



National Committee on Uniform Traffic Control Devices

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Item No.: 17B.RW-01

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

TECHNICAL COMMITTEE: Regulatory and Warning Signs Committee
ITEM NUMBER: 17B.RW.01
TOPIC: Horizontal Alignment Signing
ORIGIN OF REQUEST: NCHRP 03-106, Traffic Control Device Guidelines for Curves. Joint Task Force: Tom Heydel (chair), Bruce Ibarguen, Dan Waddle, Paul Carlson, Jim Pline, Bob Seyfried, Zoubir Ouadah (Markings Technical Committee), Dan Paddick.
AFFECTED SECTIONS OF MUTCD: 2C.06, 2C.07, 2C.09, 2C.10, 2C.11, 2C.12, 2C.13, 2C.14, 2C.15, 3B.01, 3B.07, 3B.12, 3B.13, 3F.01, 3F.04

DEVELOPMENT HISTORY: task force: 4-16-17, 4-23-17 revised, revised 4-30-17, revised 5-6-17, revised 5-11-17, revised 5-12-17, revised 5-26-17, updated 5-28-17, revised 6-17-17, revised 6-26-17, revised 6-28-17, revised 6-29-17, revised 7-8-17 (combined 17B.RW.02 with this ballot item), revised following sponsor comments 12-16-17, revised 12-21-17, revised 12-21-17 (2), revised 12-23-17, revised 12-26-17, revised 12-27-17, revised 12-27-17 (2), revised 1-3-18 and 1-4-18 following sponsor comments, Tabled by Council 1-5-18

- Approved by RW Technical Committee: 06/29/2017
- Approved by Markings Technical Committee: 06/29/2017
- Approved by RW Technical Committee following sponsor comments: 01/03/2018
- Approved by Markings Technical Committee following sponsor comments: 01/03/2018
- Approved by NCUTCD Council: Tabled by Council 1-5-2018 READY FOR RESUBMITTAL TO SPONSORS
- Approved by RW Technical Committee following sponsor comments: MM/DD/YYYY
- Approved by Markings Technical Committee following sponsor comments: MM/DD/YYYY

NOTE TO BE PROVIDED IN VERSION SENT FOR SPONSOR REVIEW

This is a proposal for recommended changes to the MUTCD that has been developed by a technical committee of the NCUTCD. The NCUTCD is distributing it to its sponsoring organizations for review and comment. Sponsor comments will be considered in revising the proposal prior to NCUTCD Council consideration. This proposal does not represent a revision of the MUTCD and does not constitute official MUTCD standards, guidance, or options. If approved by the NCUTCD Council, the recommended changes will be submitted to FHWA for consideration for inclusion in a future MUTCD revision. The MUTCD can be revised only through the federal rulemaking process.

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SUMMARY:

The final report for NCHRP 03-106, Traffic Control Device Guidelines for Curves was issued April 2015 by Texas A & M Transportation Institute, Texas A & M University and Vanasse Hangen Brustlin, Inc. That research included writing MUTCD text to revise Table 2C-5 along with sections of Part 2C and Part 3 that apply to TCD guidelines for curves.

The objective of the research was to identify potential improvements to the MUTCD guidelines for the application of TCD's on curves.

In addition, a separate issue emerged that Sections 2C.14 and 2C.15 should be combined into one section to address Exit and Ramp Speed signs and Combination Horizontal Alignment/Advisory Exit and Ramp Speed Signs since we are impacting Section 2C.14 anyway. It made sense to just incorporate that task forces work (item 17B.RW.02) into this proposal as directed by RWSTC and make it into one ballot item 17B.RW.01.

DISCUSSION:

The research used unfamiliar driver behavior on actual test roadway segments and crash-based safety studies to determine how drivers respond to various traffic control devices. Presently, Table 2C-5 deals only with warning signs but does not factor other traffic control devices such as pavement marking, raised pavement markers and delineators.

As a result of the research the MUTCD language was revised to reflect the driver behavior to the traffic control devices and modify the language in the MUTCD to account for that behavior and safety analysis.

Sections in Part 2C and Part 3 were evaluated related to traffic control devices for curves and how it relates to volumes and speed.

In addition, Sections 2C.14 and 2C.15 are combined into one section. This is not part of the NCHRP 03-106 report, MUTCD language proposal. However, to avoid two separate ballot items impacting the same section in the MUTCD, we included it into this proposal, since both the NCHRP report and the other RWSTC task force for Section 2C.14 impact section 2C.14.

This item was tabled by Council on January 5, 2018 due to the high number of sponsor comments (271). Sponsor vote as ballot item: 27 concur, 37 concur in part and 4 do not concur. As a result it was tabled by Council and recommended that RWSTC send out again as a ballot item for the June 2018 meeting. The proposal incorporates the sponsor comments and the revised proposal is as follows below. **This proposal is being kept as item # 17B.RW.01 since that was the item # when it originally went to sponsors. This will avoid confusion with changing the number.**

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

79 comments may be provided with the MUTCD text. These comments are indicated by
80 [highlighted light blue in brackets].

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82 **PART 1. GENERAL**
83 **CHAPTER 1A. GENERAL**

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86 **PART 2. SIGNS**

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88 **Chapter 2C. WARNING SIGNS AND OBJECT MARKERS**

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90 **Section 2C.06 Treatments for Changes in Horizontal Alignment Horizontal Alignment**
91 **Warning Signs**

92 Support:

93 01 A variety of horizontal alignment warning signs (see Figure 2C-1), pavement markings (see
94 Chapter 3B), and delineation (see Chapter 3F). can be used to advise motorists of a change in the
95 roadway alignment. Uniform application of these traffic control devices with respect to the
96 amount of change in the roadway alignment conveys a consistent message establishing driver
97 expectancy and promoting effective roadway operations. ~~The design and application of~~
98 ~~horizontal alignment warning signs to meet those requirements the needs of motorists are~~
99 ~~addressed in Sections 2C.06 through 2C.15.~~

100 **Figure 2C-1 Horizontal Alignment Signs and Plaques**



101 **Standard: Option`**

102 02 The following list identifies some possible treatments (traffic control devices and non-traffic
103 control devices that may be used in advance of or within a change in horizontal alignment.
104 ~~In advance of horizontal curves on freeways, on expressways, and on roadways with more~~
105 ~~than 1,000 AADT that are functionally classified as arterials or collectors, horizontal~~
106 ~~alignment warning signs shall be used in accordance with Table 2C-5 based on the speed~~
107 ~~differential between the roadway's posted or statutory speed limit or 85th percentile speed,~~
108 ~~whichever is higher, or the prevailing speed on the approach to the curve, and the~~
109 ~~horizontal curve's advisory speed. (green cross outs above approved by Council January~~
110 ~~2011, RW # 7, Attachment # 8)~~
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Table 2C-5. Horizontal Alignment Sign Selection

Type of Horizontal Alignment Sign	Difference Between Speed Limit and Advisory Speed			
	5 mph	10 mph	15 mph	20 mph or more
Turn (W1-1), Curve (W1-2), Reverse Turn (W1-3), Reverse Curve (W1-4), Winding Road (W1-5), and Combination Horizontal Alignment/Intersection (W10-1) (see Section 2C.07 to determine which sign to use)	Recommended Optional	Required Recommended	Required	Required
Advisory Speed Plaque (W13-1P)	Recommended Optional	Required Recommended	Required	Required
Chevrons (W1-8) and/or One Direction Large Arrow (W1-6)	Optional	Recommended Optional ¹	Required Recommended ²	Required
Exit Speed (W13-2) and Ramp Speed (W13-3) on exit ramp	Optional	Optional	Recommended	Required

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Note: Required means that the sign and/or plaque shall be used, recommended means that the sign and/or plaque should be used, and optional means that the sign and/or plaque may be used. See Section 2C.06 for roadways with less than 1,000 ADT.

120 (Table 2C-5 items shown above was approved by Council January 20, 2011, RW #8, Attachment
121 # 9)

122 **We are now deleting the above Table 2C-5 that was modified and approved by Council on**
123 **January 20, 2011 and providing a new Table 2C-5**

125 ¹ ~~Optional when one or more of the treatments listed in Section 3A.07 are used. Remove this~~
126 ~~previously approved sentence~~

127 ² ~~Recommended when one or more of the treatments listed in Section 3A.07 are used. Remove~~
128 ~~this previously Council approved sentence~~

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130 Support:

131 ~~The curve safety countermeasures identified below have been shown to be beneficial when~~
132 ~~applied in combination with horizontal alignment warning signs to enhance safety around curves:~~

- 133 1. ~~Wide Edge lines,~~
- 134 2. ~~Delineators,~~
- 135 3. ~~Raised Retroreflective Pavement Markers~~
- 136 4. ~~Longitudinal Rumble Strips or Stripes~~
- 137 5. ~~Profiled Pavement Markings and/or~~
- 138 6. ~~Other curve safety countermeasures with demonstrated safety benefits in reducing~~
139 ~~horizontal curve crashes. (Delete previously Council approved items from June~~
140 ~~27,2013.~~

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- 142 A. ~~Horizontal alignment signs (Turn (W1-1, W1-1a), Curve (W1-2, W1-2a, W1-10 series),~~
143 ~~Reverse Turn (W1-3), Reverse Curve (W1-4), Winding Road (W1-5), Exit Speed (W13-~~

- 144 2), Ramp Speed (W13-3), Combination Horizontal Alignment (Advisory Exit or Ramp
- 145 Speed W13-6 and W13-7) signs.
- 146 B. Advisory Speed Plaque (W13-1P).
- 147 C. Chevrons (W1-8)
- 148 D. Delineators (Chapter 3F)
- 149 E. One Direction Large Arrow (W1-6) sign
- 150 F. Retroreflective Raised Pavement Markers (Section 3B.12 through 3B.13).
- 151 G. Increased sign or marking retroreflectivity.
- 152 H. Increased sign size
- 153 I. Wide Edge Lines.
- 154 J. Pavement, Word, Symbol and Arrow markings (symbol or words) Section 3B.20
- 155 K. Rumble Strips
- 156 L. Driver Feedback Sign (Section 2C.08a)
- 157 M. Speed reduction pavement markings (Section 3B.22)
- 158 N. Treatments that are not traffic control devices such as:
 - 159 a. Improved surface friction (high friction surface treatments)
 - 160 b. Safety edge (angled pavement edge treatment)
 - 161 c. Illumination (lighting improvements)
 - 162 d. Increased superelevation

163 ~~Examples of curve safety countermeasures with demonstrated safety benefits include~~
164 ~~illumination, safety edge, and high friction surface treatments. (Approved by Council June 27~~
165 ~~2013, Attachment # 3, RW # 2)~~

166 ~~Delete this sentence above that was approved by Council on June 27, 2013 and list them above~~
167 ~~instead.~~

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Option:

~~03 Horizontal Alignment Warning signs may also be used on other roadways or on arterial and collector roadways with less than 1,000 AADT based on engineering judgment.~~

Guidance:

03 Except as provided in Section 2C.06a, the selection of traffic control devices used to warn road users of a change in horizontal alignment or to provide guidance in navigating the change in horizontal alignment should be based on engineering judgment considering one or more of the following factors:

1. The speed of traffic on the approach to the change in horizontal alignment.
2. The recommended advisory speed for the change in horizontal alignment
3. The difference between the speed limit and the advisory speed or the speed differential, for the change in horizontal alignment.
4. Daily traffic volumes on the roadway.
5. The typical mix of vehicle types on the roadway
6. Sight distance throughout the change in horizontal alignment.
7. Other types of traffic control devices that are used in advance of and within the change in horizontal alignment on the same roadway segment.
8. The crash history of the change in horizontal alignment.

Section 2C.06a Device Selection for Changes in Horizontal Alignment

Support:

01 For purposes of selecting traffic control devices for changes in horizontal alignment, an arterial and collector is considered to have pavement markings when a centerline and/or edgelines are present.

Standard:

02 Except as provided in paragraphs 07, 09 and 10 below, the devices indicated in Table 2C-5 represent the minimum traffic control that shall be used:

- a. When the AADT on the arterial or collector is greater than 4,000 vehicles per day and the roadway has pavement markings
- b. When the AADT is greater than 2,000 vehicles per day if the arterial or collector does not have pavement markings
- c. On Freeways and Expressways.

03 An Advisory Speed Plaque shall be used with a Horizontal Alignment sign when the difference between the speed limit and the advisory speed is 20 MPH or more if the roadway has pavement markings. If the roadway does not have pavement markings, an Advisory Speed Plaque shall be used with a horizontal alignment sign if the difference between the speed limit and the advisory speed is 15 MPH or more.

Guidance:

04 Except as provided in paragraphs 07, 09, and 10 below, the devices indicated in Table 2C-5 represent the minimum traffic control that should be used when:

- 217 a. The AADT on the arterial or collector is greater than 2,000 vehicles per day and the
218 roadway has pavement markings.
219 b. The AADT on the arterial collector is greater than 1,000 vehicles per day and the
220 roadway does not have pavement markings
221 05 An Advisory Speed Plaque should be used with a Horizontal Alignment sign when the
222 difference between the speed limit and the advisory speed is 15 MPH or more if the arterial or
223 collector has pavement markings. If the roadway does not have pavement markings an Advisory
224 Speed Plaque should be used if the difference between the speed limit and the advisory speed is
225 10 MPH or more.

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227 Option:

- 228 06 The devices indicated in Table 2C-5 represent the minimum traffic control that may be used
229 on other roadways or on arterial and collector roadways with 1000 vehicles per day or less.
230 07 A One Direction Large Arrow (W1-6) sign may be used in place of or to supplement
231 delineators or Chevrons when geometric conditions limit the number of delineators or Chevrons
232 that are visible or can be installed within the change in horizontal alignment below the number
233 specified in Sections 2C.09 or 3F.04.
234 08 Additional or supplemental devices may be used for a change in horizontal alignment on the
235 basis of engineering judgment.
236 09 Devices may be omitted for changes in horizontal alignment when the speed limit on the
237 approach to an alignment change is 20 mph or less
238 10 Devices may be omitted for changes in horizontal alignment on urban streets with a 1000
239 vehicles per day or less on the basis of engineering judgment.

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Table 2C-5. Selection of Devices for Changes in Horizontal Alignment

Speed Limit ^a (mph)	Devices for Curve Advisory Speed (mph) ^b										
	20	25	30	35	40	45	50	55	60	65	70
25	M ^p	—	—	—	—	—	—	—	—	—	—
30	W	M ^p	—	—	—	—	—	—	—	—	—
35	D	W	M ^p	—	—	—	—	—	—	—	—
40	C	D	W	M ^p	—	—	—	—	—	—	—
45	C	C	D	W	M ^p	—	—	—	—	—	—
50	C	C	C	D	W	M ^p	—	—	—	—	—
55	C	C	C	C	D	W	M ^p	—	—	—	—
60	C	C	C	C	C	D	W	M ^p	—	—	—
65	C	C	C	C	C	C	D	W	M ^p	—	—
70	C	C	C	C	C	C	C	D	W	M ^p	—
75	C	C	C	C	C	C	C	C	D	W	M ^p

Notes:

^aThe 85th percentile speed may be used in place of the speed limit (Section 2C.06a).

^bDevice abbreviations: M – markings (paved roadways), W – advance warning sign, D – delineators plus advance warning sign, C – chevrons plus advance warning sign.—“Pavement markings may be excluded on unpaved roadways; otherwise the other provisions of the Table apply”. The small superscript “p” above the “M” means condition for paved roads.

^pAn advance warning sign shall be used on roads without pavement markings as described in Section 2C.06a, paragraph 01. An arterial or collector are considered to have pavement markings when centerline, edgeline and/or lanelines are present.

Table 2C-5 is based on the difference between the speed limit and the curve advisory speed.

Section 2C.07 Horizontal Alignment Signs (W1-1 through W1-5, W1-11, W1-15)

Standard:

~~01-If Table 2C-5 indicates that a horizontal alignment sign (see Figure 2C-1) is required, recommended, or allowed, the sign installed in advance of the curve shall be a Curve (W1-2) sign unless a different sign is recommended or allowed by the provisions of this Section.~~

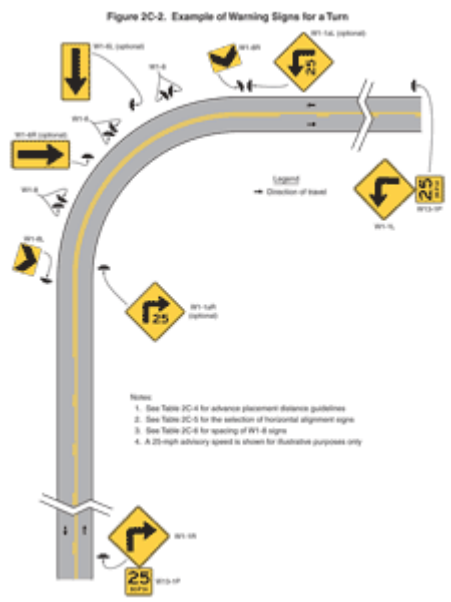
286 **02 A Turn (W1-1) sign shall be used instead of a Curve sign in advance of curves that have**
287 **advisory speeds of 30 mph or less (see Figure 2C-2).**

288 Guidance:

289 02 01 A turn sign (W1-1) should be used instead of a Curve sign in advance of curves when the
290 advisory speed is 1/2 or less of the posted speed or a speed differential of 25 MPH or more exists.
291 (approved by Council January 20, 2011, RW # 8, attachment #9)

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Figure 2C-2 Example of Warning Signs for a Turn



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295 Guidance:

296 03 02 Where there are two changes in roadway alignment in opposite directions that are
297 separated by a tangent distance of less than 600 feet, the Reverse Turn (W1-3) sign should be
298 used instead of multiple Turn (W1-1) signs ~~and~~ or the Reverse Curve (W1-4) sign should be used
299 instead of multiple Curve (W1-2) signs.

300 Support:

301 02a Figure 2C-2 provides an example of warning signs used for a turn.

302 Option:

303 04 03 A Winding Road (W1-5) sign may be used instead of multiple Turn (W1-1) or Curve (W1-
304 2) signs where there are three or more changes in roadway alignment each separated by a tangent
305 distance of less than 600 feet.

306 05 04 A NEXT XX MILES (W7-3aP) supplemental distance plaque (see Section 2C.55) may be
307 installed below the Winding Road sign where continuous roadway curves exist for a specific
308 distance.

309 06 05 If the curve has a change in horizontal alignment of 135 degrees or more, the Hairpin Curve
310 (W1-11) sign may be used instead of a Curve or Turn sign.

311 07 06 If the curve has a change of direction of approximately 270 degrees, such as on a cloverleaf
312 interchange ramp, the 270-degree Loop (W1-15) sign may be used instead of a Curve or Turn
313 sign.

314 *Guidance:*
315 *08 07 When the Hairpin Curve sign or the 270-degree Loop sign is installed, either a One-*
316 *Direction Large Arrow (W1-6) sign or Chevron Alignment (W1-8) signs should be installed on*
317 *the outside of the turn or curve.*

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319 **Section 2C.08 Advisory Speed Plaque (W13-1P)**

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321 *Option:*
322 *01 The Advisory Speed (W13-1P) plaque (see Figure 2C-1) may be used to supplement any*
323 *warning sign to indicate the advisory speed for a condition.*

324 **Standard:**

325 *02 The use of the Advisory Speed plaque for horizontal curves shall be in accordance with*
326 *Section 2C.06a ~~the information shown in Table 2C-5.~~ The Advisory Speed plaque shall also*
327 *be used where an engineering study indicates a need to advise road users of the advisory*
328 *speed for other roadway conditions.*

329 *03 **If used, T**he Advisory Speed plaque shall carry the message XX MPH. The speed*
330 *displayed shall be a multiple of 5 mph.*

331 *04 Except in emergencies or when the condition is temporary, an Advisory Speed plaque*
332 *shall not be installed until the advisory speed has been determined by an engineering study.*

333 *05 The Advisory Speed plaque shall only be used to supplement a warning sign and shall not*
334 *be installed as a separate sign installation.*

335 *06 The advisory speed shall be determined by an engineering study that follows established*
336 *engineering practices. (See Section 1A.04, Traffic Control Devices Handbook)*

337 *NOTE: Edit committee changed Section 1A.11 to be 1A.04 for publications.*

338 **Support:**

339 ~~*07 Among the established engineering practices that are appropriate for the determination of the*~~
340 ~~*recommended advisory speed for a change in horizontal alignment horizontal curve are the*~~
341 ~~*following:*~~

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

343 ~~*— B. A design speed equation*~~

344 ~~*— C. A traditional ball bank indicator or other equivalent device using the following criteria:*~~

345 ~~*—— 1. 16 degrees of ball bank for speeds of 20 mph or less*~~

346 ~~*—— 2. 14 degrees of ball bank for speeds of 25 to 30 mph*~~

347 ~~*—— 3. 12 degrees of ball bank for speeds of 35 mph and higher*~~

348 ~~*08 The 16, 14, and 12 degrees of ball bank criteria are comparable to the current AASHTO*~~
349 ~~*horizontal curve design guidance. Research has shown that drivers often exceed existing posted*~~
350 ~~*advisory curve speeds by 7 to 10 mph.*~~

351
352 *Guidance:*

353 *09 The advisory speed should be determined based on free-flowing traffic conditions.*

354 *10 Because changes in conditions, such as roadway geometrics, surface characteristics, or sight*
355 *distance, might affect the advisory speed, each location should be evaluated periodically or*
356 *when conditions change.*

357
358 **Section 2C.08a Driver Feedback Sign (WX-XX):**

359 **Option:**

360 01 A supplemental driver feedback LED sign indicating YOUR SPEED XX MPH (WX-XX)
361 sign may be used near the point of curvature of a horizontal curve to supplement the standard
362 alignment warning sign or used downstream of a posted speed limit sign. The vehicle speed
363 display may be static or flash at acceptable rates (See Section 2A.07)

364 **Standard:**

365 02 The legend, YOUR SPEED, on a YOUR SPEED XX MPH (WX-XX) sign shall be a
366 black legend with a font size in conformance with the appropriate facility type on a yellow
367 retroreflective background. The LED legend displaying the speed value shall be a yellow
368 illuminated legend with not less than 20 mm pitch LEDs covering the stroke width of a 10
369 inch series numeral on an opaque black background.

370 **Option:**

371 03 A driver feedback LED sign that displays the legend “SLOW TO XX MPH” may be used to
372 activate the sign speed legend when the approaching vehicle speed exceeds the posted speed.
373 (approved by Council June 28, 2014, Attachment # 1, RW # 3)

374
375 Delete paragraph 3 from the previously approved Council item from June 28, 2014 and replace it
376 with:

377 03 When an approaching vehicle exceeds the posted speed and activates the sign speed legend, a
378 driver feedback LED sign that displays the legend “SLOW TO XX MPH” may be used. The
379 driver feedback sign may be installed with the speed limit sign or separately

380
381 **Section 2C.09 Chevron Alignment Sign (W1-8)**

382 **Standard:**

383 **01 The use of the Chevron Alignment (W1-8) sign (see Figures 2C-1 and 2C-2) to provide**
384 **additional emphasis and guidance for a change in horizontal alignment shall be in**
385 **accordance with the information shown in Table 2C-5.**

386 **Option:**

387 02 ~~When used,~~ Chevron Alignment signs may be used instead of or in addition to standard
388 delineators. (approved by Council January 19, 2012, attachment # 8, RW #8)

389 **Standard:**

390 **03 The Chevron Alignment sign shall be a vertical rectangle. No border shall be used on the**
391 **Chevron Alignment sign.**

392 **04 ~~If used,~~ The Chevron Alignment signs shall be installed on the outside of a turn or curve,**
393 **in line with and at approximately a right angle to approaching traffic. Chevron Alignment**
394 **signs shall be installed at a minimum height of 4 feet, measured vertically from the bottom**
395 **of the sign to the elevation of the near edge of the traveled way.**

396 **Option:**

397 04a LEDs may be used to enhance chevron signs and, if vehicle activated the LEDs may be
398 flashed concurrently but not sequentially within the sign panel.

399 **Standard:**

400 04b The LEDs used in the chevron alignment sign shall consist of yellow LEDs outlining the
401 chevron symbol. (approved by Council June 28, 2014, RW # 3, Attachment # 1)

402 **Guidance:**

403 *05 The approximate spacing of Chevron Alignment signs on the turn or curve measured from the*
404 *point of curvature (PC) should be as shown in Table 2C-6.*

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Table 2C-6. Typical Spacing of Chevron Alignment Signs on Horizontal Curves

Advisory Speed	Curve Radius	Sign Spacing
15 mph or less	Less than 200 feet	40 feet
20 to 30 mph	200 to 400 feet	80 feet
35 to 45 mph	401 to 700 feet	120 feet
50 to 60 mph	701 to 1,250 feet	160 feet
More than 60 mph	More than 1,250 feet	200 feet

Note: The relationship between the curve radius and the advisory speed shown in this table should not be used to determine the advisory speed.

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06 If used, Chevron Alignment signs should be visible for a sufficient distance to provide the road user with adequate time to react to the change in alignment.

Standard:

07 Chevron Alignment signs shall not be placed on the far side of a T-intersection facing traffic on the stem approach to warn drivers that a through movement is not physically possible, as this is the function of a Two-Direction (or One-Direction) Large Arrow sign.

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).

Section 2C.10 ~~Supplemental~~ Horizontal Alignment/Advisory Speed Signs (W1-1a, W1-2a)

Option:

01 The Turn (W1-1) sign or the Curve (W1-2) sign may be combined with the Advisory Speed (W13-1P) plaque (see Section 2C.08) to create a combination ~~supplemental~~ Turn/Advisory Speed (W1-1a) sign or ~~supplemental~~ combination Curve/Advisory Speed (W1-2a) sign (see Figure 2C-1).

02 The ~~supplemental~~ combination Horizontal Alignment/Advisory Speed sign may be used to supplement the advance ~~supplemental~~ Horizontal Alignment warning sign and Advisory Speed plaque ~~based upon an engineering study.~~ (approved by Council June 26, 2014, RW # 4, Retain 2009 MUTCD language using the term Horizontal not supplemental and not change it to FHWA's edits)

Standard:

03 If used, the combination Horizontal Alignment/Advisory Speed sign shall not be used alone and shall not be used as a substitute for a Horizontal Alignment warning sign and Advisory Speed plaque at the advance warning location. The combination Horizontal Alignment/Advisory Speed sign shall only be used as a supplement to the advance Horizontal Alignment warning sign. If used, the combination Horizontal Alignment/Advisory Speed sign shall be installed at the beginning of the turn or curve.

Guidance:

04 The advisory speed displayed on the combination ~~supplemental~~ Horizontal Alignment/Advisory Speed sign should be based on the advisory speed for the horizontal curve using recommended engineering practices (see Section 2C.08).

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445 **Section 2C.11 Combination Horizontal Alignment/Intersection Signs (W1-10 Series)**

446 Option:

447 01 The Turn (W1-1) sign or the Curve (W1-2) sign may be combined with the Cross Road (W2-
448 1) sign or the Side Road (W2-2 or W2-3) sign to create a combination Horizontal
449 Alignment/Intersection (W1-10 series) sign (see Figure 2C-1) that depicts the condition where an
450 intersection occurs within or immediately adjacent to a turn or curve.

451 *Guidance:*

452 02 *Elements of the combination Horizontal Alignment/Intersection sign related to horizontal*
453 *alignment should comply with the provisions of Section 2C.07, and elements related to*
454 *intersection configuration should comply with the provisions of Section 2C.46. The symbol*
455 *design should approximate the configuration of the intersecting roadway(s). No more than one*
456 *Cross Road or two Side Road symbols should be displayed on any one combination Horizontal*
457 *Alignment/Intersection sign.*

458 **Standard:**

459 03 **The use of the combination Horizontal Alignment/Intersection sign shall be in**
460 **accordance with the appropriate Turn or Curve sign information shown in ~~Table 2C-5~~**
461 **[Section 2C.07](#)**

462

463 **Section 2C.12 One-Direction Large Arrow Sign (W1-6)**

464 Option:

465 01 A One-Direction Large Arrow (W1-6) sign (see Figure 2C-1) may be used either as a
466 supplement or alternative to Chevron Alignment signs [or delineators](#) in order to delineate a
467 change in horizontal alignment (see Figure 2C-2).

468 02 A One-Direction Large Arrow (W1-6) sign may be used to supplement a Turn or Reverse Turn
469 sign (see Figure 2C-2) to emphasize the abrupt curvature.

470 **Standard:**

471 03 **The One-Direction Large Arrow sign shall be a horizontal rectangle with an arrow**
472 **pointing to the left or right.**

473 ~~04 The use of the One-Direction Large Arrow sign shall be in accordance with the~~
474 ~~information shown in Table 2C-5.~~

475 05 **If used, the One-Direction Large Arrow sign shall be installed on the outside of a turn or**
476 **curve in line with and at approximately a right angle to approaching traffic.**

477 06 **The One-Direction Large Arrow sign shall not be used where there is no alignment**
478 **change in the direction of travel, such as at the beginnings and ends of medians or at center**
479 **piers.**

480 07 **The One-Direction Large Arrow sign directing traffic to the right shall not be used in the**
481 **central island of a roundabout.**

482 *Guidance:*

483 08 ~~If used,~~ *the One-Direction Large Arrow sign should be visible for a sufficient distance to*
484 *provide the road user with adequate time to react to the change in alignment.*

485

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

487 Option:

488 01 A Truck Rollover ~~Warning~~ (W1-13) sign (see Figure 2C-1) may be used to warn drivers of
489 vehicles with a high center of gravity, such as trucks, tankers, and recreational vehicles, of a

490 curve or turn where geometric conditions might contribute to a loss of control and a rollover as
491 determined by an engineering study-judgment.

492 **Support:**

493 ~~02—Among the established engineering practices that are appropriate for the determination of the
494 truck rollover potential of a horizontal curve are the following:~~

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

496 ~~B. A design speed equation~~

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

498 **Standard:**

499 ~~03~~ **If a Truck Rollover ~~Warning~~ (W1-13) sign is used, it shall be accompanied by an
500 Advisory Speed (W13-1P) plaque indicating the recommended speed for vehicles with a
501 higher center of gravity (see Section 1A.04, Traffic Control Devices Handbook).**

502 **NOTE:** Edit committee changed Section 1A.11 to be 1A.04 for publications.

503 Option:

504 Option:

505 ~~04~~ The Truck Rollover ~~Warning~~ sign may be displayed as a static sign, as a static sign
506 supplemented by a ~~flashing~~ warning beacon, or as a driver feedback changeable-message LED
507 sign activated by the detection of an approaching vehicle with a high center of gravity that is
508 traveling in excess of the recommended speed for the condition. The driver feedback LED sign
509 may be yellow LEDs in the warning sign border or a flashing advisory speed legend in the
510 advisory speed plaque.

511 Guidance:

512 ~~04a~~ The driver feedback LED sign should be a yellow LED legend on a black opaque background
513 displaying the vehicle speed approaching the change in horizontal alignment. The detected speed
514 should have a steady or flashing message displaying the vehicle speed approaching the change
515 in horizontal alignment. (approved by Council June 28, 2014, RW # 3, Attachment # 1)

516

517

518 ~~04b~~ An additional Truck Rollover sign may be placed in advance of the initial Truck Rollover
519 sign.

520 Guidance:

521 ~~04c~~ The location of the additional Truck Rollover sign should be determined by engineering
522 judgment.

523 **Standard**

524 ~~04d~~ **If an additional Truck Rollover sign is used, it shall be accompanied by an advisory**
525 **speed plaque and either by a distance plaque or a RAMP plaque.**

526

527 **Support:**

528 ~~05~~ The curved arrow on the Truck Rollover ~~Warning~~ sign shows the direction of roadway
529 curvature. The truck tips in the opposite direction.

530

531 **Figure 2C-12**

532

533 Add:



534

535

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

538

539 **Section 2C.14 Advisory Exit and Ramp Speed Signs (W13-2 and W13-3), and Combination**
540 **Horizontal Alignment/Advisory Exit and Ramp Speed Signs (W13-6 and W13-7)**

541 **Standard:**

542 ~~01 Advisory Exit Speed (W13-2) and Advisory Ramp Speed (W13-3) signs (see Figure 2C-1)~~
543 ~~shall be vertical rectangles.~~ The use of Advisory Exit Speed (W13-2), ~~and~~ Advisory Ramp
544 Speed (W13-3), Combination Horizontal Alignment/Advisory Exit Speed (W13-6) and
545 Combination Horizontal Alignment/Advisory Ramp Speed (W13-7) signs on freeway and
546 ~~expressway~~ turning roadways, exits and ramps shall be in accordance with the information
547 shown in Table 2C-5.

548 01a Advisory Exit Speed, Advisory Ramp Speed, Combination Horizontal
549 Alignment/Advisory Exit and Combination Horizontal Alignment/Advisory Ramp Speed
550 signs (See Figure 2C-1) shall be vertical rectangles.

551 01b The Advisory Exit Speed and Advisory Ramp Speed signs on freeway and expressway
552 ramps shall be used when the difference between the speed limit and the advisory speed is
553 20 mph or greater.

554 Guidance:

555 01c The Advisory Exit Speed and Advisory Ramp Speed signs on freeway and expressway ramps
556 should be used when the difference between the speed limit and the advisory speed is 15 mph or
557 greater.

558 Option:

559 01d The Advisory Exit Speed and Advisory Ramp Speed signs on freeway and expressway ramps
560 may be used on any ramp on the basis of engineering judgment or engineering study.

561

562 Guidance:

563 02 If used, the Advisory Exit Speed sign and the Combination Horizontal Alignment/Advisory Exit
564 Speed sign should be installed along the deceleration lane. and the See Section 2C.08 for the
565 determination of the displayed advisory speed. displayed should be based on an engineering
566 study. When a Truck Rollover (W1-13) sign (see Section 2C.13) is also installed for the ramp, the
567 advisory exit speed should be based on the truck advisory speed for the horizontal alignment
568 using recommended engineering practices.

569 03 If used, the Advisory Exit Speed and the Combination Horizontal Alignment/Advisory Exit
570 signs should be visible in time for the road user to decelerate and make an exiting maneuver.

571 Support:

572 04 Table 2C-4 lists recommended advance sign placement distances for deceleration to various
573 advisory speeds.

574 Option:

575 04a The Advisory Ramp Speed sign or a Combination Horizontal Alignment/Advisory Ramp
576 Speed sign may be installed along the ramp to confirm the ramp advisory speed beyond the exit
577 gore.

578 04b Where there is a need to remind road users of the recommended advisory speed, a horizontal
579 alignment warning sign with an advisory speed plaque or a Combination Horizontal
580 Alignment/Ramp Advisory Speed sign may be installed beyond the exit gore or on the outside of
581 the curve, provided that it is apparent that the sign applies only to exiting traffic. These signs
582 may also be used at intermediate points along the ramp, especially if the ramp curvature changes

583 and the subsequent curves on the ramp have a different advisory speed than the initial ramp
584 curve.

585 *Guidance:*

586 *05 If used, the Advisory Ramp Speed sign should be installed on the ramp to confirm the ramp*
587 *advisory speed.*

588 *05a The horizontal alignment symbol displayed on the Combination Horizontal*
589 *Alignment/Advisory Exit and Ramp signs should be consistent with the ramp curve.*

590 *06 If used, Chevron Alignment (W1-8) signs and/or One-Direction Large Arrow (W1-6) signs*
591 *should be installed on the outside of the exit curve as described in Sections 2C.09 and 2C.12.*

592 *Option:*

593 *07 Where there is a need to remind road users of the recommended advisory speed, a horizontal*
594 *alignment warning sign with an advisory speed plaque may be installed at or beyond the*
595 *beginning of the exit curve or on the outside of the curve, provided that it is apparent that the*
596 *sign applies only to exiting traffic. These signs may also be used at intermediate points along the*
597 *ramp, especially if the ramp curvature changes and the subsequent curves on the ramp have a*
598 *different advisory speed than the initial ramp curve.*

599 *Support:*

600 *08 06 Figure 2C-3 shows an example of advisory speed signing for an exit ramp. NOTE: This*
601 *figure was revised and approved by Council on 6-30-17 (16B.RW.04)*

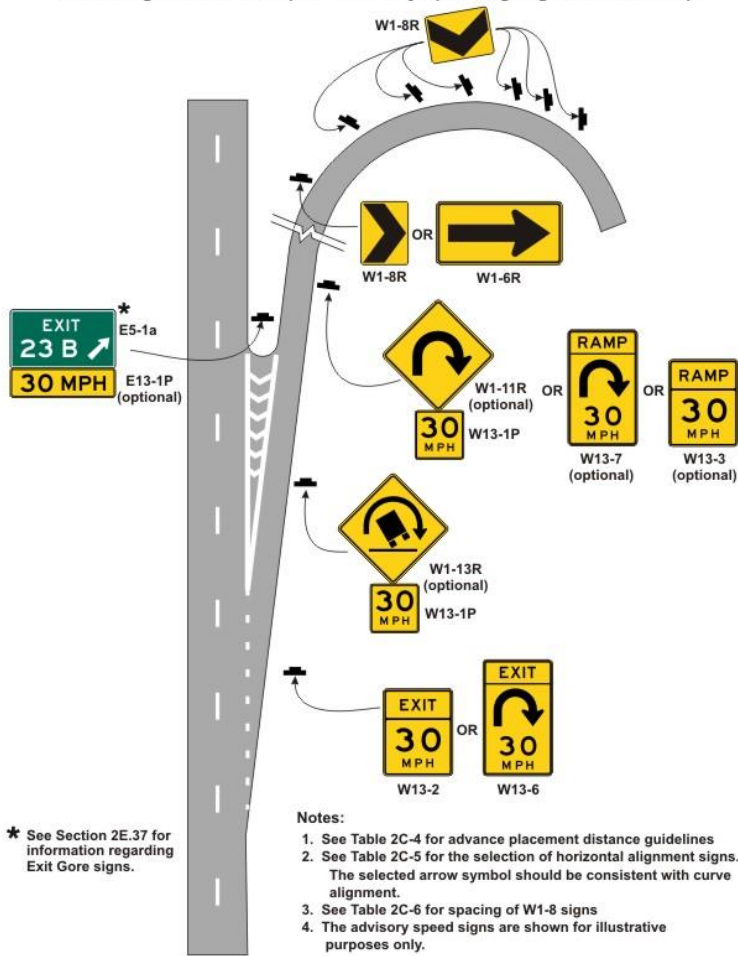
Figure 2C-3 Example of Advisory Speed Signing for an Exit Ramp (deleted)



602

603 **Figure 2C-3 is revised as shown below: 16B.RW.04 Previously Approved by Council 6-30-**
604 **17**

Revised Figure 2C-3. Example of Advisory Speed Signing for an Exit Ramp



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Section 2C.15 Combination Horizontal Alignment/Advisory Exit and Ramp Speed Signs (W13-6 and W13-7)

Option:

A horizontal alignment sign (see Section 2C.07) may be combined with an Advisory Exit Speed or Advisory Ramp Speed sign to create a combination Horizontal Alignment/Advisory Exit Speed (W13-6) sign or a combination Horizontal Alignment/Advisory Ramp Speed (W13-7) sign (see Figure 2C-1). These combination signs may be used where the severity of the exit ramp curvature might not be apparent to road users in the deceleration lane or where the curvature needs to be specifically identified as being on the exit ramp rather than on the mainline.

PART 3 – MARKINGS

CHAPTER 3A. GENERAL

Section 3A.XX after Section 3A.07 as follows:
New Section following existing Section 3A.07

624 **Section 3A.07 Application of Markings, Delineation, and Rumble Strips in Combination**
625 **with Horizontal Alignment Warning Signs**

626 **Option:**

627 **The following curve safety countermeasures may be used to supplement selected curve**
628 **signing requirements as indicated in Table 2C-5.**

- 629 1. **Wide Edge lines**
- 630 2. **Delineators**
- 631 3. **Raised Retroreflective Pavement Markers**
- 632 4. **Longitudinal Rumble Strips or Stripes**
- 633 5. **Profiled Pavement Markings, and/or**
- 634 6. **Other treatments with demonstrated safety benefits in reducing horizontal curve**
635 **crashes**

636
637 **Support:**

638 **Examples of curve safety countermeasures with demonstrated safety benefits include**
639 **illumination, safety edge, and high friction surface treatments. (Previously APPROVED by**
640 **COUNCIL, June 27, 2013)**

641
642

643 C:\nctcd\June 2016\17B-RW-01 Sections 2C.06, etc Horizontal Alignment signs 1-2-17, revised 1-21-17, revised 4-16-17 (2),
644 revised 4-23-17, revised 4-30-17, revised 5-6-17, revised 5-11-17, 5-12-17, revised 5-26-17, updated 5-28-17, revised 6-17-17,
645 revised 6-26-17, revised 6-28-17, revised 6-29-17, revised 7-8-17 (combined 17B.RW.02 with this ballot item), revised following
646 sponsor comments 12-21-17, revised following sponsor comments 12-21-17 (2), revised 12-23-17, revised 12-26-17, revised 12-
647 27-17, revised following sponsor comments 12-27-17 (2), revised 1-3-18, revised 1-4-18, revised following tabling by Council 1-
648 7-18, updated 1-8-18