National Committee on
Uniform Traffic Control Devices

13236 North 7th Street, Suite 4-259, Phoenix, Arizona 85022
Phone/Text: 231-4-NCUTCD (231-462-8823)
E-mail: secretary@ncutcd.org

Item No.: 20B-RW-03

NCUTCD Proposal for Changes to the Manual on Uniform Traffic Control Devices

TECHNICAL COMMITTEE:	Regulator and Warning Signs Technical Committee
ITEM NUMBER:	20B-RW-03
TOPIC:	Electronic Display Traffic Control
ORIGIN OF REQUEST:	Electronic Display Traffic Control Joint Task Force: Randy McCourt & Joanne Conrad (Co-Chairs); RW (Jay Swinea, Rich Meredith, Sue Chrysler, Charles Meyer); Markings (Jim Powell, Harry Campbell); GMI (Matt Rauch, John Hansen, Maurice Palumbo); Signals (George Butzer, Richard Nassi, Scott Wainwright (Edit)); TTC (Neil Boudreau, Gerry Ullman); RR/LRT (JoNette Kuhnau).
AFFECTED SECTIONS OF MUTCD (2009):	Section 1A.04 Relation to Other Publications
Edit Committee	Section 1C.02 Definitions of Headings, Words, and Phrases in this Manual
RWSTC:	Section 2A.04 Design of Signs Section 2A.07 Retroreflectivity and Illumination Section 2A.10 Sign Color Section 2A.15 Enhanced Conspicuity for Standard Signs Section 2B.02 Design of Regulatory Signs Section 2B.05 STOP Sign (R1-1) and ALL WAY Plaque (R1-3P) Section 2B.08 YIELD Sign (R1-2) Section 2B.13 Speed Limit Sign (R2-1) Section 2B.18 Movement Prohibition Signs Section 2B.25 BEGIN and END Plaques (R3-9cP, R3-9dP) Section 2B.26 Reversible Lane Control Signs Section 2B.37 DO NOT ENTER Sign (R5-1) Section 2B.38 WRONG WAY Sign (R5-1a) Section 2B.53 Traffic Signal Signs (R10-5 through R10-30) Section 2B.54 No Turn on Red Signs Section 2B.56 Ramp Metering Signs (R10-28 and R10-29) Section 2C.02 Application of Warning Signs Section 2C.03 Design of Warning Signs Section 2C.08a Driver Feedback Signs (WX-XX) Section 2C.13 Truck Rollover Warning Sign (W1-13)

RWSTC:	Section 2C.32 Surface Condition Signs
	Section 2C.35 Weather Condition Signs
	Section 2C.37 Advance Ramp Control Signal Signs
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GMI:	Section 2D.35 Trailblazer Assembly
	Section 2E.54 Weigh Station Signing
	Section 2F.05 Regulatory Signs for Toll Plazas
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	CHAPTER 2L. CHANGEABLE MESSAGE SIGNS
Signals:	Section 4S.01 General Design and Operation of Flashing Beacons
	Section 4S.04 Speed limit beacons
	Section 4T.01 Application of Lane-Use Control Signals
	Section 4T.02 Meaning of Lane-Use Control Signal Indications
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TTC:	Section 6F.60 Portable Changeable Message Signs
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RWSTC:	Section 7B.15 School Speed Limit Assembly (S4-1P, S4-2P, S4-3P, S4-4P, S4-6P, S5-1) and END SCHOOL SPEED LIMIT Sign
RR/LRT:	Section 8B.08 Part-Time Turn Prohibitions During Preemption
	Section 8B.19 Light Rail Transit Approaching Warning Sign

DEVELOPMENT HISTORY:

- Approved by Task Force: 05/14/2020
- Approved by RW Technical Committee: 06/17/2020
- Approved by Markings Technical Committee: 06/18/2020
- Approved by GMI Technical Committee: 06/17/2020
- Approved by Signals Technical Committee: 06/18/2020
- Approved by TTC Technical Committee: 06/18/20202
- Approved by Railroad and Light Rail Technical Committee: 06/19/2020
- Approved by Edit Committee: 07/10/2020
- Approved by Task Force following sponsor comments: 12/04/2020
- Approved by Edit Committee following sponsor comments: 01/06/2021
- Approved by RW Technical Committee following sponsor comments: 01/11/2021
- Approved by GMI Technical Committee following sponsor comments: 01/13/2021
- Approved by Signals Technical Committee following sponsor comments: 01/13/2021
- Approved by TTC Technical Committee following sponsor comments: 01/13/2021
- Approved by RR/LRT Technical Committee following sponsor comments: 01/11/2021
- Approved by NCUTCD Council: 01/20/2021

This is a proposal for recommended changes to the MUTCD that has been approved by the NCUTCD Council. This proposal does not represent a revision of the MUTCD and does not constitute official MUTCD standards, guidance, or options. It will be submitted to FHWA for consideration for inclusion in a future MUTCD revision. The MUTCD can be revised only by the FHWA through the federal rulemaking process.

SUMMARY:

Use of dynamic message signs and LEDs have evolved since the 2009 MUTCD. The Electronic Display Traffic Control Task Force formed in 2018 and has reviewed all changeable message sign applications in the MUTCD to bring consistency with current technology and practices. A survey was undertaken to define current practices in the profession. Focused attention was on 2009 MUTCD chapters 2L (Changeable Message Signs) and 4M (Lane-Use Control Signals). Several collateral definitions and sections have been reviewed and updated to align with Task Force findings and the recent official ruling from FHWA (4(09)-70(I) on lane-use control signal indications for ATM.

DISCUSSION:

For several years now, full-matrix dynamic message signs (DMS) have been available and are being commonly deployed with Advanced Traffic Management strategies, especially on freeways and expressways. When the 2009 MUTCD was approved, this technology was in its nascent stage of development. These high-quality DMS displays are full-color, utilize LEDs and have small pixel pitch (spacings) capable of accurately depicting standard traffic control signs and symbols in high resolution. Many states and toll authorities are using such DMS to open and close lanes and shoulders, implement variable lane-by-lane speed limits, and warn of traffic conditions ahead, thus improving capacity and safety and providing better management of incidents. These displays are typically very large and overhead-mounted on gantries and have been placed at ½ mile apart. Numerous applications have emerged (see Figure 1 samples) that create circumstances not contemplated in the MUTCD.

The Electronic Display Task Force (formed in 2018) has met numerous times to address how greater consistency could be achieved in MUTCD changeable message signs (CMS). Because electronic display involves more than CMS, the task force engaged many technical committees. The Task Force work consisted of:

- Conduct a survey of professionals to identify gaps and inconsistencies in data as well as current practices.
- Review definitions to provide greater potential for consistent understanding.
- Review of MUTCD Chapters 2L and 4M for proposed changes, focusing on how criteria are presented for manual users related to electronic signs
- Identify criteria that are best established in NEMA TS-4 as a supporting reference document for implementation
- Assess other sections of the MUTCD for consistency to bring uniformity to the overall discussion and presentation of electronic displays.

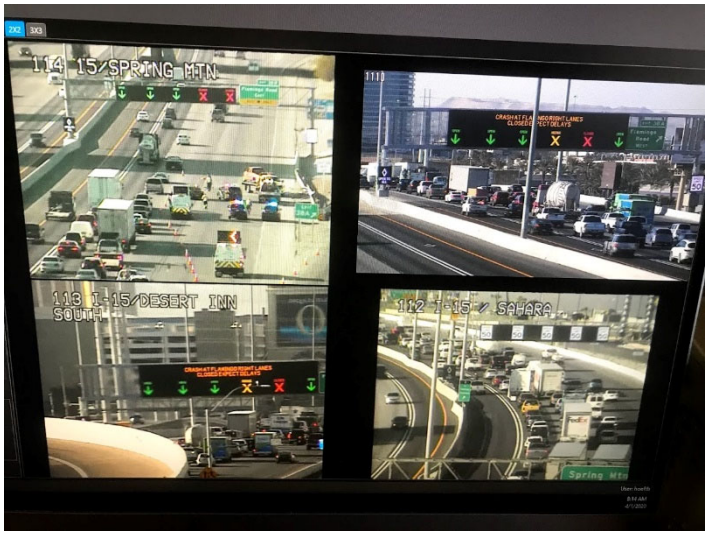
The survey (completed by 73 NCUTCD and 314 industry participants) highlighted the following gaps in information and needs for consideration by the task force:

- Color and font requirements for electronic displays of traffic control devices
- Legibility needs
- Brightness and dimming references
- Use of graphics in electronic displays
- Pitch of pixels in electronic displays needed for a DMS
- Use of LEDs in borders of signs
- Impacts of future technologies

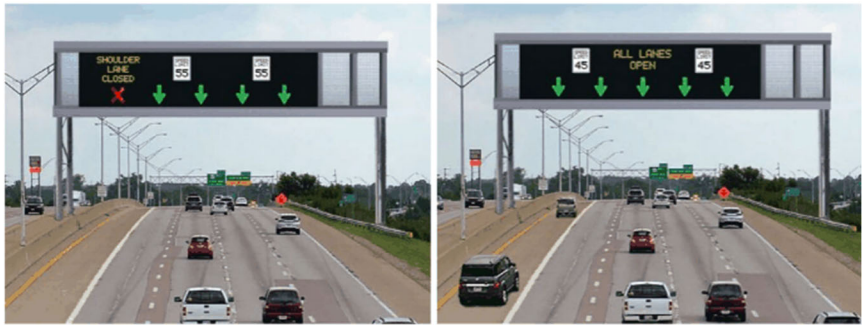
- Color of backgrounds for CMS
- Spacing standards for DMS
- How advertising should be addressed

Figure 1. Example Applications of Dynamic Message Signs in USA

Las Vegas



Columbus Smartline



Minneapolis

Each of these has been addressed in this proposal. Extensive reorganization of definitions were completed. The Task Force recommends that for signs that the term Changeable Message Sign be the over arching terms used with four key functional groups underneath that include DMS,

hybrid, blank-out and line matrix (note: variable as a term was dropped for uniformity reasons as its definition is redundant and repetitive to CMS – Webster definition: subject to variation or change). In the same fashion, beacons and signals were reorganized to place all forms of these devices under a single title to assist users in finding the various applications.

A critical guiding principle was established that (this is similar to section 2L.05, paragraph 17):

> *Dynamic message, hybrid and blank-out signs shall display an exact duplicate of a standard sign with no apparent loss of resolution or recognition to the road user when compared with a static version of the as shown in the "Standard Highway Signs and Markings" book (see Section 1A.11) in terms of shape, color, size, Standard Alphabets and letter forms, route shields, and other typical sign legend elements.*

Substantial work was done to refine Chapter 2L addressing gaps outlined in the industry survey. It addresses standards for electronic displays for freeway DMS (maximum 20mm pixel pitch) and conventional road guidance. It clarifies applications of hybrid and blank-out signs which are then referenced in appropriate sections of Part 2. It clarifies applications for black backgrounds on hybrid signs as an option to the guiding principle above. Additionally, the use of CMS as a part of temporary traffic control is established included the cross application (consistency) of sequential chevrons warning in advance of lane-use control signals on freeways.

It should be noted that there has been some initial experimentation as well as NCHRP research on diagonal down Lane Use Control Signal (LUCS) arrows in freeway Active Traffic Management Systems to denote a “merge out of this lane ahead” condition and steady yellow X LUCS with the word “SLOW” to denote the lane is open but caution should be exercised (such as for a stopped traffic queue in the lane ahead or for maintenance work on the adjacent shoulder.) However, FHWA has indicated that their official interpretation there were no conclusive results and Sue Chrysler, the TTI researcher on the NCHRP project, concluded that future field testing is needed to confirm the initially positive findings for these indications with static computer displays. FHWA 2016 research indicated streaming chevrons had highest comprehension, as a warning not a replacement to “X” in Part 4.

The longstanding guidance in Section 4T.03 for 2,300 feet as the minimum distance for LUCS minimum color legibility (paragraph 06) and as the maximum spacing between successive sets of LUCS (paragraph 08) has been called into question in view of more recent experience on freeways, with typical ½ mile (2,640 feet) spacing defined in Parts 2 and 6. This topic is worthy of research, and until that research is complete, it is recommended to uniformly use ½ mile.

RECOMMENDED MUTCD CHANGES

The following present the proposed changes to the current MUTCD within the context of the current MUTCD language. Proposed additions to the MUTCD are shown in blue underline and proposed deletions from the MUTCD are shown in ~~red strikethrough~~. Changes previously approved by NCUTCD Council (but not yet adopted by FHWA) are shown in green double underline for additions and ~~green double strikethrough~~ for deletions. In some cases, background comments may be provided with the MUTCD text. These comments are indicated by [highlighted light blue in brackets].

PART 1. GENERAL

CHAPTER 1A. GENERAL

1A.04~~1A.11~~ Relation to Other Publications

Standard:

01 **To the extent that they are incorporated by specific reference, the latest editions of the following publications, or those editions specifically noted, shall be a part of this Manual: "Standard Highway Signs and Markings" book (FHWA); and "Color Specifications for Retroreflective Sign and Pavement Marking Materials" (appendix to subpart F of Part 655 of Title 23 of the Code of Federal Regulations).**

Support:

02 The "Standard Highway Signs and Markings" book includes standard alphabets and symbols and arrows for signs and pavement markings.

04 Other publications that are useful sources of information with respect to the use of this Manual are as follows: ~~listed in this paragraph. See Addresses in this Manual for ordering information for the following publications (later editions might also be available as useful sources of information):~~ [Council Approved 6-09-2016]

1A. "Active Traffic Management (ATM) Implementation and Operations Guide," FHWA-HOP-17-056, December 2017

36. "NEMA TS-4-2016 ~~Standards Publication TS 4-2005~~ Hardware Standards for Dynamic Message Signs (DMS) With NTCIP Requirements," ~~2005~~ 2016 Edition (National Electrical Manufacturers Association) ~~(NEMA)~~

CHAPTER 1C. DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

Section 1C.02~~1A.13~~ Definitions of Headings, Words, and Phrases in this Manual [16B-EC-01, 6-26-2014]

Standard:

01 **Unless otherwise defined in this Section, or in other Parts of this Manual, words or phrases shall have the meaning(s) as defined in the most recent editions of the "Uniform Vehicle Code," "AASHTO Transportation Glossary (Highway Definitions)," and other publications mentioned in Section ~~1A.11~~1A.04.** [16B-EC-01, 6-26-2014]

02 **The following words and phrases, when used in this Manual, shall have the following meanings:** (Definitions below approved by Edit Committee 7-10-2020)

3A. Active Traffic Management (ATM) - the dynamic management of congestion (recurrent and nonrecurrent) through variations in lane use and/or associated traffic control strategies and other techniques based on prevailing and/or predicted traffic conditions for improving capacity, safety and operations.

20. Beacon—a highway traffic signal with one or more signal ~~sections~~ indications that operates in a flashing mode.

a. Hybrid Beacon—a special type of beacon (see Hybrid Beacon).

~~95.~~ b. Intersection Control Beacon—a beacon used only at an intersection to control two or more directions of travel.

c. Rapid Flashing Beacon - a beacon actuated by a pedestrian or bicyclist with a rapid-pulsing flash rate to enhance conspicuity of pedestrian, school, or trail crossing warning signs at or in advance of uncontrolled, marked crosswalks.

~~216.~~d. Speed Limit Sign Beacon—a beacon used to supplement a SPEED LIMIT sign.

~~223.~~e. **Stop Beacon—a beacon used to supplement a STOP sign, a DO NOT ENTER sign, or a WRONG WAY sign.**

~~250.~~f. **Warning Beacon—a beacon used only to supplement an appropriate warning or regulatory sign or marker.**

~~28. Changeable Message Sign—a sign that is capable of displaying more than one message (one of which might be a "blank" display), changeable manually, by remote control, or by automatic control. Electronic-display changeable message signs are referred to as Dynamic Message Signs in the National Intelligent Transportation Systems (ITS) Architecture and are referred to as Variable Message Signs in the National Electrical Manufacturers Association (NEMA) standards publication.~~ **[Moved to definition 193.b**

~~61. Emergency-Vehicle Hybrid Beacon—a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist authorized emergency vehicles in entering or crossing a street or highway.~~ **[Moved to definition 20.a.i above]**

~~62. Emergency-Vehicle Traffic Control Signal—a special traffic control signal that assigns the right-of-way to an authorized emergency vehicle.~~ **[Moved to definition 86.d.i]**

75. Flashing-Light Signals—a warning device consisting of two red signal indications arranged horizontally that are activated to flash alternately when rail traffic is approaching or present at a grade crossing.

86. Highway Traffic Signal—a power-operated traffic control device by which traffic is warned or directed to take some specific action. These devices do not include power-operated signs (except as provided in Chapters 4S and 4T), steadily-illuminated raised pavement markers, gates, Flashing Light Signals (see Section 8C.02), [16B-EC-01, 6-26-2014] warning lights (see Section 6F.83), or steady-burning electric lamps. Highway traffic signals include:

a. Flashing Beacon – See Beacon.

b. In-Roadway Warning Lights—a special type of highway traffic signal installed in the roadway surface to warn road users that they are approaching a condition on or adjacent to the roadway that might not be readily apparent and might require the road users to ~~slow down~~ reduce speed and/or come to a stop. [Definition 90, relocated and revised as indicated]

c. Lane-Use Control Signal—a signal face or comparable display on a full-matrix Dynamic Message Sign (see Chapters 2L and 4T) displaying indications to permit or prohibit the use of specific lanes of a roadway or shoulders, or to indicate the impending prohibition of such use. [Definition 101, relocated and revised as indicated]

d. Traffic Control Signal (traffic signal) – a~~ny~~ highway traffic signal placed at intersections, movable bridges, fire stations, midblock crosswalks, alternating one-way section of a single lane road, private driveways, or other locations that require conflicting traffic to be directed to stop and permitted to proceed in an orderly manner. These devices do not include pedestrian hybrid beacons (see Chapter 4F) or emergency-vehicle hybrid beacons (see Section 4G.04). [16B-EC-01, 6-26-2014, definition 239 relocated and revised as indicated] **Special traffic control signals include:**

i. Emergency-Vehicle Traffic Control Signal—a ~~special~~ traffic control signal that ~~assigns the right-of-way to~~ directs all conflicting traffic to stop in order to permit the driver of an authorized emergency vehicle to proceed into the roadway or intersection. [16B-EC-01, 6-26-2014 – Definition 62, relocated]

ii. **Movable Bridge Traffic Control Signal—a ~~highway~~ traffic control signal installed at a movable bridge to notify traffic to stop during periods when the roadway is closed to allow the bridge to open.** [Definition 121, relocated]

iii. **Portable Traffic Control Signal—a temporary component of a traffic control signal on a mobile support with one or more signal faces that is designed so that it can be easily transported ~~and reused at different locations~~, deployed, or relocated as part of a temporary traffic control signal, or during construction and maintenance as a temporary part of a permanent traffic control signal installation.** [Definition 149, relocated and revised as indicated]r

iv. **Pre-signal – a ~~special highway~~ traffic control signal ~~faces~~ located at a grade crossing that control traffic approaching ~~a~~ the grade crossing and operated in coordination with~~as a part of~~ the adjacent interconnected intersection traffic control signals. ~~in conjunction with the traffic control signal faces that control traffic approaching a highway-highway intersection beyond the tracks. Supplemental near-side traffic control signal faces for the highway-highway intersection are not considered pre-signals. Pre-signals are typically used where the clear storage distance is insufficient to store one or more design vehicles~~** [Approved by Council 6/26/2014 – Definition 154 relocated and revised as indicated]

v. **Queue Cutter signal – a ~~special~~ type of traffic control signal that is intended to prevent vehicular queuing across tracks at a grade crossing where traffic queuing occurs and is activated for one direction of travel by an approaching train, by an approaching bus on a busway, actuation from a downstream queue detection system, by time of day or a combination of any of these. A queue cutter signal is not operated as a part of a downstream intersection traffic control signal but is an independently controlled traffic control signal.** [Approved by Council 6/26/2014]

vi. **Ramp Control Signal (Ramp Meter) – a ~~highway~~ traffic control signal installed to control the flow of traffic onto a freeway at an entrance ramp or at a freeway-to-freeway ramp connection.** [Definition 169, relocated and revised as indicated]

vii. **Temporary Traffic Control Signal – a traffic control signal that is installed for a limited time-period using fixed or portable traffic control signal units.** [Definition 228, relocated and revised as indicated]

88. **Hybrid Beacon—a special type of beacon that is intentionally placed in a dark mode (no indications displayed) between periods of operation and, when operated, displays both steady and flashing traffic control signal indications. Hybrid beacon applications include:**

~~61.~~ i. **Emergency-Vehicle Hybrid Beacon—~~a special type of hybrid beacon~~ used to warn and control traffic at an unsignalized location to assist authorized emergency vehicles in entering or crossing a street or highway.**

~~142.~~ ii. **Pedestrian Hybrid Beacon— ~~a special type of hybrid beacon~~ used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk.**

[Moved back to definition 88 from definition 20.a above due to sponsor comment for clarity]

90. **In-Roadway Warning Lights—see Highway Traffic Signal.~~a special type of highway traffic signal installed in the roadway surface to warn road users that they are~~**

~~approaching a condition on or adjacent to the roadway that might not be readily apparent and might require the road users to slow down and/or come to a stop.~~ [Moved to definition 86.b]

~~95. Intersection Control Beacon—a beacon used only at an intersection to control two or more directions of travel.~~ [Moved to definition 20.b above

~~101. Lane-Use Control Signal—a signal face displaying indications to permit or prohibit the use of specific lanes of a roadway or to indicate the impending prohibition of such use.~~ [Moved to definition 86.c]

101A. LED enhanced sign – a static sign~~, other than a changeable message or blank-out sign, that includes~~ embedded with LED units as described in Section 2A.07 to improve the conspicuity or increase the legibility of sign legends and borders [14A-RW-07, 6-28-2014]

~~121. Movable Bridge Signal—a highway traffic signal installed at a movable bridge to notify traffic to stop during periods when the roadway is closed to allow the bridge to open.~~ [Moved to definition 86.d.ii]

~~142. Pedestrian Hybrid Beacon—a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk.~~ [Moved to definition 20.a.ii above]

~~149. Portable Traffic Control Signal—a temporary traffic control signal that is designed so that it can be easily transported and reused at different locations.~~ [Moved to definition 86.d.iii]

~~154. Pre-signal—traffic control signal faces that control traffic approaching a grade crossing in conjunction with the traffic control signal faces that control traffic approaching a highway-highway intersection beyond the tracks. Supplemental near-side traffic control signal faces for the highway-highway intersection are not considered pre-signals. Pre-signals are typically used where the clear storage distance is insufficient to store one or more design vehicles.~~ [Approved by Council 6/26/2014, moved to definition 86.d.iv]

~~165A. Queue cutter signal – A traffic control signal that is intended to prevent vehicular queuing across tracks at a grade crossing where traffic queuing occurs and is activated for one direction of travel by an Approaching train, by an approaching bus on a busway, actuation from a downstream queue detection system, by time of day or a combination of any of these. A queue cutter signal is not operated as a part of a downstream intersection traffic control signal but is an independently controlled traffic control signal.~~ [Council Approved 6-26-2014, moved to definition 86.d.v]

~~169. Ramp Control Signal—a highway traffic signal installed to control the flow of traffic onto a freeway at an entrance ramp or at a freeway-to-freeway ramp connection.~~ [Moved to definition 86.d.vi]

170. Ramp Meter—see ~~Ramp Control~~Highway Traffic Signal.

191A. Shoulder – a longitudinal area contiguous with the traveled way primarily for accommodation of stopped vehicles for emergency use or for a managed lane ~~facility~~.~~and for lateral support of base and surface courses.~~ [16B-EC-01, 6-26-2014 – revised as indicated]

193. Sign—with regard to controlling traffic, a~~ny~~ traffic control device that is intended to communicate specific information to road users through a word, symbol, and/or arrow legend. Signs do not include highway traffic signals, pavement markings, delineators,

or channelization devices. Signs whose purpose is unrelated to traffic control are addressed in Section 1D.04.

a. Static Sign – a traffic control device that permanently displays a constant message(s) through a word, symbol and/or arrow legend.

b. **Changeable Message Sign -** a traffic control device that is capable of displaying one or more alternative messages and/or symbols used for active traffic management, regulation, warning, guidance and applications listed in Section 2L.02). Changeable message signs include, but are not limited to: [Definition 28 relocated and revised as indicated]

i. Dynamic Message Sign - a full matrix, high definition unit that is capable of displaying multiple text and symbol traffic control devices and messages, replicating traffic control devices with no apparent loss of resolution or recognition.

ii. Hybrid Sign - combines both static and dynamic elements in one traffic control display. Dynamic element examples include variable speed limits, driver feedback and travel time displays.

iii. Blank-Out Sign – displays a single predetermined message only when activated. When not activated, the sign legend is not visible.

iv. Line Matrix Sign - displays characters in lines of text, sometimes in groups of character matrix, line matrix or full matrix. The sign does not display traffic control device symbols, only text (alpha, numeric, keyboard symbol) and can be fixed-mounted or portable.

197A. Signal – See Highway Traffic Signal.

~~216. Speed Limit Sign Beacon – a beacon used to supplement a SPEED LIMIT sign.~~ [Moved to definition 20.d above]

~~223. Stop Beacon – a beacon used to supplement a STOP sign, a DO NOT ENTER sign, or a WRONG WAY sign.~~ [Moved to definition 20.e above]

228. Temporary Traffic Control Signal— See Highway Traffic Signal. ~~a traffic control signal that is installed for a limited time period.~~ [Moved to definition 86.d.vii]

239. Traffic Control Signal (Traffic Signal)— See Highway Traffic Signal.~~any highway traffic signal by which traffic is alternately directed to stop and permitted to proceed.~~

~~250. Warning Beacon – a beacon used only to supplement an appropriate warning or regulatory sign or marker.~~ [Moved to definition 20.f above]

Section 1C.03~~1A.14~~ Meanings of Acronyms and Abbreviations in this Manual [16B-EC-01, 6-26-2014]

Standard:

01 **The following acronyms and abbreviations, when used in this Manual, shall have the following meanings:**

7A. ATM – Active Traffic Management

10A. DMS – Dynamic Message Sign

PART 2. SIGNS

CHAPTER 2A. GENERAL

Section ~~2A.06~~ 2A.04 Design of Signs

Support:

01 This Manual shows many typical standard signs and object markers approved for use on streets, highways, bikeways, and pedestrian crossings.

02 In the specifications for individual signs and object markers, the general appearance of the legend, color, and size are shown in the accompanying tables and illustrations, and are not always detailed in the text.

03 Detailed drawings of standard signs, object markers, alphabets, symbols, and arrows (see Figure 2D-2) are shown in the "Standard Highway Signs **and Markings" book** ~~and Markings" book~~.**~~publication~~** Section 1A.11 contains information regarding how to obtain this publication.

04 The basic requirements of a sign are that it be legible to those for whom it is intended and that it be understandable in time to permit a proper response. Desirable attributes include:

A. High visibility by day and night; and
B. High legibility (adequately sized letters, symbols, or arrows, and a short legend for quick comprehension by a road user approaching a sign).

05 Standardized colors and shapes are specified so that the several classes of traffic signs can be promptly recognized. Simplicity and uniformity in design, position, and application are ~~important.~~ essential for a sign to be effective.

Standard:

06 **The term legend shall include all word messages and symbol and arrow designs that are intended to convey specific meanings.**

07 **Uniformity in design shall include shape, color, dimensions, legends, borders, and illumination or retroreflectivity.**

08 **Standardization of these designs does not preclude further improvement by minor ~~changes in~~ modification to the proportion or orientation of symbols, width of borders, or layout of word messages, but all shapes and colors shall be as indicated.**

09 **All symbols shall be unmistakably similar to, or mirror images of, the adopted symbol signs, all of which are shown in the "Standard Highway Signs and Markings" book ~~and Markings" book~~ ~~publication~~ (see Section 1A.11). Symbols and colors shall not be modified unless otherwise provided in this Manual. ~~All~~ Symbols, ~~and~~ colors or other design features for signs not shown in the "Standard Highway Signs and Markings" book ~~and Markings" book~~ ~~publication~~ shall follow the procedures for experimentation and change described in Section 1A.10. (approved by Council 6/26/2014)**

09a **Dynamic message signs, hybrid signs and blank-out signs shall meet the design requirements of paragraphs 06 through 09. They shall display duplicates of standard signs or other sign legends using standard symbols, the Standard Alphabets and letter forms, route shields and other typical sign legends with no apparent loss of resolution or recognition to the road user when compared with static versions of the same sign or legend, except as noted in Section 2L.04 for hybrid and blank-out signs.**

Option:

10 Although the standard design of symbol signs cannot be modified, the orientation of the symbol may be changed to better reflect the direction of travel, if appropriate.

Standard:

11 **Where a standard word message is applicable, the wording shall be as provided in this Manual.**

12 **In situations where word messages are required other than those provided in this Manual, the signs shall be of the same shape and color as standard signs of the same functional type.**

Option:

13 State and local highway agencies and owners of site roadways open to public travel may develop special word ~~message~~ legend signs in situations where roadway conditions make it necessary to provide road users with additional regulatory, warning, or guidance information, such as when road users need to be notified of special regulations or warned about a situation that might not be readily apparent. Unlike colors that have not been assigned or symbols that have not been approved for signs, new word ~~message~~ legend signs may be used without the need for experimentation. (approved by Council 1/08/2016)

Support:

13a Certain special word legends signs might be unclear to the road user. Although experimentation is not required for such word legends, they might still require an evaluation to determine comprehension or possible misinterpretation by the road user. (approved by Council 6/26/2014)

~~**Standard:**~~

~~**14 Except as provided in Paragraph 16 and except for the Carpool Information (D12-2) sign (see Section 2I.11), Internet addresses and e-mail addresses, including domain names and uniform resource locators (URL), shall not be displayed on any sign, supplemental plaque, sign panel (including logo sign panels on Specific Service signs), or changeable message sign.**~~

~~*Guidance:*~~

~~*15 Unless otherwise provided in this Manual for a specific sign, and except as provided in Paragraph 16, telephone numbers of more than four characters should not be displayed on any sign, supplemental plaque, sign panel (including logo sign panels on specific service signs), or changeable message sign.*~~

14 Unless otherwise provided in this Manual for a specific sign: telephone numbers, internet addresses, email addresses, domain names, uniform resource locators (URL), quick response (QR) codes, bar codes, social media metadata/handles or other graphics for optical scanning for purpose of obtaining information shall not be displayed on signs, supplemental plaques, sign panels or changeable message signs.

Option:

~~16 Internet addresses, e-mail addresses, or telephone numbers with more than four characters may be displayed on signs, supplemental plaques, sign panels, and changeable message signs that are intended for viewing only by pedestrians, bicyclists, occupants of parked vehicles, or drivers of vehicles on low-speed roadways where engineering judgment indicates that an area is available for drivers to stop out of the traffic flow to read the message.~~

14a Internet addresses, e-mail addresses, or telephone numbers, quick response (QR) codes, bar codes, social media metadata/handles or other graphics for the purpose of obtaining information (other than those for maintenance or inventory purposes, see Paragraph XX and XX of this Section) may be displayed on the face of signs, supplemental plaques, sign panels, and changeable message signs that are intended for viewing only by pedestrians, bicyclists, or occupants of parked vehicles and not visible to motor vehicle drivers.

Standard:

~~17~~ 15 **Pictographs (see definition in Section 1A.13) shall not be displayed on signs except as specifically provided in this Manual. Pictographs shall be simple, dignified, and devoid of any advertising, and not contain any quick response (QR) codes or other graphics designed for optical scanning for the purpose of obtaining information. When used to represent a political jurisdiction (such as a State, county, or municipal corporation) the pictograph shall be the official designation adopted by the jurisdiction. When used to represent a college or university, the pictograph shall be the official seal adopted by the institution. Pictorial representations of university or college programs shall not be permitted to be displayed on a sign.**

15a **No items other than official traffic control signs, inventory stickers, sign installation dates, sign sizes, sign designations, anti-vandalism stickers, and inventory or maintenance codes shall be mounted on the back of a sign unless otherwise provided in this Manual for a specific sign.** (approved by Council 6/26/2014)

Section 2A.07 Retroreflectivity and Illumination

Support:

01 There are many materials currently available for retroreflection and various methods currently available for the illumination of signs and object markers. New materials and methods continue to emerge. New materials and methods can be used as long as the signs and object markers meet the standard requirements for color, both by day and by night.

Standard:

02 **Regulatory, warning, and guide signs and object markers shall be retroreflective (see Section 2A.08) or illuminated to show the same shape and similar color by both day and night, unless otherwise provided in the text discussion in this Manual for a particular sign or group of signs.**

03 **The requirements for sign illumination shall not be considered to be satisfied by street or highway lighting.**

Option:

04 Sign elements may be illuminated by the means shown in Table 2A-1.

05 Retroreflection of sign elements may be accomplished by the means shown in Table 2A-2.

~~06 Light Emitting Diode (LED) units may be used individually within the~~ border ~~, legend or symbol of a sign in a one-legend "blank-out" sign, part-time sign or driver feedback sign to enhance the sign conspicuity and increase the sign legibility These application of LED units are not considered as changeable message signs. and in the border of a sign, except for changeable message signs, to improve the conspicuity, increase the legibility of sign legends and borders, or provide a changeable message~~ [6/28/2014, 14A-RW-07]

~~Support:~~

~~06a LED units that are used to illuminate the full sign matrix, background and legend, are changeable message signs (CMS) covered in Part 2L. Regulatory and Warning LED signs are covered in Parts 2B, 2C and 7.~~ [6/28/2014, 14A-RW-07]

Standard:

06 **If flashed on a sign for enhanced conspicuity (Section 2A.15), ~~all~~ LED units shall flash simultaneously at a ~~rate of more than 50 and less than 60 times per minute. any~~ steady rate between 50 and 120 times per minute. All the LED units ~~in a sign legend or border~~ shall be illuminated simultaneously with no sequential (chasing) or variable flash (dancing) rates,**

except as provided in Section 2L.04, paragraphs 02 and 02a. ~~A cluster of LED units shall not be used within the border of a sign.~~ [6/28/2014, 14A-RW-07, moved from paragraph 09]

07 **Except as provided in Paragraphs 11 and 12 and changeable message signs (Chapter 2L), neither individual LEDs nor groups of LEDs shall be placed within the background area of a sign.** ~~The application of LEDs to display sign legends or symbols shall use a maximum pitch of 20 mm to cover the stroke width of the letter or symbol.~~ [Moved to 2L.04 paragraph 09A]

08 ~~If used,~~ **The LEDs shall not protrude outside the sign border or legend when used in such applications and shall have a maximum diameter of 1/4 inch and shall be the following colors based on the type of sign:**

Table 2A-1. Illumination of Sign Elements

Means of Illumination	Sign Element To Be Illuminated
Light behind the sign face	▪ Symbol or word message ▪ Background ▪ Symbol, word message, and background (through a translucent material)
Attached or independently mounted light source designed to direct essentially uniform illumination onto the sign face	▪ Entire sign face
~~Light emitting diodes (LEDs)~~	▪ ~~Symbol or word message~~ ▪ ~~Portions of the Sign border~~
LED and ~~O~~other devices, or treatments that highlight the sign shape, color, and/or message: Luminous tubing Fiber optics Incandescent light bulbs Luminescent panels	▪ Symbol or word message ▪ Sign border ▪ Entire sign face ▪ Entire background

Table 2A-2. Retroreflection of Sign Elements

Means of Retroreflection	Sign Element
Reflector "buttons" or similar units	Symbol Word message Border
A material that has a smooth, sealed outer surface over a microstructure that reflects light	Symbol Word message Border Background

A. White or red, ~~if used with STOP or YIELD~~ with red background regulatory signs.

B. White, ~~if used~~ with other regulatory signs ~~other than STOP or YIELD signs.~~

C. White or yellow~~, if used~~ with warning signs.

D. White or green ~~if used~~ with guide signs.

E. White, yellow, or orange, ~~if used~~ with temporary traffic control signs.

F. White, ~~or~~ yellow or fluorescent yellow-green, ~~if used~~ with school area or pedestrian or bicycle warning signs. [6/28/2014, 14A-RW-07],

~~09 If flashed, all LED units shall flash simultaneously at a rate of more than 50 and less than 60 times per minute.~~ any steady rate between 50 and 120 times per minute. All the LED units ~~in a sign legend or border~~ shall be illuminated simultaneously with no sequential (chasing) or variable flash (dancing) rates. ~~A cluster of LED units shall not be used within the border of a sign.~~ [6/28/2014, 14A-RW-07, moved to paragraph 06]

10 **The uniformity of the sign design shall be maintained without any decrease in visibility, legibility, or driver comprehension during either daytime or nighttime conditions.** The LEDs shall not produce disability glare that obscures the sign legend. The LED units shall have the capability to be dimmed automatically by a timing mechanism or a device sensitive to ambient light (photo-electric cell).

Option:

11 For STOP and YIELD signs and other regulatory signs with a red background, red LEDs ~~they~~ may be placed within the sign background~~border or within~~ one border width or less from the edge of the border~~within the background of the sign~~. [6/28/2014, 14A-RW-07]

11a For DO NOT ENTER (see Section 2B.37) and CHEVRON (see Section 2C.09) signs, LEDs may be placed on the outer edge of the shape within the background of the sign.

12 For STOP/SLOW paddles used by flaggers (see Section 6E.03) ~~used by flaggers~~ and the STOP paddles used by adult crossing guards (see Section 7D.05) ~~used by adult crossing guards~~ [6/28/2014, 14A-RW-07], LEDs forming the shape of letters in the legend may be used within the background~~individual LEDs or groups of LEDs may be used~~.

Support:

13 Other methods of enhancing the conspicuity of standard signs are described in Section 2A.15.

14 Information regarding the use of retroreflective material on the sign support is contained in Section 2A.21.

Section 2A.10 Sign Color

[Delete entirely all the rows (eight) in Table 2A-5 associated with Changeable Message Signs – they are able to emulate all the colors noted by type of sign – they do not have to have black backgrounds. Specific call outs in sections of Part 2 and in Chapter 2L are made to address where black background is permitted]

Section 2A.15 Enhanced Conspicuity for Standard Signs

Option:

01 Based upon engineering judgment, where the improvement of the conspicuity of a standard regulatory, warning, or guide sign is desired, any of the following methods may be used, as appropriate, to enhance the sign's conspicuity (see Figure 2A-1):

A. Increasing the size of a standard regulatory, warning, or guide sign.

B. Doubling-up of a standard regulatory, warning, or guide sign by adding a second identical sign on the left- hand side of the roadway.

C. Adding a solid yellow or fluorescent yellow rectangular "header panel" above a standard regulatory sign, with the width of the panel corresponding to the width of the standard regulatory sign. A legend of "NOTICE," "STATE LAW," or other

appropriate text may be added in black letters within the header panel for a period of time determined by engineering judgment.

D. Adding a NEW plaque (see Section 2C.62) above a new standard regulatory or warning sign, for a period of time determined by engineering judgment, to call attention to the new sign.

E. Adding one or more red or orange flags (cloth or retroreflective sheeting) above a standard regulatory or warning sign, with the flags oriented so as to be at 45 degrees to the vertical.

F. Adding a solid yellow, a solid fluorescent yellow, or a diagonally striped black and yellow (or black and fluorescent yellow) strip of retroreflective sheeting at least 3 inches wide around the perimeter of a standard warning sign. This may be accomplished by affixing the standard warning sign on a background that is 6 inches larger than the size of the standard warning sign.

G. Adding a warning beacon (see Section 4L.03) to a standard regulatory (other than a STOP or a Speed Limit sign), warning, or guide sign.

H. Adding a speed limit sign beacon (see Section 4L.04) to a standard Speed Limit sign.

I. Adding a stop beacon (see Section 4L.05) to a STOP sign.

J. Adding light emitting diodes (LEDs) ~~units~~ within the ~~symbol,or legend ,of a sign or~~ border of a standard regulatory, warning, or guide sign, as provided in Section 2A.07. [6/28/2014, 14A-RW-07]

K. Adding a strip of retroreflective material to the sign support in compliance with the provisions of Section 2A.21.

L. Using other methods that are specifically allowed for certain signs as described elsewhere in this Manual.

Support:

02 Sign conspicuity improvements can also be achieved by removing non-essential and illegal signs from the right-of-way (see Section 1A.08), and by relocating signs to provide better spacing.

Standard:

03 **The NEW plaque (see Section 2C.62) shall not be used alone.**

04 **Strobe lights shall not be used to enhance the conspicuity of highway signs.**

Figure 2A-1 Examples of Enhanced Conspicuity for Signs

Modify Figure 2A-1 - Add F. LED in sign border
Note: Recommend that FHWA re-letter (reorganize) text to match Figure 2A-1

CHAPTER 2B. REGULATORY SIGNS, BARRICADES, AND GATES

Section 2B.02 Design of Regulatory Signs

Standard:

01 **Regulatory signs shall be rectangular unless specifically designated otherwise. Regulatory signs shall be designed in accordance with the sizes, shapes, colors, and legends contained in the "Standard Highway Signs and Markings" book (see Section 1A.11).**

Option:

02 Regulatory word message signs other than those classified and specified in this Manual and the "Standard Highways Signs and Markings" book (see Section 1A.11) may be developed to aid the enforcement of other laws or regulations.

03 Except for symbols on regulatory signs, minor modifications may be made to the design provided that the essential appearance characteristics are met. Support:

04 The use of educational plaques to supplement symbol signs is described in Section 2A.12.

~~*Guidance:*~~

05 ~~*Changeable message LED signs displaying part-time regulatory message incorporating a prohibitory message that includes a red circle and slash on a static sign should display a red symbol that approximates the same red circle and slash as closely as possible. The prohibited movement symbol should be a white LED symbol on a black background or a black symbol on a full matrix whiter LED background.*~~

~~Option:~~

05a The conspicuity ~~LEDs in the border~~ of regulatory signs may be enhanced (see Section 2A.15) using LEDs in the border ~~static, or flash at rates~~ per Section 2A.07(~~09~~06-12). [6/28/2014, 14A-RW-07]

~~**Standard:**~~

~~05b **A regulatory sign displayed entirely with LEDs and incorporated within the border of a larger full matrix changeable message sign shall display the regulatory sign legend in the size, shape, color and legend of the standard regulatory sign.**~~

~~05c **A full matrix LED display shall not be used for a STOP (R1-1) sign or a YIELD (R1-2) sign.**~~ [6/28/2014, 14A-RW-07 – Moved to Sections 2B.05 and 2B.08]

05b Consistent with the provisions of Chapter 2L and Section 2A.04, changeable message signs may be used to display a regulatory message, except as provided in Section 2B.05 paragraph 03A and Section 2B.08 paragraph 03A.

Section 2B.04b. Alternatives to Changing Intersection Right-of-Way Control (approved by Council [15B-RW-02, 1/08/2016 - Note: only text to address edit of beacon terminology shown]

Option:

02 Alternatives that may be considered include, but are not limited to, the following:

G. Installing an intersection control beacon or stop~~red flashing~~ beacon at the intersection to supplement Stop control;

H. Installing warning ~~yellow flashing~~ beacons on warning signs in advance of a STOP or YIELD sign controlled intersection on major- and/or minor-street approaches;

Section 2B.05 STOP Sign (R1-1) and ALL WAY Plaque (R1-3P)

Standard:

01 **When it is determined that a full stop is always required on an approach to an intersection, a STOP (R1-1) sign (see Figure 2B-1) shall be used.**

02 **The STOP sign shall be an octagon with a white legend and border on a red background.**

03 **Secondary legends shall not be used on STOP sign faces.**

03a **The STOP (R1-1) sign shall not be displayed using a changeable message sign.** [Moved from Section 2B.02]

04 **At intersections where all approaches are controlled by STOP signs (see Section 2B.07), an ALL WAY supplemental plaque (R1-3P) shall be mounted below each STOP sign. The ALL WAY plaque (see Figure 2B-1) shall have a white legend and border on a red background.**

05 **The ALL WAY plaque shall only be used if all intersection approaches are controlled by STOP signs.**

06 **Supplemental plaques with legends such as 2-WAY, 3-WAY, 4-WAY, or other numbers of ways shall not be used with STOP signs.**

Support:

07 The use of the CROSS TRAFFIC DOES NOT STOP (W4-4P) plaque (and other plaques with variations of this word message) is described in Section 2C.59.

Guidance:

08 *Plaques with the appropriate alternative messages of TRAFFIC FROM LEFT (RIGHT) DOES NOT STOP (W4-4aP) or ONCOMING TRAFFIC DOES NOT STOP (W4-4bP) should be used at intersections where STOP signs control all but one approach to the intersection, unless the only non-stopped approach is from a one-way street.*

Option:

09 An EXCEPT RIGHT TURN (R1-10P) plaque (see Figure 2B-1) may be mounted below the STOP sign if an engineering study determines that a special combination of geometry and traffic volumes is present that makes it possible for right-turning traffic on the approach to be permitted to enter the intersection without stopping.

Support:

10 The design and application of Stop Beacons are described in Section 4L.05.

Figure 2B-1 STOP and YIELD Signs and Plaques

Section 2B.08 YIELD Sign (R1-2)

Standard:

01 **The YIELD (R1-2) sign (see Figure 2B-1) shall be a downward-pointing equilateral triangle with a wide red border and the legend YIELD in red on a white background.**

Support:

02 The YIELD sign assigns right-of-way to traffic on certain approaches to an intersection. Vehicles controlled by a YIELD sign need to slow down to a speed that is reasonable for the existing conditions or stop when necessary to avoid interfering with conflicting traffic.

03a **The YIELD (R1-2) sign shall not be displayed using a changeable message sign.** [Moved from Section 2B.02]

Section 2B.13 Speed Limit Sign (R2-1)

Standard:

01 **Speed zones (other than statutory speed limits) shall only be established on the basis of an engineering study that has been performed in accordance with traffic engineering practices. ~~The engineering study shall include an analysis of the current speed distribution of free-flowing vehicles.~~** (Approved by Council January 11, 2019, 18B-RW-03 , attachment # 12)

Guidance:

01a *~~Other factors~~ Factors that ~~may~~ should be considered when establishing or reevaluating speed limits within speed zones are the following:* [paragraph 01a and A-D moved from paragraph 16 and revised as indicated]

A. *Speed distribution of free-flowing vehicles (such as current 85th percentile, the pace, and review of past speed studies)*
B. *Reported crash experience for at least a 12-month period relative to similar roadways.*
C. *Road characteristics (such as lane widths, curb/shoulder condition, grade, alignment, median type, and sight distance).*
D. *Road context (such as roadside development and environment including number of driveways and land use, functional classification, parking practices, presence of sidewalks/bicycle facilities).*
E. *Road Users (such as pedestrian activity, bicycle activity)*

01b *When a speed limit within a speed zone is posted on freeways, expressways, or rural highways, it should maximize the percentage of vehicles in the pace and should be within 5 mph of the 85th-percentile speed of free-flowing ~~traffic~~ vehicles.*[paragraph 01b moved from paragraph 12 and revised as indicated]

01c *States and local agencies should conduct engineering studies to reevaluate non-statutory speed limits on segments of their roadways that have undergone significant changes since the last review. (such as in ~~the addition or elimination of parking or driveways, changes in the number of travel lanes, changes in the configuration of bicycle lanes~~, road geometrics, road context, traffic control signal coordination, or traffic volumes).* [paragraph 01c moved from paragraph 10 and revised as indicated]

01d *Speed studies for signalized intersection approaches should be taken outside the influence area of the traffic control signal, which is generally considered to be approximately 1/2 mile to avoid obtaining skewed results for the 85th-percentile speed. If the signal spacing is less than 1 mile, the speed study should be at approximately the middle of the segment.* [paragraph 01d moved from paragraph 13 and revised as indicated]

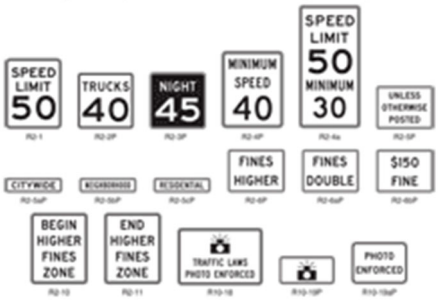
(Approved by Council January 11, 2019, 18B-RW-03 , attachment # 12)

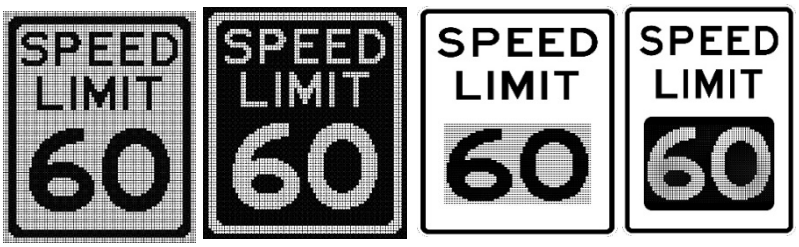
Standard:

02 **The Speed Limit (R2-1) sign (see Figure 2B-3) shall display the limit established by law, ordinance, regulation, or as adopted by the authorized agency based on the engineering study. The speed limits displayed shall be in multiples of 5 mph.**

RX-XX Dynamic Message Signs (DMS) and Hybrid Signs

Figure 2B-3. Speed Limit and Photo Enforcement Signs and Plaques





[Add images: R2-1 Variable Speed Limit using Dynamic Message Sign and Hybrid sign.]

03 **Speed Limit (R2-1) signs, indicating speed limits for which posting is required by law, shall be located at the points of change from one speed limit to another.**

04 **At the downstream end of the section to which a speed limit applies, a Speed Limit sign showing the next speed limit shall be installed. ~~Additional Speed Limit signs shall be installed beyond major intersections and at other locations where it is necessary to remind road users of the speed limit that is applicable.~~**

Support:

04a The Traffic Control Devices Handbook contains suggested criteria on the spacing of speed limit signs. [approved by Council 1/20/2011, moved from the paragraph 07a position to this location]

Guidance:

04~~a~~b *Additional Speed Limit signs should be installed beyond major intersections and at other locations to remind road users of the speed limit that is applicable*.(approved by Council 6/24/2011)

Standard

05 **Speed Limit signs indicating the statutory speed limits shall be installed at entrances to the State and, where appropriate, at jurisdictional boundaries in urban areas.**

Support:

06 In general, the maximum speed limits applicable to rural and urban roads are established:

A. Statutorily – a maximum speed limit applicable to a particular class of road, such as freeways or city streets, that is established by State law; or

B. As altered speed zones – based on engineering studies.

07 State statutory limits might restrict the maximum speed limit that can be established on a particular road, notwithstanding what an engineering study might indicate.

~~07a. The Traffic Control Devices Handbook contains suggested criteria on the spacing of speed limit signs.~~ (approved by Council 1/20/2011)

~~21.15.~~07a Advisory Speed signs and plaques are discussed in Sections 2C.08 and 2C.14. Temporary Traffic Control Zone Speed signs are discussed in Part 6. The WORK ZONE (G20-5aP) plaque intended for installation above a Speed Limit sign is discussed in Section 6F.12. School Speed Limit signs are discussed in Section 7B.15 [moved from paragraph 15]

Option:

08 If a jurisdiction has a policy of installing Speed Limit signs in accordance with statutory requirements only on the streets that enter a city, neighborhood, or residential area to indicate the speed limit that is applicable to the entire city, neighborhood, or residential area unless otherwise posted, a CITYWIDE (R2-5aP), NEIGHBORHOOD (R2-5bP), or RESIDENTIAL (R2-5cP) plaque may be mounted above the Speed Limit sign and an UNLESS OTHERWISE POSTED (R2-5P) plaque may be mounted below the Speed Limit sign (see Figure 2B-3).

Guidance:

09 *A Reduced Speed Limit Ahead (W3-5 or W3-5a) sign (see Section 2C.38) should be used to inform road users of a reduced speed zone where the speed limit is being reduced by more than 10 mph, or where engineering judgment indicates the need for advance notice to comply with the posted speed limit ahead.*

~~10 States and local agencies should conduct engineering studies to reevaluate non-statutory speed limits on segments of their roadways that have undergone significant changes since the last review, such as the addition or elimination of parking or driveways, changes in the number of travel lanes, changes in the configuration of bicycle lanes, changes in traffic control signal coordination, or significant changes in traffic volumes~~. [moved to paragraph 01c]

~~11~~ 10 *No more than three speed limits should be displayed on any one Speed Limit sign or assembly.*

~~12 When a speed limit within a speed zone is posted, it should be within 5 mph of the 85th-percentile speed of free-flowing traffic.~~ [moved to paragraph 01b]

~~13 Speed studies for signalized intersection approaches should be taken outside the influence area of the traffic control signal, which is generally considered to be approximately 1/2 mile, to avoid obtaining skewed results for the 85th-percentile speed.~~ [moved to paragraph 01d]

~~Support:~~

~~14 Advance warning signs and other traffic control devices to attract the motorist's attention to a signalized intersection are usually more effective than a reduced speed limit zone.~~ [moved to paragraph 11a]

~~*Guidance:*~~

~~15~~ 11 *An advisory speed plaque (see Section 2C.08) mounted below a warning sign should be used to warn road users of an advisory speed for a roadway condition. A Speed Limit sign should not be used for this situation.*

11a Advance traffic control warning signs (see Section 2C.36), advance intersection warning signs (see Section 2C.46), and/or other traffic control devices ~~are~~ provide appropriate warning prior ~~to attract the motorist's attention~~ to a signalized intersection. ~~are usually more effective than a reduced~~ A speed limit sign ~~zone~~ should not be used for this purpose. [moved from paragraph 14 and revised as indicated] (Approved by Council January 11, 2019, 18B-RW-03 , attachment # 12)

Option:

~~16 Other factors that may be considered when establishing or reevaluating speed limits are the following:~~

~~A. Road characteristics, shoulder condition, grade, alignment, and sight distance;~~

~~B. The pace;~~

~~C. Roadside development and environment;~~

~~D. Parking practices and pedestrian activity; and~~

~~E. Reported crash experience for at least a 12-month period.~~ [moved to paragraph 01a]

(Approved by Council January 11, 2019, 18B-RW-03 , attachment # 12)

~~17~~ 12 ~~Two~~Three types of Speed Limit signs may be used indicating a fixed or variable speed limit: ~~one to designate passenger car speeds,~~

A. ~~including any nighttime information or minimum speed limit that might apply or~~ A maximum speed limit;

B. ~~the other to show any~~ A special speed limit~~s~~ for trucks and/or other vehicles; and

C. Special speed limits for nighttime or minimum speeds.

~~18~~ 13 A ~~changeable message~~ variable speed limit [14A-RW-07, 6/28/2014]sign that changes the speed limit for traffic and ambient conditions may be displayed using hybrid or dynamic message signs (see Figure 2B-3 and Chapter 2L) and installed provided that the appropriate speed limit is displayed at the proper times and locations in accordance with paragraphs (04) and (05). [11B-RW-05, 1/19/2012]

~~**Standard:**~~

~~18a 13a **The variable speed limit sign legend "SPEED LIMIT" shall be a black legend on a white retroreflective background.**~~

~~Option:~~

~~18b 13b The variable speed limit legend may be indicated by a display of white LEDs which are~~ [18B-RW-03, 1-11-2019]~~white on an opaque black background.~~ [14A-RW-07, 6/28/2014]

~~19~~ 14 ~~A changeable message~~The driver feedback sign (WX-XX) that displays to approaching drivers the speed at which they are traveling may be installed as a hybrid or dynamic message sign (see Chapter 2L). ~~in conjunction with a Speed Limit sign~~ to supplement the Speed Limit sign (see Section 2C.08a). [14A-RW-07, 6/28/2014]

~~*Guidance:*~~

~~20 *If a changeable message sign displaying approach speeds is installed, the legend YOUR SPEED XX MPH or such similar legend should be displayed. The color of the changeable message legend should be a yellow legend on a black background or the reverse of these colors.*~~ [approved by Council 1/28/2014]

~~Support:~~

~~21 15 Advisory Speed signs and plaques are discussed in Sections 2C.08 and 2C.14. Temporary Traffic Control Zone Speed signs are discussed in Part 6. The WORK ZONE (G20-5aP) plaque intended for installation above a Speed Limit sign is discussed in Section 6F.12. School Speed Limit signs are discussed in Section 7B.15.~~ [moved to paragraph 07a

Section 2B.17 Higher Fines Signs and Plaque (R2-6P, R2-10, and R2-11) [Note: only text to address edit of beacon terminology shown]

08 The following may be mounted below an R2-10 sign or R2-6P plaque:

A. A supplemental plaque specifying the times that the higher fines are in effect (similar to the S4-1P plaque shown in Figure 7B-1), or

B. A supplemental plaque WHEN CHILDREN (WORKERS) ARE PRESENT, or

C. A supplemental plaque WHEN FLASHING (similar to the S4-4P plaque shown in Figure 7B-1) if used in conjunction with a warning~~yellow flashing~~ beacon.

Section 2B.18 Movement Prohibition Signs (R3-1 through R3-4, R3-18, and R3-27)

Standard:

01 ~~**Except as provided in Paragraphs 11 and 13, where specific movements are prohibited, Movement Prohibition signs shall be installed.**~~ **Movement Prohibition signs shall be**

installed where specific movements are prohibited at an intersection approach except As provided in Paragraphs 11 and 13.

Guidance:

01a Movement Prohibition signs should only be used to prohibit a turn or through movement from an entire approach and should not be used to designate movements that are required or permitted from a specific lane or lanes on multi-lane approach.

02 Movement Prohibition signs should be placed where they will be most easily seen by road users who might be intending to make the movement.

Support:

02a Sections 2B.19, 2B.20, 2B.21 and 2B.22 contain information regarding lane control signs that indicate the required or permitted movements from individual lanes. (approved by Council 6/19/2015)

Option:

07 If both left turns and U-turns are prohibited, the combination No U-Turn/No Left Turn (R3-18) sign (see Figure 2B-4) may be used instead of separate R3-2 and R3-4 signs.

Guidance:

08 If No Straight Through (R3-27) signs (see Figure 2B-4) are used, at least one should be placed either over the roadway or at a location where it can be seen by road users who might be intending to travel straight through the intersection.

09 If turn prohibition signs are installed in conjunction with traffic control signals:

A. The No Right Turn sign should be installed adjacent to a signal face viewed by road users in the right-hand lane.

B. The No Left Turn (or No U-Turn or combination No U-Turn/No Left Turn) sign should be installed adjacent to a signal face viewed by road users in the left-hand lane.

C. A NO TURNS sign should be placed adjacent to a signal face viewed by all road users on that approach, or two signs should be used.

Figure 2B-4 Movement Prohibition and Lane Control Signs and Plaques

Option:

10 If turn prohibition signs are installed in conjunction with traffic control signals, an additional Movement Prohibition sign may be post-mounted to supplement the sign mounted overhead.

11 Where ONE WAY signs are used (see Section 2B.40), No Left Turn and No Right Turn signs may be omitted.

12 When the movement restriction applies during certain time periods only, the following Movement Prohibition signing alternatives may be used and are listed in order of preference:

A. ~~Changeable message~~ ~~A part-time regulatory~~ signs ~~that displays prohibitive~~ ~~m~~Movement prohibition using blank-out or dynamic message signs (see Chapter 2L)

for the hours during which the prohibition is applicable, especially at signalized intersections. [14A-RW-07, 6/28/2014]

B. Permanently mounted signs incorporating a supplementary legend showing the hours and days during which the prohibition is applicable.

C. Portable signs, installed by proper authority, located off the roadway at each corner of the intersection. The portable signs are only to be used during the time that the movement prohibition is applicable.

~~**Standard:**~~

~~12a. **The blank-out LED part-time prohibitive movement sign shall consist of a red LED circle and slash with white LED prohibited movement on an opaque black background.**~~ [14A-RW-07, 6/28/2014]

13 Movement Prohibition signs may be omitted at a ramp entrance to an expressway or a channelized intersection where the design is such as to indicate clearly the one-way traffic movement on the ramp or turning lane.

Standard:

14 **The No Left Turn (R3-2) sign, the No U-Turn (R3-4) sign, and the combination No U-Turn/No Left Turn (R3-18) sign shall not be used at approaches to roundabouts to prohibit drivers from turning left onto the circulatory roadway of a roundabout.**

Support:

15 At roundabouts, the use of R3-2, R3-4, or R3-18 signs to prohibit left turns onto the circulatory roadway might confuse drivers about the possible legal turning movements around the roundabout. Roundabout Directional Arrow (R6-4 series) signs (see Section 2B.43) and/or ONE WAY (R6-1R or R6-2R) signs are the appropriate signs to indicate the travel direction within a roundabout.

Section 2B.25 BEGIN and END Plaques (R3-9cP, R3-9dP)

Option:

01 The BEGIN (R3-9cP) or END (R3-9dP) plaque (see Figure 2B-6) may be used to supplement a regulatory sign to inform road users of the location where a regulatory condition begins or ends.

Standard:

02 **If used, the BEGIN or END plaque shall be mounted directly above a regulatory sign.**

Figure 2B-6 Center and Reversible Lane Control Signs and Plaques

Section 2B.26 Reversible Lane Control Signs (R3-9e through R3-9i)

Option:

01 A reversible lane may be used for through traffic (with left turns either permitted or prohibited) in alternating directions during different periods of the day, and the lane may be used for exclusive left turns in one or both directions during other periods of the day as well.

Reversible Lane Control (R3-9e through R3-9i) signs (see Figure 2B-6) may be either static type or changeable message (see Chapter 2L) type. These signs may be either post-mounted or overhead.

Standard:

02 **Post-mounted Reversible Lane Control signs shall be used only as a supplement to overhead signs or signals. ~~p~~Post-mounted signs shall be identical in design to the overhead signs and an additional legend such as CENTER LANE shall be added to the sign (R3-9f) to indicate which lane is controlled. For both word messages and symbols, this legend shall be at the top of the sign.**

03 **Where it is determined by an engineering study that lane-use control signals or physical barriers are not necessary, the lane shall be controlled by overhead Reversible Lane Control signs (see Figure 2B-7).** Option:

04 Reversing traffic flow may be controlled with pavement markings and Reversible Lane Control signs (without the use of lane control signals), when all of the following conditions are met:

A. Only one lane is being reversed,
B. An engineering study indicates that the use of Reversible Lane Control signs alone would result in an acceptable level of safety and efficiency, and
C. There are no unusual or complex operations in the reversible lane pattern.

Standard:

05 **Reversible Lane Control signs shall contain the legend or symbols designating the allowable uses of the lane and the time periods such uses are allowed. Where symbols and legends are used, their meanings shall be as shown in Table 2B-2.**

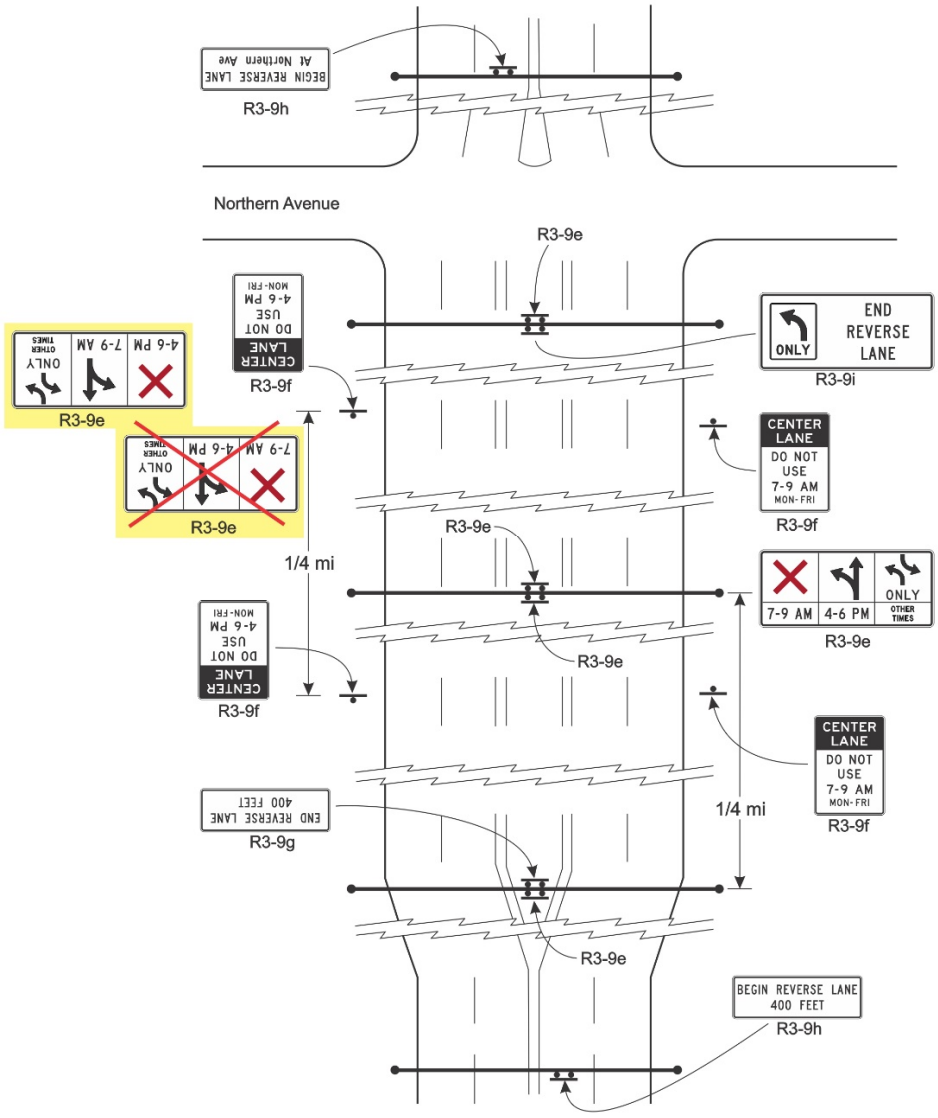
Table 2B-2. Meanings of Symbols and Legends on Reversible Lane Control Signs

Symbol / Word Message	Meaning
Red X on white background	Lane closed
Upward pointing black arrow on white background (if left turns are permitted, the arrow shall be modified to show left / through arrow)	Lane open for through travel and any turns not otherwise prohibited
Black two-way left-turn arrows on white background and legend ONLY	Lane may be used only for left turns in either direction (i.e., as a two-way left-turn lane)
Black single left-turn arrow on white background and legend ONLY	Lane may be used only for left turns in one direction (without opposing left turns in the same lane)

Figure 2B-7 Location of Reversible Two-Way Left-Turn Signs

Revise Left R3-9e sign below to read RED X (4-6 PM) (Approved by Council 1-11-13)

Figure 2B-7. Location of Reversible Two-Way Left-Turn Signs



06 **Reversible Lane Control signs shall consist of a white background with a black legend and border, except for the R3-~~9d~~ 9e sign, where the color red is used.**

07 **Symbol signs, such as the R3-~~9d~~ 9e sign, shall consist of the appropriate symbol in the upper portion of the sign with the appropriate times of the day and days of the week below it. All times of the day and days of the week shall be accounted for on the sign to eliminate confusion to the road user.**

08 **In situations where more than one message is conveyed to the road user, such as on the R3-~~9d~~ 9e sign, the sign legend shall be arranged as follows: (Approved by Council 6/28/2014)**

- **A. The prohibition or restriction message is the primary legend and shall be on the top for word message signs and to the far left for symbol signs,**
- **B. The permissive use message shall be displayed as the second legend, and**
- **C. The OTHER TIMES message shall be displayed at the bottom for word message signs and to the far right for symbol signs.**

Option:

09 The symbol signs may also include a downward pointing arrow with the legend THIS LANE. The term OTHER TIMES may be used for either the symbol or word message sign.

Standard:

10 **A Reversible Lane Control sign shall be mounted over the center of the lane that is being reversed and shall be perpendicular to the roadway alignment.**

11 **If the vertical or horizontal alignment is curved to the degree that a driver would be unable to see at least one sign, and preferably two signs, then additional overhead signs shall be installed. The placement of the signs shall be such that the driver will have a definite indication of the lanes specifically reserved for use at any given time. Special consideration shall be given to major generators introducing traffic between the normal sign placement.**

12 **Transitions at the entry to and exit from a section of roadway with reversible lanes shall be carefully reviewed, and advance signs shall be installed to notify or warn drivers of the boundaries of the reversible lane controls. The R3-9g or R3-9h signs shall be used for this purpose.**

Option:

13 More than one sign may be used at the termination of the reversible lane to emphasize the importance of the message (R3-9i).

Standard:

14 **Warning~~Flashing~~ beacons, if used to ~~accentuate~~ supplement the overhead Reversible Lane Control signs, shall comply with the applicable requirements for warning~~flashing~~ beacons in Chapter 4~~L~~S.** [14A-RW-07, 6/28/2014]

15 **When used in conjunction with Reversible Lane Control signs, the Turn Prohibition signs (R3-1 to R3-4, R3-18) shall be mounted overhead and separate from the Reversible Lane Control signs. The Turn Prohibition signs shall be designed and installed in accordance with Section 2B.18.**

Guidance:

16 *For additional emphasis, a supplemental plaque stating the distance of the prohibition, such as NEXT 1 MILE, should be added to the Turn Prohibition signs that are used in conjunction with Reversible Lane Control signs.*

17 *If used, overhead signs should be located at intervals not greater than 1/4 mile. The bottom of the overhead Reversible Lane Control signs should not be more than 19 feet above the pavement grade.*

18 *Where more than one sign is used at the termination of a reversible lane, they should be at least 250 feet apart. Longer distances between signs are appropriate for streets with speeds over 35 mph, but the separation should not exceed 1,000 feet.*

19 *Because left-turning vehicles have a significant impact on the safety and efficiency of a reversible lane operation, if an exclusive left-turn lane or two-way left-turn lane cannot be incorporated into the lane-use pattern for a particular peak or off-peak period, consideration should be given to prohibiting left turns and U-turns during that time period.*

Section 2B.37 DO NOT ENTER Sign (R5-1)

Standard:

01 **The DO NOT ENTER (R5-1) sign (see Figure 2B-11) shall be used where ~~traffic is prohibited~~ a two-way roadway becomes a one-way roadway as shown in Figure 2B-14, and**

near the downstream end of an Interchange exit ramp as shown in Figure 2B-18 (see Section 2B.41).~~from entering a restricted roadway.~~

01a **Except as noted in paragraph 4, a DO NOT ENTER (R5-1) sign shall be installed at an intersection with a divided highway where the ~~median width is 30 feet or greater~~ crossing functions as two separate intersections as shown in Figure 2B-12.** (paragraph 01a revisions approved by Council June 21, 2019, 19A-RW-01, Attachment # 2)

Option:

01b A DO NOT ENTER (R5-1) sign may be installed at an intersection with a divided highway where the ~~median width is less than 30 feet~~ crossing functions as a single intersection as shown in Figure 2B-16.

01c A DO NOT ENTER (R5-1) sign may be omitted ~~at an intersection with~~ on a low speed urban street that is a divided highway at a crossing that functions as two separate intersections ~~where the median width is 30 feet or greater.~~

Guidance:

02 *The DO NOT ENTER sign, if used, should be placed directly in view of a road user at the point where a road user could wrongly enter a divided highway, one-way roadway, or ramp (see Figures 2B-12), 2B-14 and 2B-18). The sign should be mounted as shown in figure 2B.18 ~~on the right-hand side of the roadway~~, facing traffic that might enter the roadway or ramp in the wrong direction. At a ~~an intersection~~ crossing with a divided highway that functions as a single intersection ~~where the median width is less than 30 feet,~~ the sign, if used should be placed on the outside edge of the roadway facing traffic that might enter the roadway in the wrong direction.* (approved by council June 21, 2019 , 19A-RW-01, Attachment # 2)

03 *If the DO NOT ENTER sign would be visible to traffic to which it does not apply, the sign should be turned away from, or shielded from, the view of that traffic.*

Option:

~~04 The DO NOT ENTER sign may be installed where it is necessary to emphasize the one-way traffic movement on a ramp or turning lane.~~ (approved by Council 6-28-13

04 SROPT: A DO NOT ENTER sign may be omitted only if an R4-7 or R6-1 is installed for divided roadway median openings when the operating speeds are less than 25 mph on a SITE ROADWAY OPEN TO PUBLIC TRAVEL. (approved by Council 1/08/2016)

05 A second DO NOT ENTER sign ~~on the left-hand side of the roadway~~ may be used, particularly where traffic approaches from an intersecting roadway (see Figure 2B-12). (approved by Council 6/28/2013)

Option:

05a ~~Red LEDs may be installed within the border of the DO NOT ENTER sign to enhance the conspicuity of the sign. The LEDs may be vehicle actuated to flash at the rates as shown in Section 2A.07 (09).~~ (approved by Council 6/28/2014)

05b Where the Do Not Enter condition is limited by time, ~~or~~ day, event or condition, a blank-out sign or DMS sign (see Chapter 2L) may be used.

Support:

06 Section 2B.~~41~~ XX contains information regarding an optional lower mounting height for DO NOT ENTER signs that are located along an exit ramp facing a road user who is traveling in the wrong direction.

Figure 2B-11 Selective Exclusion Signs

Add NO SNOWMOBILE Symbol sign (R5-XX) (approved by Council 6-19-09)

Section 2B.38 WRONG WAY Sign (R5-1a)

Option:

01 The WRONG WAY (R5-1a) sign (see Figure 2B-11) may be used as a supplement to the DO NOT ENTER sign where ~~an exit ramp intersects a crossroad or~~ a crossroad intersects a one-way roadway in a manner that does not physically discourage or prevent wrong-way entry (see Figure 2B-12).

Guidance:

02 *If used, the WRONG WAY sign should be placed at a location along the exit ramp or the one-way roadway farther from the crossroad than the DO NOT ENTER sign (see Section 2B.41).*

02a The WRONG WAY sign should be placed on the same side of the road as the DO NOT ENTER sign.

(approved by Council June 21, 2019, 19A-RW-01, Attachment # 2)

Support:

03 Section 2B.~~41~~ XX contains information regarding an optional lower mounting height for WRONG WAY signs that are located along an exit ramp facing a road user who is traveling in the wrong direction. (approved by Council 6/28/2013)

Option:

~~02a Red LEDs may be installed within the border of the WRONG WAY sign to enhance the conspicuity of the sign. The LEDs may be vehicle actuated to flash at the rates as shown in Section 2A.07(09).~~ (approved by Council 6/28/2014)

03b Where the Wrong Way condition is limited by time, ~~or~~ day, event or condition, a blank-out sign or DMS (see Chapter 2L) may be used.

Section 2B.52 Traffic Signal Pedestrian and Bicycle Actuation Signs (R10-1 through R10-4, and R10-24 through R10-26) [Note: only text to address edit of beacon terminology shown]

Option:

08 The R10-25 sign (see Figure 2B-26) may be used where a pushbutton detector has been installed for pedestrians to activate In-Roadway Warning Lights (see Chapter 4N) or ~~flashing~~ warning beacons that have been added to the pedestrian warning signs.

Section 2B.53 Traffic Signal Signs (R10-5 through ~~R10-30)~~ ~~R10-XX~~ R10-YY)

Option:

01 To supplement traffic signal control, Traffic Signal signs R10-5 through ~~R10-30~~ R10-YY may be used to regulate road users (see Figure 2B-27).

02 ~~Traffic Signal signs (see Figure 2B-27) may be installed at certain locations to clarify signal control.~~ Among the legends that may be used for this purpose are: ~~LEFT ON GREEN ARROW ONLY (R10-5), STOP HERE ON RED (R10-6 or R10-6a) for observance of stop lines, DO NOT BLOCK INTERSECTION (R10-7) for avoidance of traffic obstructions, USE LANE(S) WITH GREEN ARROW (R10-8) for obedience to lane-use control signals (see Chapter 4M), LEFT TURN YIELD ON GREEN (symbolic circular green) (R10-12), and LEFT TURN YIELD ON FLASHING RED ARROW AFTER STOP (R10-27).~~ Change the above list of legends from paragraph format to a bulleted list for better clarity and insert the new LEFT (RIGHT) TURN YIELD ON FLASHING (symbolic yellow arrow) sign below

- LEFT ON GREEN ARROW ONLY (R10-5),
- STOP HERE ON RED (R10-6 or R10-6a),
- DO NOT BLOCK INTERSECTION (R10-7),
- USE LANE(S) WITH GREEN ARROW (R10-8), (see Chapter 4M),
- LEFT TURN YIELD ON GREEN (symbolic circular green) (R10-12),
- LEFT (RIGHT) TURN YIELD ON FLASHING (symbolic yellow arrow)
- (R10-YY or R10-YYa), or
- LEFT (RIGHT) TURN YIELD ON FLASHING RED ARROW AFTER STOP (R10-27 or R10-27a)

(Approved by Council January 10, 2019, 18B-RW-02, Attachment # 8)

Guidance:

03 *If used, the LEFT ON GREEN ARROW ONLY (R10-5) sign, the LEFT TURN YIELD ON GREEN (symbolic circular green) (R10-12) sign, LEFT TURN YIELD ON FLASHING (symbolic yellow arrow) (R10-YY) sign, or the LEFT TURN YIELD ON FLASHING RED ARROW AFTER STOP (R10-27) sign should be located adjacent to the left-turn signal face. If used, the RIGHT TURN YIELD ON FLASHING (symbolic yellow arrow) (R10-YYa), or the RIGHT TURN YIELD ON FLASHING RED ARROW AFTER STOP (R10-27a) sign should be located adjacent to the right-turn signal face.* (Approved by Council January 10, 2019, 18B-RW-02, Attachment # 8)

Option:

04 If needed for additional emphasis, ~~any of the signs described in paragraph 02~~ above ~~an additional LEFT TURN YIELD ON GREEN (symbolic circular green) (R10-12) sign with~~ an AT SIGNAL (R10-31P) supplemental plaque (see Figure 2B-27) may be installed with the signs described in paragraph 02 in advance of the intersection. (Approved by Council January 10, 2019, 18B-RW-02, Attachment # 8)

05 In situations where traffic control signals are coordinated for progressive timing, the Traffic Signal Speed (I1-1) sign may be used (see Section 2H.03).

05b ~~Where the DO NOT BLOCK INTERSECTION or TURNING VEHICLES STOP/YIELD TO PEDESTRIAN/BIKE signs are limited to time or day, event or condition, a blank-out sign (see Chapter 2L) may be used.~~ [Moved from paragraph 05a to 09a]

Standard:

06 **The CROSSWALK STOP ON RED (symbolic circular red) (R10-23) sign (see Figure 2B-27) shall only be used in conjunction with pedestrian hybrid beacons (see Section 4F.02).**

07 **The EMERGENCY SIGNAL (R10-13) sign (see Figure 2B-27) shall be used in conjunction with emergency-vehicle traffic control signals (see Section 4G.02).**

08 **The EMERGENCY SIGNAL—STOP ON FLASHING RED (R10-14 or R10-14a) sign**

(see Figure 2B-27) shall be used in conjunction with emergency-vehicle hybrid beacons (see Section 4G.04).

Option:

09 In order to remind drivers who are making turns at a signalized intersection to yield to or stop for pedestrians, bicycles or both, a Turning Vehicles Yield to (Stop for) Pedestrians (R10-15, R10-15a), Bicycles (R10-15x) or Pedestrians and Bicycles (R10-15xy) sign (see Figure 2B-27) may be used. (approved by Council June 28, 2014, Attachment # 31, Bicycle # 9, 14B.BIK.02)

09a Where the DO NOT BLOCK INTERSECTION or TURNING VEHICLES STOP/YIELD TO PEDESTRIAN/BIKE signs are limited to time, day, event or condition, a blank-out sign or DMS (see Chapter 2L) may be used. [Moved from paragraph 05a to 09a]

Standard:

09b The Turning Vehicles Stop for Pedestrians (R10-15a) sign shall only be used in jurisdictions where laws, ordinances or resolutions specifically require that a driver must stop for a pedestrian. (approved by Council 1/06/2017, RWSTC, 16A.RW.02)

Option:

09c At signalized intersections on roadways with a bicycle lane or separated bicycle lane positioned adjacent to a general purpose lane from which turns are permitted, a Turning Vehicles Yield to Bicycles (R10-15b) sign (see Figure 2B-27 and Figure 9C-6) may be used on the approach to the intersection to remind drivers who are making turns to yield to a bicycle in the bicycle lane when turning across or merging into the bicycle lane.

09d At signalized intersections on roadways with a shared use path that crosses intersecting streets or driveways, **or where turning vehicles would cross an adjacent bicycle lane and crosswalk,** a Turning Vehicles Yield to Bicycles and Pedestrians (R10-15c) sign (see Figure 2B-27) may be used **on the approach to the intersection** to remind drivers who are making turns to yield to bicycles and to pedestrians in the crosswalk.

Standard:

09e The Turning Vehicles Yield to Bicycles (R10-15b) sign or Turning Vehicles Yield to Bicycles and Pedestrians (R10-15c) sign shall not be used at signalized intersections where the bicycle movement is protected by the signal phasing from all-conflicting simultaneous motor vehicle movement at the signalized location.

Guidance:

09f *The Turning Vehicles Yield to Bicycles (R10-15b) sign should not be used **on the approach to** signalized intersections where a bicycle lane or separated bicycle lane transitions to a shared lane for use by turning vehicles together with through or turning bicyclists.*

Support:

09g Use of R10-15b and R10-15c signs at unsignalized intersections and mid-block locations is described in Section 9B.14

(Approved by Council January 11, 2019 Item 18B-BIK-01 Attachment # 13, Bicycle Technical Committee item, paragraphs 09b to 09g above)

Option:

10 A U-TURN YIELD TO RIGHT TURN (R10-16) sign (see Figure 2B-27) may be installed near the left-turn signal face if U-turns are allowed on a protected left-turn movement on an approach from which a right-turn GREEN ARROW signal indication is simultaneously being displayed to drivers making a right turn from the conflicting approach to their left.

10a A U-TURN SIGNAL (R10-XX) sign (see Figure 2B-27) may be installed adjacent to the signal face that exclusively controls a u-turn movement. (approved by Council 6/20/2009, RWSTC)

ADD sign R10-15a to Figure 2B.27. Add * fluorescent yellow-green background color may be used instead of yellow for this sign. (approved by Council 1-6-2017, 16A.RW.02)

R10-15b 30 x 30 add to sign details, Figure 2B-27. Add * fluorescent yellow-green background color may be used instead of yellow for this sign. 14B.BIK.02

R10-15c (30 x 30)

R10-15xy 30 x 36 add to sign details, Figure 2B-27. Add * fluorescent yellow-green background color may be used instead of yellow for this sign. 14B.BIK.02

Add the following sign to Figure 2B-27:

LEFT (RIGHT) TURN YIELD ON FLASHING *(symbolic yellow arrow)* sign (R10-YY or R10-YYa) (Approved by Council January 10, 2019, 18B-RW-02, Attachment # 8)

Section 2B.54 No Turn on Red Signs (R10-11 Series, R10-17a, and R10-30)

Standard:

01 **Where a right turn on red (or a left turn on red from a one-way street to a one-way street) is to be prohibited, a symbolic NO TURN ON RED (symbolic circular red) (R10-11) sign (see Figure 2B-27) or a NO TURN ON RED (R10-11a, R10-11b) word message sign (see Figure 2B-27) shall be used.**

Guidance:

02 *If used, the No Turn on Red sign should be installed near the appropriate signal head.*

03 *A No Turn on Red sign should be considered when an engineering study finds that one or more of the following conditions exists:*

A. Inadequate sight distance to vehicles approaching from the left (or right, if applicable);

B. Geometrics or operational characteristics of the intersection that might result in unexpected conflicts;

C. An exclusive pedestrian phase;

D. An unacceptable number of pedestrian conflicts with right-turn-on-red maneuvers, especially involving children, older pedestrians, or persons with disabilities;

E. More than three right-turn-on-red accidents reported in a 12-month period for the particular approach; or

F. The skew angle of the intersecting roadways creates difficulty for drivers to see traffic approaching from their left.

Option:

04 When the No Turn on Red restriction applies at signalized intersections during certain time periods only, the following signing alternatives may be used:

A. ~~Prohibited~~ Movement Prohibition ~~signs~~ (R3-1, R3-4, R3-18, R3-27) or NO TURN ON RED signs displayed by using blank-out sign or DMS ~~dynamic message signs~~ (see Chapter 2L) for the hours during which the prohibition is applicable.~~, especially at signalized intersections.~~ This may apply during one or more portion(s) of a particular cycle of the traffic control signal. [Moved from paragraph 05]

B. ~~Permanently mounted~~ Static signs incorporating a supplementary legend (R10-20aP, see Figure 2B-27) showing the hours and days during which the prohibition is applicable.

~~04 A supplemental R10-20aP plaque (see Figure 2B-27) showing times of day (similar to the S4-1P plaque shown in Figure 7B-1) with a black legend and border on a white background may be mounted below a No Turn on Red sign to indicate that the restriction is in place only during certain times.~~

05 ~~Alternatively, a~~ ~~A blank-out part-time restrictive prohibitive movement ()R3-1, R3-2, R3-4, R3-18 and R3-27) LED sign (See Section 2B.18) may be used instead of a static NO TURN ON RED sign, to display either the NO TURN ON RED legend or the No Right Turn symbol or word message, as appropriate, only at certain times during the day or during one or more portion(s) of a particular cycle of the traffic signal.~~ [Moved to paragraph 04]

~~05a Alternatively, a supplemental R10-20aP plaque (see Figue 2B.27) showing times of day (similar to the S4-1P plaque shown in Figure 7B-1) with a black legend and border on a white background may be mounted below a No Turn on Red sign to indicate that the restriction is in place only during certain times. White LEDs may be used in the border and activated during periods of turn prohibition to enhance the sign conspicuity.~~ [14A-RW-07, 6/28/2014]

06 On signalized approaches with more than one right-turn lane, a NO TURN ON RED EXCEPT FROM RIGHT LANE (R10-11c) sign (see Figure 2B-27) may be post-mounted at the intersection or a NO TURN ON RED FROM THIS LANE (with down arrow) (R10-11d) sign

(see Figure 2B-27) may be mounted ~~directly~~ over the approximate center of the lane from which turns on red are prohibited. (1/11/2013)

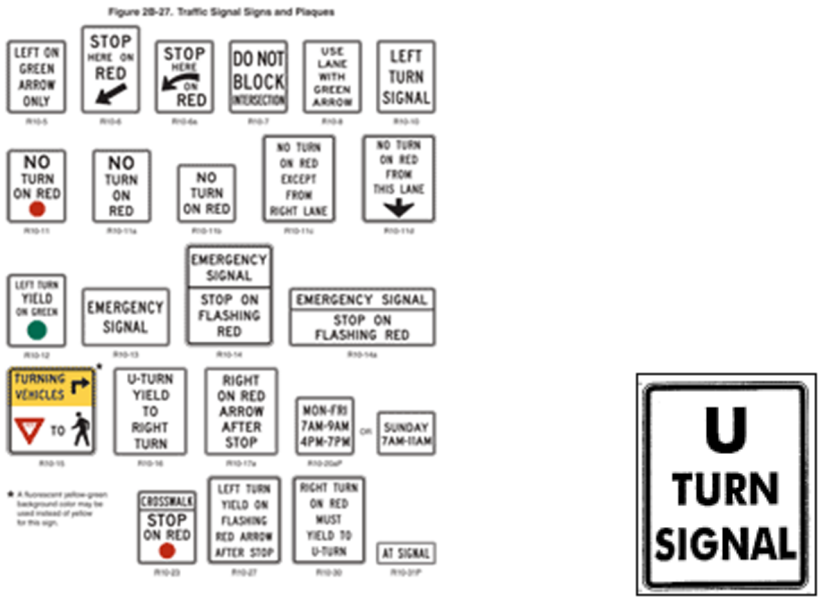
Guidance:

07 *Where turns on red are permitted and the signal indication is a steady RED ARROW, the RIGHT (LEFT) ON RED ARROW AFTER STOP (R10-17a) sign (see Figure 2B-27) should be installed adjacent to the RED ARROW signal indication.*

Option:

08 A RIGHT TURN ON RED MUST YIELD TO U-TURN (R10-30) sign (see Figure 2B-27) may be installed to remind road users that they must yield to conflicting u-turn traffic on the street or highway onto which they are turning right on a red signal after stopping.

Figure 2B-27 Traffic Signal Signs and Plaques



((add U-TURN SIGNAL sign (R10-xx)) (approved by Council June 20, 2009)

Section 2B.56 Ramp Metering Signs (R10-28 and R10-29)

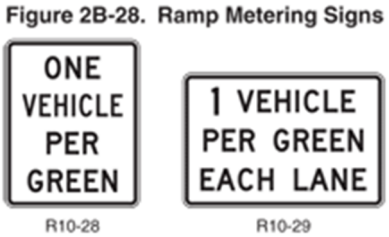
Option:

01 When ramp control signals (see Chapter 4I) are used to meter traffic on a freeway or expressway entrance ramp, regulatory signs with legends appropriate to the control may be installed adjacent to the ramp control signal faces.

02 For entrance ramps with only one controlled lane, an XX VEHICLE(S) PER GREEN (R10-28) sign (see Figure 2B-28) may be used to inform road users of the number of vehicles that are permitted to proceed during each short display of the green signal indication. For entrance ramps with more than one controlled lane, an XX VEHICLE(S) PER GREEN Each Lane (R10-29) (see Figure 2B-28) sign may be used to inform road users of the number of vehicles that are permitted to proceed from each lane during each short display of the green signal indication.

03 Where the Ramp Meter condition is limited by time, day, event or condition, a blank-out sign or DMS (see Chapter 2L) may be used.

Figure 2B-29 Ramp Metering Signs



CHAPTER 2C. WARNING SIGNS AND OBJECT MARKERS

Section 2C.02 Application of Warning Signs

Standard:

01 **The use of warning signs shall be based on an engineering study or on engineering judgment.**

Guidance:

02 *The use of warning signs should be kept to a minimum as the unnecessary use of warning signs tends to breed disrespect for all signs. In situations where the condition or activity is seasonal or temporary, the warning sign should be removed or covered when the condition or activity does not exist.*

Option:

03 Consistent with the provisions of Chapter 2L and Section 2A.04, changeable message signs may be used to display a warning message.

04 Consistent with the provisions of Chapter 4~~L~~S, a Warning Beacon may be used in combination with a standard warning sign.

Support:

05 The categories of warning signs are shown in Table 2C-1.

06 Warning signs provided in this Manual cover most of the conditions that are likely to be encountered. Additional warning signs for low-volume roads (as defined in Section 5A.01), temporary traffic control zones, school areas, grade crossings, and bicycle facilities are discussed in Parts 5 through 10, respectively.

07 Section 1A.09 contains information regarding the assistance that is available to jurisdictions that do not have engineers on their staffs who are trained and/or experienced in traffic control devices.

Section 2C.03 Design of Warning Signs

Table 2C-2. Warning Sign and Plaque Sizes

Sign or Plaque	Sign Designation	Section	Conventional Road		Expressway	Freeway	Minimum	Oversized
			Single Lane	Multi-Lane				
Driver Feedback	Wx-XX	2C.08a	24x30*	~~24x~~30x42**	3~~6~~0x42***	3~~6~~0x42***	—	36 x 48***

*12" hybrid sign numbers

** 15" hybrid sign numbers

***18" hybrid sign numbers

Section 2C.08a Driver Feedback Signs (WX-XX)

Option:

01 A driver feedback signs may be installed to supplement a SPEED LIMIT (R2-1) sign or the advisory speed plaque (W13-1P) on a horizontal alignment sign.~~or speed limit sign. A supplemental driver feedback LED sign indicating YOUR SPEED XX MPH (WX-XX) sign may be used near the point of curvature of a horizontal curve to supplement the standard horizontal alignment warning sign (which includes an advisory speed plaque)~~[17B-RW-01, 6-22-2018, in parenthesis~~, or downstream of a posted speed limit sign.~~

01a The YOUR SPEED XX (WX-XX) sign (see Figure 2C-1) may be a hybrid sign or DMS ~~(dynamic message sign)~~ (see Chapter 2L) and vehicle speed display numbers ("XX") may be

steady~~static~~ or flash at acceptable rates (see Section 2A.07) for excessive speed. [14A-RW-07, June 28, 2014]

Standard:

02 **The legend~~, YOUR SPEED,~~ on a YOUR SPEED XX ~~MPH~~ (WX-XX) sign shall be a black legend ~~with a font size in conformance with the appropriate facility type~~ on a yellow retroreflective background, with fonts comparable to those used on a speed limit sign. ~~The LED legend displaying the speed value shall be a yellow illuminated legend with not less than 20 mm pitch LEDs covering the stroke width of a 10 inch series numeral on an opaque black background.~~** [14A-RW-07, June 28, 2014]

Option:

~~03 A driver feedback LED sign that displays the legend "SLOW TO XX MPH" may be used to activate the sign speed legend when the approaching vehicle speed exceeds the posted speed.~~ 14A-RW-07, June 28, 2014] Delete paragraph 3 from the previously approved Council item

03 When an approaching vehicle activates the sign speed legend, a YOUR SPEED XX ~~MPHdriver feedback LED~~ sign may ~~that~~ displays the legend "SLOW DOWN" in place of numbers when the speed is considered excessive. ~~The driver feedback sign may be installed to supplement the speed limit sign or advisory speed sign~~ [17B-RW-01, 6-22-2018]

03a The vehicle speed display numbers on a hybrid sign may be yellow on an opaque black background.

[Insert Driver Feedback Hybrid and DMS to Figure 2C-1]

Figure 2C-1 Horizontal Alignment Signs and Plaques

Section 2C.09 Chevron Alignment Sign (W1-8)

Option:

04a LEDs may be used to enhance chevron signs and, if vehicle activated the LEDs may be flashed concurrently on a single sign and ~~but not~~ sequentially~~within the~~ along a series of signs from upstream to downstream~~panel~~.

Standard:

04b **The LEDs used in the chevron alignment sign shall consist of yellow LEDs outlining the chevron symbol.** [14A-RW-07, 6-28-14)

Standard:

08 **Chevron Alignment signs shall not be used to mark obstructions within or adjacent to the roadway, including the beginning of guardrails or barriers, as this is the function of an object marker (see Section 2C.63)~~, except as provided in Section 2L.04 (paragraph 02) and Section 6F.61~~.**

Section 2C.13 Truck Rollover ~~Warning~~ Sign (W1-13)

Option:

01 A Truck Rollover ~~Warning~~ (W1-13) sign (see Figure 2C-1) may be used to warn drivers of vehicles with a high center of gravity, such as trucks, tankers, and recreational vehicles, of a curve or turn where geometric conditions might contribute to a loss of control and a rollover as determined by ~~an~~ engineering ~~study~~ judgment.

~~Support:~~

~~02 Among the established engineering practices that are appropriate for the determination of the truck rollover potential of a horizontal curve are the following:~~

~~A. An accelerometer that provides a direct determination of side friction factors~~

~~B. A design speed equation~~

~~C. A traditional ball-bank indicator using 10 degrees of ball-bank~~

(Approved by Council June 22, 2018, Attachment # 1, 17B-RW-01)

Standard:

03 **If a Truck Rollover ~~Warning~~ (W1-13) sign is used, it shall be accompanied by an Advisory Speed (W13-1P) plaque indicating the recommended speed for vehicles with a higher center of gravity**

Support:

See Section 1A.04, Traffic Control Devices Handbook for use of Truck Rollover sign.

NOTE: Edit committee changed Section 1A.11 to be 1A.04 for publications. (Approved by Council June 22, 2018, Attachment # 1, 17B-RW-01)

Option:

04 The Truck Rollover ~~Warning~~ sign may be displayed as a static sign and may be~~, as a static sign~~ supplemented by a ~~flashing~~ warning beacon, yellow LEDs in the warning sign border, or ~~as~~ a driver feedback (see Section 2C.08a)~~changeable message~~ ~~LED~~ sign activated by the detection of an approaching vehicle with a high center of gravity that is traveling in excess of the recommended speed for the condition. ~~The driver feedback LED sign may be yellow LEDs in the warning sign border or a flashing advisory speed legend in the advisory speed plaque.~~

~~*Guidance:*~~

~~*04a The driver feedback LED sign should be a yellow LED legend on a black opaque background displaying the vehicle speed approaching the change in horizontal alignment. The detected speed should have a steady or flashing message displaying the vehicle speed approaching the change in horizontal alignment.*~~ [14A-RW-07, June 28, 2014]

Option

04b An additional Truck Rollover sign may be placed in advance of the initial Truck Rollover sign.

Guidance:

04c The location of the additional Truck Rollover sign should be determined by engineering judgment.

Standard

04d **If an additional Truck Rollover sign is used, it shall be accompanied by an advisory speed plaque and either by a distance plaque or a RAMP plaque.**

Support:

05 The curved arrow on the Truck Rollover ~~Warning~~ sign shows the direction of roadway curvature. The truck tips in the opposite direction.

Figure 2C-12

Add:

(Paragraphs 04b, 04c, 04d and ramp plaque in Section 2C.13 items above were approved by Council 6-30-17, RW #4 17A.RW.04)

Section 2C.32 Surface Condition Signs (W8-5, W8-7, W8-8, W8-11, W8-13, and W8-14)

Option:

01 The Slippery When Wet (W8-5) sign (see Figure 2C-6) may be used to warn of unexpected slippery conditions. Supplemental plaques with legends such as ICE, WHEN WET, STEEL DECK, or EXCESS OIL may be used with the W8-5 sign to indicate the reason that the slippery conditions might be present.

02 The LOOSE GRAVEL (W8-7) sign (see Figure 2C-6) may be used to warn of loose gravel on the roadway surface.

03 The ROUGH ROAD (W8-8) sign (see Figure 2C-6) may be used to warn of a rough roadway surface.

04 An UNEVEN LANES (W8-11) sign (see Figure 2C-6) may be used to warn of a difference in elevation between travel lanes.

05 The BRIDGE ICES BEFORE ROAD (W8-13) sign (see Figure 2C-6) may be used in advance of bridges to advise bridge users of winter weather conditions. The BRIDGE ICES BEFORE ROAD sign may be removed or covered during seasons of the year when its message is not relevant.

06 The FALLEN ROCKS (W8-14) sign (see Figure 2C-6) may be used in advance of an area that is adjacent to a hillside, mountain, or cliff where rocks frequently fall onto the roadway.

06a Where the surface condition is limited by event or condition, a blank-out sign or DMS (see Chapter 2L) may be used with proper detection.

Guidance:

07 *When used, Surface Condition signs should be placed in advance of the beginning of the affected section (see Table 2C-4), and additional signs should be placed at appropriate intervals along the road where the condition exists.*

Section 2C.35 Weather Condition Signs (W8-18, W8-19, W8-21, and W8-22)

Option:

01 The ROAD MAY FLOOD (W8-18) sign (see Figure 2C-6) may be used to warn road users that a section of roadway is subject to frequent flooding. A Depth Gauge (W8-19) sign (see Figure 2C-6) may also be installed within a roadway section that frequently floods.

Standard:

02 If used, the Depth Gauge sign shall be in addition to the ROAD MAY FLOOD sign and shall indicate the depth of the water at the deepest point on the roadway.

Option:

03 The GUSTY WINDS AREA (W8-21) sign (see Figure 2C-6) may be used to warn road users that wind gusts frequently occur along a section of highway that are strong enough to impact the stability of trucks, recreational vehicles, and other vehicles with high centers of gravity. A NEXT XX MILES (W7-3a) supplemental plaque may be mounted below the W8-21 sign to inform road users of the length of roadway that frequently experiences strong wind gusts.

04 The FOG AREA (W8-22) sign (see Figure 2C-6) may be used to warn road users that foggy conditions frequently reduce visibility along a section of highway. A NEXT XX MILES (W7-3a) supplemental plaque may be mounted below the W8-22 sign to inform road users of the length of roadway that frequently experiences foggy conditions.

04a Where the weather condition is limited by event or condition, a blank-out sign or DMS (see Chapter 2L) may be used with proper detection.

Section 2C.36 Advance Traffic Control Signs (W3-1, W3-2, W3-3, W3-4)

[Only provided to address two minor edits to references as corrected in the two paragraphs below to Section 4S.03]

Option:

07 The Advance Traffic Control sign may be supplemented with a ~~A~~ warning beacon (see Section 4~~L~~S.03) ~~may be used with an Advance Traffic Control sign~~ (approved by Council January 9, 2012, Attachment # 3, RW # 1)or yellow LEDs within the border of the sign (approved by Council June 28, 2014, RW # 3, Attachment # 1)

10 The BE PREPARED TO STOP sign may be supplemented with a warning beacon (see Section 4~~L~~S.03) or yellow LEDs within the border of the sign. (approved by Council June 28, 2014, RW # 3, Attachment # 1)

Section 2C.37 Advance Ramp Control Signal Signs (W3-7 and W3-8)

Option:

01 A RAMP METER AHEAD (W3-7) sign (see Figure 2C-6) may be used to warn road users that a freeway entrance ramp is metered and that they will encounter a ramp control signal (see Chapter 4I).

01a Where the advance ramp control signal condition is limited by time, day, event or condition, blank-out or DMS (see Chapter 2L) may be used.

Guidance:

02 When the ramp control signals are operated only during certain periods of the day, a RAMP METERED WHEN FLASHING (W3-8) sign (see Figure 2C-6) should be installed in advance of the ramp control signal near the entrance to the ramp, or on the arterial on the approach to the ramp, to alert road users to the presence and operation of ramp meters.

Standard:

03 The RAMP METERED WHEN FLASHING sign shall be supplemented with a warning beacon (see Section 4~~L~~S.03) that flashes when the ramp control signal is in operation.

Section 2C.39 DRAW BRIDGE Sign (W3-6)

Standard:

01 A DRAW BRIDGE (W3-6) sign (see Figure 2C-6) shall be used in advance of movable bridge signals and gates (see Section 4J.02) to give warning to road users, except in urban conditions where such signing would not be practical.

Option:

01a A blank-out sign or DMS (see Chapter 2L) may be used to supplement the DRAW BRIDGE (W3-6) sign to warn when the movable bridge signals and gates are in effect using a ROAD CLOSED AHEAD message.

CHAPTER 2D. GUIDE SIGNS—CONVENTIONAL ROADS

Section 2D.35 Trailblazer Assembly

Support:

01 Trailblazer assemblies provide directional guidance to a particular road facility from other highways in the vicinity. This guidance is accomplished by installing Trailblazer assemblies at strategic locations to indicate the direction to the nearest or most convenient point of access. The use of the word TO indicates that the road or street where the sign is posted is not a part of the indicated route, and that a road user is merely being directed progressively to the route.

Standard:

02 **A Trailblazer assembly shall consist of a TO auxiliary sign, a route sign for a numbered or named highway (see Section 2D.53) or an Auto Tour Route sign (see Section 2H.07), and a single-headed Directional Arrow auxiliary sign pointing in the direction leading to the route. Where the Trailblazer assembly is for an alternative route, the appropriate auxiliary sign for an alternative route (see Section 2D.16) shall also be included in the assembly.**

Option:

03 A Cardinal Direction auxiliary sign may be used with a Trailblazer assembly.

Guidance:

04 *The TO auxiliary sign, Cardinal Direction auxiliary sign, and Directional Arrow auxiliary sign should be of the standard size provided for auxiliary signs of their respective type. The route sign should be the size provided in Section 2D.11.*

Option:

05 Trailblazer assemblies may be installed with other Route Sign assemblies, or alone, in the immediate vicinity of the designated facilities.

05a Where the directional guidance is limited by time, day, event or condition (for example, construction), a hybrid sign or DMS (see Chapter 2L) may be used.

CHAPTER 2E. GUIDE SIGNS – FREEWAY AND EXPRESSWAYS

Section 2E.54 Inspection~~Weigh~~ Station Signing (approved by Council June 28, 2014, 14B-GMI-09, not picked up in that proposal)

Standard:

01 **Inspection~~Weigh~~ Station signing on freeways and expressways shall be the same as that provided in Section 2D.49, except for lettering size and the advance posting distance for the Exit Direction sign, which shall be located a minimum of 1,500 feet in advance of the gore.**

Support:

02 Inspection~~Weigh~~ Station sign layouts for freeway and expressway applications are shown in the "Standard Highway Signs and Markings" book (see Section 1A.11).

Option:

03 The INSPECTION STATION (D8-2) guide sign may be a hybrid sign or DMS (see Chapter 2L).

CHAPTER 2F. TOLL ROAD SIGNS

Section 2F.05 Regulatory Signs for Toll Plazas

Support:

01 Toll plaza operations often include lane-specific restrictions on vehicle type, forms of payment accepted, and speed limits or required stops. Vehicles are typically required to come to

a stop to pay the toll or receive a toll ticket in the attended and exact change or automatic lanes. Electronic toll collection (ETC) lanes with favorable geometrics typically allow vehicles to move through the toll plaza without stopping, but usually within a set regulatory speed limit or advisory speed. In some ETC lanes and in most lanes that accommodate non-ETC vehicles, a stop might be required while the ETC payment is processed because of geometric or other conditions.

Guidance:

02 *Regulatory signs applicable only to a particular lane or lanes should be located in a position that makes their applicability clear to road users approaching the toll plaza.*

03 *Regulatory signs, or regulatory panels within guide signs, indicating restrictions on vehicle type and forms of toll payment accepted at a specific toll plaza lane should be installed over the applicable lane either on the toll plaza canopy or on a separate structure immediately in advance of the canopy located in a manner such that each sign is clearly related to an individual toll lane.*

Support:

04 Section 2F.13 contains information regarding the incorporation of regulatory messages into guide signs for toll plazas.

05 Section 2F.16 contains information regarding the design and use of toll plaza canopy signs.

Guidance:

06 *One or more Speed Limit (R2-1) signs (see Section 2B.13) should be installed in the locations provided in Paragraph 8 for an ETC-Only lane at a toll plaza in which an enforceable regulatory speed limit is established for a lane in which it is intended that vehicles move through the toll plaza without stopping while toll payments requiring stops occur in other lanes at the toll plaza. The speed limit displayed on the signs should be based on an engineering study taking into account the geometry of the plaza and the lanes and other appropriate safety and operational factors.*

07 *A Speed Limit (R2-1) sign should not be installed for a toll plaza lane that is controlled by a STOP (R1-1) sign or where a stop is required.*

Option:

08 Speed limit signs may be installed over the applicable lane on the toll plaza canopy, on the approach end of the toll booth island, on the toll booth itself, or on a vertical element of the canopy structure. Down arrows or diagonally downward-pointing directional arrows may be used to supplement the speed limit signs if an engineering study or engineering judgment indicates that the arrow is needed to clarify the applicability of a sign to a specific lane or to improve compliance.

Standard:

09 **A STOP (R1-1) sign shall not be installed for a toll plaza lane that is operated as an ETC-Only lane and that is designed for tolls to be collected while vehicles continue moving.**

Option:

10 A STOP (R1-1) sign may be installed to require vehicles to come to a complete stop to pay a toll in an attended or exact change lane, even if that lane is also available for optional use by vehicles with registered ETC accounts. A PAY TOLL (R3-29P) or TAKE TICKET (R3-30P) plaque (see Figure 2F-2), as appropriate to the operation, may be installed directly under the STOP (R1-1) sign for a toll plaza lane, if needed.

Figure 2F-2 Toll Plaza Regulatory Signs and Plaques

11 The mounting height of the STOP sign and any supplemental plaque may be less than the normal mounting height requirements if constrained by the physical features of the toll island or toll plaza.

12 The lateral offset of a STOP or other regulatory sign located within a toll plaza island may be reduced to a minimum of 1 foot from the face of the toll island or raised barrier to the nearest edge of the sign.

Guidance:

13 *If used, a STOP (R1-1) sign for a toll plaza cash payment lane should be located in a longitudinal position as near as practical to the point where a vehicle is expected to stop to pay the toll or take a ticket.*

Option:

14 A Toll Rate (R3-28) sign (see Figure 2F-2) may be installed in advance of the toll plaza to indicate the toll applicable to the various vehicle types.

Guidance:

15 *If used, the Toll Rate (R3-28) sign should be located between the toll plaza and the first advance sign informing road users of the toll plaza.*

16 *The R3-28 sign should not contain more than three lines of legend. Each lines that shows a toll amount should display only a single toll amount.*

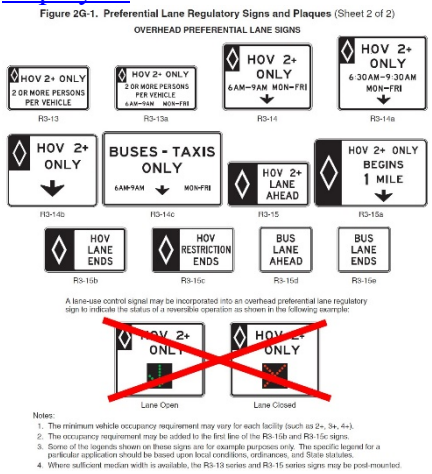
Option:

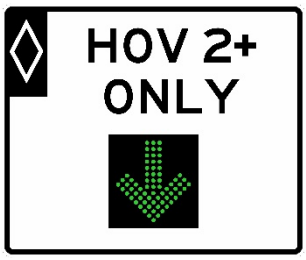
17 Additional toll rate information exceeding three lines of legend may be displayed on the toll booth adjacent to the payment window of an attended lane or the payment receptacle of an exact change or automatic lane where it is visible to a road user who has stopped to pay the toll, but is not visible to approaching road users who have not yet entered the toll lane.

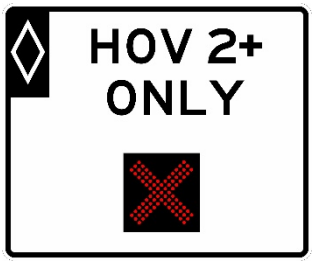
17a The TOLL RATE (R3-28) sign may be a hybrid sign or DMS (see Chapter 2L).

CHAPTER 2G. PREFERENTIAL AND MANAGED LANE SIGNS

[Replace these graphics that currently show single stroke symbols in Figure 2G-1 Preferential Lane Regulatory Signs and Plaques] Add note "5. Refer to Chapter 4T for arrow and X displays."







CHAPTER 2H. GENERAL INFORMATION SIGNS

Section 2H.03 Traffic Signal Speed Sign (I1-1)

Option:

01 The Traffic Signal Speed (I1-1) sign (see Figure 2H-1), reading SIGNALS SET FOR XX MPH, may be used to indicate a section of street or highway on which the traffic control signals are coordinated into a progressive system timed for a specified speed at all hours during which they are operated in a coordinated mode.

02 If different system progression speeds are set for different times of the day, a changeable message element (see Chapter 2L) may be used for the numerals of the Traffic Signal Speed (I1-1) sign. If the system is operated in coordinated mode only during certain times, a blank-out version of the Traffic Signal Speed (I1-1) sign may be used to display the message only during those times.

Guidance:

03 *If used, the sign should be mounted as near as practical to each intersection where the timed speed changes, and at intervals of several blocks throughout any section where the timed speed remains constant.*

Standard:

04 **The Traffic Signal Speed sign shall be a minimum of 24 x 36 inches with the longer dimension vertical. It shall have a white message and border on a green background.**

~~*Guidance:*~~

~~*The LED message panel on a green Traffic Signal Speed sign shall be a white LED legend on a black opaque background.*~~ [6/28/2014, 14A-RW-07]

CHAPTER 2L. CHANGEABLE MESSAGE SIGNS

Section 2L.01 Description of Changeable Message Signs

Support:

01 A changeable message sign (CMS) is a ~~electronic~~ traffic control device that is capable of displaying one or more alternative messages and includes dynamic message signs (DMS), hybrid signs, blank-out signs and line matrix signs (see Section 1A.13). ~~Some changeable message signs have a blank mode when no message is displayed, while others display multiple messages with only one of the messages displayed at a time (such as OPEN/CLOSED signs at weighinspection stations).~~

01a The provisions in this Chapter apply to both permanent and portable changeable message signs with electronic displays. Additional provisions that only apply to portable changeable message signs can be found in Sections 6F.60 and 6F.61.

01aa The provisions in this Chapter do not apply to changeable message signs with non-electronic displays that are changed either manually or electromechanically, such as a hinged-panel, rotating-drum, or back-lit curtain or scroll CMS. [Moved paragraph 02 here]

01b DMS are able to emulate any traffic control sign (see Section 2A.04). Hybrid and blank-out signs are able to emulate those signs as designated in Part 2. Hybrid signs provide inserts to static signs where legend information changes depending upon conditions. Blank-out signs are able to address traffic control by time of day or period/event conditions by being able to display information only for those times and blank at other times where the conditions do not exist. As a quick reference, Table 2L-0A shows common uses of Hybrid and Blank-out signs and includes references to the appropriate sections.

01c Line matrix signs are able to be used for temporary traffic control as designated in Part 6.

Table 2L-0A
Common Uses of Hybrid and Blank-Out Signs

Hybrid Sign Type	Section	Blank-out Sign Type	Section
Speed Limit	2B.13	Turn Prohibition	2B.18/8B.08
Reversible Lane Control	2B.26	Do Not Enter	2B.37
Driver Feedback	2C.08a	Wrong Way	2B.38
Truck Rollover Warning	2C.13	Signal Signs	2B.53
Trailblazer/Route	2D.35	No Turn on Red	2B.54
Inspection Station	2E.54	Ramp Metering	2B.56
Toll Facility	2F.05, 06, 07, 08, 09, 13	Surface Conditions	2C.32
Preferential Lane - Regulatory	2G.03	Weather Conditions	2C.35
Preferential Lane – Guide	2G.10	Advance Ramp Control Warning	2C.37
Priced Lanes	2G.17	Draw Bridge Warning	2C.39
Travel Times	2G.18	School Speed Limit Assembly	7B.15
Traffic Signal Speed Progression	2H.03	Bus/LRT Approaching	2B.23a/8B.19

01d CMS hardware standards are contained in NEMA TS4-2016 and FCC compliance (including but not limited to 47CFR part 2, subpart J; part 15, subpart B; and part 90, subpart J).

01e Some changeable message signs have a blank mode when no message is displayed, while others display multiple messages with only one of the messages displayed at a time (such as

OPEN/CLOSED signs at inspection stations). [14B-GMI-09, 6-28-14 replaced weigh with inspection]

02 ~~The provisions in this Chapter apply to both permanent and portable changeable message signs with electronic displays. Additional provisions that only apply to portable changeable message signs can be found in Section 6F.60. The provisions in this Chapter do not apply to changeable message signs with non-electronic displays that are changed either manually or electromechanically, such as a hinged panel, rotating drum, or back-lit curtain or scroll CMS.~~[Moved paragraph 2 up to paragraph 01aa]

Standard:

03 **Except as provided in Paragraph 2 of Section 2L.02, changeable message signs shall display only traffic operational, regulatory, warning, and guidance information. Advertising messages shall not be displayed on changeable message signs or its supports or other equipment.**

04 **The design of legends for non-electronic display changeable message signs shall comply with the provisions of Chapters 2A through 2K, 2M, and 2N of this Manual. All other changeable message signs shall comply with the design and application principles established in this Chapter, ~~and in~~Chapter 2A and other provision noted for specific signs.** [14A-RW-07, 6-28-14]

~~*Guidance:*~~

~~*05 Blank-out signs that display only single-phase, predetermined electronic display legends that are limited by their composition and arrangement of pixels or other illuminated forms in a fixed arrangement (such as a blank-out sign indicating a part-time turn prohibition, a blank-out or changeable lane-use sign, or a changeable OPEN/CLOSED sign for a weighinspection station) should comply with the provisions of the applicable Section for the specific type of sign, provided that the letter forms, symbols, and other legend elements are duplicates of the static messages as detailed in the "Standard Highway Signs and Markings" bookpublication (see Section 1A.11). Because such a sign is effectively an illuminated version of a static sign, the size of its legend elements, the overall size of the sign, and placement of the sign should comply with the applicable provisions for the static version of the sign.*~~ [14B-GMI-09, 6-28-14]

Section 2L.02 Applications of Changeable Message Signs

Support:

01 Changeable message signs have a large number of applications. They can include a variety of applications that vary over time including, but not limited to, the following:

A. Incident management and route diversion
B. Warning of adverse weather conditions
C. Special event applications associated with traffic control or conditions
~~D. Control at crossing situations~~ [14B-GMI-08, 6-28-14]
D. Special l~~L~~ane use, ramp, and roadway regulatory control and warning
E. ~~Priced~~Tolled or other types of priced managed lanes
F. Travel times
G. Warning situations
H. Traffic regulations
I. Speed control or warning
J. Variable d~~D~~estination guidance
K. Supporting temporary traffic control applications
L. Active Traffic Management

Option:

02 Changeable message signs may be used by State and local highway agencies to display short-term safety messages as a supporting element of a broader safety campaign, transportation-related messages, emergency homeland security messages, and America's Missing: Broadcast Emergency Response (AMBER) alert messages. [14B-GMI-08, 6-28-14]

Guidance:

03 *State and local highway agencies should develop and establish a policy regarding the display of the types of messages provided in Paragraph 2. When changeable message signs are used at multiple locations to address a specific situation, the message displays should be consistent along the roadway corridor and adjacent corridors, which might necessitate coordination among different operating agencies.*

Support:

04 Examples of safety campaign supporting messages include "SEAT BELT BUCKLED?" and "DON'T DRINK AND DRIVE." Examples of transportation-related messages include "STADIUM EVENT SUNDAY, EXPECT DELAYS NOON TO 4 PM" and "OZONE ALERT CODE RED—USE TRANSIT." [14B-GMI-08, 6-28-14]

Guidance:

05 *When a CMS is used to display a safety or ~~transportation~~transportation-related message, the message should be simple, brief, legible, and clear. A CMS should not be used to display a safety or transportation-related message if doing so would adversely affect respect for the sign. "CONGESTION AHEAD" or other overly simplistic or vague messages should not be displayed alone. These messages should be supplemented with a message on the location or distance to the congestion or incident, delay and travel time, alternative route, or other similar messages.* [14B-GMI-08, 6-28-14]

Standard:

06 **~~When a CMS is used to display a safety, transportation-related, emergency homeland security, or AMBER alert message, the display~~ The format of CMS displays shall not be of a type that could be considered similar to advertising displays.** [14B-GMI-08, 6-28-14]

Support:

07 Section 2B.13 contains information regarding the design of changeable message signs that are used to display variable speed limits that change based on ambient or operational conditions, or that display the speed at which approaching drivers are traveling.

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

Support:

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

02 For the more common types of changeable message signs, the longest measured legibility distances on sunny days occur during mid-day when the sun is overhead. Legibility distances are much shorter when the sun is behind the sign face, when the sun is on the horizon and shining on the sign face, or at night.

03 Visibility is the characteristic that enables a CMS to be seen. Visibility is associated with the point where the CMS is first detected, whereas legibility is the point where the message on the CMS can be read. Environmental conditions such as rain, fog, and snow impact the visibility of

changeable message signs and can reduce the available legibility distances. During these conditions, there might not be enough viewing time for drivers to read the message.

Guidance:

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

05 ~~*The changeable message regulatory and warning signs used individually or as part of the legend for a larger Changeable Message sign should meet the standard size and legend requirements for those specific signs in Parts 2B and 2C.*~~ [14A-RW-07, 6-28-14]

Section 2L.04 Design Characteristics of Changeable Message Signs

Standard:

01 **Changeable message signs shall not include advertising, animation, ~~rapid flashing,~~ dissolving, exploding, scrolling, or other dynamic elements, except as noted in paragraphs 2, 2a and 2b.** [14A-RW-07, 6-28-14]

01a **The design of messages on dynamic message signs, hybrid signs and blank-out signs shall conform to the provisions of Section 2A.04 and the likeness of static signs shown in sections of Part 2.**

01b **Regulatory blank-out signs shall not flash.**

01c **A flashing beacon within a DMS shall conform to Chapter 4S and shall not be within any traffic control device on the message display. No more than two flashing beacon indications shall be permitted on any DMS.**

Support:

01d As a quick reference, the common hybrid and blank-out signs are shown in Table 2L-0A.

02 Basic flashing is where illuminated elements are simultaneously on and then off repetitively. Simultaneous flashing of CMS or LED elements is described in Section 2A.07. Coordinated flashing can occur in the follow ways:

A. Sequential flashing is where the flashing elements of the sign progressively display a message either within a sign, for example a sequential arrow (see Figure 6F-6) or from sign to sign, for example a series of Chevron Alignment signs.

B. Alternating or dancing flashing is where the same symbol or pair of flashing beacons is displayed in a different horizontal position on the traffic control device, for example alternating diamond caution (see Figure 6F-6).

C. Rapid flashing is where the flash rate differs from simultaneous (see Chapter 4L).

~~Sections 6F.60 and 6F.61 contains information regarding the use of arrow boards that use flashing or sequential displays for lane closures.~~

D. Streaming flashing is where a similar symbol is displayed progressively across a DMS multiple times (as opposed to one change which would be alternating or dancing discussed above). Streaming indicates motion, for example, a sequential chevron (see Figure 6F-6).

Option:

02a Displays using coordinated flashing may be displayed for the following:

A. Temporary traffic control advance warning arrow boards that use alternating, sequential or streaming displays (see Sections 6F.60 and 6F.61) or their CMS equivalent;

B. A series of Chevron Alignment signs (see Section 2C.09) sequentially or their CMS equivalent;

C. Rapid flash beacon or their CMS equivalent (see Chapter 4S); and

D. Advance warning of potential lane closure on freeways and expressways using streaming chevrons on a DMS (similar to W1-8 and Section 6F.61)) more than ½ mile in advance of the yellow X lane-use control signal (see Section 4T.03) as lane change direction guidance.

02b BUS APPROACHING (symbol), BUS or LRT APPROACHING warning blank-out signs (see Section 2B.23a and 8B.19) may be flashed similar to flashing beacons (see Chapter 4S).

[Note: 2B.23a refers to a Section in 20B-RW-02]

02c Permanent changeable message signs may be used to supplement temporary traffic control, where they are present in appropriate locations.

Guidance:

~~03 Except in the cases of a limited-legend blank-out electronic-display changeable message regulatory sign) that is used in place of a static regulatory sign an activated blank-out warning sign that supplements a static warning sign at a separate location, the changeable message signs should be used as a supplement to and not as a substitute for conventional signs and markings, except as noted herein.~~ [14A-RW-07, 6-28-14]

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

04A *Full-matrix DMS display should be limited to no more than three traffic control devices and/or text messages.*

NOTE: Please add a graphic the depicts what 04a would look like as a part of a DMS; eg. show lane use controls, variable speed limits and flashing beacon as an ok example, all three of these plus a guide sign display and/or text message element as not ok.

05 *The spacing between characters in a word should be between 25 to 40 percent of the letter height. The spacing between words in a message should be between 75 and 100 percent of the letter height. Spacing between the message lines should be between 50 and 75 percent of the letter height.*

06 *Except as provided in Paragraph 18, word messages on changeable message signs should be composed of all upper-case letters. The minimum letter height should be 18 inches for changeable message signs on roadways with speed limits of 45 mph or higher. The minimum letter height should be 12 inches for changeable message signs on roadways with speed limits of less than 45 mph.*

Support:

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

Guidance:

08 *~~The width-to-height ratio of the sign characters should be between 0.7 and 1.0. The stroke width-to-height ratio should be 0.2.~~ Characters should match Standard Alphabet for traffic control devices.*

Support:

09 Pixel densities for line matrix signs that conform to the required character height-to-width

ratio are defined in NEMA TS-4 2016 Sections 5.6.2.2 and 5.6.2.3. ~~The width-to-height ratio is commonly accomplished using a minimum font matrix density of five pixels wide by seven pixels high.~~

Standard:

09a **For DMS, hybrid and blank-out signs the maximum pixel pitch shall be 20 mm for freeway and expressway applications.**

Option:

09b DMS, hybrid and blank-out sign applications for conventional roads may utilize pixel pitch at greater density to achieve no apparent loss of resolution or to improve road user recognition (typically between 8mm and 16mm).

09c Hybrid, blank-out and line matrix signs may use a black background with white or yellow characters or reverse images as provided in this Manual for a specific sign (see Chapters 2B, 2C, 2F, 2G and 2H).

Standard:

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

Guidance:

~~11 *The luminance of changeable message signs should meet criteria for daytime and nighttime conditions. Luminance contrast should be between 8 and 12 for all conditions.*~~

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

Support:

13 Legibility distances for negative-contrast changeable message signs are likely to be at least 25 percent shorter than those of positive-contrast messages. In addition, the increased light emitted by negative-contrast changeable message signs has not been shown to improve detection distances.

Standard:

~~14 **The colors used for the legends and backgrounds on changeable message signs shall be as provided in Table 2A-5.**~~

~~*Guidance:*~~

~~15 *If a black background is used, the color used for the legend on a changeable message sign should match the background color that would be used on a standard sign for that type of legend, such as white or red for regulatory, yellow for warning, orange for temporary traffic control, red for stop or yield, fluorescent pink for incident management, and fluorescent yellow-green or yellow for bicycle, pedestrian, and school warning*~~. [14A-RW-07, 6-28-14]

Standard:

16 **If a green background is used for a guide message on a CMS or if a blue background is used for a motorist services message on a CMS, the background color shall be provided by green or blue lighted pixels such that the entire CMS would be lighted, not just the white legend.**

~~Support:~~

17 ~~Some CMS that employ newer technologies have the capability to display an exact duplicate of a standard sign or other sign legend using standard symbols, the Standard Alphabets and letter forms, route shields, and other typical sign legend elements with no apparent loss of resolution or recognition to the road user when compared with a static version of the same sign legend. Such signs are of the full-matrix type and can typically display full-color legends. Use of such~~

~~technologies for new CMS is encouraged for greater legibility of their displays and enhanced recognition of the message as it pertains to regulatory, warning, or guidance information.~~

Guidance:

18 ~~*If used, the CMS described in the preceding paragraph should not display symbols or route shields unless they can do so in the appropriate color combinations. For a single-phase message where the Standard Alphabets and other legend elements of standard designs are used, the lettering style, size, and line spacing should comply with the applicable provisions for the type of message displayed as provided elsewhere in this Manual.*~~ *For two-phase messages, larger legend heights should be used as described previously in this Section because of the need for such messages to be legible at a greater distance. Regardless of the number of phases, the CMS should comply with the legibility and visibility provisions of Section 2L.03.*

Section 2L.05 Message Length and Units of Information

Guidance:

01 *The maximum length of a message should be dictated by the number of units of information contained in the message, in addition to the size of the CMS. A unit of information, which is a single answer to a single question that a driver can use to make a decision, should not be more than four words.*

Support:

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

Table 2L-1. 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

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

Phase 1	Phase 2
MAJOR CRASH **AT EXIT 12**	**TO NEW YORK** **USE ROUTE 46**

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

Standard:

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

05 **Techniques of message display such as fading, ~~rapid flashing,~~ exploding, dissolving, or moving messages shall not be used. The text of the message shall not scroll or travel horizontally or vertically across the face of the sign.**

Guidance:

06 *When designing and displaying messages on changeable message signs, the following principles relative to message design should be used:*

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

Option:

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

Guidance:

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

09 *When the message on a CMS includes an abbreviation, the provisions of Section 1A.15 should be used.*

Section 2L.06 Installation of Permanent Changeable Message Signs

Standard:

01a **CMS shall be placed in accordance with the provisions of Sections 2A.16 through 2A.20.**

Guidance:

01 ~~*A CMS that is used in place of a static sign (such as a blank-out or variable legend regulatory sign) should be located in accordance with the provisions of Chapter 2A. The following factors should be considered when installing other permanent changeable message signs:*~~ *Changeable message signs should not:*

- ~~*A. Changeable message signs should be located sufficiently upstream of known bottlenecks and high crash locations to enable road users to select an alternate route or take other appropriate action in response to a recurring condition.*~~ [Moved to 2L.07 (02)]
- ~~*B. Changeable message signs should be located sufficiently upstream of major diversion decision points, such as interchanges, to provide adequate distance over which road users can change lanes to reach one destination or the other.*~~ [Moved to 2L.07 (03)]
- ~~*C.*~~ *A.* ~~*Changeable message signs should not b*~~*Be located within an interchange except for toll plazas or managed lanes.*

~~D.~~ B. ~~Changeable message signs should not b~~Be positioned at locations where the information load on drivers is already high because of guide signs and other types of information.

~~E.~~ C. ~~Changeable message signs should not b~~Be located in areas where drivers frequently perform lane-changing maneuvers in response to static guide sign information, or because of merging or weaving conditions.

Support:

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

2L.07 Changeable Message Signs for Active Traffic Management (ATM)

Support:

01a ATM advises motorists of changing traffic conditions and regulations. One method is lane-use management to dynamically close individual lanes during incidents and to open shoulders for part-time travel to increase capacity during congested periods. MUTCD Chapter 4T characterizes lane-use management implemented by lane-use control signals that are often full-matrix DMS (see Chapter 4T). Section 4T.03 addresses minimum size requirements of lane-use control signal indications for various facility types.

Guidance:

01b *CMS should be considered for use in systems that implement various ATM strategies some of which are identified in Section 2L.02.*

02 *Signs should be located sufficiently upstream of known bottlenecks and high crash locations to enable road users to select an alternate route or take other appropriate action in response to a recurring condition.*

03 *Signs should be located sufficiently upstream of major diversion decision points, such as interchanges, to provide adequate distance over which road users can change lanes to reach one destination or the other.*

PART 4. HIGHWAY TRAFFIC SIGNALS

CHAPTER ~~4L~~ 4S. FLASHING BEACONS

[14A-STC-01, Changes shown in green in this Chapter approved by Council 6/24/14]

[Paragraphs in the new "Chapter 4S Flashing Beacons" moved from the existing "Chapter 4L Flashing Beacons".]

Section ~~4L.01~~ 4S.01 General Design and Operation of Flashing Beacons

Support:

01 A Flashing Beacon is a highway traffic signal with one or more signal sections that operates in a simultaneous or alternating flashing mode. It can provide traffic control when used as an intersection control beacon (see Section ~~4L.02~~ 4S.02), or it can provide warning when used in other applications (see Sections ~~4L.03, 4L.04, and 4L.05~~ 4S.03 Warning Beacon, 4S.04 Speed Limit Sign Beacon, and 4S.05 Stop Beacon. Other beacons also flash and are addressed in other chapters (Rapid Flash Beacon (Chapter 4L) and hybrid beacons which flash as a part of their operational characteristics (Chapters 4K Pedestrian Hybrid Beacon and 4N Emergency-Vehicle Hybrid Beacon)). [Note: FHWA may find it helpful to place the new RRFB chapter (reserved as 4L) within Chapter 4S as one of several Flashing Beacons.]

Standard:

02 **Flashing Beacon units and their mountings shall comply with the provisions of Chapters 4D and 4E, except as otherwise provided in this Chapter.**

03 **Beacons shall be flashed at a rate of not less than 50 or more than 60 times per minute. The illuminated period of each flash shall be a minimum of 1/2 and a maximum of 2/3 of the total cycle.**

04 **A beacon shall not be included within the border of a sign except for Interchange Exit Direction signs with advisory speed panels (see Figure 2E-27)** and CMS (see paragraphs 06a to 06d and Section 2L.04)**~~School Speed Limit Sign Beacons (see Sections 4L.04 and 7B.15)~~.**

04a **There shall be two nominal diameter sizes for flashing beacon signal indications: 8 inches and 12 inches.**

Guidance:

05 *If used to supplement a warning or regulatory sign, the edge of the beacon signal housing should normally be located no closer than 12 inches outside of the nearest edge of the sign* or from the nearest edge of any of the signs and plaques in a sign assembly.

Option:

06 An automatic dimming device may be used to reduce the brilliance of flashing yellow signal indications during night operation.

06a Flashing indications of a Warning Beacon (see Section 4S.03) or a Speed Limit Sign Beacon (see Section 4S.04) may be displayed as an integral part of a Dynamic Message Sign (DMS) (see Section 2L.04) using full matrix display technology, provided that such displays of flashing beacon signal sections comply with the provisions of Chapter 4S and utilize LED pixels as the light source, with brightness, intensity, and legibility at least equal to that of LED traffic signal displays.

06b DMS displays of flashing beacon indications may be in conjunction with displays of other non-conflicting messages, such as speed limits, advisory speeds, and other regulatory, warning, or guide messages.

Support:

06c When displayed on a DMS flashing beacon indications do not have visors or housings in the traditional sense, and thus also are not composed of signal sections or signal faces. However, it is intended that such indications are displayed in a manner that mimic that of signal sections and/or faces.

Standard

06d **When displayed within a DMS, a beacon shall be below, above, or alongside (but not within) any sign or text message that is also displayed by the DMS, except as shown on Figure 2E-27.**

Section ~~4L.04~~4S.04 Speed Limit Sign Beacon [14A-STC-01, 6-28-14]
[Note: only text to address edit of beacon terminology shown]
Option:

03 A Speed Limit Sign Beacon may be used with a fixed or variable Speed Limit sign. If applicable, a ~~flashing~~Speed Limit Sign Beacon (with an appropriate accompanying sign) may be used to indicate that the displayed speed limit is in effect.

CHAPTER ~~4M~~ 4T. LANE-USE CONTROL SIGNALS

[Paragraphs in the new "Chapter 4T Lane-Use Control Signals" moved from existing "Chapter 4M Lane-Use Control Signals".]

Section ~~4M.01~~ 4T.01 Application of Lane-Use Control Signals
[14A-STC-01, Changes shown in green in this Section approved by Council 6/24/14]
Support:

01 Lane-use control signals are special overhead signals that permit or prohibit the use of specific lanes of a street or highway or that indicate the impending prohibition of their use. Lane-use control signals are distinguished by placement of special signal ~~faces~~ displays (signal faces or DMS over a certain lane or lanes of the roadway and by their distinctive shapes and symbols. Supplementary signs are sometimes used to explain their meaning and intent.

02 Lane-use control signals are most commonly used for reversible-lane control, but are also used in certain non-reversible lane applications including Active Traffic Management, and for toll plaza lanes (see Section ~~4K.02~~ 4R.02).

Guidance:

03 *An engineering study should be conducted to determine whether a reversible-lane operation can be controlled satisfactorily by static signs (see Section 2B.26) or whether lane-use control signals are necessary. Lane-use control signals should be used to control reversible-lane operations if any of the following conditions are present:*

- *A. More than one lane is reversed in direction;*
- *B. Two-way or one-way left turns are allowed during peak-period reversible operations, but those turns are from a different lane than used during off-peak periods;*
- *C. Other unusual or complex operations are included in the reversible-lane pattern;*
- *D. Demonstrated crash experience occurring with reversible-lane operation controlled by static signs that can be corrected by using lane-use control signals at the times of transition between peak and off-peak patterns; and/or*
- E. *An engineering study indicates that the safety and efficiency of the traffic operations of a reversible-lane system would be improved by lane-use control signals.*

Standard:

04 **Pavement markings (see Section 3B.03) shall be used in conjunction with reversible-lane control signals.**

Option:

05 Lane-use control signals may also be used if there is no intent or need to reverse lanes, but there is a need to indicate the open or closed status of one or more lanes, such as:

A. On a freeway, if it is desired to close certain lanes at certain hours to facilitate the merging of traffic from a ramp or other freeway;
B. On a freeway, near its terminus, to indicate a lane that ends;
C. On a freeway, ~~or long~~ bridge, or tunnel, to indicate that a lane or shoulder is open or closed to through traffic, or to indicate that a lane may be temporarily blocked by a crash, breakdown, construction or maintenance activities, or similar temporary conditions; and
D. On a conventional road or driveway, at access or egress points to or from a facility, such as a parking garage, where one or more lanes of the access or egress are opened or closed at various times.

05a A USE LANE(S) WITH GREEN ARROW (R10-8) sign (see Section 2B.53 and Figure 2B-27) may be used in conjunction with lane-use control signals.

Section ~~4M.02~~ 4T.02 Meaning of Lane-Use Control Signal Indications

[Changes shown in green in this Section approved by Council 6/24/14]

Standard:

01 **The meanings of lane-use control signal indications shall be as follows:**

A. A steady DOWNWARD GREEN ARROW signal indication shall mean that a road user is permitted to drive in the lane or shoulder over which the arrow signal indication is located.
B. A steady YELLOW X signal indication shall mean that a road user is to prepare to vacate the lane or shoulder over which the signal indication is located because a lane control change is being made to a steady RED X signal indication.
C. A steady WHITE TWO-WAY LEFT-TURN ARROW signal indication (see Figure ~~4M-1~~ 4T-1) shall mean that a road user is permitted to use a lane over which the signal indication is located for a left turn, but not for through travel, with the understanding that common use of the lane by oncoming road users for left turns is also permitted.
D. A steady WHITE ONE WAY LEFT-TURN ARROW signal indication (see Figure ~~4M-1~~ 4T-1) shall mean that a road user is permitted to use a lane or shoulder over which the signal indication is located for a left turn (without opposing turns in the same lane), but not for through travel.
E. A steady RED X signal indication shall mean that a road user is not permitted to use the lane or shoulder over which the signal indication is located and that this signal indication shall modify accordingly the meaning of other traffic controls present.

Section ~~4M.03~~ 4T.03 Design of Lane-Use Control Signals

[Changes shown in green in this Section approved by Council 6/24/14]

Standard:

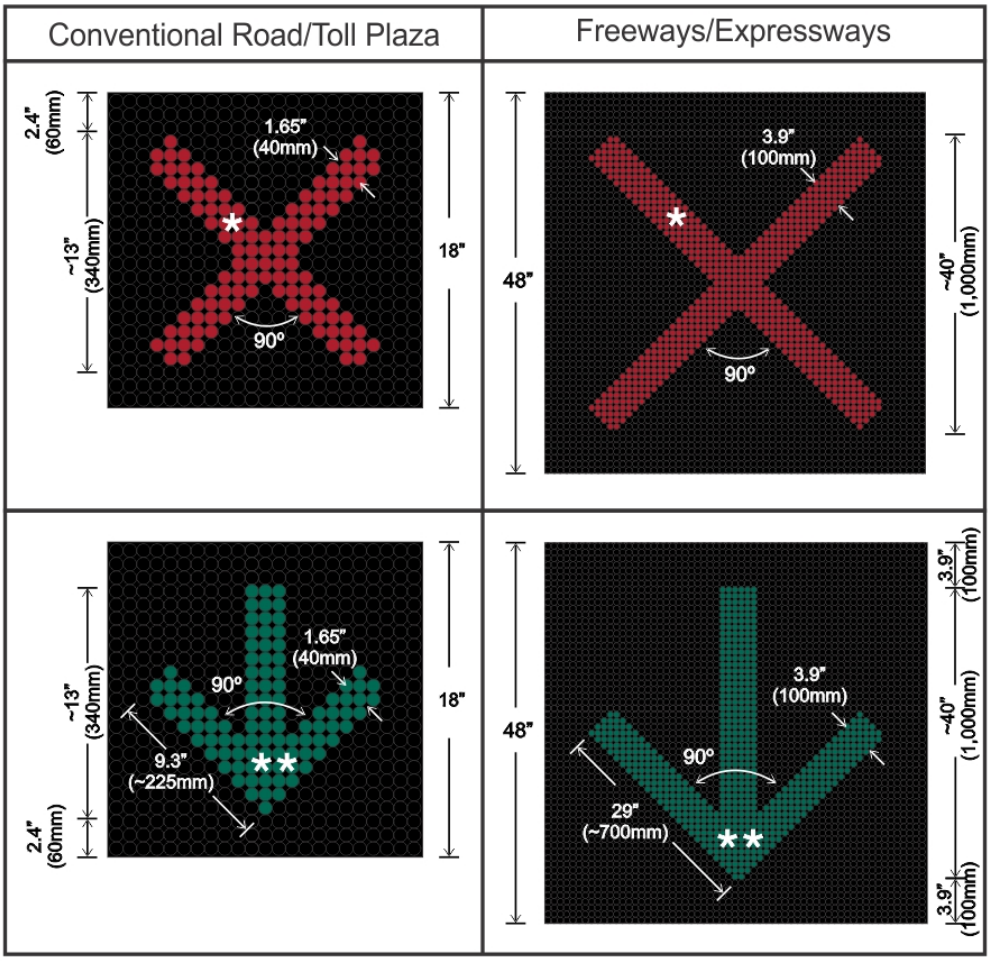
01 **All lane-use control signal indications shall be in units with rectangular signal displays~~faces~~ and shall have opaque backgrounds. Nominal minimum height and width of each DOWNWARD GREEN ARROW, YELLOW X, and RED X signal display~~faces~~ shall be:**

A. **18 inches for typical applications on conventional roads and at toll plazas,**

B. 48 inches for typical applications on freeways and expressways.

01a Design and dimensions of the DOWNWARD GREEN ARROW, YELLOW ARROW, and RED X signal indications shall be as shown in Figure 4T-1a.

Figure 4T-1a Minimum Sizes of Lane-Use Control Signal Displays and Indications



NOTES:
Minimum dimensions, scale proportionally for larger sizes.
For freeways/expressways, larger stroke symbols are possible.
Stroke is measured to center of the pixel.
Figure shows both display dimensions (black area) and indication dimensions (arrow and X)

Legend:
* Red or Yellow (illuminated), black background
** Green (illuminated), black background

01b **The WHITE TWO-WAY LEFT-TURN ARROW and WHITE ONE WAY LEFT-TURN ARROW signal faces shall have a nominal minimum height and width of 30 inches.**

Option:

01c Except for lane-use control signals at toll plazas (see Section ~~4K.02~~ 4R.02), in areas with minimal visual clutter and with speeds of 35 mph or less ~~than 40 mph~~, lane-use control signal displays~~faces~~ with nominal height and width of 12 inches may be used for the DOWNWARD GREEN ARROW, YELLOW X, and RED X displays~~faces~~, and lane-use control signal displays

~~faces~~ with nominal height and width of 18 inches may be used for the WHITE TWO-WAY LEFT-TURN ARROW and WHITE ONE-WAY LEFT-TURN ARROW signal displays~~faces~~

[Moved paragraph 13 here]

Standard:

02 **Each lane to be reversed or closed shall have signal ~~faces~~displays with at least a DOWNWARD GREEN ARROW and a RED X symbol.**

03 **Each reversible lane that also operates as a two-way or one-way left-turn lane during certain periods shall have signal ~~faces~~displays that also include the applicable WHITE TWO-WAY LEFT-TURN ARROW or WHITE ONE WAY LEFT-TURN ARROW symbol.**

04 **Each non-reversible lane immediately adjacent to a reversible lane shall have signal indications that display a DOWNWARD GREEN ARROW to traffic traveling in the permitted direction and a RED X to traffic traveling in the opposite direction.**

05 **If in separate signal sections, the relative positions, from left to right, of the signal indications shall be RED X, YELLOW X, DOWNWARD GREEN ARROW, WHITE TWO-WAY LEFT-TURN ARROW, WHITE ONE WAY LEFT-TURN ARROW.**

~~Standard~~ *Guidance*:

06 *The color of lane-use control signal indications~~shall~~ should be clearly visible for ½ mile ~~2,300 feet~~ at all times under normal atmospheric conditions, unless otherwise physically obstructed.*

07 *Lane-use control signal ~~faces~~displays ~~shall~~ should be located approximately over the center of the lane controlled.*

08 *If the area to be controlled is more than ½ mile~~2,300 feet~~ in length, or if the vertical or horizontal alignment is curved, intermediate lane-use control signal ~~faces~~displays ~~shall~~ should be located over each controlled lane at frequent intervals. This location ~~shall~~ should be such that road users will at all times be able to see at least one signal indication and preferably two along the roadway, and will have a definite indication of the lanes specifically reserved for their use.*

09 *All lane-use control signal ~~faces~~displays~~shall~~ should be located in a straight line across the roadway approximately at right angles to the roadway alignment.*

10 *On roadways having intersections controlled by traffic control signals, the lane-use control signal ~~face~~display ~~shall~~ should be located sufficiently far in advance of or beyond such traffic control signals to prevent them from being misconstrued as traffic control signals.*

Standard:

11 **Except as provided in Paragraph 12, the bottom of the signal housing of any lane-use control signal face shall be a minimum of 15 feet and a maximum of 19 feet above the pavement grade. A lane-use control signal displayed on a DMS shall meet overhead sign clearance provisions in Section 2A.18.**

Option:

12 The bottom of a lane-use control signal housing may be lower than 15 feet above the pavement if it is mounted on a canopy or other structure over the pavement, but not lower than the vertical clearance of the structure.

~~13 Except for lane-use control signals at toll plazas (see Section 4K.02 4R.02), in areas with minimal visual clutter and with speeds of less than 40 mph, lane-use control signal facesdisplays with nominal height and width of 12 inches may be used for the DOWNWARD GREEN ARROW, YELLOW X, and RED X signal facesdisplays, and lane-use control signal facesdisplays with nominal height and width of 18 inches may be used for the WHITE TWO-~~

~~WAY LEFT-TURN ARROW and WHITE ONE-WAY LEFT-TURN ARROW signal facesdisplays.~~ [Moved to paragraph 01b]

14 Other sizes of lane-use control signal displays~~faces~~ larger than 18 inches with message recognition distances appropriate to signal spacing may be used for the DOWNWARD GREEN ARROW, YELLOW X, and RED X signal displays~~faces.~~

15 Non-reversible lanes not immediately adjacent to a reversible lane on any street so controlled may also be provided with signal indications that display a DOWNWARD GREEN ARROW to traffic traveling in the permitted direction and a RED X to traffic traveling in the opposite direction.

16 The signal indications provided for each lane may be in separate signal sections or may be superimposed in the same signal section.

16a Lane-use control signal indications may be displayed as an integral part of a DMS (see Section 2L.03 and 2L.04) using full matrix display technology, provided that such displays of lane-use control signal indications comply with the provisions of Chapter 4T and utilize LED pixels as the light source with brightness, intensity, and legibility at least equal to that of LED traffic signal displays.

16b DMS displays of lane-use control signal indications may be in conjunction with displays of other non-conflicting messages, such as speed limits, advisory speeds, and other regulatory, warning, or guide messages.

Support:

16c When displayed on a DMS, lane-use control signal indications do not have visors or housings in the traditional sense, and thus also are not composed of signal sections or signal faces. However, it is intended that such indications are displayed in a manner that mimic that of signal sections and/or faces.

PART 6 - TEMPORARY TRAFFIC CONTROL

CHAPTER 6F. TEMPORARY TRAFFIC CONTROL ZONE DEVICES

Section 6F.60 Portable Changeable Message Signs

Support:

01 Portable changeable message signs (PCMS) are TTC devices installed for temporary use with the flexibility to display a variety of messages. In most cases, portable changeable message signs follow the same provisions for design and application as those given for permanently mounted changeable message signs in Chapter 2L. The information in this Section describes situations where the provisions for portable changeable message signs differ from those given in Chapter 2L.

02 ~~Portable changeable message signs are used most frequently on high-density urban freeways, but have applications on all types of highways where highway alignment, road user routing problems, or other pertinent conditions require advance warning and information.~~

03 Portable changeable message signs have a wide variety of applications in TTC zones including: roadway, lane, or ramp closures; incident management; width restriction information; speed control or reductions; advisories on work scheduling; road user management and diversion; warning of adverse conditions or special events; and other operational control.

04 The primary purpose of portable changeable message signs in TTC zones is to advise the road user of unexpected situations. Portable changeable message signs are particularly useful as they are capable of:

A. Conveying complex messages,
B. Displaying real time information about conditions ahead, and
C. Providing information to assist road users in making decisions prior to the point where actions must be taken.

05 Some typical applications include the following:

A. Where the speed of vehicular traffic is expected to drop substantially;
B. Where significant queuing and delays are expected;
C. Where adverse environmental conditions are present;
D. Where there are changes in alignment or surface conditions;
E. Where advance notice of ramp, lane, or roadway closures is needed;
F. Where crash or incident management is needed; and/or
G. Where changes in the road user pattern occur.

Guidance:

06 *The components of a portable changeable message sign should include: a message sign, control systems, a power source, and mounting and transporting equipment. The front face of the sign should be covered with a protective material.*

Standard:

07 **Portable changeable message signs shall comply with the applicable design and application principles established in Chapter 2A, Chapter 2L, and other provisions noted for specific signs. Portable changeable message signs shall display only traffic operational, regulatory, warning, and guidance information, and shall not be used for advertising messages.**

Support:

08 Section 2L.02 contains information regarding overly simplistic or vague messages that is also applicable to portable changeable message signs.

Standard:

09 **The colors used for legends on portable changeable message signs shall comply with those shown in Table 2A-5.**

Support:

10 Section 2L.04 contains information regarding the luminance, luminance contrast, and contrast orientation that is also applicable to portable changeable message signs.

Guidance:

11 *Portable changeable message signs should be visible from 1/2 mile under both day and night conditions.*

Support:

12 Section 2B.13 contains information regarding the design of portable changeable message signs that are used to display speed limits that change based on operational conditions, or are used to display the speed at which approaching drivers are traveling.

Option:

12a A portable changeable message sign combined with radar detection may be used to convey the speeds of approaching drivers as a message (see Section 2C.08a).

12b Portable hybrid signs in TTC applications may use appropriate-sized line matrix inserts on all roadway types.

Guidance:

13 *A portable changeable message sign should be limited to three lines of eight characters per line or should consist of a full matrix display*.

14 *Except as provided in Paragraph 15, the letter height used for portable changeable message sign messages should be a minimum of 18 inches.comply with provisions in Section 2L.04.*

Option:

15 For portable changeable message signs mounted on service patrol trucks or other incident response vehicles, a letter height as short as 10 inches may be used. Shorter letter sizes may also be used on a portable changeable message sign used on low speed facilities provided that the message is legible from at least 650 feet.

16 The portable changeable message sign may vary in size.

Guidance:

17 *Messages on a portable changeable message sign should consist of no more than two phases, and a phase should consist of no more than three lines of text. Each phase should be capable of being understood by itself, regardless of the order in which it is read. Messages should be centered within each line of legend. If more than one portable changeable message sign is simultaneously legible to road users, then only one of the signs should display a sequential message at any given time.*

Support:

18 Road users have difficulties in reading messages displayed in more than two phases on a typical three-line portable changeable message sign.

Standard:

19 **Techniques of message display such as animation, rapid flashing, dissolving, exploding, scrolling, travelling horizontally or vertically across the face of the sign, or other dynamic elements shall not be used.**

Guidance:

20 *When a message is divided into two phases, the display time for each phase should be at least 2 seconds, and the sum of the display times for both of the phases should be a maximum of 8 seconds.*

21 *All messages should be designed with consideration given to the principles provided in this Section and also taking into account the following:*

A. The message should be as brief as possible and should contain three thoughts (with each thought preferably shown on its own line) that convey:

1. The problem or situation that the road user will encounter ahead,

2. The location of or distance to the problem or situation, and

3. The recommended driver action.

B. If more than two phases are needed to display a message, additional portable changeable message signs should be used. When multiple portable changeable message signs are needed, they should be placed on the same side of the roadway and they should be separated from each other by a distance of at least 1,000 feet on freeways and expressways, and by a distance of at least 500 feet on other types of highways.

Standard:

~~22 When the word messages shown in Tables 1A-1 or 1A-2 need to be abbreviated on a portable changeable message sign, the provisions described in Section 1A.15 shall be followed.~~

~~23 In order to maintain legibility, portable changeable message signs shall automatically adjust their brightness under varying light conditions.~~

24 **The control system shall include a display screen upon which messages can be reviewed before being displayed on the message sign. The control system shall be capable of maintaining memory when power is unavailable.**

~~25 Portable changeable message signs shall be equipped with a power source and a battery back-up to provide continuous operation when failure of the primary power source occurs.~~

26 **The mounting of portable changeable message signs on a trailer, a large truck, or a service patrol truck shall be such that the bottom of the message sign shall be a minimum of 7 feet above the roadway in urban areas and 5 feet above the roadway in rural areas when it is in the operating mode.**

Guidance:

27 *Portable changeable message signs should be used as a supplement to and not as a substitute for conventional signs and pavement markings.*

28 *When portable changeable message signs are used for route diversion, they should be placed far enough in advance of the diversion to allow road users ample opportunity to perform necessary lane changes, to adjust their speed, or to exit the affected highway.*

29 *Portable changeable message signs should be sited and aligned to provide maximum legibility and to allow time for road users to respond appropriately to the portable changeable Message sign message.*

30 *Portable changeable message signs should be placed off the shoulder of the roadway and behind a traffic barrier, if practical. Where a traffic barrier is not available to shield the portable changeable message sign, it should be placed off the shoulder and outside of the clear zone. If a portable changeable message sign has to be placed on the shoulder of the roadway or within the clear zone, it should be delineated with retroreflective TTC devices.*

31 *When portable changeable message signs are used in TTC zones, they should display only TTC messages*

32 *When portable changeable message signs are not being used to display TTC messages, they should be relocated such that they are outside of the clear zone or shielded behind a traffic barrier and turned away from traffic. If relocation or shielding is not practical, they should be delineated with retroreflective TTC devices.*

~~33 Portable changeable message sign trailers should be delineated on a permanent basis by affixing retroreflective material, known as conspicuity material, in a continuous line on the face of the trailer as seen by oncoming road users.~~

Standard:

33a Portable changeable message sign trailers shall be delineated on a permanent basis by affixing a continuous line of retroreflective materials to all sides of the trailer.

Section 6F.61 Arrow Boards

Standard:

01 **An arrow board shall be a sign with a matrix of elements capable of either flashing or sequential displays. This sign shall provide additional warning and directional information to assist in merging and controlling road users through or around a TTC zone.**

Guidance:

02 *An arrow board in the arrow or chevron mode should be used to advise approaching traffic of a lane closure along major multi-lane roadways in situations involving heavy traffic volumes, high speeds, and/or limited sight distances, or at other locations and under other conditions where road users are less likely to expect such lane closures.*

03 *If used, an arrow board should be used in combination with appropriate signs, channelizing devices, or other TTC devices.*

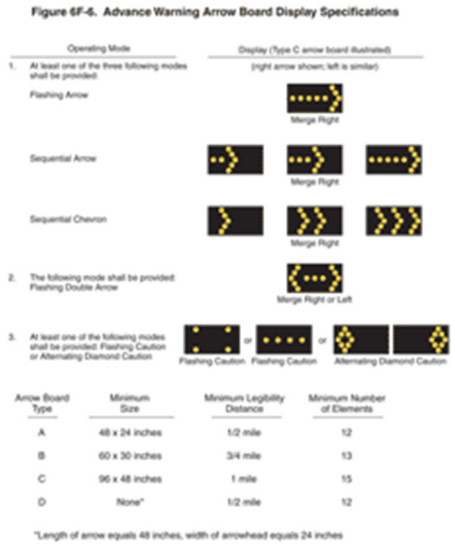
04 *An arrow board should be placed on the shoulder of the roadway or, if practical, farther from the traveled lane.* ~~*It should be delineated with retroreflective TTC devices.*~~ *When an arrow board is not being used, it should be removed; if not removed, it should be shielded*~~*; or if the previous two options are not feasible, it should be delineated with retroreflective TTC devices*~~*.*

Standard:

04a **Arrow boards shall be delineated on a permanent basis by affixing a continuous line of retroreflective material to all sides of the trailer.**

05 **Arrow boards shall meet the minimum size, legibility distance, number of elements, and other specifications shown in Figure 6F-6.**

Figure 6F-6 Advance Warning Arrow Board Display Specifications



Support:

06 Type A arrow boards are appropriate for use on low-speed urban streets. Type B arrow boards are appropriate for intermediate-speed facilities and for maintenance or mobile operations on high-speed roadways. Type C arrow boards are intended to be used on high-speed, high-volume motor vehicle traffic control projects. Type D arrow boards are intended for use on vehicles authorized by the State or local agency.

Standard:

07 **Type A, B, and C arrow boards shall have solid rectangular appearances. A Type D arrow board shall conform to the shape of the arrow.**

08 **All arrow boards shall be finished in non-reflective black. The arrow board shall be mounted on a vehicle, a trailer, or other suitable support.**

Guidance:

09 *The minimum mounting height, measured vertically from the bottom of the board to the roadway below it or to the elevation of the near edge of the roadway, of an arrow board should be 7 feet , except on vehicle-mounted arrow boards, which should be as high as practical.*

10 *A vehicle-mounted arrow board should be provided with remote controls.*

Standard:

11 **Arrow board elements shall be capable of at least a 50 percent dimming from full brilliance. The dimmed mode shall be used for nighttime operation of arrow boards.**

Guidance:

12 *Full brilliance should be used for daytime operation of arrow boards.*

Standard:

13 **The arrow board shall have suitable elements capable of the various operating modes. The color presented by the elements shall be yellow.**

Guidance:

14 *If an arrow board consisting of a bulb matrix is used, the elements should be recess-mounted or equipped with an upper hood of not less than 180 degrees.*

Standard:

15 **The minimum element on-time shall be 50 percent for the flashing mode, with equal intervals of 25 percent for each sequential phase. The flashing rate shall be not less than 25 or more than 40 flashes per minute.**

16 **An arrow board shall have the following three mode selections:**

A. A Flashing Arrow, Sequential Arrow, or Sequential Chevron mode;

B. A flashing Double Arrow mode; and

C. A flashing Caution or Alternating Diamond mode.

17 **An arrow board in the arrow or chevron mode shall be used only for stationary or moving lane closures on multi-lane roadways.**

18 **For shoulder work, blocking the shoulder, for roadside work near the shoulder, or for temporarily closing one lane on a two-lane, two-way roadway, an arrow board shall be used only in the caution mode.**

Guidance:

19 *For a stationary lane closure, the arrow board should be located on the shoulder at the beginning of the merging taper.*

20 *Where the shoulder is narrow, the arrow board should be located in the closed lane.*

Standard:

21 **When arrow boards are used to close multiple lanes, a separate arrow board shall be used for each closed lane.**

Guidance:

22 *When arrow boards are used to close multiple lanes, if the first arrow board is placed on the shoulder, the second arrow board should be placed in the first closed lane at the upstream end of the second merging taper (see Figure 6H-37). When the first arrow board is placed in the first closed lane, the second arrow board should be placed in the second closed lane at the downstream end of the second merging taper.*

23 *For mobile operations where a lane is closed, the arrow board should be located to provide adequate separation from the work operation to allow for appropriate reaction by approaching drivers.*

Standard:

24 **A vehicle displaying an arrow board shall be equipped with high-intensity rotating, flashing, oscillating, or strobe lights.**

25 **Arrow boards shall only be used to indicate a lane closure. Arrow boards shall not be used to indicate a lane shift.**

Option:

26 A portable changeable message sign may be used to simulate an arrow board display.

PART 7 – TRAFFIC CONTROL FOR SCHOOL AREAS

CHAPTER 7B. SIGNS

Section 7B.10 Higher Fines Zone Signs (R2-10, R2-11) and Plaques

[Note: only text to address edit of beacon terminology shown]

Option:

02 Where appropriate, one of the following plaques may be mounted below the sign that identifies the beginning point of the higher fines zone:

A. An S4-1P plaque (see Figure 7B-1) specifying the times that the higher fines are in effect,
B. WHEN CHILDREN ARE PRESENT (S4-2P) plaque (see Figure 7B-1), or
C. WHEN FLASHING (S4-4P) plaque (see Figure 7B-1) if used in conjunction with a warning~~yellow flashing~~ beacon.

Section 7B.12 School Crossing Assembly

[Note: only text to address edit of beacon terminology shown]

Option:

04a The In-Street Pedestrian Crossing sign or In-Street Schoolchildren Crossing sign may be used at intersections or midblock crossings with flashing beacons. [13A-RW-07, 1/27/13]

Section 7B.15 School Speed Limit Assembly (S4-1P, S4-2P, S4-3P, S4-4P, S4-6P, S5-1) and END SCHOOL SPEED LIMIT Sign (S5-3)

Standard:

01 **A School Speed Limit assembly (see Figure 7B-1) or a School Speed Limit (S5-1) sign (see Figure 7B-1) shall be used to indicate the speed limit where a reduced school speed limit zone has been established based upon an engineering study or where a reduced school speed limit is specified for such areas by statute. The School Speed Limit assembly or School Speed Limit sign shall be placed at or as near as practical to the point where the reduced school speed limit zone begins (see Figures 7B-3 and 7B-5).**

02 **If a reduced school speed limit zone has been established, a School (S1-1) sign shall be installed in advance (see Table 2C-4 for advance placement guidelines) of the first School Speed Limit sign assembly or S5-1 sign that is encountered in each direction as traffic approaches the reduced school speed limit zone (see Figures 7B-3 and 7B-5).**

~~03 Where increased fines are imposed for traffic violations within a reduced school speed limit zone, a FINES HIGHER (R2-6P), FINES DOUBLE (R2-6aP), or $XX FINE (R2-6bP) plaque (see Figure 2B-3) shall be installed as a supplement to the reduced school speed limit sign to notify road users.~~ (approved by Council 1-20-11)

04 **Except as provided in Paragraph 5, the downstream end of an authorized and posted reduced school speed limit zone shall be identified with an END SCHOOL SPEED LIMIT (S5-3) sign (see Figures 7B-1 and 7B-5).**

Option:

05 If a reduced school speed limit zone ends at the same point as a higher fines zone, an END SCHOOL ZONE (S5-2) sign may be used instead of a combination of an END HIGHER FINES ZONE (R2-11) sign and an END SCHOOL SPEED LIMIT (S5-3) sign.

06 A standard Speed Limit sign showing the speed limit for the section of highway that is downstream from the authorized and posted reduced school speed limit zone may be mounted on

the same post above the END SCHOOL SPEED LIMIT (S5-3) sign or the END SCHOOL ZONE (S5-2) sign.

Guidance:

07 *The beginning point of a reduced school speed limit zone should be at least 200 feet in advance of the school grounds or a school crossing ~~or other school related activities~~; however, this 200-foot distance should be increased if the reduced school speed limit is 30 mph or higher but not greater than 500 feet.* [approved by Council 1-8-2010]

07a *Where increased fines are imposed for traffic violations within a reduced school speed limit zone, a FINES HIGHER (R2-6P, FINES DOUBLE (R2-6aP), or $XX FINE (R2-6bP) plaque (See Figure 2B.3 should be installed as a supplement to the reduced school speed limit sign to notify road users. If the FINES HIGHER, FINES DOUBLE, or $XX FINES plaque is used as shown in Section 7B.10, then the duplicate plaque shown in this section is not necessary. (approved by Council 1/20/2011)*

Standard:

08 **The School Speed Limit assembly shall be either ~~a~~ static~~fixed message~~ signs ~~assembly~~ or a blank-out sign (see Chapter 2L).~~changeable message~~ ~~part-time regulatory LED sign.~~** [14A-RW-07, June 28, 2014]

09 **The ~~fixed message~~static sign School Speed Limit assembly shall consist of a top plaque (S4-3P) with the legend SCHOOL, a Speed Limit (R2-1) sign, and a bottom plaque (S4-1P, S4-2P, S4-4P, or S4-6P) indicating the specific periods of the day and/or days of the week that the special school speed limit is in effect (see Figure 7B-1).**

Option:

10 A hybrid sign or DMS may be used for the SPEED LIMIT (R2-1) sign in a School Speed Limit Assembly. Warning beacons may be used for situations where greater emphasis of the special school speed limit is needed.~~The part-time regulatory LED Changeable message signs (see Chapter 2L and Section 6F.60) may be used to inform drivers of the school speed limit. If~~ The sign ~~is may be internally illuminated or an LED speed legend with , it may have a white legend on a black opaque background. The part-time regulatory speed LED Changeable message signs with flashing beacons may be used for situations to enhance where greater emphasis of the special school speed limit. is needed.~~ [14A-RW-07, June 28, 2014]

Guidance:

11 ~~*Even though it might not always be practical because of special features to make part-time regulatory LED changeable message signs conform in all respects to the standards in this Manual for fixed-message signs, during the periods that the school speed limit is in effect, their basic shape, message, legend layout, and colors should comply with the standards for fixed-message signs.*~~

Option:

12 A confirmation light, flasher or device to indicate that the speed limit message is in operation ~~should be considered for inclusion~~ may be used on the back of a hybrid sign or DMS~~dynamic message sign~~ used to display the SPEED LIMIT (R2-1) sign.~~the part-time regulatory LED changeable message sign.~~ [14A-RW-07, June 28, 2014]

~~**Standard:**~~

~~13 **Fluorescent yellow-green pixels or yellow LEDs shall be used when the "SCHOOL" message is displayed on a part-time regulatory changeable message sign for a school speed limit.**~~

~~Option:~~

14 ~~The part-time regulatory LED~~ ~~Changeable message~~ ~~signs may use b~~Blank-out signs ~~messages~~, hybrid signs or DMS may be used ~~or other methods in order~~ to display the school speed limit only during the periods it applies.

15 A driver feedback (WX-XX) sign ~~Changeable message signs that display the speed of approaching drivers (see Section 2C.08 2B.13)~~ may be used to supplement ~~in~~ a school speed limit zone. [14A-RW-07, June 28, 2014] The driver feedback (WX-XX) sign may use a fluorescent yellow-green background for this application.

16 A Speed Limit Sign Beacon (see Section 4L.04) also may be used~~,~~ with a WHEN FLASHING legend to identify the periods that the school speed limit is in effect.

PART 8 – TRAFFIC CONTROL FOR RAILROAD AND LIGHT RAIL TRANSIT CROSSINGS

Section 8B.19 Light Rail Transit Approaching ~~Activated~~ ~~Blank-Out~~ Warning Sign (W10-7)

Support:

01 The Light Rail Transit Approaching ~~Activated Blank-Out~~ (W10-7) warning sign (see Figure 8B-4) supplements the traffic control devices to warn road users crossing the tracks of approaching LRT equipment.

Option:

02 A Light Rail Transit Approaching ~~Activated~~ ~~Blank-Out~~ warning sign may be used at signalized intersections near highway-LRT grade crossings or at crossings controlled by STOP signs or automatic gates.

Standard:

02a **The Light Rail Transit Approaching (W10-7) warning sign shall be a blank-out sign (see Chapter 2L) and shall be activated by the approaching LRT.**

[This section was modified and replaced as Section 8C.11, 13B-RR-01, 06/28/2014]

Section ~~8B.08~~8C.11 Movements Prohibited ~~Turn Restrictions~~ During Preemption

Guidance:

01 *At a signalized intersection where the distance to a grade crossing ~~that~~ is ~~located~~ within 100 feet or less and ~~200 feet of a highway-rail grade crossing, measured from the edge of the track to the edge of the roadway, where~~ the intersection traffic control signals are preempted by the approach of a train, all ~~existing turning~~ movements from the signalized intersection approaching the ~~toward the highway-rail~~ grade crossing should be prohibited during the signal preemption sequences.*

Option:

01a *All movements toward the track may be prohibited at a signalized intersection that has a clear storage of more than 100 feet.*

02 A ~~blank-out or changeable message~~ ~~turn prohibition LED~~ [14A-RW-07, 06/28/2014] changeable message sign and/or appropriate highway traffic signal indication or other similar type sign may be used to prohibit turning movements toward the ~~highway-rail~~ grade crossing during preemption. The NO LEFT TURN (R3-1)~~a~~ and NO RIGHT TURN (R3-2)~~a~~ signs (see Sections 2B.18 and 2B.23a) ~~shown in Figure 8C-1~~8B-1 may be used for this purpose as part-time Movement Prohibition signs.

~~**Figure 8C-1. Example of Blank-out Sign**~~

[Move graphic to paragraph 02B]

Standard:

02a **Part-time Movement ~~Turn p~~Prohibition signs that are associated with rail preemption shall be blank-out signs or DMS~~changeable message signs~~ (see Chapter 2L) and be visible or activated only when its message is applicable.** ~~the highway-rail grade crossing restriction is in effect.~~ [moved from paragraph 07, revised as indicated]

Option:

02b A supplemental blank-out legend which displays the word "TRAIN" may be included as a part of the blank-out or changeable message sign (see Figure 8C-1). A supplemental blank-out legend which displays the symbol for a train or a light-rail transit vehicle may be included as a part of the blank-out or changeable message sign. See Section 2H-1 for train and LRT symbols.

Figure 8C-1 Examples of Part-time Movement Prohibition Changeable Message Signs

R3-2 Blank-out R3-2 DMS R3-2 Blank-out and DMS with supplemental TRAIN

[moved from paragraph 02, improved graphics from Council Approval and added R3-2]

Support:

02c Including the word "TRAIN" or a symbol for a train or light-rail transit vehicle (W10-7) as part of the part-time Movement Prohibition ~~blank-out or changeable message~~ sign advises road users that the prohibition being displayed by the sign is in effect due to the presence of a train approaching or across a nearby ~~rail~~ grade crossing.

02d Rail operations can include the use of activated changeable message~~blank-out~~ signs for turn prohibitions at grade crossings other than intersections controlled by a traffic control signal. The signs are typically used where a semi-exclusive or mixed-use alignment is within or parallel to the roadway where road users might turn across the tracks.

~~02 LRT operations can include the use of activated blank-out sign technology for turn prohibition signs. The signs are typically used on roads paralleling a semi-exclusive or mixed-use LRT alignment where road users might turn across the LRT tracks. A blank-out sign displays its message only when activated. When not activated, the sign face is blank.~~

Guidance:

04 *An LRT-activated Part-time Movement ~~blank-out turnp~~Prohibition ~~(R3-1a or R3-2a)~~ sign should be used where:* ~~*an intersection adjacent to a highway-LRT crossing is controlled by STOP signs, or is controlled by traffic control signals with permissive turn movements for road users crossing the tracks*~~.

1. *There is no active warning system for the LRT grade crossing, and*
2. *Vehicles travelling along a roadway would typically be permitted to turn left or right across tracks located within 100 feet of an adjacent roadway, and*
3. *The turning drivers are not controlled by a traffic signal.*

Option:

~~05 An LRT-activated blank-out turn prohibition (R3-1a or R3-2a) sign may be used for turning movements that cross the tracks.~~

~~06 As an alternative to LRT-activated blank-out turn prohibition signs at intersections with traffic control signals, exclusive traffic control signal phases such that all movements that cross the tracks have a steady red indication may be used in combination with No Turn on Red (R10-11, R10-11a, or R10-11b) signs (see Section 2B.53).~~

~~**Standard:**~~

~~07 **Turn prohibition signs that are associated with preemption shall be visible or activated only when the grade crossing restriction is in effect.**~~ [moved to paragraph 02A]