DYNAMIC MESSAGE SIGN MESSAGE DESIGN & DISPLAY MANUAL TRAINING

Two-Day Course

Participant Notebook

Product 0-4023-P3
February 2006

MAJOR ACCIDENT
AT ROLAND
LEFT 2 LANES CLOSED

**Dynamic Message Sign
Message Design and
Display Manual**

Project performed
in Cooperation with the
Texas Department of Transportation and the
Federal Highway Administration

Project 0-4023: Automated Dynamic Message Sign (DMS) Message Design and Display
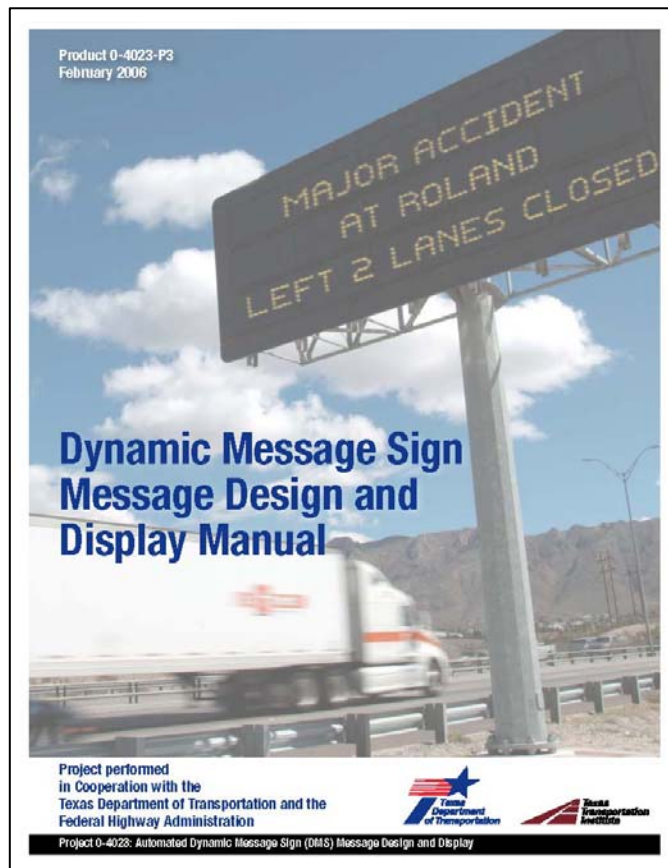
**for
Texas Department of Transportation**

March 2009

Dynamic Message Sign
Message Design & Display
Manual
Training Course

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

DMS Manual: pg 1-1

1-2

DMSs

Represent primary concept of ITS to public

DMS Manual: pg 1-1

1-3

DMSs

Messages should be consistent with respect to:

- Content
- Format
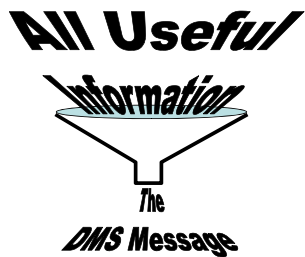- Application

DMS Manual: pg 1-1

1-4

DMS Message Design Process

DMS operations require good understanding of:
- Traffic operations
- Human factors

DMS Manual: pg 1-2

1-5

Message Design Process

All Useful Information
The DMS Message

DMS Manual: no page reference

1-6

Message Design Process

Required message reading time $\leq$ Reading time available while approaching DMS

DMS Manual: pg 1-2

1-7

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

1-8

There is a Maximum Message Length

Affected by:

- Legibility distance of message

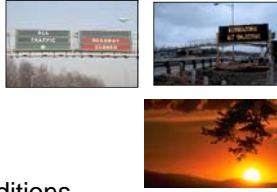- Motorist perception, information processing capabilities

DMS Manual: pg 1-2

1-9

Available Message Viewing Distance

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

DMS Manual: pg 1-2

1-10

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 Manual: pg 1-3

1-11

DMS Near Incident/Roadwork

DMS Manual: pg 1-2

1-12

DMS Far From Incident/Roadwork

DMS Manual: pg 1-2

1-13

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DMS on a Different Freeway

DMS Manual: pg 1-2

1-14

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Manual Designed for:

- New users of DMSs
- Experienced users of DMSs

At
- Entry level
- Experienced with traffic operations
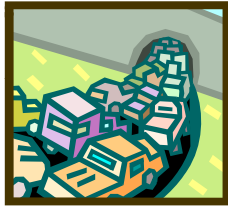- Managers

DMS Manual: pg 1-1

1-15

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Principles of DMS Operations
Module 2

2-1

DMSs are used to manage traffic by displaying:

- Early warning messages

DMS Manual: pg 2-1

2-2

DMSs are used to manage traffic by displaying:

- Early warning messages
- Advisory messages

DMS Manual: pg 2-1

2-3

DMSs are used to manage traffic by displaying:

- Early warning messages
- Advisory messages
- Alternative routing messages

DMS Manual: pg 2-1

2-4

What Motorists Expect From DMSs

- Up-to-the-minute information

DMS Manual: pg 2-2

2-5

What Motorists Expect From DMSs

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

DMS Manual: pg 2-2

2-6

What Motorists Expect From DMSs

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

DMS Manual: pg 2-2

2-7

What Motorists Expect From DMSs

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

DMS Manual: pg 2-2

2-8

Credibility Is Critical!

Never display specific traffic information before it is verified

DMS Manual: pg 2-2

2-9

How Is Credibility Damaged?

By displaying messages that are:
– Inaccurate

RT LANE
CLOSED
AHEAD

DMS Manual: pg 2-2   2-10

How Is Credibility Damaged?

By displaying messages that are:
– Inaccurate
– Not current

ACCIDENT
1 MILE

DMS Manual: pg 2-2   2-11

How Is Credibility Damaged?

By displaying messages that are:
– Inaccurate
– Not current
– Irrelevant

DMS Manual: pg 2-2   2-12

How Is Credibility Damaged?

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

> CAUTION
> CONGESTION
> AHEAD

DMS Manual: pg 2-2

2-13

How Is Credibility Damaged?

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

> EXPECT
> 1 MIN DELAY
> AHEAD

DMS Manual: pg 2-2

2-14

How Is Credibility Damaged?

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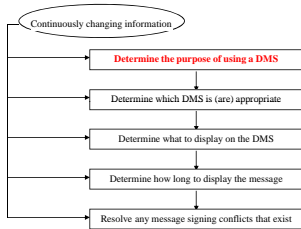- – Incorrect (especially numbers)

DMS Manual: pg 2-2

2-15

DMS Manual: no page reference   2-16

DMS Manual: no page reference   2-17

DMS Operating Fundamentals

Module 3

DMS Operating Fundamentals

Continuously 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

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

3-3

Determine Purpose

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

DMS Manual: pg 3-2

3-4

Determine Purpose

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

DMS Manual: pg 3-3

3-5

Determine Purpose

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

DMS Manual: pg 3-3

3-6

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

DMS Manual: pg 3-3

3-7

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

DMS Manual: pg 3-3

3-8

Determine Purpose

What degree of response is desired?
- Keep message displayed for more response
- Turn message off for less response

DMS Manual: pg 3-4

3-9

Determine Appropriate DMSs

Proximity of DMSs to problem

Questions:

- Expected problem longer than expected travel time?
- Significant number of motorists passing sign?

DMS Manual: pg 3-4   3-10

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

DMS Manual: pg 3-4   3-11

Determine Appropriate DMSs

External Influences

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

DMS Manual: pg 3-5   3-12

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

DMS Manual: pg 3-5

3-13

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

DMS Manual: pg 3-5

3-14

Determine What to Display

On diversion routes, operator must know:
- Current traffic conditions
- Current traffic capacity constraints
- Guide sign information

DMS Manual: pg 3-6

3-15

Determine Duration of Display

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

DMS Manual: pg 3-7   3-16

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

DMS Manual: pg 3-7   3-17

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

DMS Manual: pg 3-7   3-18

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

DMS Manual: pg 3-8   3-19

Principles of DMS Message Design

Module 4

PART 1
Overview of Issues

DMS Manual: pg 4-1

4-2

Overview of DMS Issues

Direct link with motoring public

Effective Messages   *Poorly Designed Message*

DMS Manual: pg 4-1

4-3

Overview of DMS Issues

Direct link with motoring public
Messages must be standard and consistent

DMS Manual: pg 4-1

4-4

Overview of DMS Issues

Direct link with motoring public
Messages must be standard and consistent
Only few seconds to communicate
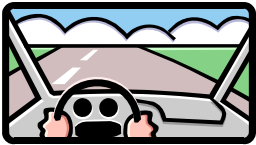
DMS Manual: pg 4-1

4-5

Overview of DMS Issues

Message length controlled by exposure time

DMS Manual: pg 4-1

4-6

Overview of DMS Issues

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

DMS Manual: pg 4-1

4-7

Overview of DMS Issues

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

DMS Manual: pg 4-2

4-8

PART 2
Selecting an Audience

DMS Manual: pg 4-3

4-9

Audience for Message

Why is it necessary to think about the audience of the message?

DMS Manual: pg 4-3

4-10

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

DMS Manual: pg 4-3

4-11

PART 3
Definitions and Message Design Considerations

DMS Manual: pg 4-4

4-12

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

DMS Manual: pg 4-4

4-13

Message Content

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

DMS Manual: pg 4-4

4-14

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

DMS Manual: pg 4-4

4-15

Message Length

8-word maximum at 55 mph

7-word maximum at 65 mph

What if the message is longer than this?

DMS Manual: pg 4-5

4-16

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

DMS Manual: pg 4-5

4-17

Message Load and Info Unit

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

DMS Manual: pg 4-6

4-18

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*

DMS Manual: pg 4-7

4-19

Message Format

Must place Information Units in the proper order to:

• Enhance motorist expectations
• Reduce reading time
• Enhance understanding

DMS Manual: pg 4-7

4-20

PART 4
Base DMS Message

DMS Manual: pg 4-8

4-21

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

DMS Manual: pg 4-8

4-22

Base DMS Message

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

DMS Manual: pg 4-8

4-23

Base DMS Message

The *Base DMS Message* Elements (cont'd)
- Effect on Travel
- Audience for Action
- Action
- One Good Reason for Following Action

DMS Manual: pg 4-8

4-24

Descriptor Element

Descriptor element informs motorists of the unusual situation

DMS Manual: pg 4-8

4-25

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

DMS Manual: pg 4-9

4-26

Location Element

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

For unfamiliar motorists:
- Reference by distance, exit numbers

DMS Manual: pg 4-9

4-27

Location Element

Preferred by Familiar or Unfamiliar Drivers?

familiar

ACCIDENT
AT ROWLAND

unfamiliar

ACCIDENT
1 MILE

*both familiar
and unfamiliar*

ACCIDENT
AT EXIT 12

DMS Manual: pg 4-9

4-28

Location Element

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

DMS Manual: no page number

4-29

DMS Manual: no page number

4-30

AUSTIN

51st St.

38 ½ St.

35

MLK Blvd.

FREEWAY CLOSED
BETWEEN 38 1/2 ST
AND 51ST ST

DMS Manual: no page number

4-34
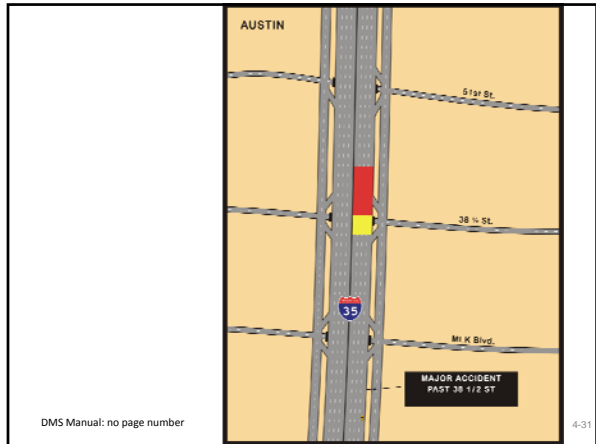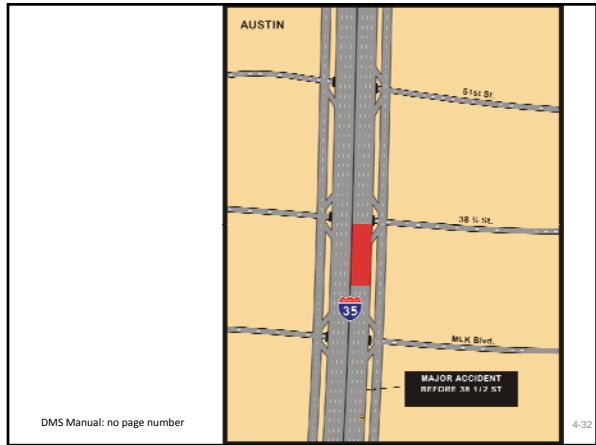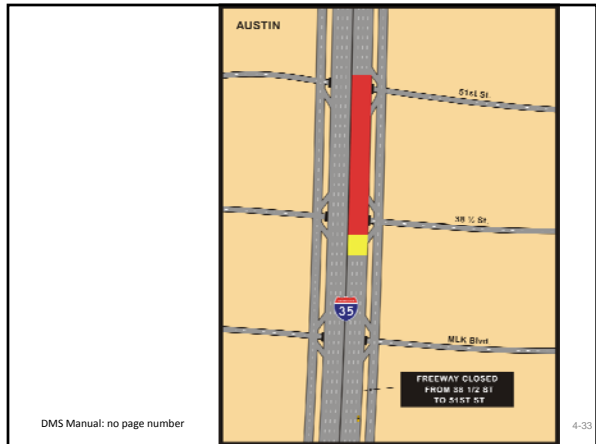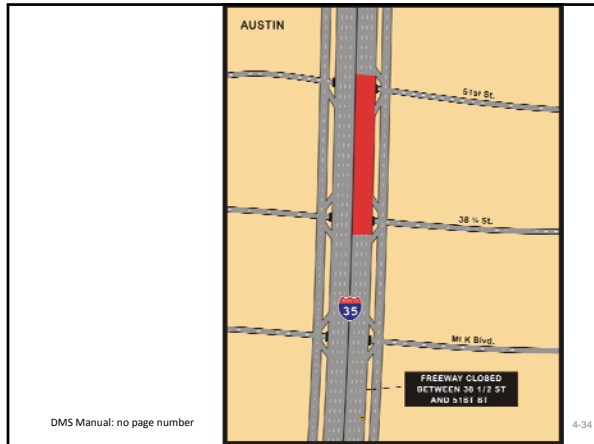
Lanes Affected Element

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

DMS Manual: pg 4-10

4-35

Closure Descriptor Element

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

DMS Manual: pg 4-10

4-36

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

DMS Manual: pg 4-10

4-37

Effect on Travel Element

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

ACCIDENT AT EXIT 12 20 MIN DELAY USE ROUTE 46	ACCIDENT AT EXIT 12 USE ROUTE 46 AVOID 20 MIN DELAY	ACCIDENT AT EXIT 12 USE ROUTE 46 SAVE 20 MIN
Example of "X MIN DELAY"	*Example of "AVOID X MIN DELAY"*	*Example of "SAVE X MIN"*

DMS Manual: pg 4-11

4-38

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 8:20	TRAVEL TIME TO DOWNTOWN 8-12 MINS

DMS Manual: pg 4-12

4-39

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

DMS Manual: pg 4-13

4-40

Audience for Action Element

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

MAJOR ACCIDENT PAST I-30
FAIR PARK USE FITZHUGH

"TRAFFIC" not required

MAJOR ACCIDENT FAIR PARK TRAFFIC USE FITZHUGH

"TRAFFIC" required

DMS Manual: pg 4-14

4-41

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

DMS Manual: pg 4-14

4-42

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

DMS Manual: pg 4-14

4-43

PART 5
Word and Word Phrase Meanings and Criteria

DMS Manual: pg 4-15

4-44

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

DMS Manual: pg 4-15

4-45

Word Meanings & Criteria

ROADWORK – shorter than CONSTRUCTION

*EXIT – w*hen 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

DMS Manual: pg 4-15

4-46

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

DMS Manual: pg 4-17 and TTI Report 0-4748-1

4-47

PART 6
Diversion/Detour Route Descriptors

DMS Manual: pg 4-19

4-48

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)

DMS Manual: pg 4-19

4-49

PART 7
Dynamic Features on DMSs

DMS Manual: pg 4-23

4-50

Dynamic Features on DMSs

AVOID flashing an entire one-phase message

**MAJOR ACCIDENT
AT ROWLAND
LEFT 2 LANES CLOSED**

DMS Manual: pg 4-23

4-51

Dynamic Features on DMSs

AVOID flashing one
line of a one-
phase message

> **MAJOR ACCIDENT
> AT ROWLAND
> LEFT 2 LANES CLOSED**

DMS Manual: pg 4-23

4-52

Dynamic Features on DMSs

AVOID alternating text

> **MAJOR ACCIDENT
> AT ROWLAND
> LEFT 2 LANES CLOSED**

DMS Manual: pg 4-24

4-53

Dynamic Features on DMSs

AVOID alternating text

> **MAJOR ACCIDENT
> AT ROWLAND
> TUNE TO 530 AM**

DMS Manual: pg 4-24

4-54

**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

DMS Manual: pg 5-1 & 6-1   5&6-2

Lane Closures: DMS Close to
Incident/Roadwork

DMS Manual: pg 5-2 & 6-2   5&6-3

Incident/Roadwork Descriptor

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

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

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

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

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

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

DMS Manual: pg 5-2 & 6-2   5&6-4

Incident/Roadwork Location

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

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

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

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

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

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

DMS Manual: pg 5-3 & 6-3   5&6-5

Lanes Closed

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

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

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

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

Large Signs	Portable Signs
CENTER LANE CLOSED	CENTER	LANE	CLOSED
CENTER LANES CLOSED	CENTER	LANES	CLOSED
CENTER [number] LANES CLOSED	CENTER	[number] LANES	CLOSED
ALL LANES CLOSED	ALL	LANES	CLOSED
LEFT LANE CLOSED	LEFT	LANE	CLOSED
LEFT [number] LANES CLOSED	LEFT	[number] LANES	CLOSED
RIGHT LANE CLOSED	RIGHT	LANE	CLOSED
RIGHT [number] LANES CLOSED	RIGHT	[number] LANES	CLOSED

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

DMS Manual: pg 5-4 & 6-4   5&6-6

Effect on Travel

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

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

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

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

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

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

DMS Manual: pg 5-5 & 6-5   5&6-7

Action
Motorists are <u>not</u> 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

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

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

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

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

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

DMS Manual: pg 5-6 & 6-6   5&6-8

Action
soft diversion

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

Large Signs	Portable Signs
USE OTHER ROUTES	USE | OTHER | ROUTES

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

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

Large Signs	Portable Signs
USE OTHER ROUTES	USE | OTHER | ROUTES

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

DMS Manual: pg 5-7 & 6-7   5&6-9

Action
Motorists are advised to take a specific Type 2 diversion route

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

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

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

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

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

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

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

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

DMS Manual: pg 5-8 & 6-8   5&6-10

Audience for Action

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

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

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

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

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

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

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

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

DMS Manual: pg 5-9 & 6-9

5&6-11

Good Reason for Following Action

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

Large Signs
AVOID DELAY
AVOID MAJOR DELAY
SAVE *[number]* MINUTES
BEST ROUTE TO *[destination]*

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

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

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

Large Signs
AVOID DELAY
AVOID MAJOR DELAY
SAVE *[number]* MINUTES
BEST ROUTE TO *[destination]*

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

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

DMS Manual: pg 5-10 & 6-10   5&6-12

Slide 1

DMS Far From Incident/Roadwork

Tables differ slightly for Lanes Closed

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

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

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

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

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

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

DMS Manual: pg 5-4 & 5-13

5&6-13

Slide 2

DMS on Different Freeway

Tables different for Incident Location

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

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

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

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

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

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

DMS Manual: pg 5-3 & 5-22

5&6-14

Slide 3

DMS on Different Freeway

Tables different for Action: 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

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

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

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

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

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

DMS Manual: pg 5-6 & 5-25

5&6-15

Total Freeway or Ramp Closures

DMS Manual: pg 5-30 & 6-29   5&6-16

Action: with diversion

Table 6.32 ACCEPTABLE TERMS FOR ACTION
DMS ON SAME FREEWAY AND RELATIVELY CLOSE TO CLOSURE
MOTORISTS ARE ADVISED TO TAKE A SPECIFIC TYPE 6 DIVERSION (DETOUR) ROUTE

Large Signs   Portable Signs
EXIT AND FOLLOW DETOUR   EXIT AND | FOLLOW | DETOUR
EXIT AND FOLLOW SIGNS   EXIT AND | FOLLOW | SIGNS
FOLLOW DETOUR   FOLLOW | DETOUR
FOLLOW SIGNS   FOLLOW | SIGNS

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

DMS Manual: pg 6-35   5&6-17

Action: with diversion

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

Large Signs   Portable Signs
EXIT AND FOLLOW DETOUR   EXIT AND | FOLLOW | DETOUR
EXIT AND FOLLOW SIGNS   EXIT AND | FOLLOW | SIGNS
FOLLOW DETOUR   FOLLOW | DETOUR
FOLLOW SIGNS   FOLLOW | SIGNS
EXIT AT [highway; street name] [cardinal direction] | EXIT | AT | [highway; street name] [cardinal direction] |
   FOLLOW DETOUR   FOLLOW | DETOUR
EXIT AT [highway; street name] [cardinal direction] | EXIT | AT | [highway; street name] [cardinal direction] |
   FOLLOW SIGNS   FOLLOW | SIGNS
EXIT AT [route number] [cardinal direction] | EXIT | AT | [route number] [cardinal direction] |
   FOLLOW DETOUR   FOLLOW | DETOUR
EXIT AT [route number] [cardinal direction] | EXIT | AT | [route number] [cardinal direction] |
   FOLLOW SIGNS   FOLLOW | SIGNS
TAKE [exit ramp name] EXIT] | TAKE | [exit ramp name] | EXIT |
   FOLLOW DETOUR   FOLLOW | DETOUR
TAKE [exit ramp name] EXIT | TAKE | [exit ramp name] | EXIT |
   FOLLOW SIGNS   FOLLOW | SIGNS
TAKE [highway; street name] [cardinal direction] | TAKE | [highway; street name] [cardinal direction] |
   FOLLOW DETOUR   FOLLOW | DETOUR
TAKE [highway; street name] [cardinal direction] | TAKE | [highway; street name] [cardinal direction] |
   FOLLOW SIGNS   FOLLOW | SIGNS
TAKE [route number] [cardinal direction] | TAKE | [route number] [cardinal direction] |
   FOLLOW DETOUR   FOLLOW | DETOUR
TAKE [route number] [cardinal direction] | TAKE | [route number] [cardinal direction] |
   FOLLOW SIGNS   FOLLOW | SIGNS

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

DMS Manual: pg 5-38   5&6-18

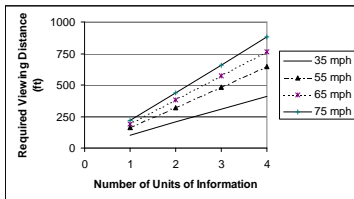## Establishing the Maximum Message Length

Module 7

PART 1
Message Length and DMS Viewing Distance Requirements

DMS Manual: pg 7-1   7-2

Required Viewing Distances to DMS

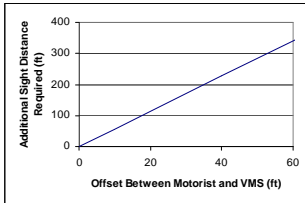- For a given number of info units: Higher speeds require higher, legibility distances

DMS Manual: pg 7-1   7-3

Sight Distance for Lateral Offset

- Longer lateral distances require more legibility distance

DMS Manual: pg 7-2   7-4

Factors Reducing Legibility Distance to a DMS

Lighting Conditions

DMS Manual: pg 7-2   7-5

Factors Reducing Legibility Distance to a DMS

Sun Position

DMS Manual: pg 7-2   7-6

Factors Reducing Legibility Distance to a DMS

Vertical & Horizontal Curvature

DMS Manual: pg 7-2   7-7

Factors Reducing Legibility Distance to a DMS

Spot obstructions

DMS Manual: pg 7-2   7-8

Factors Reducing Legibility Distance to a DMS

Rain or fog

DMS Manual: pg 7-2   7-9

Factors Reducing Legibility Distance to a DMS

Trucks in the traffic stream

DMS Manual: pg 7-2   7-10

Therefore,

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

DMS Manual: pg 7-2   7-11

PART 2
Maximum Legibility Distances for Day & Night Operations

DMS Manual: pg 7-4   7-12

Day & Night

Suggested legibility distances

Table 7.1 Suggested DMS Legibility Distances for Use in Message Design (ft)

Condition	Light-Emitting Diode[A]	Fiberoptic	Incandescent Bulb	Reflective Disk
Mid-Day	800	700	700	700
Washout	800	700	700	400
Backlight	600	400	400	200
Nighttime	600	600	600	350

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs

DMS Manual: pg 7-4   7-13

Day & Night

Maximum number of units of info

Table 7.2 Maximum Number of Units of Information in DMS Message (Base Maximum Message Length)

Condition	Light-Emitting Diode[A]			Fiberoptic			Incandescent Bulb			Reflective Disk		
	0-35 mph	36-55 mph	56-70 mph	0-35 mph	36-55 mph	56-70 mph	0-35 mph	36-55 mph	56-70 mph	0-35 mph	36-55 mph	56-70 mph
Mid-Day	5 units	4 units	4 units	5 units	4 units	3 units	5 units	4 units	3 units	5 units	4 units	3 units
Washout	5 units	4 units	4 units	5 units	4 units	3 units	5 units	4 units	3 units	4 units	3 units	2 units
Backlight	4 units	4 units	3 units	4 units	3 units	2 units	4 units	3 units	2 units	2 units	1 unit	1 unit
Nighttime	4 units	4 units	3 units	4 units	3 units	3 units	4 units	3 units	3 units	3 units	2 units	1 unit

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs

DMS Manual: pg 7-5   7-14

Reduce Units for Vertical Curves

Only necessary in very extreme cases

Table 7.5 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Vertical Curve
PORTABLE LED DMS[A]
Mounting Height: 7 feet

Condition	Vertical Curve Design Speed					
	20-foot Offset			60-foot Offset		
	30 mph	35 mph	40 mph	30 mph	35 mph	40 mph
Mid-Day	3 units	2 units	1 unit	5 units	5 units	3 units
Washout	3 units	2 units	1 unit	5 units	5 units	3 units
Backlight	2 units	1 unit	1 unit	4 units	4 units	2 units
Nighttime	2 units	1 unit	1 unit	4 units	4 units	2 units

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.

DMS Manual: pg 7-9   7-15

Slide 1

Reduce Units for Horizontal Curves
(Necessary only in extreme cases)

Table 7.9 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Horizontal Curve
PORTABLE LED DMS*
Offset: 2 feet

Curve Radii (ft)	Mid-Day and Washout — Offset of Sight Obstruction from Edge of Travel Lanes (feet)							Backlight and Nighttime — Offset of Sight Obstruction from Edge of Travel Lanes (feet)						
	10	20	50	100	150	200	250	10	20	50	100	150	200	250
250	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
500	N/A	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A	N/A	N/A	N/A
750	3 units	3 units	2 units	1 unit				2 units	1 unit					
1000	3 units	3 units	2 units					1 unit	1 unit					
1250	3 units	3 units	1 unit					1 unit	1 unit					
1500	3 units	2 units	1 unit					1 unit						
1750	3 units	2 units	1 unit					1 unit						
2000	3 units	2 units						1 unit						
2250	3 units	2 units						1 unit						
2500	3 units	2 units						1 unit						
2750	3 units	2 units						1 unit						
3000	3 units	2 units						1 unit						
4000	2 units	1 unit												
5000	2 units													
7500	2 units													
10000	2 units													

*Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.
N/A Adequate sight distance not available for any message.

DMS Manual: pg 7-14   7-16

Slide 2

Reduce Units for Horizontal Curves
(Necessary only in extreme cases)

Table 7.12 Number of Units of Information that Must Be Subtracted from Number Given in Table 7.2 Due to Horizontal Curve
PORTABLE LED DMS*
Offset: 10 feet

Curve Radii (ft)	Mid-Day and Washout — Offset of Sight Obstruction from Edge of Travel Lanes (feet)							Backlight and Nighttime — Offset of Sight Obstruction from Edge of Travel Lanes (feet)						
	10	20	50	100	150	200	250	10	20	50	100	150	200	250
250	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
500	N/A	N/A	N/A	N/A	N/A	1 unit		N/A	N/A	N/A	N/A	N/A	N/A	N/A
750	5 units	4 units	3 units	2 units	1 unit			4 units	3 units	2 units	1 unit			
1000	5 units	4 units	3 units	1 unit	1 unit			4 units	3 units	2 units				
1250	5 units	4 units	2 units	1 unit	1 unit			4 units	3 units	1 unit				
1500	5 units	4 units	2 units	1 unit				4 units	3 units	1 unit				
1750	5 units	4 units	2 units	1 unit				4 units	3 units	1 unit				
2000	5 units	3 units	1 unit	1 unit				4 units	2 units					
2250	5 units	3 units	1 unit					4 units	2 units					
2500	5 units	3 units	1 unit					4 units	2 units					
2750	5 units	3 units	1 unit					4 units	2 units					
3000	5 units	3 units	1 unit					4 units	2 units					
4000	5 units	3 units	1 unit					4 units	2 units					
5000	5 units	2 units						4 units	1 unit					
7500	5 units	2 units						4 units	1 unit					
10000	5 units	1 unit						4 units						

*Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.
N/A Adequate sight distance not available for any message.

DMS Manual: pg 7-17   7-17

Slide 3

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

DMS Manual: pg 7-18   7-18

Reduce Units for Fog

Table 7.13 Number of Units of Information that Must Be <u>Subtracted</u> from Number Given in Table 7.2 Due to Effects of Fog in Daytime Conditions PORTABLE LED[A] DMS									
Visibility Range in Fog	**No Offset**			**20-ft Offset**			**60-ft Offset**		
	0-35 mph	36-55 mph	56-70 mph	0-35 mph	36-55 mph	56-70 mph	0-35 mph	36-55 mph	56-70 mph
0.5 mi	0	0	0	0	0	0	0	0	0
0.25 mi	0	0	1 unit	0	1 unit	1 unit	2 units	2 units	2 units
0.1 mi	2 units	2 units	2 units	3 units	3 units	3 units	5 units[B]	4 units[B]	4 units[B]

[A] Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs.
[B] Adequate sight distance not available for any message under this viewing condition.

DMS Manual: pg 7-19

7-19

Reduce Units for Large Trucks

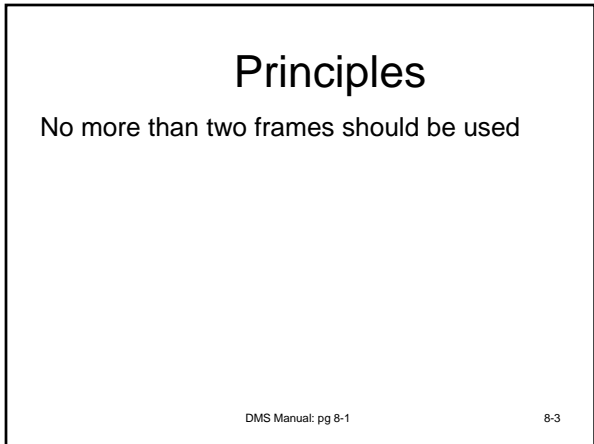| Table 7.17 Percent of Motorists Able to Fully Read a DMS Message with Maximum Base Number of Units (Eight-Lane Roadway: Four Lanes in Each Direction)									
	Operating Speed Range								
	0-35 mph			**36-55 mph**			**56-70 mph**		
Percent Trucks	2000 vph	4000 vph	6000 vph	2000 vph	4000 vph	6000 vph	2000 vph	4000 vph	6000 vph
5	90	80	70	90	80	70	90	80	70
10	80	60	45	80	65	45	80	65	45
20	65	35	20*	70	35	20*	65	35	20*
30	60	30*	30*	60	30*	30*	55	30*	30*
50	50*	50*	50*	50*	50*	50*	50*	50*	50*

Note: Assumes a 70%/20%/10%/0% split of truck traffic in shoulder, right center, left center, and median travel lanes, respectively.
* Under these conditions, only truck drivers are assumed to be able to see the DMS.
vph = vehicles per hour.

DMS Manual: pg 7-22

7-20

Dealing with Long Messages

Module 8

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PART 1
Splitting Messages

DMS Manual: pg 8-1   8-2

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Principles

No more than two frames should be used

DMS Manual: pg 8-1   8-3

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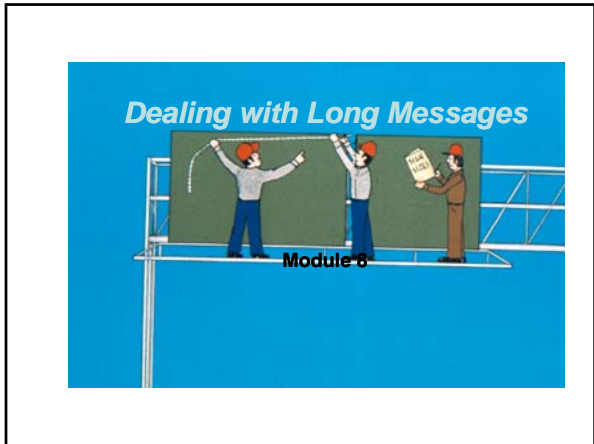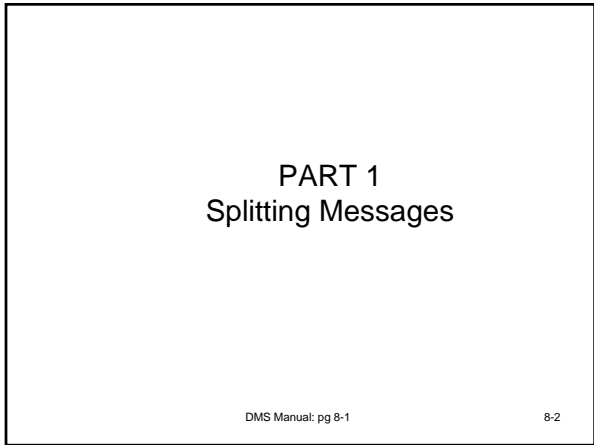
Principles

Each frame must be understood by itself

Acceptable   *Unacceptable*

MAJOR ACCIDENT AT I-10	GALVESTON USE I-610 EAST		MAJOR ACCIDENT AT I-10 GALVESTON TRAFFIC	USE I-610 EAST
Phase 1	*Phase 2*		*Phase 1*	*Phase 2*

DMS Manual: pg 8-1   8-4

Principles

Compatible units of information should be displayed on the same frame

Acceptable   *Unacceptable*

MAJOR ACCIDENT AT RIVER DR	EXIT AT RT-20 USE OTHER ROUTES		MAJOR ACCIDENT AT RIVER DR EXIT AT RT 20	USE OTHER ROUTES
Phase 1	*Phase 2*		*Phase 1*	*Phase 2*

DMS Manual: pg 8-2   8-5

Principles

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

Acceptable   *Unacceptable*

MAJOR ACCIDENT AT RIVER DR	EXIT AT RT-20 USE OTHER ROUTES		MAJOR ACCIDENT AT RT-20	EXIT AT RIVER DRIVE USE OTHER ROUTES
Phase 1	*Phase 2*		*Phase 1*	*Phase 2*

DMS Manual: pg 8-3   8-6

Principles

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

Acceptable   *Unacceptable*

| BEST ROUTE |
| TO DALLAS |
| USE I-30 |

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

DMS Manual: pg 8-4 (example is different than in manual)   8-7

PART 2
Approaches to Reducing Message
Length

DMS Manual: pg 8-5   8-8

Reducing Message Length

Delete "Dead" Words
Formatting Messages
Using Abbreviations

DMS Manual: pg 8-5   8-9

Delete Dead Words

Street, Avenue, Boulevard

Ahead

DMS Manual: pg 8-5   8-10

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

DMS Manual: pg 8-6   8-11

Formatting Messages

Messages <u>with</u> *Incident Descriptor*
(One Frame)

Table 8.1 Format Order When *Incident Descriptor* Message Element is Used for Incidents

Message Elements for Lane Closure Incidents	Message Elements for Freeway Closure Incidents
1. Incident Descriptor	1. Incident Descriptor
2. Incident Location	2. Incident Location
3. Lanes Closed (Blocked)	3. Lanes Closed (Blocked)
4. Audience for Action (if needed)	4. Audience for Action (if needed)
5. Action	5. Action
6. Good Reason for Following Action*	

* When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

DMS Manual: pg 8-6   8-12

Formatting Messages

Messages <u>with</u> *Incident Descriptor*

(Two Frames)

Table 8.2 Format Order for Two-Phase Messages When *Incident Descriptor* Message Element is Used for Incidents

Message Phase 1	Message Phase 2
1. Incident Descriptor	3. Lanes Closed (Blocked)
2. Incident Location	4. Action
1. Incident Descriptor	3. Audience for Action
2. Incident Location	4. Action
1. Incident Descriptor	4. Audience for Action
2. Incident Location	5. Action
3. Lanes Closed (Blocked)	
1. Incident Descriptor	3. Audience for Action
2. Incident Location	4. Action
	5. Good Reason for Following Action[A]

[A] When *BEST ROUTE TO* is used as the Good Reason, then *the Good Reason for Following Action* message element is placed before the *Action* message element.

DMS Manual: pg 8-6   8-13

Formatting Messages

Similar tables are available for

- Messages <u>with</u> *Roadwork Descriptor*
- Messages <u>without</u> *Incident Descriptor*
- Messages <u>without</u> *Roadwork Descriptor*

DMS Manual: pg 8-7 through 8-9   8-14

Using Abbreviations

Acceptable

Table 8.9 ACCEPTABLE Abbreviation Terms For Texas Drivers

Word or Phrase	ACCEPTABLE Abbreviation Term	Word or Phrase	ACCEPTABLE Abbreviation Term
Access	NO ACCS	Lower Level	LOWR LVL MAINT
Access Road	ACCES RD	Maintenance	MAINT WORK
Accident At	ACCDT AT	Major	MAJ ACCIDENT
Ahead	[incident, distance, etc.] AHD	Major Accident	MAJ ACCDT
Aquarium	[name] AQRM	Mile(s)	[number] MI
Avenue	AVE	Minor	MNR ACCIDENT
Blocked	LANE BLKD	Minor Accident	MNR ACCDT
	FREEWAY BLKD	Minute(s)	[number] MIN
Boulevard	[name] BLVD	Monday	MON
Bridge	[name] BRDG	National Park	[name] NATL PRK
Center	CNTR	North	N
	CNTR LANE		
	ARTS CNTR	Oversized	OVRSZ LOAD
Center Lane	CNTR LN	Parking	PKING
Chemical Spill	CHEM SPILL	Parking Lot	PRK LOT
Closed	EXPRESSWAY CLSD		PKING LOT
	FREEWAY CLSD	Prepare	PREP TO STOP
	LANE CLSD	Pavement	WET PVMT
	LN CLSD	Quality	AIR QLTY
		Right	RGT

DMS Manual: pg 8-11   8-15

Using Abbreviations

Unacceptable Terms

Table 8.10 UNACCEPTABLE Abbreviation Terms		
Word/Phrase	**Abbreviation Tested**	**Recommended Alternatives**
Alternate Route	ALT RT	OTHER RTE
Detour Route	DETOUR RT	DETOUR RTE
Feeder Road	FEED RD	FEEDER RD
Frontage Road	FRNTG RD	FRONTAGE RD
High Occupancy Vehicle Lane	HOV LANE	Investigate other terms
Interchange 14	INTCH 14	Use full word: INTERCHANGE 14
Incident at	INCDT AT / INCID AT	ACCDT AT / ACCDT AT
Major Congestion	MAJ CONG	MAJ CONGESTION
Road Work	RD WK	ROADWORK
Vicinity of	VIC OF	BEFORE, PAST, AT
Eastbound Traffic	EB TRAFFIC	[route] E
Northbound Traffic	NB TRAFFIC	[route] N
Southbound Traffic	SB TRAFFIC	[route] S
Westbound Traffic	WB TRAFFIC	[route] W
[route] Eastbound	[route] SB	[route] E
[route] Northbound	[route] EB	[route] N
[route] Southbound	[route] NB	[route] S
[route] Westbound	[route] WB	[route] W

DMS Manual: pg 8-12

8-16

PART 3
Reducing Message Units of Information

DMS Manual: pg 8-13

8-17

Reformatting

Units of information can be reduced by:

- Omitting unimportant words
- Omitting redundant information
- Combining *Base DMS Message* elements

DMS Manual: pg 8-13

8-18

The Original Message:

ROAD CLOSED AHEAD
DUE TO CONSTRUCTION
FOLLOW DETOUR ROUTE

Can Be Shortened To:

ROAD CLOSED
1 MILE
FOLLOW DETOUR

With Better Results.

DMS Manual: pg 8-13   8-19

PART 4
Reducing Units of Info from Base
Message

DMS Manual: pg 8-14   8-20

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

DMS Manual: pg 8-14   8-21

Initial Reduction Approaches

Reducing Redundancy in Incident/
Roadwork Messages

• Omit reference to same freeway

Table 8.11 Example of Omitting Reference to Same Freeway as Incident/Roadwork and DMS	
Message Elements	Revised Message Elements
Incident on Same Freeway (US-75 North) as DMS (US-75 North)	
Incident Descriptor MAJOR ACCIDENT ON US-75 NORTH	MAJOR ACCIDENT PAST I-635
Location PAST I-635	
Lanes Closed ALL LANES CLOSED	ALL LANES CLOSED

DMS Manual: pg 8-14   8-22

Initial Reduction Approaches

Combining Message Elements for Incident
Messages

• Combine *Incident Descriptor, Location,
Lanes Affected* elements

Table 8.12 Examples of Combining *Incident Descriptor, Incident Location* and *Lanes Closed* Message Elements	
Message Elements	Revised Message Elements
Incident on Same Freeway (US-75 North) as DMS (US-75 North)	
Incident Descriptor MAJOR ACCIDENT	FREEWAY CLOSED AT ARAPAHO RD
Location AT ARAPAHO RD	
Lanes Closed ALL LANES CLOSED	

DMS Manual: pg 8-15   8-23

Initial Reduction Approaches

Incident on Another Freeway (I-635 West) than DMS (US-75 North)	
Incident Descriptor MAJOR ACCIDENT	I-635 WEST CLOSED AT HILLSIDE RD
Location ON I-635 WEST AT HILLSIDE RD	
Lanes Closed ALL LANES CLOSED	
Closed Roadway Due to Incident on Same Freeway (US-75 North) as DMS (US-75 North)	
Incident Descriptor TRUCK ACCIDENT	FREEWAY CLOSED
Location PAST ARAPAHO RD	
Lanes Closed ALL LANES CLOSED	
Location of Closure AT ARAPAHO RD	
Audience for Action US-75 NORTH TRAFFIC	
Action EXIT AT ARAPAHO RD FOLLOW DETOUR	EXIT AT ARAPAHO FOLLOW DETOUR
Closed Exit Ramp at Major Interchange (I-635) on Same Freeway (US-75 North) as DMS (US-72 North)	
Incident Descriptor MAJOR ACCIDENT	RAMP CLOSED
Location ON I-635 WEST RAMP	
Lanes Closed RAMP CLOSED	
Location of Closure TO I-635 WEST	TO I-635 WEST
Audience for Action I-635 WEST TRAFFIC	
Action EXIT FORREST LANE FOLLOW DETOUR	EXIT AT FORREST LANE FOLLOW DETOUR

DMS Manual: pg 8-15   8-24

Initial Reduction Approaches

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

Table 8.13 Example of Combining *Location of Closure* Message Element With *Action* Message Element

Message Elements		Revised Message Elements
Closed Roadway Due to Incident on Same Freeway (US-75 North) as DMS (US-75 North)		
Incident Descriptor	TRUCK ACCIDENT	FREEWAY CLOSED
Location	PAST ARAPAHO RD	
Lanes Closed	ALL LANES CLOSED	
Location of Closure	AT ARAPAHO RD	
Audience for Action	US-75 NORTH TRAFFIC	
Action	EXIT AT ARAPAHO RD	EXIT AT ARAPAHO RD
	FOLLOW DETOUR	FOLLOW DETOUR

DMS Manual: pg 8-16   8-25

Initial Reduction Approaches

Combining/Replacing Message Elements for Roadwork Messages

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

Table 8.14 Examples of Combining *Roadwork Descriptor* Message Element with *Lanes Closed* Message Element

Message Elements		Revised Message Elements
Roadwork on Same Freeway (US-75 North) as DMS (US-75 North)		
Roadwork Descriptor	ROADWORK	LEFT 2 LANES CLOSED
Lane Closure Location	PAST ARAPAHO RD	PAST ARAPAHO RD
Lanes Closed	LEFT 2 LANES CLOSED	

DMS Manual: pg 8-17   8-26

Initial Reduction Approaches

Closed Roadway Due to Roadwork on Same Freeway (US-75 North) as DMS (US-75 North)		
Roadwork Descriptor	ROADWORK	FREEWAY CLOSED
Lane Closure Location	PAST ARAPAHO RD	
Lanes Closed	ALL LANES CLOSED	
Location of Closure	AT ARAPAHO RD	
Audience for Action	US-75 NORTH TRAFFIC	
Action	EXIT AT ARAPAHO RD	EXIT AT ARAPAHO RD
	FOLLOW DETOUR	FOLLOW DETOUR

DMS Manual: pg 8-17   8-27

Initial Reduction Approaches

- Combine *Roadwork Descriptor, Location* and *Lanes Closed* message elements

Table 8.15 Example of Combining *Roadwork Descriptor, Closure Location* and *Lanes Closed* Message Elements	
Message Elements	**Revised Message Elements**
Roadwork on Different Highway (I-635 West) than DMS (US-75 North)	
Roadwork Descriptor ROADWORK	I-635 WEST CLOSED
Closure Location ON I-635 WEST	
FROM HILLCREST RD	FROM HILLCREST
TO PRESTON RD	TO PRESTON
Lanes Closed ALL LANES CLOSED	

DMS Manual: pg 8-18   8-28

Initial Reduction Approaches

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

Table 8.16 Example of Combining *Location of Closure* Message Element and *Action* Message Element	
Message Component and Message	**Revised Message**
Closed Roadway Due to Roadwork on Same Freeway as DMS	
Roadwork Descriptor ROADWORK	FREEWAY CLOSED
Lane Closure Location PAST ARAPAHO RD	
Lanes Closed ALL LANES CLOSED	
Location of Closure AT ARAPAHO RD	
Audience for Action US-75 NORTH TRAFFIC	
Action EXIT AT ARAPAHO RD	EXIT AT ARAPAHO
FOLLOW DETOUR	FOLLOW DETOUR

DMS Manual: pg 8-18   8-29

Secondary Reduction Approaches

Reducing Number of Destinations in *Action* Message Element

Table 8.17 Example of Reducing Number of Destinations in the *Action* Message Element			
Reduced Message After Applying Initial Reduction Approaches		**Revised Message**	
Roadwork on Same Highway (I-20 East) as DMS (I-20 East)			
I-20 CLOSED	BEST ROUTE TO DALLAS/ I-35 E USE I-30	I-20 CLOSED	BEST ROUTE TO DALLAS USE I-30
Phase 1	*Phase 2*	*Phase 1*	*Phase 2*

DMS Manual: pg 8-19   8-30

Priority Reduction Principles

Table 8.18 Information Order of Priority for Incidents

Message Elements For Lane Closure Incidents	Message Elements for Freeway Closure Incidents
1. Lane Closure (Blockage	1. Freeway Closure (Blocked)
2. Lane Closure Location	2. Location of Closure
3. Diversion Action	3. Diversion Action
4. Audience for Action (if needed)	4. Audience for Action (if needed)

Table 8.19 Information Order of Priority for Roadwork

Message Elements For Lane Closure for Roadwork	Message Elements for Freeway Closure for Roadwork
1. Lane Closure (Blockage)	1. Freeway Closure (Blocked)
2. Lane Closure Location	2. Location of Closure
3. Action Concerning Speed Reductions	3. Action Concerning Speed Reductions
4. Diversion Action	4. Diversion Action
5. Audience for Action (if needed)	5. Audience for Action (if needed)

DMS Manual: pg 8-20   8-31

Designing Messages for Incidents and Roadwork

Modules 9 & 10

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

DMS Manual: pg 9-i &10-i   9&10-2

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

DMS Manual: pg 9-i &10-i   9&10-3

Procedure for Incidents

Lane Closure (Blockage)

1. Establish initial maximum allowable number of units of information based on DMS type and operating speeds

DMS Manual: pg 9-1   9&10-4

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

DMS Manual: pg 9-1   9&10-5

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

DMS Manual: pg 9-2   9&10-6

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

DMS Manual: pg 9-2   9&10-7

Procedure for Incidents

Lane Closure (Blockage)

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

DMS Manual: pg 9-2   9&10-8

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

DMS Manual: pg 9-4   9&10-9

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

DMS Manual: pg 9-5   9&10-10

Procedure for Incidents

Lane Closure (Blockage)

8. Adjust message to fit on existing DMS

DMS Manual: pg 9-5   9&10-11

Procedure for Incidents

Lane Closure (Blockage)

8. Adjust message to fit on existing DMS
9. Adjust message to fit on 3 lines or less

DMS Manual: pg 9-5   9&10-12

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

DMS Manual: pg 9-6   9&10-13

Procedure for Incidents

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

*   *Module 7: Establishing Maximum Message Length*

DMS Manual: pg 7-1   9&10-14

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…

DMS Manual: pg 7-1, 5-1, & 6-1   9&10-15

Modifying Messages to Improve Effectiveness

Module 12

Improving Message Effectiveness

Table 12.1 Incident Messages

Old Message		Recommended Message*		Notes
First Phase	Second Phase	First Phase	Second Phase	
ACCIDENT AHEAD USE CAUTION		ACCIDENT AT [location]		• It is best to give the location of the incident. Knowledge of the incident location is useful to motorists to make diversion and other driving decisions. • AHEAD is redundant and need not be displayed because it is understood by motorists that the accident is ahead on the freeway.
ACCIDENT AHEAD 21ST STREET USE CAUTION		ACCIDENT AT 21ST STREET LEFT 2 LANES CLOSED		• AT should be disaplced before the location of the incident. • Knowledge of the number of lanes closed is useful to motorists to evaluate the potential 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. • AHEAD is redundant and need not be displayed because it is understood by motorists that the accident is ahead on the freeway.
ACCIDENT AHEAD I-84 EXPECT DELAYS		ACCIDENT AT [location] LEFT 2 LANES CLOSED		• It is best to give the location of the incident rather than the information that the accident is on I-84. If the DMS is on I-84, it will be understood by motorists that the accident is on I-84 and it need not be displayed. • Knowledge of the incident location is useful to motorists to make diversion and other driving decisions. • Knowledge of the number of lanes closed is useful to motorists to evaluate the potential 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. • AHEAD is redundant and need not be displayed because it is understood by motorists that the accident is ahead on I-84.

* Assumes 3- or 4-line, 20 character per line DMS.

DMS Manual: pg 12-2

12-2

Improving Message Effectiveness

Old Message		Recommended Message*		Notes
First Phase	Second Phase	First Phase	Second Phase	
ACCIDENT AHEAD RIGHT LANES USE CAUTION		ACCIDENT AT [location] RIGHT 2 LANES CLOSED		• It is best to give the location of the incident rather than the information that the accident is ahead. Knowledge of the incident location is useful to motorists to make diversion and other driving decisions. • Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay. • AHEAD is redundant and need not be displayed because it is understood by motorists that the accident is ahead.
ACCIDENT AHEAD ONE RIGHT LANE OPEN	ACCIDENT AHEAD BROOK BRIDGE EXPECT DELAYS	ACCIDENT AT BROOK BRIDGE LEFT 2 LANES CLOSED		• The current message has five units of information and can be reduced to three units. • Knowledge of the number of lanes closed is useful to motorists to evaluate the potential 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. • AHEAD is redundant and need not be displayed because it is understood by motorists that the accident is ahead on the freeway.
ACCIDENT AHEAD REDUCE SPEED MERGE LEFT	RIGHT LANE CLOSED AHEAD DRIVE CAREFULLY	ACCIDENT AT [location] RIGHT LANE CLOSED		• The current message has five units of information and can be reduced to three units. • It is best to give the location of the accident. Knowledge of the accident location is useful to motorists to make diversion and other driving decisions. • Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay. • AHEAD is redundant and need not be displayed because it is understood by motorists that the accident is ahead on the freeway. • MERGE LEFT is redundant to RIGHT LANE CLOSED and can be omitted.

DMS Manual: pg 12-3

12-3

Improving Message Effectiveness

Old Message		Recommended Message[*]		Notes
First Phase	Second Phase	First Phase	Second Phase	
ALL LANES CLOSED AHEAD KEEP RIGHT		FREEWAY CLOSED EXIT AT[location] FOLLOW DETOUR		• *FREEWAY CLOSED* is used rather than *ALL LANES CLOSED* because it is shorter and means the same thing to motorists. • Telling motorists where to exit is useful. • Telling motorists to follow a detour that is set up because of the closure gives motorists the assurance that they will have positive guidance along the alternative route.
ACCIDENT IH-84 EAST AT ROWLAND	USE ALTERNATE ROUTES	ACCIDENT AT ROWLAND USE OTHER ROUTES		• If the DMS is located on I-84 East, the accident is understood to be on I-84 East and is need not be displayed. • *OTHER* is used rather than *ALTERNATE* because it is shorter and easier to read and will be understood by motorists.
		ACCIDENT ON I-84 EAST AT ROWLAND	USE OTHER ROUTES	• If the DMS is located on a cross freeway to I-84 East, then *ON I-84 EAST* must be displayed. • *I-84* should be used rather than *IH-84*. Human factors research by TTI revealed that motorists do not understand "IH."
IH-84 EAST ACCIDENT AT ROWLAND	USE ALTERNATE ROUTES	ACCIDENT AT ROWLAND USE OTHER ROUTES		• If the DMS is located on I-84 EAST, the accident is understood to be on I-84 EAST and is need not be displayed. • The problem *ACCIDENT* should always be on the top line. • *OTHER* is used rather than *ALTERNATE* because it is shorter and easier to read and will be understood by motorists.
IH-84 EAST ACCIDENT DOWNTOWN	TWO RIGHT LANES CLOSED	ACCIDENT PAST DOWNTOWN RIGHT 2 LANES CLOSED		• If the DMS is located on I-84 East, the accident is understood to be on I-84 East and is need not be displayed. • The problem *ACCIDENT* should always be on the top line. • *2* should be used rather than *TWO* because it is shorter and more easily read by motorists. • *PAST* is displayed in front of *DOWNTOWN* to reduce possibility of confusion as to the location of the accident.

DMS Manual: pg 12-4

12-4

Improving Message Effectiveness

Old Message		Recommended Message[*]		Notes
First Phase	Second Phase	First Phase	Second Phase	
IH-84 EB AT ROWLAND MAJOR ACCIDENT		MAJOR ACCIDENT AT ROWLAND 2 LANES CLOSED		• The incident should be displayed on the top line followed by the location. • The word *AT* should be separated from the first unit of information and be placed with the location of the incident (second unit of information). A message line should not contain portions of two different units of information. • Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay. • Human factors research conducted by TTI revealed that a large majority of Texas motorists do not understand the meaning of the abbreviation *ER*.
IH-84 EAST CLOSED AS ROWLAND	USE ALTERNATE ROUTES	FREEWAY CLOSED AT ROWLAND USE OTHER ROUTES		• *FREEWAY* is used rather than *I-84 EAST* because it is shorter and easier to read and is well understood to mean the freeway on which the motorist is traveling. • The word *CLOSED* from the first unit of information should be separated from the word *AT* from the second unit of information. A message line should not contain portions of two different units of information. • *OTHER* is used rather than *ALTERNATE* because it is shorter and easier to read.
IH-84 EB AT ROWLAND ACCIDENT	LEFT 2 LANES CLOSED EXPECT DELAY	ACCIDENT AT ROWLAND LEFT 2 LANES CLOSED		• If the DMS is located on I-84 EAST, the accident is understood to be on I-84 EAST and is need not be displayed. • The word *AT* should be separated from the first unit of information and be placed with the location of the incident (second unit of information). A message line should not contain portions of two different units of information. • Knowledge of the number of lanes closed is useful to motorists to evaluate the potential amount of delay. • *AHEAD* is redundant and need not be displayed because it is understood by motorists that the accident is ahead on I-84. • The abbreviation *ER* should not be used. Recent human factors studies conducted by TTI indicated that a large percentage of Texas motorists would not understand the abbreviation *ER*. • When two lanes are closed due to an accident, most motorists will *EXPECT DELAYS*. Thus, it can be omitted.

DMS Manual: pg 12-5

12-5

Improving Message Effectiveness

Old Message		Recommended Message[*]		Notes
First Phase	Second Phase	First Phase	Second Phase	
IH-84 EB AT ROWLAND FREEWAY CLOSED	AVOID DELAY USE ALTERNATE ROUTES	FREEWAY CLOSED AT ROWLAND USE OTHER ROUTES		• The current message has five units of information and can be reduced to three units. • The incident should be displayed on the top line followed by the incident location. • Human factors research conducted by TTI revealed that a large majority of Texas motorists do not understand the meaning of the abbreviation *ER*. • *OTHER* is used rather than *ALTERNATE* because it is shorter and easier to read and will be understood by motorists.
FREEWAY CLOSED AT ROWLAND MAJOR ACCIDENT	ALL TRAFFIC EXIT ROWLAND	FREEWAY CLOSED EXIT AT ROWLAND USE SERVICE RD		• The current message has five units of information and can be reduced to four units. • *FREEWAY CLOSED* is used rather than *MAJOR ACCIDENT* because it represents the immediate problem the motorists will face. • If the freeway is closed, the motorists will understand that *ALL TRAFFIC* must exit. The recommendation is to tell the motorists that they should *EXIT AT WASHINGTON* and then *USE SERVICE ROAD* to bypass the incident.
MAJOR ACCIDENT AT ROWLAND ON MAIN LANES	AVOID DELAY USE ALTERNATE ROUTE	MAJOR ACCIDENT AT ROWLAND USE OTHER ROUTES		• Information that the accident is *ON MAIN LANES* will be understood by motorists and it need not be displayed. • *OTHER* is used rather than *ALTERNATE* because it is shorter and easier to read. • The motorist would assume that if told to use other routes the motorist would avoid delay. Thus *AVOID DELAY* need not be displayed.
MAJOR ACCIDENT AT ROWLAND CLEARED AT 5:10	LEFT 2 LANES CLOSED EXPECT DELAY	MAJOR ACCIDENT AT ROWLAND CLEARED AT 5:10		• Conflicting information is given in the current message. The first message phase states that the accident was cleared at 5:10, the second phase states that two lanes are closed. The recommended message is based on the assumption that the former is true.

DMS Manual: pg 12-6

12-6

Message Design Example - Incident: Large DMS

Module 14

All Lanes Closed

DMS Manual: pg 14-2

14-2

All Lanes Closed

Define Situation
- **Analyze Incident and Incident Scene Characteristics**

DMS Manual: pg 14-3

14-3

All Lanes Closed

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

DMS Manual: pg 14-4

14-4

DMS #1: All Lanes Closed

Identify DMS Characteristics

DMS Manual: pg 14-4

14-5

DMS #1: All Lanes Closed

Identify DMS Characteristics
Review Conditions at DMS Location

DMS Manual: pg 14-4

14-6

DMS #1: All Lanes Closed

Identify DMS Characteristics

Review Conditions at DMS Location

Identify Diversion Route Characteristics

DMS Manual: pg 14-4

14-7

DMS #1: All Lanes Closed

DMS Manual: pg 14-2 &14-4

14-8

DMS #1: All Lanes Closed

Identify DMS Characteristics

Review Conditions at DMS Location

Identify Diversion Route Characteristics

Set Objectives

DMS Manual: pg 14-5

14-9

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

DMS Manual: pg 14-5

14-10

Step 1

Determine Freeway Operating Speed at the DMS Location.

Freeway speed is *30 mph*

DMS Manual: pg 14-5

14-11

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*

DMS Manual: pg 14-5

14-12

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

DMS Manual: pg 14-6   14-13

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   14-14

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   14-15

**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

DMS #1: All Lanes Closed
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 Manual: pg 14-6   14-19

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*

DMS Manual: pg 14-6   14-20

Define *Base DMS Message* to Satisfy Motorist Information Needs

DMS Manual: pg 14-6   14-21

DMS #1: All Lanes Closed

Step 12

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

Incident Descriptor: MAJOR ACCIDENT

DMS Manual: pg 14-6   14-22

DMS #1: All Lanes Closed

Step 13

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

Location: PAST I-22

DMS Manual: pg 14-6   14-23

DMS #1: All Lanes Closed

Step 14

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

Lanes Closed: ALL LANES CLOSED

DMS Manual: pg 14-6   14-24

DMS #1: All Lanes Closed

Step 15

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

DMS Manual: pg 14-7

14-25

DMS #1: All Lanes Closed

Step 16

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

DMS Manual: pg 14-7

14-26

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**

DMS Manual: pg 14-7

14-27

Step 21

Establish Whether *Action* Message Is for a Select Group of Motorists

"No." Go to Step 23

14-28

Step 23

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

"Yes." Go to Step 25

14-29

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

14-30

Reduce the Number of Message Units If Necessary

14-31

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

14-32

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

14-33

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 14-8

14-34

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

14-35

DMS #1: All Lanes Closed

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 Manual: pg 14-9

14-36

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

DMS Manual: pg 14-9

14-37

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

DMS Manual: pg 14-9

14-38

DMS #1: All Lanes Closed

Step 45

Review Message for Inconsistencies and Incompatibility
No inconsistencies in message

DMS Manual: pg 14-9

14-39

Step 46

Make Additional Adjustments if Necessary
No adjustments necessary

FREEWAY CLOSED
EXIT AT I-22
FOLLOW DETOUR

3 Units of Information

DMS Manual: pg 14-9   14-40

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**

DMS Manual: pg 14-9   14-41

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)

DMS Manual: pg 14-10   14-42

AMBER Alert

Module 15

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*

DMS Manual: pg 15-1   15-2

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)

DMS Manual: pg 15-3   15-3

---

1. Situation Descriptor

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

DMS Manual: pg 15-4   15-4

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

DMS Manual: pg 15-4   15-5

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

DMS Manual: pg 15-5   15-6

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

DMS Manual: pg 15-6   15-7

Priority of AMBER Alert Information

5. Tune To Radio

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

DMS Manual: pg 15-6   15-8

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 Manual: pg 16-1   16-2

DMS Messages

Traffic management component involves
- Closing access to the city (area)
- Evacuation of the city (area)

DMS Manual: pg 16-3   16-3

Closing Access to City/Area

Similar to roadway closures due to
  incidents/roadwork

DMS relatively close to event

```
I (XX) NORTH CLOSED
  AT (Location)
```

```
I (XX) NORTH CLOSED
  AT (Location)
 TUNE TO 530 AM
```

DMS Manual: pg 16-3

16-4

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

16-5

Evacuation of City/Area

```
HOV LANES OPEN
TO ALL TRAFFIC
```

DMS Manual: pg 16-4

16-6

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
  - http://tti.tamu.edu/documents/0-4962-P1.pdf

DMS Manual: no page reference   16-7

Stage 1: All Season

Phase 1

HURRICANE
SEASON
IS HERE

DMS Manual: no page reference   16-8

Stage 1: All Season

Phase 1

HURRICANE
SEASON
IS HERE

Phase 2

DO YOU KNOW YOUR EVACUATION ROUTE?	EVACUATION ROUTE INFORMATION CALL <phone # >	PLAN TO RIDESHARE WITH NEIGHBORS OR FAMILY
RIDESHARING REDUCES EVACUATION TRAFFIC	MAKE AN EVACUATION PLAN	IS YOUR VEHICLE MAINTENANCE UP TO DATE?
	YOUR EMERGENCY BROADCAST NETWORK IS xxxx AM	

DMS Manual: no page reference   16-9

Stage 2: Prior to Evacuation

Phase 1

```
HURRICANE
IN
GULF
```

DMS Manual: no page reference   16-10

Stage 2: Prior to Evacuation

Phase 1
```
HURRICANE
IN
GULF
```

Phase 2

EVACUATION ROUTE INFORMATION CALL <phone # >	RED CROSS SHELTER INFORMATION CALL <phone # >	PLAN TO RIDESHARE WITH NEIGHBORS OR FAMILY
RIDESHARING REDUCES EVACUATION TRAFFIC	REMEMBER TO TAKE MAPS IF EVACUATING	YOUR EMERGENCY BROADCAST NETWORK IS xxxx AM
	CHECK YOUR EVACUATION SUPPLIES	

DMS Manual: no page reference   16-11

Stage 3: Evacuation

Phase 1

```
HURRICANE
EVACUATION
IN PROGRESS
```

DMS Manual: no page reference   16-12

Stage 3: Evacuation

Phase 1

HURRICANE
EVACUATION
IN PROGRESS

Phase 2

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

DMS Manual: no page reference

16-13

Stage 4: Not Safe to Evacuate

Phase 1   Phase 2

GO TO
NEAREST
SHELTER

HURRICANE
LANDFALL
SOON

SEEK
SHELTER
NOW

EXTREME
WIND
WARNING

LOCAL SHELTER
INFORMATION
CALL< phone #>

DMS Manual: no page reference

16-14

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

DMS Manual: pg 17-1   17-2

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

DMS Manual: pg 17-1   17-3

Message Format for Passable

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

> **WATER ON FREEWAY**
> *(Water Location)*
> *(Action)*

DMS Manual: pg 17-2   17-4

1*. Water Descriptor*

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

DMS Manual: pg 17-2   17-5

---

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]

DMS Manual: pg 17-2   17-6

---

2. *Water Location (Cont.)*

Depends upon whether water is
- **Upstream of exit ramp**

    BEFORE [exit ramp name]

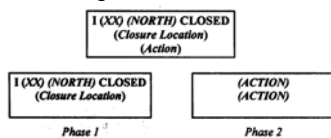DMS Manual: pg 17-3   17-7

3. *Action*

BE PREPARED TO STOP
USE CAUTION

DMS Manual: pg 17-3   17-8

Message Format for Flood

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


```
          I (XX) (NORTH) CLOSED
              (Closure Location)
                  (Action)

I (XX) (NORTH) CLOSED           (ACTION)
   (Closure Location)           (ACTION)

      Phase 1                   Phase 2
```

DMS Manual: pg 17-4   17-9

Ozone

Module 18

DMS Messages

Day prior to ozone action day

OZONE ACTION DAY TOMORROW	RIDE THE BUS (FREE) SHARE A RIDE
Phase 1	*Phase 2*

Option 1

OZONE ACTION DAY TOMORROW	REDUCE TRIPS WORK AT HOME
Phase 1	*Phase 2*

Option 2

DMS Manual: pg 18-1   18-2

DMS Messages

Day of ozone action day

OZONE ACTION DAY TODAY	REDUCE TRIPS WALK TO LUNCH
Phase 1	*Phase 2*

DMS Manual: pg 18-2   18-3

Planned Special Events
Module 19

Impacts & Strategies

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

DMS Manual: pg 19-1   19-2

Impacts & Strategies

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

DMS Manual: pg 19-1   19-3

DMS Messages – Driving to Event

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

DMS Manual: pg 19-3   19-4

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 Manual: pg 19-3   19-5

DMS Messages – Driving to Event

Informing of exits to take or routes to use

FAIR PARK
TAKE NEXT 2 EXITS

FAIR PARK
EXIT AT 2ND AVE

Example 1   Example 2

DMS Manual: pg 19-3   19-6

DMS Messages – Driving to Event

Divert to Alternative Route

FAIR PARK TAKE FITZHUGH AVOID MAJOR DELAY	FAIR PARK TAKE FITZHUGH SAVE 20 MIN	FAIR PARK TAKE FITZHUGH AVOID 20 MIN DELAY
Example 1	*Example 2*	*Example 3*

FAIR PARK BEST ROUTE USE FITZHUGH AVE
Example 4

DMS Manual: pg 19-4   19-7

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
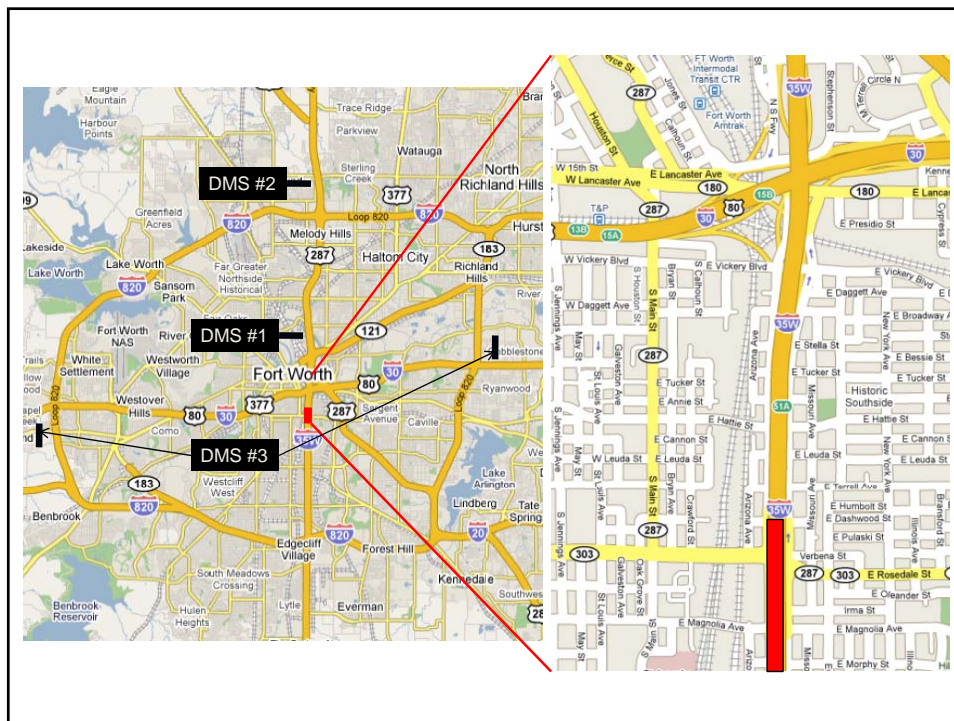
Rural Example

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)?