

ATTACHMENT NO. 9

RW No. 8, January 2011

TECHNICAL COMMITTEE: Regulatory & Warning Signs following sponsor comments

TOPIC: Turn Warning Signs

STATUS/DATE OF ACTION:

TC Drafts: 01/29/2010, 2/5/2010, 02/08/10, 3/05/10, 3/30/10, 3/31/10, 01/10/11 Revision Yellow

TC Approval: 06/30/10

Transmitted to Sponsors: 10/28/2010

TC Approval following sponsor comments: 1-19-11

Council Approval: 01-20-11

ORIGIN OF REQUEST: Task force James Pline (chair), Tom Heydel, Fred Ranck

AFFECTED SECTIONS OF MUTCD: Section 2C.07 Horizontal Alignment Signs

BACKGROUND:

The NCUTCD recommended the following Guidance Statement: " A Turn (W1-1) sign should be used instead of a Curve sign in advance of curves that have advisory speed of 30 mph or less " The FHWA in their final rulemaking raised this provision from **Guidance "should"** to a **Standard "shall"** requirement. The FHWA decision, FR 74, No. 240 (12/16/2009) Item 117 was based on the comments of a State DOT, two local DOT's and a NCUTCD member suggesting that the statement be changed to a STANDARD to promote uniformity. The comments were as follows;

Kansas DOT (Lee Holmes) Page 672, Line 16: Change the "should" to "shall". Flexibility in signing for curves should be discouraged.

City of Los Angeles, CA (John Fisher - NCUTCD member) Section 2C.07, Page 672, Lines 15-17:

Clear rules are needed for the application of the Turn (W1-1) sign. This Guidance should be changed to a Standard in order to promote uniformity.

The Port Authority of NY & NJ (Jose Rivera) Pg. 672- Lines 15-17: Guidance should also include use of engineering judgment and geometric alignment, not just 30mph or less as was the case in the 2003 edition.

Lee Roadifer (NCUTCD member, works for WY DOT) Page 672, lines 16 & 17: I recommend there be an added condition to the recommended use of the Turn sign beyond having an advisory speed of 30 mph or less. In order for the Turn sign to be recommended, the curve should "look" like a turn to the driver. That is, it should involve a change in horizontal alignment approximating a 90 degree turn. The Turn sign does not look appropriate to the driver when the turn is relatively abrupt (thus necessitating a 30 mph or lower advisory) but only changes the roadway alignment up to roughly 60 degrees.

Mendocino County, CA (Stephen Ford) Page 672, Lines 16-17: The historical distinction between Turn and Curve signs should be maintained. Their consistent use, reinforced by advisory speed plaques, provides drivers with information on the severity of the curve ahead. The use of the Turn (W1-1) and Reverse Turn (W1-3) sign should be the standard in advance of curves that have

52 advisory speeds of 50 km/h (30 mph) or less. The use of the Curve (W1-2) and Reverse Curve (W1-4) sign should be the standard
53 in advance of curves that have advisory speeds of 60 kmh (35 mph) or more.

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55 Three comments relate to a need for a Standard statement with the other two
56 addressing geometrics and engineering judgment. The support for upgrading this
57 provision to a standard statement is not that overwhelming considering the deliberate
58 and extended experience of the RWSTC members, review by the NCUTCD Sponsors,
59 and the considerate approval of the NCUTCD Council.

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61 **HISTORY:**

62 A Turn sign has been a part of the MUTCD since the original 1927 AASHO
63 edition. Initially, the Turn sign was recommended for turns having a radius of less than
64 200 feet. The 1948 MUTCD revised the requirements for a Turn sign to mark curvature
65 over 28 degrees, other curves 15 to 27 degrees with a 45 degree central angle and all
66 curves with a ball-bank indication of 10 degrees or more at speeds less than 31 mph.
67 The 1961, 1971, 1978, and 1988 MUTCD eliminated the curve geometrics and
68 indicated that the Turn sign is intended for use. when the advisory speed is 30 mph or
69 less. A change to the Manual was requested and denied on 9/21/78 that wanted the
70 arrow to more closely resemble the alignment rather than indicate curve severity and
71 delete the reference to speed. The 2000 and 2003 MUTCD established the sanctity of
72 shall, should and may but with horizontal alignment signing being an option based on
73 engineering judgment. Because of the problems with Turn sign applications, the
74 NCUTCD recommended and FHWA approved a footnote to Table 2C-5 stating that
75 "Engineering judgment should be used to determine whether the Turn or Curve sign
76 should be used".

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78 **RESEARCH:**

79 Although the Turn sign has been in use for eighty years, there has been no
80 research addressing the difference between curve and turn signs, driver reaction to
81 each one and clarification of turn sign applications. The long term application of the turn
82 sign has provided some experience and understanding of the sign application by those
83 responsible for alignment signing.

84 The public comprehension of turn and curve signs have been tested finding that
85 drivers have difficulty in explaining the difference between the two signs. A 1993 study
86 by TTI¹ found that the curve sign had more favorable responses (43.6%) than the turn
87 sign (38.2%), however, the questions may have had some influence on the results. A
88 1994 study² of symbol comprehension and legibility by 480 drivers in various age
89 groups rated them as follows;

90 Comprehension By Age Group

91 Sign	18-39	40-59	60-69	70+
92 Right Turn	91%	93%	94%	89%
93 Right Curve	97%	96%	94%	89%

94
95 The Australian signing policies use larger curve signs for higher curve approach
96 speeds and recognize a speed differential for turn sign application. The Zone for using a
97 Turn sign is as follows;

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	85%ile Curve		Curve Advisory Speed	
	Approach Speed Km/h	Mph	Km/h	Mph
102	120	74.4	50 or less	31 or less
103	100	62.0	41.6 or less	25.8 or less
104	80	49.6	33.3 or less	20.6 or less
105	60	37.2	25.0 or less	15.5 or less
106	40	24.8	16.6 or less	10.3 or less

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 108 The result being that there must be a greater speed reduction for the curve at higher
 109 approach speed to justify usage of a turn sign.
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- 111 1. Hawkins, Womack & Mounce, "Driver Comprehension of Warning Signs", TRB
 112 Annual Meeting, Texas Transportation Institute, January 1993.
- 113 2. Dewar, Kline & Swanson, "Age Difference in Comprehension of Traffic Sign
 114 Symbols", Transportation Research Record 1456, TRB, 1994.

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 116 **DISCUSSION**

117 The development of the 2009 MUTCD raised some new issues since it was
 118 determined that horizontal alignment signing shall be required on major roadways while
 119 remaining as an option based on engineering judgment for lesser roadways. Application
 120 of the Turn sign was discussed extensively with consideration of geometric provisions,
 121 differential speed, and the use of engineering studies and engineering judgment. No
 122 strong consensus could be reached so the NCUTCD recommended a Guidance
 123 statement, "A Turn (W1-1) sign should be used in advance of curves with an Advisory
 124 speed of 50 km/h (30 mph) or less" that was also published in the FHWA Notice of
 125 Rulemaking. The rationale' being that as a Guidance statement some engineering
 126 judgment could be used in the field to install a Curve (W1-2) sign if it appeared more
 127 appropriate. Raising the use of a Turn (W1-1) to a Standard mandates that a Turn (W1-
 128 1) sign shall be used any time an Advisory Speed (W13-1) plaque is installed with an
 129 advisory speed of 30 mph or less regardless of the curve geometrics, posted speed,
 130 and engineering studies. Nothing detracts from uniformity more than using an
 131 inappropriate device to sign a condition in the field. If the roadway alignment looks like a
 132 curve in the field it should be signed as a curve and conversely, a sharp change in
 133 alignment should be signed as a turn. The wide range of roadway classifications,
 134 geometrics, posted speed and roadway surfaces on the 5 million miles of public road
 135 system make the application of a singular provision across the variety of field conditions
 136 requires the use of some engineering judgment for realistic signing..

137 The NCUTCD reiterates the previous recommendations that this be a Guidance
 138 statement with some clarifying provisions for the following reasons ;

- 139 1. For the last 10 years, the use of the Turn signs has been based on engineering
 140 judgment with no citation of a problem with this application other than an
 141 expressed need by a few as noted above for standardization and uniformity. It is
 142 not "Uniformity" to sign a change in horizontal alignment as a Turn when it looks
 143 like a curve to the driver.

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2. The requirement mandates a Turn sign on any and all roads when an Advisory Speed plaque of 30 mph or less. is used This may be appropriate on high speed roadways where there is a large speed differential requiring vehicles to slow considerably to the lower advisory speed. However, on lower speed roadways with a 35 or 40 mph speed, the advisory speed may be only 5 to 10 mph lower than the posted speed with the alignment appearing as a curve and not a sharp turn. The lower speed roadways would include city streets, recreational routes, local access roads, gravel and unimproved roads A Guidance statement provides some latitude to not use a Turn sign if it does not fit the field conditions. Also, a speed differential provision limits the use of a Turn sign unless there is a need to make a significant reduction in the approach speed,
 3. The comments indicate a need for the symbol to depict the alignment with a Turn to be used for the sharper right angle turns. The Manual partially accomplishes this by providing special alignment symbols for Hairpin (135°) and Loop (270°) curves. There is not a large visual difference between the 90 degree Turn symbol and the 45 degree Curve symbol. The Task Force developing the 2009 MUTCD requirements recommended that the Turn sign only be used for changes in alignment of approximately 90 degrees. This requirement was not approved by the Technical Committee because of questions relating to what was approximately 90 degrees". The other option would be calling it a right angle turn. The approximate angle appears best since it covers a variation of a few degrees, the Guidance statement makes this a recommended angle not an exact dimension, and it appears to be the best method to describe a roadway alignment that looks like a turn.
 4. The failure to use a Turn sign for alignments with Advisory Speed less than 30 mph became a tort liability issue in the 1980's and 1990's. While drivers may not totally recognize the subtle difference between the two signs, attorneys began to recognize the MUTCD requirements with damages awarded based on using a Curve Sign when a Turn Sign was required. The MUTCD became more of a legal issue in 2000 when the standards were sanctified resulting in the previously cited footnote provisions on use of engineering judgment. The Manual text should avoid situations where the wording becomes the support for a legal decision rather than a clear message to drivers. Either sign provides a clear and simple message that the roadway alignment is changing with a suggested speed for the curve. A reasonable and prudent driver readily recognizes message depicted although it may not be the true pattern of the roadway.
 5. Whereas, an engineering study is required to determine Advisory Speeds; and Table 2C-5 is based on a differential between posted, or statutory speeds, ; and Table 2C-5 provides some choices on traffic control device selection, and there is a need to balance field conditions with visual perceptions and therefore, some engineering judgment is needed to determine the appropriate horizontal alignment signing. You would think that the decision to use any of the devices noted in Table 2C-5 would be a part of an engineering study process so the use of either a curve or turn sign should not be excluded from that decision by this mandated requirement.

- 189 6. The rationale' for the recommended Manual changes based on the above
190 information and discussion are as follows;
- 191 a. The use of a Turn sign should be a Guidance (recommended) statement so
192 that under most situations a Turn sign would be used but permitting the
193 application of some engineering judgment to modify the signing to fit field
194 conditions documented in the engineering study associated with horizontal
195 alignment signing.
- 196 b. The provision for an advisory speed of 30 mph or less has been in existence
197 since 1948 and is retained because of its traditional usage with turn signs for
198 higher speed roadways but modified to reflect a speed difference on lower
199 speed roadways where there is a greater need to decelerate for the sharper
200 alignment. .
- 201 c. It is the consensus that a turn should look like a turn of approximately 90
202 degrees. The Guidance concept provides the latitude to address any minor
203 variations in the angle versus motorist perceptions.
- 204 d. A turn should have some characteristics of making a turn so that if it looks like
205 a turn and drives like a turn, then it should be signed as turn. A speed
206 reduction along with the angle of the turn begins to define this difference
207 between a curve and a turn. A review of Table 2C-5 MUTCD indicates that a
208 15 mph speed differential requires a change in other curve signing and
209 appears to be an appropriate break point for turn versus curve signs. The 15
210 mph differential speed is proposed for 35 mph or less increasing to 30 mph
211 on higher speed roadways. This graduated speed differential is also greater
212 than the 10 mph speed variation that drivers expect in their normal driving
213 activities.

214 215 **RECOMMENDED MUTCD PROVISIONS/ REVISIONS**

216 217 **Section 2C.07 Horizontal Alignment Signs (W1-1 through W1-5, W1-11, W1-15)**

218 219 **Standard:**

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

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

225 226 227 Guidance:

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229 A turn sign (W1-1) should be used instead of a Curve sign in advance of curves
230 when the advisory speed is ½ or less of the posted speed or a speed differential of
231 25 MPH or more.

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235 ⁰³ *Where there are two changes in roadway alignment in opposite directions that are separated*
236 *by a tangent distance of less than 600 feet, the Reverse Turn (W1-3) sign should be used instead*

237 *of multiple Turn (W1-1) signs and the Reverse Curve (W1-4) sign should be used instead of*
238 *multiple Curve (W1-2) signs.*

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240 Option:

241 04 A Winding Road (W1-5) sign may be used instead of multiple Turn (W1-1) or Curve (W1-2) signs
242 where there are three or more changes in roadway alignment each separated by a tangent distance of less
243 than 600 feet.

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245 05 A NEXT XX MILES (W7-3aP) supplemental distance plaque (see Section 2C.55) may be installed
246 below the Winding Road sign where continuous roadway curves exist for a specific distance.

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248 06 If the curve has a change in horizontal alignment of 135 degrees or more, the Hairpin Curve (W1-11)
249 sign may be used instead of a Curve or Turn sign.

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251 07 If the curve has a change of direction of approximately 270 degrees, such as on a cloverleaf interchange
252 ramp, the 270-degree Loop (W1-15) sign may be used instead of a Curve or Turn sign.

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254 Guidance:

255 08 *When the Hairpin Curve sign or the 270-degree Loop sign is installed, either a One-Direction Large*
256 *Arrow (W1-6) sign or Chevron Alignment (W1-8) signs should be installed on the outside of the turn or*
257 *curve.*

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259 VOTE: RWSTC For: 20

260 Opposed : 1

261 Abstentions: 1

262 Approved

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264 VOTE: COUNCIL For: 36

265 Opposed: 0

266 Abstentions: 1

267 approved 1-20-11

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269 C:\ncutcd\january 2011\RW # 8 Turn sign 1-19-11, 1-20-11 approved by council

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