DYNAMIC MESSAGE SIGN
MESSAGE DESIGN & DISPLAY
MANUAL TRAINING
One-Day “Core” Course

Participant Notebook

for
Texas Department of Transportation

March 2009
Principles of DMS Operations

Module 2

DMSs are used to manage traffic by displaying:

- Early warning messages
- Advisory messages

DMSs are used to manage traffic by displaying:

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

- Early warning messages
- Advisory messages
- Alternative routing messages

What Motorists Expect From DMSs

- Up-to-the-minute information

What Motorists Expect From DMSs

- Up-to-the-minute information
- Reliable information
What Motorists Expect From DMSs

• Up-to-the-minute information
• Reliable information
• Accurate information

Credibility Is Critical!

Never display specific traffic information before it is verified
How Is Credibility Damaged?

By displaying messages that are:

- Inaccurate

---

How Is Credibility Damaged?

By displaying messages that are:

- Inaccurate
- Not current

---

How Is Credibility Damaged?

By displaying messages that are:

- Inaccurate
- Not current
- Irrelevant

---
How Is Credibility Damaged?
By displaying messages that are:

- Inaccurate
- Not current
- Irrelevant
- Obvious

CAUTION
CONGESTION AHEAD

How Is Credibility Damaged?
By displaying messages that are:

- Inaccurate
- Not current
- Irrelevant
- Obvious
- Trivial

EXPECT 1 MIN DELAY AHEAD

How Is Credibility Damaged?
By displaying messages that are:

- Inaccurate
- Not current
- Irrelevant
- Obvious
- Trivial
- Incorrect (especially numbers)
DMS Operating Fundamentals

Module 3

Determine which DMS is (are) appropriate

Determine the purpose of using a DMS

Continuously changing information

Determine which DMS is (are) appropriate

Determine what to display on the DMS

Determine how long to display the message

Resolve any message signing conflicts that exist

Determine Purpose

What is the problem I am trying to address?

- Type of problem
- Location of problem
- Scope (e.g., number of lanes blocked, minor or major)
- Potential duration
- Extent of impacts
Determine Purpose
What verified information do I have?
• Incident
• Conditions on primary route
• Conditions on diversion route

Determine Purpose
Who is the audience for the DMS message?
• All users of the freeway
• Select group

Determine Purpose
What type of driver response is desired?
• Reduce speed
• Move out of blocked/closed lane
• Take another route
Determine Purpose
What type of driver response is desired?
• Reduce speed
• Move out of blocked/closed lane
• Take another route

Effective messages encourage driver response

Determine Purpose
Where should the response take place?
• Type of response desired
• Layout of the roadway system
• Type and severity of problem
• Existing guidance along alternative route

Determine Purpose
What degree of response is desired?
• Keep message displayed for more response
• Turn message off for less response
Determine Appropriate DMSs

Proximity of DMSs to problem

Questions:
• Expected problem longer than expected travel time?
• Significant number of motorists passing sign?

Characteristics of DMS hardware
• Type of sign
• Number of lines
• Number of characters per line
• Need to move portable signs in place
• Relationship to info on static signs

External Influences
• Traffic speed
• Vertical/ horizontal curves
• Sun position
• Guide signs
• Rain or fog
Determine What to Display
Base information needs and DMS message
• Type of problem
• Location of problem
• Lanes affected
• Location of lane closure
• Effect on Travel

Determine What to Display
Base information needs and DMS message
• Audience for message
• Proper response or driving action by motorist
• Reason to follow recommended driving action

On diversion routes, operator must know:
• Current traffic conditions
• Current traffic capacity constraints
• Guide sign information
Determine Duration of Display

Off-peak
• May be desirable to turn message off by hand

Peak
• May be desirable to estimate duration and have system turn message off automatically

Resolve Signing Conflicts

Most common types of conflicts:
• Two events on same freeway
• One event on freeway and second on intersecting freeway
• One event on freeway and second on connecting freeway in adjacent state
Resolve Signing Conflicts

Most common types of conflicts:

• Two events on intersecting freeway

• One event on an intersecting freeway and a second on a connecting freeway in an adjacent state
Principles of DMS Message Design

Module 4

PART 1
Overview of Issues

Overview of DMS Issues
Direct link with motoring public
Effective Messages Poorly Designed Message
Overview of DMS Issues

Direct link with motoring public

Messages must be standard and consistent

Only few seconds to communicate
Overview of DMS Issues

Message length controlled by exposure time
Some needed information must be omitted

PART 2
Selecting an Audience
Why is it necessary to think about the audience of the message?

Unfamiliar Motorists Will Have Difficulty Understanding:
• Local street and highway names
• Abbreviations for local landmarks, bridges, entertainment and recreational facilities

= longer message processing times

PART 3
Definitions and Message Design Considerations
Message Design Considerations

*Content*: specific information displayed  
*Length*: number of words or characters  
*Load*: number of units of information  
*Info Unit*: answer to a motorist question  
*Format*: order of information units

Message Content

Motorists want to know:  
• What is wrong ahead  
• Where  
• What to do  
• Reason to follow advice

Message Length

Constraints:  
• Message must fit on DMS  
• Maximum length controlled by reading time  
• Motorist time shares reading & driving task  
• Motorist must read entire DMS message  
• Message familiarity enhances reading time  
  – Reading time longer if unfamiliar  
  – Reading time shorter if familiar
Message Length

8-word maximum at 55 mph
7-word maximum at 65 mph

What if the message is longer than this?

Message Length

8-word maximum at 55 mph
7-word maximum at 65 mph

If too long, motorists may reduce speed

We should always try to minimize the length of the message

Message Load and Info Unit

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Info Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What happened?</td>
<td>ACCIDENT</td>
<td>1 Unit</td>
</tr>
<tr>
<td>2. Where?</td>
<td>FAST ROWLAND</td>
<td>1 Unit</td>
</tr>
<tr>
<td>3. Who is advisory for?</td>
<td>FAIR PARK</td>
<td>1 Unit</td>
</tr>
<tr>
<td>4. What is advised?</td>
<td>USE FITZHUGH</td>
<td>1 Unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Units</td>
</tr>
</tbody>
</table>
Message Load and Info Units

Information Units for Entire Message:
- No more than 4 units for speeds $\geq$ 35 mph
- No more than 5 units for speeds < 35 mph

Information Units in a Message Phase:
- No more than 3 units

Information Units on a Line:
- No more than 2 units

Message Format

Must place Information Units in the proper order to:
- Enhance motorist expectations
- Reduce reading time
- Enhance understanding

PART 4
Base DMS Message
Base DMS Message

The “Base” DMS Message:
• Sum total of all information motorists want to have
• Will normally exceed the maximum number of information units
• Must normally be reduced in length

Base DMS Message

The Base DMS Message Elements
• Incident/Roadwork Descriptor
• Incident/Roadwork Location
• Lanes Affected
• (Closure Descriptor)
• (Location of Closure)

Base DMS Message

The Base DMS Message Elements (cont’d)
• Effect on Travel
• Audience for Action
• Action
• One Good Reason for Following Action
Descriptor Element

*Descriptor element* informs motorists of the unusual situation

Location Element

*Location element* informs motorists of the location of unusual situation

- Must follow the Descriptor
- No need for route number or name if on same freeway

Location Element

For commuters:
- Reference to street names, exit names or numbers, landmarks

For unfamiliar motorists:
- Reference by distance, exit numbers
Location Element

Preferred by Familiar or Unfamiliar Drivers?

- **familiar**
  - ACCIDENT
  - AT ROWLAND

- **unfamiliar**
  - ACCIDENT
  - 1 MILE

- **both familiar and unfamiliar**
  - ACCIDENT
  - AT EXIT 12

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Location Element

Subtle differences in location terms can be important
- Near
- At
- Before
- Past
- From
- Between

DMS Manual: no page number

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DMS Manual: no page number
Lanes Affected Element

*Lanes Affected* element gives specific info about which lanes or exit ramps are closed or blocked.

Helps motorists prepare to change to open lanes or use another ramp.

Closure Descriptor Element

*Closure Descriptor* element used in place of *Incident/Roadwork Descriptor* when all lanes are closed.
Effect on Travel Element

Effect on Travel element informs motorist of severity of problem

Helps motorist make informed diversion decisions

Can imply expected arrival time

Effect on Travel Element

Delay

• (number) MIN DELAY
• AVOID (number) MIN DELAY
• SAVE (number) MIN

Effect on Travel Element

Travel Time

• Motorists can measure and refute
• Speed sensors ⊇ large errors in congested conditions
Audience for Action Element

*Audience for Action* element used only when the *Action* applies to a specific group of motorists

Thus, must always be accompanied by an *Action* message element

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Audience for Action Element

The word *TRAFFIC* with a destination is not generally used. There is one exception

---

Action Element

*Action* element is necessary because it tells motorists what to do

It is best that every incident management message have an *Action* statement
Good Reason Element

Motorists must be confident that he/she is taking the best course of action

In most cases, the Good Reason is implied

PART 5
Word and Word Phrase Meanings and Criteria

Word Meanings & Criteria

USE - Route that will take motorists to destination

TAKE - Directive to begin first “leg” of route

FOLLOW - Motorist will be guided by other signs

EXIT - Sometimes used as a verb

GO – Not used
Word Meanings & Criteria

ROADWORK – shorter than CONSTRUCTION
EXIT – when referring to an off ramp on freeway
RAMP – when referring to an on ramp
NITE – shorter than NIGHT
FOR 1 WEEK – Mon through Fri
WEEKEND – Sat AM to Sun PM

Advance Notification Messages

• Use dates only when necessary
• Use text/number format (i.e., JUN 12)
• Do not repeat month abbreviation (i.e., JUN 12 – 15)
• Avoid day/date/time messages because it far exceeds information load limits

PART 6
Diversion/Detour Route Descriptors
Route Characteristic Differences

- Presence of electronic or human surveillance
- Existing guide signs or trailblazers to freeway
- Police and/or traffic control personnel at critical decision points
- Incident emergency route plan signing
- Roadwork traffic control plan (temporary traffic control devices present)

See Tables 4.1 and 4.2 (p. 4-22)

PART 7
Dynamic Features on DMSs

Dynamic Features on DMSs

- AVOID flashing an entire one-phase message

MAJOR ACCIDENT
AT ROWLAND
LEFT 2 LANES CLOSED
Dynamic Features on DMSs

AVOID flashing one line of a one-phase message

MAJOR ACCIDENT AT ROWLAND LEFT 2 LANES CLOSED

Dynamic Features on DMSs

AVOID alternating text

MAJOR ACCIDENT AT ROWLAND LEFT 2 LANES CLOSED

Dynamic Features on DMSs

AVOID alternating text

MAJOR ACCIDENT AT ROWLAND TUNE TO 530 AM
Designing Base Message: Incidents and Roadwork
Modules 5 & 6

Base Message Elements
Incident/Roadwork Descriptor
Incident/Roadwork Location
Lanes Closed
Effect on Travel
Audience for Action
Action
Good Reason for Following Action

Lane Closures: DMS Close to Incident/Roadwork
Effect on Travel

Motorists are not advised to take an alternative route: No diversion

soft diversion
Action

Motorists are advised to take a specific Type 2 diversion route

Audience for Action

Good Reason for Following Action
### DMS Far From Incident/Roadwork

Tables differ slightly for Lanes Closed

<table>
<thead>
<tr>
<th>Lane</th>
<th>Message</th>
<th>Lane</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>LANE CLOSED</td>
<td>Right</td>
<td>LANE CLOSED</td>
</tr>
<tr>
<td>Middle</td>
<td>LANE CLOSED</td>
<td>Right</td>
<td>LANE CLOSED</td>
</tr>
<tr>
<td>Right</td>
<td>LANE CLOSED</td>
<td>Right</td>
<td>LANE CLOSED</td>
</tr>
</tbody>
</table>

### DMS on Different Freeway

Tables different for Incident Location

<table>
<thead>
<tr>
<th>Lane</th>
<th>Message</th>
<th>Lane</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>INCIDENT LOCATION</td>
<td>Right</td>
<td>INCIDENT LOCATION</td>
</tr>
<tr>
<td>Middle</td>
<td>INCIDENT LOCATION</td>
<td>Right</td>
<td>INCIDENT LOCATION</td>
</tr>
<tr>
<td>Right</td>
<td>INCIDENT LOCATION</td>
<td>Middle</td>
<td>INCIDENT LOCATION</td>
</tr>
</tbody>
</table>

### DMS on Different Freeway

Tables different for Action: No Diversion

<table>
<thead>
<tr>
<th>Lane</th>
<th>Message</th>
<th>Lane</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>ACTION: NO DIVERSION</td>
<td>Right</td>
<td>ACTION: NO DIVERSION</td>
</tr>
<tr>
<td>Middle</td>
<td>ACTION: NO DIVERSION</td>
<td>Right</td>
<td>ACTION: NO DIVERSION</td>
</tr>
<tr>
<td>Right</td>
<td>ACTION: NO DIVERSION</td>
<td>Middle</td>
<td>ACTION: NO DIVERSION</td>
</tr>
</tbody>
</table>
Establishing the Maximum Message Length

Module 7

PART 1
Message Length and DMS Viewing Distance Requirements

Required Viewing Distances to DMS

• For a given number of info units: Higher speeds require higher, legibility distances
Sight Distance for Lateral Offset

- Longer lateral distances require more legibility distance

![Graph showing relationship between offset and required distance](image)

Factors Reducing Legibility Distance to a DMS

Lighting Conditions

![Daytime and nighttime conditions](image)

Factors Reducing Legibility Distance to a DMS

Sun Position

![Sunset condition](image)
Factors Reducing Legibility
Distance to a DMS
Vertical & Horizontal Curvature

Factors Reducing Legibility
Distance to a DMS
Spot obstructions

Factors Reducing Legibility
Distance to a DMS
Rain or fog
Factors Reducing Legibility Distance to a DMS
Trucks in the traffic stream

Therefore,
Maximum allowable number of units of information may have to be REDUCED

PART 2
Maximum Legibility Distances for Day & Night Operations
Day & Night

Suggested legibility distances

<table>
<thead>
<tr>
<th>Condition</th>
<th>Light-Emitting</th>
<th>Reflective</th>
<th>Incandescent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Day</td>
<td>700</td>
<td>900</td>
<td>300</td>
</tr>
<tr>
<td>Mid-Day</td>
<td>500</td>
<td>700</td>
<td>200</td>
</tr>
<tr>
<td>Twilight</td>
<td>300</td>
<td>500</td>
<td>100</td>
</tr>
<tr>
<td>Nighttime</td>
<td>100</td>
<td>300</td>
<td>50</td>
</tr>
</tbody>
</table>

Note: only for the lower ambient indoor public pedestrian zone (DDW)

Day & Night

Maximum number of units of info

<table>
<thead>
<tr>
<th>Condition</th>
<th>Light-Emitting</th>
<th>Reflective</th>
<th>Incandescent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-Day</td>
<td>1.5 units</td>
<td>1.6 units</td>
<td>1.3 units</td>
</tr>
<tr>
<td>Twilight</td>
<td>1.0 units</td>
<td>1.2 units</td>
<td>1.0 units</td>
</tr>
<tr>
<td>Nighttime</td>
<td>0.8 units</td>
<td>0.9 units</td>
<td>0.8 units</td>
</tr>
</tbody>
</table>

Note: only for the lower ambient indoor public pedestrian zone (DDW)

Reduce Units for Vertical Curves

Only necessary in very extreme cases

<table>
<thead>
<tr>
<th>Condition</th>
<th>Vertical Curve Design Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70 mph</td>
</tr>
<tr>
<td>Mid-Day</td>
<td>3 units</td>
</tr>
<tr>
<td>Twilight</td>
<td>1 unit</td>
</tr>
<tr>
<td>Nighttime</td>
<td>0.5 unit</td>
</tr>
</tbody>
</table>

Note: only for the lower ambient indoor public pedestrian zone (DDW)
Reduce Units for Horizontal Curves
(Necessary only in extreme cases)

Reduce Units for Rain
Generally rain is insignificant
• As a rule, use maximum values in Table 7.2

Exception: rainfall over 2 inches per hour
• Reduce units of info in Table 7.2 by 1
### Reduce Units for Fog

**Table 7.13 Number of Units of Information that Must Be Ignored from Number Given in Table 7.3 Due to Effect of Fog In Suppression Conditions**

<table>
<thead>
<tr>
<th>Visibility</th>
<th>No Offset</th>
<th>25 ft Offset</th>
<th>50 ft Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 - 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.25 in</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

*Values only for the scene management reducing number provided by management Linda.*

*Adapted sight distance not available for any distance under the viewing conditions.*

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### Reduce Units for Large Trucks

**Table 7.15 Percent of Misfires Due to Fully Loaded LCVs**

<table>
<thead>
<tr>
<th>Percent</th>
<th>25 ft</th>
<th>50 ft</th>
<th>75 ft</th>
<th>100 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>0.5%</td>
<td>0.2%</td>
<td>0.1%</td>
<td>0.05%</td>
</tr>
<tr>
<td>2%</td>
<td>0.9%</td>
<td>0.45%</td>
<td>0.25%</td>
<td>0.15%</td>
</tr>
<tr>
<td>3%</td>
<td>1.4%</td>
<td>0.7%</td>
<td>0.35%</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

*Percent of misfires due to fully loaded LCVs.*

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Dealing with Long Messages

Module 8

PART 1
Splitting Messages

Principles
No more than two frames should be used
Principles

Each frame must be understood by itself

**Acceptable**

**Unacceptable**

Compatible units of information should be displayed on the same frame

**Acceptable**

**Unacceptable**

A message line should not contain portions of two different units of information

**Acceptable**

**Unacceptable**
Principles

Limit of 3 units of info on a single frame at high speeds

Acceptable
BEST ROUTE TO DALLAS
USE I-30

Unacceptable
I-45 CLOSED AT SMITH ST
USE I-30 TO I-35E

PART 2
Approaches to Reducing Message Length

Reducing Message Length
Delete “Dead” Words
Formatting Messages
Using Abbreviations
Delete Dead Words
Street, Avenue, Boulevard
Ahead

Formatting Messages
Order of information units dependent upon whether Incident/Roadwork Descriptor message element is:
• Part of message, or
• Replaced by or combined with Lanes Closed message element

Formatting Messages
Messages with Incident Descriptor
(One Frame)
Formatting Messages

Messages with *Incident Descriptor*
(Two Frames)

<table>
<thead>
<tr>
<th>Incident Descriptor</th>
<th>Roadwork Descriptor</th>
<th>Action</th>
<th>Action for Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident 1</td>
<td>Roadwork 1</td>
<td>Action 1</td>
<td>Action 1 for Action 1</td>
</tr>
<tr>
<td>Incident 2</td>
<td>Roadwork 2</td>
<td>Action 2</td>
<td>Action 2 for Action 2</td>
</tr>
<tr>
<td>Incident 3</td>
<td>Roadwork 3</td>
<td>Action 3</td>
<td>Action 3 for Action 3</td>
</tr>
<tr>
<td>Incident 4</td>
<td>Roadwork 4</td>
<td>Action 4</td>
<td>Action 4 for Action 4</td>
</tr>
</tbody>
</table>

Note: DO NOT ASSOCIATE more than one code, message, or any other code sequence with one message.
Following action message should be placed before the fusion message channel.

- Similar tables are available for
  - Messages with *Roadwork Descriptor*
  - Messages without *Incident Descriptor*
  - Messages without *Roadwork Descriptor*

Using Abbreviations

Acceptable

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Acceptable Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCIDENT</td>
<td>INCIDENT</td>
</tr>
<tr>
<td>ROADWORK</td>
<td>ROADWORK</td>
</tr>
<tr>
<td>ACTION</td>
<td>ACTION</td>
</tr>
<tr>
<td>ACTION FOR ACTION</td>
<td>ACTION FOR ACTION</td>
</tr>
</tbody>
</table>

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Using Abbreviations

Unacceptable Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
<th>Recommended Substitute</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFLA</td>
<td>&quot;Traffic Light&quot;</td>
<td>&quot;Traffic Light&quot;</td>
</tr>
<tr>
<td>PRE</td>
<td>&quot;Present&quot;</td>
<td>&quot;Present&quot;</td>
</tr>
<tr>
<td>ODOT</td>
<td>&quot;Oregon Department of Transportation&quot;</td>
<td>&quot;ODOT&quot;</td>
</tr>
<tr>
<td>WSW</td>
<td>&quot;West Side&quot;</td>
<td>&quot;West Side&quot;</td>
</tr>
<tr>
<td>SSE</td>
<td>&quot;South Side&quot;</td>
<td>&quot;South Side&quot;</td>
</tr>
<tr>
<td>NNE</td>
<td>&quot;Northeastern&quot;</td>
<td>&quot;Northeastern&quot;</td>
</tr>
<tr>
<td>ESE</td>
<td>&quot;Southeastern&quot;</td>
<td>&quot;Southeastern&quot;</td>
</tr>
<tr>
<td>E</td>
<td>&quot;East&quot;</td>
<td>&quot;East&quot;</td>
</tr>
<tr>
<td>W</td>
<td>&quot;West&quot;</td>
<td>&quot;West&quot;</td>
</tr>
<tr>
<td>S</td>
<td>&quot;South&quot;</td>
<td>&quot;South&quot;</td>
</tr>
<tr>
<td>N</td>
<td>&quot;North&quot;</td>
<td>&quot;North&quot;</td>
</tr>
<tr>
<td>NE</td>
<td>&quot;Northeast&quot;</td>
<td>&quot;Northeast&quot;</td>
</tr>
<tr>
<td>SE</td>
<td>&quot;Southeast&quot;</td>
<td>&quot;Southeast&quot;</td>
</tr>
</tbody>
</table>

PART 3
Reducing Message Units of Information

Reformatting
Units of information can be reduced by:
• Omitting unimportant words
• Omitting redundant information
• Combining Base DMS Message elements
PART 4
Reducing Units of Info from Base Message

Reducing Base Message Units
Reduce the number of units of info in the Base DMS Message by:
• Applying Initial Reduction Approaches
• Then Secondary Reduction Approaches using
• Priority Reduction Principles
Initial Reduction Approaches
Reducing Redundancy in Incident/Roadwork Messages
• Omit reference to same freeway

<table>
<thead>
<tr>
<th>Message Elements</th>
<th>Revised Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Type: CAR ACCIDENT</td>
<td>CAR ACCIDENT</td>
</tr>
<tr>
<td>Location: 1050 NO STAGE 100</td>
<td>1050 NO STAGE 100</td>
</tr>
<tr>
<td>Lanes Affected: ALL LANE CLOSED</td>
<td>ALL LANE CLOSED</td>
</tr>
</tbody>
</table>

Initial Reduction Approaches
Combining Message Elements for Incident Messages
• Combine Incident Descriptor, Location, Lanes Affected elements

<table>
<thead>
<tr>
<th>Message Elements</th>
<th>Revised Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Type: CAR ACCIDENT</td>
<td>CAR ACCIDENT</td>
</tr>
<tr>
<td>Location: 1050 NO STAGE 100</td>
<td>1050 NO STAGE 100</td>
</tr>
<tr>
<td>Lanes Affected: ALL LANE CLOSED</td>
<td>ALL LANE CLOSED</td>
</tr>
</tbody>
</table>

Initial Reduction Approaches

<table>
<thead>
<tr>
<th>Message Elements</th>
<th>Revised Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Type: CAR ACCIDENT</td>
<td>CAR ACCIDENT</td>
</tr>
<tr>
<td>Location: 1050 NO STAGE 100</td>
<td>1050 NO STAGE 100</td>
</tr>
<tr>
<td>Lanes Affected: ALL LANE CLOSED</td>
<td>ALL LANE CLOSED</td>
</tr>
</tbody>
</table>

DMS Message Design and Display Manual Training  Page 8-8
Initial Reduction Approaches

- Combine Location of Closure and Action message elements

```
<table>
<thead>
<tr>
<th>Original Message Elements</th>
<th>Reduced Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Closure</td>
<td>FIREWAY CLOSED</td>
</tr>
<tr>
<td>Action</td>
<td></td>
</tr>
</tbody>
</table>
```

Initial Reduction Approaches

Combining/Replacing Message Elements for Roadwork Messages

- Combine/Replace Roadwork Descriptor with Lanes Closed elements

```
<table>
<thead>
<tr>
<th>Original Message Elements</th>
<th>Reduced Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadwork Descriptor</td>
<td>LEFT LANES CLOSED</td>
</tr>
<tr>
<td>Lanes Closed</td>
<td></td>
</tr>
</tbody>
</table>
```

Initial Reduction Approaches
Initial Reduction Approaches

• Combine Roadwork Descriptor, Location and Lanes Closed message elements

<table>
<thead>
<tr>
<th>Scenario of Combining Roadwork Description and Lanes Closed</th>
<th>Revised Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadwork Descriptor</td>
<td>Revised Message Elements</td>
</tr>
<tr>
<td>Location Descriptors</td>
<td></td>
</tr>
<tr>
<td>Lanes Closed</td>
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</tbody>
</table>

Initial Reduction Approaches

• Combining Location of Closure and Action message elements

<table>
<thead>
<tr>
<th>Scenario of Combining Location of Closure and Action</th>
<th>Revised Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Closure</td>
<td>Revised Message Elements</td>
</tr>
<tr>
<td>Action</td>
<td></td>
</tr>
</tbody>
</table>

Secondary Reduction Approaches

Reducing Number of Destinations in Action Message Element

<table>
<thead>
<tr>
<th>Scenario of Reducing Number of Destinations in Action</th>
<th>Revised Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destinations</td>
<td>Revised Message Elements</td>
</tr>
</tbody>
</table>
Priority Reduction Principles

Table A.7 Information Order of Priority

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Message Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snow Storms</td>
<td>Low Impact (Red)</td>
</tr>
<tr>
<td>Floods</td>
<td>Low Impact (Red)</td>
</tr>
<tr>
<td>Storms</td>
<td>Low Impact (Red)</td>
</tr>
<tr>
<td>Health</td>
<td>Low Impact (Red)</td>
</tr>
<tr>
<td>Safety</td>
<td>Low Impact (Red)</td>
</tr>
</tbody>
</table>

Table B.8 Information Order of Priority

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Message Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquakes</td>
<td>Low Impact (Red)</td>
</tr>
<tr>
<td>Tsunamis</td>
<td>Low Impact (Red)</td>
</tr>
<tr>
<td>Tsunamis</td>
<td>Low Impact (Red)</td>
</tr>
<tr>
<td>Earthquakes</td>
<td>Low Impact (Red)</td>
</tr>
<tr>
<td>Tsunamis</td>
<td>Low Impact (Red)</td>
</tr>
<tr>
<td>Earthquakes</td>
<td>Low Impact (Red)</td>
</tr>
</tbody>
</table>

DMS Manual pg 8-20
Exercises
Urban Example

A tanker truck overturns on I-35W southbound just past the I-30 interchange. All lanes are closed southbound beginning at the Rosedale Exit (see map on next slide)

- What message should be put on a DMS just upstream of the closure (DMS #1)?
- What message should be put on a DMS prior to I-820 (DMS #2)?
- What message should be put on DMSs on I-30 approaching I-35W (DMS #3)?

Assume all DMS can display 3 lines at 18 characters per line
Rural Example

Road repairs are being made in the left lane of I-10 eastbound (2 lanes per direction) just past the I-10/I-20 split in west Texas (see map on next page). The lane closure begins just past the curve.

• What message should be put on a DMS located upstream of the I-10/I-20 split (3 lines, 15 characters per line)?
DYNAMIC MESSAGE SIGN
MESSAGE DESIGN & DISPLAY
MANUAL TRAINING

Instructor Guide

For
Texas Department of Transportation

March 2009
# DMS MESSAGE DESIGN AND DISPLAY
## TRAINING WORKSHOP

### Agenda

#### Day 1

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductions*</td>
<td>20 Min</td>
</tr>
<tr>
<td>Module 1</td>
<td>30 Min</td>
</tr>
<tr>
<td>Module 2*</td>
<td>30 Min</td>
</tr>
<tr>
<td>Break</td>
<td>20 Min</td>
</tr>
<tr>
<td>Module 3*</td>
<td>45 Min</td>
</tr>
<tr>
<td>Module 4*</td>
<td>75 Min</td>
</tr>
<tr>
<td>Break</td>
<td>20 Min</td>
</tr>
<tr>
<td>Modules 5 &amp; 6*</td>
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</tr>
<tr>
<td>Module 7*</td>
<td>30 Min</td>
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</tbody>
</table>

#### Day 2

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>Module 8*</td>
<td>30 Min</td>
</tr>
<tr>
<td>Break</td>
<td>20 Min</td>
</tr>
<tr>
<td>Modules 9 &amp; 10</td>
<td>20 Min</td>
</tr>
<tr>
<td>Module 12</td>
<td>10 Min</td>
</tr>
<tr>
<td>Module 14</td>
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<tr>
<td>Break</td>
<td>20 Min</td>
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<tr>
<td>Final Exercises*</td>
<td>60 Min</td>
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<tr>
<td>Break</td>
<td>20 Min</td>
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<tr>
<td>Module 15</td>
<td>10 Min</td>
</tr>
<tr>
<td>Module 16</td>
<td>20 Min</td>
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<tr>
<td>Module 17</td>
<td>20 Min</td>
</tr>
<tr>
<td>Module 18</td>
<td>5 Min</td>
</tr>
<tr>
<td>Module 19</td>
<td>20 Min</td>
</tr>
</tbody>
</table>

* For a one-day course, these core modules involve 5 hours of instruction.
OBJECTIVE OF MODULE:
• Introduce the DMS Message Design and Display Manual
• Introduce key concepts to be covered

DURATION:
• 30 Min

POINTS TO ADD:
• Discuss instructor background
• Query students on name, background, previously involvement with DMS and portable changeable message signs (PCMS)
Dynamic Message Signs (DMSs):
Primary real-time links of TxDOT to the motoring public

POINTS TO ADD:
• If message is not well designed and understood, public impression of TxDOT is degraded
POINTS TO ADD:

• Other ITS components important (fiber, cameras, sensors, etc.), but are not readily seen or acknowledged by most motorists
DMSs

Messages should be consistent with respect to:

• Content
• Format
• Application

POINTS TO ADD:
• Content = what’s said in the message
• Format = how the message is organized
• Application = where and how the message is used in a particular situation
  • Example: whether or not motorists are told if it is a “TRUCK ACCIDENT” or just “MAJOR ACCIDENT”
  • Preference would be the latter, but some districts prefer to use former
DMS Message Design Process

DMS operations require good understanding of:

• Traffic operations
• Human factors

POINTS TO ADD:

• Traffic operations affect how much time a driver will have to view a message if the sign is readable from a given distance away
  • i.e., dependent on how fast traffic is traveling
• Traffic operations concepts are also needed to assess how roadway curvature, large trucks, etc. affect reading times
• An understanding of human factors is needed to understand how far away drivers can read a DMS, and how environmental conditions affect this visibility.
• Human factors also come into play in determining how much information motorists can process and use to make decisions
POINTS TO ADD:

• What information motorists want and could use to make driving decisions typically exceeds what they could read and process from a DMS while driving a vehicle.

• Thus, information must be prioritized and limited to what they can handle.
POINTS TO ADD:

• The message designer must limit the amount of information presented on the sign so that the time it takes to read the message (while driving) is less than the maximum time available the sign provides for reading the message.
**Message Design Process**

- Required message reading time \(\leq\) Reading time available while approaching DMS
- Distance traveled during time needed to read message \(\leq\) Maximum distance at which message can first be read

DMS Manual: pg 1-2

**POINTS TO ADD:**

- Distances traveled during a set period of time are dependent on speed

**ASK:**

- What will a driver do to give him or her more time to read a message? (slow down, possibly creating large speed differentials in traffic stream)
There is a Maximum Message Length

Affected by:
• Legibility distance of message
• Motorist perception, information processing capabilities

POINT TO ADD:
• Even if the DMS is made extremely large, motorist information processing capabilities limit how much information can be effectively used while driving
• Generally, we can only keep up to 5 units of information straight in our short-term memory
Available Message Viewing Distance

Affected by:
• Type of DMS
• Sun position
• Geometric design
• Environmental conditions

POINTS TO ADD:
• We will talk about each of these in more detail later in the workshop
Focus of Manual

• Design of effective messages for incidents & roadwork
• When & where to display messages
• Design of effective messages for:
  – AMBER alert
  – High water & floods
  – Ozone
  – Planned special events

POINTS TO ADD:

• Some concepts presented may differ from your local district practices
• Information presented is based on 30+ years of national research and experiences
• Where practices differ from what is in this manual, find out why the differences exist
POINTS TO ADD:

• Motorist information needs differ depending on where they are relative to an incident or roadwork location

ASK:

• When motorists are just upstream of an incident, what options do they have? (None) What information can they react to?
  • What the problem is
  • Where it is
  • What lane is it in
ASK:

• When motorists are farther upstream of an incident, what options do they have? (they could find a different route) What information can they react to?
  • What the problem is (helps them assess how bad it is)
  • Where it is (how it affects their trip)
  • How many lanes closed (how bad it is)
  • What other route(s) should be used
POINTS TO ADD:

• In some cases, it is important to help motorists on an intersecting roadway know that there is a problem
  • It may affect some motorists planning to go that way
  • Prepares the rest that there may be more traffic, weaving, etc. from the traffic that is diverting
Manual Designed for:

- New users of DMSs
- Experienced users of DMSs

At
- Entry level
- Experienced with traffic operations
- Managers

POINTS TO ADD:

- Part of the manual explains the underlying principles of message design (new user)
- Part of the manual provides quick reference look up tables for consistent formatting of message elements (experienced users)
- Part of the manual provides analytical procedures to use in high-level message design decisions (managers)

ASK:

Any questions?
OBJECTIVE OF MODULE:
Describe the key principles that affect how effective (or ineffective) a DMS message will be for a motorist

DURATION:
30 Min
DMSs are used to manage traffic by displaying:

- Early warning messages

POINTS TO ADD:

- If drivers know about something that will happen in future, they have much more flexibility in how to respond
DMSs are used to manage traffic by displaying:

• Early warning messages
• Advisory messages

POINTS TO ADD:
• Informing drivers of what they will encounter downstream helps them be better prepared to properly react

ASK:
• How well can you make snap or immediate decisions? Are your decisions and actions usually improved if you have some advance warning about the need to make a decision or to react?
DMSs are used to manage traffic by displaying:

• Early warning messages
• Advisory messages
• Alternative routing messages

POINTS TO ADD:

• Sometimes, it is necessary to encourage or direct drivers to use other routes. This can reduce traffic demand and congestion at the problem location

DMS Manual: pg 2-1
What Motorists Expect From DMSs

• Up-to-the-minute information

POINTS TO ADD:
• Drivers understand that the signs can be easily changed and should reflect what is going on

ASK:
• What are the challenges to providing up-to-the-minute information?
• How do you address these challenges?
What Motorists Expect From DMSs

- Up-to-the-minute information
- Reliable information

POINTS TO ADD:
- Drivers want to be able to trust the information so that they can make the best decision possible for them

ASK:
- What are the challenges to providing reliable information?
- How do you address these challenges?
What Motorists Expect From DMSs

• Up-to-the-minute information
• Reliable information
• Accurate information

POINTS TO ADD:
• Accurate and reliable information are similar in meaning, but do have subtle differences

ASK:
• Can you have reliable information that is not accurate?
  • Small time between when a problem occurs and when the information is posted on the sign
• Can you have accurate information that is not reliable?
  • Trying to post travel times that are too precise (minutes and seconds), because traffic conditions change too fast
What Motorists Expect From DMSs

- Up-to-the-minute information
- Reliable information
- Accurate information
- Relevant information

POINTS TO ADD:
- Relevant implies that the information being presented will be useful to a significant portion of motorists viewing the sign
Credibility Is Critical!

Never display specific traffic information before it is verified

POINTS TO ADD:

• “Verified” means that it comes from a DOT or other trusted source and not just a cell phone call from a driver. This is most important when deciding on posting messages about an incident (its location, number of lanes affected, etc.). Automated travel time messages are considered to be verified by the system software, but incident alarms created by the software need to be verified to determine location, lanes blocked, etc. as well.

ASK:

• What can happen if unverified information is used?
  • False alarm (no problem exists)
  • Problem location incorrect
  • Etc.
How Is Credibility Damaged?

By displaying messages that are:

- Inaccurate

ASK:

• If it is actually the left lane closed, what problems does that create for the driver?

• Is that worse than if they had not known anything about the problem?

POINTS TO ADD:

• None

DMS Manual: pg 2-2

2-10
How Is Credibility Damaged?

By displaying messages that are:

- Inaccurate
- Not current

POINTS TO ADD:

- Displaying information after the problem has been cleared severely weakens TXDOT credibility with the motoring public
How Is Credibility Damaged?

By displaying messages that are:

- Inaccurate
- Not current
- Irrelevant

ASK:

- What should a motorist who sees this sign decide or do? (nothing. Humorous, but totally irrelevant)

POINTS TO ADD:

- Other examples include messages that support a local team (i.e., “GO AGGIES! BEAT XXXX”)
How Is Credibility Damaged?

By displaying messages that are:

- Inaccurate
- Not current
- Irrelevant
- Obvious

POINTS TO ADD:

• This may be a useful message if it is due to an unexpected situation (i.e., incident) and is beyond the visible range of the congestion. Once in congestion, it is of no use, though
How Is Credibility Damaged?

By displaying messages that are:
- Inaccurate
- Not current
- Irrelevant
- Obvious
- Trivial

POINTS TO ADD:
• None

ASK:
• Would you do anything different if you saw this message on your way home?
How Is Credibility Damaged?

By displaying messages that are:
- Inaccurate
- Not current
- Irrelevant
- Obvious
- Trivial
- Incorrect (especially numbers)

POINTS TO ADD:
• None
POINTS TO ADD:
• Credibility of this sign was damaged because no one checked the contractor’s employee after he was told to put a message on the sign.

ASK:
• What does this message say? (Prepare to Stop)

• Is this a credible sign? (no, click on red X)
POINTS TO ADD:

• Posting Spanish messages is not currently common practice within TxDOT.
DMS Operating Fundamentals

Module 3

OBJECTIVE OF MODULE:
• Provide an overview of the systems engineering process applied to DMS use

DURATION:
• 45 Min

POINTS TO ADD:
• DMS are tools used to help solve or improve upon problems that drivers encounter
• Systems engineering is a well-accepted approach used in many disciplines to guide problem resolution procedures.
• The problem, and information needed to mitigate the problem, should dictate what, where, and how DMSs are used
POINTS TO ADD:
• Note that the overall process is a continuously reinforcing system
• The process is also very dynamic, dependent upon when in the process new information is obtained or conditions change
Determine Purpose

What is the problem I am trying to address?

• Type of problem
• Location of problem
• Scope (e.g., number of lanes blocked, minor or major)
• Potential duration
• Extent of impacts

POINTS TO ADD:

• The better the problem being addressed is understood, the better the message that can be created to address it
• It is always important to understand as much about the characteristics of the problem as possible. These are the types of things drivers want to know
Determine Purpose

What verified information do I have?
• Incident
• Conditions on primary route
• Conditions on diversion route

POINTS TO ADD:
• Verified information is that which comes from a trusted source. It may be from cameras, other DOT personnel, law enforcement, etc.
• Information provided directly from drivers is generally not considered verified
Determine Purpose

Who is the audience for the DMS message?
• All users of the freeway
• Select group

POINTS TO ADD:
• None

ASK
• What types of groups may have a need for specific information targeted for them?
  • truck traffic
  • traffic destined for a specific venue
  • traffic planning to travel on the route in the future
  • etc.
Determine Purpose

What type of driver response is desired?
• Reduce speed
• Move out of blocked/closed lane
• Take another route

POINTS TO ADD:
• Being more alert and aware of potential trouble may be another response, but is harder to observe or measure
Determine Purpose

What type of driver response is desired?
• Reduce speed
• Move out of blocked/closed lane
• Take another route

*Effective messages encourage driver response*

POINTS TO ADD:
• none
Determine Purpose

Where should the response take place?
• Type of response desired
• Layout of the roadway system
• Type and severity of problem
• Existing guidance along alternative route

POINTS TO ADD:
• Layout refers to both the location of exits and entrances, continuity of alternative routes, and number of possible alternative routes
Determine Purpose
What degree of response is desired?
• Keep message displayed for more response
• Turn message off for less response

POINTS TO ADD:
• For some messages, you can manage the degree of response by how you choose to display the message
• Changing the content of a message is another way to manage the response to reduce driver response

ASK:
• Can all messages be managed in this way? (no) Which ones can? (messages targeting drivers for a particular destination like a fair or concert) Which ones can’t? (messages that indicate an incident ahead)
• How could a message content be changed to affect response? (i.e., showing the estimated delay to increase delay, remove the delay statement to reduce response)
Determine Appropriate DMSs

Proximity of DMSs to problem
Questions:
• Expected problem longer than expected travel time?
• Significant number of motorists passing sign?

POINTS TO ADD:
• It is often difficult to know whether a significant number of motorists passing a DMS are destined to travel past the incident or situation

• ASK
  • How do you decide how far away from the problem you will activate DMSs?
Determine Appropriate DMSs

Characteristics of DMS hardware
• Type of sign
• Number of lines
• Number of characters per line
• Need to move portable signs in place
• Relationship to info on static signs

POINTS TO ADD:
• If a permanent DMS is not located in the proper location, or cannot present all of the information that needs to be presented, it may be necessary to supplement them with portable signs (PCMS, static warning signs)
• We do not want to have contradictory information presented on a DMS and on a static sign
Determine Appropriate DMSs

External Influences
- Traffic speed
- Vertical/horizontal curves
- Sun position
- Guide signs
- Rain or fog

POINTS TO ADD:
• External influences, combined with the characteristics of the DMS itself, define how much time a driver has to view and read a message
• Some of these are only considered in initial positioning of the DMS, others should at least be thought about each time it is used

• ASK
• Which items are “one-time” factors, and which are “each time” factors? (curvature is a one-time consideration, others may affect messages each time the sign is used)
Determine What to Display

Base information needs and DMS message
• Type of problem
• Location of problem
• Lanes affected
• Location of lane closure
• Effect on Travel

POINTS TO ADD:
• These items are what research indicates drivers want to have in order to make a driving decision and response to a situation
Determine What to Display

Base information needs and DMS message
• Audience for message
• Proper response or driving action by motorist
• Reason to follow recommended driving action

POINTS TO ADD:
• None
Determine What to Display

On diversion routes, operator must know:

- Current traffic conditions
- Current traffic capacity constraints
- Guide sign information

POINTS TO ADD:

- Whenever diversion routes are specified, we do not want to put drivers in a worse situation than they already are

- ASK

  - Why would an operator need to know the current capacity constraints when determining what to display? (affects how much traffic the diversion route can handle, could affect what the operator chooses to put on the message to encourage diversion)
Determine Duration of Display

Off-peak
• May be desirable to turn message off by hand

POINTS TO ADD:
• Turning messages on and off by hand allows operators to be more responsive to actual events and conditions, but significantly increases operator workload
Determine Duration of Display

Off-peak
• May be desirable to turn message off manually once no longer needed

Peak
• May be desirable to estimate duration and have system turn message off automatically

POINTS TO ADD:
• On the other hand, having the system turn off messages automatically can reduce operator workload and protect against “forgetting” to turn it off, but reduces responsiveness of the message to conditions

DMS Manual: pg 3-7
Resolve Signing Conflicts

Most common types of conflicts:
• Two events on same freeway
• One event on freeway and second on intersecting freeway
• One event on freeway and second on connecting freeway in adjacent state

POINTS TO ADD:
• None
Resolve Signing Conflicts

Most common types of conflicts:
• Two events on intersecting freeway
• One event on an intersecting freeway and a second on a connecting freeway in an adjacent state

POINTS TO ADD:
• None

ASK
• What priorities do you establish regarding messages when more than one situation exists that DMS could be used for?
OBJECTIVE OF MODULE:
• Present concepts regarding audience selection, message design definitions, concept of a base message, word and word phrase meanings

DURATION:
• 75 Min
PART 1
Overview of Issues

POINTS TO ADD:

• none
Overview of DMS Issues

Direct link with motoring public

*Effective Messages*  *Poorly Designed Message*

POINTS TO ADD:

• How DMS are used reflect directly on how the public perceives TxDOT
Overview of DMS Issues

Direct link with motoring public
Messages must be standard and consistent

POINTS TO ADD:
• Motorists travel to different locations, see how other agencies operate their signs
• Consistency improves performance for both familiar and unfamiliar motorists
• Similar in concept to why we standardize signs and markings in the MUTCD
Overview of DMS Issues

Direct link with motoring public
Messages must be standard and consistent
Only few seconds to communicate

POINTS TO ADD:
• Time that driver can actually see and read the sign is limited, and must be shared with the other driving tasks that must continuously be attended to
Overview of DMS Issues
Message length controlled by exposure time

POINTS TO ADD:
• Important to only present as much information as drivers can effectively read and process while driving

ASK:
• If a driver does not have enough time to read a message while driving, what can he do to give him more time? (slow down)
• If they slow down, what types of problems can that create? (speed differentials, higher accident potential)
POINTS TO ADD:

• The more drivers know about a particular situation and what they should do, the better they can react.

• Unfortunately, there is usually not enough time available on a single DMS to present all of this information to drivers.

Overview of DMS Issues

Message length controlled by exposure time

Some needed information must be omitted
Overview of DMS Issues

Message length controlled by exposure time
Some needed information must be omitted
Motorist understanding must be enhanced

POINTS TO ADD:
• There are ways in which the information in a message is presented that can make it easier to motorists to understand. This will increase the likelihood that motorists will correctly interpret the message and act appropriately
• Motorists travel to different locations, see how other agencies operate their signs
PART 2
Selecting an Audience

POINTS TO ADD:
• None
POINTS TO ADD:

• Information needs can much be different for different audiences
• These information needs may have different levels of urgency
• May have to decide which audience information needs are most critical to be met
Audience for Message

Unfamiliar Motorists Will Have Difficulty Understanding:
• Local street and highway names
• Abbreviations for local landmarks, bridges, entertainment and recreational facilities

= longer message processing times

POINTS TO ADD:
• Also, unfamiliar motorists will be less likely to make diversion decisions based on local hwy names and landmarks provided in message (which may be a good thing in some cases)
PART 3
Definitions and Message Design Considerations

POINTS TO ADD:
• None
Message Design Considerations

*Content*: specific information displayed

*Length*: number of words or characters

*Load*: number of units of information

*Info Unit*: answer to a motorist question

*Format*: order of information units

**POINTS TO ADD:**

- Length and Load are obviously related
- Length is important when trying to figure out if the message can fit on a given sign
- Load is important when determining how much information can be provided to drivers without overloading them
Message Content

Motorists want to know:
• What is wrong ahead
• Where
• What to do
• Reason to follow advice

POINTS TO ADD:
• Many times, the reason is implied by knowing what is wrong and what to do
Message Length

Constraints:
• Message must fit on DMS
• Maximum length controlled by reading time
• Motorist time shares reading & driving task
• Motorist must read entire DMS message
• Message familiarity enhances reading time
  – Reading time longer if unfamiliar
  – Reading time shorter if familiar

POINTS TO ADD:
• Usually, reading time limits amount of information that can be displayed. However, drivers have upper limits to how much they can process at one time (i.e., we can’t just make sign letters bigger and put more on them)
• Drivers obtain information from DMS through short (0.5 sec) glances to the sign as they drive. They are not looking at the sign the entire time it is legible
Message Length

8-word maximum at 55 mph
7-word maximum at 65 mph

What if the message is longer than this?

POINTS TO ADD:
• Drivers need 2 seconds per unit of information
• Drivers can only process up to 4 units of information at one time
• Signs are designed to provide legibility distances that meet this 4-unit maximum, but not for the design driver (what we design for)

ASK:
• If message is longer, what happens? (drivers slow down to give themselves more reading time, drivers incorrectly read message and make incorrect decisions or fail to make a decision at all)
Message Length

8-word maximum at 55 mph
7-word maximum at 65 mph

*If too long, motorists may reduce speed*

*We should always try to minimize the length of the message*

POINTS TO ADD:
Represents having 8 seconds or viewing time of the sign when traveling at that speed
Drivers require about 2 seconds per unit of information, or about 1 second per word. Given current DMS design characteristics, these are good maximums to try and stay below (although it is not always easy to do)
Message Load and Info Unit

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What happened?</td>
<td>ACCIDENT</td>
<td>1 Unit</td>
</tr>
<tr>
<td>2. Where?</td>
<td>PAST ROWLAND</td>
<td>1 Unit</td>
</tr>
<tr>
<td>3. Who is advisory for?</td>
<td>FAIR PARK</td>
<td>1 Unit</td>
</tr>
<tr>
<td>4. What is advised?</td>
<td>USE FITZHUGH</td>
<td>1 Unit</td>
</tr>
</tbody>
</table>

4 Units

POINTS TO ADD:

• As shown here, a unit of information can be 1 or 2 words (and in some cases, 3 words).
Message Load and Info Units

Information Units for Entire Message:
- No more than 4 units for speeds ≥ 35 mph
- No more than 5 units for speeds < 35 mph

Information Units in a Message Phase:
- No more than 3 units

Information Units on a Line:
- No more than 2 units

POINTS TO ADD:
• If 5 units, good chance that one of the 5 will not be retained and used by drivers (exceeds short-term memory capacity of some humans)
• Although 2 units can be shown on same lane, they cannot be just part of the unit (i.e., start the unit on one line, finish on the second, start 2nd unit on the 2nd line, finish on the 3rd line)
Message Format

Must place Information Units in the proper order to:

• Enhance motorist expectations
• Reduce reading time
• Enhance understanding

POINTS TO ADD:

• Drivers develop an expectancy of where certain bits of info will be found on a sign (like they know where distance info on a guide sign will be)
PART 4
Base DMS Message

POINTS TO ADD:
• None
Base DMS Message

The “Base” DMS Message:
• Sum total of all information motorists want to have
• Will normally exceed the maximum number of information units
• Must normally be reduced in length

POINTS TO ADD:
• Base message consists of base message elements in the manual
• Identifying all of the elements prior to message design ensures that the operator has fully thought through all facets of the situation and what types of information a driver might be able to use to make a better driving decision
Base DMS Message

The *Base DMS Message Elements*
- Incident/Roadwork Descriptor
- Incident/Roadwork Location
- Lanes Affected
- (Closure Descriptor)
- (Location of Closure)

POINTS TO ADD:
• 9 points are shown on this slide and next, but those in parentheses are only applicable to full roadway closure situations
Base DMS Message

The *Base DMS Message Elements* (cont’d)

- Effect on Travel
- Audience for Action
- Action
- One Good Reason for Following Action

POINTS TO ADD:

- none
Descriptor Element

Descriptor element informs motorists of the unusual situation

POINTS TO ADD:
• Number 1 item always indicated by motorists is to be told what the problem is. It helps them establish expectations about what they are likely to encounter.
Location Element

*Location* element informs motorists of the location of unusual situation

- Must follow the Descriptor
- No need for route number or name if on same freeway

POINTS TO ADD:
- None
LOCATION ELEMENT

For commuters:
• Reference to street names, exit names or numbers, landmarks

For unfamiliar motorists:
• Reference by distance, exit numbers

POINTS TO ADD:
• Most commuters travel without knowing distances (rely on names and landmarks)
• Unfamiliar drivers generally have no frame of reference of where a street name is relative to their route (unless it is where they intended to exit)
POINTS TO ADD:
• None

ASK:
• Is 1st message for familiar or unfamiliar? (familiar)
• Is 2nd message for familiar or unfamiliar? (unfamiliar)
• Is 3rd message for familiar or unfamiliar? (both)
Location Element

Subtle differences in location terms can be important
  – Near
  – At
  – Before
  – Past
  – From
  – Between

POINTS TO ADD:
• Studies have indicated that these terms do consistently imply where the problem is located on a facility
POINTS TO ADD:
• When the term “AT” is used, it implies to motorists that the exit to the cross street referenced by the “AT” term may not be available, but the entrance ramp past the cross-street would be open and available
POINTS TO ADD:

• The term “PAST” implies to drivers that the exit ramp to the location named is open. However, the entrance ramp past the named location is not expected to be available to be used by drivers to return to the freeway
POINTS TO ADD:

• If the term “BEFORE” is used in the location element, the exit ramp to the named location is believed not be available, but the entrance past that name location is expected to be open and available.
POINTS TO ADD:

• When the problem extends over a length of roadway, the “FROM” to “TO” terms can be used together.

• The exit to the “FROM” location is expected by drivers to be open, and the entrance ramp after the “TO” location is also expected to be open and beyond the limits of the roadway problem.
POINTS TO ADD:

• The terms “BETWEEN” and “AND” work like the “FROM/TO” pair to indicate a length of roadway segment

• This pair is longer than “FROM/TO”, so it doesn’t tend to be used as much

• Driver expectations of ramp availability is the same as for the “FROM/TO” combination
Lanes Affected Element

*Lanes Affected* element gives specific info about which lanes or exit ramps are closed or blocked.

Helps motorists prepare to change to open lanes or use another ramp.

POINTS TO ADD:
• none
Closure Descriptor Element

*Closure Descriptor* element used in place of *Incident/Roadwork Descriptor* when all lanes are closed

POINTS TO ADD:

- Often, the point where the roadway is closed is a significant distance upstream of where the problem is located
- On freeways, this will always be at an exit ramp
Effect on Travel Element

*Effect on Travel* element informs motorist of severity of problem

Helps motorist make informed diversion decisions

Can imply expected arrival time

POINTS TO ADD:

• Drivers are looking for information they can use on whether or not they should seek another route
• Lanes closed can also imply travel time impacts
**Effect on Travel Element**

**Delay**
- (number) MIN DELAY
- AVOID (number) MIN DELAY
- SAVE (number) MIN

<table>
<thead>
<tr>
<th>Example of DELAY*</th>
<th>Example of AVOID DELAY*</th>
<th>Example of SAVE DELAY*</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCIDENT AT EXIT 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 MIN DELAY USE ROUTE 46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DMS Manual: pg 4-11

**POINTS TO ADD:**
- Drivers correctly interpret DELAY to mean additional time beyond their normal trip time.
- Driver threshold of tolerable delay before seeking a different route depends on the network.
  - If frontage road available (and relatively open), 5 minutes or more of delay may yield substantial delay.
  - W/O frontage roads, generally takes 20 minutes of delay before most people will consider diverting.
- Very few agencies now using “SAVE XX MIN”. Some concern that it can be misinterpreted by drivers, especially if their total trip time is still longer than normal. If they do not know how much additional delay they would have had, they may refute agency claims that they actually saved time by taking the alternative route.
Effect on Travel Element

Travel Time
- Motorists can measure and refute
- Speed sensors ⇒ large errors in congested conditions

POINTS TO ADD:
- Travel times are desired by motorists
- FHWA encourages display of travel times on DMS (July 2004 policy memorandum)
- Systems that use spot sensors to measure speed and extrapolate to travel times can yield large errors in actual travel times when conditions are congested
- Fortunately, drivers understand that estimates are approximations only. This can be further emphasized as shown (one on left is how Houston formats their message, one on right is how San Antonio does it). Examples of these formats can be found outside of TX as well
Audience for Action Element

*Audience for Action* element used only when the *Action* applies to a specific group of motorists

Thus, must always be accompanied by an *Action* message element

POINTS TO ADD:

• Special events can often require audience-specific information
# Audience for Action Element

The word *TRAFFIC* with a destination is not generally used. There is one exception.

<table>
<thead>
<tr>
<th>MAJOR ACCIDENT</th>
<th>MAJOR ACCIDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAST I-30</td>
<td>PAST I-30</td>
</tr>
<tr>
<td>FAIR PARK</td>
<td>FAIR PARK</td>
</tr>
<tr>
<td>USE FITZHUGH</td>
<td>USE FITZHUGH</td>
</tr>
<tr>
<td>&quot;TRAFFIC&quot; not required</td>
<td>&quot;TRAFFIC&quot; required</td>
</tr>
</tbody>
</table>

DMS Manual: pg 4-14

### POINTS TO ADD:

- None

### ASK:

- Why does the message on the right require the word "TRAFFIC"?
- What would happen if it was not included in that message? (drivers would be confused whether FAIRPARK was the location of the accident or the audience who should use FITZHUGH)
Action Element

*Action* element is necessary because it tells motorists what to do

It is best that every incident management message have an *Action* statement

POINTS TO ADD:
• none
Good Reason Element

Motorists must be confident that he/she is taking the best course of action

In most cases, the Good Reason is implied

POINTS TO ADD:
• Again, special event messages are often where a good reason is beneficial in the message if you want the motorist to make a specific action (such as use a different route to the venue)
PART 5
Word and Word Phrase Meanings and Criteria

POINTS TO ADD:
• none
**Word Meanings & Criteria**

*USE* - Route that will take motorists to destination

*TAKÉ* - Directive to begin first “leg” of route

*FOLLOW* - Motorist will be guided by other signs

*EXIT* - Sometimes used as a verb

*GO* – Not used

**POINTS TO ADD:**
- USE implies that the motorist need not return back to the original route, that the USE route will get them directly to their destination
- TAKE implies additional info is forthcoming, help will exist along the way
- FOLLOW implies a trailblazing or other signing will guide all along the route
- Remember that EXIT is both a noun and a verb. OK to use as a verb (EXIT AT xx), but make sure it is obvious that it is not the noun (EXIT xx) that is being referred to
Word Meanings & Criteria

ROADWORK – shorter than CONSTRUCTION

EXIT – when referring to an off ramp on freeway

RAMP – when referring to an on ramp

NITE – shorter than NIGHT

FOR 1 WEEK – Mon through Fri

WEEKEND – Sat AM to Sun PM

POINTS TO ADD:
• FOR 1 WEEK does not include weekends
• WEEKEND does not include Friday PM or early Monday morning up to peak period
Advance Notification Messages

• Use dates only when necessary
• Use text/number format (i.e., JUN 12)
• Do not repeat month abbreviation (i.e., JUN 12 – 15)
• Avoid day/date/time messages because it far exceeds information load limits

POINTS TO ADD:
• Dates only when necessary – drivers do not easily translate dates into days in the future when they may be traveling
• If “Tomorrow” would work for the message, that would be a better choice
• Posting day, date, and time information about a future event is of little or no benefit, because drivers cannot process that much information correctly
PART 6
Diversion/Detour Route Descriptors

POINTS TO ADD:
• None
Route Characteristic Differences

- Presence of electronic or human surveillance
- Existing guide signs or trailblazers to freeway
- Police and/or traffic control personnel at critical decision points
- Incident emergency route plan signing
- Roadwork traffic control plan (temporary traffic control devices present)
- See Tables 4.1 and 4.2 (p. 4-22)

POINTS TO ADD:

- All of these factors influence what type of information can be posted on a message that indicates diversion or detour information to drivers.
- Specific diversion route information is typically not provided for fear of overloading the recommended route (although many drivers will choose a route different than the recommended route exactly because of that concern).
PART 7
Dynamic Features on DMSs

POINTS TO ADD:
• None
Dynamic Features on DMSs

AVOID flashing an entire one-phase message

MAJOR ACCIDENT AT ROWLAND LEFT 2 LANES CLOSED

POINTS TO ADD:
• Does not necessarily imply more important info to drivers
• Increases reading time required by drivers (may have to reduce amount of information to be provided)
• May also reduce level of comprehension by drivers
• No evidence to suggest that drivers are more likely to “see” the message if it is flashing (drivers do see messages even when not flashing; they may choose to ignore the info regardless of whether the message is flashed or not).
Dynamic Features on DMSs

AVOID flashing one line of a one-phase message

MAJOR ACCIDENT AT ROWLAND LEFT 2 LANES CLOSED

POINTS TO ADD:
• This technique also increases reading time, reduce comprehension rate by drivers
• Flashing info may be remembered; however, this comes at a price of lower retention rates of the other info
Dynamic Features on DMSs

AVOID alternating text

MAJOR ACCIDENT
AT ROWLAND
LEFT 2 LANES CLOSED

POINTS TO ADD:

• This technique also increases reading time over the standard practice of dividing the info into two separate phases
Dynamic Features on DMSs

POINTS TO ADD:
• This technique also increases reading time over the standard practice of dividing the info into two separate phases
OBJECTIVE OF MODULE:
Illustrate how the tables in Modules 5 and 6 are used to select statements and phrases corresponding to each base message element

DURATION:
30 Min
Base Message Elements

Incident/Roadwork Descriptor
Incident/Roadwork Location
Lanes Closed
Effect on Travel
Audience for Action
Action
Good Reason for Following Action

POINTS TO ADD:
• These were described in Module 4. In these modules, tables have been prepared to aid selection of appropriate phrase formats for each element
POINTS TO ADD:

• Much of the information in Modules 5 and 6 is redundant, intended to be used as reference modules to look up appropriate/acceptable phrasing of base message elements

• Will review what exists in the portion of the modules that target lane closure situations, DMS close to the problem
POINTS TO ADD:

• The process in both modules is identical. Tables have been prepared for each of the base message elements previously discussed. The user goes to the appropriate table for each element and selects a phrase.

• The tables show how the phrase would be displayed on a permanent DMS and also on a PCMS.
POINTS TO ADD:

• For roadwork situations, location of the problem often extends over a significant length of roadway (i.e., lanes are closed for several miles). Table 6.2 shows how the “FROM/TO” combination of terms are used to define the problem location.
POINTS TO ADD:

• When displaying that multiple lanes are closed, consensus of panel was to use LEFT or RIGHT x LANES CLOSED
POINTS TO ADD:

• Generally, EXPECT DELAY does not provide much useful info to drivers (seen too much, does not imply anything to drivers)

• MAJOR delay, implies 45 minutes of delay or more (to 50 percent or more of drivers)

• MINOR delay implies 20 minutes of less to most drivers

ASK:

• If delays are between 20 and 45 minutes, what should be used? (if MAJOR is used, drivers are expecting worse conditions than they will actually encounter, probably a better choice than just EXPECT DELAY)
Action

Motorists are not advised to take an alternative route: No diversion

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

<table>
<thead>
<tr>
<th>Large Sign</th>
<th>Portable Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE PREPARED TO STOP</td>
<td>USE CAUTION</td>
</tr>
<tr>
<td>USE CAUTION</td>
<td>USE CAUTION</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Large Sign</th>
<th>Portable Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE PREPARED TO STOP</td>
<td>USE CAUTION</td>
</tr>
<tr>
<td>USE CAUTION</td>
<td>USE CAUTION</td>
</tr>
</tbody>
</table>

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

POINTS TO ADD:

• Action elements depend on whether or not diversion recommendations are to be made (diversion can be hard (forced) or soft (encouraged, but not required)

• If no diversion is going to be suggested, these terms are suggested for consideration

ASK:

• Have you used action statements different than these when there is no recommendation to divert?
POINTS TO ADD:

- Many operators like to use the term ALTERNATIVE, but it is obviously longer than the word OTHER

ASK:

- Have any of you used different terms to encourage drivers to use a different route?
Points to Add:

- From Tables 4.1 and 4.2, a type 2 diversion route has:
  - Surveillance (electronic, regular manual checks of conditions, etc.)
  - Signing that exists to direct motorists how to get back to the freeway or to the destination (if it is a diversion route for a special event, for instance)
POINTS TO ADD:

• Although an audience for action statement is often not used because it is implied (i.e., for ALL TRAFFIC), it is worthwhile to always think about exactly who the message is targeted for.
POINTS TO ADD:

• BEST ROUTE TO is most commonly used in conjunction with special events

• Also good practice to at least think about why a driver should follow the action recommended. If it is not obvious from the other information, this message element can be very helpful in improving driver response

ASK:

• Has anyone ever used a different good reason to follow the action in their message?
DMS Far From Incident/Roadwork

Tables differ slightly for LANES CLOSED

<table>
<thead>
<tr>
<th>Table 5.3 TERMS FOR LANES CLOSED</th>
<th>Table 5.12 TERMS FOR LANES CLOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LARGE SIGNS</strong></td>
<td><strong>PORTABLE SIGNS</strong></td>
</tr>
<tr>
<td>ALL LANES CLOSED</td>
<td>ALL LANES CLOSED</td>
</tr>
<tr>
<td>CENTER LANE CLOSED</td>
<td>CENTER LANE CLOSED</td>
</tr>
<tr>
<td>CENTER REAR LANE CLOSED</td>
<td>CENTER REAR LANE CLOSED</td>
</tr>
<tr>
<td>LEFT LANE CLOSED</td>
<td>LEFT LANE CLOSED</td>
</tr>
<tr>
<td>RIGHT LANE CLOSED</td>
<td>RIGHT LANE CLOSED</td>
</tr>
<tr>
<td>EXIT TO FREEWAY/CLOSED</td>
<td>EXIT TO FREEWAY/CLOSED</td>
</tr>
</tbody>
</table>

* Indicates that the next section of the message will be displayed on the next lane(s) of DMS.

**POINTS TO ADD:**

- The rest of modules 5 and 6 are formatted in the same way (tables for each element)
- There exists a section for DMS far upstream from the incident or roadwork, and one for DMS on different roadways that intersect with the roadway with the incident or roadwork
- Most of the tables are the same for each DMS location section. A few tables do differ slightly, though

**ASK:**

- What is the primary different between the LANES CLOSED terms shown in Table 5.3 and those in Table 5.12? (which lanes closed are not shown in 5.12)
- Why not show which lanes are closed far upstream? (no need, can create operational problems at upstream interchanges because drivers have positioned themselves into open lanes too far upstream)
POINTS TO ADD:

• Formatting of info about incident location differs slightly for DMS on a different roadway as compared to one on the same roadway

DMS Manual. pg 5-3 & 5-22
POINTS TO ADD:

• If a DMS is located on a different freeway than where the problem is located, there may be a need to encourage drivers not to exit and use that cross roadway. **STAY ON xx** is therefore needed sometimes.
POINTS TO ADD:

- Modules 5 and 6 also have sections for total roadway closures. Within each section, subsections also exist for DMS close, DMS far upstream, and DMS on different roadways.
Action: with diversion

Table 4.32 Acceptable Terms for Action

<table>
<thead>
<tr>
<th>Large Signs</th>
<th>Portable Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXIT AND (TO EXIT/DIYOUR)</td>
<td>EXIT AND (TO EXIT/DIYOUR)</td>
</tr>
<tr>
<td>EXIT AND FOLLOW SIGNS</td>
<td>EXIT AND FOLLOW SIGNS</td>
</tr>
<tr>
<td>FOLLOW DIYOUR</td>
<td>FOLLOW DIYOUR</td>
</tr>
<tr>
<td>FOR DIYOUR</td>
<td>FOR DIYOUR</td>
</tr>
</tbody>
</table>

* Indicates that the next portion of the message will be displayed on the next frame(s) of DMS.

POINTS TO ADD:

• Full roadway closures often require more extensive routing information to be provided to motorists. This will require use of EXIT, TAKE, etc. directions to be used

• A Type 5 diversion route is one with (see Table 4.1):
  
  • Police or traffic controllers at key locations directing traffic
  
  • Formal incident emergency route signing
POINTS TO ADD:

• Full roadway closures often require more extensive routing information to be provided to motorists. This will require use of EXIT, TAKE, etc. directions to be used.

• A Type 5 diversion route is one with (see Table 4.1):
  • Police or traffic controllers at key locations directing traffic
  • Formal incident emergency route signing
Establishing the Maximum Message Length

Module 7

OBJECTIVE OF MODULE:
Describe the procedures required to determine the maximum length of a message a sign, given that sign's characteristics, roadway geometrics, and environmental conditions

DURATION:
45 Min
PART 1
Message Length and DMS Viewing
Distance Requirements

POINTS TO ADD:
• None
Required Viewing Distances to DMS

• For a given number of info units: Higher speeds require higher, legibility distances

ASK:
• If a sign (under prevailing conditions) cannot provide the legibility distance required for a message of a given number of information units, what can the operator do? (cut back on the number of units)

POINTS TO ADD:
• This assumes that 2 seconds viewing time is needed per unit of information presented
POINTS TO ADD:

• If a sign is positioned off to the side of the road, we assume the sign is not useful to drivers once it is beyond 10 degrees beyond the driver’s line of sight.

• This graph indicates how far upstream of the sign this 10 degree angle is reached, for a given offset distance.

• For LED signs, their optics are such that they cannot even be viewed much beyond a 15 degree angle anyway.

• This distance must therefore be subtracted from a sign’s legibility distance because this distance is not usable viewing time.
POINTS TO ADD:

- Legibility at night is usually lower than during the day, even though it seems as though you can see the sign from farther away at night (target distance versus legibility distance)
Factors Reducing Legibility  
Distance to a DMS

Sun Position

POINTS TO ADD:
• Sun positions immediately on the sign face, and directly into the driver’s eyes both used to seriously reduce DMS legibility
• With better LEDs now, only sun in the face of the driver is a now a problem
POINTS TO ADD:

- Roadway geometrics are usually not a problem for permanent DMS, because they are mounted higher.
- PCMS can be adversely affected by these conditions (and require reductions to information being presented), but only rarely.
POINTS TO ADD:

• As with roadway geometrics, this is generally not a problem for permanent DMS (designers typically check for possible obstructions prior to designing and installing the sign)

• Spot obstructions can be a problem for PCMS (equipment or materials parked upstream on the shoulder, barriers and traffic control devices, etc.)
Factors Reducing Legibility
Distance to a DMS

Rain or fog

POINTS TO ADD:
• None
POINTS TO ADD:

• Assessing how trucks will affect sign legibility is a complex process, since drivers tend to move around large vehicles depending on traffic volumes, topography, etc. It is possible to examine how much roadway space is available in between and around large trucks that will provide a given amount of viewing time to a sign.
Therefore,

Maximum allowable number of units of information may have to be REDUCED

POINTS TO ADD:

• Important to note that a given sign may not be able to display the same amount of information at all times under all conditions
PART 2
Maximum Legibility Distances for
Day & Night Operations

POINTS TO ADD:
• None
Day & Night

Suggested legibility distances

<table>
<thead>
<tr>
<th>Condition</th>
<th>Light-Emitting Diode*</th>
<th>Fiberoptic</th>
<th>Incandescent Bulb</th>
<th>Reflective Disk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-Day</td>
<td>800</td>
<td>700</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>Washout</td>
<td>800</td>
<td>700</td>
<td>700</td>
<td>400</td>
</tr>
<tr>
<td>Backlight</td>
<td>600</td>
<td>400</td>
<td>400</td>
<td>200</td>
</tr>
<tr>
<td>Nighttime</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>350</td>
</tr>
</tbody>
</table>

* Valid only for the newer aluminum indium gallium phosphide (or equivalent) LDPs

POINTS TO ADD:

• These are for 18 inch character heights, normal fonts
• Distances are probably less for compressed fonts (depending on how the characters are designed)
Day & Night

Maximum number of units of info

<table>
<thead>
<tr>
<th>Condition</th>
<th>Light-Emitting Diode</th>
<th>Fiberoptic</th>
<th>Incandescent Bulb</th>
<th>Reflective Disk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-35 mph</td>
<td>36-55 mph</td>
<td>56-70 mph</td>
<td>0-35 mph</td>
</tr>
<tr>
<td>Mid-Day</td>
<td>5 units</td>
<td>4 units</td>
<td>3 units</td>
<td>5 units</td>
</tr>
<tr>
<td>Washout</td>
<td>5 units</td>
<td>4 units</td>
<td>3 units</td>
<td>5 units</td>
</tr>
<tr>
<td>Backlight</td>
<td>4 units</td>
<td>4 units</td>
<td>3 units</td>
<td>4 units</td>
</tr>
<tr>
<td>Nighttime</td>
<td>4 units</td>
<td>4 units</td>
<td>3 units</td>
<td>4 units</td>
</tr>
</tbody>
</table>

Valid only for the newer aluminum chloride-gallium phosphosphate (or equivalent) LEDs

POINTS TO ADD:
• The distances on the previous page can be divided by the speed of traffic and converted to maximum units of info that can be viewed over those distances (assuming 2 sec per unit)
Reduce Units for Vertical Curves

Only necessary in very extreme cases

<table>
<thead>
<tr>
<th>Condition</th>
<th>20-foot Offset 30 mph</th>
<th>20-foot Offset 35 mph</th>
<th>20-foot Offset 40 mph</th>
<th>60-foot Offset 30 mph</th>
<th>60-foot Offset 35 mph</th>
<th>60-foot Offset 40 mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-Day</td>
<td>3 units</td>
<td>2 units</td>
<td>1 unit</td>
<td>5 units</td>
<td>5 units</td>
<td>3 units</td>
</tr>
<tr>
<td>Washout</td>
<td>3 units</td>
<td>2 units</td>
<td>1 unit</td>
<td>5 units</td>
<td>5 units</td>
<td>3 units</td>
</tr>
<tr>
<td>Backlight</td>
<td>2 units</td>
<td>1 unit</td>
<td>1 unit</td>
<td>4 units</td>
<td>4 units</td>
<td>2 units</td>
</tr>
<tr>
<td>Nighttime</td>
<td>2 units</td>
<td>1 unit</td>
<td>1 unit</td>
<td>4 units</td>
<td>4 units</td>
<td>2 units</td>
</tr>
</tbody>
</table>

*Valid only for the newer aluminum indium gallium phosphate (or equivalent) LEDs.

POINTS TO ADD:

• Permanent DMS not a problem, only a PCMS issue usually
• The units shown are then subtracted from the maximum shown in Table 7.2
• Speeds shown are the design speed of the roadway (not operating speed)
• Note that these only apply if the PCMS is located on an actual hill that is obscuring sight distance to the sign.
Reduce Units for Horizontal Curves
(Necessary only in extreme cases)

POINTS TO ADD:
• Horizontal curvature doesn’t really cause problems for overhead signs, only PCMS
• Need to know actual curve radii to accurately estimate how much a message would need to be reduced
• Good practical advice – don’t put the PCMS within or just downstream of a sharp curve
Reduce Units for Horizontal Curves
(Necessary only in extreme cases)

POINTS TO ADD:
• Horizontal curvature doesn’t really cause problems for overhead signs, only PCMS
• Need to know actual curve radii to accurately estimate how much a message would need to be reduced
• Good practical advice – don’t put the PCMS within or just downstream of a sharp curve
Reduce Units for Rain

Generally rain is insignificant
• As a rule, use maximum values in Table 7.2

Exception: rainfall over 2 inches per hour
• Reduce units of info in Table 7.2 by 1

POINTS TO ADD:
• Although rain and fog may reduce legibility distance a little, people also tend to drive slower in rain and fog

ASK:
• What are the key challenges in adjusting messages due to weather conditions? (difficult to measure how hard raining, how bad fog is, know how long it will be that severe conditions vary dramatically from one sign to the next, and change over time very quickly)
Reduce Units for Fog

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

<table>
<thead>
<tr>
<th>Visibility Range in Fog</th>
<th>0-35 mph</th>
<th>36-55 mph</th>
<th>56-70 mph</th>
<th>0-35 mph</th>
<th>36-55 mph</th>
<th>56-70 mph</th>
<th>0-35 mph</th>
<th>36-55 mph</th>
<th>56-70 mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 mi</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.25 mi</td>
<td>0</td>
<td>0</td>
<td>1 unit</td>
<td>0</td>
<td>1 unit</td>
<td>1 unit</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.1 mi</td>
<td>2 units</td>
<td>2 units</td>
<td>2 units</td>
<td>3 units</td>
<td>3 units</td>
<td>3 units</td>
<td>2 units</td>
<td>2 units</td>
<td>2 units</td>
</tr>
</tbody>
</table>

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.

POINTS TO ADD:

• Once again, only PCMS are susceptible to this

• Generally, fog must be pretty thick to require adjustment (visibility reduced to ¼ mile or less)
Reduce Units for Large Trucks

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)

<table>
<thead>
<tr>
<th>Percent Trucks</th>
<th>0.35 mph</th>
<th>3.5 mph</th>
<th>6.6 mph</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000 vph</td>
<td>4000 vph</td>
<td>6000 vph</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
<td>65</td>
<td>45</td>
</tr>
<tr>
<td>20</td>
<td>65</td>
<td>35</td>
<td>20*</td>
</tr>
<tr>
<td>30</td>
<td>60</td>
<td>30*</td>
<td>20*</td>
</tr>
<tr>
<td>50</td>
<td>50*</td>
<td>30*</td>
<td>20*</td>
</tr>
</tbody>
</table>

Note. Assumes a 70%/20%/10%/9% split of total traffic in shoulders, right cutout, 60 cutout, and median travel lanes, respectively.

* Under these conditions, only trucks are assumed to be able to see the DMS.

DMS Manual, pg 7-22

POINTS TO ADD:

• Table 7.17 describes the percentage of drivers who could find a space in the traffic stream to read a message of 4 units of information on an 8-lane facility.

• No guarantees that drivers would react cooperatively to fill in all gaps, so values are probably high.

• If conditions are where the percentage is down below 80 percent or so, may want to think about reducing the length of the message.
OBJECTIVE OF MODULE:

• Tie the various modules together (particularly modules 5&6, 7, and 8) by listing all of the steps that would be required to create a new message

DURATION:

• 20 Min
Procedure for Incidents

PART 1: Lane closure (blockage) incidents
PART 2: Incidents that require closing the freeway
PART 3: Incidents on intersecting freeway that require closing the connector ramp

POINTS TO ADD:

• Separate sequences of steps (mostly the same) exist for all three of the listed conditions. The user would go to their particular part of interest
Procedure for Incidents

In each PART:
• DMS on same freeway and relatively close to the incident
• DMS on same freeway but relatively far from incident
• DMS on different freeway than incident

POINTS TO ADD:
• Within each part, the steps (again very repetitive) are provided for each type of DMS of interest
• Concept of manual is that the operator or manager could go to this module, find the correct part, then find the correct DMS, and then follow the steps to create a message
Procedure for Incidents

Lane Closure (Blockage)
1. Establish initial maximum allowable number of units of information based on DMS type and operating speeds

POINTS TO ADD:
• None
Procedure for Incidents

Lane Closure (Blockage)
1. Establish initial maximum allowable number of units of information based on DMS type and operating speeds
2. Assess whether the message must be reduced because of local geometric sight distance restrictions to the DMS

POINTS TO ADD:
• None
Procedure for Incidents

Lane Closure (Blockage)

3. Assess whether the message must be reduced because of local environmental sight distance restrictions to the DMS such as of rain or fog

POINTS TO ADD:

• None
**Procedure for Incidents**

*Lane Closure (Blockage)*

3. Assess whether the message must be reduced because of local environmental sight distance restrictions to the DMS because of rain or fog

4. Finalize the maximum allowable units of information in the message

Points to Add:

• None
Procedure for Incidents

Lane Closure (Blockage)

5. Define the Base DMS Message to satisfy motorist information needs

POINTS TO ADD:

• “Need” in this context is more closely related to “wants.” A driver would be more likely and more accurately to make a correct driving response if they have all of the info in the base message. However, they will not necessarily have problems or make mistakes if they do not have the information.
Procedure for Incidents

_Lane Closure (Blockage)_

5. Define the _Base DMS Message_ to satisfy motorist information needs

6. Reduce the number of message units if necessary

POINTS TO ADD:

- None
Procedure for Incidents

Lane Closure (Blockage)
5. Define the Base DMS Message to satisfy motorist information needs
6. Reduce the number of message units if necessary
7. Format the message

POINTS TO ADD:
• None
Procedure for Incidents

Lane Closure (Blockage)

8. Adjust message to fit on existing DMS

POINTS TO ADD:

• None
Procedure for Incidents

Lane Closure (Blockage)
8. Adjust message to fit on existing DMS
9. Adjust message to fit on 3 lines or less

POINTS TO ADD:
• None
Procedure for Incidents

Lane Closure (Blockage)
8. Adjust message to fit on existing DMS
9. Adjust message to fit on 3 lines or less
10. Finalize DMS message

POINTS TO ADD:
• None
Procedure for Incidents

Detailed step-by-step procedure
Refers user to tables in

• Module 7: Establishing Maximum Message Length

POINTS TO ADD:

• None
Procedure for Incidents

Detailed step-by-step procedure
Refers user to tables in

• Module 7: Establishing Maximum Message Length
• Module 5: Designing the Base DMS Message for Incidents

For roadwork messages, tables in Module 6 would be used instead…

DM3 Manual, pg 7-1, 5-1, & 0-1

POINTS TO ADD:
• None
Modifying Messages to Improve Effectiveness

Module 12

OBJECTIVE OF MODULE:
• Introduce participants to the tables in the module that can be used as good examples

DURATION:
• 10 Min
**POINTS TO ADD:**

- These examples come from all across the U.S.
- They illustrate how a message can be improved, and provide bullet lists of rationale behind why the recommended message design is preferable to the original (old) message.

<table>
<thead>
<tr>
<th>Original Message</th>
<th>Recommended Message</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCIDENT AHEAD, USE CAUTION</td>
<td>ACCIDENT AT [location]</td>
<td>• It is best to give the location of the incident. Knowledge of the incident location is useful to motorists to make decisions and allow adequate reaction time. •ACCENT is redundant and should not be displayed because it is understood by motorists that the accident is ahead of the freeway.</td>
</tr>
<tr>
<td>ACCIDENT AHEAD, AT 25TH STREET, LEFT LANE CLOSED</td>
<td>ACCIDENT AT 25TH STREET, LEFT LANE CLOSED</td>
<td>• It should be displayed before the location of the incident. •Knowledge of the number of lanes closed is useful to maintain to ensure the proper amount of delay. •Knowledge of which lanes are closed is useful to motorists to determine which lanes they should use to travel past the incident. •Redundant in practice and could cause confusion because it is understood by motorists that the accident is ahead of the freeway.</td>
</tr>
<tr>
<td>ACCIDENT AHEAD, EXPECT DELAYS</td>
<td>ACCIDENT AT [location], LEFT LANE CLOSED</td>
<td>• It is best to give the location of the incident. •Knowledge of the incident location is useful to motorists to make decisions and allow adequate reaction time. •Redundant in practice and could cause confusion because it is understood by motorists that the accident is ahead of the freeway.</td>
</tr>
</tbody>
</table>

*Assumes 5 or 4 line, 25 character per line DMS.*

DMS Manual, pg 12-2
# Improving Message Effectiveness

## Old Message vs. Recommended Message

<table>
<thead>
<tr>
<th>Old Message</th>
<th>Recommended Message</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCIDENT AHEAD RIGHT LANE CLOSED AHEAD</td>
<td>ACCIDENT AHEAD RIGHT LANE CLOSED AHEAD</td>
<td>-</td>
</tr>
<tr>
<td>ACCIDENT AHEAD BROOK BRIDGE CLOSED AHEAD</td>
<td>ACCIDENT AHEAD BROOK BRIDGE CLOSED AHEAD</td>
<td>-</td>
</tr>
<tr>
<td>ACCIDENT AHEAD SHORE ROAD CLOSED AHEAD</td>
<td>ACCIDENT AHEAD SHORE ROAD CLOSED AHEAD</td>
<td>-</td>
</tr>
</tbody>
</table>

- It is best to give the same message twice rather than the information that the accident is ahead. Knowledge of the accident location is needed to convince an automobile driver to avoid an accident, rather than simply telling a driver to avoid the accident.
- Knowledge of the number of lanes closed is useful in situations to evaluate the potential amount of delay.
- AREAS are isolated and used not to be deployed because it is not really known how those accidents are ahead.

**DMS Manual pg 12-3**

### Points to Add:

- Often, a two phase message can be reduced down to a single phase and be more effective for motorists
### Improving Message Effectiveness

<table>
<thead>
<tr>
<th>G/IC Message</th>
<th>Recommended Message</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALL LANES CLOSED AHEAD</strong></td>
<td><strong>EXIT AT [location] FOR LAFAYETTE</strong></td>
<td><strong>FREIGHT CLOSER AHEAD</strong> and <strong>EXIT AT [location] FOR LAFAYETTE</strong> because it is clearer and less confusing.</td>
</tr>
<tr>
<td>A/A HUNI ROAD EAST AT ROWLAND</td>
<td>USE ALTERNATE ROUTES</td>
<td><strong>A/A HUNI ROAD EAST AT ROWLAND</strong> and <strong>USE OTHER ROUTES</strong>.</td>
</tr>
<tr>
<td>R-341 EAST ACROSS AT ROWLAND</td>
<td>USE ALTERNATE ROUTES</td>
<td><strong>ACROSS</strong> and <strong>USE OTHER ROUTES</strong>.</td>
</tr>
<tr>
<td><strong>ACCIDENT DOWNTOWN</strong></td>
<td><strong>TWO RIGHT LANES CLOSED</strong></td>
<td><strong>ACCIDENT</strong> and <strong>TWO RIGHT LANES CLOSED</strong>.</td>
</tr>
</tbody>
</table>

**POINTS TO ADD:**

- In other examples, multiple versions of two phase messages are shown how they can be improved.
- In some instances, multiple approaches to improving the messages would work equally well. In those instances, the multiple improved message versions are all shown.
## Improving Message Effectiveness

<table>
<thead>
<tr>
<th>Old Message</th>
<th>Recommended Message</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGHWAY CLOSED</td>
<td>MAJOR ACCIDENT</td>
<td></td>
</tr>
<tr>
<td>USE ALTERNATIVE ROUTE</td>
<td>HIGHWAY CLOSED</td>
<td></td>
</tr>
<tr>
<td>USE OTHER ROUTES</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIGHWAY CLOSED</td>
<td>MAJOR ACCIDENT</td>
<td></td>
</tr>
<tr>
<td>USE ALTERNATIVE ROUTE</td>
<td>HIGHWAY CLOSED</td>
<td></td>
</tr>
<tr>
<td>USE OTHER ROUTES</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIGHWAY CLOSED</td>
<td>LIFT LINES</td>
<td></td>
</tr>
<tr>
<td>USE ALTERNATIVE ROUTE</td>
<td>LIFT LINES</td>
<td></td>
</tr>
<tr>
<td>USE OTHER ROUTES</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### POINTS TO ADD:

- Examples are provided for both incident messages and roadwork messages.
## Improving Message Effectiveness

<table>
<thead>
<tr>
<th>Old Message</th>
<th>Recommended Message</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1-4 W/D AT ROWLAND</strong></td>
<td><strong>FREEWAY CLOSED AT ROWLAND</strong></td>
<td>The current message has 8 units of information and can be understood by a majority of drivers.</td>
</tr>
<tr>
<td><strong>AVOID DELAY</strong></td>
<td><strong>USE OTHER ROUTES</strong></td>
<td>No further improvements can be made.</td>
</tr>
<tr>
<td><strong>C/C ALTERNATE ROUTE</strong></td>
<td><strong>C/C ALTERNATE ROUTE</strong></td>
<td>No further improvements can be made.</td>
</tr>
</tbody>
</table>

| **FREEWAY CLOSED AT ROWLAND MAJOR ACCIDENT** | **ALL TRAFFIC EXIT ROWLAND** | The current message has 8 units of information and can be understood by a majority of drivers. |
| | **FREEWAY CLOSED EXIT AT ROWLAND USE SERVICE ROAD** | No further improvements can be made. |

| **MAJOR ACCIDENT AT 1-4 W/D VAN MAIN LANE** | **AVOID DELAY** | Information that the accident is on SCUTCH LANE will be understood by a majority of drivers and should not be duplicated. |
| | **C/C ALTERNATE ROUTE** | No further improvements can be made. |

| **MAJOR ACCIDENT AT ROWLAND CLOSED EXIT DELAYS** | **MAJOR ACCIDENT AT ROWLAND CLOSED EXIT DELAYS** | No further improvements can be made. |

### POINTS TO ADD:  
- None
OBJECTIVE OF MODULE:
If most participants have not designed a message before, this optional module can be shown to illustrate the step-by-step procedure to create a message.

DURATION:
45 Min
POINTS TO ADD:

• Note that DMS #2 is located several exits upstream of the interchange
• The accident is located within the interchange
All Lanes Closed

Define Situation
  • Analyze Incident and Incident Scene Characteristics

POINTS TO ADD:
  • None
All Lanes Closed

Design Message for DMS on Same Freeway Relatively Close to Incident

• DMS #1

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Identify DMS Characteristics

POINTS TO ADD:
• None
DMS #1: All Lanes Closed

Identify DMS Characteristics

Review Conditions at DMS Location

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Identify DMS Characteristics
Review Conditions at DMS Location
Identify Diversion Route Characteristics

POINTS TO ADD:
• None
DMS #1: All Lanes Closed

DMS Manual: pg 14-2 & 14-4

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Identify DMS Characteristics
Review Conditions at DMS Location
Identify Diversion Route Characteristics
Set Objectives

POINTS TO ADD:
• None
DMS #1: All Lanes Closed

Establish Initial Maximum Allowable Number of Units of Info in the Message Based on DMS Type and Freeway Operating Speeds

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

**Step 1**

Determine Freeway Operating Speed at the DMS Location.

Freeway speed is *30 mph*

**POINTS TO ADD:**

• None
DMS #1: All Lanes Closed

Step 2

Determine the Initial Maximum Allowable Number of Units of Information in the Message from Table 7.2, page 7-4.

Based on sun position, max allowable of 5 units

POINTS TO ADD:

• None
Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to DMS

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

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 on page 7-6

No reductions in max of 5 units
Go to Step 5

DMS Manual: pg 14-6

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

**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* on page 7-10

No reductions in max of 5 *units*

Go to Step 7

DMS Manual: pg 14-6

---

POINTS TO ADD:

• None
Assess Whether the Message Must Be Reduced Because of Environmental Sight Distance Restrictions to DMS (Rain/Fog)

POINTS TO ADD:
• None
DMS #1: All Lanes Closed

Step 7

Determine Whether Rainfall near the DMS Exceeds 2 Inches per Hour

No. No reductions in max of 5 units
Go to Step 9

Points to Add:
• None
Step 9

Determine Whether Fog Exists near the DMS
No. No reductions in max of 5 units
Go to Step 11

POINTS TO ADD:
• None
Finalize the Maximum Allowable Units of Information in the Message

POINTS TO ADD:
• None
DMS #1: All Lanes Closed

Step 11

Based on Steps 1 through 10, Finalize the Maximum Allowable Number of Units of Information in the Message

No reductions in max of 5 units

POINTS TO ADD:
• None
Define *Base DMS Message* to Satisfy Motorist Information Needs

**POINTS TO ADD:**

• None
Step 12

Select Incident Descriptor Message Element from Table 5.28, page 5-31

*Incident Descriptor:* MAJOR ACCIDENT

**POINTS TO ADD:**

- None
Step 13

Select Incident Location Message Element from Table 5.29, page 5-32

Location: PAST I-22

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Step 14

Select *Lanes Closed* Message Element from Table 5.30, page 5-33

*Lanes Closed:* ALL LANES CLOSED

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Step 15

Select Closure Location Message Element from Table 5.31, page 5-34

Closure Location: AT I-22

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Step 16

Determine Whether Diversion Traffic Control is in Place

“Yes.” Go to Step 20

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

**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

**POINTS TO ADD:**
- None
POINTS TO ADD:

• None
DMS #1: All Lanes Closed

**Step 23**

Examine Whether the Diversion Route May Be Perceived by Motorists as Being a Most Logical Route

“Yes.” Go to Step 25

---

**POINTS TO ADD:**

• None
DMS #1: All Lanes Closed

Summary

Incident Descriptor: MAJOR ACCIDENT
Location: PAST I-22
Lanes Closed: ALL LANES CLOSED
Closure Location: AT I-22
Action: EXIT AT I-22
FOLLOW DETOUR

6 Units of Information

DMS Manual: pg 14-7

POINTS TO ADD:

• None
Reduce the Number of Message Units If Necessary

POINTS TO ADD:
• None
DMS #1: All Lanes Closed

Step 25

Examine Whether the Number of Units of Information Units in the Base DMS Message Is Greater than the Maximum Allowable from Step 11

“Yes.”
Base DMS Message = 6 units
Maximum Allowable = 5 units
Continue to Step 26

POINTS TO ADD:
• None
DMS #1: All Lanes Closed

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

FREEWAY CLOSED
EXIT AT I-22
FOLLOW DETOUR

3 Units of Information

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Step 27

Examine Whether the Number of Units of Information Units in the Base DMS Message Is Greater than the Maximum Allowable from Step 11

“No.”
Revised DMS Message = 3 units
Maximum Allowable = 5 units
Go to Step 32

DMS Manual: pg 14-6

POINTS TO ADD:
• None
DMS #1: All Lanes Closed

Step 32

Format the Message According to Guidelines in the Sections on FORMATTING MESSAGES on page 8-6 and REDUCING MESSAGE UNITS OF INFORMATION FROM THE BASE MESSAGE on Page 8-14

Tables 8-5 and 8-12 apply

Freeway Closure: FREEWAY CLOSED
Location of Closure & Action: EXIT AT I-22
FOLLOW DETOUR

DMS Manual: pg 14-8

POINTS TO ADD:

• None
Step 37

Examine Whether There are 3 or Fewer Decision-Relevant Units of Information Displayed on Each of the Phases

“Yes.” Go to Step 39

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

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." Go to Step 41

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Step 41

Examine Whether the Message or Any of the Message Lines Are Too Long to Fit in the Available Message Space

“No.” Go to Step 45

POINTS TO ADD:

• None
POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Step 46

Make Additional Adjustments if Necessary
No adjustments necessary

FREEWAY CLOSED
EXIT AT I-22
FOLLOW DETOUR

3 Units of Information

POINTS TO ADD:
• None
DMS #1: All Lanes Closed

Summary

Base DMS Message vs. Final Message

MAJOR ACCIDENT  FREEWAY CLOSED
PAST I-22
ALL LANES CLOSED
AT I-22
EXIT AT I-22  EXIT AT I-22
FOLLOW DETOUR  FOLLOW DETOUR

POINTS TO ADD:

• None
DMS #1: All Lanes Closed

Assess Effects of Large Trucks on the Ability of Motorists to View the Message (Tables 7.14 – 7.17, pages 7-21 & 7-22)

POINTS TO ADD:

• None
OBJECTIVE OF MODULE:
• Summarize general operations during amber and silver alerts, highlight research findings that have influenced current message protocols being used

DURATION:
• 10 Min
Programs & Policies

Texas AMBER alert network and policies
• Activated by Governor Rick Perry
• TX Dept of Public Safety is in charge
• Any law enforcement agency can activate
• When activated, TxDOT displays on DMSs
• TxDOT coordinator for design and display of messages Brian Fariello, San Antonio

POINTS TO ADD:
• None
Priority of Information

1. Situation descriptor
2. Vehicle descriptor
3. License plate number
4. Telephone number (to dial)
5. Tune to radio (local radio or HAR)

POINTS TO ADD:
- Driver surveys indicate this is the priority of information desired
Priority of AMBER Alert Information

1. Situation Descriptor

KIDNAPPED CHILD
AMBER ALERT - OK
(SILVER ALERT – Understood?)
ABducted CHILD – not as good
MISSING CHILD – No

POINTS TO ADD:
• Some drivers confused amber alert with homeland security threat levels (change to Kidnapped Child)
• Missing child implied that foul play was not expected. Thus, is an appropriate term for a silver alert when an elderly person cannot be located
2. Vehicle Description

Color
Make
Vehicle type (pickup, van, etc.)

Many drivers are not able to identify differences among models

Should never be displayed unless the license plate number is also displayed

POINTS TO ADD:

• Although drivers say they can, very few can distinguish between vehicle make
• General vehicle types work best (auto, van, pickup, etc.)
POINTS TO ADD:

- Amber alert messages far exceed the recommended maximum # of units for a message
- These are PSA type messages, not those that require immediate driver decisions and actions
- It should be remembered that drivers will not likely be able to recall much of the info even a few seconds after passing the sign
Priority of AMBER Alert Information

4. Telephone Number

Typical 10-digit number
• Equals 3 units of information
• If included will exceed max. units
• Majority will not read and recall
• When used should be short or easy to remember
  – DIAL 911 (511), CALL 1 FIND A CHILD
• Will dial 911 if not given

POINTS TO ADD:
• None
Priority of AMBER Alert Information

5. Tune To Radio

Appropriate messages
TUNE TO 530 AM
TUNE RADIO TO 530 AM
Always include AM/FM

POINTS TO ADD:
• For areas with an HAR system, this may be the most effective way to get information out to drivers
Catastrophic Event

Module 16

OBJECTIVE OF MODULE:

• Summarize general operations and recommended messages for major catastrophes

DURATION:

• 15 Min
Programs & Policies

National Incident Management System – Incident Command System
Texas Office of Homeland Security
Governor’s Division of Emergency Management
State Operation Center
Texas Security Analysis and Alert Center

FHWA Policy

POINTS TO ADD:
• TxDOT serves in a support role when emergency conditions occur
DMS Messages

Traffic management component involves
- Closing access to the city (area)
- Evacuation of the city (area)
Closing Access to City/Area

Similar to roadway closures due to incidents/roadwork
DMS relatively close to event

POINTS TO ADD:
• Principles of message design remain the same
Closing Access to City/Area

DMS far from event

(City or Location) CLOSED TO ALL TRAFFIC
Option 1

ALL ROADS TO (City or Location) CLOSED
Option 2

DMS Manual: pg 16-4
Evacuation of City/Area

HOV LANES OPEN TO ALL TRAFFIC

DMS Manual: pg 16-4
Points to Add:

• Information on next few slides is not in manual. Result of TxDOT research project 0-4962
Stage 1: All Season

Phase 1

HURRICANE
SEASON
IS HERE

POINTS TO ADD:
• This is the recommended phase during stage 1
POINTS TO ADD:

• Phase 2 examples of messages that can be used to create a library or rotation of messages throughout the season
Stage 2: Prior to Evacuation

Phase 1
HURRICANE
IN
GULF

POINTS TO ADD:
• Phase 1 for all messages during this stage
POINTS TO ADD:

• Phase 2 examples that can be used to create a library or rotation of messages during this stage
POINTS TO ADD:
• Phase 1 of message during this stage
Stage 3: Evacuation

POINTS TO ADD:
• Phase 1 examples that can be used during this stage
• In the second box on the left, only one of the location options in the bottom line would be used
• Last message on left would be appropriate when shoulder lanes have been activated for evacuation
POINTS TO ADD:

• There are two possible phase 1 message options during this phase. The first one listed is a general warning. The second is an example if there are specific warnings or conditions to advise drivers about.

• Right side are phase 2 message examples. Any of these can be mixed with either phase 1 example.
High Water & Floods

Module 17

OBJECTIVE OF MODULE:

• Summarize recommendations regarding messages to warn about high water and flooding conditions

DURATION:

• 15 Min
Conditions & Driver Needs

High water on freeway but *passable*
- Be alerted about high water
- Know the location of high water
- Be confident that they can pass through
- Be confident that they do not have to exit

POINTS TO ADD:
- On high-speed facilities, standing water can be hazardous for drivers. Drivers want to be notified if standing water exists, and whether it is ok to drive through (if across all lanes)
Conditions & Driver Needs

High water on freeway and *flooded*

- Be alerted about freeway closure
- Know the location of closure
- Be informed as to which exits to take

POINTS TO ADD:

- None
Message Format for Passable

1. Water descriptor message element
2. Water location message element
3. Action message element

POINTS TO ADD:

- The overall message format for water on road messages is the same as for incident and roadwork messages (problem, location, action)
1. Water Descriptor

No clear cut choice
WATER ON ROAD (FREEWAY)
WATER AHEAD

POINTS TO ADD:
• None
2. Water Location

Depends upon whether water is
• Downstream of crossing hwy or street
  
  \[PAST \{\text{hwy}, \text{street name}\}\]

• Between exit & entrance ramp
  
  \[AT \{\text{hwy}, \text{streets name}\}\]
  \[PAST \{\text{exit ramp name}\}\]

POINTS TO ADD:
• Location terms previously discussed also apply in this module
2. Water Location (Cont.)

Depends upon whether water is
• Upstream of exit ramp

BEFORE [exit ramp name]

POINTS TO ADD:
• None
3. Action

BE PREPARED TO STOP
USE CAUTION

POINTS TO ADD:
• None

ASK:
• Do you use any other types of action statements for water on road conditions?
**Message Format for Flood**

1. Freeway closure descriptor message element
2. Closure location message element
3. Action message element

![Diagram of message format]

POINTS TO ADD:

- If roadway is flooded, road closure messages are similar to those for total road closures for incidents or roadwork

DMS Manual: pg 17-4
OBJECTIVE:
• Illustrate common messages used to support ozone action days

DURATION:
• 5 Min
DMS Messages

Day prior to ozone action day

1. **Phase 1**
   - **Option 1**: Ozone Action Day Tomorrow
   - **Phase 2**: Ride the Bus (Free) Share a Ride

2. **Phase 1**
   - **Option 2**: Ozone Action Day Tomorrow
   - **Phase 2**: Reduce Trips Work at Home

DMS Manual: pg 18-1

POINTS TO ADD:
- None
DMS Messages

Day of ozone action day

OZONE ACTION DAY TODAY
Phase 1

REDUCE TRIPS WALK TO LUNCH
Phase 2

POINTS TO ADD:

• None

DMS Manual: pg 18-2
Planned Special Events  
Module 19

OBJECTIVE OF MODULE:
• Summarize recommendations regarding design of special event message

DURATION:
• 15 Min
Impacts & Strategies

Driver groups
• Traveling to the event
• Not traveling to the event

POINTS TO ADD:
• None
**Impacts & Strategies**

Categories of events
- Discrete/recurring at permanent venue
- Continuous
- Street use
- Regional/multi-venue
- Rural

POINTS TO ADD:
- Recurrent events at permanent venues allows operators to “tweak” plans after each occurrence and evolve a plan that is most effective (also develops driver expectancy)
DMS Messages – Driving to Event

Likely scenarios
• Inform of direct route to event
• Divert to alternative route

POINTS TO ADD:
• None
**DMS Messages – Driving to Event**

Best signing strategies
- Audience for Action (top line)
- Exit information or route information
- Parking information
  
  *Important, but should not be displayed on DMS*
- Trailblazers guiding to venue/parking

POINTS TO ADD:
- For special events signing, display of audience as top line of message is recommended
**DMS Messages – Driving to Event**

Informing of exits to take or routes to use

**Example 1**

FAIR PARK
TAKE NEXT 2 EXITS

**Example 2**

FAIR PARK
EXIT AT 2ND AVE

DMS Manual: pg 19-3

**POINTS TO ADD:**

• None
DMS Messages – Driving to Event

Divert to Alternative Route

POINTS TO ADD:
• None
OBJECTIVE:
• Allow participants to utilize concepts presented in workshop to create messages for various hypothetical situations

DURATION:
• 1 hour
Urban Example

A tanker truck overturns on I-35W southbound just past the I-30 interchange. All lanes are closed southbound beginning at the Rosedale Exit (see map on next slide)

• What message should be put on a DMS just upstream of the closure (DMS #1)?
• What message should be put on a DMS prior to I-820 (DMS #2)?
• What message should be put on DMSs on I-30 approaching I-35W (DMS #3)?

*Assume all DMS can display 3 lines at 18 characters per line*

POINTS TO ADD:

• None
POINTS TO ADD:

• Note that the DMS of interest on I-30 are outside of the I-820 loop.
POINTS TO ADD:

• This slide is not provided in the student workbooks.

• Information on this DMS is likely to be most useful to local drivers. However, indicating that the freeway is closed will tell most familiar drivers that they need to find another route to their destination if possible.

• At some point, it is likely that law enforcement will implement a complete detour onto the frontage road around the incident. Since telling familiar drivers that the freeway is closed will encourage diversion, it would be best if those unfamiliar drivers who reach the incident location simply followed that detour rather than try to find their own way around the problem. Notifying them that there is a detour to follow will reduce their anxiety about what they should do.
POINTS TO ADD:

• This slide is not in the student notebooks.
• It is possible to identify the problem, location, and effect on traffic in different ways on a single phase. However, if one allows the driver to recognize that a FREEWAY CLOSED condition will generate large delays, one can avoid using an effect on traffic statement, and provide a preferred action instead, as in the 2nd one-phase example.
• For DMS far upstream and a severe problem such as this, it would be most beneficial if any traffic could be diverted as far away from the incident as possible. Identifying a specific audience and a specific route gives the driver more information and confidence to follow that information. It should be noted that drivers destined beyond Waco (Austin, San Antonio, etc.) will understand that the message applies to them as well. These drivers are also less likely to know exactly where Rosedale is, and so will not likely try to find another route around the problem. Indicating that the problem is beyond a major interchange (I-30) is also helpful to those drivers (familiar and unfamiliar) who had planned to exit at that interchange to know that the interchange is open.
POINTS TO ADD:

• Remember that this slide is not in the student workbooks.
• The goals are similar to those for DMS #2. However, since the problem is not on the drivers roadway, the audience for the message must be identified. In the top examples, this means that a unit of information must be used (compare these messages to the #2 signs).
• For the preferred message, the “USE OTHER ROUTES, AVOID MAJOR DELAYS” message could work well for DMS inside the I-820 loop. However, it would be more beneficial to encourage non-local drivers from entering the downtown area, which is why WACO TRAFFIC are encouraged to use the alternate route.
Rural Example

Road repairs are being made in the left lane of I-10 eastbound (2 lanes per direction) just past the I-10/I-20 split in west Texas (see map on next page). The lane closure begins just past the curve.

• What message should be put on a DMS located upstream of the I-10/I-20 split (3 lines, 15 characters per line)?

POINTS TO ADD:

• None
POINTS TO ADD:

• Note that the advance warning signs for the lane closure will extend upstream into the I-10/I-20 split. Most likely, they will say “LEFT LANE CLOSED”

• Also, the DMS is located prior to the widening of I-10 for the split, so there is only two lanes.
**POINTS TO ADD:**

• Remember that this slide is not included in the student workbooks.

• Using “LEFT LANE CLOSED” upstream on the DMS could cause confusion for drivers, since the left lane would be the one destined for I-20

• Although motorists normally assume the problem (ROADWORK) is on the roadway they are on if a roadway is not specified, it is less clear at major freeway splits.

• Consequently, in this example, it may be necessary to indicate which roadway the roadwork is located (i.e., the audience of the message), its location (past I-20), and that it involved a lane closure (so they expect additional signing about which lane is closed). Remind them it is not necessary to tell them which lane is closed far upstream.