon the normal contrast levels generated by the sign. Legibility distances are affected once degraded contrast levels fall below minimum levels. The use of contrast as the primary measure for assessing DMS legibility does create problems in considering nighttime conditions, however. Contrast levels at night are nearly infinite, and so the impact of fog is not easily interpreted from the above equation or graph. It is conceivable that fog could have a negligible impact on nighttime legibility because of these high original contrast levels (or fog might even enhance legibility slightly by reducing the effects of irradiation when the DMS luminance levels are too high). On the other hand, the above mathematical model does not take into consideration the effects of light scatter and refraction of the vehicle headlights back to the driver, which would raise the apparent ambient light levels at the driver's eye and possibly reduce contrast levels (and thus legibility distances).

# C.2 PROCEDURE

This section presents a very simple procedure to check whether the DMS viewing distance desired for a given message will result in a contrast ratio that exceeds the minimum required under a given fog condition. Figure C.2 presents contrast reduction factors for daytime fog conditions. The analyst selects the desired DMS viewing distance and the appropriate fog condition. The value read from the y-axis is the reduction factor that is applied to the normal contrast ratio for that particular sign.

The following general guidelines are suggested for initial contrast ratios in daylight but overcast conditions. The reflective disk values are based on TTI data and published literature for sunny conditions (which are probably slightly higher than would be achieved in overcast conditions). The values for LED DMSs are those observed by TTI under sunny conditions, increased by approximately 50 percent to account for lower ambient light when the sky is overcast. Data are needed in the future to better define these ranges.

| DMS Type | Normal Contrast Ratio Range |
|---|---|
| Reflective Disk | 5–10 |
| Light-Emitting | 20–50 |

The following example illustrates how Figure C.2 is used to assess whether weather conditions would affect the necessary visibility distance of the DMS.

# C.3 EXAMPLE 1

A permanent LED DMS is located in the middle of a six-lane freeway (offset between the motorist in the right lane and the middle of the DMS = 60 ft). A fog that rolled in the previous evening is still present the next morning as the peak period begins, limiting visibility to about 0.75 mile. A series of messages designed for use during peak period incidents on that sign have been developed with four units of information and are stored at the control center for downloading. Traffic speeds have only reduced slightly (i.e., 60 mph). Can the original messages with four units of information be used in this foggy condition?

**PROCEDURE:**

1. Figure C.2 is used with (2 * 4 * 60 * 1.47 + 300) = 1004 ft required visibility distance (300 ft is the additional distance required for the lateral offset) and an extrapolation between the 1- and 0.5-mile visibility curves.
2. The resulting adjustment factor is 0.4.
3. It is assumed that the DMS normally generates a contrast ratio of approximately 25 in normal weather. Multiply this value by the 0.4 adjustment factor.
4. The resulting ratio, 10, is within the optimum range. No adjustments are needed.

## C.4 EXAMPLE 2

Assume the same conditions as previous but that the technology is a reflective disk DMS with a normal contrast ratio in the morning peak of approximately 8.

**PROCEDURE:**

The same adjustment factor (0.4) is used to multiply by the normal contrast ratio (8). The product is 3.2, which is at the lower threshold of human performance. Given that driving in adverse weather typically increases the demand for the motorist's attention, the DMS message designer may be better served to reduce the length of the messages to 3 units of information (so that the message can be read in 6 seconds or less) on this day.

# APPENDIX D. EFFECTS OF LARGE TRUCKS ON DMS LEGIBILITY

Large trucks can be a major cause of sight obstructions to DMSs. Motorists traveling close behind or adjacent to a truck may have a limited amount of time to read a DMS. If they follow too closely, they may not be able to see the DMS at all. This can occur in some instances for permanent overhead DMSs. However, the majority of concerns relating to trucks pertain to the portable DMSs located to the side of the travel lanes.

Evaluating truck obstructions of DMSs requires a slightly different analysis approach. This is because a motorist has the ability to adjust his or her speed slightly relative to that of a truck and find a travel position that allows for adequate viewing. However, as the number of trucks on the roadway increases, the amount of roadway space that a motorist can travel in with an unobstructed view decreases. If the number of vehicles traveling on the facility approaches or exceeds the number that can "fit" into the unobstructed viewing spaces, then some motorists will not be able to read all of a DMS message. Depending on the specific message being presented, this can begin to create operational problems on the facility.

## D.1 THEORY

Large trucks can significantly obstruct a motorist's reading distance to a DMS. Motorists traveling close behind or adjacent to a truck may be limited in the amount of time they have to read a DMS, or may not be able to see the DMS at all. This can occur in some instances for DMSs mounted directly over the travel lanes. However, the majority of concerns relating to trucks pertain to DMSs located to the side of the travel lanes.

Others have noted the problems that trucks create with respect to obstructing both roadside and overhead signing. Unfortunately, only limited efforts have been undertaken to date to quantify the magnitude of the obstruction problem. Furthermore, those who have tried to assess the impacts have only addressed simple signing situations having limited reading time requirements.

Evaluating truck obstructions of a DMS requires a slightly different analysis approach than that used for horizontal and vertical curvature. This is because a motorist has the ability to adjust his or her speed slightly relative to that of a truck and find a travel position that allows for adequate viewing. However, as the number of trucks on the roadway increases, the amount of roadway space that a motorist can travel in with an unobstructed view decreases. If the number of vehicles traveling on the facility approaches or exceeds the number that can "fit" into the unobstructed viewing spaces, then some motorists will not be able to read all of a DMS message. Depending on the specific message being presented, this can begin to create operational problems on the facility.

To analyze the roadside-mounted (i.e., portable) DMS visibility problem, the proportion of driving area on a roadway where visibility distances to a DMS are unacceptable (i.e., less than required viewing times) is computed. Figure D.1 illustrates the geometrics of this situation for a shoulder lane passenger vehicle and truck (this could occur either on a multi-lane roadway or on a two-lane, two-way highway). The analysis process relies on the assumption that DMS reading must be completed within the 10° driver cone of vision. Simple trigonometric relationships are then used establish the minimum acceptable passenger vehicle-truck separation for a side-mounted DMS positioned at a given offset distance from the edge of the travel lane.

The minimum gap size required for the passenger vehicle driver to read the DMS is the difference between the required sight distance (*S*) and the sign-to-back-of-truck-distance (*x*). Using the equations illustrated in Figure D.1, this can be written as:

$$\mathit{Minimum\ Gap} = S\left(1 - \frac{(L - TW) + s}{\frac{2}{3}L + s}\right) \tag{1}$$

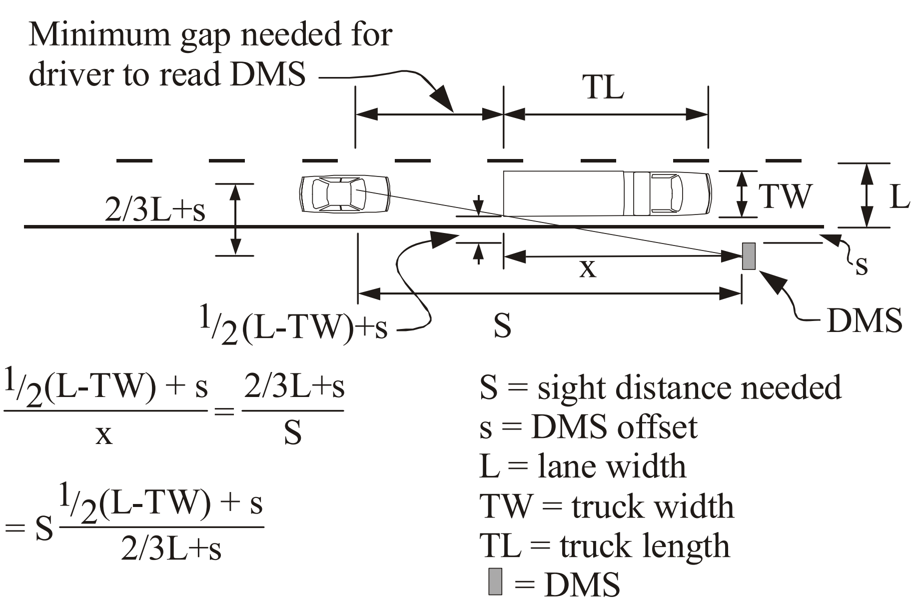
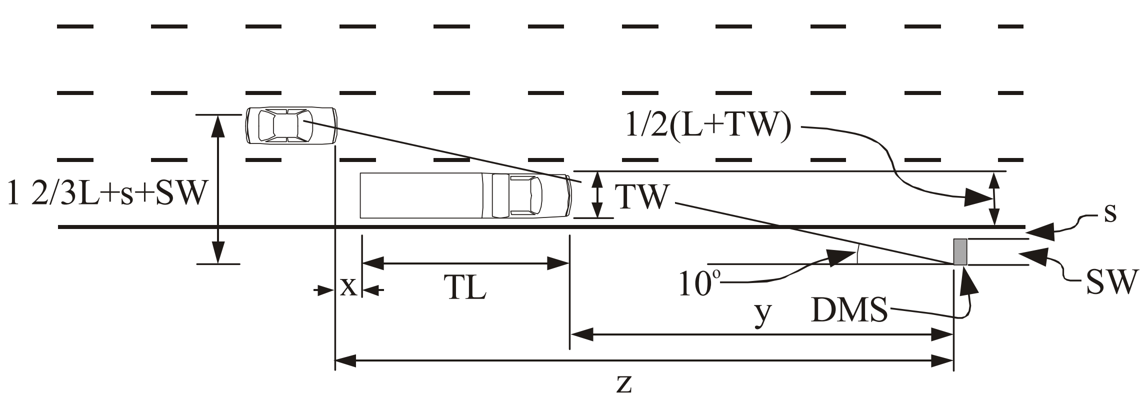



**Figure D.1  Effect of a Truck on Shoulder Lane Vehicles Seeing a DMS**

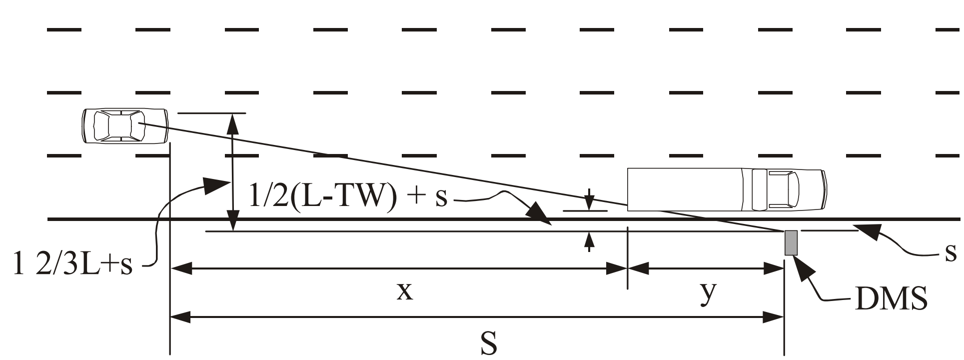
Figure D.2 presents a similar analysis when a truck is in the shoulder lane and a passenger vehicle is in the adjacent lane. Because the motorist in a passenger vehicle in this scenario can see the roadside both in front of and behind the truck from the adjacent lane, the situation is analyzed in two phases. The first phase considers how far back the passenger vehicle can be relative to the truck and still be able to adequately read the DMS by looking in front of the truck (depicted in Figure D.2a). The second phase addresses how far behind the truck the passenger vehicle must be in order to read the DMS from behind the truck (shown in Figure D.2b).




$$y = [1/2(L + TW) + s+SW] / \tan 10^{\circ}$$

$$z = [1\ 2/3L + s+SW] / \tan 10^{\circ}$$

(a)




$$y = S\left(\frac{1/2(L\text{-}TW) - s}{1\ 2/3L+s}\right)$$

(b)

**Figure D.2 Effect of a Truck on Adjacent Lane Vehicles Seeing a DMS**

The distance between these two locations (equal to the sum of the variable *x* from both figures) defines the roadway section in the adjacent lane next to the truck where a driver cannot adequately read the DMS message. In Figure D.2a, the location of the passenger vehicle relative to the back of the truck can be written as follows:

$$x = z - y - TL = \frac{\frac{7}{6}L - \frac{1}{2}TW}{\tan 10^\circ} - TL \qquad (2)$$

where,

$L$ = lane width (ft)
$TL$ = truck length (ft)
$TW$ = truck width (ft)

The other variables are as defined in the figure. This position reflects the fact that the reading of the message needs to be completed before the sign is out of the driver 10° cone of vision. If a vehicle is any farther behind the front of the truck than position $x$, the DMS will become obscured before reaching that critical cone of vision, and thus the full reading distance needed will not be provided.

Likewise, the variable $x$ in Figure D.2b is defined in terms of lane width, truck width, and DMS offset as shown in the following equation:

$$x = S - y = S\left(1 - \frac{\frac{1}{2}(L - TW) + s}{1\frac{2}{3}L + s}\right) \qquad (3)$$

This allows the driver to experience the full reading DMS distance from behind the truck. If the driver is any closer to the back of the truck, the needed reading distance will not be achieved. With the variable $x$ in both equations defined relative to the same location on the truck, their sum defines the length of roadway in that adjacent lane where DMS viewing is not adequate.

The same type of analysis is valid for each lane to the left of the truck. The total effect of a single truck is the sum of inadequate viewing lengths in each lane. The same type of approach is then used to evaluate the influence of trucks in other lanes (the relative offset of the DMS will be measured to the next lane, though). In general, the influence of these trucks in the left lanes will be much less significant than for the trucks in the right shoulder lane *when the DMSs are positioned to the right of the travel lanes*.

Once the impact of an individual truck in each of the travel lanes has been estimated in terms of the length of lane segment that is obscured, the next step in the analysis is to determine whether adequate “viewing capacity” exists for the traffic that is using the facility.

# D.2. PROCEDURE

The analysis procedure to assess the impact of large trucks on DMS viewing time requires an iterative process that begins with a required viewing distance corresponding to particular DMS message of interest. This distance is simply the number of units of information being presented multiplied by 2 seconds each (i.e., the necessary viewing time), and then multiplied by the average travel speed of the vehicle. Other data required at this point in the analysis include the following:

- The number of travel lanes on the facility,
- The lateral offset of the DMS to the travel lanes,
- The volume of traffic on the roadway per direction,
- The percent of traffic that comprises large trucks, and
- An estimate of how truck traffic distributes itself among the available travel lanes (i.e., what percentage travels in the shoulder lane, what percentage travels in the next adjacent lane, etc.).

The procedure consists of the following steps:

1. Divide the total traffic volume on the roadway into an auto volume and truck volume (truck volume = total volume × percent of trucks on the roadway; auto volume = total volume – truck volume).
2. Estimate the truck volume in each lane (based on local data, as there are no true "typical" truck lane distributions. Most trucks travel in the right lane).
3. Estimate the density of trucks in each lane per mile (truck volume in each lane/average truck speed). Estimate average automobile density (auto volume/average speed).
4. Estimate the necessary viewing distance for a particular DMS message of interest (as described above).
5. Select the appropriate truck influence table (Table D.1 or D.2) for the roadway being analyzed. Enter the table using the necessary viewing distance to find the truck influence distance for each truck in each lane. This distance represents the space around each truck where a motorist will not be able to obtain the desired viewing distance for the DMS message.
6. Multiply the influence distance of each truck in each lane by the number of trucks in each lane and sum these distances over all lanes. This is the total truck viewing influence per mile.
7. Subtract the total truck viewing influence distance per mile from the total available viewing distance in the absence of trucks (equal to the number of travel lanes multiplied by 5280 ft/mile). The result is the lane distance per mile where acceptable viewing distance to the DMS is attainable.
8. Divide the available viewing distance by the minimum space needed by each automobile while traveling down the roadway. As a conservative value, this is estimated to be equal to vehicle spacing near capacity conditions (between approximately 120 and 165 ft per automobile). Multiply this by the average speed of traffic on the roadway to estimate the volume that represents the automobile "viewing capacity" on that roadway section for that particular DMS message.
9. Divide the automobile volume on the roadway by the automobile "viewing capacity."

10. If the ratio is significantly less than unity (<1), then there is adequate space on the roadway to view the DMS message of interest.

If the ratio approaches or exceeds unity, there is inadequate viewing capacity and many motorists will not have enough viewing time to read the DMS message in its entirety. If this occurs, the analyst must reduce the DMS message in order to reduce the necessary viewing distance. The analysis then returns to step 4 to reassess the available viewing capacity for the reduced message. This process continues until an acceptable auto-volume-to-available-viewing-capacity ratio is achieved.

This process is more easily understood in the context of the following examples.

# D.3 EXAMPLE 1

A portable DMS is to be placed alongside a two-lane facility (one lane per direction) upstream of a shoulder work zone scheduled between 9 a.m. and 3 p.m. The facility has no paved shoulder, so the DMS is located 2 ft from the edge of the travel lane. Traffic volumes on the facility are approximately 600 vehicles/hour, with 25 percent of these being large trucks (average length = 75 ft). Travel speeds on the roadway are 70 mph. Can the DMS message designer use a message that contains four units of information?

**PROCESS:**

1. Truck volume = 0.25 * 600 = 150 trucks/hour; auto volume = 600 – 150 = 450 autos/hour.
2. All truck traffic will be located in the single lane.
3. Truck density = 150/70 = 2.1 trucks/mile.
4. Estimated DMS viewing distance = 4 units * 2 sec/unit * 70 mph * 1.47 fps/mph = 823 ft
5. Estimate each truck's influence distance for a viewing distance of 823 ft (extrapolated in Table D.1) = 590 ft.
6. Compute total truck influence distance = 590 ft/truck * 2.1 trucks/mile = 1240 ft/mile.
7. Compute lane distance where acceptable viewing occurs = 5280 ft/mile – 1240 ft/mile = 4040 ft/mile.
8. Estimate available automobile viewing capacity = 4040 ft/mile ÷ 140 ft/auto = 28.9 autos/mile. Multiply this value by 70 mph to estimate the available viewing capacity of 2023 autos/hour.
9. Compare ratio of automobile demand to available viewing capacity => 450 ÷ 2023 = 0.22. Since this is significantly less than unity, the roadway section is expected to have sufficient space where adequate viewing of the DMS message can occur. No reduction in reading time of 8 seconds is required.

| Table D.1 Influence Distance of Each Truck (ft): 2-ft DMS Offset from Travel Lanes | | | | | |
|---|---|---|---|---|---|
| Necessary Viewing Distance for DMS Message (ft) | | Lane that Truck is Located in (1 is the shoulder lane) | | | |
| | | 1 | 2 | 3 | 4 |
| 2-Lane Highway: | 100 | 138 | | | |
| | 200 | 200 | | | |
| | 300 | 263 | | | |
| | 400 | 325 | | | |
| | 500 | 388 | | | |
| | 600 | 450 | | | |
| | 700 | 513 | | | |
| | 800 | 575 | | | |
| | 900 | 638 | | | |
| | 1000 | 700 | | | |
| 4-Lane Highway: | 100 | 240 | 103 | | |
| | 200 | 386 | 132 | | |
| | 300 | 531 | 160 | | |
| | 400 | 677 | 189 | | |
| | 500 | 822 | 217 | | |
| | 600 | 967 | 245 | | |
| | 700 | 1113 | 274 | | |
| | 800 | 1258 | 302 | | |
| | 900 | 1404 | 331 | | |
| | 1000 | 1549 | 359 | | |
| 6-Lane Highway: | 100 | 281 | 177 | 93 | |
| | 200 | 515 | 259 | 112 | |
| | 300 | 750 | 341 | 130 | |
| | 400 | 984 | 423 | 149 | |
| | 500 | 1218 | 505 | 167 | |
| | 600 | 1453 | 587 | 185 | |
| | 700 | 1687 | 669 | 204 | |
| | 800 | 1922 | 751 | 222 | |
| | 900 | 2156 | 833 | 240 | |
| | 1000 | 2391 | 916 | 259 | |
| 8-Lane Highway: | 100 | 281 | 194 | 93 | 89 |
| | 200 | 582 | 342 | 179 | 102 |
| | 300 | 909 | 490 | 262 | 116 |
| | 400 | 1235 | 638 | 345 | 129 |
| | 500 | 1561 | 786 | 427 | 143 |
| | 600 | 1888 | 933 | 510 | 157 |
| | 700 | 2214 | 1081 | 593 | 170 |
| | 800 | 2540 | 1229 | 675 | 184 |
| | 900 | 2866 | 1377 | 758 | 197 |
| | 1000 | 3193 | 1525 | 840 | 211 |

| Table D.2. Influence Distance of Each Truck (ft): 10-ft DMS Offset from Travel Lanes | | | | | |
|---|---|---|---|---|---|
| Necessary Viewing Distance for DMS Message (ft) | | Lane that Truck is Located in (1 is the shoulder lane) | | | |
| | | 1 | 2 | 3 | 4 |
| 2-Lane Highway: | 100 | 110 | | | |
| | 200 | 144 | | | |
| | 300 | 179 | | | |
| | 400 | 214 | | | |
| | 500 | 249 | | | |
| | 600 | 283 | | | |
| | 700 | 318 | | | |
| | 800 | 353 | | | |
| | 900 | 388 | | | |
| | 1000 | 422 | | | |
| 4-Lane Highway: | 100 | 190 | 96 | | |
| | 200 | 286 | 117 | | |
| | 300 | 381 | 138 | | |
| | 400 | 477 | 158 | | |
| | 500 | 572 | 179 | | |
| | 600 | 668 | 200 | | |
| | 700 | 764 | 221 | | |
| | 800 | 859 | 242 | | |
| | 900 | 955 | 263 | | |
| | 1000 | 1050 | 283 | | |
| 6-Lane Highway: | 100 | 214 | 159 | 90 | |
| | 200 | 382 | 223 | 105 | |
| | 300 | 549 | 288 | 120 | |
| | 400 | 717 | 352 | 135 | |
| | 500 | 884 | 416 | 149 | |
| | 600 | 105 | 480 | 164 | |
| | 700 | 1219 | 545 | 179 | |
| | 800 | 1387 | 609 | 194 | |
| | 900 | 1555 | 673 | 209 | |
| | 1000 | 1722 | 738 | 224 | |
| 8-Lane Highway: | 100 | 214 | 167 | 90 | 87 |
| | 200 | 422 | 287 | 134 | 98 |
| | 300 | 667 | 407 | 193 | 110 |
| | 400 | 913 | 528 | 251 | 121 |
| | 500 | 1159 | 648 | 310 | 133 |
| | 600 | 1405 | 768 | 369 | 144 |
| | 700 | 1651 | 888 | 428 | 156 |
| | 800 | 1897 | 1009 | 487 | 168 |
| | 900 | 2142 | 1129 | 545 | 179 |
| | 1000 | 2388 | 1249 | 604 | 191 |

# D.4 EXAMPLE 2

A portable DMS is to be placed alongside a six-lane facility (three lanes per direction) to assist in the management of a downstream incident. The DMS is located 10 ft from the edge of the travel lane. Traffic volumes on the facility are approximately 4500 vehicles/hour, with 10 percent of these being large trucks (average length = 75 ft). Local data indicate that 80 percent of the truck traffic uses the right travel lane, with 10 percent of trucks using the center and median lanes. Travel speeds on the roadway are 60 mph. Can the DMS message designer use a message that contains four units of information?

**PROCESS:**

1. Truck volume = 0.10 * 4500 = 450 trucks/hour; auto volume = 4500 – 450 = 4050 autos/hour.
2. Truck volumes per lane will be 0.80 * 450 = 360 trucks/hour in the shoulder lane, 0.10 * 450 = 45 trucks/hour in the center and median lanes.
3. Truck density: 360/60 = 6 trucks/mile in the shoulder lane, 45/60 = 0.75 trucks/mile in center and median lanes.
4. Estimated DMS viewing distance = 4 units * 2 sec/unit * 60 mph * 1.47 fps/mph = 705 ft.
5. Estimate each truck's influence distance for a viewing distance of 705 ft (extrapolated in Table D.1) = 1220 ft for the shoulder lane, 545 ft in the center lane, and 179 ft in the median lane.
6. Compute total truck influence distance:
   1220 ft/truck * 6 trucks/mile = 7320 ft/mile for shoulder lane trucks
   545 ft/truck * 0.75 trucks/mile = 410 ft/mile for median lane trucks
   <u>179 ft/truck * 0.75 trucks/mile = 130 ft/mile for shoulder lane trucks</u>
   7860 ft/mile obstructed viewing due to trucks.
7. Compute lane distance where acceptable viewing occurs
   5280 ft/mile * 3 lanes – 7860 ft/mile = 7980 ft/mile
   ====> 7980 lane ft/mile has viewing conditions that offer 705 ft of viewing distance to the DMS.
8. Estimate available automobile viewing capacity = 7980 ft/mile ÷ 140 ft/auto = 57 autos/mile. This equates to a viewing capacity volume of 57 * 60 = 3420 autos/hour.
9. Compare ratio of automobile demand to available viewing capacity = 4050 ÷ 3420 = 1.2. Since this is greater than unity, the roadway section will not have sufficient space where adequate viewing of the DMS message can occur. Reductions in the number of units of information are required.

Based on these calculations, suppose that the analyst than adjusts the DMS message to 2 units of information. To check whether this is acceptable, the analyst returns to step 4 in the process and proceeds through the process again:

4. Estimated required DMS viewing distance = 2 * 2 * 60 * 1.47 = 355 ft.

5. Estimate each truck's influence distance for a viewing distance of 355 ft (extrapolated in Table D.2) = 635 ft for the shoulder lane, 320 ft in the center lane, and 125 ft in the median lane.
6. Compute total truck influence distance:
   635 ft/truck * 6 trucks/mile = 3810 ft/mile for shoulder lane trucks
   320 ft/truck * 0.75 trucks/mile = 240 ft/mile for median lane trucks
   <u>125 ft/truck * 0.75 trucks/mile = 95 ft/mile for shoulder lane trucks</u>
   4145 ft/mile obstructed viewing due to trucks.
7. Compute lane distance where acceptable viewing occurs
   5280 ft/mile * 3 lanes – 4145 ft/mile = 11,695 ft/mile.
8. Estimate available automobile viewing capacity = 11,695 ft/mile ÷ 140 ft/auto = 84 autos/mile.  This equates to a viewing capacity volume of 84 * 60 = 5015 autos/hour.
9. Compare ratio of automobile demand to available viewing capacity = 4050 ÷ 5015 = 0.80.  Since this is less than unity, the roadway section will have sufficient space where adequate viewing of the DMS message can occur.

It should be noted that a demand to available viewing capacity ratio less than unity does not guarantee that all automobile drivers will see the DMS for the required viewing distance, only that there is potential space within the traffic stream as a whole where adequate viewing is possible.  Some motorists may still choose to travel immediately behind or adjacent to large trucks, and their view will be obstructed.  Unless they adjust their position relative to the truck, they will still miss the DMS message.  From an operational standpoint, however, the lower the demand to available viewing capacity ratio, the less likely that automobile drivers will travel in obstructed viewing locations around large trucks and the greater the likelihood of reaching the intended audience with the DMS message.