



# National Committee on Uniform Traffic Control Devices

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## NCUTCD Approved Changes to the Manual on Uniform Traffic Control Devices

### TECHNICAL COMMITTEE:

Temporary Traffic Control Committee

### ITEM NUMBER:

19B-TTC-02

### TOPIC:

Use of Positive Protection in Work Zones

### ORIGIN OF REQUEST:

FHWA MUTCD Team

### AFFECTED SECTIONS OF MUTCD:

Section 6D.03 Worker Safety Considerations; Section 6F.84a Positive Protection Devices, Section 6F.85 Temporary Traffic Barriers; Section 6G.02 Work Duration; Chapter 6H. Typical Applications (Notes for Figure 6H-3, Notes for Figure 6H-4, Notes for Figure 6H-6, Notes for Figure 6H-10, Notes for Figure 6H-11, Notes for Figure 6H-12, Notes for Figure 6H-13, Notes for Figure 6H-15, Notes for Figure 6H-17, Notes for Figure 6H-18, Notes for Figure 6H-21, Notes for Figure 6H-22, Notes for Figure 6H-23, Notes for Figure 6H-24, Notes for Figure 6H-25, Notes for Figure 6H-27, Notes for Figure 6H-30, Notes for Figure 6H-31, Notes for Figure 6H-32, Notes for Figure 6H-33, Notes for Figure 6H-35, Notes for Figure 6H-37, Notes for Figure 6H-38, Figure 6H-38, Notes for Figure 6H-40, Notes for Figure 6H-41, Notes for Figure 6H-42, Notes for Figure 6H-43, Notes for Figure 6H-44, Notes for Figure 6H-46).

### DEVELOPMENT HISTORY

- Approved by TTC Technical Committee: 06/20/2019
- Sponsor comments reviewed and modifications approved by TTC Technical Committee: 01/08/2020
- Approved by Edit Committee: 01/08/2020
- Approved by Council: 01/10/2020

*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 through the federal rulemaking process.*

20 **SUMMARY**

21 Per the National Work Zone Safety Clearinghouse, in 2017 there were 799 work zone related  
22 fatalities including 132 workers and 126 pedestrians. Fatalities in work zones have been  
23 increasing steadily from a low of 521 in 2010. There were approximately 37,000 work zone  
24 related injuries in 2017.

25  
26 The 2009 Edition of the MUTCD includes no reference for Infrastructure Owners & Operators  
27 (IOOs) and other practitioners regarding CFR Title 23 Part 630 Subpart K as it relates to the  
28 potential use of Positive Protection Devices in temporary traffic control zones.

29  
30 The Temporary Traffic Control Technical Committee has worked with industry transportation  
31 safety leaders to propose the following changes to specific sections of Part 6 Temporary Traffic  
32 Control of the MUTCD as it relates to considering the use of Positive Protection Devices.

33  
34 **DISCUSSION**

35 The Code of Federal Regulation (CFR) Title 23 Part 630 Subpart K – Temporary Traffic Control  
36 (630.1102 — 630.1110) rule was issued by the Federal Highway Administration (FHWA) in  
37 December 5, 2007 and became effective on December 4, 2008. The purpose was to decrease the  
38 likelihood of highway work zone fatalities and injuries to workers and road users. It applies to  
39 Federal-aid highway projects but is encourage for use on all highway projects.

40  
41 This rule requires transportation agencies that receive Federal-aid highway funding to consider  
42 road user and worker safety in their processes, procedures, and/or guidance. This included use of  
43 positive protection devices to prevent the intrusion of motorized traffic into the work space and  
44 other potentially hazardous areas in the work zone. Positive protection devices include portable  
45 concrete barriers, ballast filled barriers, steel barriers, moveable concrete barriers, portable  
46 barriers, shadow vehicles with truck or trailer mounter attenuators (TMA) and vehicle arrestor  
47 systems. To comply with this requirement, agencies developed new or modified their existing  
48 policies, procedures, and/or guidance. The CFR is specific to Federal-aid highway funding, but  
49 the positive protection principles are applicable to all temporary traffic control zones and are  
50 appropriate for inclusion in the MUTCD.

51  
52 With the timing of the rulemaking process for the 2009 Edition of the MUTCD, there is no  
53 reference in the Manual for Infrastructure Owners & Operators (IOOs) and other practitioners to  
54 find out more information regarding CFR Title 23 Part 630 Subpart K as it relates to the potential  
55 use of Positive Protection Devices in temporary traffic control zones. Industry leaders such as  
56 the American Traffic Safety Services Association (ATSSA) produced documents such as  
57 “Guidelines on the Use of Positive Protection in Temporary Traffic Control Zones” and the  
58 “Work Zone Positive Protection Toolbox” under the Federal Highway Administration (FHWA)  
59 Work Zone Safety Grant. The “National Work Zone Safety Information Clearinghouse” and the  
60 FHWA’s website on Positive Protection give additional information to assist IOOs and other  
61 practitioners decide on the use of positive protection devices in their temporary traffic control  
62 zones.

63  
64 The Temporary Traffic Control Technical Committee has worked with industry transportation  
65 safety leaders to propose the following changes to specific sections of Part 6 Temporary Traffic

66 Control of the MUTCD as it relates to considering the use of Positive Protection Devices. This  
67 includes:

- 68 • A reference to Section 6F.85 Temporary Traffic Barriers within Section 6D.03 Worker  
69 Safety Considerations
- 70 • Adding a new section, Section 6F-84a that covers “Positive Protective Devices” and lists  
71 the corresponding support and guidance statements on when to consider the use of  
72 Positive Protection Devices.
- 73 • Adding a reference to CFR Title 23 Part 630 Subpart K within Section Section 6F.84a  
74 Positive Protective Devices.
- 75 • Modified a Support statement in Section 6G.85 Temporary Traffic Barriers to add a new  
76 sentence that lists of examples of different devices included in this category.
- 77 • A reference to Section 6F-84a Positive Protective Devices in Section 6G.02 Work  
78 Duration regarding consideration for using highly portable barriers for short-term or  
79 mobile operations.
- 80 • Adding the Option statement: “Positive protection devices may be used per Section  
81 6F.84a” within the notes pages of specific Typical Applications in Chapter 6H.
- 82 • For Typical Applications in Chapter 6H that currently depict the use of a truck mounted  
83 attenuator, the Option statement: “Additional positive protection devices may be used per  
84 Section 6F.84a” will be added to the notes pages.
- 85 • All notes will be renumbered to reflect a higher priority placement for the use of positive  
86 protective devices.

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## 88 **RECOMMENDED MUTCD CHANGES**

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

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**PART 1 GENERAL**  
**CHAPTER 1A. GENERAL**

100 **Section 1A.11 Relation to Other Publications**

101 Support:

102 [XX. “Guidelines on the Use of Positive Protection in Temporary Traffic Control Zones,” 2010](#)  
103 [Edition \(FHWA\)](#)

104  
105 **PART 6 TEMPORARY TRAFFIC CONTROLS**  
106 **CHAPTER 6D. PEDESTRIAN AND WORKER SAFETY**

107  
108 **Section 6D.03 Worker Safety Considerations**

109 Support:

110 01 Equally as important as the safety of road users traveling through the TTC zone is the safety  
111 of workers. TTC zones present temporary and constantly changing conditions that are  
112 unexpected by the road user. This creates an even higher degree of vulnerability for workers on  
113 or near the roadway.

114 02 Maintaining TTC zones with road user flow inhibited as little as possible, and using TTC  
115 devices that get the road user’s attention and provide positive direction are of particular  
116 importance. Likewise, equipment and vehicles moving within the activity area create a risk to  
117 workers on foot. When possible, the separation of moving equipment and construction vehicles  
118 from workers on foot provides the operator of these vehicles with a greater separation clearance  
119 and improved sight lines to minimize exposure to the hazards of moving vehicles and equipment.

120 *Guidance:*

121 03 *The following are the key elements of worker safety and TTC management that should be*  
122 *considered to improve worker safety:*

- 123 A. *Training—all workers should be trained on how to work next to motor vehicle traffic in a*  
124 *way that minimizes their vulnerability. Workers having specific TTC responsibilities*  
125 *should be trained in TTC techniques, device usage, and placement.*
- 126 B. *Temporary Traffic Barriers—temporary traffic barriers should be placed along the work*  
127 *space depending on factors such as lateral clearance of workers from adjacent traffic,*  
128 *speed of traffic, duration and type of operations, time of day, and volume of traffic ([See](#)*  
129 *[Section 6F.85](#)).*
- 130 C. *Speed Reduction—reducing the speed of vehicular traffic, mainly through regulatory*  
131 *speed zoning, funneling, lane reduction, or the use of uniformed law enforcement officers*  
132 *or flaggers, should be considered.*
- 133 D. *Activity Area—planning the internal work activity area to minimize backing-up*  
134 *maneuvers of construction vehicles should be considered to minimize the exposure to*  
135 *risk.*
- 136 E. *Worker Safety Planning—a trained person designated by the employer should conduct a*  
137 *basic hazard assessment for the worksite and job classifications required in the activity*  
138 *area. This safety professional should determine whether engineering, administrative, or*  
139 *personal protection measures should be implemented. This plan should be in accordance*  
140 *with the Occupational Safety and Health Act of 1970, as amended, “General Duty*  
141 *Clause” Section 5(a)(1) - Public Law 91-596, 84 Stat. 1590, December 29, 1970, as*  
142 *amended, and with the requirement to assess worker risk exposures for each job site and*

143 *job classification, as per 29 CFR 1926.20 (b)(2) of “Occupational Safety and Health*  
144 *Administration Regulations, General Safety and Health Provisions” (see Section 1A.11).*

146 **PART 6 TEMPORARY TRAFFIC CONTROLS**  
147 **CHAPTER 6F. TEMPORARY TRAFFIC CONTROL ZONE DEVICES**

149 **Section 6F.84a Positive Protection Devices**

150 **Support:**

151 01 The function of positive protection devices is to reduce risk to workers and road users by  
152 reducing the risk of vehicle intrusion into the work space.

153 02 Examples of positive protection devices include temporary traffic barriers (see Section  
154 6F.85), truck-mounted attenuators (see Section 6F.86), and vehicle arrestor systems.

155 **Guidance:**

156 04 The need for positive protection devices should be based on engineering judgment and  
157 should consider the following factors:

158 A. Work zones that provide workers no means of escape from motorized traffic (e.g.,  
159 tunnels, bridges, etc.);

160 B. Longer duration work zones (e.g., two weeks or more) resulting in substantial worker  
161 exposure to motorized traffic;

162 C. Projects with high anticipated operating speeds (e.g., 45 mph or higher), especially  
163 when combined with high traffic volumes;

164 D. Work operations that place workers close to travel lanes open to traffic; and

165 E. Roadside hazards, such as drop-offs or unfinished bridge decks, that will remain in  
166 place overnight or longer.

167 **Support:**

168 05 For additional information see the “Guidelines on the Use of Positive Protection in  
169 Temporary Traffic Control Zones” (see Section 1A.11) and 23 CFR Part 630, Subpart K.

171 **Section 6F.85 Temporary Traffic Barriers**

172 **Support:**

173 01 Temporary traffic barriers are devices designed to help prevent penetration by vehicles  
174 while minimizing injuries to vehicle occupants, and to protect workers, bicyclists, and  
175 pedestrians. Examples of temporary traffic barriers include portable concrete barriers, ballast  
176 filled barriers, steel barriers, portable barriers, and moveable concrete barriers.

177 02 The four primary functions of temporary traffic barriers are:

178 A. To keep vehicular traffic from entering work areas, such as excavations or material  
179 storage sites;

180 B. To separate workers, bicyclists, and pedestrians from motor vehicle traffic;

181 C. To separate opposing directions of vehicular traffic; and

182 D. To separate vehicular traffic, bicyclists, and pedestrians from the work area such as false  
183 work for bridges and other exposed objects.

184 **Option:**

185 03 Temporary traffic barriers may be used to separate two-way vehicular traffic.

186 **Guidance:**

187 ~~04—Because the protective requirements of a TTC situation have priority in determining the~~  
188 ~~need for temporary traffic barriers, their use should be based on an engineering.~~

189 **Standard:**  
190 0504 Temporary traffic barriers shall be supplemented with standard delineation, pavement  
191 markings, or channelizing devices for improved daytime and nighttime visibility if they are  
192 used to channelize vehicular traffic. The delineation color shall match the applicable  
193 pavement marking color.

194 0605 Temporary traffic barriers, including their end treatments, shall be crashworthy. In  
195 order to mitigate the effect of striking the upstream end of a temporary traffic barrier, the  
196 end shall be installed in accordance with AASHTO's "Roadside Design Guide" (see Section  
197 1A.11) by flaring until the end is outside the acceptable clear zone or by providing  
198 crashworthy end treatments.

199 Option:

200 0706 Warning lights or steady-burn lamps may be mounted on temporary traffic barrier  
201 installations.

202 Support:

203 0807 Movable barriers are capable of being repositioned laterally using a transfer vehicle that  
204 travels along the barrier. Movable barriers enable short-term closures to be installed and removed  
205 on long-term projects. Providing a barrier-protected work space for short-term closures and  
206 providing unbalanced flow to accommodate changes in the direction of peak-period traffic flows  
207 are two of the advantages of using movable barriers.

208 0908 Figure 6H-45 shows a temporary reversible lane using movable barriers. The notable feature  
209 of the movable barrier is that in both Phase A and Phase B, the lanes used by opposing traffic are  
210 separated by a barrier.

211 1009 Figure 6H-34 shows an exterior lane closure using a temporary traffic barrier. Notes 7  
212 through 9 address the option of using a movable barrier. By using a movable barrier, the barrier  
213 can be positioned to close the lane during the off-peak periods and can be relocated to open the  
214 lane during peak periods to accommodate peak traffic flows. With one pass of the transfer  
215 vehicle, the barrier can be moved out of the lane and onto the shoulder. Furthermore, if so  
216 desired, with a second pass of the transfer vehicle, the barrier could be moved to the roadside  
217 beyond the shoulder.

218 1110 More specific information on the use of temporary traffic barriers is contained in Chapters 8  
219 and 9 of AASHTO's "Roadside Design Guide" (see Section 1A.11).

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## PART 6 TEMPORARY TRAFFIC CONTROLS

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### CHAPTER 6G. TYPE OF TEMPORARY TRAFFIC CONTROL ZONE ACTIVITIES

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#### Section 6G.02 Work Duration

224 Support:

225 01 Work duration is a major factor in determining the number and types of devices used in TTC  
226 zones. The duration of a TTC zone is defined relative to the length of time a work operation  
227 occupies a spot location.  
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229 **Standard:**

230 02 The five categories of work duration and their time at a location shall be:

231 A. Long-term stationary is work that occupies a location more than 3 days.

232 B. Intermediate-term stationary is work that occupies a location more than one  
233 daylight period up to 3 days, or nighttime work lasting more than 1 hour.



234 **C. Short-term stationary is daytime work that occupies a location for more than 1 hour**  
235 **within a single daylight period.**

236 **D. Short duration is work that occupies a location up to 1 hour.**

237 **E. Mobile is work that moves intermittently or continuously.**

238 Support:

239 03 At long-term stationary TTC zones, there is ample time to install and realize benefits from  
240 the full range of TTC procedures and devices that are available for use. Generally, larger  
241 channelizing devices, temporary roadways, ~~and~~ temporary traffic barriers, and positive  
242 protection devices are used.

243 **Standard:**

244 04 **Since long-term operations extend into nighttime, retroreflective and/or illuminated**  
245 **devices shall be used in long-term stationary TTC zones.**

246 *Guidance:*

247 05 *Inappropriate markings in long-term stationary TTC zones should be removed and replaced*  
248 *with temporary markings.*

249 Support:

250 06 In intermediate-term stationary TTC zones, it might not be feasible or practical to use  
251 procedures or devices that would be desirable for long-term stationary TTC zones, such as  
252 altered pavement markings, temporary traffic barriers, ~~and~~ temporary roadways, and positive  
253 protection devices. The increased time to place and remove these devices in some cases could  
254 significantly lengthen the project, thus increasing exposure time.

255 **Standard:**

256 07 **Since intermediate-term operations extend into nighttime, retroreflective and/or**  
257 **illuminated devices shall be used in intermediate-term stationary TTC zones.**

258 Support:

259 08 Most maintenance and utility operations are short-term stationary work.

260 09 As compared to stationary operations, mobile and short-duration operations are activities  
261 that might involve different treatments. Devices having greater mobility might be necessary such  
262 as signs mounted on trucks. Devices that are larger, more imposing, or more visible can be used  
263 effectively and economically. The mobility of the TTC zone is important.

264 *Guidance:*

265 10 *Safety in short-duration or mobile operations should not be compromised by using fewer*  
266 *devices simply because the operation will frequently change its location.*

267 Option:

268 11 Positive protection devices may be used in short duration or mobile operations when the  
269 provisions in Section 6F.84a, paragraph 04 exist.

270 +12 Appropriately colored or marked vehicles with high-intensity rotating, flashing, oscillating,  
271 or strobe lights may be used in place of signs and channelizing devices for short-duration or  
272 mobile operations. These vehicles may be augmented with signs or arrow boards.

273 Support:

274 +13 During short-duration work, it often takes longer to set up and remove the TTC zone than to  
275 perform the work. Workers face hazards in setting up and taking down the TTC zone. Also, since  
276 the work time is short, delays affecting road users are significantly increased when additional  
277 devices are installed and removed.

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279 Option:  
280 ~~13~~ 14 Considering these factors, simplified control procedures may be warranted for short-duration  
281 work. A reduction in the number of devices may be offset by the use of [positive protection](#)  
282 [devices](#) or other more dominant devices such as high-intensity rotating, flashing, oscillating, or  
283 strobe lights on work vehicles.

284 Support:  
285 ~~14~~ 15 Mobile operations often involve frequent short stops for activities such as litter cleanup,  
286 pothole patching, or utility operations, and are similar to short-duration operations.

287 *Guidance:*  
288 ~~15~~ 16 *Warning signs and high-intensity rotating, flashing, oscillating, or strobe lights should be*  
289 *used on the vehicles that are participating in the mobile work.*

290 Option:  
291 ~~16~~ 17 Flags and/or channelizing devices may additionally be used and moved periodically to keep  
292 them near the mobile work area.

293 ~~17~~ 18 Flaggers may be used for mobile operations that often involve frequent short stops.

294 Support:  
295 ~~18~~ 19 Mobile operations also include work activities where workers and equipment move along  
296 the road without stopping, usually at slow speeds. The advance warning area moves with the  
297 work area.

298 *Guidance:*  
299 ~~19~~ 20 *When mobile operations are being performed, a shadow vehicle equipped with an arrow*  
300 *board or a sign should follow the work vehicle, especially when vehicular traffic speeds or*  
301 *volumes are high. Where feasible, warning signs should be placed along the roadway and moved*  
302 *periodically as work progresses.*

303 ~~20~~ 21 *Under high-volume conditions, consideration should be given to scheduling mobile*  
304 *operations work during off-peak hours.*

305 ~~21~~ 22 *If there are mobile operations on a high-speed travel lane of a multi-lane divided highway,*  
306 *arrow boards should be used.*

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### 308 **Standard:**

309 ~~22~~ 23 **Mobile operations shall have appropriate devices on the equipment (that is, high-**  
310 **intensity rotating, flashing, oscillating, or strobe lights, signs, or special lighting), or shall**  
311 **use a separate vehicle with appropriate warning devices.**

312 Option:

313 ~~23~~ 24 For mobile operations that move at speeds of less than 3 mph, mobile signs or stationary  
314 signing that is periodically retrieved and repositioned in the advance warning area may be used.

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**PART 6 TEMPORARY TRAFFIC CONTROLS  
CHAPTER 6H. TYPICAL APPLICATIONS**

**Notes for Figure 6H-3—Typical Application 3  
Work on the Shoulders**

*Guidance:*

1. A *SHOULDER WORK* sign should be placed on the left side of the roadway for a divided or one-way street only if the left shoulder is affected.

*Option:*

2. [Positive protection devices may be used per Section 6F.84a.](#)

~~2.3.~~ The Workers symbol signs may be used instead of SHOULDER WORK signs.

~~3.4.~~ The SHOULDER WORK AHEAD sign on an intersecting roadway may be omitted where drivers emerging from that roadway will encounter another advance warning sign prior to this activity area.

~~4.5.~~ For short duration operations of 60 minutes or less, all signs and channelizing devices may be eliminated if a vehicle with activated high-intensity rotating, flashing, oscillating, or strobe lights is used.

~~5.6.~~ Vehicle hazard warning signals may be used to supplement high-intensity rotating, flashing, oscillating, or strobe lights.

**Standard:**

~~6.7.~~ **Vehicle hazard warning signals shall not be used instead of the vehicle’s high-intensity rotating, flashing, oscillating, or strobe lights.**

~~7.8.~~ **When paved shoulders having a width of 8 feet or more are closed, at least one advance warning sign shall be used. In addition, channelizing devices shall be used to close the shoulder in advance to delineate the beginning of the work space and direct vehicular traffic to remain within the traveled way.**

343 **Notes for Figure 6H-4—Typical Application 4**

344 **Short Duration or Mobile Operation on a Shoulder**

345 *Guidance:*

346 *1. In those situations where multiple work locations within a limited distance make it practical to*  
347 *place stationary signs, the distance between the advance warning sign and the work should not*  
348 *exceed 5 miles.*

349 *2. In those situations where the distance between the advance signs and the work is 2 miles to 5*  
350 *miles, a Supplemental Distance plaque should be used with the ROAD WORK AHEAD sign.*

351 *Option:*

352 [3. Additional positive protection devices may be used per Section 6F.84a.](#)

353 ~~3.4.~~ The ROAD WORK NEXT XX MILES sign may be used instead of the ROAD WORK  
354 AHEAD sign if the work locations occur over a distance of more than 2 miles.

355 ~~4.5.~~ Stationary warning signs may be omitted for short duration or mobile operations if the work  
356 vehicle displays high-intensity rotating, flashing, oscillating, or strobe lights.

357 ~~5.6.~~ Vehicle hazard warning signals may be used to supplement high-intensity rotating, flashing,  
358 oscillating, or strobe lights.

359 **Standard:**

360 ~~6.7.~~ **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity**  
361 **rotating, flashing, oscillating, or strobe lights.**

362 ~~7.8.~~ **If an arrow board is used for an operation on the shoulder, the caution mode shall be**  
363 **used.**

364 ~~8.9.~~ **Vehicle-mounted signs shall be mounted in a manner such that they are not obscured**  
365 **by equipment or supplies. Sign legends on vehicle-mounted signs shall be covered or turned**  
366 **from view when work is not in progress.**

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368 **Notes for Figure 6H-6—Typical Application 6**  
369 **Shoulder Work with Minor Encroachment**

370 *Guidance:*

- 371 1. All lanes should be a minimum of 10 feet in width as measured to the near face of the  
372 channelizing devices.  
373 2. The treatment shown should be used on a minor road having low speeds. For higher-  
374 speed traffic conditions, a lane closure should be used.

375 *Option:*

376 3. [Additional positive protection devices may be used per Section 6F.84a.](#)

377 ~~3.4.~~ For short-term use on low-volume, low-speed roadways with vehicular traffic that does  
378 not include longer and wider heavy commercial vehicles, a minimum lane width of 9 feet  
379 may be used.

380 ~~4.5.~~ Where the opposite shoulder is suitable for carrying vehicular traffic and of adequate  
381 width, lanes may be shifted by use of closely-spaced channelizing devices, provided that the  
382 minimum lane width of 10 feet is maintained.

383 ~~5.6.~~ Additional advance warning may be appropriate, such as a ROAD NARROWS sign.

384 ~~6.7.~~ Temporary traffic barriers may be used along the work space.

385 ~~7.8.~~ The shadow vehicle may be omitted if a taper and channelizing devices are used.

386 ~~8.9.~~ A truck-mounted attenuator may be used on the shadow vehicle.

387 ~~9.10.~~ For short-duration work, the taper and channelizing devices may be omitted if a  
388 shadow vehicle with activated high-intensity rotating, flashing, oscillating, or strobe lights is used.

389 ~~10.11.~~ Vehicle hazard warning signals may be used to supplement high-intensity  
390 rotating, flashing, oscillating, or strobe lights.

391 **Standard:**

392 ~~11.12.~~ **Vehicle-mounted signs shall be mounted in a manner such that they are not**  
393 **obscured by equipment or supplies. Sign legends on vehicle-mounted signs shall be**  
394 **covered or turned from view when work is not in progress.**

395 ~~12.13.~~ **Shadow and work vehicles shall display high-intensity rotating, flashing,**  
396 **oscillating, or strobe lights.**

397 ~~13.14.~~ **Vehicle hazard warning signals shall not be used instead of the vehicle's**  
398 **high-intensity rotating, flashing, oscillating, or strobe lights.**

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**Notes for Figure 6H-10—Typical Application 10  
Lane Closure on a Two-Lane Road Using Flaggers**

Option:

1. [Positive protection devices may be used per Section 6F.84a.](#)
- 1.2. For low-volume situations with short work zones on straight roadways where the flagger is visible to road users approaching from both directions, a single flagger, positioned to be visible to road users approaching from both directions, may be used (see Chapter 6E).
- ~~2.3.~~ The ROAD WORK AHEAD and the END ROAD WORK signs may be omitted for short-duration operations.
- ~~3.4.~~ Flashing warning lights and/or flags may be used to call attention to the advance warning signs. A BE PREPARED TO STOP sign may be added to the sign series.

Guidance:

~~4.5.~~ *The buffer space should be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped*

Standard:

~~5.6.~~ **At night, flagger stations shall be illuminated, except in emergencies.**

Guidance:

~~6.7.~~ *When used, the BE PREPARED TO STOP sign should be located between the Flagger sign and the ONE LANE ROAD sign.*

~~7.8.~~ *When a grade crossing exists within or upstream of the transition area and it is anticipated that queues resulting from the lane closure might extend through the grade crossing, the TTC zone should be extended so that the transition area precedes the grade crossing.*

~~8.9.~~ *When a grade crossing equipped with active warning devices exists within the activity area, provisions should be made for keeping flaggers informed as to the activation status of these warning devices.*

~~9.10.~~ *When a grade crossing exists within the activity area, drivers operating on the left-hand side of the normal center line should be provided with comparable warning devices as for drivers operating on the right-hand side of the normal center line.*

~~10.11.~~ *Early coordination with the railroad company or light rail transit agency should occur before work starts.*

Option:

~~11.12.~~ A flagger or a uniformed law enforcement officer may be used at the grade crossing to minimize the probability that vehicles are stopped within 15 feet of the grade crossing, measured from both sides of the outside rails.

**Notes for Figure 6H-11—Typical Application 11**  
**Lane Closure on a Two-Lane Road with Low Traffic Volumes**

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Option:

1. [Positive protection devices may be used per Section 6F.84a.](#)
- ~~2.~~ This TTC zone application may be used as an alternate to the TTC application shown in Figure 6H-10 (using flaggers) when the following conditions exist:
  - a. Vehicular traffic volume is such that sufficient gaps exist for vehicular traffic that must yield.
  - b. Road users from both directions are able to see approaching vehicular traffic through and beyond the worksite and have sufficient visibility of approaching vehicles.
- ~~3.~~ The Type B flashing warning lights may be placed on the ROAD WORK AHEAD and the ONE LANE ROAD AHEAD signs whenever a night lane closure is necessary.

449 **Notes for Figure 6H-12—Typical Application 12**  
450 **Lane Closure on a Two-Lane Road Using Traffic Control Signals**

451 **Standard:**

- 452 **1. Temporary traffic control signals shall be installed and operated in accordance with**  
453 **the provisions of Part 4. Temporary traffic control signals shall meet the physical**  
454 **display and operational requirements of conventional traffic control signals.**
- 455 **2. Temporary traffic control signal timing shall be established by authorized officials.**  
456 **Durations of red clearance intervals shall be adequate to clear the one-lane section**  
457 **of conflicting vehicles.**
- 458 **3. When the temporary traffic control signal is changed to the flashing mode, either**  
459 **manually or automatically, red signal indications shall be flashed to both**  
460 **approaches.**
- 461 **4. Stop lines shall be installed with temporary traffic control signals for intermediate**  
462 **and long-term closures. Existing conflicting pavement markings and raised**  
463 **pavement marker reflectors between the activity area and the stop line shall be**  
464 **removed. After the temporary traffic control signal is removed, the stop lines and**  
465 **other temporary pavement markings shall be removed and the permanent**  
466 **pavement markings restored.**
- 467 **5. Safeguards shall be incorporated to avoid the possibility of conflicting signal**  
468 **indications at each end of the TTC zone.**

469 *Guidance:*

- 470 *6. Where no-passing lines are not already in place, they should be added.*
- 471 *7. Adjustments in the location of the advance warning signs should be made as needed to*  
472 *accommodate the horizontal or vertical alignment of the roadway, recognizing that the*  
473 *distances shown for sign spacings are minimums. Adjustments in the height of the signal*  
474 *heads should be made as needed to conform to the vertical alignment.*

475 *Option:*

- 476 8. Positive protection devices may be used per Section 6F.84a.
- 477 ~~8.~~ 9. Flashing warning lights shown on the ROAD WORK AHEAD and the ONE LANE  
478 ROAD AHEAD signs may be used.
- 479 ~~9-10.~~ Removable pavement markings may be used.

480 *Support:*

- 481 ~~10-11.~~ Temporary traffic control signals are preferable to flaggers for long-term projects  
482 and other activities that would require flagging at night.
- 483 ~~11-12.~~ The maximum length of activity area for one-way operation under temporary  
484 traffic control signal control is determined by the capacity required to handle the peak  
485 demand.

486



487 **Notes for Figure 6H-13—Typical Application 13**  
488 **Temporary Road Closure**

489 Support:

490 1. Conditions represented are a planned closure not exceeding 20 minutes during the daytime.

491 **Standard:**

492 **2. A flagger or uniformed law enforcement officer shall be used for this application. The**  
493 **flagger, if used for this application, shall follow the procedures provided in Sections 6E.07**  
494 **and 6E.08.**

495 *Guidance:*

496 *3. The uniformed law enforcement officer, if used for this application, should follow the*  
497 *procedures provided in Sections 6E.07 and 6E.08.*

498 Option:

499 4. A BE PREPARED TO STOP sign may be added to the sign series.

500 [5. Positive protection devices may be used per Section 6F.84a.](#)

501 *Guidance:*

502 ~~5.6.~~ *When used, the BE PREPARED TO STOP sign should be located before the Flagger symbol*  
503 *sign.*

504

505 **Notes for Figure 6H-15—Typical Application 15**  
506 **Work in the Center of a Road with Low Traffic Volumes**

507 *Guidance:*

- 508 7. *The lanes on either side of the center work space should have a minimum width of 10*  
509 *feet as measured from the near edge of the channelizing devices to the edge of the*  
510 *pavement or the outside edge of the paved shoulder.*

511 *Option:*

512 2. [Positive protection devices may be used per Section 6F.84a.](#)

513 ~~2.3.~~ Flashing warning lights and/or flags may be used to call attention to the advance  
514 warning signs.

515 ~~3.4.~~ If the closure continues overnight, warning lights may be used on the channelizing  
516 devices.

517 ~~4.5.~~ A lane width of 9 feet may be used for short-term stationary work on low-volume, low-  
518 speed roadways when motor vehicle traffic does not include longer and wider heavy  
519 commercial vehicles.

520 ~~5.6.~~ A work vehicle displaying high-intensity rotating, flashing, oscillating, or strobe lights  
521 may be used instead of the channelizing devices forming the tapers or the high-level  
522 warning devices.

523 ~~6.7.~~ Vehicle hazard warning signals may be used to supplement high-intensity rotating,  
524 flashing, oscillating, or strobe lights.

525 **Standard:**

526 **~~7.8.~~ Vehicle hazard warning signals shall not be used instead of the vehicle's high-**  
527 **intensity rotating, flashing, oscillating, or strobe lights.**

528

529 **Notes for Figure 6H-17—Typical Application 17**  
530 **Mobile Operations on a Two-Lane Road**

531 **Standard:**

- 532 **1. Vehicle-mounted signs shall be mounted in a manner such that they are not**  
533 **obscured by equipment or supplies. Sign legends on vehicle-mounted signs shall be**  
534 **covered or turned from view when work is not in progress.**  
535 **2. Shadow and work vehicles shall display high-intensity rotating, flashing, oscillating,**  
536 **or strobe lights.**  
537 **3. If an arrow board is used, it shall be used in the caution mode.**

538 *Guidance:*

- 539 *4. Where practical and when needed, the work and shadow vehicles should pull over*  
540 *periodically to allow vehicular traffic to pass.*  
541 *5. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should*  
542 *maintain the minimum distance from the work vehicle and proceed at the same speed.*  
543 *The shadow vehicle should slow down in advance of vertical or horizontal curves that*  
544 *restrict sight distance.*  
545 *6. The shadow vehicles should also be equipped with two high-intensity flashing lights*  
546 *mounted on the rear, adjacent to the sign.*

547 *Option:*

548 7. Additional positive protection devices may be used per Section 6F.84a.

549 ~~7.8.~~ The distance between the work and shadow vehicles may vary according to terrain,  
550 paint drying time, and other factors.

551 ~~8.9.~~ Additional shadow vehicles to warn and reduce the speed of oncoming or opposing  
552 vehicular traffic may be used. Law enforcement vehicles may be used for this purpose.

553 ~~9.10.~~ A truck-mounted attenuator may be used on the shadow vehicle or on the work  
554 vehicle.

555 ~~10.11.~~ If the work and shadow vehicles cannot pull over to allow vehicular traffic to pass  
556 frequently, a DO NOT PASS sign may be placed on the rear of the vehicle blocking the  
557 lane.

558 *Support:*

559 ~~11.12.~~ Shadow vehicles are used to warn motor vehicle traffic of the operation ahead.

560 **Standard:**

561 ~~12.13.~~ **Vehicle hazard warning signals shall not be used instead of the vehicle's**  
562 **high-intensity rotating, flashing, oscillating, or strobe lights.**  
563

564 **Notes for Figure 6H-18—Typical Application 18**  
565 **Lane Closure on a Minor Street**

566 **Standard:**

567 **1. This TTC shall be used only for low-speed facilities having low traffic volumes.**

568 Option:

569 2. Where the work space is short, where road users can see the roadway beyond, and where  
570 volume is low, vehicular traffic may be self-regulating.

571 **Standard:**

572 **3. Where vehicular traffic cannot effectively self-regulate, one or two flaggers shall be used**  
573 **as illustrated in Figure 6H-10.**

574 Option:

575 4. Flashing warning lights and/or flags may be used to call attention to the advance warning  
576 signs.

577 5. A truck-mounted attenuator may be used on the work vehicle and the shadow vehicle.

578 [6. Additional positive protection devices may be used per Section 6F.84a.](#)

579

580 **Notes for Figure 6H-21—Typical Application 21**  
581 **Lane Closure on the Near Side of an Intersection**

582 **Standard:**

- 583 **1. The merging taper shall direct vehicular traffic into either the right-hand or left-**  
584 **hand lane, but not both.**

585 *Guidance:*

- 586 *2. In this typical application, a left taper should be used so that right-turn movements will*  
587 *not impede through motor vehicle traffic. However, the reverse should be true for left-*  
588 *turn movements.*  
589 *3. If the work space extends across a crosswalk, the crosswalk should be closed using the*  
590 *information and devices shown in Figure 6H-29.*

591 *Option:*

- 592 4. Positive protection devices may be used per Section 6F.84a.  
593 ~~4.5.~~ Flashing warning lights and/or flags may be used to call attention to the advance  
594 warning signs.  
595 ~~5.6.~~ A shadow vehicle with a truck-mounted attenuator may be used.  
596 ~~6.7.~~ A work vehicle with high-intensity rotating, flashing, oscillating, or strobe lights may  
597 be used with the high-level warning device.  
598 ~~7.8.~~ Vehicle hazard warning signals may be used to supplement high-intensity rotating,  
599 flashing, oscillating, or strobe lights.

600 **Standard:**

- 601 **8.9. Vehicle hazard warning signals shall not be used instead of the vehicle's high-**  
602 **intensity rotating, flashing, oscillating, or strobe lights.**  
603

604 **Notes for Figure 6H-22—Typical Application 22**  
605 **Right-Hand Lane Closure on the Far Side of an Intersection**

606 *Guidance:*

- 607 1. *If the work space extends across a crosswalk, the crosswalk should be closed using the*  
608 *information and devices shown in Figure 6H-29.*

609 *Option:*

610 2. Positive protection devices may be used per Section 6F.84a.

611 ~~2.3.~~ The normal procedure is to close on the near side of the intersection any lane that is not  
612 carried through the intersection, as shown. ~~However, W~~hen this results in the closure of a  
613 right-hand lane having significant right turning movements, then the right-hand lane may be  
614 restricted to right turns only requiring through traffic to utilize the left lane, as shown. ~~This~~  
615 ~~procedure increases the through capacity by eliminating right turns from the open through~~  
616 ~~lane.~~ [Approved by NCUTCD Council, June 2014].

617 ~~3.4.~~ For intersection approaches reduced to a single lane, left-turning movements may be  
618 prohibited to maintain capacity for through vehicular traffic.

619 ~~4.5.~~ Flashing warning lights and/or flags may be used to call attention to the advance  
620 warning signs.

621 ~~5.6.~~ Where the turning radius is large, it may be possible to create a right-turn island using  
622 channelizing devices or pavement markings.

623 ~~6.7.~~ If “dimension A” is not available to create a temporary right-turn lane, the installation  
624 of continuous channelizers from the end of the taper to the intersection may occur. As a  
625 result, the “RIGHT-LANE MUST TURN RIGHT” signs would not be installed. [Approved  
626 by NCUTCD Council, June 2014].

627



628 **Notes for Figure 6H-23—Typical Application 23**  
629 **Left-Hand Lane Closure on the Far Side of an Intersection**

630 *Guidance:*

- 631 2. *If the work space extends across a crosswalk, the crosswalk should be closed using the*  
632 *information and devices shown in Figure 6H-29.*

633 *Option:*

634 [2. Positive protection devices may be used per Section 6F.84a.](#)

635 ~~2.3.~~ Flashing warning lights and/or flags may be used to call attention to the advance  
636 warning signs.

637 ~~3.4.~~ The normal procedure is to close on the near side of the intersection any lane that is not  
638 carried through the intersection. However, when this results in the closure of a left lane  
639 having significant left-turning movements, then the left lane may be reopened as a turn bay  
640 for left turns only, as shown.

641 *Support:*

642 [4.5.](#) By first closing off the left lane and then reopening it as a turn bay, the left-turn  
643 bay allows storage of turning vehicles so that the movement of through traffic is not  
644 impeded. A left-turn bay that is long enough to accommodate all turning vehicles during a  
645 traffic signal cycle will provide the maximum benefit for through traffic. Also, an island is  
646 created with channelizing devices that allows the LEFT LANE MUST TURN LEFT sign to  
647 be repeated on the left adjacent to the lane that it controls.  
648

649 **Notes for Figure 6H-24—Typical Application 24**  
650 **Half Road Closure on the Far Side of an Intersection**

651 *Guidance:*

- 652 1. *If the work space extends across a crosswalk, the crosswalk should be closed using the*  
653 *information and devices shown in Figure 6H-29.*
- 654 2. *When turn prohibitions are implemented, two turn prohibition signs should be used, one*  
655 *on the near side and, space permitting, one on the far side of the intersection.*

656 *Option:*

657 3. [Positive protection devices may be used per Section 6F.84a.](#)

658 ~~3.4.~~ A buffer space may be used between opposing directions of vehicular traffic as shown  
659 in this application.

660 ~~4.5.~~ The normal procedure is to close on the near side of the intersection any lane that is not  
661 carried through the intersection, as shown. ~~However,~~ When this results in the closure of a  
662 right-hand lane having if there is a significant right-turning movement, then the right-hand  
663 lane may be restricted to right turns only requiring through traffic to utilize the left lane, ~~as~~  
664 ~~shown.~~ [\[Approved by NCUTCD Council, June 2014\].](#)

665 ~~5.6.~~ Where the turning radius is large, a right-turn island using channelizing devices or  
666 pavement markings may be used.

667 ~~6.7.~~ There may be insufficient space to place the back-to-back Keep Right sign and No Left  
668 Turn symbol signs at the end of the row of channelizing devices separating opposing  
669 vehicular traffic flows. In this situation, the No Left Turn symbol sign may be placed on the  
670 right and the Keep Right sign may be omitted.

671 ~~7.8.~~ For intersection approaches reduced to a single lane, left-turning movements may be  
672 prohibited to maintain capacity for through vehicular traffic.

673 ~~8.9.~~ Flashing warning lights and/or flags may be used to call attention to advance warning  
674 signs.

675 ~~9.10.~~ Temporary pavement markings may be used to delineate the travel path through  
676 the intersection.

677 ~~10.11.~~ If “dimension A” is not available to create a temporary right-turn lane, the  
678 installation of continuous channelizers from the end of the taper to the intersection may  
679 occur. As a result, the “RIGHT-LANE MUST TURN RIGHT” signs would not be  
680 installed. [\[Approved by NCUTCD Council, June 2014\].](#)

681 ~~Support:~~

682 ~~3. Keeping the right-hand lane open increases the through capacity by eliminating right~~  
683 ~~turns from the open through lane.~~

684 ~~4. A temporary turn island reinforces the nature of the temporary exclusive right-turn lane~~  
685 ~~and enables a second RIGHT-LANE MUST TURN RIGHT sign to be placed in the~~  
686 ~~island.~~ [\[Approved by NCUTCD Council, June 2014\].](#)

687

688 **Notes for Figure 6H-25—Typical Application 25**  
689 **Multiple Lane Closures at an Intersection**

690 *Guidance:*

691 1. *If the work space extends across a crosswalk, the crosswalk should be closed using the*  
692 *information and devices shown in Figure 6H-29.*

693 ~~2. If the left through lane is closed on the near side approach, the LEFT LANE MUST~~  
694 ~~TURN LEFT sign should be placed in the median to discourage through vehicular traffic~~  
695 ~~from entering the left turn bay. [Approved by NCUTCD Council, June 2014].~~

696 *Support:*

697 ~~3.2.~~ The normal procedure is to close on the near side of the intersection any lane that is not  
698 carried through the intersection as shown. [Approved by NCUTCD Council, June 2014].

699 *Option:*

700 ~~4.3.~~ Positive protection devices may be used per Section 6F.84a.

701 ~~5.4~~ If the left-turning movement that normally uses the closed turn bay is small and/or the  
702 gaps in opposing vehicular traffic are frequent, left turns may be permitted on that approach.

703 ~~6.5.~~ Flashing warning lights and/or flags may be used to call attention to the advance  
704 warning signs.  
705

706 **Notes for Figure 6H-27—Typical Application 27**  
707 **Closure at the Side of an Intersection**

708 *Guidance:*

- 709 4. *The situation depicted can be simplified by closing one or more of the intersection*  
710 *approaches. If this cannot be done, and/or when capacity is a problem, through*  
711 *vehicular traffic should be directed to other roads or streets.*  
712 5. *Depending on road user conditions, flagger(s) or uniformed law enforcement officer(s)*  
713 *should be used to direct road users within the intersection.*

714 **Standard:**

- 715 **6. At night, flagger stations shall be illuminated, except in emergencies.**

716 *Option:*

- 717 7. Flashing warning lights and/or flags may be used to call attention to the advance  
718 warning signs.  
719 8. For short-duration work operations, the channelizing devices may be eliminated if a  
720 vehicle displaying high-intensity rotating, flashing, oscillating, or strobe lights is  
721 positioned in the work space.  
722 9. A BE PREPARED TO STOP sign may be added to the sign series.

723 *Guidance:*

- 724 10. *When used, the BE PREPARED TO STOP sign should be located before the Flagger*  
725 *symbol sign.*  
726 11. *ONE LANE ROAD AHEAD signs should also be used to provide adequate advance*  
727 *warning.*

728 *Support:*

- 729 12. Turns can be prohibited as required by vehicular traffic conditions. Unless the streets  
730 are wide, it might be physically impossible to make certain turns, especially for large  
731 vehicles.

732 *Option:*

- 733 [10. Positive protection devices may be used per Section 6F.84a.](#)  
734 ~~10.~~11. Vehicle hazard warning signals may be used to supplement high-intensity  
735 rotating, flashing, oscillating, or strobe lights.

736 **Standard:**

- 737 ~~11.~~12. **Vehicle hazard warning signals shall not be used instead of the vehicle's**  
738 **high-intensity rotating, flashing, oscillating, or strobe lights.**  
739

740 **Notes for Figure 6H-30—Typical Application 30**  
741 **Interior Lane Closure on a Multi-Lane Street**  
742 **Notes for Figure 6H-30—Typical Application 30**  
743 **Interior Lane Closure on a Multi-Lane Street**

744 *Guidance:*

- 745 1. *This information applies to low-speed, low-volume urban streets. Where speed or volume*  
746 *is higher, additional signing such as LEFT LANE CLOSED XX FT should be used*  
747 *between the signs shown.*

748 *Option:*

749 [2. Additional positive protection devices may be used per Section 6F.84a.](#)

750 ~~2.3.~~ The closure of the adjacent interior lane in the opposing direction may not be necessary,  
751 depending upon the activity being performed and the work space needed for the operation.

752 ~~3.4.~~ Shadow vehicles with a truck-mounted attenuator may be used.  
753

754 **Notes for Figure 6H-31—Typical Application 31**  
755 **Lane Closure on a Street with Uneven Directional Volumes**

756 **Standard:**

- 757 **1. The illustrated information shall be used only when the vehicular traffic volume**  
758 **indicates that two lanes of vehicular traffic shall be maintained in the direction of**  
759 **travel for which one lane is closed.**

760 **Option:**

- 761 **2. The procedure may be used during a peak period of vehicular traffic and then changed to**  
762 **provide two lanes in the other direction for the other peak.**

763 **Guidance:**

- 764 **3. For high speeds, a LEFT LANE CLOSED XX FT sign should be added for vehicular**  
765 **traffic approaching the lane closure, as shown in Figure 6H-32.**
- 766 **4. Conflicting pavement markings should be removed for long-term projects. For short-term**  
767 **and intermediate-term projects where this is not practical, the channelizing devices in the**  
768 **area where the pavement markings conflict should be placed at a maximum spacing of**  
769 **1/2 S feet where S is the speed in mph. Temporary markings should be installed where**  
770 **needed.**
- 771 **5. If the lane shift has curves with recommended speeds of 30 mph or less, Reverse Turn**  
772 **signs should be used.**
- 773 **6. Where the shifted section is long, a Reverse Curve sign should be used to show the initial**  
774 **shift and a second sign should be used to show the return to the normal alignment.**
- 775 **7. If the tangent distance along the temporary diversion is less than 600 feet, the Double**  
776 **Reverse Curve sign should be used at the location of the first Two Lane Reverse Curve**  
777 **sign. The second Two Lane Reverse Curve sign should be omitted.**

778 **Standard:**

- 779 **8. The number of lanes illustrated on the Reverse Curve or Double Reverse Curve**  
780 **signs shall be the same as the number of through lanes available to road users, and**  
781 **the direction of the reverse curves shall be appropriately illustrated.**

782 **Option:**

783 9-10. Positive protection devices may be used per Section 6F.84a.

784 ~~10-11.~~ A longitudinal buffer space may be used in the activity area to separate opposing  
785 vehicular traffic.

786 ~~11-12.~~ Where two or more lanes are being shifted, a W1-4 (or W1-3) sign with an ALL  
787 LANES (W24-1cP) plaque (see Figure 6F-4) may be used instead of a sign that illustrates  
788 the number of lanes.

789 ~~12-13.~~ Where more than three lanes are being shifted, the Reverse Curve (or Turn) sign  
790 may be rectangular.

791 ~~13-14.~~ A work vehicle or a shadow vehicle may be equipped with a truck-mounted  
792 attenuator.

793



794 **Notes for Figure 6H-32—Typical Application 32**  
795 **Half Road Closure on a Multi-Lane, High-Speed Highway**

796 **Standard:**

- 797 **1. Pavement markings no longer applicable shall be removed or obliterated as soon as**  
798 **practical. Except for intermediate-term and short-term situations, temporary**  
799 **markings shall be provided to clearly delineate the temporary travel path. For**  
800 **short-term and intermediate-term situations where it is not feasible to remove and**  
801 **restore pavement markings, channelization shall be made dominant by using a very**  
802 **close device spacing.**

803 *Guidance:*

- 804 *2. When paved shoulders having a width of 8 feet or more are closed, channelizing devices*  
805 *should be used to close the shoulder in advance of the merging taper to direct vehicular*  
806 *traffic to remain within the traveled way.*  
807 *3. Where channelizing devices are used instead of pavement markings, the maximum*  
808 *spacing should be  $\frac{1}{2} S$  feet where  $S$  is the speed in mph.*  
809 *4.- If the tangent distance along the temporary diversion is less than 600 feet, a Double*  
810 *Reverse Curve sign should be used instead of the first Reverse Curve sign, and the second*  
811 *Reverse Curve sign should be omitted.*

812 *Option:*

- 813 5. [Positive protection devices may be used per Section 6F.84a.](#)  
814 ~~5-6.~~ Warning lights may be used to supplement channelizing devices at night.  
815 ~~6-7.~~ A truck-mounted attenuator may be used on the work vehicle and/or the shadow  
816 vehicle.  
817

818 **Notes for Figure 6H-33—Typical Application 33**  
819 **Stationary Lane Closure on a Divided Highway**

820 **Standard:**

- 821 **1. This information also shall be used when work is being performed in the lane**  
822 **adjacent to the median on a divided highway. In this case, the LEFT LANE**  
823 **CLOSED signs and the corresponding Lane Ends signs shall be substituted.**  
824 **2. When a side road intersects the highway within the TTC zone, additional TTC**  
825 **devices shall be placed as needed.**

826 *Guidance:*

- 827 *3. When paved shoulders having a width of 8 feet or more are closed, channelizing devices*  
828 *should be used to close the shoulder in advance of the merging taper to direct vehicular*  
829 *traffic to remain within the traveled way.*

830 *Option:*

- 831 *4. A truck-mounted attenuator may be used on the work vehicle and/or shadow vehicle.*  
832 *5. [Additional positive protection devices may be used per Section 6F.84a.](#)*  
833

834 *Support:*

- 835 ~~5.6.~~ Where conditions permit, restricting all vehicles, equipment, workers, and their  
836 activities to one side of the roadway might be advantageous.

837 **Standard:**

- 838 ~~6.7.~~ **An arrow board shall be used when a freeway lane is closed. When more**  
839 **than one freeway lane is closed, a separate arrow board shall be used for each closed**  
840 **lane.**  
841

842 **Notes for Figure 6H-35—Typical Application 35**  
843 **Mobile Operation on a Multi-Lane Road**

844 **Standard:**

- 845 **1. Arrow boards shall, as a minimum, be Type B, with a size of 60 x 30 inches.**
- 846 **2. Vehicle-mounted signs shall be mounted in a manner such that they are not**  
847 **obscured by equipment or supplies. Sign legends on vehicle-mounted signs shall be**  
848 **covered or turned from view when work is not in progress.**
- 849 **3. Shadow and work vehicles shall display high-intensity rotating, flashing, oscillating,**  
850 **or strobe lights.**
- 851 **4. An arrow board shall be used when a freeway lane is closed. When more than one**  
852 **freeway lane is closed, a separate arrow board shall be used for each closed lane.**

853 *Guidance:*

- 854 *5. Vehicles used for these operations should be made highly visible with appropriate*  
855 *equipment, such as flags, signs, or arrow boards.*
- 856 *6. Shadow Vehicle 1 should be equipped with an arrow board and truck-mounted*  
857 *attenuator.*
- 858 *7. Shadow Vehicle 2 should be equipped with an arrow board. An appropriate lane closure*  
859 *sign should be placed on Shadow Vehicle 2 so as not to obscure the arrow board.*
- 860 *8. Shadow Vehicle 2 should travel at a varying distance from the work operation so as to*  
861 *provide adequate sight distance for vehicular traffic approaching from the rear.*
- 862 *9. The spacing between the work vehicles and the shadow vehicles, and between each*  
863 *shadow vehicle should be minimized to deter road users from driving in between.*
- 864 *10. Work should normally be accomplished during off-peak hours.*
- 865 *11. When the work vehicle occupies an interior lane (a lane other than the far right or far*  
866 *left) of a directional roadway having a right-hand shoulder 10 feet or more in width,*  
867 *Shadow Vehicle 2 should drive the right-hand shoulder with a sign indicating that work*  
868 *is taking place in the interior lane.*

869 *Option:*

- 870 *12. A truck-mounted attenuator may be used on Shadow Vehicle 2.*
- 871 *13. [Additional positive protection devices may be used per Section 6F.84a.](#)*
- 872 ~~14-15.~~ *On high-speed roadways, a third shadow vehicle (not shown) may be used with*  
873 *Shadow Vehicle 1 in the closed lane, Shadow Vehicle 2 straddling the edge line, and*  
874 *Shadow Vehicle 3 on the shoulder.*
- 875 ~~15-16.~~ *Where adequate shoulder width is not available, Shadow Vehicle 3 may also*  
876 *straddle the edge line.*

877

878 **Notes for Figure 6H-37—Typical Application 37**  
879 **Double Lane Closure on a Freeway**

880 **Standard:**

- 881 **1. An arrow board shall be used when a freeway lane is closed. When more than one**  
882 **freeway lane is closed, a separate arrow board shall be used for each closed lane.**

883 *Guidance:*

- 884 2. *Ordinarily, the preferred position for the second arrow board is in the closed exterior*  
885 *lane at the upstream end of the second merging taper. However, the second arrow board*  
886 *should be placed in the closed interior lane at the downstream end of the second merging*  
887 *taper in the following situations:*
- 888 a. *When a shadow vehicle is used in the interior closed lane, and the second arrow*  
889 *board is mounted on the shadow vehicle;*
  - 890 b. *If alignment or other conditions create any confusion as to which lane is closed*  
891 *by the second arrow board; and*
  - 892 c. *When the first arrow board is placed in the closed exterior lane at the*  
893 *downstream end of the first merging taper (the alternative position when the*  
894 *shoulder is narrow).*

895 *Option:*

- 896 3. Flashing warning lights and/or flags may be used to call attention to the initial warning  
897 signs.
- 898 4. A truck-mounted attenuator may be used on the shadow vehicle.
- 899 5. Additional Positive protection devices may be used per Section 6F.84a.

- 900
- 901 ~~5-6~~. If a paved shoulder having a minimum width of 10 feet and sufficient strength is  
902 available, the left and adjacent interior lanes may be closed and vehicular traffic carried  
903 around the work space on the right-hand lane and a right-hand shoulder.

904 *Guidance:*

- 905 ~~6-7~~. *When a shoulder lane is used that cannot adequately accommodate trucks, trucks*  
906 *should be directed to use the normal travel lanes.*
- 907

Notes for Figure 6H-38—Typical Application 38  
Interior Lane Closure on a Freeway

Standard:

1. An arrow board shall be used when a freeway lane is closed. When more than one freeway lane is closed, a separate arrow board shall be used for each closed lane.
2. If temporary traffic barriers are installed, they shall comply with the provisions and requirements in Section 6F.85.
3. The barrier shall not be placed along the shifting taper. The lane shall first be shifted using channelizing devices and pavement markings.
4. For long-term stationary work, existing conflicting pavement markings shall be removed and temporary markings shall be installed before traffic patterns are changed.

Guidance:

5. For a long-term closure, a barrier should be used to provide additional safety to the operation in the closed interior lane. A buffer space should be used at the upstream end of the closed interior lane.
6. The ~~first~~ arrow board displaying an arrow pointing to the right should be on the left hand shoulder at the beginning of the taper. ~~The arrow board displaying a double arrow should be centered in the closed interior lane and placed at the downstream end of the shifting taper.~~
7. ~~If the two arrow boards create confusion, the 2L distance between the end of the merging taper and beginning of the shift taper should be extended so that road users can focus on one arrow board at a time.~~
8. ~~The placement of signs should not obstruct or obscure arrow boards.~~
7. For long-term use, the ~~dashed~~ broken lane lines should be made solid white in the two-lane section.

Option:

8. As an alternative to initially closing the left-hand lane, as shown in the typical application, the right-hand lane may be closed in advance of the interior lane closure with appropriate channelization and signs.
- 8a. The Interior Lane Shift Ahead (W9-4) symbol sign may be mirrored to indicate a right lane shift.
9. A short, single row of channelizing devices in advance of the vehicular traffic split to restrict vehicular traffic to their respective lanes may be added.
10. DO NOT PASS signs may be used.
11. If a paved shoulder having a minimum width of 10 feet and sufficient strength is available, the left-hand and center lanes may be closed and motor vehicle traffic carried around the work space on the right-hand lane and a right-hand shoulder.

Guidance:

12. When a shoulder lane is used that cannot adequately accommodate trucks, trucks should be directed to use the normal travel lanes.

Option:

13. A work vehicle with a truck mounted attenuator may be utilized within the closed interior lane between the buffer space and the work area. [Approved by Council 01/11/2019]
14. Positive protection devices may be used per Section 6F.84a.

954 **Notes for Figure 6H-40—Typical Application 40**  
955 **Median Crossover for an Entrance Ramp**

956 *Guidance:*

- 957 1. *The typical application illustrated should be used for carrying an entrance ramp across a*  
958 *closed directional roadway of a divided highway.*
- 959 2. *A temporary acceleration lane should be used to facilitate merging.*
- 960 3. *When used, the YIELD or STOP sign should be located far enough forward to provide*  
961 *adequate sight distance of oncoming mainline vehicular traffic to select an acceptable*  
962 *gap, but should not be located so far forward that motorists will be encouraged to stop in*  
963 *the path of the mainline traffic. If needed, yield or stop lines should be installed across*  
964 *the ramp to indicate the point at which road users should yield or stop. Also, a longer*  
965 *acceleration lane should be provided beyond the sign to reduce the gap size needed.*

966 *Option:*

- 967 4. [Positive protection devices may be used per Section 6F.84a.](#)
- 968 ~~4.5.~~ If vehicular traffic conditions allow, the ramp may be closed.
- 969 ~~5.6.~~ A broken edge line may be carried across the temporary entrance ramp to assist in  
970 defining the through vehicular traffic lane.
- 971 ~~6.7.~~ When a temporary traffic barrier is used to separate opposing vehicular traffic, the Two-  
972 Way Traffic signs and the DO NOT ENTER signs may be eliminated.
- 973



974 **Notes for Figure 6H-41—Typical Application 41**  
975 **Median Crossover for an Exit Ramp**

976 *Guidance:*

- 977 1. *This typical application should be used for carrying an exit ramp across a closed*  
978 *directional roadway of a divided highway. The design criteria contained in the AASHTO*  
979 *“Policy on the Geometric Design of Highways and Streets” (see Section 1A.11) should*  
980 *be used for determining the curved alignment.*
- 981 2. *The guide signs should indicate that the ramp is open, and where the temporary ramp is*  
982 *located. Conversely, if the ramp is closed, guide signs should indicate that the ramp is*  
983 *closed.*
- 984 3. *When the exit is closed, a black on orange EXIT CLOSED sign panel should be placed*  
985 *diagonally across the interchange/intersection guide signs and channelizing devices*  
986 *should be placed to physically close the ramp.*
- 987 4. *In the situation (not shown) where channelizing devices are placed along the mainline*  
988 *roadway, the devices’ spacing should be reduced in the vicinity of the off ramp to*  
989 *emphasize the opening at the ramp itself. Channelizing devices and/or temporary*  
990 *pavement markings should be placed on both sides of the temporary ramp where it*  
991 *crosses the median and the closed roadway.*
- 992 5. *Advance guide signs providing information related to the temporary exit should be*  
993 *relocated or duplicated adjacent to the temporary roadway.*

994 **Standard:**

- 995 **6. A temporary EXIT sign shall be located in the temporary gore. For better visibility,**  
996 **it shall be mounted a minimum of 7 feet from the pavement surface to the bottom of**  
997 **the sign.**

998 *Option:*

999 [7. Positive protection devices may be used per Section 6F.84a.](#)

1000 ~~7-8.~~ Guide signs referring to the exit may need to be relocated to the median.

1001 ~~8-9.~~ The temporary EXIT sign placed in the temporary gore may be either black on orange  
1002 or white on green.

1003 ~~9-10.~~ In some instances, a temporary deceleration lane may be useful in facilitating the  
1004 exiting maneuver.

1005 ~~10-11.~~ When a temporary traffic barrier is used to separate opposing vehicular traffic, the  
1006 Two-Way Traffic signs may be omitted.

1007

1008 **Notes for Figure 6H-42—Typical Application 42**  
1009 **Work in the Vicinity of an Exit Ramp**

1010 *Guidance:*

- 1011 1. *The guide signs should indicate that the ramp is open, and where the temporary ramp is*  
1012 *located. However, if the ramp is closed, guide signs should indicate that the ramp is*  
1013 *closed.*
- 1014 2. *When the exit ramp is closed, a black on orange EXIT CLOSED sign panel should be*  
1015 *placed diagonally across the interchange/intersection guide signs.*
- 1016 3. *The design criteria contained in the AASHTO “Policy on the Geometric Design of*  
1017 *Highways and Streets” (see Section 1A.11) should be used for determining the alignment.*

1018 **Standard:**

- 1019 **4. A temporary EXIT sign shall be located in the temporary gore. For better visibility,**  
1020 **it shall be mounted a minimum of 7 feet from the pavement surface to the bottom of**  
1021 **the sign.**

1022 *Option:*

1023 5. [Positive protection devices may be used per Section 6F.84a.](#)

1024 ~~5.6.~~ The temporary EXIT sign placed in the temporary gore may be either black on orange  
1025 or white on green.

1026 ~~6.7.~~ An alternative procedure that may be used is to channelize exiting vehicular traffic onto  
1027 the right-hand shoulder and close the lane as necessary.

1028 **Standard:**

1029 ~~7.8.~~ **An arrow board shall be used when a freeway lane is closed. When more than one**  
1030 **freeway lane is closed, a separate arrow board shall be used for each closed lane.**  
1031

**Notes for Figure 6H-43—Typical Application 43**  
**Partial Exit Ramp Closure**

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*Guidance:*

1. *Truck off-tracking should be considered when determining whether the minimum lane width of 10 feet is adequate (see Section 6G.08).*

Option:

2. Positive protection devices may be used per Section 6F.84a.

**Notes for Figure 6H-44—Typical Application 44  
Work in the Vicinity of an Entrance Ramp**

*Guidance:*

1. *An acceleration lane of sufficient length should be provided whenever possible as shown on the left diagram.*

**Standard:**

2. **For the information shown on the diagram on the right-hand side of the typical application, where inadequate acceleration distance exists for the temporary entrance, the YIELD sign shall be replaced with STOP signs (one on each side of the approach).**

*Guidance:*

3. *When used, the YIELD or STOP sign should be located so that ramp vehicular traffic has adequate sight distance of oncoming mainline vehicular traffic to select an acceptable gap in the mainline vehicular traffic flow, but should not be located so far forward that motorists will be encouraged to stop in the path of the mainline traffic. Also, a longer acceleration lane should be provided beyond the sign to reduce the gap size needed. If insufficient gaps are available, consideration should be given to closing the ramp.*
4. *Where STOP signs are used, a temporary stop line should be placed across the ramp at the desired stop location.*
5. *The mainline merging taper with the arrow board at its starting point should be located sufficiently in advance so that the arrow board is not confusing to drivers on the entrance ramp, and so that the mainline merging vehicular traffic from the lane closure has the opportunity to stabilize before encountering the vehicular traffic merging from the ramp.*
6. *If the ramp curves sharply to the right, warning signs with advisory speeds located in advance of the entrance terminal should be placed in pairs (one on each side of the ramp).*

**Option:**

7. [Positive protection devices may be used per Section 6F.84a.](#)

~~7.8.~~ A Stop Beacon (see Section 4L.05) or a Type B high-intensity warning flasher with a red lens may be placed above the STOP sign.

~~8.9.~~ Where the acceleration distance is significantly reduced, a supplemental plaque may be placed below the Yield Ahead sign reading NO MERGE AREA.

**Standard:**

~~9.10.~~ **An arrow board shall be used when a freeway lane is closed. When more than one freeway lane is closed, a separate arrow board shall be used for each closed lane.**

1076 **Notes for Figure 6H-46—Typical Application 46**  
1077 **Work in the Vicinity of a Grade Crossing**

1078 *Guidance:*

- 1079 1. *When grade crossings exist either within or in the vicinity of roadway work activities,*  
1080 *extra care should be taken to minimize the probability of conditions being created, by*  
1081 *lane restrictions, flagging, or other operations, where vehicles might be stopped within*  
1082 *the grade crossing, considered as being 15 feet on either side of the closest and farthest*  
1083 *rail.*

1084 **Standard:**

- 1085 2. **If the queuing of vehicles across active rail tracks cannot be avoided, a uniformed**  
1086 **law enforcement officer or flagger shall be provided at the grade crossing to prevent**  
1087 **vehicles from stopping within the grade crossing (as described in Note 1), even if**  
1088 **automatic warning devices are in place.**

1089 *Guidance:*

- 1090 3. *Early coordination with the railroad company or light rail transit agency should occur*  
1091 *before work starts.*  
1092 4. *In the example depicted, the buffer space of the activity area should be extended*  
1093 *upstream of the grade crossing (as shown) so that a queue created by the flagging*  
1094 *operation will not extend across the grade crossing.*  
1095 5. *The DO NOT STOP ON TRACKS sign should be used on all approaches to a grade*  
1096 *crossing within the limits of a TTC zone.*

1097 *Option:*

- 1098 6. [Positive protection devices may be used per Section 6F.84a.](#)  
1099 ~~6.7.~~ 7. [Flashing warning lights and/or flags may be used to call attention to the advance](#)  
1100 [warning signs.](#)  
1101 ~~7.8.~~ 8. [A BE PREPARED TO STOP sign may be added to the sign series.](#)

1102 *Guidance:*

- 1103 ~~8.9.~~ 9. [When used, the BE PREPARED TO STOP sign should be located before the Flagger](#)  
1104 [symbol sign.](#)

1105 **Standard:**

- 1106 ~~9.10.~~ 10. [At night, flagger stations shall be illuminated, except in emergencies.](#)