



National Committee on Uniform Traffic Control Devices

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National Committee on Uniform Traffic Control Devices (NCUTCD) Recommended Changes to Proposed Text for 11th Edition of the MUTCD Docket Number: FHWA-2020-0001

6 **Federal Register Item Number:** 295 - 303

7 **NPA MUTCD Section Numbers:** Sections 2L.01 – 2L.09

8 **Summary:** Summary of changes shown in docket comment

9 **Legend:** Base text shown in proposal is the NPA “clean” proposed text.

- 10 • Addition to NPA text: Added text proposed by NCUTCD.
- 11 • Deletion of NPA text: ~~Deleted text proposed by NCUTCD.~~
- 12 • Moving NPA text: Moved text proposed by NCUTCD.
- 13 • NPA text added by FHWA and not previously approved by Council: NPA text not
- 14 previously approved by Council but recommended for approval.
- 15 • Explanatory note (normally accompany each change within the NPA text): [Note that
- 16 explains purpose of recommended change.]
- 17 • References in 00X-XXX-00 format refer to previous NCUTCD recommendations
- 18 approved by Council and sent to FHWA, which may be seen on the NCUTCD website
- 19 at <https://ncutcd.org>.

21 The following pages present NCUTCD recommendations for changes to the MUTCD NPA
22 proposed text and figures for Chapter 2L. Below is a summary of the NCUTCD position for
23 each section of this chapter. A more detailed summary is provided at the beginning of each
24 section.

- 26 • NPA #295: Section 2L.01. Changes recommended based on Council action in spring 2021.
 - 27 • NPA #296: Section 2L.02. Changes recommended based on Council action in spring 2021.
 - 28 • NPA #297: Section 2L.03. Changes recommended based on Council action in spring 2021.
 - 29 • NPA #298: Section 2L.04. Changes recommended based on Council action in spring 2021.
 - 30 • NPA #299: Section 2L.05. Changes recommended based on Council action in spring 2021.
 - 31 • NPA #300: Section 2L.06. Changes recommended based on Council action in spring 2021.
 - 32 • NPA #301: Section 2L.07. Changes recommended based on Council action in spring 2021.
 - 33 • NPA #302: Section 2L.08. Changes recommended based on Council action in spring 2021.
 - 34 • NPA #303: Section 2L.09. Changes recommended based on Council action in spring 2021.
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41 **Section 2L.01 Comments:** NCUTCD recommends revising 2L.01 as follows:

- 42 • NCUTCD recommends rearranging some text for clarity.
 - 43 • NCUTCD does not agree with the Support statement defining a changeable message sign to
44 be a traffic control device at all times. There are situations where CMSs, especially portable
45 CMSs, may be used for informative messages not strictly involving traffic control.
 - 46 • Revise the Standard statement on the display of names or logos of manufacturers, brands, or
47 model numbers to only prohibit display of this type of information on the front of a CMS, and
48 allow the display of names or logos of manufacturers, brands, or model numbers on the back
49 side (away from traffic) of CMSs. Some roadway agencies own a number of portable CMSs
50 and it may be helpful to have the manufacturer's name and/or model number visible to
51 roadway agency personnel as they manage their CMS fleet.
 - 52 • Other edits in accordance with NCUTCD recommendations 14B-GMI-09 and 20B-RW-03.
- 53

54 **Section 2L.01 Description of Changeable Message Signs**

55 Support:

56 A changeable message sign (CMS) is a traffic control device that is capable of displaying
57 one or more alternative messages and includes dynamic message signs (DMS), hybrid signs,
58 blank-out signs and line matrix signs (see Section 1C.02). ~~Some changeable message signs have~~
59 ~~a blank mode when no message is displayed, while others display multiple messages with only~~
60 ~~one of the messages displayed at a time (such as OPEN/CLOSED signs at weigh stations).~~
61 (relocate per 20B-RW-03)

62 The provisions in this Chapter apply to both permanent and portable changeable message
63 signs with electronic displays or the electronic display portion of an otherwise conventional static
64 sign. Additional provisions that only apply to portable changeable message signs can be found in
65 Section 6L.05. The provisions in this Chapter generally do not apply to changeable message signs
66 with non-electronic displays that are changed either manually or electromechanically, such as a
67 hinged-panel, rotating-drum, or back-lit curtain or scroll CMS.

68 ~~The CMS is a traffic control device at all times regardless of the type of message being~~
69 ~~displayed. Accordingly, the limitations on design, format and manner of displayed of a message~~
70 ~~conveyed on a traffic control device apply to changeable message signs regardless of the type of~~
71 ~~message being displayed at any given time. Some of the general provisions regarding traffic~~
72 ~~control devices are reiterated in this Chapter. However, this Chapter is not an independent or~~
73 ~~stand-alone reference for changeable message signs. Users of Chapter 2L are expected to consult~~
74 ~~the other chapters in this Manual for criteria on how to develop effective messages that comply~~
75 ~~with this Manual and meet the expectancy and limitations of the road user. In this regard, the~~
76 ~~engineering processes applied to decisions about whether to use a particular sign, for example, are~~
77 ~~no different for the decisions about the type and content of the message under consideration for~~
78 ~~display on a changeable message sign. The other limited use messages allowed on CMS as~~
79 ~~provided for in this chapter likewise fall under the same MUTCD provisions as the primary use~~
80 ~~traffic operation regulatory, warning and guidance messages except as stated otherwise in this~~
81 ~~chapter.~~

82 DMS are able to emulate the appearance of any traffic control sign. Hybrid and blank-out
83 signs are able to emulate those signs as designated in Part 2. Hybrid signs provide inserts to static
84 signs where legend information changes depending upon conditions. Blank-out signs are able to
85 address traffic control by time of day or period/event conditions by being able to display
86 information only for those times and blank at other times when the conditions do not exist.

87 Line matrix signs are able to be used for temporary traffic control as designated in Part 6.

88 [CMS hardware standards are contained in NEMA TS4-2016 and FCC compliance](#)
89 [\(including but not limited to 47CFR part 2, subpart J; part 15, subpart B; and part 90, subpart J\).](#)
90 [\(add per 20B-RW-03\)](#)

91 [Some changeable message signs have a blank mode when no message is displayed, while](#)
92 [others display multiple messages with only one of the messages displayed at a time \(such as](#)
93 [OPEN/CLOSED signs at weigh inspection stations\).](#) [\(relocate per 20B-RW-03, revise per 14B-](#)
94 [GMI-09\)](#)

95 **Standard:**

96 **The design of legends for non-electronic display changeable message signs shall comply**
97 **with the provisions of Chapters 2A through 2K, 2M, and 2N of this Manual. Other**
98 **changeable message signs shall comply with the design and application principles**
99 **established in this Chapter, Chapter 2A, and provisions elsewhere in this Manual for**
100 **specific signs.**

101 **No items other than inventory or maintenance-related information (see Section 2A.05)**
102 **shall be displayed on the front or back of a CMS or portable CMS. Names or logos of the**
103 **manufacturer, brand, or model shall not be displayed on a CMS or portable CMS, either in**
104 **the message display itself or on the front of the exterior housing.** [\(only prohibit on front of](#)
105 [CMS - allow on other sides\)](#)

106 *Guidance:*

107 *Blank-out signs that display only single-phase, predetermined electronic-display legends that*
108 *are limited by their composition and arrangement of pixels or other illuminated forms in a fixed*
109 *arrangement ~~(such as a blank-out sign indicating a part time turn prohibition, a blank-out or~~*
110 *~~changeable lane-use sign, or a changeable OPEN/CLOSED sign for a weigh station)~~ should*
111 *comply with the provisions of the applicable Section for the specific type of sign, provided that the*
112 *letter forms, symbols, and other legend elements are duplicates of the static messages as detailed*
113 *in the “Standard Highway Signs” publication (see Section 1A.11). Because such a sign is*
114 *effectively an illuminated version of a static sign, the size of its legend elements, the overall size*
115 *of the sign, and placement of the sign should comply with the applicable provisions for the static*
116 *version of the sign.* [\(revise per 20B-RW-03\)](#)

118 **Section 2L.02 Comments:** NCUTCD generally agrees with 2L.02, but recommends the
119 following changes:

- 120 • Allow exceptions for other types of alerts (Silver and Blue Alerts) required by state statute or
121 executive order.
- 122 • Add more examples of CMS messages in accordance with NCUTCD recommendation 20B-
123 RW-03.
- 124 • Allow vehicle and license plate information to be displayed as part of AMBER or other
125 alerts. These alerts are less effective or do not make sense if vehicle and license plate
126 information are not displayed.
- 127 • Delete the text in the Guidance statement regarding unconventional or obscure messages and
128 focus on the types of messages that are expected.
- 129 • Other editorial changes.

130 NCUTCD recommends FHWA research the use of a “+” symbol to determine if an alternative
131 legend should be used.

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134 **Section 2L.02 Applications of Changeable Message Signs**

135 **Standard:**

136 **Changeable message signs shall display only traffic operational, regulatory, warning, and**
137 **guidance information except as otherwise provided for in this chapter. Advertising or other**
138 **messages not related to traffic control, except as otherwise provided for in this chapter, shall**
139 **not be displayed on changeable message signs or its supports or other equipment. (revise to**
140 **clarify exceptions for other messages)**

141 **Option:**

142 Changeable message signs may display traffic safety campaign messages (as a supporting
143 element of a broader safety campaign), transportation-related messages, emergency homeland
144 security messages, and America's Missing: Broadcast Emergency Response (AMBER) alert or
145 similar messages, all as provided for in this Chapter.

146 **Guidance:**

147 CMS should not be used in place of static guide signs for conditions that do not change,
148 except for blank-out type signs used to display regulatory, warning, and guidance information
149 that routinely reoccurs but only on a part-time basis. Similarly, when only certain elements of a
150 message on a non-changeable sign is subject to change, only those elements of the sign should be
151 in an electronic display, for example the prices shown on the R3-48 and R3-48a signs (see
152 Figure 2G-17).

153 **Support:**

154 The purpose of Changeable message signs is to provide real-time traffic regulatory, warning
155 or guidance messages as follows:

- 156 A. Incident management and route diversion
- 157 B. Warning of adverse roadway conditions due to weather
- 158 C. Special event applications associated with traffic control or conditions
- 159 D. Lane, ramp, and roadway control
- 160 E. Priced or other types of managed lanes
- 161 F. Travel times
- 162 G. Warning situations
- 163 H. Traffic regulations
- 164 I. Speed control or warning (add per 20B-RW-03)
- 165 J. Variable Destination guidance (add per 20B-RW-03)
- 166 K. Supporting temporary traffic control (add per 20B-RW-03)
- 167 L. Active Traffic Management (add per 20B-RW-03)

168 CMS provide significant flexibility and capability in communicating many types of real-time
169 traffic control messages to road users. While their intended purpose is the display of traffic
170 regulatory, warning, or guidance information, other limited uses are also allowed under certain
171 conditions, as provided in this Chapter. Their integrity as an official traffic control device rests
172 significantly on their judicious use and proper messaging format and content, regardless of the
173 message type being displayed.

174 **Standard:**

175 **State and local highway agencies that have permanently installed or positioned CMS**
176 **shall issue and maintain a policy regarding the use and display of all types of messages to**
177 **be used on their CMS. The policy shall define the types of messages that will be allowed,**
178 **the priority of messages, the proper syntax of messages, the timing of messages, and other**
179 **important messaging elements to ensure messages displayed meet the basic principles that**
180 **govern the design and use of traffic control devices in general (see Section 1D.01) and**
181 **traffic signs in particular as provided for in this Manual.**

182 **Guidance:**

183 State and local agencies that use CMS but do not have permanently installed or positioned
184 signs should develop and establish a policy as discussed in the preceding paragraph.

185 *When changeable message signs are used at multiple locations to address a specific*
186 *situation, the message displays should be consistent along the roadway corridor and adjacent*
187 *corridors, which might necessitate coordination among different operating agencies.*

188 ~~*AMBER alerts, when displayed, should not pre-empt messages related to traffic or travel*~~
189 ~~*conditions.*~~

190 AMBER alert messages should be kept as brief as possible and display only that information
191 which will direct road users to another source, such as broadcast or highway advisory radio, for
192 detailed information about the alert. ~~*Other information, such as detailed descriptions of persons,*~~
193 ~~*vehicles, or license plate numbers, should not be displayed in an AMBER alert message on a*~~
194 ~~*CMS.*~~

195 **Standard:**

196 **Other types of “alert” messages that are unrelated to traffic or travel conditions shall**
197 **not be displayed on CMS.**

198 Support:

199 Examples of traffic safety campaign messages include “FASTEN SEAT BELTS, FINE +
200 AND POINTS” and “IMPAIRED DRIVERS, LOSE LICENSE +AND GO TO JAIL.” Examples
201 of transportation-related messages include “STADIUM EVENT SUNDAY, DELAYS NOON
202 TO 4 PM” and “OZONE ALERT—USE TRANSIT.”

203 *Guidance:*

204 *When a CMS is used to display a traffic safety campaign or transportation-related message,*
205 *the message should be simple, brief, legible, and clear (see Section ID.01). A CMS should not be*
206 *used to display a traffic safety campaign or transportation-related message if doing so could*
207 *adversely affect respect for the sign. “CONGESTION AHEAD” or other overly simplistic or*
208 *vague messages should not be displayed alone. These messages should be supplemented with a*
209 *message on the location or distance to the congestion or incident, delay and travel time,*
210 *alternative route, or other similar messages.*

211 When displayed, traffic safety campaign and transportation-related messages should be
212 simple and direct (see Section ID.01). Traffic safety campaign messages should emphasize the
213 applicable regulation or warning and reference any penalties associated with violations of the
214 regulation. ~~*Messages with obscure or secondary meanings, such as those with popular culture*~~
215 ~~*references, unconventional sign legend syntax, or that are intended to be humorous, should not*~~
216 ~~*be used as they may be misunderstood or understood only by a limited segment of road users and*~~
217 ~~*require greater time to process and understand. Similarly, slogan type messages and the display*~~
218 ~~*of statistical information should not be used.*~~

219 Traffic safety campaign and transportation-related messages should be relevant to the road
220 user on the roadway on which the message is displayed. For example, messages regarding
221 school bus-stop safety should not be displayed on freeways where school bus stops are not found.

222 **Standard:**

223 **The format of CMS displays shall not be of a type that could be considered similar to**
224 **advertising or promotional displays.**

225 **Traffic safety campaign messages shall not be displayed on CMS unless they are part of**
226 **an active, coordinated safety campaign that uses other media forms as the primary means**
227 **of outreach.**

228 Guidance:

229 Traffic safety campaigns using CMS should include coordinated enforcement efforts where
230 penalties or enforcement type ~~warnings~~ notifications are part of the message displayed on the
231 CMS.

232 **Support:**

233 In times of a declared state of emergency, it might be appropriate to display messages related
234 to evacuation, homeland security or emergency information. Traffic patterns, movement or other
235 situations might be atypical due to the emergency, necessitating unique messaging not
236 specifically related to traffic conditions.

237 **Standard:**

238 **Homeland security and emergency messages shall only be displayed in declared states**
239 **of emergency when there is an imminent threat to the general population. Generic security**
240 **or personal safety messages shall not be displayed when there is no context of a declared**
241 **state of emergency or known imminent national security threat. Homeland security and**
242 **emergency messages shall not be promotional or advisory in nature, including the message**
243 **design, layout or manner of display.**

244 **Guidance:**

245 Homeland Security and emergency messages should undergo significant levels of scrutiny
246 prior to being approved for broadcast to ensure accuracy and consistency with emergency
247 conditions. These messages should be designed to convey a clear and simple meaning in a
248 similar format to traffic control messages.

249 **Support:**

250 Section 2B.221 contains information regarding the design of changeable message signs that
251 are used to display variable speed limits that change based on ambient or operational conditions
252 on the variable Speed Limit (R2-1) sign.

253 Section 2C.13 contains information regarding the design of changeable message signs that
254 are used to display the speed at which approaching ~~drivers~~ vehicles are traveling on the ~~Driver~~
255 Vehicle Speed Feedback (W13-20, W13-20aP) sign and plaque.

256 Section 2H.03 contains information regarding the design of changeable message signs that
257 are used to display variable speeds for traffic signal progression on the Traffic Signal Speed (11-
258 1) sign.

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262 **Section 2L.03 Comments: NCUTCD agrees with 2L.03 as presented in the NPA.**

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264 **Section 2L.03 Legibility and Visibility of Changeable Message Signs**

265 **Support:**

266 The maximum distance at which a driver can first correctly identify letters and words on a
267 sign is called the legibility distance of the sign. Legibility distance is affected by the
268 characteristics of the sign design and the visual capabilities of drivers. Visual capabilities, and
269 thus legibility distances, vary among drivers.

270 For the more common types of changeable message signs, the longest measured legibility
271 distances on sunny days occur during mid-day when the sun is overhead. Legibility distances are
272 much shorter when the sun is behind the sign face, when the sun is on the horizon and shining on
273 the sign face, or at night. Visibility is the characteristic that enables a CMS to be seen.

274 Visibility is associated with the point where the CMS is first detected, whereas legibility is the
275 point where the message on the CMS can be read. Environmental conditions such as rain, fog, and

276 snow impact the visibility of changeable message signs and can reduce the available legibility
277 distances. During these conditions, there might not be enough viewing time for drivers to read the
278 message.

279 *Guidance:*

280 *Changeable message signs used on roadways with speed limits of 55 mph or higher should be*
281 *visible from 1/2 mile under both day and night conditions. The message should be designed to be*
282 *legible from a minimum distance of 600 feet for nighttime conditions and 800 feet for normal*
283 *daylight conditions. When environmental conditions that reduce visibility and legibility are*
284 *present, or when the legibility distances stated in the previous sentences in this paragraph cannot*
285 *be practically achieved, messages composed of fewer units of information should be used and*
286 *consideration should be given to limiting the message to a single phase (see Section 2L.05 for*
287 *information regarding the lengths of messages displayed on changeable message signs).*

288 *The electronic display of standardized regulatory and warning signs used individually or as*
289 *part of the legend for a larger sign should meet the size and legend requirements for those*
290 *specific signs in Chapters 2B and 2C of this Manual.*

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293 **Section 2L.04 Comments:** NCUTCD recommends revising 2L.04 as follows, including some
294 revisions in accordance with NCUTCD recommendation 20B-RW-03:

- 295 • The specifications proposed in the NPA would produce the required character height (Table
296 2L-1) only for signs with a particular pixel size and density. NCUTCD recommends
297 removing the content referencing width to height ratio and stroke width to height
298 ratio. NCUTCD instead recommends a reference to NEMA standards that describe letter
299 shape so users can choose the appropriate font to reach the character size requirements in
300 Table 2L-1 for their particular sign.
- 301 • Delete references to luminance, as this is not measurable from a maintenance and operational
302 standpoint. If this is for the manufactured condition at time of installation, that should be
303 stated, or otherwise delete.
- 304 • Correct errors in color references.
- 305 • Supplement the Standard statement to specify that no fixed border other than LED pixels
306 shall be used to make up the border.
- 307 • Various editorial changes.
- 308 • FHWA should consider adding a 20mm (0.79") pixel pitch font library for alphabet and
309 symbols in the Standard Highway Signs publication.

310

311 **Section 2L.04 Design Characteristics of Messages**

312 **Standard:**

313 **Except as provided in Paragraph 2, messages shall not include animation, flashing,**
314 **dissolving,**
315 **exploding, scrolling, or other dynamic display elements.**

316 **When a portable CMS is used as an arrow board that uses a flashing or sequential**
317 **display for a lane or shoulder closure, the display and operation shall be considered that of**
318 **an arrow board and shall comply with the provisions of Section 6F.61.**

319 *Guidance:*

320 *In developing messages for display on changeable message signs, the provisions of Section*
321 *ID.01 should be consulted for the principles of an effective traffic control device.*

322 **Standard:**

323 All message displays on CMS, whether for traffic operational regulatory, warning or
 324 guidance information, or for the other allowable message types as defined in this section,
 325 shall follow the same design and display principles found in this manual ~~the MUTCD~~ used
 326 for other traffic control signs, except as provided elsewhere in this chapter.

327 *Guidance:*

328 *Except in the case of a limited-legend CMS (such as a blank-out or a part-time regulatory*
 329 *sign display) that is used in place of a static regulatory sign or an activated blank-out warning*
 330 *sign that supplements a static warning sign at a separate location, the signs should be used as a*
 331 *supplement to and not as a substitute for conventional signs and markings unless otherwise*
 332 *provided for in this Manual.*

333 *Support:*

334 When CMS are overused for messages not directly associated with real-time driving
 335 conditions, road users may pay less attention ~~the sign to CMS~~ thereby limiting ~~its~~ their
 336 effectiveness as a traffic control devices. ~~Instead of limiting the use of such messages, some~~
 337 ~~agencies have gone to other means in an attempt to draw attention back to the signs when the~~
 338 ~~signs are displaying real-time driving conditions.~~

339 *Guidance:*

340 Warning beacons should not be installed on CMS for the purpose of drawing attention to
 341 certain types of messages over others. Instead, CMS should be used predominately to display
 342 messages that are critical to real-time travel conditions.

343 CMS *word messages* should be limited to no more than three lines, with no more than 20
 344 characters per line.

345 The spacing between characters in a word should be between 25 and 40 percent of the letter
 346 height. The spacing between words in a message should be between 75 and 100 percent of the
 347 letter height. Spacing between the message lines should be between 50 and 75 percent of the
 348 letter height. See Table 2L-1 for spacing between characters, words, and lines of text.

349 Except as provided in Paragraph 18 of this Section, and in Paragraph 5 of Section 2L.01,
 350 word messages on changeable message signs should be composed of all upper-case letters. The
 351 minimum letter height should be 18 inches for changeable message signs on roadways with
 352 speed limits of 45 mph or higher. The minimum letter height should be 12 inches for changeable
 353 message signs on roadways with speed limits of less than 45 mph. When a message is composed
 354 of two phases and higher informational load (see Section 2L.05), the letter height should be 18
 355 inches, regardless of the speed limit, to optimize legibility distance and available viewing time.

356

357 **Table 2L-1. Spacing Between Message Characters, Words and**
 358 **Lines of Text**
 359

Height of Letters used on CMS	Spacing between Characters in Words	Horizontal Spacing between Words	Vertical Spacing between lines of Text
12	3 - 5	9 - 12	6 - 9
18	4 1/2 - 7	13 1/2 - 18	9 - 13 1/2

360 Note: All units are in inches

361

362 NCUTCD agrees with Table 2L-1 as presented in the NPA.

363

364 Support:

365 Using letter heights of more than 18 inches will not result in proportional increases in
366 legibility distance.

367 Guidance:

368 ~~The width-to-height ratio of the sign characters should be between 0.7 and 1.0. The stroke~~
369 ~~width-to-height ratio should be 0.2. Characters should match Standard Alphabet as provided in~~
370 ~~the Standard Highway Signs publication.~~ [revise per 20B-RW-03 – this text was added to clarify
371 the fonts for CMS avoiding out of date language associated with line matrix signs]

372 For DMS, hybrid and blank-out signs the maximum pixel pitch should be 20 mm for freeway and
373 expressway applications. [revise per 20B-RW-03 - OK as Guidance]

374 Support:

375 ~~The width-to-height ratio is commonly accomplished using a minimum font matrix density~~
376 ~~of five pixels wide by seven pixels high. Required character font ratios (width and stroke) are~~
377 ~~defined in NEMA TS-4 Section 5.6.~~ [reference NEMA instead of using pixel criteria with
378 limited applicability]

379 Option:

380 DMS, hybrid and blank-out sign applications for conventional roads may utilize pixel pitch at
381 greater density to achieve no apparent loss of resolution or to improve road user recognition
382 (typically between 8mm and 16mm).

383 Hybrid, blank-out and line matrix signs may use a black background with white or yellow
384 characters or reverse images as provided in this Manual for a specific sign (see Chapters 2B, 2C,
385 2F, 2G and 2H). [add per 20B-RW-03]

386

387 **Standard:**

388 **Changeable message signs shall automatically adjust their brightness under varying**
389 **light conditions to maintain legibility.**

390 Guidance:

391 ~~The luminance of changeable message signs should meet industry criteria for daytime and~~
392 ~~nighttime conditions. Luminance contrast should be between 8 and 12 for all conditions.~~
393 [delete per 20B-RW-03 - not measurable from a maintenance and operational standpoint]

394 *Contrast orientation of changeable message signs should always be positive, that is, with*
395 *luminous characters on a dark or less luminous background.*

396 Support:

397 Legibility distances for negative-contrast changeable message signs are likely to be at least
398 25 percent shorter than those of positive-contrast messages. In addition, the increased light
399 emitted by negative-contrast changeable message signs has not been shown to improve detection
400 distances and might visually overwhelm the darker characters of the sign legend.

401 **Standard:**

402 **The colors used for the legends and backgrounds on changeable message signs shall be**
403 **as provided in Table 2A-52, except as otherwise noted in this section.**

404 ~~If a black background is used on a CMS, the color used for the legend on a changeable~~
405 ~~message sign shall be match the background color that would be used on a standard sign~~
406 ~~for that type of legend as specified for CMS in Table 2A-2.~~ [This is in error and should be

407 deleted - colors are to be as those referenced in prior sections consistent with static sign
408 equivalents and the option added above.]

409 **If a green background is used for a guide message on a Digital Message Sign**
410 **(DMS)~~CMS~~ or if a blue background is used for a motorist services message on a DMS~~CMS~~,**
411 **the background color shall be provided by green or blue lighted pixels such that the entire**
412 **DMS~~CMS~~ would be lighted, not just the white legend. No fixed border shall be used on the**
413 **edge of the message sign other than LED pixels to make up the border colors.**

414 Support:

415 Some CMS that employ newer technologies have the capability to display a near duplicate of
416 a standard sign or other sign legend using standard symbols, the Standard Alphabets and letter
417 forms, route shields, and other typical sign legend elements with no apparent loss of resolution or
418 recognition to the road user when compared with a static version of the same sign legend. Such
419 signs are of the full-matrix type and can typically display full-color legends. Figure 2L-1 shows
420 comparative examples of the effects of varying pixel densities on legend form.

421 *Guidance:*

422 *If used, the CMS described in the preceding paragraph should not display symbols or route*
423 *shields unless they can do so in the appropriate legend and background color combinations.*
424 *Where an LED matrix is used to form the changeable legend, signs with pixel spacing greater*
425 *than 20mm should display only word legends and no symbols or route shields.*

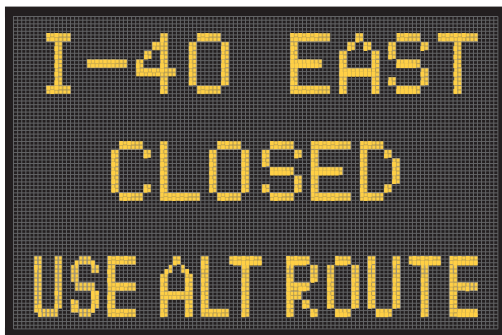
426 *For a single-phase message where the Standard Alphabets and other legend elements of*
427 *standard designs are used, the lettering style, size, and line spacing should comply with the*
428 *applicable provisions for the type of message displayed as provided elsewhere in this Manual.*
429 *For two-phase messages, larger legend heights should be used as described previously in this*
430 *Section because of the need for such messages to be legible at a greater distance. Regardless of*
431 *the number of phases, the CMS should comply with the legibility and visibility*
432 *provisions of Section 2L.03.*

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436 **Figure 2L-1. Example of CMS Capability to Display Sign Legends based on Pixel**
437 **Pitch**
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440 Color Full-matrix CMS with pixel pitches of 20 mm or less are typically capable
441 of displaying legends nearly identical to conventional sign legends, including
442 route shields and symbols as provided in the MUTCD.
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452 CMS with insufficient pixel density, typically with pixel pitches greater than 20
453 mm – whether full color or monochrome – are generally not capable of
454 adequately displaying conventional sign legends with sufficient clarity and
455 should only display monochrome character based legends.
456

457 Figure 2L-1, while satisfactorily portraying the differences between full-matrix color and
458 monochrome CMS displays with different pixel densities, should be examined for the
459 appropriateness of the color schemes chosen for the example sign message(s) (“CLOSED, USE
460 ALT ROUTE” See 6I.01 and 6I.03).

461 .

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463 **Section 2L.05 Comments:** NCUTCD agrees with 2L.05 with minor editorial changes.
464

465 **Section 2L.05 Message Length and Units of Information**

466 *Guidance:*

467 *The maximum length of a message should be dictated by the number of units of information*
468 *contained in the message, in addition to the size of the CMS. A unit of information, which is a*

469 *single answer to a single question that a driver can use to make a decision, should not be more*
470 *than four words.*

471 Support:

472 In order to illustrate the concept of units of information, Table 2L-1 shows an example
473 message that is comprised of four units of information.

474 The maximum allowable number of units of information in a CMS message is based on the
475 principles described in this Section, the current highway operating speed, the legibility
476 characteristics of the CMS, and the lighting conditions.

477 **Standard:**

478 **Each message shall consist of no more than two phases. A phase shall consist of no more**
479 **than three lines of text. Each phase shall be understood by itself and the meaning of the**
480 **entire message shall be the same, regardless of the sequence in which the phases are it is**
481 **read. Each line of legend shall be centered on the sign. Except for signs located on toll plaza**
482 **structures or other facilities with a similar booth-lane arrangement, if more than one CMS**
483 **is visible to road users, then only one sign shall display a sequential message at any given**
484 **time.**

485 **Abbreviations displayed on CMS shall comply with the provisions of Section 1A.15.**

486 *Guidance:*

487 *When designing and displaying messages on changeable message signs, the following principles*
488 *should be used:*

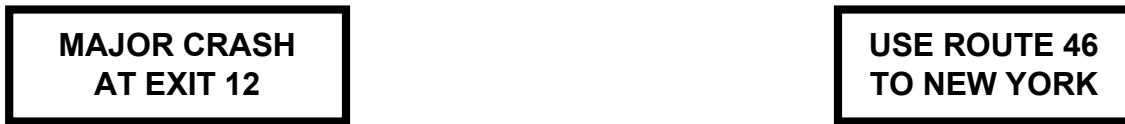
- 489 A. *The minimum time that an individual phase is displayed should be based on 1 second per*
490 *word or 2 seconds per unit of information, whichever produces a lesser value. The*
491 *display time for a phase should never be less than 2 seconds.*
- 492 B. *The maximum cycle time of a two-phase message should be 8 seconds.*
- 493 C. *The duration between the display of two phases should not exceed 0.3 seconds.*
- 494 D. *No more than three units of information should be displayed in a message phase.*
- 495 E. *No more than four units of information should be in a message when the traffic operating*
496 *speeds are 35 mph or more.*
- 497 F. *No more than five units of information should be in a message when the traffic operating*
498 *speeds are less than 35 mph.*
- 499 G. *Only one unit of information should appear on each line of the CMS.*
- 500

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Table 2L-2. Example of Units of Information

Question	Answer	Number of Information Units
What happened?	MAJOR CRASH	1
Where?	AT EXIT 12	1
Who is the advisory for?	Drivers Heading TO NEW YORK	1
What is advised?	USE ROUTE 46	1

504 Note: The following is an example of a two-phase message
505 that could be developed from the four information units
506 shown in this table:
507



508
509
510

Phase 1

Phase 2

NCUTCD agrees with Table 2L-2 as presented in the NPA.

511
512

Option:

513 A unit of information consisting of more than one word may be displayed on more than one
514 line. An additional changeable message sign at a downstream location may be used for the
515 purpose of allowing the entire message to be read twice.

516 If more than two phases would be needed to display the necessary information, additional
517 changeable message signs may be used to display this information as a series of two distinct,
518 independent messages with a maximum of two phases at each location, in accordance with the
519 provisions of Paragraph 4 of this Section.

520 Support

521 Table 2L-3 and Table 2L-4 provide examples of message construction for changeable
522 message signs. Each example shows the message content, layout, and phasing for a potential
523 message and an improved message. The improved message for each example has been optimized
524 for recognition, comprehension, and effectiveness.

525
526

Table 2L-3. Examples of Message Construction for CMS

Example	Phase	Potential Message	Improved Message	Comments
1	1	EXIT 10	EXIT 10 CLOSED	Diversionsary message: Each message phase should convey a complete thought independent of the other message phase. The entire message should also make sense regardless of which phase read first.
	2	CLOSED USE EXIT 12	USE EXIT 12	
2	1	ROADWORK AHEAD	ROAD WORK AHEAD	Advance warning message: Condensing ROAD and WORK into single word is not necessary since sign width will accommodate the conventional 2-word message. A general CAUTION message is not specific enough to be actionable by the road user. Message should not be repeated to fill sign.
	2	CAUTION CAUTION CAUTION	FINES DOUBLE	
3	1	RIGHT LANE CLOSED	RIGHT LANE CLOSED 1 MILE	Advance warning message: Use of single phase message reduces time necessary to read and glances away from the road. Second phase does not provide a complete message.
	2	1 MILE	N/A Single-Phase Message	
4	1	RT LN CLSD 1 MI	RIGHT LANE CLOSED 1 MILE	Advance warning message: Less common abbreviations (Table 1A-2) are not warranted when the sign can accommodate the full message. Abbreviations in Table 1A-2 should be limited only to portable CMS where the number of characters per line is limited.
	2	N/A Single-Phase Message	N/A Single-Phase Message	
5	1	9TH AVENUE SOUTHWEST KEEP RIGHT	9TH AVE SW KEEP RIGHT	Directional message: Conventional abbreviations for street name descriptors (Table 2D-3) are used for consistency with standard signs to improve recognition and reduce the apparent amount of legend.
	2	N/A Single-Phase Message	N/A Single-Phase Message	
6	1	EXPWY CONGESTED USE 101 FOR AIRPORT	US 19 CONGESTED	Diversionsary message: Lack of Expressway route number is vague to unfamiliar road user. Adding exit number for diversion route simplifies message.
	2	N/A Single-Phase Message	AIRPORT USE EXIT 101	
7	1	TRAVEL TIME TO I-89 13 MINUTES	I-89 JCT 12 MILES 13 MINS	Travel time information: TRAVEL TIME legend is extraneous and out of context for the distance message. Changing only one line of legend between phases compromises recognition of the message.
	2	TRAVEL TIME TO I-89 12 MILES	N/A Single-Phase Message	
8	1	SEAT BELTS SAVE LIVES	STATE LAW FASTEN SEAT BELTS	Safety campaign regulatory message: Slogan-type message does not convey the legal requirement. As an alternative, the STATE LAW legend could be eliminated and the fine for violations displayed on a second phase to convey the regulatory nature of the message.
	2	N/A Single-Phase Message	N/A Single-Phase Message	
9	1	DONT TEXT JUST DRIVE	NO HAND-HELD PHONE BY DRIVER	Regulatory message. Slogan-type message does not convey the legal requirement. Phase 2 of the improved message can be eliminated without any loss of meaning to Phase 1.
	2	IT CAN WAIT	\$250 FINE AND POINTS	

Note: Examples shown are for single-color CMS with pixel spacing greater than 20 mm and use all upper-case lettering. **Multi-color, full matrix CMS-width**

NCUTCD agrees with Table 2L-3 as presented in the NPA, except that typographic errors should be corrected.

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Table 2L-4. Examples of Message Construction for Portable CMS*

Example	Phase	Potential Message	Improved Message	Comments
1	1	EXIT 10	EXIT 10 CLOSED	Diversionsary message. Each phase conveys a complete thought.
	2	CLOSED USE EXIT 12	USE EXIT 12	
2	1	ROADWORK AHEAD	ROAD WORK AHEAD	Advance warning message. Condensing ROAD and WORK into a single word is unnecessary because the sign width will accommodate the conventional 2-word phrase. A general CAUTION message is not specific enough to be useful to the road user. Message should not be repeated to fill the sign.
	2	CAUTION CAUTION CAUTION	FINES DOUBLE	
3	1	RIGHT LANE CLOSED	RIGHT LN CLOSED 1 MILE	Advance warning message. Separation of the message into 2 phases is unnecessary. Second phase does not provide a complete message.
	2	1 MILE	N/A Single-Phas Message	
4	1	RT LN CLSD 1 MI	RIGHT LN CLOSED 1 MILE	Advance warning message. Less common abbreviations (Table 1A-XX) are not warranted when the sign can accommodate the full message.
	2	N/A Single-Phas Message	N/A Single-Phas Message	
5	1	9TH AVENUE SW	9 AVE SW KEEP RIGHT	Directional message. Conventional abbreviations for street name descriptors (Table 2D-XX) are used for consistency with standard signs to improve recognition and reduce the apparent amount of legend.
	2	KEEP RIGHT	N/A Single-Phas Message	
6	1	ROAD WORK	ROADWOR K NEXT	Advance warning message. Condensing ROAD and WORK into single word (see Table 1A-XX) accommodates a single-phase message.
	2	NEXT 3 MILES	N/A Single-Phas Message	
7	1	SEAT BELTS	FASTEN SEAT BELTS	Safety campaign regulatory message. Slogan-type message does not convey the legal requirement. As an alternative, the STATE LAW legend could be eliminated and the fine for violations displayed on a second phase to convey the regulatory nature of th message.
	2	SAVE LIVES	STATE LAW	
8	1	DONT TEXT	NO HAND- HELD PHONE	Regulatory message. Slogan-type message does not convey the legal requirement.
	2	JUST DRIVE	BY DRIVER	

* Examples shown are for a portable CMS where the display width is generally limited to 8 characters per line of legend.

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537 NCUTCD agrees with Table 2L-4 as presented in the NPA except as follows:

- 538 • Line 6: the Improved Message appears to need some formatting work. For example,
539 “Roadwork” should be shown on one line. Also, it appears the balance of the message is
540 missing after the word “Next”. Otherwise, the Potential Message appears to be the better
541 option.
- 542 • Correct the typographic error in the bottom callout.

544 **Section 2L.06 Comments:** NCUTCD recommends deletion of 2L.06 as presented in the NPA,
545 because it is too vague to provide any useful information.
546

548 **Section 2L.06 Frequency of Display of Messages**

549 Support:

550 ~~Overuse of certain types of traffic control devices can result in a reduction of their effectiveness~~
551 ~~(see Section 2A.04) due to habituation, a phenomenon by which repeated exposure to a stimulus~~
552 ~~results in diminished response. With respect to signs, habituation can occur through repeated~~
553 ~~exposure to a message, especially those messages that might not be perceived as having~~
554 ~~relevance to the road user, resulting in diminished responsiveness of the road user to that sign or~~
555 ~~message. Because messages can be changed or extinguished, the effectiveness of changeable~~
556 ~~message signs is tied more to the messages displayed thereon, the frequency of displayed~~
557 ~~messages, and the relevance to the road user, rather than to the installation of the signs~~
558 ~~themselves.~~

559 Guidance:

560 ~~Changeable message signs should be used judiciously to avoid habituation and preserve their~~
561 ~~effectiveness during the display of real-time messages about traffic conditions or traffic~~
562 ~~advisories.~~

565 **Section 2L.07 Comments:** NCUTCD agrees with 2L.07 as presented in the NPA.

567 **Section 2L.07 Travel Time Messages**

568 Support:

569 Travel times provide road users useful information about the level of congestion on segments
570 of highways that motorists experience frequent incidents that slows traffic. Travel times are only
571 helpful to the road user if they have a general understanding of the length of the road segment the
572 travel time is related to so that they can compare that to the time it takes them to travel a similar
573 distance on a highway without congestion. However, travel time messages requires road users to
574 read and process a significant amount of information and careful consideration is needed to
575 ensure the overall message is not overloading the motorist.

576 Guidance:

577 Travel times should be tied to the distance to a particular destination or junction so that road
578 users can estimate the level of congestion based on the time to travel that distance. When travel
579 times are displayed on changeable message signs, such as during peak traffic conditions, the
580 message should comply with the provisions of Section. 2E.49 and 2E.50. If both a travel time and
581 distance are displayed, the sign should display only one destination. A distance displayed as part
582 of a travel time message should be displayed as an integer rounded to the nearest whole mile.

583 Option:
584 A reference-location-based exit number (see Section 2E.22) may be displayed in lieu of a
585 destination name or junction thereby providing the necessary distance information to the road
586 user. If reference-location-based exit numbers are displayed, then up to two travel times may be
587 displayed provided that the distance to the exit is not also displayed.
588

589
590 **Section 2L.08 Comments:** NCUTCD generally agrees with 2L.08 as presented in the NPA with
591 minor editorial changes.
592

593 **Section 2L.08 Traffic Safety Campaign Messages**

594 Support:

595 An allowable ancillary use of changeable message signs is the display of traffic safety
596 messages in conjunction with a traffic safety campaign that includes other forms of media as the
597 primary communication and education mechanism.

598 Guidance:

599 The broad traffic safety campaign marketing message should be appropriately shortened or
600 otherwise modified to comply with the provisions of Section 2L.05 when a traffic safety campaign
601 message is displayed on a changeable message sign.

602 For consistency on a national level, traffic safety campaigns should be coordinated with those
603 on the National Highway Transportation Safety Administration's annual communications
604 calendar.

605 **Standard:**

606 **Traffic control messages shall have ~~priority~~ ~~primaey~~ over traffic safety campaign**
607 **messages.**
608

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610 **Section 2L.09 Comments:** NCUTCD recommends revising 2L.09 in accordance with NCUTCD
611 recommendation 20B-RW-03 by adding Support to address active traffic management and
612 editing the item list for clarity.
613

614 **Section 2L.09 Location of Permanent Changeable Message Signs**

615 Support:

616 Careful consideration of CMS installation location is important to having a safe and
617 effective message, taking into account several factors. CMS message length and complexity will
618 vary and often include two-phase displays, all of which may require longer glance times by
619 motorists than would be required for conventional sign messages. CMS are also generally used
620 on higher speed, multi-lane facilities with high traffic volumes where more time might be
621 required to properly respond to a message, such as by changing lanes or reducing ~~their~~ speed. It is
622 also ~~not un~~common for other signs to be in the same vicinity of the desired location for a CMS
623 raising the concern of overloading road users with information.

624 CMS can be considered for use in systems that implement various active traffic management
625 strategies, some of which are identified in Section 2L.02. [add per 20B-RW-03]

626 Guidance:

627 A CMS that is used in place of a static sign (such as a blank-out or variable legend regulatory

628 sign) should be located in accordance with the provisions of Chapter 2A and the provisions for
629 the static sign it replaces. ~~The following factors should be considered when installing other~~
630 ~~permanent changeable message signs:~~ Changeable message signs should:

- 631 A. ~~Changeable message signs should~~ Be located sufficiently upstream of known bottlenecks
632 and high crash locations to enable road users to select an alternate route or take other
633 appropriate action in response to a recurring condition.
- 634 B. ~~Changeable message signs should~~ Be located sufficiently upstream of major diversion
635 decision points, such as interchanges, to provide adequate distance over which road users
636 can change lanes to reach one destination or the other.
- 637 C. ~~Changeable message signs should~~ Not be located within an interchange except for toll
638 plazas or managed lanes.
- 639 D. ~~Changeable message signs should~~ Not be positioned at locations where the information
640 load on drivers is already high because of guide signs and other types of information.
- 641 E. ~~Changeable message signs should~~ Not be located in areas where drivers frequently
642 perform lane- changing maneuvers in response to static guide sign information, or
643 because of merging or weaving conditions.

644 **[revise per 20B-RW-03 - improve clarity and uniformity]**

645 Support:

646 Information regarding the design and application of portable changeable message signs in
647 temporary traffic control zones is contained in Section 6F.60.