Research Report
KTC-01-14/SPR233-00-1F

KENTUCKY TRANSPORTATION CENTER

College of Engineering

Management and Effective Use of Changeable Message Signs
(Final Report)

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Management and Effective Use of Changeable Message Signs

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in cooperation with

Kentucky Transportation Cabinet
Commonwealth of Kentucky

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16. Abstract

Changeable message signs (CMS) are used to communicate accurate, timely, and pertinent information to travelers on Kentucky's roadways. This information helps travelers avoid hazards or delays and respond properly to changing roadway conditions. In an ideal environment, the Kentucky Transportation Cabinet (KYTC) would be able to allocate CMS to various areas of the state based upon changing needs. The location of each sign would be monitored, and the message could be controlled and checked remotely.

Currently these capabilities do not exist. KYTC has four different types of portable CMS in use throughout the state. Each type has different internal and external interfaces, and each requires different replacement parts. Also, there is no policy or guidelines in place for the use of these signs. The decision on how and when the CMS are used is made at the district level on a case-by-case basis.

This research effort includes an evaluation of Kentucky's current inventory and usage of CMS, identification of key issues associated with the signs, and identification of state and regional policies on the management and use of CMS. Recommended guidelines for the management and use of CMS are included in this report.

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EXECUTIVE SUMMARY

Changeable message signs (CMS) are used to communicate accurate, timely, and pertinent information to travelers on Kentucky's roadways. This information helps travelers avoid hazards or delays and respond properly to changing roadway conditions. In an ideal environment, the Kentucky Transportation Cabinet (KYTC) would be able to allocate CMS to various areas of the state based upon changing needs. The location of each sign would be monitored, and the message could be controlled and checked remotely.

Currently these capabilities do not exist. KYTC has four different types of portable CMS in use throughout the state. Each type has different internal and external interfaces, and each requires different replacement parts. Also, there is no policy or guidelines in place for the use of these signs. The decision on how and when the CMS are used is made at the district level on a case-by-case basis.

This research effort includes an evaluation of Kentucky's current inventory and usage of CMS, identification of key issues associated with the signs, and identification of state and regional policies on the management and use of CMS. Recommended guidelines for the management and use of CMS are included in this report.

ACKNOWLEDGMENTS

The authors would like to thank the Study Advisory Committee for their invaluable direction and input throughout this project. Thanks also to the district offices for providing detailed information for the statewide CMS inventory.

1.0 INTRODUCTION

Changeable message signs (CMS), also called variable message signs or dynamic message signs, are used to communicate accurate, timely, and pertinent information to travelers on Kentucky's roadways. Using these signs, messages can be displayed to convey specific information about existing conditions. This can help travelers avoid hazards or delays and respond properly to changing roadway conditions.

In an ideal environment, the Kentucky Transportation Cabinet (KYTC) would be able to dynamically allocate its changeable message signs to various areas of the state, shifting resources as necessary to respond to changing demands. The location of each sign would be monitored from a central location, and KYTC would be able to remotely monitor and change the message displayed on each CMS. Travelers would be provided with simple, accurate, timely, and pertinent information.

Unfortunately, such capabilities do not exist today. KYTC currently has four different types of portable CMS in use throughout the state. Each type has different software, electronics, and external interfaces, and each requires different replacement parts. As a result, KYTC is severely hampered in its ability to effectively manage its CMS resources. Substantial problems exist with regard to sign maintenance, interoperability, allocation, and external connectivity.

There is also concern as to how and when CMS are used and the types of messages that should be displayed on them. The district offices within KYTC get numerous requests for the use of the signs, and currently there is no policy or guidelines in place for the use of them. Therefore the decision on how the signs may be used is made at the district level on a case-by-case basis.

1.1 OBJECTIVE

The objective of this research effort is to develop recommendations for the management and use of CMS resources to achieve optimum efficiency and effectiveness. This will be accomplished by evaluating Kentucky's current inventory and usage of CMS, identifying key issues and problems associated with CMS, and identifying other state or regional policies on the management and operation of CMS.

2.0 PROCEDURE

The work for this project was accomplished in five major tasks.

Task 1: A detailed inventory of Kentucky's CMS was prepared.

Task 2: Available literature was reviewed to ascertain what steps other states have taken to achieve effective management and operation of CMS resources. This task included the identification and review of state and regional policies regarding the use of CMS and the messages displayed on them.

Task 3: Key stakeholders were identified and a focus group session was held to identify key issues, challenges, and opportunities related to management and operation of Kentucky's CMS resources.

Task 4: A set of alternatives was generated for Kentucky to achieve optimum management and operation of CMS resources. These alternatives were evaluated by the project team and by the key stakeholders identified in Task 3.

Task 5: A set of recommended strategies was developed and presented to the KYTC in a final report.

2.1 TASK 1: INVENTORY

The Study Advisory Committee (SAC) recommended specific items of information to include as part of the inventory. Based on their input, a spreadsheet was developed to collect the following information for each CMS: District, Division, and Crew Assignment; Manufacturer; Model, Serial, and State-Assigned Numbers; Power Source; Manufactured Date; Number of Lines and Characters for Display; Trailer Tire Size; Remote Communication Capability; Cellular Provider and Phone Number; Condition of the Sign (Good, Fair, Poor); Problems with the Sign; and Additional Comments. Since the CMS are controlled and maintained at each of the District Offices, the Operations Branch Manager in each district was initially contacted to collect this information. The spreadsheet was distributed by email or fax to each Operations Branch Manager or his designated point-of-contact.

2.2 TASK 2: LITERATURE AND INTERNET SEARCH

A literature and Internet search was performed to obtain information regarding the use and management of CMS. Staff at the Kentucky Transportation

Center (KTC) library performed a national search for policies, articles, and reports concerning the management and use of CMS. Guidelines from 12 states were reviewed. In addition, the Manual on Uniform Traffic Control Devices (MUTCD) and the American Traffic Safety Services Association (ATSSA) policies were reviewed. Recommendations for the use, non-use, placement, and message design pertaining to CMS were compared and analyzed.

2.3 TASK 3: FOCUS GROUP SESSION

Stakeholders with interest in the management and use of CMS were identified and invited to participate in a focus group meeting. See Appendix A for a list of those who attended the meeting. Participants were given a brief overview of the purpose of the study. They were also provided with some information on the inventory in Kentucky and the guidelines in place by other states or organizations. The participants were then divided into two groups: policy and technical. The policy group dealt with the issues surrounding how and when the CMS would be used and the types of messages displayed on them. The technical group focused on the technical barriers preventing compatibility and efficient management of the CMS.

Each group was asked to brainstorm regarding issues or problems related to CMS in their specific areas (management or use). Each person in the group discussed three of his or her own issues with the rest of the group. Once all the issues were discussed, the list was refined and the issues were grouped into categories.

Next, each person voted for five issues they felt were most important, and the issues were ranked based upon the voting. Each group was then broken into two working teams (for a total of four working teams) and asked to address several selected issues. The two working teams within the policy group were asked to identify guidelines or policy that would address their issues. The two working teams within the technical group were asked to identify solutions that would address their issues. A spokesperson from each team was then asked to present the ideas of their team to everyone in attendance.

2.4 TASK 4: GENERATING ALTERNATIVES

A set of alternatives was drafted based upon the solutions and guidelines developed by the focus group participants and the information collected during the literature and Internet searches. These alternatives were reviewed and revised as necessary by the KTC project team.

2.5 TASK 5: RECOMMENDED STRATEGIES

The alternatives were presented to the study advisory committee in the form of recommendations. They were approved with a few modifications. The recommendations are presented in section 4.0 of this report.

3.0 RESULTS

3.1 TASK 1: INVENTORY

There are 118 CMS in the state assigned to various districts. Two of those have not been located and two are assigned to the Drive Smart program. (Drive Smart is a public safety program within the Kentucky Transportation Cabinet Division of Driver Safety.) Figure 1 shows how the CMS are assigned by district.

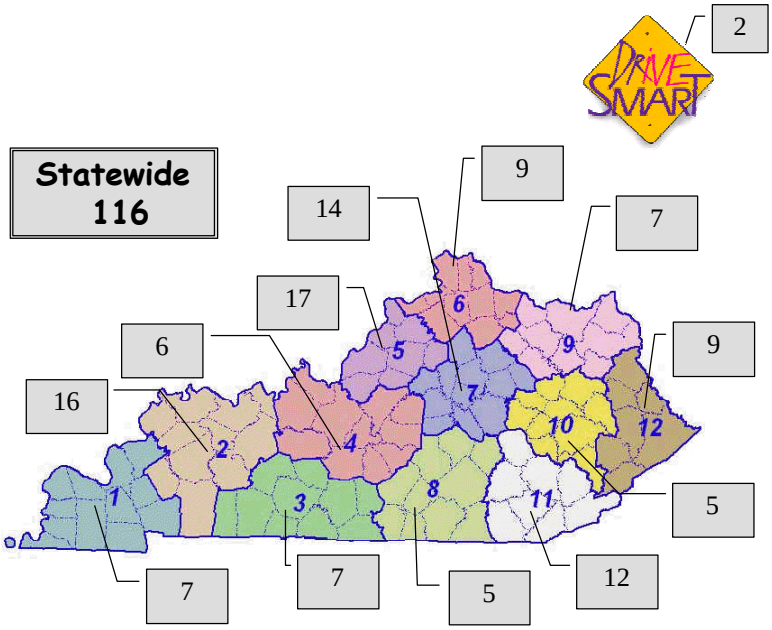

Figure 1. CMS Assignment by District

There are four manufacturers supplying CMS to Kentucky. The majority of signs are manufactured by Addco (64 signs, 55%). Thirty-seven (32%) are Precision Solar Controls, 11 (9%) are Wanco, and 4 (4%) are American Signal Company signs.

All of the signs are battery powered with solar backup and have 3 text lines capable of displaying a total of 24 characters. All use light-emitting diode (LED) display technology.

Twenty-seven signs need a state-assigned number. (These signs are new or have not been documented in a previous inventory.) These signs are found in districts 5, 7, 8, 10 and 11. Two of the twenty-seven signs are assigned to Drive Smart.

Eighty-six of the signs have a communication component, but only 45 of those are activated. Thirty signs do not have a communication component at all. The cellular provider varies by district.

Based upon the condition of the CMS as reported by the districts, the signs were labeled "good", "fair", or "poor". "Good" implies that the sign is functioning properly. "Fair" implies that the sign is usable, but is not functioning to its fullest extent. A sign classified as "poor" means that the sign is not functioning. A few of these signs in the "poor" category may function after repair; others have been junked for parts.

The inventory was collected and summarized in an Excel spreadsheet. The contents of that spreadsheet are attached in Appendix B.

3.2 TASK 2: LITERATURE AND INTERNET SEARCH

The Internet and literature searches resulted in the review of 12 state policies, the MUTCD guidelines, and the ATSSA guidelines. Of those that were reviewed, most made recommendations on the appropriate use, placement, and message type for CMS. Each policy reviewed is summarized in Appendix C.

3.3 TASK 3: FOCUS GROUP SESSION

The major issues/problems from the focus group session are summarized in Table 1 on the following page. The policy working groups developed guidelines to address these issues and the technical working groups developed solutions to meet their problems. The policy and technical work reports can be found in Appendix D.

Policy	Technical
1. Use only when violating expectations	1. Who repairs them?
2. Signs used too much	2. Software compatibility
3. Use for special events	3. Hardware compatibility
4. Standards messages and placement	4. Communication requirements

5. Clear and concise messages	5. Cost/availability of parts
6. Use for emergency	6. Difficulty programing messages
7. Don't use for unnecessary notification	7. Verification of message status
8. Use for advance notice of temporary road closures	8. Policy on use
9. Warning devices for traffic flow changes	9. No reliable communication path
10. Jurisdiction of control	10. Towing truck
11. Balance safety and visibility	11. Life of LEDs
12. Crash incident management	12. Specification development
13. Delay time	
14. Communicate remotely with sign	
15. Duration of crash hazard	
16. Standardize mechanics of usage	
17. Symbols are better	
18. Major roadways requiring lane closures	
19. Maintenance activities with closures	
20. Pavement conditions	
21. Don't use for weather	
22. Not for time, temperature, or slogans	
23. No advertising	
24. Not for speed limits	

Table 1. Major Issues Addressed by the Policy and Technical Working Groups

4.0 RECOMMENDATIONS

KTC makes the following recommendations with regard to the management and use of changeable message signs (CMS) in Kentucky:

4.1 MANAGEMENT

4.1.1 Specifications

1. The Kentucky Transportation Cabinet should develop their own specifications for CMS.
    A. This effort should be led by a qualified consultant with input from District and Central Office representatives, as appropriate.
    B. Special items that need to be included in the specifications:

i. Training on use and repair from the manufacturer
ii. List of replacement parts to be provided with the sign
iii. Requirements for programming with an emphasis on user-friendliness
iv. Ability to operate the sign remotely
v. Technical specifications/warranty for LEDs
vi. Compatibility with the National Cooperative Highway Research Program (NHCRP) Report #350
vii. Compatibility with National Transportation Communications for ITS Protocol (NTCIP) standards
viii. Requirements for software that is compatible with KYTC's computer operating platform

4.1.2 Repair

1. An in-house repair shop should be established by KYTC in a central location for the district offices.
    A. Spare parts should be stored at this location.
    B. Technicians will learn from experience, but should also have basic training from the manufacturer of the signs.
2. Basic repair should be done at the district level.
    A. Technicians at each district office should receive training from the manufacturer.
3. Work should be contracted out in special situations.

4.1.3 Testing

1. Testing of the equipment should be done in the factory to ensure the signs meet the developed specifications.
    A. The Division of Equipment should continue to recheck equipment upon receipt from the vendor.
2. Signs turned over to the KYTC from a contractor shall meet KYTC Division of Construction specifications prior to acceptance by KYTC.
3. Certification for the LEDs should be obtained from the manufacturer.

4.1.4 Towing

1. A four-wheel drive vehicle is recommended for towing the signs.
2. A class 3 hitch and electrical hookups are required.

4.1.5 Communications

1. Direct power and communication hookups should be provided at locations where CMS are frequently used.

2. A camera should be deployed to verify the message with semi-permanent and permanent installations.
3. Software should continue to be used for message verification.
4. KYTC should create a statewide data radio network to support communications for the signs and other applications.

4.1.6 Old Signs

1. Old signs should be retrofitted to be compatible with the new specifications, if cost effective. Otherwise, a target date should be established for all old signs to be phased out.

4.1.7 Control of the Signs

1. The district offices should retain primary control of the CMS assigned to them.
2. The Chief District Engineer should follow the basic guidelines for use of the signs, but will have final say as to the use of the CMS in his/her own district.
3. The district offices should begin keeping track of the time and money spent on maintenance of the signs.
4. The Statewide Transportation Operations Center will coordinate effort between the districts.

4.2 USE

1. The Kentucky Transportation Cabinet should publish guidelines for the use of changeable message signs.
2. These guidelines should provide highway personnel with general information on the application, placement, and operation of CMS.

The Kentucky Transportation Center makes the following recommendations for guidelines based upon current CMS standards and practice from many sources, including the FHWA, other state DOTs, the MUTCD, and the ATSSA. It is understood that each CMS installation or use requires individual consideration due to the specific location or purpose. However, there will be elements that are constant in nearly all applications. Accordingly these recommended guidelines bring a level of uniformity, while still being open to regional experience and engineering judgement.

4.2.1 Application

The primary purpose of CMS is to advise the driver of unexpected traffic and routing situations. Examples of applications where CMS can be effective include:

- Closures (road, lane, bridge, ramp, shoulder, interstate)
- Changes in alignment or surface conditions
- Significant delays, congestion
- Construction / maintenance activities (delays, future activities)
- Detours / alternate routes
- Special events with traffic and safety implications
- Crash / incidents
- Vehicle restrictions (width, height, weight, flammable)
- Advance notice of new traffic control device
- Real-time traffic conditions (must be kept up-to-date)
- *Public service announcements that improve highway safety
- Emergency situations
- Referral to HAR (if available)

* Use the CMS for special campaigns that will have a specified beginning and ending date. The CMS should not be used for more than 3 weeks with any special campaign.

CMS should not be used for:

- Replacement of static signs (e.g. road work ahead), regulatory signs (e.g. speed limits), pavement markings, standard traffic control devices, conventional warning or guide signs
- Replacement of lighted arrow board
- Advertising (Don't advertise the event unless clarifying "action" to be taken by driver. - e.g. Speedway traffic next exit)
- Generic messages (e.g. have a nice day, welcome to our state)
- Test messages (portable CMS)
- Weather related activities (e.g. anti-icing, deicing)
- Describing recurrent congestion (e.g. rush hour)
- Time and temperature
- Public service announcements (general traffic safety and/or non-traffic-related announcements)

4.2.2 Messages

Basic principles that are important to providing proper messages and insuring the proper operation of a CMS are:

- Visible for at least ½ mile under ideal daytime and nighttime conditions
- Legible from all lanes at a minimum distance of 650 feet
- Entire message readable twice while traveling at the posted speed
- Two message panels should be used. (Three panels may be used on roadways where vehicles are traveling less than 45 mph.)

- Each panel should convey a single thought; short and concise
- Don't use two unrelated panels on a sign
- Don't use the sign for two unrelated messages
- Should not scroll horizontally or vertically
- Should not contain both the words *left* and *right*
- Use standardized abbreviations and messages (See Appendix E for a list of standard abbreviations and messages.)
- Should be accurate and timely
- Avoid filler/unnecessary words and periods (caution, danger, hazardous, a, an, the)
- Avoid using local names or landmarks
- Avoid numeric speeds
- Use words (not numbers) for dates
- With 2 message panels, use the following format: panel 1 – "problem/distance" and panel 2 – "action"
- With 3 message panels, use the following format: panel 1 – "problem", panel 2 – "distance", and panel 3 – "action"

4.2.3 Placement

Placement of the CMS is important to insure that the sign is visible to the driver and provides ample time to take any necessary action. The basic principles of placement for a CMS are:

- *When 2 signs are needed, place on the same side of the roadway and at least 1,000 feet apart
- Place behind semi-rigid/rigid protection (guardrail, barrier) or outside of the clear zone
- *Place 1,000 feet in advance of work zone
- Place at least one mile ahead of decision point
- Signs should not be dual mounted (one on each side of roadway facing same direction)
- Point trailer hitch downstream
- Secure to immovable object to prevent theft (if possible)
- Do not place in sags or just beyond crests
- Check for reflection of sun to prevent the blinding of motorists
- Should be turned ~3° from perpendicular toward the edge of the pavement
- Bottom of sign shall be 7 feet above the elevation of edge of roadway
- Should be removed when not in use

* These principles are only applicable to controlled access roadways. For all other types of roadways, the speed of the vehicle should be considered for placement of the CMS.

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APPENDICES

APPENDIX A

Focus Group Participants

Last Name	First Name	Organization	District	Division
Albright	Nancy	Kentucky Transportation Cabinet	Central Office	Operations/ITS
Anderson	Glenn	Kentucky Transportation Cabinet	Central Office	Operations/ITS
Arvin	Randall	Kentucky Transportation Cabinet	11	Operations
Blackburn	Jason	Kentucky Transportation Cabinet	10	
Booker	Trevor	Kentucky Transportation Cabinet	Central Office	Construction
Bowling	Gene	Kentucky Transportation Cabinet	7	
Coe	Jason	Kentucky Transportation Cabinet	8	
Cornette	Donnie	Kentucky Transportation Cabinet	2	Traffic
Crossfield	John	Kentucky Transportation Cabinet	Central Office	Operations/ITS
Cunningham	Charles	Kentucky Transportation Cabinet	Central Office	Operations/ITS
Francis	Jim	Kentucky Transportation Cabinet	5	Operations
Hans	Rob	Kentucky Transportation Cabinet	6	
Hood	Todd	TRIMARC		
Jobe	Tom	Kentucky Transportation Cabinet	4	Operations
Knowles	Chuck	Kentucky Transportation Cabinet	Central Office	Operations
Leach	David	Kentucky Transportation Cabinet	9	
Lowe	Jerry	Kentucky Transportation Cabinet	12	Operations
Raymer	Gary	Kentucky Transportation Cabinet	4	Construction
Resig	Phil	Kentucky Transportation Cabinet	Central Office	Equipment
Sweger	Brent	Federal Highway Administration		
Thomas	Allen	Kentucky Transportation Cabinet	1	Operations
Wolfe	Jeff	Kentucky Transportation Cabinet	Central Office	Traffic

APPENDIX B

Kentucky CMS Inventory

(see excel spreadsheet for now)

APPENDIX C

Summary of Reviewed Guidelines

STATE:	**Illinois (1)**
PURPOSE:	To advise the driver of unexpected traffic and routing situations.
USE:	♦ significant delays ♦ changes in alignment or surface conditions ♦ special speed control measures ♦ lane closures where sight distance is restricted and or congestion occurs ♦ road or ramp closures with or without detours ♦ accident and incident management requiring display of special messages ♦ advisories and advance notice of construction activities
PROHIBITED USE:	♦ lighted arrow replacement ♦ advance notice of new traffic signal or sign ♦ advertising of any kind ♦ replacement of required static signing or pavement markings
PLACEMENT:	♦ when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet ♦ activated 1,000 feet in advance of a work zone unless heavy truck traffic then three to five miles may be warranted ♦ should not be placed closer than 6 feet or farther than 20 feet from the edge of the travel lane; however, farther is better ♦ the bottom of the sign should be 7 feet above the elevation of the edge of the roadway ♦ should be turned ~3 degrees from perpendicular toward the edge of pavement
MESSAGE DESIGN:	♦ visible for at least ½ mile under ideal daytime and nighttime conditions ♦ legible for a minimum of 750 feet for traffic on all lanes and remain legible for at least 650 feet up to 100 feet from the CMS ♦ entire message readable twice while traveling at the posted speed ♦ recommended that no more than 2 message screens be used ♦ each screen should convey a single thought ♦ messages should not scroll horizontally or vertically ♦ blank screens should not be used unless turned off ♦ sensational incident information should be avoided ♦ should not contain both the words *right* and *left*
OTHER	A list of "template" messages was provided.

STATE:	**Indiana (1)**
PURPOSE:	To provide nonstandard, appropriate, and timely information to motorists.
USE:	♦ supplemental traffic control device in construction areas
PROHIBITED USE:	♦ replacement of standard traffic control devices ♦ display of generic messages such as “Drive Safely” or “Have a Nice Day”
PLACEMENT:	♦ normally on right side of roadway ♦ should never be dual mounted (one on each side of roadway) facing the same direction ♦ when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet ♦ the bottom of the sign should be 7 feet above the elevation of the edge of the roadway ♦ desirable to place CMS behind a guard rail or as far from the travel lane as is feasible
MESSAGE DESIGN:	♦ entire message readable twice while traveling at the posted speed ♦ recommended that no more than 2 message screens be used ♦ should be short and concise ♦ should answer the questions: when, what, where ♦ abbreviated words should be limited to common abbreviations ♦ must be accurate and timely
OTHER:	

STATE:	**Iowa (1)**
PURPOSE:	To advise the motorist of unexpected traffic and routing situations
USE:	♦ supplemental traffic control device in construction areas
PROHIBITED USE:	♦ replacement of standard road work sign ♦ advertising special events ♦ replacement of regulatory speed limit signs ♦ replacement of an advance arrow panel ♦ happy messages such as “Have a Good Day” or “Drive Safely”
PLACEMENT:	♦ off of the outside shoulder of the highway ♦ the bottom of the sign should be 7 feet above the elevation of the edge of the roadway ♦ should be turned ~3 degrees from perpendicular toward the edge of the pavement ♦ should never be dual mounted (one on each side of roadway) facing the same direction ♦ when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet
MESSAGE DESIGN:	♦ legible for at least 650 feet ♦ visible for at least ½ mile under ideal daytime and nighttime conditions ♦ no more than 2 message panels be used for any message cycle ♦ each panel should convey a single thought ♦ messages should be as brief as possible ♦ abbreviations should be easily understood ♦ entire message readable twice while traveling at the posted speed ♦ messages should not scroll horizontally or vertically ♦ must be accurate and timely
OTHER:	

STATE: **Michigan (1)**

PURPOSE:

USE:
- ramp and lane closures
- freeway closures
- planned maintenance work
- detour or alternate routes
- special event traffic conditions
- incident management
- notice of operations – obstructed view
- construction zone traffic backups

PROHIBITED USE:
- replacement of an advance arrow panel
- advertising
- advance notice of new traffic signal or sign
- replacement of required static signing or pavement markings

PLACEMENT:
- when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet

MESSAGE DESIGN:
- no more than 2 message panels be used for any message cycle
- clear and concise
- must be readily understood by drivers
- describe the road work or incident location
- when using dates, use words not numbers
- use default message ("Drive Safely") when power is lost
- when not in use, turn off
- keep abbreviations to a minimum

OTHER:

STATE: **Minnesota (1)**

PURPOSE:

USE:
- in conjunction with conventional signs, pavement markings, and lighting

PROHIBITED USE:
- lighted arrow replacement
- regulatory messages
- advertising of any kind
- replacement of required static signing or pavement markings

PLACEMENT:
- when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet
- typically are placed on the shoulder of the roadway; however, further from the traveled lane is desirable
- the bottom of the sign should be 7 feet above the elevation of the edge of the roadway
- placed only on one side of the roadway but either right or left is acceptable

MESSAGE DESIGN:
- visible for at least ½ mile under ideal daytime and nighttime conditions
- legible for a minimum of 750 feet for traffic on all lanes and remain legible for at least 650 feet up to 100 feet from the CMS
- entire message readable twice while traveling at the posted speed
- no more than 2 displays are used with any message cycle
- each screen should convey a single thought
- messages should not scroll horizontally or vertically
- reliable up-to-date information
- correct delay times, if given
- the work or incident location is accurately described
- abbreviations are easily understood or words are spelled out

OTHER:

STATE: **New York (1, 2)**

PURPOSE: Convey information that is: critical in nature; requires motorists to alter their driving in some manner and take specific action as a result; enables motorists to safely and conveniently reach their destinations on current or future trips; and assists in the protection of personnel in construction and maintenance work zones or inspection sites.

USE:
- congestion
- changes in travel speeds or travel lanes
- alternate routes
- special events
- weather
- construction / maintenance
- incidents / accidents
- inform of a change in current or future traffic conditions
- supplemental static signs, particularly in construction areas
- public service campaigns (e.g. seat belt use, DWI, ozone alerts)

PROHIBITED USE:
- tell motorists something they already know
- display unnecessary information such as "Please Be Careful, Drive Safely" unless default message
- information that is so specific it gives motorists a false sense of security
- advertising

PLACEMENT:
- when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet
- should be turned ~3 degrees from perpendicular toward the edge of pavement
- as a security measure, if a CMS is to be stationed in one location for any length of time, it should be secured to an immovable fixed object
- if used to inform motorists of a traffic diversion, the CMS should be located at least one mile in advance of the interchange or intersection
- should be placed on the right side of the roadway whenever possible
- should be placed behind a guardrail or barrier for protection; otherwise they should be located outside of the clear recovery area
- should not be located and operated simultaneously on both the right and left sides of the roadway

MESSAGE DESIGN:
- visible for at least ½ mile under ideal daytime and nighttime conditions
- upstream sight distance should be between 650 feet and 1000 feet
- legible from all lanes of traffic for at least 650 feet in advance of the sign
- entire message readable twice while traveling at the posted speed
- use only one screen if possible but no more than 2 message screens if not
- each screen should convey a single thought
- messages should be accurate and up-to-date
- clear and concise
- should not reference a time frame for how long the incident may last
- if HAR is available, message should refer motorists to HAR

- VMS should have a display at all times

OTHER:

As technology advances and the cost of CMS systems comes down, it is conceivable that these systems could be used for commercial purposes. This concern has been noted and appropriate action will be taken if it becomes necessary under Section 1114 of the New York Vehicle and Traffic Law.

New York has a list of standard approved words, messages, and abbreviations for the use of their VMS.

STATE: **North Carolina (1, 3)**

PURPOSE: To advise the driver of unexpected traffic and routing situations.

USE:
- accident and incident management
- ramp, lane, or roadway closures
- changes in alignment or surface conditions
- significant expected traffic delays
- expected decrease of traffic speed
- new detours
- changes to detours
- adverse environmental conditions
- advanced notice for scheduled incidents or construction activity
- other public information that assists the DOT in improving highway safety and reducing congestion

PROHIBITED USE:
- advertising of any kind
- replacement of conventional warning or guide sign

PLACEMENT:
- when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet
- should not be placed closer than 6 feet or farther than 20 feet from the edge of the travel lane
- the bottom of the sign should be 7 feet above the elevation of the edge of the roadway
- should be turned ~3 degrees from perpendicular toward the edge of pavement
- do not place in sags or just beyond crests
- if facing east or west, should be checked to ensure that the reflection of the sun does not blind motorists
- should be placed behind existing rigid or semi-rigid protection; if not feasible, should be delineated with drums
- normally should be placed on the right side of the roadway

MESSAGE DESIGN:
- visible for at least ½ mile under ideal daytime and nighttime conditions
- legible from all lanes at a distance of 1000 feet
- entire message readable twice while traveling at the posted speed
- recommended that no more than 2 message screens be used
- each screen should convey a single thought
- messages should be as brief as possible
- messages should not scroll horizontally or vertically
- should not contain both the words *right* and *left* in same sequence
- screen should remain blank when not displaying a listed message
- avoid filler words (e.g. ahead, caution)
- use standard abbreviations familiar to the driver population
- slowly flashing the problem statement should attract attention; however, do not flash a large portion of text or flash at fast intervals

OTHER: A programming sheet was provided. A reading time of a CMS was provided. Standard abbreviations and typical messages were provided.

STATE: **Oregon (1, 4)**

PURPOSE: To provide information for motorists to make rapid decisions in response to traffic and/or adverse weather conditions.

USE:
- accident and incident management
- ramp, lane, or roadway closures
- drawbridge operations
- emergency situations
- construction / maintenance operations
- adverse weather / environmental conditions events
- traffic operations information associated with special events
- public service announcements
- travel time information (discouraged on portable CMS)
- travel-related information directed at individual vehicles (permanent CMS only)
- special events
- messages relating to changes in public law

PROHIBITED USE:
- advertising of any kind, including tourist information
- public service announcements (portable CMS)
- test messages (portable CMS)

PLACEMENT:
- visible for at least ½ mile under ideal daytime and nighttime conditions
- legible from all lanes at a distance of 1000 feet
- should be placed on the shoulder of the roadway or if practical, can be placed beyond the clear zone
- when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet

MESSAGE DESIGN:
- use common abbreviations that are easily understood
- eliminate unnecessary words (e.g. a, an, the)
- eliminate the use of the period when the meaning or intent of the message is not sacrificed
- message length should be limited to eight words
- numeric speeds as part of the message should be avoided
- reference to an exit number is preferred over actual distances
- local names or landmarks should be avoided as much as possible
- message should not project road conditions more than 24 hours in advance
- recommended that no more than 2 message screens be used
- default message is “blank”
- entire message readable twice while traveling at the posted speed

OTHER: Sample message displays were provided.

STATE:	**Texas (5, 6)**
PURPOSE:	To provide driver with enough information to make rapid decisions.
USE:	♦ accident and incident management ♦ route diversion ♦ construction / maintenance operations ♦ adverse weather / environmental conditions events ♦ traffic operations information associated with special events
PROHIBITED USE:	♦ tell motorists something they already know
PLACEMENT:	♦ legible from all lanes at a distance of 1000 feet ♦ when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet
MESSAGE DESIGN:	♦ use common abbreviations that are easily understood ♦ eliminate unnecessary words (e.g. ahead) ♦ message length should be limited to eight words ♦ recommended that no more than 2 message screens be used ♦ entire message readable twice while traveling at the posted speed ♦ asterisks should be displayed at the end of the message cycle to positively separate repetitions of the message ♦ names describing certain special activities should be displayed rather than the location where the activity is being held ♦ symbols and logos should not be used
OTHER:	Standard abbreviations were provided.

STATE:	**Virginia (1, 7, 8)**
PURPOSE:	To advise motorists of changed traffic conditions.
USE:	♦ accident/incidents ♦ congestion ♦ work zones ♦ shoulder, bridge, lane, or roadway closures ♦ weather related conditions ♦ pedestrians or bicyclists ♦ alternate route ♦ special events ♦ future events (e.g. work zone, special event)
PROHIBITED USE:	♦ advertising ♦ replacement of an arrow board ♦ greetings or general safety statements (e.g. "Please Drive Safely")
PLACEMENT:	♦ when 2 signs are needed they should be separated by at least 1,000 feet ♦ prior to major decision point ♦ prior to present and expected traffic backups ♦ sight distance should be at least 1000 feet ♦ should be placed off the shoulder ♦ placed on side of roadway closest to affected travel lane (normally on right side of the roadway)
MESSAGE DESIGN:	♦ legible from all lanes at a distance of 650 feet ♦ entire message readable twice while traveling at the posted speed ♦ sensational incident information should be avoided ♦ recommended that no more than 2 message screens be used ♦ "Delay" or "Congestion" should not be used unless followed by a distance or location ♦ each screen should convey a single thought ♦ should not contain both the words *right* and *left* in same sequence ♦ screen should remain blank when not displaying a message ♦ avoid unnecessary information (e.g. slow, caution, please be careful) ♦ use standard abbreviations that are easily understood ♦ only use well-known symbols and words
OTHER:	Recommended abbreviations were provided. A readable distance chart and equation for the CMS was provided.

STATE: **Washington (1)**

PURPOSE:

USE:

- regulatory and lane control
- traffic restrictions (prohibition of vehicles from using a roadway)
- lane, ramp or roadway closures
- bridge draw span openings
- flammable restrictions
- weight, height, width restrictions
- incidents
- disabled vehicles and accidents
- special events
- supplement to construction traffic control
- detours
- advanced notice for high-impact closures
- only freeway or transportation related events or services should be considered for PSAs
- display phone numbers of the commuter information line, carpool matching, and transit
- public transit information and rideshare promotions

PROHIBITED USE:

- describe recurrent congestion (normal day to day backups)
- weather or driving conditions
- public service announcements other than traffic related should be avoided

PLACEMENT:

MESSAGE DESIGN:

OTHER:

STATE: **Wisconsin (1, 9)**

PURPOSE:

USE:
- display real-time or changing condition information
- ramp, lane, or roadway closures
- advisory speeds
- alternate route advisories
- supplemental device to a required static sign
- special events messages if specific provisions are met

PROHIBITED USE:
- replacement of static warning or regulatory signs
- generic messages not pertaining to specific work zones or special events (e.g. Buckle Up, Welcome To Wisconsin)

PLACEMENT:
- should be placed as far away from the live traffic lanes as possible
- for freeway maintenance work, place the sign on the shoulder

MESSAGE DESIGN:
- entire message readable twice while traveling at the posted speed
- recommended that no more than 2 or 3 message screens be used
- the first screen should describe the traffic condition ahead and the second screen should advise the driver of the appropriate action to take
- avoid nonstandard words such as “danger”, “hazardous”, or “caution”
- if traffic is moving slowly, indicate “Expect No Delays” or “Traffic Moving Smoothly”, or have a blank screen

OTHER:

Manual on Uniform Traffic Control Devices (MUTCD) (10)

PURPOSE: To advise the road user of unexpected situations.

USE:
- ramp, lane, or roadway closures
- crash or emergency incident management
- width restriction information
- changes in alignment or surface conditions
- significant expected traffic delays
- speed reductions
- advisories on work scheduling
- road user management and diversion
- warning of adverse environmental conditions
- operation control

PROHIBITED USE:
- replacement of conventional signs or pavement markings

PLACEMENT:
- when 2 signs are needed→ same side of roadway, separated by at least 1,000 feet
- should be placed on the shoulder of the roadway or further, if possible
- the bottom of the sign should be 7 feet above the elevation of the edge of the roadway
- should be shielded with a barrier or crash cushion when within the clear zone
- should be removed when not being used

MESSAGE DESIGN:
- visible for at least ½ mile under ideal daytime and nighttime conditions
- legible from all lanes at a minimum distance of 650 feet
- entire message readable twice while traveling at the posted speed
- recommended that no more than 2 message screens be used
- each screen should convey a single thought
- if message is displayed in one phase, top line should be problem, center line should be location, and bottom line should be driver action
- messages should be as brief as possible
- messages should not scroll horizontally or vertically
- if message is longer than two phases, additional CMS should be used
- use standard abbreviations that are easily understood

American Traffic Safety Services Association (ATSSA) (11)

PURPOSE: To advise the driver of unexpected traffic and routing situations.

USE:
- accident and incident management
- new detours
- changes to detours and bypasses
- introduction to lane drop where a continuous lane once existed
- special speed control measures
- in lieu of flaggers on freeways and expressways
- lane closures where sight distance is restricted and/or congestion occurs
- road closures
- advisories and advance notice of construction activity

PROHIBITED USE:

PLACEMENT:
- when 2 signs are needed they should be separated by at least 1,000 feet
- normally placed on the shoulder of the roadway; however, placement farther from the travel lane is desirable
- should be turned ~3 degrees from perpendicular toward the edge of pavement
- should be placed only on one side of the roadway – either left or right depending upon the needs
- should never be placed and operated simultaneously on both the right and left sides of the roadway

MESSAGE DESIGN:
- legible from all lanes at a distance of 650 feet
- visible for at least ½ mile under ideal daytime and nighttime conditions
- short and concise
- entire message readable twice while traveling at the posted speed
- recommended that no more than 2 message screens be used

OTHER: Recommended abbreviations and standard messages were provided.

APPENDIX D

Policy and Technical Work Reports

Policy Work Report - Needs, Issues, & Concerns

1. Use Only When Violating Expectations (7 votes – "Yes" category)
   - Drivers not expecting speed changes, lane changes, lane shifts, delays, stops, closures

2. Signs Used Too Much (6 votes – "Overuse" category)
   - Establish use/non-use criteria
   - Consider duration of use
   - Determine disadvantages of overuse
   - Determine advantages of prudent use
   - Determine the number of CMS needed and how they will be distributed
   - Survey use/procedures in other states
   - Develop a checklist of questions to determine if use is appropriate
   - Determine best management of use and who will staff
   - Need a guideline that deals with use criteria and management
   - Importance of message control and verification
   - Importance of tracking location (GIS/GPS)

3. Use For Special Events (5 votes – "Yes" category)
   - Depends on the level of attendance and out-of-town travelers
   - Don't advertise event (only use route names) unless clarifying "action" to be taken by driver (e.g. Speedway traffic next exit)
   - If you use DMS for one event, then all events expect you to use DMS for their event
   - Consider KyTC's stake in using the DMS (perhaps clear congested roads)
   - Use for events where there are potential conflicts with traffic (e.g. parking along roadway, pedestrians crossing roadway)
   - May diminish requests to use DMS for advertising if guidelines/policies are in place

4. Standard Messages and Placement (4 votes – "Guidance" category)
   - Need safety criteria… i.e. clear zone
   - What research has been done on standard messages
   - What's the best placement (vertical/horizontal) and spacing (vision cone?)
   - Need guidance for placement considering safety and visibility
   - Need a statewide standard message set
   - Use MUTCD for size and color ???
   - Display mechanics (eg, frames, duration, times) based upon speed of vehicle
   - Determine standard abbreviations/symbols

- Determine landmarks for travel times

5. Clear and Concise Messages (4 votes – "Guidance" category)
   - Don't use filler or implied words (e.g. caution, ahead)
   - Standardized messages
   - Common abbreviations
   - 2 panels only
   - Set flash rates relative to conditions (e.g. speed, site distance)

6. Use for Emergency (3 votes – "Yes" category)
   - Update detour routes and delay times (keep current)
   - Guidelines re: duration
   - Classify emergency types… HAZMAT, weather, special events, snow, accidents
   - Use by other agencies??? (i.e., Emergency Management)

7. Don't Use For Unnecessary Notification (3 votes – "No" category)
   - Refer to "2. Signs Used Too Much"
   - Is static sign appropriate?

8. Use for Advance Notice of Temporary Road Closure (3 votes – "Yes" category)
   - Define temporary (hours,days,etc.)
   - Construction detour
   - Future event (i.e., ramp closure)
   - Need standard message format
   - How advance should the notice be? (time/distance)
   - Use immediately prior to event

9. Warning Device For Traffic Flow Changes (3 votes – "Yes" category)
   - Refer to "1. Use Only When Violating Expectations"

10. Jurisdiction of Control (2 votes – "Guidance" category)
    - Need someone responsible in each district
    - Address the 'architecture' issue of control
    - What can best be done from Operations Center? (strategic placement…what's required… locator)
    - Needs collaboration between districts and with central office (operations center)
    - Control may change in phases (operations center and district offices)
    - Coordination by central, but 'literal control' at district?
    - Major events crossing district lines needs ops center
    - Some signs stored on maintenace lots, others should be pre-positioned in key locations

11. Balance Safety and Visibility (2 votes – "Guidance" category)
- Keep out of clear zone if possible
- Protect DMS if possible (e.g. behind guardrail)
- When the DMS is within the clear zone, it should be crashworthy or shielded.
- Turn DMS so trailer hitch is downstream

12. Crash Incident Management (2 votes – "Yes" category)
- Refer to "6. Use for Emergency"
- Need standard detours and standard messages (re: interchanges)
- Inform drivers of delays
- Need detour information updated periodically
- What criteria kicks this in???
- Key need for notification/communication to travelers (this will require interagency communication)
- Need specified point/person for notification at district (emergency email address?)

13. Delay Time (2 votes – "Yes" category)
- Don't use exact amounts (e.g. 5 minutes, 20 minutes) – be general (e.g. minor delay)
- Need technology to predict accurate times

14. Communicate Remotely with Sign (1 vote – "Guidance" category)
- What are the advantages?
  - Update messages with changing conditions
  - Turn it off when not needed
- Need GPS locator
- What about verification? (video camera)
- Communicate from central office, district offices, or vehicle
- Need standard software and communication protocol

15. Duration of Crash Hazard (1 vote – "Guidance" category)
- Only use for major incident (e.g. Hazmat)

16. Standardize Mechanics of Usage (1 vote – "Guidance" category)
- Refer to "4. Standard Messages and Placement"

17. Symbols are Better (1 vote – "Guidance" category)
- Need technology (graphics, color)

18. Major Roads Requiring Lane Closures (delays) (1 vote – "Guidance" category)
- Define major roads…
- What about all roads?
- Consider the level of disruption that will occur

19. Maintenance Activities with Closures (1 vote – "Yes" category)
- Use same guidelines as construction activities
- Refer to "1. Use Only When Violating Expectations"

20. Pavement Conditions (RWIS) (1 vote – "Yes" category)
- Use with permanent signs only?
- Consider how signs will be plugged into the RWIS system (Is there are architecture issue?)
- How will the system work, directly with RWIS or through the Operations Center (RWIS>>>Ops Ctr>>>**Sign**<<<RWIS or dedicated sensors)
- What are the appropriate messages???

21. Don't Use For Weather (1 vote – "No" category)
- Don't use for de-icing activities
- Anti-icing?
- How does weather affect driver expectation?
- Possible DMS or static sign on escort vehicle for snow/ice activities

22. Not for Time, Temperature, or Slogans (1 vote – "No" category)
- Need to work through their best judgement
- What do other states do?
- Contribution to overuse?
- Travel times? re: urban areas only
- Consider whether there is an unique application for this in rural areas

23. No Advertising (1 vote – "No" category)
- Don't use for advertising

24. Not for Speed Limit (1 vote – "No" category)
- Use to note double fine? Maybe

Policy Team 1: Nancy Albright, Randall Arvin, Jason Blackburn, Gary Raymer, Allen Thomas, Jeff Wolfe
Policy Team 2: Donnie Cornette, John Crossfield, Rob Hans, Tom Jobe, Chuck Knowles, Brent Sweger

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Other Issues

(1 Vote)
Hazmat Incident Management

Sight Distance is Restricted and Traffic Delayed
Up-To-Date Information

(0 Votes)
Signs used as static signs
Used for weather, anti-icing, flooding
Use for specific local traffic events
NTCIP – Include in our specs
Turn off when not in use
Avoid repetitions

Comments recorded at the close of the meeting:

- Jim Francis mentioned keeping track of the amount of time and money spent using signs for advertising. Chuck Knowles agreed this would be a good idea.
- Although we focused on portable DMS, some of these issues apply to permanent DMS.
- For construction projects, the specifications need to include the message type/set that should be used. This is to ensure that the contractor follows the state policy.
- District 10 would like more of the signs instead of having to borrow them. Jim Francis said that district 5 makes sure that every county with an interstate has at least one sign.

Comments recorded after the meeting:

- DMS are used for: emergency and planned detours, drive smart activities, local events which may cause unusual traffic congestion, when new traffic signals are activated, anti-icing activities, some construction projects for which DMS was not a bid item, snow and ice removal, rest area closures due to water or power problems.
- Either the Operations or Traffic Division should be responsible for the signs.

Technical Work Report - Needs, Issues, & Concerns

1. Who Repairs Them? (9 votes – "Maintenance" category)
   - In the future, including training as a requirement in the specifications.
   - Establish an in-house repair shop in a central location for the DMS. The technicians would probably need to learn from experience. Spares could be kept at this location.
   - Basic repair should be done in the field at the district level. These technicians would require training from the manufacturer.
   - If necessary, some work on the DMS could be contracted out.

2. Software Compatibility (8 votes – "Integration" category)
   - Software should be compatible with Cabinet's computer operating platform.
   - Any future purchases of DMS must be compatible with "first bulleted item".
   - Set target date for all DMS's to be compatible.

3. Hardware Compatibility (7 votes – "Integration" category)
   - Write specifications around a selected brand.
   - Design our own specifications/sign. This is the preferred method.
   - Use price contracts to purchase a particular brand.
   - Phase out old signs, but use as long as possible.

4. Communication Requirements (6 votes – "Communication"category)
   - Provide direct hookups at frequently used locations.
   - Future DMS purchases must be compatible with standard specification (to be determined by Cabinet).
   - Set goal and target date by which all DMS's will be compatible with specification. Must be capable of being operated remotely by central office or district.

5. Cost/Availability of Replacement Parts (4 votes – "Maintenance" category)
   - With our own design, cost and availability should be improved or better controlled.
   - A repair shop may lengthen the life of the signs/parts and therefore lower lifecycle costs.
   - Spare parts should be ordered with the purchase of the sign. This will improve availability.

6. Difficulty Programming Messages (4 votes – "Operations"category)
   - Develop a specification for programming with emphasis on user-friendliness.
   - Future purchases use this specification.
   - Set target date for statewide compliance with specification.

7. Verification of Message Status (3 votes – "Operations" category)

- Software/Hardware Verification – not always reliable, but could continue to use
- Camera – Use in advance of the sign for more reliable information. Cameras should be used more often with permanent or semi-permanent uses of DMS. The camera image will supplement the data from the software/hardware.

8. Policy on Use/Priority (2 votes – "Policy" category)

- Allow each district to set policy on use/priority.
- Set statewide policy on standard message wording (for consistency).

9. No Reliable Communication Path (2 votes – "Communication" category)

- Analog Cellular – in most places around the state
- Digital Cellular – in a few places around the state
- CDPD – in a very few places around the state
- State-owned data radio network – would need to create, but could also be used by others (ie, State Police, Motor Vehicle Enforcement, etc.)
- Satellite – everywhere, but costly
- Currently, the guy in a truck is the most reliable way.

10. No Standard Hardware (1 vote – "Maintenance" category)

(This problem/issue was not addressed by the group.)

11. Life of LEDs (1 vote – "Maintenance" category)

- Write good specifications.
- Do testing to measure light output.
- Do factory inspections.
- Get certification from the manufacturer.

12. Towing Truck (1 vote – "Operations" category)

- Vehicle towing sign should be equipped with Class 3 hitch.
- Electrical hookups should be required (brake lights, turn signals).
- Should be four-wheel-drive.

13. Specification Requirements (changed to Specification Development) (1 vote – "Specs" category)

- Get help from a consultant to design our own DMS.
- Have a user group define requirements for the sign.

14. NCHRP 350 (1 vote – "Specs" category)

(This problem/issue was not addressed by the group.)

Technical Team 1: Glenn Anderson, Jason Coe, Charlie Cunningham, Todd Hood, Phil Resig
Technical Team 2: Trevor Booker, Gene Bowling, Jim Francis, David Leach, Jerry Lowe

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Other Issues (0 Votes)
Lack of Manufacturing and Distributor Information
Lack of Diagnostics for Trouble-Shooting
Stability in Wind
Durability of Hardware
Vandalism

Comments recorded at the close of the meeting:

- For towing the signs, a Class 3 hitch would be needed.
- Although we focused on portable DMS, some of these issues apply to permanent DMS.

Comments recorded after the meeting:

- The biggest problem is getting the signs repaired. The districts could make minor repairs and replace batteries, but a contract with a central vendor would be used for complicated repairs.
- Reliable communication is also a big issue. Cell phone service is very unreliable and land lines are not practical for the mobile signs. In some circumstances, we need to be able to call the DMS and change the sign from a computer.

APPENDIX E

STANDARD CMS ABBREVIATIONS AND MESSAGES

The following is a list of standard abbreviations to be used on CMS.

Word	Abbreviation	Example	
		Panel 1	Panel 2
Access	ACCS	ACCIDENT AHEAD	USE ACCS RD NEXT RIGHT
Alternate	ALT	ACCIDENT AHEAD	USE ALT RTE NEXT RIGHT
Avenue	AVE	5TH AVE CLOSED AHEAD	DETOUR NEXT LEFT
Blocked	BLKD	5TH AVE RIGHT 2 LNS BLKD	MERGE LEFT
Boulevard	BLVD	SCOTT BLVD CLOSED	USE ALT ROUTE
Bridge	BRDG	SMITH BRDG CLOSED	USE ALT ROUTE
Cardinal Directions	N, E, S, W	N I75 CLOSED EXIT 118	PREPARE TO STOP
Center	CNTR	N I-75 TRAF USE CNTR LN	
Commercial	COMM	OVERSIZE COMM VEHICLES	USE EXIT 120
Condition(s)	COND	ICY COND POSSIBLE	
Congestion	CONG	HEAVY CONG NEXT 3MI	
Construction	CONST	CONST WORK NEXT 7MI	EXPECT DELAYS

Downtown	DWNTN	DWNTN TRAF USE EXIT 40	
Eastbound	E-BND	E-BND I65 CLOSED	DETOUR NEXT EXIT
Emergency	EMER	EMER VEHICLES AHEAD	PREPARE TO STOP
Entrance, Enter	ENT	TRUCK ENT AHEAD	
Exit	EX,EXT	DWNTN TRAF USE EXT 101B	
Expressway	EXPWY	WTRSN EXPWY CLOSED	DETOUR EXIT 10
Freeway	FRWY, FWY	GN SNYDR FRWY CLOSED	DETOUR EXIT 15
Hazardous Material	HAZMAT	HAZMAT SPILL EXIT 130	ALL TRAF USE EXIT 25
Highway	HWY	ACCIDENT AA HWY MP 37	EXPECT DELAYS
Information	INFO	TUNE TO 1240 AM	FOR TRAFFIC INFO
Interstate	I	E-BND I64 CLOSED	DETOUR EXIT 94
Lane	LN	LEFT LN CLOSED 1 MILE	MERGE RIGHT
Left	LFT	LFT LANE CLOSED 1 MILE	MERGE RIGHT
Local	LOC	LOC TRAF USE ALT ROUTE	
Maintenance	MAINT	TRAFFIC SLOW	MAINT WORK ON

		AHEAD	BRIDGE
Mile	MI	ACCIDENT MI PT 47 RT LN	USE LEFT LANE
Northbound	N-BND	OVRTRNED TRACTOR TRAILER	N-BND RAMP CLOSED
Oversized	OVRSZ	OVRSZ COMM VEHICLES	MUST EXIT
Parking	PKING	NO PKING ALONG ROADWAY	
Parkway	PKWY	CUM PKWY EXIT 93 CLOSED	DETOUR AT EXIT 94
Prepare	PREP	ACCIDENT 3 MILES AHEAD	PREP FOR SUDDEN STOP
Right	RGT	EVENT PARKING NEXT RGT	
Road	RD	COLBY RD CLOSED AHEAD	TURN RIGHT TO DETOUR
Roadwork	RDWK	RDWK NEXT 4 MILES	POSSIBLE DELAYS
Route	RTE	NARROW BRIDGE AHEAD	TRUCK TRAF USE ALT RTE
Shoulder	SHLDR	ROADWORK ON SHLDR 3 MILES	
Slippery	SLIP	MUDSLIDE SLIP RD POSSIBLE	
Southbound	S-BND	S-BND I-75 CLOSED	DETOUR EXIT 50
Speed	SPD	REDUCED SPD ZONE AHEAD	
Street	ST	MAIN ST	USE

		CLOSED AT MLK	ALT ROUTE
Traffic	TRAF	NARROW BRIDGE AHEAD	TRUCK TRAF USE ALT RTE
Vehicle	VEH	OVERSZ OVERWT COMM VEH	USE I275 NEXT RIGHT
Westbound	W-BND	W-BND I64 CLOSED	DETOUR EXIT 50
Work	WRK	N I275 BRDG WRK 2 MILES	TRUCK TRAF USE ALT RTE

Certain abbreviations are prone to inviting confusion because another word is abbreviated or could be abbreviated in the same way. DO NOT USE THESE ABBREVIATIONS.

Abbrev.	**Intended Word**	**Word Erroneously Given**
ACC	Accident	Access (Road)
CLRS	Clears	Colors
DLY	Delay	Daily
FDR	Feeder	Federal
L	Left	Lane (Merge)
LT	Light (Traffic)	Left
PARK	Parking	Park
POLL	Pollution (Index)	Poll
RED	Reduce	Red
STAD	Stadium	Standard
TEMP	Temporary	Temperature
WRNG	Warning	Wrong

TYPICAL MESSAGES

The following is a list of typical messages used on CMS. The first table displays messages that consist of the **problem** that you want the driver to be aware of and in some situations the **distance** to that problem. The second table displays the messages that describe the **action** that you want the driver to take.

Problem / Distance

ACCIDENT	ACCIDENT 4 MILES AHEAD	COLBY ROAD CLOSED	EXIT 45 CLOSED
BRIDGE CLOSED	BRIDGE SLIPPERY	ICE ON BRIDGE	CENTER LANE CLOSED
MAJOR DELAYS	DEBRIS AHEAD	DENSE FOG	DISABLED VEHICLE
EMER VEHICLES ONLY	EVENT PARKING	FLAGGER 2 MILES	FOG 3 MILES
FREEWAY CLOSED	FRESH OIL	HAZMAT SPILL	ICE
INCIDENT AHEAD	LANES NARROW	LANE SHIFT	LEFT LANE CLOSED
LEFT LANE NARROWS	LEFT 2 LANES CLOSED	LEFT SHOULDER CLOSED	LOOSE GRAVEL
MEDIAN WORK 5 MILES	MOVING WORK ZONE	WORKERS IN ROADWAY	NEXT EXIT CLOSED
NO OVERSIZE LOADS	NO PASSING	NO SHOULDER	ONE LANE BRIDGE
PEOPLE CROSSING	RAMP CLOSED	RAMP SLIPPERY	RIGHT LANE CLOSED
RIGHT 2 LANES CLOSED	RIGHT LANE NARROWS	RIGHT SHOULDER CLOSED	ROAD CLOSED
ROAD CLOSED	ROAD SLIPPERY	ROAD WORK	ROAD WORK

6 MILES			TOMORROW
ROAD WORK 4 MILES	SHOULDER BLOCKED	NEW SIGNAL 2 MILES	SINGLE LANE
SLOW 1-WAY TRAFFIC	SOFT SHOULDER	STALLED VEHICLES AHEAD	TRAFFIC BACKUP
TRAFFIC SLOWS	TRUCK CROSSING	TRUCKS ENTERING	TOW TRUCK AHEAD
UNEVEN LANES	WATER ON ROAD	WET PAINT	WORK ZONE 12 MILES
WORKERS AHEAD			

Action

ALL TRAFFIC EXIT RT	AVOID DELAYS USE US25	CONSIDER ALT ROUTE	DETOUR
DETOUR 2 MILES	DO NOT PASS	EXPECT DELAYS	FOLLOW ALT ROUTE
KEEP LEFT	KEEP RIGHT	MERGE 2 MILES	MERGE LEFT
MERGE RIGHT	ONE-WAY TRAFFIC	PASS TO LEFT	PASS TO RIGHT
PREPARE TO STOP	REDUCE SPEED	SLOW	SLOW DOWN
STAY IN LANE	STAY ON US25	STOP AHEAD	STOP 5 MILES
TUNE RADIO 1510 AM	USE COLBY ROAD	USE CENTER LANE	USE DETOUR ROUTE
USE LEFT LANE	USE NEXT EXIT	USE RIGHT LANE	WATCH FOR FLAGGER

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