



# National Committee on Uniform Traffic Control Devices

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

Federal Register Item Number: 453 to 459

NPA MUTCD Section Numbers: Chapter 5B

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

- [NCUTCD recommendation for text to be added in final rule.](#)
- ~~NCUTCD recommendation for text to be deleted in final rule.~~
- [NCUTCD recommendation for text to be moved/relocated in final rule.](#)
- NPA text that was not previously approved by NCUTCD but is now approved.
- Explanatory note: [\[Note that explains purpose of recommended change.\]](#)

The following pages present NCUTCD recommendations for changes to the MUTCD NPA proposed text for Chapter 5B. Below is a summary of the NCUTCD position for each section of this chapter. A more detailed summary is provided at the beginning of each section.

NPA #453, Chapter 5B: NCUTCD agrees with NPA (no changes recommended).

NPA #454, Section 5B.01: Changes recommended based on Council action in virtual meetings in spring 2021.

NPA #455, Section 5B.02: Changes recommended based on Council action in virtual meetings in spring 2021.

NPA #456, Section 5B.03: Changes recommended based on Council action in virtual meetings in spring 2021.

NPA #457, Section 5B.04: Changes recommended based on Council action in virtual meetings in spring 2021.

NPA #458, Section 5B.05: Changes recommended based on Council action in virtual meetings in spring 2021.

NPA #459, Section 5B.06: Changes recommended based on Council action in virtual meetings in spring 2021.

### CHAPTER 5B. PROVISIONS FOR TRAFFIC CONTROL DEVICES

**Part 5 Comments:** This is a new Part added to the MUTCD in the NPA. NCUTCD recommends all of Part 5 be revised from Standard, Guidance, or Option to Support so agencies can obtain information they can use to prepare their network for Automated Vehicles (AVs) and continue to be in compliance with the Manual without the burden of having to conform to new provisions in Part 5 different from those in other parts of the MUTCD.

41 **New Section 5B.01 Comments:** NCUTCD recommends adding a new Support section to Chapter  
42 5B to reinforce the intent of this Chapter.

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44 **5B.01 General**

45 **Support:**

46 The purpose of this Chapter is to provide agencies with specific traffic control device provisions that support  
47 automated vehicle deployment. The provisions described in this Chapter are based on the current body of  
48 knowledge recognizing that this is an evolving area.  
49 Agencies can help to prepare a roadway to support the safe deployment of automated vehicle technology by  
50 focusing maintenance, replacement and new construction on the uniform application of traffic control devices  
51 as described below. [New section to reinforce the intent of this Chapter]

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55 **Section 5B.01 Comments:** NCUTCD recommends revising 5B.01 (now 5B.02) as follows:

- 56 • Revise Guidance to Support (see general Part 5 comment)
- 57 • Revise references to DAS to AVs
- 58 • Add section references as appropriate
- 59 • Revise content for simplicity and clarity and delete content that is unnecessary or not specific to  
60 AVs
- 61 • Revise the content on LED refresh rate to simplify wording and add reference to FCC compliance  
62 (47 CFR)

63 **Section 5B.012 Signs**

64 **Support:**

65 ~~DAS~~ AVs uses machine vision technology to locate, read, and comprehend traffic signs and  
66 appropriately make vehicle operational decisions. Location, condition, uniformity, design characteristics, and  
67 consistent application (see Sections 2A.04 to 2A.21) all affect the ability of machine vision to perform these  
68 functions.

69 ~~Guidance:~~ [changed to Support]

70 ~~— Sign location and application of should be clearly associated with the displayed message to the specific~~  
71 ~~lane or road to which it applies, such as in In~~ the case of parallel roads or lanes with different speed limits or  
72 restrictions, AV operation can be enhanced by sign applications that ~~of should be clearly associated with the~~  
73 displayed message to the specific lane or road to which it applies. [relocated text and edited for clarity]

74 ~~— The practice of sign and information spreading (see Section 2A.19) should be used to limit the amount of~~  
75 ~~information displayed in one location or on one sign to minimize sign clutter.~~

76 ~~— Signs with designs that are otherwise not provided for in this Manual or the Standard Highway Signs~~  
77 ~~publication should use standardized sign design practices and features as provided for in this Manual for the~~  
78 ~~type of sign, the location, and character of the roadway on which it is used.~~ [delete as unnecessary and not  
79 specific to AVs]

80 AV detection ~~The illuminated portion of fixed-location CMS electronic display signs using LEDs should~~  
81 ~~have a standard refresh/flicker rate.~~ The can be enhanced by application of an LED refresh rate of the LEDs  
82 ~~should be~~ greater than 200 Hz to reduce refresh/flicker rate impacts (for refresh rates above 240 Hz consider  
83 FCC compliance under 47CFR part 2, subpart J; part 15, subpart B; and part 90, subpart J). ~~be easier for the~~  
84 ~~camera to detect.~~ [edited for clarity and expanded to provide additional information]

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89 **Section 5B.02 Comments:** NCUTCD recommends revising 5B.02 (now 5B.03) as follows:

- 90 • Revise Guidance to Support (see general Part 5 comment)
- 91 • Revise references to DAS to AVs
- 92 • Revise content for simplicity and clarity and delete content that is unnecessary or not specific to
- 93 AVs
- 94 • Delete references to line widths, as this is addressed in Part 3
- 95 • Relocate material on work zones to 5B.04 (now 5B.05)
- 96 • Add a reference to broken lines with 15-foot line segments and 25-foot gaps on Interstates,
- 97 freeways, and expressways in accordance with NCUTCD recommendation 19B-MKG-02
- 98 • Delete references to decorative items in crosswalks, since NCUTCD is unaware of specific
- 99 information relative to negative impacts of decorative elements in crosswalks on roadways with
- 100 low speeds

101  
102 **Section 5B.023 Markings**

103 Support:

104 DAS AVs uses machine vision camera technology to locate, read and comprehend pavement markings.

105 Location, condition, uniformity, design characteristics, and consistent application all have some effect on the

106 ability of machine vision to perform this function. Certain pavement marking applications and practices have

107 been shown through research to better support AV operations, while also benefiting, or at least not detracting

108 from, the performance of the human operator. Such practices include the following:

109 ~~A.— Normal width longitudinal lines on freeways, expressways, and ramps of at least 6 inches wide (see~~

110 ~~Section 3A.04).~~

111 ~~B.— Edge lines of at least 6 inches in width on roadways with posted speeds greater than 40 mph (see~~

112 ~~Section 3B.09). [delete - line width is addressed in Part 3]~~

113 Guidance: [Change to Support]

114 ~~The following should be considered to better accommodate machine vision used to support the~~

115 ~~automation of vehicles:~~

116 ~~A. Normal width longitudinal lines of at least 6 inches wide on conventional roadways. [delete - line~~

117 ~~width is addressed in Part 3]~~

118 ~~BA. Edge lines of at least 6 inches in width on conventional roadways with posted speeds of 40 mph or~~

119 ~~greater less. [retain, as this statement is specific to supporting driving automation system~~

120 ~~technologies, since many lane departure warning and lane-keeping technologies engage when vehicle~~

121 ~~speeds reach 40 mph]~~

122 ~~C.— Dotted edge line extensions along all entrance and exit ramps, all auxiliary lanes, and all tapers~~

123 ~~where a deceleration or auxiliary lane is added (see Section 3B.11). [delete - addressed in Part 3]~~

124 ~~DB. Chevron markings (see Section 3B.25) in the neutral areas of exit gores to distinguish them from~~

125 ~~travel lanes.~~

126 ~~E.— Continuous markings at the beginning of work zones and in all lane transitions [relocate to 5B.04~~

127 ~~(now 5B.05)]~~

128 ~~F.— Raised pavement markers only as a supplement to, rather than as a substitute for, markings (see~~

129 ~~Sections 3B.16 and 3B.17). [delete - addressed in Part 3]~~

130 ~~GC. Uniform contrast markings on light-colored pavements to create greater contrast.~~

131 ~~H.— Broken lines (see Section 3B.06) of at least 10 ft in length with a maximum gap of 30 ft. [delete -~~

132 ~~addressed in Part 3]~~

133 ~~D. Broken lines with 15-foot line segments and 25-foot gaps on Interstates, freeways, and expressways.~~

134 ~~[add per 19B-MKG-02]~~

135 ~~I.— Avoidance of decorative elements in crosswalks. [delete - unsupported]~~

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**Section 5B.03 Comments:** NCUTCD recommends revising 5B.03 (now 5B.04) as follows:

- Revise Guidance to Support (see general Part 5 comment)
- Revise content for simplicity and clarity and delete content that is unnecessary or not specific to AVs
- Revise the content on LED refresh rate to specify a refresh rate greater than 200 Hz, since refresh rates below 200 Hz may cause traffic signal indications to appear dark to machine vision, even if they appear normal to human vision
- Add a reference to signal backplates with retroreflective borders, since machine vision may not recognize the presence of the traffic signal, especially at night - also, retroreflective backplates corroborate the presence of the traffic signal and the need to treat a dark signal as a stop condition
- Add content on the use of flashing yellow arrows for permissive left turns, since a circular green indication over an exclusive turn lane could be mistaken as a protected turn treatment by machine vision

**Section 5B.034 Highway Traffic Signals**

*Guidance Support:* [change to Support]

The following considerations ~~should can~~ be used to better accommodate machine vision used to support the automation of vehicles and benefit the performance of the human vehicle operator:

- A. Consistency of Ttraffic signal design ~~should be consistent~~ along corridors with respect to the placement of signal faces overhead on span-wire and mast arms versus post-mounting on the side of the roadway.
- B. Consistency along a corridor in Tthe number of signal faces for approach lanes and the selection of signal indications and signal clusters ~~should be consistent along a corridor~~ to promote uniform displays for identical or similar situations.
- C. ~~The~~ Refresh rates greater than 200 Hz (see Section 5B.02) of ~~the~~ LED traffic signals ~~should be consistent throughout the jurisdiction and be greater than 200 Hz to allow for~~ greater consistency in machine vision detection.  
[specify refresh rates above 200 Hz]
- D. Providing signal faces with backplates having retroreflective borders (see Section 4D.05) to make signals more prominent and detectable by machine vision systems.  
[add material on backplates]
- E. Using signal display designs that utilize a FLASHING YELLOW ARROW for permissive left-turns. Signal faces that display a CIRCULAR GREEN indication and which are located over or directly in line with a left-turn lane can be difficult for machine vision systems to interpret regarding left-turn right of way.  
[add material on permissive left turns]

*Support:*

Achieving uniformity along a corridor is desirable for machine vision technology, but can be challenging. Multiple options are available for traffic signal displays to allow design variations based on specific intersection variables such as available overhead clearance, utility conflicts, signal support design constraints and other factors. Where possible, connected and automated vehicles (CAV) needs with respect to traffic signals are better addressed through vehicle to ~~infrastructure everything~~ (V2X~~I~~) for the reasons stated above and for reliability and accuracy of critical communications under all environmental conditions.

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187 **Section 5B.04 Comments:** NCUTCD recommends revising 5B.04 (now 5B.05) as follows:  
188 • Revise Guidance to Support (see general Part 5 comment)  
189 • Extensively revise content for simplicity and clarity and delete content that is unnecessary or not  
190 specific to AVs  
191 • Add content on markings from 5B.02 (now 5B.03)

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194 **Section 5B.045 Temporary Traffic Control**

195 *Guidance:* [change to Support]

196 *Considerations should be given to better accommodate machine vision used to support the automation of*  
197 *vehicles and benefit the performance of the human vehicle operator in and through work zones.*

198 *The type of signs, spacing and mounting height should follow the requirements of Section 6B.04 Advance*  
199 *Warning Area and 6F.02 Sign Placement. The END ROAD WORK (G20-2) sign should be used to establish*  
200 *the end of the work zone.* [Moved and reworded as item A below]

201 **Standard:** Support:

202 Automated vehicles use machine vision technology to detect and safely navigate work zones. The  
203 following considerations can be used to support the automated vehicles and benefit the performance of the  
204 human vehicle operator:

205 A. Uniform application and maintenance of TTC devices (Section 6A.03).

206 B. Maintenance of **Existing** pavement markings ~~shall be maintained~~ in all long-term stationary (see  
207 Section 6G.02) temporary traffic control zones in accordance with Chapters 3A and 3B, except as  
208 otherwise provided for temporary pavement markings in Section 6F.78. **Pavement markings shall**  
209 **match the alignment of the markings in place at both ends of the TTC zone.**

210 C. Use of Pavement markings as applicable (see Part 3) ~~shall be placed~~ along the entire length of any  
211 paved detour or temporary roadway prior to the detour or roadway being opened to road users.

212 D. Removal of ~~or obliterate~~ pavement markings that are no longer applicable as soon as practical, for  
213 long-term stationary operations in the temporary traveled way. ~~shall be.~~ **Pavement marking**  
214 **obliteration shall remove the non-applicable pavement marking material, and the obliteration method**  
215 **shall minimize pavement scarring. Painting over existing pavement markings with black paint or**  
216 **spraying with asphalt shall not be accepted as a substitute for removal or obliteration.**

217 *Guidance:* [change to Support]

218 *To better accommodate machine vision used to support the automation of vehicles;*

219 E. Use of wider channelizing devices ~~should be~~ (at least 8 inches wide) with retroreflective material ~~to~~  
220 ~~machine detection in all weather conditions.~~

221 F. Use of continuous markings at the beginning of work zones and in lane transitions. ~~Markings~~  
222 ~~entering the work zone and through lane shifts should be made with highly visible and continuous~~  
223 ~~materials, (not intermittent buttons and reflectors).~~ [relocated from 5B.02 (now 5B.03) and  
224 edited]

- 234 **Section 5B.05 Comments:** NCUTCD recommends revising 5B.05 (now 5B.06) as follows:  
235 • Revise Guidance to Support (see general Part 5 comment)  
236 • Extensively revise content for simplicity and clarity and delete content that is unnecessary or not  
237 specific to AVs

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239 **Section 5B.056 Traffic Control for Railroad and Light Rail Transit Grade Crossings**

240 Support ~~Guidance:~~ [change to Support]

241 Automated vehicles use machine vision technology to detect and comprehend signs and markings at active  
242 and passive grade crossings.

243 Promote uniformity and improve the ability of machine vision technology to recognize grade crossings, by  
244 providing consistent location and condition of the appropriate signs and markings, including the removal of  
245 signs and markings associated with railroad crossings and tracks that are paved over, removed, out of service,  
246 or no longer active (see Section 8A.09 and 8B.08).

247 ~~*For passive and active grade crossings, placement of signs and markings should be consistent along a*~~  
248 ~~*corridor to promote uniformity and to improve the ability of machine vision technology to recognize highway*~~  
249 ~~*rail grade crossings.*~~

250 V2X is one example of communication technology that can be used to relay information regarding the  
251 arrival or presence of a train at a grade crossing.

252 ~~*For active grade crossings, V2I communication should be used to relay information on the arrival or*~~  
253 ~~*presence of a train at a highway rail grade crossing.*~~ [edited for clarity]

254 ~~*To better accommodate machine vision used to support the automation of vehicles, the signs and pavement*~~  
255 ~~*markings associated with railroad crossings and tracks that are no longer active should be removed.*~~ [edited  
256 for clarity]

257 Where possible, the use of V2X infrastructure can improve reliability and accuracy of critical  
258 communications at grade crossings and involves coordination with and approval by the railroad, transit agency,  
259 road authority and regulatory agency with statutory authority (if applicable).

260 ~~Support:~~

261 ~~*Where possible, CAV needs with respect to highway rail grade crossings are better addressed through*~~  
262 ~~*V2I infrastructure for reasons of reliability and accuracy of critical communications under all environmental*~~  
263 ~~*conditions.*~~ [edited for clarity]

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266 **Section 5B.06 Comments:** NCUTCD recommends revising 5B.06 (now 5B.07) as follows:

- 267 • Revise Guidance to Support (see general Part 5 comment)  
268 • Revise content on segregated bicycle facilities, as separation is inappropriate, infeasible, or  
269 impractical due to cost or maintenance impacts on a large percentage of streets or highways  
270 • Delete the sentence referencing markings for the ends of bike lanes, as no uniform markings have  
271 yet been established for this condition

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273 **Section 5B.067 Traffic Control for Bicycle Facilities**

274 ~~Guidance:~~ Support: [change to Support]

275 ~~*To better accommodate machine vision used to support the automation of vehicles, bicycle facilities*~~  
276 ~~*should be segregated from other vehicle traffic using physical barriers where practicable.*~~

277 Bicycle facilities that are separated from other vehicle traffic using physical barriers better accommodate  
278 machine vision used to support the automation of vehicles. [revise]

279 ~~*Road markings should indicate the end of a bike lane that is merged with other traffic.*~~ [delete]

280