DYNAMIC MESSAGE SIGN
MESSAGE DESIGN & DISPLAY
MANUAL TRAINING
Two-Day Course

Participant Notebook

for
Texas Department of Transportation

March 2009
Dynamic Message Signs (DMSs):
Primary real-time links of TxDOT to the motoring public

DMSs
Represent primary concept of ITS to public
DMSs
Messages should be consistent with respect to:

• Content
• Format
• Application

DMS Message Design Process
DMS operations require good understanding of:

• Traffic operations
• Human factors

Message Design Process

All Useful Information
The DMS Message

DMS Manual: pg 1-1
DMS Manual: pg 1-2
DMS Manual: no page reference
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

There is a Maximum Message Length

Affected by:
- Legibility distance of message
- Motorist perception, information processing capabilities
Available Message Viewing Distance

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

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

DMS Near Incident/Roadwork
Manual Designed for:

- New users of DMSs
- Experienced users of DMSs

At

- Entry level
- Experienced with traffic operations
- Managers
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
• 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
- Relevant 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
- Obvious
- Trivial

CAUTION
CONGESTION AHEAD

How Is Credibility Damaged?

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

DMS Manual: pg 3-2

DMS Operating Fundamentals

Continuous changing information

Determine the purpose of using a DMS

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

DMS Manual: pg 3-1

3-2

3-3
Determine Purpose

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

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

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?

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

Determine Appropriate DMSs

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

Determine What to Display
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

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
Overview of DMS Issues

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

PART 2
Selecting an Audience
Audience for Message

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?

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 ≥ 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

Location Element

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

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DMS Message Design and Display Manual Training
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

Example of "MIN DELAY"

Example of "AVOID MIN DELAY"

Example of "SAVE MIN"

Effect on Travel Element

Travel Time

- Motorists can measure and refute
- Speed sensors : large errors in congested conditions

TRAVEL TIME TO DOWNTOWN
10 MIN AT RUSH

TRAVEL TIME TO DOWNTOWN
9-12 MINS
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
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
Action

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

DMS Manual pg 5-6 & 6-6 556-6

Action

soft diversion

DMS Manual pg 5-7 & 6-7 556-8
**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

DMS on Different Freeway

Tables different for Incident Location

DMS on Different Freeway

Tables different for Action: No Diversion
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

Factors Reducing Legibility Distance to a DMS

Lighting Conditions

Factors Reducing Legibility Distance to a DMS

Sun Position
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 Diodes</th>
<th>Reflectors</th>
<th>Incandescent Lamps</th>
<th>Reflective Film</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>300</td>
<td>700</td>
<td>700</td>
<td>400</td>
</tr>
<tr>
<td>Night</td>
<td>400</td>
<td>400</td>
<td>200</td>
<td>150</td>
</tr>
</tbody>
</table>

Note only for the upper limit unless posted by responsible HOS.

Day & Night
Maximum number of units of info

Reduce Units for Vertical Curves
Only necessary in very extreme cases
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 GREEN from No Offset
Number Givens in Table 7-13 Due to Effects of Fog in Suppression Conditions

<table>
<thead>
<tr>
<th>Visibility</th>
<th>0.25 mile</th>
<th>0.5 mile</th>
<th>0.75 mile</th>
<th>1 mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25 mile</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.5 mile</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.75 mile</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1 mile</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* Valid only for the color which gives the green distance of suppression. *

Reduce Units for Large Trucks

Table 7-17. Percent of Motorists Able to Fully Read a DMS Message with Suppression

<table>
<thead>
<tr>
<th>Percent</th>
<th>25-50 mph</th>
<th>25-70 mph</th>
<th>25-75 mph</th>
<th>25-80 mph</th>
<th>25-90 mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>90%</td>
<td>90%</td>
<td>90%</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>20</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>30</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>40</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
</tr>
<tr>
<td>50</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>60</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>70</td>
<td>30%</td>
<td>30%</td>
<td>30%</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>80</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>90</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
</tbody>
</table>

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

* Data shown in percent. *
PART 1
Splitting Messages

Principles
No more than two frames should be used
**Principles**

Each frame must be understood by itself

**Acceptable**

![Acceptable Example]

**Unacceptable**

![Unacceptable Example]

---

**Principles**

Compatible units of information should be displayed on the same frame

**Acceptable**

![Acceptable Example]

**Unacceptable**

![Unacceptable Example]

---

**Principles**

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

**Acceptable**

![Acceptable Example]

**Unacceptable**

![Unacceptable Example]
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

Messages with Incident Descriptor (One Frame)
Formatting Messages

Messages with Incident Descriptor
(Two Frames)

<table>
<thead>
<tr>
<th>Message Type</th>
<th>Message</th>
<th>Message</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Descriptor</td>
<td>Message 1</td>
<td>Message 2</td>
<td>Message 3</td>
</tr>
<tr>
<td>Message 4</td>
<td>Message 5</td>
<td>Message 6</td>
<td>Incident</td>
</tr>
</tbody>
</table>

Format 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>Description</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOW</td>
<td>Slow</td>
<td>OFF</td>
<td>Off</td>
</tr>
<tr>
<td>TD</td>
<td>Truck</td>
<td>R</td>
<td>Right</td>
</tr>
<tr>
<td>P</td>
<td>Parked</td>
<td>N</td>
<td>North</td>
</tr>
<tr>
<td>R</td>
<td>Right</td>
<td>M</td>
<td>Main</td>
</tr>
<tr>
<td>L</td>
<td>Left</td>
<td>N</td>
<td>North</td>
</tr>
</tbody>
</table>

DMS Manual: pg 8-6
DMS Manual: pg 8-7 through 8-9
DMS Manual: pg 8-11
Using Abbreviations

Unacceptable Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPLT</td>
<td>TPLT</td>
</tr>
<tr>
<td>TPLT MTL</td>
<td>TPLT MTL</td>
</tr>
<tr>
<td>MT MTL</td>
<td>MT MTL</td>
</tr>
<tr>
<td>MTL MTL</td>
<td>MTL MTL</td>
</tr>
<tr>
<td>MTL MTL</td>
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</tr>
<tr>
<td>MTL MTL</td>
<td>MTL MTL</td>
</tr>
<tr>
<td>MTL MTL</td>
<td>MTL MTL</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>Reduced Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Location</td>
<td>Omit Reference to Same Freeway</td>
</tr>
<tr>
<td>Message Location</td>
<td>otal Accessible Lanes on Incident Location</td>
</tr>
<tr>
<td>Lanes Affected</td>
<td>Only Lanes Affected</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>Reduced Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Location</td>
<td>Combine Incident Descriptor, Location, Lanes Affected</td>
</tr>
<tr>
<td>Message Location</td>
<td>Only Lanes Affected</td>
</tr>
<tr>
<td>Lanes Affected</td>
<td>Only Lanes Affected</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>Reduced Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Location</td>
<td>Combine Incident Descriptor, Location, Lanes Affected</td>
</tr>
<tr>
<td>Message Location</td>
<td>Only Lanes Affected</td>
</tr>
<tr>
<td>Lanes Affected</td>
<td>Only Lanes Affected</td>
</tr>
</tbody>
</table>
Initial Reduction Approaches

- Combine *Location of Closure* and *Action* message elements

<table>
<thead>
<tr>
<th>Message Elements</th>
<th>Revised Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>REPAIR CLOSED</td>
</tr>
<tr>
<td>Crash Location (12345 St)</td>
<td>INCIDENT CLOSED</td>
</tr>
<tr>
<td>Exit 15</td>
<td>LEFT LANE CLOSED</td>
</tr>
</tbody>
</table>

DMS Manual: pg 8-16

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Initial Reduction Approaches

Combining/Replacing Message Elements for Roadwork Messages

- Combine/Replace *Roadwork Descriptor* with *Lanes Closed* elements

<table>
<thead>
<tr>
<th>Message Elements</th>
<th>Revised Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadwork (12345 St)</td>
<td>LEFT LANE CLOSED</td>
</tr>
<tr>
<td>Exit 15</td>
<td>LEFT LANE CLOSED</td>
</tr>
</tbody>
</table>

DMS Manual: pg 8-17

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Initial Reduction Approaches

<table>
<thead>
<tr>
<th>Message Elements</th>
<th>Revised Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadwork (12345 St)</td>
<td>LEFT LANE CLOSED</td>
</tr>
</tbody>
</table>

DMS Manual: pg 8-17
Initial Reduction Approaches

• Combine Roadwork Descriptor, Location and Lanes Closed message elements

<table>
<thead>
<tr>
<th>Regular Message Elements</th>
<th>Reduced Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadwork Descriptor</td>
<td>PREVIOUSLY CLOSED</td>
</tr>
<tr>
<td>Location</td>
<td>FROM REARWAY TO PROVdash</td>
</tr>
<tr>
<td>Lanes Closed</td>
<td>2 LANE CLOSED</td>
</tr>
</tbody>
</table>

Initial Reduction Approaches

• Combining Location of Closure and Action message elements

<table>
<thead>
<tr>
<th>Regular Message Elements</th>
<th>Reduced Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Closure</td>
<td>FROM REARWAY TO PROVdash</td>
</tr>
<tr>
<td>Action</td>
<td>PREVIOUSLY CLOSED</td>
</tr>
</tbody>
</table>

Secondary Reduction Approaches

Reducing Number of Destinations in Action Message Element

<table>
<thead>
<tr>
<th>Regular Message Elements</th>
<th>Reduced Message Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destination 1</td>
<td>Remapped to SBR LOCATION 1</td>
</tr>
<tr>
<td>Destination 2</td>
<td>Remapped to SBR LOCATION 2</td>
</tr>
<tr>
<td>Destination 3</td>
<td>Remapped to SBR LOCATION 3</td>
</tr>
</tbody>
</table>
Priority Reduction Principles

Table A-1 Information Display of Priority

<table>
<thead>
<tr>
<th>Message Category</th>
<th>Order of Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane Change</td>
<td>1. Lane Change (Parking)</td>
</tr>
<tr>
<td>Lane Change</td>
<td>2. Lane Change (Emergency)</td>
</tr>
<tr>
<td>Lane Closure</td>
<td>3. Lane Closure (Emergency)</td>
</tr>
<tr>
<td>Traffic Control</td>
<td>4. Traffic Control (Emergency)</td>
</tr>
<tr>
<td>Traffic Incident</td>
<td>5. Traffic Incident (Emergency)</td>
</tr>
</tbody>
</table>

Table A-2 Information Display of Priority

<table>
<thead>
<tr>
<th>Message Category</th>
<th>Order of Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane Change</td>
<td>1. Lane Change (Parking)</td>
</tr>
<tr>
<td>Lane Change</td>
<td>2. Lane Change (Emergency)</td>
</tr>
<tr>
<td>Lane Closure</td>
<td>3. Lane Closure (Emergency)</td>
</tr>
<tr>
<td>Traffic Control</td>
<td>4. Traffic Control (Emergency)</td>
</tr>
<tr>
<td>Traffic Incident</td>
<td>5. Traffic Incident (Emergency)</td>
</tr>
</tbody>
</table>

DMS Manual pg 8-20
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

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
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

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

Procedure for Incidents

Lane Closure (Blockage)

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

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
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

8. Adjust message to fit on existing DMS

9. Adjust message to fit on 3 lines or less
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

Procedure for Incidents

Detailed step-by-step procedure
Refers user to tables in
• Module 7: Establishing Maximum Message Length

For roadwork messages, tables in Module 6 would be used instead…
Modifying Messages to Improve Effectiveness

Module 12

Improving Message Effectiveness

<table>
<thead>
<tr>
<th>Module</th>
<th>Improvement Action</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-1</td>
<td>Improve accuracy</td>
<td>Time 1</td>
</tr>
<tr>
<td>12-2</td>
<td>Clarify the message</td>
<td>Time 2</td>
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</table>

*Table 12-1 Action Tracker*

12-2

Improving Message Effectiveness

<table>
<thead>
<tr>
<th>Module</th>
<th>Improvement Action</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-3</td>
<td>Simplify the message</td>
<td>Time 3</td>
</tr>
<tr>
<td>12-4</td>
<td>Use consistent language</td>
<td>Time 4</td>
</tr>
</tbody>
</table>

*Table 12-2 Action Tracker*

12-3

DMS Message Design and Display Manual Training
## Improving Message Effectiveness

<table>
<thead>
<tr>
<th>Raw Message</th>
<th>Recommended Message</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCESSOR FAILURE</td>
<td>BUSINESS CONTINUITY PLAN INCIDENT</td>
<td>● Must be clear and concise.</td>
</tr>
<tr>
<td>RESTART</td>
<td>MUST BE IMMEDIATE</td>
<td>● Must be clear and concise.</td>
</tr>
<tr>
<td>PBX FAILURE</td>
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Message Design Example - Incident: Large DMS

Module 14

All Lanes Closed

Define Situation
• Analyze Incident and Incident Scene Characteristics
All Lanes Closed

Design Message for DMS on Same Freeway Relatively Close to Incident
• DMS #1

DMS #1: All Lanes Closed

Identify DMS Characteristics

DMS #1: All Lanes Closed

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

Step 1
Determine Freeway Operating Speed at the DMS Location.
Freeway speed is 30 mph

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
Assess Whether the Message Must Be Reduced Because of Local Geometric Sight Distance Restrictions to DMS

**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 #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
Assess Whether the Message Must Be Reduced Because of Environmental Sight Distance Restrictions to DMS (Rain/Fog)

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

Step 9
Determine Whether Fog Exists near the DMS
No. No reductions in max of 5 units
Go to Step 11
Finalize the Maximum Allowable Units of Information in the Message

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

Define Base DMS Message to Satisfy Motorist Information Needs
**Step 12**

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

*Incident Descriptor:* MAJOR ACCIDENT

**Step 13**

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

*Location:* PAST I-22

**Step 14**

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

*Lanes Closed:* ALL LANES CLOSED
Step 15

Select Closure Location Message Element from Table 5.31, page 5-34
Closure Location: AT I-22

Step 16

Determine Whether Diversion Traffic Control is in Place
"Yes." Go to Step 20

Step 20

Select Type 5 Diversion (Detour) Route Action Message Element from Table 5.35, page 5-38
Action: EXIT AT I-22 FOLLOW DETOUR
DMS #1: All Lanes Closed

Step 21

Establish Whether Action Message Is for a Select Group of Motorists
“No.” Go to Step 23

Step 23

Examine Whether the Diversion Route May Be Perceived by Motorists as Being a Most Logical Route
“Yes.” Go to Step 25

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
Reduce the Number of Message Units If Necessary

**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
Maxmum Allowable = 5 units
Continue to Step 26

**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
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

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

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
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

**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

**Step 45**

Review Message for Inconsistencies and Incompatibility

No inconsistencies in message
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

DMS #1: All Lanes Closed

Summary

Base DMS Message vs. Final Message

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

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)
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*

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)
1. Situation Descriptor

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

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

3. License Plate Number

- LIC # ABC-123 – Texas plate
  - Equals 3 units of information
  - If included will exceed max. units
  - Majority will not read and recall

- MA LIC # DE4-567 – out of state
  - Many will not be able to interpret
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

5. Tune To Radio

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

Module 16

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

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

Closing Access to City/Area

DMS far from event

Evacuation of City/Area
Hurricanes

- 4 Stages
  - Prior to hurricane threat (all season)
  - Prior to formal evacuations
  - During formal evacuations
  - No longer safe to evacuate
- For more information…
  - Guidelines for Hurricane Evacuation Marking and Signing

Stage 1: All Season

Phase 1

| HURRICANE SEASON IS HERE |

Phase 2

- Do you know your evacuation route?
- Plan to rideshare with neighbors or family
- Make an evacuation plan
- Is your vehicle maintenance up to date?
- Your emergency broadcast network is xxxx AM
Stage 2: Prior to Evacuation

Phase 1
- HURRICANE IN GULF

Phase 2
- PLAN TO RIDE SHARE WITH NEIGHBORS OR FAMILY
- RED CROSS SHELTER INFORMATION CALL <phone #>
- EVACUATION ROUTE INFORMATION CALL <phone #>
- RIDESHARING REDUCES EVACUATION TRAFFIC
- REMEMBER TO TAKE MAPS IF EVACUATING
- CHECK YOUR EVACUATION SUPPLIES

Remember to take maps if evacuating.

Check your evacuation supplies.

Stage 3: Evacuation

Phase 1
- HURRICANE EVACUATION IN PROGRESS

Your Emergency Broadcast Network is xxxx AM.
Stage 3: Evacuation

**Phase 2**
- **RIDESHARE WITH NEIGHBORS OR FAMILY**
- **RIDESHARING REDUCES EVACUATION TRAFFIC**
- **TUNE TO EMER BROADCAST**
- **TAKE STATE AND LOCAL MAPS**
- **FUEL AVAILABLE NEXT EXIT**
- **NEXT FUEL AVAILABLE 10 MILES OR EXIT XX**
- **DO NOT STOP ON SHOULDER**
- **RED CROSS SHELTER INFORMATION CALL < phone #>**

Stage 4: Not Safe to Evacuate

**Phase 1**
- **HURRICANE LANDFALL SOON**
- **EXTREME WIND WARNING**

**Phase 2**
- **GO TO NEAREST SHELTER**
- **SEEK SHELTER NOW**
- **LOCAL SHELTER INFORMATION CALL < phone #>**
High Water & Floods

Module 17

**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

**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
Message Format for Passable

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

1. Water Descriptor

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

2. Water Location

Depends upon whether water is
• Downstream of crossing hwy or street
  PAST [hwy, street name]
• Between exit & entrance ramp
  AT [hwy, street name]
  PAST [exit ramp name]
2. Water Location (Cont.)

Depends upon whether water is
• Upstream of exit ramp
  BEFORE [exit ramp name]

3. Action

BE PREPARED TO STOP
USE CAUTION

Message Format for Flood

1. Freeway closure descriptor message element
2. Closure location message element
3. Action message element
Ozone
Module 18

**DMS Messages**
Day prior to ozone action day

- **Phase 1**
  - **Option 1**: Ozone Action Day Tomorrow
  - **Option 2**: Ozone Action Day Tomorrow

- **Phase 2**
  - **Option 1**: Ride the Bus (Free)
  - **Option 2**: Reduce Trips Work at Home

**DMS Messages**
Day of ozone action day

- **Phase 1**
  - **Option 1**: Ozone Action Day Today

- **Phase 2**
  - **Option 2**: Reduce Trips Walk to Lunch
Planned Special Events
Module 19

Impacts & Strategies
Driver groups
• Traveling to the event
• Not traveling to the event

Impacts & Strategies
Categories of events
• Discrete/recurring at permanent venue
• Continuous
• Street use
• Regional/multi-venue
• Rural
**DMS Messages – Driving to Event**

Likely scenarios

- Inform of direct route to event
- Divert to alternative route

---

**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

---

**DMS Messages – Driving to Event**

Informing of exits to take or routes to use

- Example 1: 
  - FAIR PARK TAKES EXIT 1

- Example 2: 
  - FAIR PARK EXIT AT 2ND AVE
**DMS Messages – Driving to Event**

Divert to Alternative Route

![Diagram]

DMS Manual pg 19-4
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)?