

1 **CHAPTER 10A. GENERAL**

2 **Section 10A.01 Introduction**

3 Support:

4 Part 10 provides standards and guidelines for the design, installation, and operation of traffic control
5 devices at grade crossings of highway traffic and light rail transit vehicles to promote safety and to provide for
6 the effective, integrated movement of all traffic. The principles in Section 8A.01 are the same but, because
7 light rail vehicles sometimes operate along streets and highways in mixed traffic with automotive vehicles, the
8 traffic controls and associated standards and guidelines for highway-light rail transit grade crossings presented
9 in Part 10 can be different than those presented in Part 8.

10 Light rail transit is a mode of metropolitan transportation that employs light rail transit vehicles
11 (commonly known as light rail vehicles, streetcars, or trolleys) that operate on rails in streets in mixed traffic,
12 in semiexclusive rights-of-way, or in exclusive rights-of-way. Grade crossings with light rail transit can occur
13 at intersections or at midblock locations, including public and private driveways.

14 An initial educational campaign along with an ongoing program to continue to educate new drivers is
15 beneficial when introducing light rail operations to an area and, hence, new traffic control devices.

16 Light rail alignments can be grouped into one of the following three types:

- 17 A. Exclusive: A light rail transit right-of-way that is grade-separated or protected by a fence or traffic
18 barrier. Motor vehicles, pedestrians, and bicycles are prohibited within the right-of-way. Subways
19 and aerial structures are included within this group. This type of alignment does not have grade
20 crossings and is not further addressed in Part 10.
- 21 B. Semiexclusive: A light rail transit alignment that is in a separate right-of-way or along a street or
22 railroad right-of-way where motor vehicles, pedestrians, and bicycles have limited access and cross at
23 designated locations only.
- 24 C. Mixed-Use: An alignment where light rail transit operates in mixed traffic with all types of road users.
25 This includes streets, transit malls, and pedestrian malls where the right-of-way is shared.

26 **Standard:**

27 **Where light rail transit and railroads use the same tracks or adjacent tracks, the traffic control**
28 **devices, systems, and practices for highway-rail grade crossings described in Part 8 shall be used.**

29 Support:

30 Section 8A.01 contains a set of definitions, most of which also apply to Part 10.

31 **Section 10A.02 Use of Standard Devices, Systems, and Practices**

32 Support:

33 Because of the large number of significant variables to be considered, no single standard system of traffic
34 control devices is universally applicable for all highway-light rail transit grade crossings.

35 Guidance:

36 The appropriate traffic control system to be used at a highway-light rail transit grade crossing should be
37 determined by an engineering study conducted by the transit or highway agency in cooperation with other
38 appropriate State and local organizations.

39 **Standard:**

40 **Traffic control devices, systems, and practices shall be consistent with the design and application of**
41 **the Standards contained herein.**

42 **The traffic control devices, systems, and practices described herein shall be used at all highway-**
43 **light rail transit grade crossings.**

44 **Before any new highway-light rail transit grade crossing traffic control system is installed or**
45 **modifications are made to an existing system, approval shall be obtained from the local agencies having**
46 **statutory authority to grant such approval.**

47 Guidance:

48 To stimulate effective responses from vehicle operators and pedestrians, these devices, systems, and
49 practices should use the five basic considerations employed generally for traffic control devices and described
50 fully in Section 1A.02: design, placement, operation, maintenance, and uniformity.

51 Support:

1 Many other details of highway-light rail transit grade crossing traffic control systems that are not set forth
2 in Part 10 are contained in the publications listed in Section 1A.11.

3 **Section 10A.03 Uniform Provisions**

4 **Standard:**

5 **All signs used in highway-light rail transit grade crossing traffic control systems shall be**
6 **retroreflectorized or illuminated as described in Section 2A.07 to show the same shape and similar color**
7 **to an approaching road user during both day and night.**

8 **No sign or signal shall be located in the center of an undivided highway, except in a raised island.**

9 **Guidance:**

10 Any signs or signals located in a raised island in the center of an undivided highway should be installed
11 with a clearance of at least 0.6 m (2 ft) from outer edge of the raised island to the nearest edge of the sign or
12 signal, except as permitted in Section 2A.19.

13 Where the distance between tracks, measured along the highway between the inside rails, exceeds 30 m
14 (100 ft), additional signs or other appropriate traffic control devices should be used.

15 **Section 10A.04 Highway-Light Rail Transit Grade Crossing Elimination**

16 **Guidance:**

17 Because highway-light rail transit grade crossings are a potential source of crashes and congestion,
18 agencies should conduct engineering studies to determine the cost and benefits of eliminating these crossings.

19 **Standard:**

20 **When a highway-light rail transit grade crossing is eliminated, the traffic control devices for the**
21 **crossing shall be removed.**

22 **If the existing traffic control devices at a multiple-track highway-light rail transit grade crossing**
23 **become improperly placed or inaccurate because of the removal of some of the tracks, the existing**
24 **devices shall be relocated and/or modified.**

25 **Guidance:**

26 Where a roadway is removed from a highway-light rail transit grade crossing, the roadway approaches in
27 the light rail transit right-of-way should also be removed and appropriate signs should be placed at the
28 roadway end in accordance with Section 2L.04.

29 Where light rail transit is eliminated at a highway-light rail transit grade crossing, the tracks should be
30 removed or paved over.

31 **Option:**

32 Based on engineering judgment, the TRACKS OUT OF SERVICE (R8-9) sign (see Figure 10C-3) may be
33 temporarily installed until the tracks are removed or paved over. The length of time before the tracks will be
34 removed or paved over may be considered in making the decision as to whether to install the sign.

35 **Section 10A.05 Illumination at Highway-Light Rail Transit Crossings**

36 **Support:**

37 Illumination is sometimes installed at or adjacent to a highway-light rail transit grade crossing in order to
38 provide better nighttime visibility of the light rail transit vehicles and the highway-light rail transit grade
39 crossing (for example, where a substantial amount of light rail transit operations are conducted at night or
40 where crash history indicates that drivers experience difficulty in seeing trains or traffic control devices during
41 hours of darkness).

42 Recommended types and locations of luminaires for illuminating highway-rail (light rail transit) grade
43 crossings are contained in the American National Standards Institute's (ANSI) "Practice for Roadway
44 Lighting RP-8," which is available from the Illuminating Engineering Society (see Section 1A.11).

45 **Section 10A.06 Temporary Traffic Control Zones**

46 **Support:**

47 Temporary traffic control planning provides for continuity of operations (such as movement of traffic,
48 pedestrians and bicycles, transit operations, and access to property/utilities) when the normal function of a

1 roadway at a highway-light rail transit grade crossing is suspended because of temporary traffic control
2 operations.

3 **Standard:**

4 **Temporary traffic control operations on highways with highway-light rail transit grade crossings**
5 **shall be as outlined in Part 6.**

6 **When a highway-light rail transit grade crossing exists either within or in the vicinity of a**
7 **temporary traffic control zone, lane restrictions, flagging (see Chapter 6E), or other operations shall not**
8 **be performed in a manner that would cause vehicles to stop on the light rail transit tracks, unless a**
9 **uniformed law enforcement officer or flagger is provided at the highway-light rail transit grade**
10 **crossing to minimize the possibility of vehicles stopping on the tracks, even if automatic warning devices**
11 **are in place.**

12 **Guidance:**

13 The agencies responsible for the operation of the light rail transit and highway should be contacted when
14 the initial planning begins for any temporary traffic control zone that might directly or indirectly influence the
15 flow of traffic on mixed-use facilities where light rail transit and road users operate. Responsible agencies,
16 along with others affected, such as emergency services and businesses, should meet to plan appropriate traffic
17 detours and the necessary signing, marking, and flagging requirements for operations during temporary traffic
18 control activities. Consideration should be given to the length of time that the grade crossing is to be closed,
19 roadway classification, type of vehicle and traffic affected, the time of day, and the materials and techniques
20 of repair.

21 Temporary traffic control operations should minimize the inconvenience, delay, and crash potential to
22 affected traffic. Prior notice should be given to affected public or private parties, emergency services,
23 businesses, and road users before the free movement of vehicles or light rail transit is infringed on or blocked.

24 Temporary traffic control activities should not be permitted to extensively prolong the closing of a grade
25 crossing.

26 The width, grade, alignment, and riding quality of the highway surface at a light rail transit crossing
27 should, at a minimum, be restored to correspond with the quality of the approaches to the highway-light rail
28 transit grade crossing.

CHAPTER 10C. SIGNS AND MARKINGS

Section 10C.01 Purpose

Support:

Signs and markings regulate, warn, and guide the road users so that they, as well as light rail transit vehicle operators, can take appropriate action.

Standard:

The design and location of signs shall comply with the provisions of Part 2.

Support:

Section 8B.02 contains information regarding the sizes of signs for grade crossings.

Section 10C.02 Use of Crossbuck Assemblies at Passive Highway-Light Rail Transit Grade Crossings

Standard:

Except as noted in the Option below, the Highway-Rail Grade Crossing (R15-1) sign, commonly identified as the Crossbuck sign, shall be retroreflectorized white with the words RAILROAD CROSSING in black lettering, mounted as shown in Figure 10C-1.

Option:

At non-signalized crossings, the Crossbuck sign may be retroreflectorized white with the words RAILROAD CROSSING in retroreflectorized red lettering, mounted as shown in Figure 10C-1.

A Crossbuck sign may be used on a highway approach to a highway-light rail transit grade crossing on a semiexclusive or mixed-use alignment, alone or in combination with other traffic control devices.

Standard:

If automatic gates are not present where a Crossbuck sign is being used and if there are two or more tracks at the highway-light rail transit grade crossing, the number of tracks shall be indicated on a supplemental Number of Tracks (R15-2P) plaque of inverted T shape mounted below the Crossbuck sign in the manner and at the height indicated in Figure 10C-1.

Option:

The supplemental Number of Tracks plaque may also be used at highway-light rail transit grade crossings with automatic gates.

Standard:

If used, the Crossbuck Assembly (see Section 8B.05) comprised of a Crossbuck sign and either a STOP (R1-1) sign or a YIELD (R1-2) sign (see Figure 10C-1) shall be installed on the right-hand side of the highway on each approach to the highway-light rail transit grade crossing. Where restricted sight distance or unfavorable highway geometry exists on an approach to a highway-light rail transit grade crossing, an additional Crossbuck Assembly shall be installed on the left-hand side of the highway, possibly placed back-to-back with the Crossbuck Assembly for the opposite approach, or otherwise located so that two Crossbuck Assemblies are displayed for that approach.

A strip of retroreflective white material not less than 50 mm (2 in) in width shall be used on the back of each blade of each Crossbuck sign for the length of each blade, at all highway-light rail transit grade crossings, except those where Crossbuck signs have been installed back-to-back.

A vertical strip of retroreflective white material, not less than 50 mm (2 in) in width, shall be used on each Crossbuck Assembly support at passive highway-light rail transit grade crossings for the full length of the back of the support from the bottom of the Crossbuck sign to within 0.6 m (2 ft) above the ground.

On Crossbuck Assemblies where the YIELD or STOP sign is installed on a separate support (see Figure 10C-2), or is omitted in accordance with Section 8B.04, a vertical strip of retroreflective white material, not less than 50 mm (2 in) in width, shall be used on the front of the Crossbuck Assembly support from the bottom of the Crossbuck sign or Number of Tracks plaque to within 0.6 m (2 ft) above the ground.

Option:

1 The vertical strip of retroreflective material may be omitted from the back sides of Crossbuck Assembly
2 sign supports installed on one-way streets.

3 Guidance:

4 If used, Crossbuck Assemblies should be located with respect to the highway pavement or shoulder in
5 accordance with the criteria in Chapter 2A and Figures 2A-2 and 2A-3, and should be located with respect to
6 the nearest track in accordance with Figure 8C-2.

7 The minimum lateral offset for the nearest edge of the Crossbuck Assembly should be 1.8 m (6 ft) from
8 the edge of the shoulder or 3.7 m (12 ft) from the edge of the traveled way in rural areas, and 0.6 m (2 ft) from
9 the face of the curb in urban areas.

10 Where unusual conditions make variations in location and lateral offset appropriate, engineering judgment
11 should be used to provide the best practical combination of view and safety clearances.

12 **Section 10C.03 LOOK Sign (R15-8)**

13 Option:

14 A LOOK (for light rail transit vehicles) (R15-8) sign (see Figure 10C-3) may be mounted at highway-light
15 rail transit grade crossings on a separate sign post in the immediate vicinity of the highway-light rail transit
16 grade crossing on the light rail transit right-of-way.

17 **Section 10C.04 Use of STOP (R1-1) or YIELD (R1-2) Signs without Crossbuck Signs at** 18 **Highway-Light Rail Transit Grade Crossings**

19 **Standard:**

20 **For all highway-light rail transit grade crossings where only STOP (R1-1) or YIELD (R1-2) signs**
21 **are installed, the placement shall comply with the requirements of Section 2B.10. Stop Ahead (W3-1) or**
22 **Yield Ahead (W3-2) Advance Warning signs (see Figure 2C-6) shall also be installed if the criteria for**
23 **their installation given in Section 2C.35 is met.**

24 Guidance:

25 The use of only STOP or YIELD signs for road users at highway-light rail transit grade crossings should
26 be limited to those crossings where the need and feasibility is established by an engineering study. Such
27 crossings should have all of the following characteristics:

- 28 A. The crossing roadways should be secondary in character (such as a minor street with one lane in each
29 direction, an alley, or a driveway) with low traffic volumes and low speed limits. The specific
30 thresholds of traffic volumes and speed limits should be determined by the local agencies.
- 31 B. Light rail transit speeds do not exceed 40 km/h (25 mph).
- 32 C. The line of sight for an approaching light rail transit operator is adequate from a sufficient distance
33 such that the operator can sound an audible signal and bring the light rail transit vehicle to a stop
34 before arriving at the crossing.
- 35 D. The road user has sufficient sight distance at the stop line to permit the vehicle to cross the tracks
36 before the arrival of the light rail transit vehicle.
- 37 E. If at an intersection of two roadways, the intersection does not meet the warrants for a traffic control
38 signal as specified in Chapter 4C.
- 39 F. The light rail transit tracks are located such that vehicles are not likely to stop on the tracks while
40 waiting to enter a cross street or highway.

41 **Section 10C.05 DO NOT STOP ON TRACKS Sign (R8-8)**

42 Guidance:

43 A DO NOT STOP ON TRACKS (R8-8) sign (see Figure 10C-3) should be installed whenever an
44 engineering study determines that the potential for vehicles stopping on the tracks at a highway-light rail
45 transit grade crossing is significant. Placement of the R8-8 sign should be determined as part of the
46 engineering study. The sign, if used, should be located on the right-hand side of the highway on either the
47 near or far side of the grade crossing, depending upon which position provides better visibility to approaching
48 drivers.

49 If a STOP or YIELD sign is installed downstream from the light rail transit crossing such that vehicle
50 queues are likely to extend into the path of the light rail transit, a DO NOT STOP ON TRACKS sign (R8-8)
51 should be used.

1 Option:

2 DO NOT STOP ON TRACKS signs may be placed on both sides of the track.

3 On divided highways and one-way streets, a second DO NOT STOP ON TRACKS sign may be placed on
4 the near or far left-hand side of the highway at the grade crossing to further improve visibility of the sign.

5 **Section 10C.06 TRACKS OUT OF SERVICE Sign (R8-9)**

6 Option:

7 The TRACKS OUT OF SERVICE (R8-9) sign (see Figure 10C-3) may be used at a highway-light rail
8 transit grade crossing instead of a Crossbuck (R15-1) sign and a Number of Tracks (R15-2P) plaque when
9 light rail transit tracks have been temporarily or permanently abandoned, but only until such time that the
10 tracks are removed or paved over.

11 **Standard:**

12 **When tracks are out of service, traffic control devices and gate arms shall be removed and the**
13 **signal heads shall be removed or hooded or turned from view to clearly indicate that they are not in**
14 **operation.**

15 **The R8-9 sign shall be removed when the tracks have been removed or covered or when the**
16 **highway-light rail transit grade crossing is returned to service.**

17 **Section 10C.07 STOP HERE WHEN FLASHING Sign (R8-10, R8-10a)**

18 Option:

19 The STOP HERE WHEN FLASHING (R8-10, R8-10a) sign (see Figure 10C-3) may be used at a
20 highway-light rail transit grade crossing to inform drivers of the location of the stop line or the point at which
21 to stop when the flashing-light signals (see Section 10D.02) are activated.

22 **Section 10C.08 STOP HERE ON RED Sign (R10-6, R10-6a)**

23 Support:

24 The STOP HERE ON RED (R10-6, R10-6a) sign (see Figure 10C-3) defines and facilitates observance of
25 the stop lines at traffic control signals.

26 Option:

27 A STOP HERE ON RED sign may be used at locations where vehicles frequently violate the stop line or
28 where it is not obvious to road users where to stop.

29 Guidance:

30 If possible, stop lines should be placed at a point where the vehicle driver has adequate sight distance
31 along the track.

32 **Section 10C.09 Light Rail Transit-Activated Blank-Out Turn Prohibition Signs (R3-1a, R3-2a)**

33 Support:

34 Light rail transit operations can include the use of activated blank-out sign technology for turn prohibition
35 (R3-1a, R3-2a) signs (see Figure 10C-3). The signs are typically used on roads paralleling a semiexclusive or
36 mixed-use light rail transit alignment where road users might turn across the light rail transit tracks. A blank-
37 out sign displays its message only when activated. When not activated, the sign face is blank.

38 Guidance:

39 A light rail transit-activated blank-out turn prohibition sign should be used where an intersection adjacent
40 to a highway-light rail transit crossing is controlled by STOP signs, or is controlled by traffic control signals
41 with permissive turn movements for road users crossing the tracks.

42 Option:

43 A light rail transit-activated blank-out turn prohibition sign may be used for turning movements that cross
44 the tracks.

45 As an alternative to light rail transit-activated blank-out turn prohibition signs at intersections with traffic
46 control signals, exclusive traffic control signal phases such that all movements that cross the tracks have a
47 steady red indication may be used in combination with No Turn on Red (R10-11, R10-11a, or R10-11b) signs
48 (see Section 2B.59).

49 **Standard:**

1 **Turn prohibition signs that are associated with preemption shall be visible only when the highway-**
2 **light rail transit grade crossing restriction is in effect.**

3 **Section 10C.10 EXEMPT Highway-Rail Grade Crossing Plaques (R15-3P, W10-1aP)**

4 Option:

5 When authorized by law or regulation, a supplemental EXEMPT (R15-3P) plaque (see Figure 10C-3)
6 with a white background may be used below the Crossbuck sign or Number of Tracks plaque, if present, at the
7 highway-light rail transit grade crossing, and a supplemental EXEMPT (W10-1aP) plaque (see Figure 10C-4)
8 with a yellow background may be used below the Highway-Rail Advance Warning (W10-1) sign. Where
9 neither the Crossbuck nor the advance warning signs exist for a particular crossing, an EXEMPT (R15-3P)
10 plaque with a white background may be placed on its own post on the near right side of the approach to the
11 crossing.

12 Support:

13 These supplemental plaques inform drivers of vehicles carrying passengers for hire, school buses carrying
14 students, or vehicles carrying hazardous materials that a stop is not required at certain designated highway-
15 light rail transit grade crossings, except when a light rail transit vehicle is approaching or occupying the
16 highway-light rail transit grade crossing, or the driver's view is blocked.

17 **Section 10C.11 Divided Highway with Light Rail Transit Crossing Signs (R15-7 Series)**

18 Option:

19 The Divided Highway with Light Rail Transit Crossing (R15-7) sign (see Figure 10C-3) may be used as a
20 supplemental sign on the approach legs of a roadway that intersects with a divided highway where light rail
21 transit vehicles operate in the median. The sign may be placed beneath a STOP sign or mounted separately.

22 Guidance:

23 The number of tracks displayed on the R15-7 sign should be the same as the actual number of tracks.

24 **Standard:**

25 **When the Divided Highway With Light Rail Transit Crossing sign is used at a four-legged**
26 **intersection, the R15-7 sign shall be used. When used at a T-intersection, the R15-7a sign shall be used.**

27 **Section 10C.12 No Vehicles On Tracks Signs (R15-6, R15-6a)**

28 Support:

29 The No Vehicles On Tracks (R15-6) sign (see Figure 10C-3) is used where there are adjacent traffic lanes
30 separated from the light rail transit lane by a curb or pavement markings.

31 Guidance:

32 The DO NOT ENTER (R5-1) sign should be used where a road user could wrongly enter a light rail
33 transit only street.

34 Option:

35 A No Vehicles On Tracks sign may be used to deter vehicles from driving on the trackway. It may be
36 installed on a 0.9 m (3 ft) flexible post between double tracks, on a post alongside the tracks, or overhead.

37 Instead of the R15-6 symbol sign, a regulatory sign with the word message DO NOT DRIVE ON
38 TRACKS (R15-6a) may be used (see Figure 10C-3).

39 A reduced size of 300 x 300 mm (12 x 12 in) may be used if the R15-6 sign is installed between double
40 tracks.

41 **Standard:**

42 **The smallest size for the R15-6 sign shall be 300 x 300 mm (12 x 12 in).**

43 **Section 10C.13 Light Rail Transit Only Lane Signs (R15-4 Series)**

44 Support:

45 The Light Rail Transit Only Lane (R15-4 series) signs (see Figure 10C-3) are used for multi-lane
46 operations, where road users might need additional guidance on lane use and/or restrictions.

47 Option:

1 Light Rail Transit Only Lane signs may be used on a roadway lane limited to only light rail transit use to
2 indicate the restricted use of a lane in semiexclusive and mixed alignments.

3 Guidance:

4 If used, the R15-4a, R15-4b, and R15-4c signs should be installed on posts adjacent to the roadway
5 containing the light rail transit tracks or overhead above the light rail transit only lane.

6 Option:

7 If the trackway is paved, preferential lane markings (see Section 3B.25) may be installed but only in
8 combination with light rail transit only lane signs.

9 Support:

10 The trackway is the continuous way designated for light rail transit, including the entire dynamic
11 envelope. Section 10C.24 contains more information regarding the dynamic envelope.

12 **Section 10C.14 Do Not Pass Light Rail Transit Signs (R15-5, R15-5a)**

13 Support:

14 A Do Not Pass Light Rail Transit (R15-5) sign (see Figure 10C-3) is used to indicate that vehicles are not
15 allowed to pass light rail transit vehicles that are loading or unloading passengers where there is no raised
16 platform or physical separation from the lanes upon which other motor vehicles are operating.

17 Option:

18 The R15-5 sign may be used in mixed-use alignments and may be mounted overhead where there are
19 multiple lanes.

20 Instead of the R15-5 symbol sign, a regulatory sign with the word message DO NOT PASS STOPPED
21 TRAIN (R15-5a) may be used (see Figure 10C-3).

22 Guidance:

23 If used, the R15-5 sign should be located immediately before the light rail transit boarding area.

24 **Section 10C.15 Highway-Rail Grade Crossing Advance Warning Signs (W10 Series)**

25 **Standard:**

26 A Highway-Rail Grade Crossing Advance Warning (W10-1) sign (see Figure 10C-4) with a
27 supplemental plaque describing the type of traffic control at the highway-light rail transit grade
28 crossing shall be used on each highway in advance of every highway-light rail transit grade crossing in
29 semiexclusive alignments except in the following circumstances:

- 30 A. On an approach to a highway-light rail transit grade crossing from a T-intersection with a
31 parallel highway if the distance from the edge of the track to the edge of the parallel roadway is
32 less than 30 m (100 ft) and W10-3 signs are used on both approaches of the parallel highway;
- 33 B. On low-volume, low-speed highways crossing minor spurs or other tracks that are infrequently
34 used and where transit crews manually stop road users from entering the crossing;
- 35 C. In business or commercial areas where active highway-light rail transit grade crossing traffic
36 control devices are in use; or
- 37 D. Where physical conditions do not permit even a partially effective display of the sign.

38 The supplemental plaque shall be a No Signal (W10-10P) plaque where used in advance of a
39 crossing that does not have active traffic control devices and shall be a SIGNAL AHEAD (W10-16P)
40 plaque where used in advance of a crossing with active traffic control devices, except where the
41 highway-light rail transit grade crossing traffic control devices consist solely of traffic control signals.
42 The supplemental plaque shall be mounted directly below the W10-1 sign unless a NO TRAIN HORN
43 (W10-9P) plaque (see Section 8B.15) is used, in which case the supplemental No Signal (W10-10P) or
44 SIGNAL AHEAD (W10-16P) plaque shall be mounted directly below the W10-9P plaque.

45 Placement of the Highway-Rail Grade Crossing Advance Warning sign shall be in accordance with
46 Section 2C.05 and Table 2C-4.

47 A Yield Ahead (W3-2) or Stop Ahead (W3-1) Advance Warning sign (see Figure 2C-6) shall also be
48 installed if the criteria for their installation given in Section 2C.35 is met. If a Yield Ahead or Stop
49 Ahead sign is installed on the approach to the crossing, the W10-1 sign and supplemental plaque shall
50 be installed upstream from the Yield Ahead or Stop Ahead sign. The Yield Ahead or Stop Ahead sign

1 shall be located in accordance with Table 2C-4. The minimum distance between the signs shall be in
2 accordance with Section 2C.05 and Table 2C-4.

3 Option:

4 On divided highways and one-way streets, an additional W10-1 sign and supplemental plaque may be
5 installed on the left-hand side of the roadway.

6 **Standard:**

7 **If the distance between the light rail transit tracks in a semiexclusive alignment and a parallel**
8 **highway, from the edge of the tracks to the edge of the parallel roadway, is less than 30 m (100 ft), W10-**
9 **2, W10-3, or W10-4 signs (see Figure 10C-4) with a NO SIGNAL (W10-10P) or SIGNAL AHEAD**
10 **(W10-16P) supplemental plaque describing the type of traffic control at the highway-light rail transit**
11 **grade crossing shall be installed on each approach of the parallel highway to warn road users making a**
12 **turn that they will encounter a highway-light rail transit grade crossing soon after making a turn, and a**
13 **W10-1 sign for the approach to the tracks shall not be required to be between the tracks and the**
14 **parallel highway.**

15 **If the W10-2, W10-3, or W10-4 signs and supplemental plaques are used, sign placement in**
16 **accordance with the guidelines for Intersection Warning signs in Table 2C-4 using the speed of through**
17 **traffic shall be measured from the highway intersection.**

18 Guidance:

19 If the distance between the light rail transit tracks and the parallel highway, from the edge of the tracks to
20 the edge of the parallel roadway, is 30 m (100 ft) or more, a W10-1 sign and supplemental plaque should be
21 installed in advance of the highway-light rail transit grade crossing, and the W10-2, W10-3, or W10-4 signs
22 should not be used on the parallel highway.

23 **Section 10C.16 Low Ground Clearance Highway-Rail Grade Crossing Sign (W10-5)**

24 Guidance:

25 If the highway profile conditions are sufficiently abrupt to create a hang-up situation for long wheelbase
26 vehicles or for trailers with low ground clearance, the Low Ground Clearance Highway-Rail Grade Crossing
27 (W10-5) sign (see Figure 10C-4) should be installed in advance of the highway-light rail transit grade
28 crossing.

29 Support:

30 Information regarding the use of the W10-5 sign is contained in Section 8B.17.

31 **Section 10C.17 Light Rail Transit Approaching-Activated Blank-Out Warning Sign (W10-7)**

32 Support:

33 The Light Rail Transit Approaching-Activated Blank-Out (W10-7) warning sign (see Figure 10C-4)
34 supplements the traffic control devices to warn road users crossing the tracks of an approaching light rail
35 transit vehicle.

36 Option:

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

39 **Section 10C.18 Storage Space Signs (W10-11, W10-11a, W10-11b)**

40 Guidance:

41 A Storage Space (W10-11) sign supplemented by a word message storage distance (W10-11a) sign (see
42 Figure 10C-4) should be used where there is a highway intersection in close proximity to the highway-light
43 rail transit grade crossing and an engineering study determines that adequate space is not available to store a
44 design vehicle(s) between the highway intersection and the light rail transit vehicle dynamic envelope.

45 Support:

46 Information regarding the use of the W10-11, W10-11a, and W10-11b signs is contained in Section
47 8B.18.

48 **Section 10C.19 Skewed Crossing Sign (W10-12)**

49 Option:

1 The Skewed Crossing (W10-12) sign (see Figure 10C-4) may be used at a skewed highway-light rail
2 transit grade crossing to warn road users that the light rail transit tracks are not perpendicular to the highway.

3 Support:

4 Information regarding the use of the W10-12 sign is contained in Section 8B.19.

5 **Section 10C.20 Light Rail Transit Station Sign (I-12)**

6 Option:

7 The Light Rail Transit Station (I-12) sign (see Figure 10C-4) may be used to direct road users to a light
8 rail transit station or boarding location. It may be supplemented by the name of the transit system and by
9 arrows as provided in Section 2D.08.

10 **Section 10C.21 Emergency Notification Sign (I-13)**

11 Guidance:

12 Emergency Notification (I-13) signs (see Figure 10C-5) should be installed at all highway-light rail transit
13 grade crossings on semiexclusive alignments to provide information to road users so that they can notify the
14 transit company about emergencies or malfunctioning traffic control devices.

15 **Standard:**

16 **When Emergency Notification signs are used, they shall, at a minimum, include a unique crossing**
17 **identifier and the emergency contact telephone number in letters and numbers that are at least 13 mm**
18 **(0.5 in) in height.**

19 **The Emergency Notification signs shall be positioned so as to not obstruct any traffic control**
20 **devices or limit the view of trains approaching the highway-light rail transit grade crossing.**

21 Option:

22 In lieu of Emergency Notification signs, the unique crossing identifier and the emergency contact
23 telephone number may be displayed on the enclosure for the signal apparatus at crossings that are equipped
24 with active traffic control systems if the signal apparatus enclosure is located in direct view of road users at or
25 near the crossing.

26 **Standard:**

27 **Emergency Notification Signs shall have a white legend and border on a blue background.**

28 Guidance:

29 Emergency Notification signs should be retroreflective.

30 Emergency Notification signs, or the information placed on the signal apparatus enclosure, should be
31 oriented so as to face vehicles stopped on or at the crossing or on the traveled way near the crossing.

32 At station crossings, Emergency Notification signs or information should be posted in a conspicuous
33 location.

34 Emergency Notification signs mounted on Crossbuck Assemblies or signal masts should only be large
35 enough to provide the necessary contact information. Use of larger signs that might obstruct the view of trains
36 or other vehicles should be avoided.

37 **Section 10C.22 Pavement Markings**

38 **Standard:**

39 **All highway-light rail transit grade crossing pavement markings shall be retroreflectORIZED white.**
40 **All other markings shall be in accordance with Part 3.**

41 **On paved roadways, pavement markings in advance of a highway-light rail transit grade crossing**
42 **shall consist of an X, the letters RR, a no-passing zone marking (on two-lane, two-way highways with**
43 **center line markings in compliance with Section 3B.01), and certain transverse lines as shown in**
44 **Figures 10C-6 and 10C-7.**

45 **Identical markings shall be placed in each approach lane on all paved approaches to highway-light**
46 **rail transit grade crossings where signals or automatic gates are located, and at all other highway-light**
47 **rail transit grade crossings where the posted or statutory highway speed is 60 km/h (40 mph) or greater.**

48 **Pavement markings shall not be required at highway-light rail transit grade crossings where the**
49 **posted or statutory highway speed is less than 60 km/h (40 mph). In urban areas, pavement markings**

1 **shall not be required at highway-light rail transit grade crossings if an engineering study indicates that**
2 **other installed devices provide suitable warning and control.**

3 Guidance:

4 When pavement markings are used, the center of the X symbol should be directly in line with the
5 Advance Warning sign. The X symbol and letters should be elongated to allow for the low angle at which
6 they will be viewed.

7 Option:

8 When justified by engineering judgment, supplemental pavement marking symbol(s) may be placed
9 between the Advance Warning sign and the highway-light rail transit grade crossing.

10 **Section 10C.23 Stop Lines**

11 **Standard:**

12 **On paved roadways at highway-light rail transit grade crossings that are equipped with active**
13 **control devices such as flashing-light signals, gates, or traffic control signals, a stop line (see Section**
14 **3B.16) shall be installed to indicate the point behind which vehicles are required to stop.**

15 Guidance:

16 The stop line should be a transverse line at a right angle to the traveled way at a point where a vehicle is to
17 stop or as near to that point as practical. The stop line should be placed approximately 2.4 m (8 ft) from the
18 gate (if present), but no closer than 4.6 m (15 ft) from the nearest rail.

19 Support:

20 Section 8B.05 contains provisions regarding the use of stop lines or yield lines at passive grade crossings.

21 **Section 10C.24 Dynamic Envelope Markings**

22 Support:

23 The dynamic envelope (see Figure 10C-8) markings indicate the clearance required for the light rail
24 transit vehicle overhang resulting from any combination of loading, lateral motion, or suspension failure.

25 Option:

26 The dynamic envelope may be delineated on the pavement using pavement markings (see Figures 10C-9
27 and 10C-10) or contrasting pavement color and/or contrasting pavement texture (see Figure 10C-11).

28 **Standard:**

29 **If used, pavement markings for indicating the dynamic envelope shall comply with the provisions of**
30 **Part 3 and shall be a 100 mm (4 in) normal solid white line or contrasting pavement color and/or**
31 **contrasting pavement texture.**

32 Guidance:

33 If pavement markings are used to convey the dynamic envelope, they should be placed completely outside
34 of the dynamic envelope. If used at light-rail transit grade crossings, dynamic envelope pavement markings
35 should be placed on the highway 1.8 m (6 ft) from the nearest rail and installed parallel to the tracks, unless
36 the transit authority and/or operating company advises otherwise. The pavement markings should extend
37 across the roadway as shown in Figure 10C-9.

38 Option:

39 In semiexclusive alignments, the dynamic envelope markings may be along the light rail transit trackway
40 between intersections where the trackway is immediately adjacent to travel lanes and no physical barrier is
41 present.

42 In mixed-use alignments the dynamic envelope markings may be continuous between intersections.

43 Dynamic envelope markings may be installed at all highway-light rail transit grade crossings, unless a
44 Four-Quadrant Gate system (see Section 10D.04) is used.

45 Pavement markings for adjacent travel or parking lanes may be used instead of dynamic envelope
46 markings if the lines are outside the dynamic envelope.

1 Traffic control signals may be used instead of automatic gates at highway-light rail transit grade crossings
2 within highway-highway intersections where light rail transit speeds do not exceed 60 km/h (35 mph). Traffic
3 control signals or flashing-light signals without automatic gates may be used where the crossing is at a
4 location other than an intersection and where light rail transit speeds do not exceed 40 km/h (25 mph) and the
5 roadway is a low-volume street where prevailing speeds do not exceed 40 km/h (25 mph).

6 Automatic gates may be supplemented by cantilevered flashing-light signals (see Figure 8C-1) where
7 there is a need for additional emphasis or better visibility.

8 The effectiveness of gates may be enhanced by the use of channelizing devices or raised median islands to
9 discourage driving around lowered automatic gates.

10 **Section 10D.04 Four-Quadrant Gate Systems**

11 Option:

12 Four-Quadrant Gate systems may be installed to improve safety at highway-light rail transit grade
13 crossings based on an engineering study when less restrictive measures, such as automatic gates and
14 channelization devices, are not effective.

15 **Standard:**

16 **A Four-Quadrant Gate system shall consist of a series of automatic gates used in conjunction with**
17 **flashing-light signals to control traffic on all lanes entering and exiting the highway-light rail transit**
18 **grade crossing.**

19 **The Four-Quadrant Gate system shall consist of a drive mechanism and fully retroreflectorized**
20 **red- and white-striped gate arms with lights, and which in the down position extends individually across**
21 **the entrance and exit lanes of highway traffic as shown in Figure 8C-2. Standards contained in Section**
22 **10D.02 for flashing-light signals shall be followed for signal specifications, location, and clearance**
23 **distances.**

24 **In the normal sequence of operation, unless constant warning time or other advanced system**
25 **requires otherwise, the flashing-light signals and the lights on the gate arms (in their normal upright**
26 **positions) shall be activated immediately upon detection of the approaching light rail transit vehicle.**
27 **The gate arms for the entrance lanes of traffic shall start their downward motion not less than 3**
28 **seconds after the flashing-light signals start to operate and shall reach their horizontal position at least**
29 **5 seconds before the arrival of the light rail transit vehicle. Exit gate arm activation and downward**
30 **motion shall be based on timing requirements established by an engineering study of the individual site.**
31 **The gate arms shall remain in the down position as long as the light rail transit vehicle occupies the**
32 **highway-light rail transit crossing.**

33 **When the light rail transit vehicle clears the highway-light rail transit grade crossing, and if no**
34 **other light rail transit vehicle is detected, the gate arms shall ascend to their upright positions, following**
35 **which the flashing-light signals and the lights on the gate arms shall cease operation.**

36 **Gate arm design, colors, and lighting requirements shall be in accordance with the Standards**
37 **contained in Section 8C.04.**

38 **Except as noted in the Option below, the exit gate arms shall be designed to fail-safe in the up**
39 **position.**

40 **At locations where gate arms are offset a sufficient distance for vehicles to drive between the**
41 **entrance and exit gate arms, median islands shall be installed in accordance with the needs established**
42 **by an engineering study.**

43 Guidance:

44 The gate arm should ascend to its upright position in not more than 12 seconds.

45 Four-Quadrant Gate systems should only be used in locations with constant-warning-time light rail transit
46 vehicle detection.

47 The operating mode of the exit gates should be determined based upon an engineering study, with input
48 from the affected transit agency.

49 If the Timed Exit Gate Operating Mode is used, the engineering study, with input from the affected transit
50 agency, should also determine the Exit Gate Clearance Time.

51 If the Dynamic Exit Gate Operating Mode is used, vehicle intrusion detection devices should be installed
52 to control exit gate operation based on vehicle presence within the minimum track clearance distance.

1 Regardless of which exit gate operating mode is used, the Exit Gate Clearance Time (see Section 8A.01)
2 should be considered when determining additional time requirements for the Minimum Warning Time.

3 If a Four-Quadrant Gate system is used at a location that is adjacent to an intersection that could cause
4 vehicles to queue within the minimum track clearance distance, the Dynamic Exit Gate Operating Mode
5 should be used unless an engineering study indicates otherwise.

6 If a Four-Quadrant Gate system is interconnected with a highway traffic signal, backup or standby power
7 should be considered for the highway traffic signal. Also, circuitry should be installed to prevent the highway
8 traffic signal from leaving the track clearance green interval until all of the gates are lowered.

9 At locations where sufficient space is available, exit gates should be located downstream from the track a
10 distance that provides a safety zone long enough to accommodate at least one design vehicle between the exit
11 gate and the nearest rail.

12 Four-Quadrant Gate systems should include remote health (status) monitoring capable of automatically
13 notifying light rail transit signal maintenance personnel when anomalies have occurred within the system.

14 Option:

15 Exit gate arms may fail in the down position if the highway-light rail transit grade crossing is equipped
16 with remote health (status) monitoring.

17 Four-Quadrant Gate system installations may include median islands between opposing lanes on an
18 approach to a highway-light rail transit grade crossing.

19 Guidance:

20 Where sufficient space is available, median islands should be at least 18 m (60 ft) in length.

21 **Section 10D.05 Wayside Horn Systems**

22 Option:

23 Wayside horn systems may be installed to provide directional audible warning at highway-light rail transit
24 grade crossings, including pedestrian or other non-motorized facility grade crossings or other applications, as
25 determined by a diagnostic team. Wayside horn systems may either be installed to provide supplemental
26 audible warning where the train-mounted horn is sounded or as an alternative to the sounding of a train-
27 mounted horn.

28 **Standard:**

29 **A wayside horn system shall consist of a horn or series of horns used in conjunction with light rail**
30 **transit-activated warning systems to provide audible warning of an approaching train for traffic on the**
31 **highway approaches to the highway-light rail transit grade crossing.**

32 **The wayside horn system shall be designed using fail-safe principles. A means shall be employed to**
33 **verify the sound output from the wayside horn system.**

34 **If a wayside horn system is used at a highway-light rail transit grade crossing where the train-**
35 **mounted horn is not sounded, the highway-light rail transit grade crossing shall be equipped with**
36 **flashing-light signals and gates.**

37 **Wayside horn systems used at highway-light rail transit grade crossings where the train-mounted**
38 **horn is not sounded shall be equipped with a confirmation indicator and shall operate in conformance**
39 **with 49 CFR Part 222 where required. For other applications and where 49 CFR Part 222 is not**
40 **required, the wayside horn tone and minimum sound level shall be determined by a diagnostic team.**

41 **The wayside horn system shall produce sound output for a minimum of 15 seconds prior to the**
42 **train's arrival at the highway-light rail transit grade crossing, or simultaneously with the activation of**
43 **the flashing-light signals or the descent of the gate, and shall continue to produce sound output until the**
44 **lead vehicle of the train has traversed the crossing. Where multiple tracks are present, the wayside**
45 **horn system shall immediately reactivate when another train is detected before the previous train clears**
46 **the crossing.**

47 **The wayside horn system shall be directed toward approaching road users; however, directing the**
48 **wayside horn system toward approaching road users on adjacent roadways whose movement toward**
49 **the crossing is controlled by a STOP sign or traffic control signal shall not be required.**

50 Guidance:

51 The highway-light rail transit grade crossing should be equipped with constant warning time train
52 detection circuitry unless conditions at the crossing would prevent the proper operation of the constant

1 warning time device. Where the use of constant warning time circuitry is not possible, train detection circuits
2 should be carefully reviewed to minimize the warning time provided by the wayside horn system.

3 Wayside horn systems should be installed to provide audible warning for each roadway approach to the
4 highway-light rail transit grade crossing. The same lateral clearance and roadside safety features should apply
5 to wayside horn systems as described in the Standards contained in Section 8C.01. Wayside horn systems,
6 when mounted on a separate pole assembly, should be installed no closer than 4.6 m (15 ft) from the center of
7 the nearest track and should be positioned to not obstruct the motorists' line of sight of the flashing-light
8 signals.

9 Prior to installing any wayside horn system, the responsibility for maintenance of the system and all of the
10 appurtenances, hardware, and software should be clearly established. The responsible agency should provide
11 for the maintenance of the system and the appurtenances to retain the proper functioning of the device.

12 Option:

13 Wayside horn systems may include a delay of 3 to 5 seconds after the activation of the flashing-light
14 signals before sounding.

15 Wayside horn systems may include remote health (status) monitoring capable of automatically notifying
16 maintenance personnel when anomalies have occurred within the system.

17 Wayside horn systems may be equipped with a back-up power system.

18 **Section 10D.06 Traffic Control Signals**

19 Support:

20 There are two types of traffic control signals for controlling vehicular and light rail transit movements at
21 interfaces of the two modes. The first is the standard traffic control signal described in Part 4, which is the
22 focus of this section. The other type of signal is referred to as a light rail transit signal and is discussed in
23 Section 10D.08.

24 **Standard:**

25 **The provisions of Parts 4 and 8 relating to traffic control signal design, installation, and operation,**
26 **including interconnection with nearby automatic gates or flashing-light signals, shall be applicable as**
27 **appropriate where traffic control signals are used at highway-light rail transit grade crossings.**

28 Guidance:

29 When a highway-light rail transit grade crossing equipped with a flashing-light signal system is located
30 within 60 m (200 ft) of an intersection or midblock location controlled by a traffic control signal, the traffic
31 control signal should be provided with preemption in accordance with Section 4D.27.

32 Coordination with the flashing-light signal system should be considered for traffic control signals located
33 more than 60 m (200 ft) from the crossing. Factors to be considered should include traffic volumes, vehicle
34 mix, vehicle and light rail transit approach speeds, frequency of light rail transit vehicles, and queue lengths.

35 If the highway traffic signal has emergency vehicle preemption capability, it should be coordinated with
36 light rail transit operation.

37 Where light rail transit operates in a wide median, vehicles crossing the tracks and being controlled by
38 both near and far side traffic signal faces should receive a protected left-turn green phase from the far side
39 signal face to clear vehicles from the crossing when light rail transit vehicles are approaching the crossing.

40 Option:

41 Green indications may be provided during light rail transit phases for vehicle, pedestrian, and bicycle
42 movements that do not conflict with light rail transit movements.

43 Traffic control signals may be installed in addition to four-quadrant gate systems and automatic gates at a
44 highway-light rail transit crossing if the crossing occurs within a highway-highway intersection and if the
45 traffic control signals meet the warrants described in Chapter 4C.

46 At a location other than an intersection, when light rail transit speeds are less than 40 km/h (25 mph),
47 traffic control signals alone may be used to control road users at highway-light rail transit grade crossings only
48 when justified by an engineering study.

49 Typical circumstances may include:

- 50 A. Geometric conditions preclude the installation of highway-light rail transit grade crossing warning
51 devices.
- 52 B. Light rail transit vehicles share the same roadway with road users.

1 C. Traffic control signals already exist.

2 Support:

3 Section 4D.27 contains information regarding traffic control signals at or near highway-light rail transit
4 grade crossings that are not equipped with highway-light rail transit grade crossing warning devices.

5 **Section 10D.07 Highway Traffic Signal Preemption Turning Restrictions**

6 Guidance:

7 When a light rail transit grade crossing exists within a signalized intersection, consideration should be
8 given to providing separately controlled Protected Only Mode turn phases for the movements crossing the
9 tracks (see Section 4A.02).

10 **Standard:**

11 **Signal faces that are provided for separately controlled Protected Only Mode turn movements**
12 **toward the crossing shall display a steady red indication during the approach and/or passage of light**
13 **rail transit vehicles.**

14 Guidance:

15 When a signalized intersection that is located within 60 m (200 ft) of a highway-light rail transit grade
16 crossing is preempted, all existing turning movements toward the highway-light rail transit grade crossing
17 should be prohibited.

18 Support:

19 Part 4 contains information regarding signal phasing and timing requirements.

20 Option:

21 An activated blank-out or changeable message sign and/or an appropriate highway traffic signal display
22 may be used to prohibit turning movements toward the crossing during preemption (see Section 10C.09).

23 **Standard:**

24 **Messages on the activated blank-out or changeable message signs shall be visible only when the**
25 **highway-light rail transit intersection restriction is in effect.**

26 **Section 10D.08 Use of Traffic Control Signals for Control of Light Rail Transit Vehicles at**
27 **Grade Crossings**

28 Guidance:

29 Light rail transit movements in semiexclusive alignments at nongated grade crossings that are equipped
30 with traffic control signals should be controlled by special light rail transit signal indications.

31 Light rail transit traffic control signals that are used to control light rail transit movements only should
32 display the signal indications illustrated in Figure 10D-1.

33 Section 4D.27 contains information about the use of the signal indications shown in Figure 10D-1 for the
34 control of exclusive bus movements at “queue jumper lanes” and for the control of exclusive bus rapid transit
35 movements on semiexclusive or mixed-use alignments.

36 Option:

37 Standard traffic control signals may be used instead of light rail transit traffic control signals to control the
38 movement of light rail transit vehicles (see Section 10D.06).

39 **Standard:**

40 **If a separate set of standard traffic control signal indications (red, yellow, and green circular and**
41 **arrow indications) is used to control light rail transit movements, the indications shall be positioned so**
42 **they are not visible to motorists, pedestrians, and bicyclists (see Section 4D.12).**

43 **If the light rail transit crossing control is separate from the intersection control, the two shall be**
44 **interconnected. The light rail phase shall not be terminated until after the light rail transit vehicle has**
45 **cleared the crossing.**

46 Option:

47 Light rail transit signals may be used at grade crossings and at intersections in mixed-use alignments in
48 conjunction with standard traffic control signals where special light rail transit signal phases are used to
49 accommodate turning light rail transit vehicles or where additional light rail transit clearance time is desirable.

50 Guidance:

1 Light rail transit signal faces should be separated vertically or horizontally from the nearest highway
2 traffic signal face for the same approach by at least 0.9 m (3 ft).

3 **Section 10D.09 Pedestrian and Bicycle Signals and Crossings**

4 Guidance:

5 Where light rail transit tracks are immediately adjacent to other tracks or a road, pedestrian signalization
6 should be designed to avoid having pedestrians wait between sets of tracks or between the tracks and the road.
7 If adequate space exists for a pedestrian refuge and is justified based on engineering judgment, additional
8 pedestrian signal heads, signing, and detectors should be installed (see Section 4E.08).

9 **Standard:**

10 **When used at light rail transit crossings, pedestrian signal heads shall comply with the provisions of**
11 **Section 4E.04.**

12 Guidance:

13 Flashing-light signals (see Figure 10D-2) with a Crossbuck (R15-1) sign and an audible device should be
14 installed at pedestrian and bicycle crossings where an engineering study has determined that the sight distance
15 is not sufficient for pedestrians and bicyclists to complete their crossing prior to the arrival of the light rail
16 transit vehicle at the crossing, or where light rail transit speeds exceed 60 km/h (35 mph).

17 If an engineering study shows that flashing-light signals with a Crossbuck sign and an audible device
18 would not provide sufficient notice of an approaching light rail transit vehicle, the LOOK (R15-8) sign (see
19 Figure 10D-2) and/or pedestrian gates should be considered (see Figures 10D-3, 10D-4, and 10D-5).

20 Support:

21 A pedestrian gate is similar to an automatic gate except the gate arm is shorter.

22 The swing gate alerts pedestrians to the light rail transit tracks that are to be crossed. Swing gates are
23 designed to open away from the tracks, requiring users to pull the gate open to cross, but permitting a quick
24 exit from the trackway, and to automatically close.

25 Option:

26 Swing gates may be installed across pedestrian and bicycle walkways (see Figure 10D-6).

27 Pedestrian barriers at offset crossings may be used at pedestrian and bicycle crossings as passive devices
28 that force users to face approaching light rail transit before entering the trackway (see Figures 10D-7 and 10D-
29 8).

30 **Section 10D.10 Highway-Light Rail Transit Grade Crossing(s) Within or In Close Proximity** 31 **to Roundabouts, Traffic Circles, or Circular Intersections**

32 Support:

33 At roundabouts, traffic circles, or circular intersections that include or are within close proximity to a
34 highway-light rail transit grade crossing, a queue of vehicular traffic could cause vehicles to stop on the
35 highway-light rail transit grade crossing.

36 **Standard:**

37 **Where roundabouts, traffic circles, or circular intersections include or are within close proximity to**
38 **a highway-light rail transit grade crossing, an engineering study shall be made to determine if queuing**
39 **could impact the highway-light rail transit grade crossing. If traffic queues impact the highway-light**
40 **rail transit grade crossing, provisions shall be made to clear highway traffic from the highway-light rail**
41 **transit grade crossing prior to the arrival of a train.**

42 Guidance:

43 Among the provisions that should be considered for keeping the crossing clear of traffic or for clearing
44 traffic from the crossing prior to the arrival of a train are the following:

- 45 A. Elimination of the roundabout,
- 46 B. Geometric design revisions,
- 47 C. Highway-light rail transit grade crossing warning devices,
- 48 D. Highway traffic signals,
- 49 E. Traffic metering devices,
- 50 F. Activated signs, or
- 51 G. A combination of these or other actions.

CHAPTER 10F. PATHWAY-LIGHT RAIL TRANSIT GRADE CROSSINGS

Section 10F.01 Purpose

Support:

Traffic control for pathway-light rail transit grade crossings includes all signs, signals, markings, other warning devices, and their supports at pathway-light rail transit grade crossings and along pathway approaches to a grade crossing. The function of this traffic control is to promote safety and provide effective operation of both light rail transit and pathway traffic at pathway-light rail transit grade crossings.

Except as specifically noted in this Chapter, sidewalks are considered to be part of a highway-light rail transit grade crossing rather than a pathway-light rail transit grade crossing, and are not covered by this Chapter.

Section 10F.02 Use of Standard Devices, Systems, and Practices

Guidance:

The public agency with jurisdiction over the pathway and the regulatory agency with statutory authority, if applicable, should jointly determine the need and selection of devices at a pathway-light rail transit grade crossing.

The appropriate traffic control system to be used at a pathway-light rail transit grade crossing should be determined by a diagnostic team.

Section 10F.03 Pathway-Light Rail Transit Grade Crossing Signs and Markings

Standard:

Pathway-light rail transit grade crossing signs shall be standard in shape, legend, and color.

Traffic control devices mounted adjacent to pathways at a height of less than 2.4 m (8 ft) measured vertically from the bottom edge of the device to the elevation of the near edge of the pathway surface shall have a minimum lateral clearance of 0.6 m (2 ft) from the near edge of the device to the near edge of the pathway (see Figure 9B-1).

The minimum mounting height for post-mounted signs on pathways shall be 1.2 m (4 ft), measured vertically from the bottom edge of the sign to the elevation of the near edge of the pathway surface (see Figure 9B-1).

Pathway-light rail transit grade crossing traffic control devices shall be located a minimum of 3.7 m (12 ft) from the center of the nearest track.

The minimum sizes of pathway-light rail transit grade crossing signs shall be as shown in the shared-use path column in Table 9B-1.

When overhead traffic control devices are used on pathways, the clearance from the bottom edge of the device to the pathway surface directly under the sign or device shall be at least 2.4 m (8 ft).

Guidance:

If pathway users include those who travel faster than pedestrians, such as bicyclists or skaters, the diagnostic team should consider the use of warning signs and pavement markings in advance of the pathway-rail grade crossing (see Figure 9B-7).

Section 10F.04 Stop Lines and Detectable Warnings

Guidance:

If used at pathway-light rail transit grade crossings, the stop line should be a transverse line at the point where a pathway user is to stop. The stop line should be placed at least 0.6 m (2 ft) upstream from the gate or counterweight (if present), and at least 3.7 m (12 ft) from the nearest rail.

If used on pathway-light rail transit grade crossings or sidewalks at highway-light rail transit grade crossings, detectable warnings (see Section 3B.18) should extend across the full width of the pathway or sidewalk and should be 0.6 m (2 ft) wide in the pedestrian direction of travel. Detectable warnings should be placed at least 0.6 m (2 ft) upstream from the gate or counterweight (if present), and no closer than the stop line (if present) or 3.7 m (12 ft) from the nearest rail.

Section 10F.05 Passive Devices for Pathway-Light Rail Transit Grade Crossings

Standard:

1 **Except as noted in the Option below, where active traffic control devices are not used, a Crossbuck**
2 **Assembly shall be installed on each approach to a pathway-light rail transit grade crossing.**

3 Option:

4 The Crossbuck Assembly may be omitted at station crossings and on the approaches to a pathway-light
5 rail transit grade crossing that is located within 7.6 m (25 ft) of the traveled way at a highway-light rail transit
6 grade crossing.

7 Guidance:

8 The pathway user's ability to detect the presence of an approaching train should be considered in
9 determining the type and placement of traffic control devices or design features (such as fencing or swing
10 gates).

11 Nighttime visibility should be considered if design features (such as fencing or swing gates) are used to
12 channelize pathway users.

13 When automatic gates and swing gates are used, the pathway should be channelized to direct users to the
14 entrance to and exit from the pathway-light rail transit grade crossing.

15 **Standard:**

16 **If used, swing gates shall open away from the track(s) and return to the closed position after use.**

17 Option:

18 When used in conjunction with automatic gates at pathway-light rail transit grade crossings, swing gates
19 may be equipped with a latching device that permits the gate to be opened only by pedestrians who are on the
20 track side of the gate.

21 Refuge areas may be provided to provide a place for large numbers of pedestrians to congregate during
22 the passage of a train.

23 Guidance:

24 Where refuge areas are provided, fencing should be installed to limit access to only the pathway-light rail
25 transit grade crossing.

26 **Section 10F.06 Active Traffic Control Systems for Pathway-Light Rail Transit Grade** 27 **Crossings**

28 **Standard:**

29 **If an active traffic control system is used at a pathway-light rail transit grade crossing, flashing-**
30 **light signals and a bell or other audible warning device shall be provided for each direction of the**
31 **pathway.**

32 Support:

33 If a pathway-light rail transit grade crossing is located within 7.6 m (25 ft) of the traveled way at a
34 highway-light rail transit grade crossing equipped with an active traffic control system, a separate active
35 traffic control system for the pathway is usually not provided.

36 **Standard:**

37 **If used at pathway-light rail transit grade crossings, flashing-light signals shall be alternately**
38 **flashing red lights that are aligned horizontally and the light units shall have a diameter of at least 100**
39 **mm (4 in). The mounting height for flashing red lights installed at pathway-light rail transit grade**
40 **crossings shall be a minimum of 1.2 m (4 ft), measured vertically from the bottom edge of the lights to**
41 **the elevation of the near edge of the pathway surface.**

42 Option:

43 At station crossings where more than one track is present, additional traffic control devices may be
44 installed between the tracks as recommended by a diagnostic team.

45 **Standard:**

46 **The mounting height for flashing red lights installed between the tracks at station crossings shall be**
47 **a minimum of 0.3 m (1 ft), measured vertically from the bottom edge of the lights to the elevation of the**
48 **near edge of the pathway surface.**

49 Option:

50 Automatic gates may be used at pathway-light rail transit grade crossings as recommended by a diagnostic
51 team.

1 Guidance:

2 If used at a pathway-light rail transit grade crossing, each automatic gate should be installed to rest a
3 minimum of 0.9 m (3 ft) above the pathway when in the down position.

4 If used, the gate configuration should provide for full width coverage of the pathway on both approaches
5 to the track.

6 **Standard:**

7 **Where sidewalks are located between the edge of a roadway and active traffic control devices, the**
8 **location, placement, and height prescribed for roadway gates shall be used (see Section 10D.03).**

9 Guidance:

10 Separate automatic gates used at sidewalks should be installed to rest a minimum of 0.9 m (3 ft) above the
11 sidewalk when in the down position.

12 If separate automatic gates are used for a sidewalk, a separate gate mechanism should be provided for the
13 sidewalk gate, instead of a supplemental or auxiliary gate arm installed as a part of the same mechanism as the
14 vehicular gate, in order to prevent a pedestrian from raising the vehicular gate at a highway-light rail transit
15 grade crossing.

16

1 CHAPTER 10A. GENERAL

2 Section 10A.01 Introduction

3 Support:

4 Part 10 provides standards and guidelines for the design, installation, and operation of traffic control
5 devices at grade crossings of highway traffic and light rail transit vehicles to ~~facilitate the reasonably safe,~~
6 ~~orderly,~~ promote safety and to provide for the effective, integrated movement of all traffic. The principles in
7 Section 8A.01 are the same but, because light rail vehicles sometimes operate along streets and highways in
8 mixed traffic with automotive vehicles, the traffic controls and associated standards and guidelines for
9 highway-light rail transit grade crossings presented in Part 10 can be different than those presented in Part 8.

10 Light rail transit is a mode of metropolitan transportation that employs light rail transit vehicles
11 (commonly known as light rail vehicles, streetcars, or trolleys) that operate on rails in streets in mixed traffic,
12 in semiexclusive rights-of-way, or in exclusive rights-of-way. Grade crossings with light rail transit can occur
13 at intersections or at midblock locations, including public and private driveways.

14 An initial educational campaign along with an ongoing program to continue to educate new drivers is
15 beneficial when introducing light rail operations to an area and, hence, new traffic control devices.

16 Light rail alignments can be grouped into one of the following three types:

- 17 A. Exclusive: A light rail transit right-of-way that is grade-separated or protected by a fence or traffic
18 barrier. Motor vehicles, pedestrians, and bicycles are prohibited within the right-of-way. Subways
19 and aerial structures are included within this group. This type of alignment does not have grade
20 crossings and is not further addressed in Part 10.
- 21 B. Semiexclusive: A light rail transit alignment that is in a separate right-of-way or along a street or
22 railroad right-of-way where motor vehicles, pedestrians, and bicycles have limited access and cross at
23 designated locations only.
- 24 C. Mixed-Use: An alignment where light rail transit operates in mixed traffic with all types of road users.
25 This includes streets, transit malls, and pedestrian malls where the right-of-way is shared.

26 **Standard:**

27 **Where light rail transit and railroads use the same tracks or adjacent tracks, the traffic control**
28 **devices, systems, and practices for highway-rail grade crossings described in Part 8 shall be used.**

29 Support:

30 Section 8A.01 contains a set of definitions, most of which also apply to Part 10.

31 Section 10A.02 Use of Standard Devices, Systems, and Practices

32 Support:

33 Because of the large number of significant variables to be considered, no single standard system of traffic
34 control devices is universally applicable for all highway-light rail transit grade crossings.

35 Guidance:

36 The appropriate traffic control system to be used at a highway-light rail transit grade crossing should be
37 determined by an engineering study conducted by the transit or highway agency in cooperation with other
38 appropriate State and local organizations.

39 **Standard:**

40 **Traffic control devices, systems, and practices shall be consistent with the design and application of**
41 **the Standards contained herein.**

42 **The traffic control devices, systems, and practices described herein shall be used at all highway-**
43 **light rail transit grade crossings.**

44 **Before any new highway-light rail transit grade crossing traffic control system is installed or**
45 **modifications are made to an existing system, approval shall be obtained from the local agencies having**
46 **statutory authority to grant such approval.**

47 Guidance:

48 To stimulate effective responses from vehicle operators and pedestrians, these devices, systems, and
49 practices should use the five basic considerations employed generally for traffic control devices and described
50 fully in Section 1A.02: design, placement, operation, maintenance, and uniformity.

51 Support:

1 Many other details of highway-light rail transit grade crossing traffic control systems that are not set forth
2 in Part 10 are contained in the publications listed in Section 1A.11.

3 **Section 10A.03 Uniform Provisions**

4 **Standard:**

5 **All signs used in highway-light rail transit grade crossing traffic control systems shall be**
6 **retroreflectorized or illuminated as described in Section 2A.07 to show the same shape and similar color**
7 **to an approaching road user during both day and night.**

8 **No sign or signal shall be located in the center of an undivided highway, except in a raised island.**

9 **Guidance:**

10 ~~Such~~ Any signs or signals located in a raised island in the center of an undivided highway should be
11 installed with a clearance of at least 0.6 m (2 ft) from outer edge of the raised island to the nearest edge of the
12 sign or signal, except as ~~allowed~~ permitted edited to increase consistency in Section 2A.19.

13 Where the distance between tracks, measured along the highway between the inside rails, exceeds 30 m
14 (100 ft), additional signs or other appropriate traffic control devices should be used.

15 **Section 10A.04 Highway-Light Rail Transit Grade Crossing Elimination**

16 **Guidance:**

17 Because highway-light rail transit grade crossings are a potential source of crashes and congestion,
18 agencies should conduct engineering studies to determine the cost and benefits of eliminating these crossings.

19 **Standard:**

20 **When a highway-light rail transit grade crossing is eliminated, the traffic control devices for the**
21 **crossing shall be removed.**

22 **If the existing traffic control devices at a multiple-track highway-light rail transit grade crossing**
23 **become improperly placed or inaccurate because of the removal of some of the tracks, the existing**
24 **devices shall be relocated and/or modified.**

25 **Guidance:**

26 Where a roadway is removed from a highway-light rail transit grade crossing, the roadway approaches in
27 the light rail transit right-of-way should also be removed and appropriate signs should be placed at the
28 roadway end in accordance with Section 2L.04.

29 Where light rail transit is eliminated at a highway-light rail transit grade crossing, the tracks should be
30 removed or paved over.

31 **Option:**

32 Based on engineering judgment, the TRACKS OUT OF SERVICE (R8-9) sign (see Figure 10C-3) may be
33 temporarily installed until the tracks are removed or paved over. The length of time before the tracks will be
34 removed or paved over may be considered in making the decision as to whether to install the sign.

35 **Section ~~10C.22~~ 10A.05 Illumination at Highway-Light Rail Transit Crossings relocated from** 36 **Section 10C.22**

37 ~~Guidance~~ Support:

38 Illumination is sometimes installed at or adjacent to a highway-light rail transit grade crossing in order to
39 provide better nighttime visibility of the light rail transit vehicles and the highway-light rail transit grade
40 crossing (for example, where a substantial amount of light rail transit operations are conducted at night, or
41 where crash history indicates that drivers experience difficulty in seeing trains or traffic control devices during
42 hours of darkness) ~~illumination at and adjacent to the highway-light rail transit grade crossing should be~~
43 ~~considered.~~

44 ~~Support:~~

45 Recommended types and locations of luminaires for illuminating highway-rail (light rail transit) grade
46 crossings are contained in the American National Standards Institute's (ANSI) "Practice for Roadway
47 Lighting RP-8," which is available from the Illuminating Engineering Society (see Section 1A.11).

48 **Section ~~10A.05~~ 10A.06 Temporary Traffic Control Zones**

49 **Support:**

1 Temporary traffic control planning provides for continuity of operations (such as movement of traffic,
2 pedestrians and bicycles, transit operations, and access to property/utilities) when the normal function of a
3 roadway at a highway-light rail transit grade crossing is suspended because of temporary traffic control
4 operations.

5 **Standard:**

6 **Temporary traffic control operations on highways with highway-light rail transit grade crossings**
7 **shall be as outlined in Part 6.**

8 **When a highway-light rail transit grade crossing exists either within or in the vicinity of a**
9 **temporary traffic control zone, lane restrictions, flagging (see Chapter 6E), or other operations shall not**
10 **be performed in a manner that would cause vehicles to stop on the light rail transit tracks, unless a**
11 **uniformed ~~added to increase accuracy~~ law enforcement officer or flagger is provided at the highway-**
12 **light rail transit grade crossing to minimize the possibility of vehicles stopping on the tracks, even if**
13 **automatic warning devices are in place.**

14 **Guidance:**

15 The agencies responsible for the operation of the light rail transit and highway should be contacted when
16 the initial planning begins for any temporary traffic control zone that ~~may~~ **might** directly or indirectly
17 influence the flow of traffic on mixed-use facilities where light rail transit and road users operate.
18 Responsible agencies, along with others affected, such as emergency services and businesses, should meet to
19 plan appropriate traffic detours and the necessary signing, marking, and flagging requirements for operations
20 during temporary traffic control activities. Consideration should be given to the length of time that the grade
21 crossing is to be closed, roadway classification, type of vehicle and traffic affected, the time of day, and the
22 materials and techniques of repair.

23 Temporary traffic control operations should minimize the inconvenience, delay, and crash potential to
24 affected traffic. Prior notice should be given to affected public or private parties, emergency services,
25 businesses, and road users before the free movement of vehicles or light rail transit is infringed on or blocked.

26 Temporary traffic control activities should not be permitted to extensively prolong the closing of a grade
27 crossing.

28 The width, grade, alignment, and riding quality of the highway surface at a light rail transit crossing
29 should, at a minimum, be restored to correspond with the quality of the approaches to the highway-light rail
30 transit grade crossing.

31

1 CHAPTER 10C. SIGNS, ~~ILLUMINATION,~~ AND MARKINGS

2 Section 10C.01 Purpose

3 Support:

4 Signs and markings regulate, warn, and guide the road users so that they, as well as light rail transit
5 vehicle operators, can take appropriate action.

6 Standard:

7 The design and location of signs shall ~~conform to~~ comply with the provisions of Part 2.

8 Support:

9 Section 8B.02 contains information regarding the sizes of signs for grade crossings.

10 Section 10C.02 ~~Highway-Rail Grade Crossing (Crossbuck) Sign (R15-1) and Number of~~
11 ~~Tracks Sign (R15-2)~~ Use of Crossbuck Assemblies at Passive Highway-Light Rail Transit
12 Grade Crossings

13 Standard:

14 Except as noted in the Option below, the Highway-Rail Grade Crossing (R15-1) sign, commonly
15 identified as the Crossbuck sign, shall be retroreflectorized white with the words RAILROAD
16 CROSSING in black lettering, mounted as shown in Figure 10C-1.

17 ~~As a minimum, one Crossbuck sign shall be used on each highway approach to every highway-light~~
18 ~~rail transit grade crossing on a semiexclusive alignment, alone or in combination with other traffic~~
19 ~~control devices.~~

20 Option:

21 At non-signalized crossings, the Crossbuck sign may be retroreflectorized white with the words
22 RAILROAD CROSSING in retroreflectorized red lettering, mounted as shown in Figure 10C-1.

23 A Crossbuck sign may be used on a highway approach to a highway-light rail transit grade crossing on a
24 semiexclusive or mixed-use alignment, alone or in combination with other traffic control devices.

25 Standard:

26 If automatic gates are not present where a Crossbuck sign is being used and if there are two or
27 more tracks at the highway-light rail transit grade crossing, the number of tracks shall be indicated on
28 a supplemental Number of Tracks (R15-2P) ~~sign~~ plaque of inverted T shape mounted below the
29 Crossbuck sign in the manner and at the height indicated in Figure 10C-1.

30 Option:

31 The supplemental Number of Tracks ~~sign~~ plaque may also be used at highway-light rail transit grade
32 crossings with automatic gates.

33 Standard:

34 If used, the Crossbuck ~~sign~~ Assembly (see Section 8B.05) comprised of a Crossbuck sign and either
35 a STOP (R1-1) sign or a YIELD (R1-2) sign (see Figure 10C-1) shall be installed on the right-hand
36 edited to increase clarity side of the highway on each approach to the highway-light rail transit grade
37 crossing. Where restricted sight distance or unfavorable highway geometry exists on an approach to a
38 highway-light rail transit grade crossing, an additional Crossbuck ~~sign~~ Assembly shall be installed on
39 the left-hand edited to increase clarity side of the highway, possibly placed back-to-back with the
40 Crossbuck ~~sign~~ Assembly for the opposite approach, or otherwise located so that two Crossbuck ~~signs~~
41 Assemblies are displayed for that approach.

42 A strip of retroreflective white material not less than 50 mm (2 in) in width shall be used on the
43 back of each blade of each Crossbuck sign for the length of each blade, at all highway-light rail transit
44 grade crossings, except those where Crossbuck signs have been installed back-to-back.

45 A vertical strip of retroreflective white material, not less than 50 mm (2 in) in width, shall be used
46 on each Crossbuck Assembly support at passive highway-light rail transit grade crossings for the full
47 length of the ~~front and~~ back of the support from the bottom of the Crossbuck sign ~~or Number of Tracks~~
48 ~~sign~~ to within 0.6 m (2 ft) above the ~~edge of the roadway ground,~~ except on the side of those supports
49 ~~where a STOP (R1-1) or YIELD (R1-2) sign or flashing lights have been installed or on the back side of~~
50 ~~supports for Crossbuck signs installed on one-way streets.~~

1 On Crossbuck Assemblies where the YIELD or STOP sign is installed on a separate support (see
2 Figure 10C-2), or is omitted in accordance with Section 8B.04, a vertical strip of retroreflective white
3 material, not less than 50 mm (2 in) in width, shall be used on the front of the Crossbuck Assembly
4 support from the bottom of the Crossbuck sign or Number of Tracks plaque to within 0.6 m (2 ft) above
5 the ground.

6 Option:

7 The vertical strip of retroreflective material may be omitted from the back sides of Crossbuck Assembly
8 sign supports installed on one-way streets.

9 Guidance:

10 If used, Crossbuck ~~signs~~ Assemblies should be located with respect to the highway pavement or shoulder
11 in accordance with the criteria in Chapter 2A and Figures 2A-2 and 2A-3, and should be located with respect
12 to the nearest track in accordance with Figure 8C-2.

13 The minimum lateral ~~clearance offset~~ edited to increase consistency for the nearest edge of the Crossbuck
14 ~~sign Assembly~~ should be 1.8 m (6 ft) from the edge of the shoulder or 3.7 m (12 ft) from the edge of the
15 traveled way in rural areas, and 0.6 m (2 ft) from the face of the curb in urban areas.

16 Where unusual conditions make variations in location and lateral ~~clearance offset~~ edited to increase
17 consistency appropriate, engineering judgment should be used to provide the best practical combination of
18 view and safety clearances.

19 **Section 10C.03 LOOK Sign (R15-8)**

20 Option:

21 A LOOK (for light rail transit vehicles) (R15-8) sign (see Figure 10C-3) may be mounted at highway-light
22 rail transit grade crossings ~~as a supplemental plaque on the Crossbuck (R15-1) sign post or as~~ on a separate
23 sign post in the immediate vicinity of the highway-light rail transit grade crossing on the light rail transit right-
24 of-way.

25 **Section 10C.04 Use of STOP (R1-1) or YIELD (R1-2) Signs without Crossbuck Signs at** 26 **Highway-Light Rail Transit Grade Crossings** 3rd paragraph was relocated to Section 27 **10C.05**

28 **Standard:**

29 **For all highway-light rail transit grade crossings where only STOP (R1-1) or YIELD (R1-2) signs**
30 **are installed, the placement shall ~~conform to~~ comply with the requirements of Section 2B.10. Stop**
31 **Ahead (W3-1) or Yield Ahead (W3-2) Advance Warning signs (see Figure 2C-6) shall also be installed if**
32 **the criteria for their installation given in Section 2C.35 is met.**

33 Guidance:

34 The use of only STOP or YIELD signs for road users at highway-light rail transit grade crossings should
35 be limited to those crossings where the need and feasibility is established by an engineering study. Such
36 crossings should have all of the following characteristics:

- 37 A. The crossing roadways should be secondary in character (such as a minor street with one lane in each
38 direction, an alley, or a driveway) with low traffic volumes and low speed limits. The specific
39 thresholds of traffic volumes and speed limits should be determined by the local agencies.
- 40 B. Light rail transit speeds do not exceed 40 km/h (25 mph).
- 41 C. The line of sight for an approaching light rail transit operator is adequate from a sufficient distance
42 such that the operator can sound an audible signal and bring the light rail transit vehicle to a stop
43 before arriving at the crossing.
- 44 D. The road user has sufficient sight distance at the stop line to permit the vehicle to cross the tracks
45 before the arrival of the light rail transit vehicle.
- 46 E. If at an intersection of two roadways, the intersection does not meet the warrants for a traffic control
47 signal as specified in Chapter 4C.
- 48 F. The light rail transit tracks are located such that vehicles are not likely to stop on the tracks while
49 waiting to enter a cross street or highway.

50 ~~Option:~~

1 ~~If a STOP or YIELD sign is installed at a highway light rail transit grade crossing, it may be installed on~~
2 ~~the Crossbuck post or on a separate post at the point where the vehicle is to stop, or as near to that point as~~
3 ~~practical.~~

4 **Section 10C.05 DO NOT STOP ON TRACKS Sign (R8-8)**

5 Guidance:

6 A DO NOT STOP ON TRACKS (R8-8) sign (see Figure 10C-3) should be installed whenever an
7 engineering study determines that the potential for vehicles stopping on the tracks at a highway-light rail
8 transit grade crossing is significant. Placement of the R8-8 sign should be determined as part of the
9 engineering study. The sign, if used, should be located on the right-hand **edited to increase clarity** side of the
10 highway on either the near or far side of the grade crossing, depending upon which position provides better
11 visibility to approaching drivers.

12 If a STOP or YIELD sign is installed ~~beyond~~ **downstream from** **edited to increase clarity** the light rail
13 transit crossing such that vehicle queues are likely to extend into the path of the light rail transit, a DO NOT
14 STOP ON TRACKS sign (R8-8) should be ~~posted in accordance with Section 10C.05~~ **used.** **relocated from**
15 **Section 10C.04**

16 Option:

17 DO NOT STOP ON TRACKS signs may be placed on both sides of the track.

18 On divided highways and one-way streets, a second DO NOT STOP ON TRACKS sign may be placed on
19 the near or far left-hand **edited to increase clarity** side of the highway at the grade crossing to further improve
20 visibility of the sign.

21 **Section 10C.06 TRACKS OUT OF SERVICE Sign (R8-9)**

22 Option:

23 The TRACKS OUT OF SERVICE (R8-9) sign (see Figure 10C-3) may be used at a highway-light rail
24 transit grade crossing instead of a Crossbuck (R15-1) sign and a Number of Tracks (R15-2P) ~~sign~~ **plaque**
25 when light rail transit tracks have been temporarily or permanently abandoned, but only until such time that
26 the tracks are removed or paved over.

27 **Standard:**

28 **When tracks are out of service, traffic control devices and gate arms shall be removed and the**
29 **signal heads shall be removed or hooded or turned from view to clearly indicate that they are not in**
30 **operation.**

31 **The R8-9 sign shall be removed when the tracks have been removed or covered or when the**
32 **highway-light rail transit grade crossing is returned to service.**

33 **Section ~~10C.08~~ 10C.07 STOP HERE WHEN FLASHING Sign (R8-10, R8-10a) **Sections**** 34 **10C.07 and 10C.08 were reversed to be more consistent with Part 8**

35 Option:

36 The STOP HERE WHEN FLASHING (R8-10, **R8-10a**) sign (see Figure 10C-3) may be used at a
37 highway-light rail transit grade crossing to inform drivers of the location of the stop line or the point at which
38 to stop when the flashing-light signals (see Section 10D.02) are activated.

39 **Section ~~10C.07~~ 10C.08 STOP HERE ON RED Sign (R10-6, R10-6a)**

40 Support:

41 The STOP HERE ON RED (R10-6, **R10-6a**) sign (see Figure 10C-3) defines and facilitates observance of
42 the stop lines at traffic control signals.

43 Option:

44 A STOP HERE ON RED sign may be used at locations where vehicles frequently violate the stop line or
45 where it is not obvious to road users where to stop.

46 Guidance:

47 If possible, stop lines should be placed at a point where the vehicle driver has adequate sight distance
48 along the track.

49 **Section 10C.09 Light Rail Transit-Activated Blank-Out Turn Prohibition Signs (R3-1a, R3-2a)**

1 Support:

2 Light rail transit operations can include the use of activated blank-out sign technology for turn prohibition
3 (R3-1a, R3-2a) signs (see Figure 10C-3). The signs are typically used on roads paralleling a semiexclusive or
4 mixed-use light rail transit alignment where road users might turn across the light rail transit tracks. A blank-
5 out sign displays its message only when activated. When not activated, the sign face is blank.

6 Guidance:

7 A light rail transit-activated blank-out turn prohibition sign should be used where an intersection adjacent
8 to a highway-light rail transit crossing is controlled by STOP signs, or is controlled by traffic control signals
9 with permissive turn movements for road users crossing the tracks.

10 Option:

11 A light rail transit-activated blank-out turn prohibition sign may be used for turning movements that cross
12 the tracks.

13 As an alternative to light rail transit-activated blank-out turn prohibition signs at intersections with traffic
14 control signals, exclusive traffic control signal phases such that all movements that cross the tracks have a
15 steady ~~added to increase accuracy~~ red indication may be used in combination with No Turn on Red (R10-11,
16 R10-11a, or R10-11b) ~~added to increase accuracy~~ signs (see Section 2B.59).

17 **Standard:**

18 **Turn prohibition signs that are associated with preemption shall be visible only when the highway-**
19 **light rail transit grade crossing restriction is in effect.**

20 **Section 10C.10 EXEMPT Highway-Rail Grade Crossing ~~Sign~~ Plaques (R15-3P, W10-1aP)**

21 Option:

22 When authorized by law or regulation, a supplemental EXEMPT (R15-3P) ~~sign~~ plaque (see Figure 10C-3)
23 with a white background may be used below the Crossbuck sign or Number of Tracks ~~sign~~ plaque, if present,
24 at the highway-light rail transit grade crossing, and a supplemental EXEMPT (W10-1aP) ~~sign~~ plaque (see
25 Figure 10C-4) with a yellow background may be used below the Highway-Rail Advance Warning (W10-1)
26 sign. Where neither the Crossbuck nor the advance warning signs exist for a particular crossing, an EXEMPT
27 (R15-3P) ~~sign~~ plaque with a white background may be placed on its own post on the near right side of the
28 approach to the crossing.

29 Support:

30 These supplemental ~~signs~~ plaques inform drivers of vehicles carrying passengers for hire, school buses
31 carrying students, or vehicles carrying hazardous materials that a stop is not required at certain designated
32 highway-light rail transit grade crossings, except when a light rail transit vehicle is approaching or occupying
33 the highway-light rail transit grade crossing, or the driver's view is blocked.

34 **Section 10C.11 Divided Highway with Light Rail Transit Crossing Signs (R15-7 Series)**

35 Option:

36 The Divided Highway with Light Rail Transit Crossing (R15-7) sign (see Figure 10C-3) may be used as a
37 supplemental sign on the approach legs of a roadway that intersects with a divided highway where light rail
38 transit vehicles operate in the median. The sign may be placed beneath a STOP sign or mounted separately.

39 Guidance:

40 The number of tracks ~~shown~~ displayed ~~edited to increase consistency~~ on the R15-7 sign should be the
41 same as the actual number of tracks.

42 **Standard:**

43 **When the Divided Highway With Light Rail Transit Crossing sign is used at a four-legged**
44 **intersection, the R15-7 sign shall be used. When used at a T-intersection, the R15-7a sign shall be used.**

45 **Section 10C.12 No Vehicles On Tracks Signs (R15-6, R15-6a)**

46 Support:

47 The No Vehicles On Tracks (R15-6) sign (see Figure 10C-3) is used where there are adjacent traffic lanes
48 separated from the light rail transit lane by a curb or pavement markings.

49 Guidance:

1 The DO NOT ENTER (R5-1) sign should be used where a road user could wrongly enter a light rail
2 transit only street.

3 Option:

4 A No Vehicles On Tracks sign may be used to deter vehicles from driving on the trackway. It may be
5 installed ~~either~~ **grammar – more than two choices** on a 0.9 m (3 ft) flexible post between double tracks, on a
6 post alongside the tracks, or overhead.

7 Instead of the R15-6 symbol sign, a regulatory sign with the word message DO NOT DRIVE ON
8 TRACKS (R15-6a) may be used (see Figure 10C-3).

9 A reduced size of 300 x 300 mm (12 x 12 in) may be used if the R15-6 sign is installed between double
10 tracks.

11 **Standard:**

12 **The smallest size for the R15-6 sign shall be 300 x 300 mm (12 x 12 in).**

13 **Section 10C.13 Light Rail Transit Only Lane Signs (R15-4 Series)**

14 Support:

15 The Light Rail Transit Only Lane (R15-4 series) signs (see Figure 10C-3) are used for multi-lane
16 operations, where road users might need additional guidance on lane use and/or restrictions.

17 Option:

18 Light Rail Transit Only Lane signs may be used on a roadway lane limited to only light rail transit use to
19 indicate the restricted use of a lane in semiexclusive and mixed alignments.

20 Guidance:

21 If used, the R15-4a, R15-4b, and R15-4c signs should be installed on posts adjacent to the roadway
22 containing the light rail transit tracks or overhead above the light rail transit only lane.

23 Option:

24 If the trackway is paved, preferential lane markings (see Section 3B.25) may be installed but only in
25 combination with light rail transit only lane signs.

26 Support:

27 The trackway is the continuous way designated for light rail transit, including the entire dynamic
28 envelope. Section 10C.24 contains more information regarding the dynamic envelope.

29 **Section 10C.14 Do Not Pass Light Rail Transit Signs (R15-5, R15-5a)**

30 Support:

31 A Do Not Pass Light Rail Transit (R15-5) sign (see Figure 10C-3) is used to indicate that vehicles are not
32 allowed to pass light rail transit vehicles that are loading or unloading passengers where there is no raised
33 platform or physical separation from the lanes upon which other motor vehicles are operating.

34 Option:

35 The R15-5 sign may be used in mixed-use alignments and may be mounted overhead where there are
36 multiple lanes.

37 Instead of the R15-5 symbol sign, a regulatory sign with the word message DO NOT PASS STOPPED
38 TRAIN (R15-5a) may be used (see Figure 10C-3).

39 Guidance:

40 If used, the R15-5 sign should be located immediately before the light rail transit boarding area.

41 **Section 10C.15 Highway-Rail Grade Crossing Advance Warning Signs (W10 Series)**

42 **Standard:**

43 **A Highway-Rail Grade Crossing Advance Warning (W10-1) sign (see Figure 10C-4) with a**
44 **supplemental plaque describing the type of traffic control at the highway-light rail transit grade**
45 **crossing shall be used on each highway in advance of every highway-light rail transit grade crossing in**
46 **semiexclusive alignments except in the following circumstances:**

- 47 **A. On an approach to a highway-light rail transit grade crossing from a T-intersection with a**
48 **parallel highway if the distance from the edge of the track to the edge of the parallel roadway is**
49 **less than 30 m (100 ft) and W10-3 signs are used on both approaches of the parallel highway;**

- 1 B. On low-volume, low-speed highways crossing minor spurs or other tracks that are infrequently
2 used and ~~are flagged by~~ where transit crews manually stop road users from entering the
3 crossing;
- 4 C. In business or commercial ~~districts~~ areas where active highway-light rail transit grade crossing
5 traffic control devices are in use; or
- 6 D. Where physical conditions do not permit even a partially effective display of the sign.

7 The supplemental plaque shall be a No Signal (W10-10P) plaque where used in advance of a
8 crossing that does not have active traffic control devices and shall be a SIGNAL AHEAD (W10-16P)
9 plaque where used in advance of a crossing with active traffic control devices, except where the
10 highway-light rail transit grade crossing traffic control devices consist solely of traffic control signals.
11 The supplemental plaque shall be mounted directly below the W10-1 sign unless a NO TRAIN HORN
12 (W10-9P) plaque (see Section 8B.15) is used, in which case the supplemental No Signal (W10-10P) or
13 SIGNAL AHEAD (W10-16P) plaque shall be mounted directly below the W10-9P plaque.

14 Placement of the Highway-Rail Grade Crossing Advance Warning sign shall be in accordance with
15 ~~Chapter 2A~~ Section 2C.05 and Table 2C-4.

16 A Yield Ahead (W3-2) or Stop Ahead (W3-1) Advance Warning sign (see Figure 2C-6) shall also be
17 installed if the criteria for their installation given in Section 2C.35 is met. If a Yield Ahead or Stop
18 Ahead sign is installed on the approach to the crossing, the W10-1 sign and supplemental plaque shall
19 be installed upstream from the Yield Ahead or Stop Ahead sign. The Yield Ahead or Stop Ahead sign
20 shall be located in accordance with Table 2C-4. The minimum distance between the signs shall be in
21 accordance with Section 2C.05 and Table 2C-4.

22 Option:

23 On divided highways and one-way streets, an additional W10-1 sign and supplemental plaque may be
24 installed on the left-hand side of the roadway.

25 **Standard:**

26 If the distance between the light rail transit tracks in a semiexclusive alignment and a parallel
27 highway, from the edge of the tracks to the edge of the parallel roadway, is less than 30 m (100 ft), W10-
28 2, W10-3, or W10-4 signs (see Figure 10C-4) with a NO SIGNAL (W10-10P) or SIGNAL AHEAD
29 (W10-16P) supplemental plaque describing the type of traffic control at the highway-light rail transit
30 grade crossing shall be installed on each approach of the parallel highway to warn road users making a
31 turn that they will encounter a highway-light rail transit grade crossing soon after making a turn, and a
32 W10-1 sign for the approach to the tracks shall not be required to be between the tracks and the
33 parallel highway.

34 If the W10-2, W10-3, or W10-4 signs and supplemental plaques are used, sign placement in
35 accordance with the guidelines for Intersection Warning signs in Table 2C-4 using the speed of through
36 traffic shall be measured from the highway intersection.

37 Guidance:

38 If the distance between the light rail transit tracks and the parallel highway, from the edge of the tracks to
39 the edge of the parallel roadway, is 30 m (100 ft) or more, a W10-1 sign and supplemental plaque should be
40 installed in advance of the highway-light rail transit grade crossing, and the W10-2, W10-3, or W10-4 signs
41 should not be used on the parallel highway.

42 **Section 10C.16 Low Ground Clearance Highway-Rail Grade Crossing Sign (W10-5)**

43 Guidance:

44 If the highway profile conditions are sufficiently abrupt to create a hang-up situation for long wheelbase
45 vehicles or for trailers with low ground clearance, the Low Ground Clearance Highway-Rail Grade Crossing
46 (W10-5) sign (see Figure 10C-4) should be installed in advance of the highway-light rail transit grade
47 crossing.

48 Support:

49 Information regarding the use of the W10-5 sign is contained in Section 8B.17.

50 **Section 10C.17 Light Rail Transit Approaching-Activated Blank-Out Warning Sign (W10-7)**

51 Support:

1 The Light Rail Transit Approaching-Activated Blank-Out (W10-7) warning sign (see Figure 10C-4)
2 supplements the traffic control ~~signal~~ devices to warn road users ~~turning across~~ crossing the tracks of an
3 approaching ~~parallel~~ light rail transit vehicle.

4 Option:

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

7 **Section 10C.18 Storage Space Signs (W10-11, W10-11a, W10-11b)**

8 Guidance:

9 A Storage Space (W10-11) sign supplemented by a word message storage distance (W10-11a) sign (see
10 Figure 10C-4) should be used where there is a highway intersection in close proximity to the highway-light
11 rail transit grade crossing and an engineering study determines that adequate space is not available to store a
12 design vehicle(s) between the highway intersection and the light rail transit vehicle dynamic envelope.

13 Support:

14 Information regarding the use of the W10-11, W10-11a, and W10-11b signs is contained in Section
15 8B.18.

16 **Section 10C.19 Skewed Crossing Sign (W10-12)**

17 Option:

18 The Skewed Crossing (W10-12) sign (see Figure 10C-4) may be used at a skewed highway-light rail
19 transit grade crossing to warn ~~drivers~~ road users that the light rail transit tracks are not perpendicular to the
20 highway.

21 Support:

22 Information regarding the use of the W10-12 sign is contained in Section 8B.19.

23 **Section 10C.20 Light Rail Transit Station Sign (I-12)**

24 Option:

25 The Light Rail Transit Station (I-12) sign (see Figure 10C-4) may be used to direct road users to a light
26 rail transit station or boarding location. It may be supplemented by the name of the transit system and by
27 arrows as provided in Section 2D.08.

28 **Section 10C.21 Emergency Notification Sign (I-13 ~~or I-13a~~)**

29 Guidance:

30 ~~A~~ Emergency Notification (I-13 ~~or I-13a~~) signs (see Figure 10C-5) should be installed at all highway-
31 light rail transit grade crossings on semiexclusive alignments to provide ~~for emergency notification~~
32 information to road users so that they can notify the transit company about emergencies or malfunctioning
33 traffic control devices. ~~The sign should have a white message on blue background.~~

34 ~~Location and placement should be decided cooperatively by the transit company and the public or private~~
35 ~~highway agencies based on specific site conditions.~~

36 ~~This sign, which is for emergency notification, should convey a clear and simple message that is visible to~~
37 ~~anyone stalled or disabled on the transit tracks, and to anyone with other emergencies.~~

38 ~~Support:~~

39 ~~Examples of sign messages are shown in Figure 10C-4.~~

40 **Standard:**

41 **When Emergency Notification signs are used, they shall, at a minimum, include a unique crossing**
42 **identifier and the emergency contact telephone number in letters and numbers that are at least 13 mm**
43 **(0.5 in) in height.**

44 **The Emergency Notification signs shall be positioned so as to not obstruct any traffic control**
45 **devices or limit the view of trains approaching the highway-light rail transit grade crossing.**

46 **Option:**

47 **In lieu of Emergency Notification signs, the unique crossing identifier and the emergency contact**
48 **telephone number may be displayed on the enclosure for the signal apparatus at crossings that are equipped**

1 [with active traffic control systems if the signal apparatus enclosure is located in direct view of road users at or](#)
2 [near the crossing.](#)

3 **Standard:**

4 [Emergency Notification Signs shall have a white legend and border on a blue background.](#)

5 **Guidance:**

6 [Emergency Notification signs should be retroreflective.](#)

7 [Emergency Notification signs, or the information placed on the signal apparatus enclosure, should be](#)
8 [oriented so as to face vehicles stopped on or at the crossing or on the traveled way near the crossing.](#)

9 [At station crossings, Emergency Notification signs or information should be posted in a conspicuous](#)
10 [location.](#)

11 [Emergency Notification signs mounted on Crossbuck Assemblies or signal masts should only be large](#)
12 [enough to provide the necessary contact information. Use of larger signs that might obstruct the view of trains](#)
13 [or other vehicles should be avoided.](#)

14 ~~Section 10C.22 Illumination at Highway-Light Rail Transit Crossings~~ **relocated to Section**
15 **10A.05**

16 ~~Section 10C.23~~ **10C.22 Pavement Markings**

17 **Standard:**

18 All highway-light rail transit grade crossing pavement markings shall be retroreflectorized white.
19 All other markings shall be in accordance with Part 3.

20 [On paved roadways,](#) pavement markings in advance of a highway-light rail transit grade crossing
21 shall consist of an X, the letters RR, a no-passing zone marking ([on two-lane, two-way highways where](#)
22 [with centerline center line markings are used in compliance with Section 3B.01](#)), and certain transverse
23 lines as shown in Figures 10C-6 and 10C-7.

24 Identical markings shall be placed in each approach lane on all paved approaches to highway-light
25 rail transit grade crossings where signals or automatic gates are located, and at all other highway-light
26 rail transit grade crossings where the posted or statutory highway speed is 60 km/h (40 mph) or greater.

27 Pavement markings shall not be required at highway-light rail transit grade crossings where the
28 posted or statutory highway speed is less than 60 km/h (40 mph). ~~or~~ In urban areas, [pavement](#)
29 [markings shall not be required at highway-light rail transit grade crossings](#) if an engineering study
30 indicates that other installed devices provide suitable warning and control.

31 **Guidance:**

32 When pavement markings are used, ~~a portion~~ [the center](#) of the X symbol should be directly ~~opposite in~~
33 [line with](#) the Advance Warning sign. The X symbol and letters should be elongated to allow for the low angle
34 at which they will be viewed.

35 **Option:**

36 When justified by engineering judgment, supplemental pavement marking symbol(s) may be placed
37 between the Advance Warning sign and the highway-light rail transit grade crossing.

38 ~~Section 10C.24~~ **10C.23 Stop Lines**

39 ~~Support:~~

40 ~~Information regarding the use of stop lines at grade crossings is contained in Section 8B.21.~~

41 **Standard:**

42 [On paved roadways at highway-light rail transit grade crossings that are equipped with active](#)
43 [control devices such as flashing-light signals, gates, or traffic control signals, a stop line \(see Section](#)
44 [3B.16\) shall be installed to indicate the point behind which vehicles are required to stop.](#)

45 **Guidance:**

46 [The stop line should be a transverse line at a right angle to the traveled way at a point where a vehicle is to](#)
47 [stop or as near to that point as practical. The stop line should be placed approximately 2.4 m \(8 ft\) from the](#)
48 [gate \(if present\), but no closer than 4.6 m \(15 ft\) from the nearest rail.](#)

49 **Support:**

1 [Section 8B.05 contains provisions regarding the use of stop lines or yield lines at passive grade crossings.](#)

2 **Section ~~10C.25~~ [10C.24](#) Dynamic Envelope Markings**

3 Support:

4 The dynamic envelope (see Figure 10C-8) markings indicate the clearance required for the light rail
5 transit vehicle overhang resulting from any combination of loading, lateral motion, or suspension failure.

6 Option:

7 The dynamic envelope may be delineated on the pavement using pavement markings (see Figures 10C-9
8 and 10C-10) or contrasting pavement color and/or contrasting pavement texture (see Figure 10C-11).

9 **Standard:**

10 **If used, pavement markings for indicating the dynamic envelope shall ~~conform to~~ [comply with the](#)
11 [provisions of Part 3](#) and shall be a 100 mm (4 in) normal solid white line or contrasting pavement color
12 and/or contrasting pavement texture.**

13 Guidance:

14 If pavement markings are used to convey the dynamic envelope, they should be placed completely outside
15 of the dynamic envelope. If used at light-rail transit grade crossings, dynamic envelope pavement markings
16 should be placed on the highway 1.8 m (6 ft) from the nearest rail and installed parallel to the tracks, unless
17 the transit authority and/or operating company advises otherwise. The pavement markings should extend
18 across the roadway as shown in Figure 10C-9.

19 Option:

20 In semiexclusive alignments, the dynamic envelope markings may be along the light rail transit trackway
21 between intersections where the trackway is immediately adjacent to travel lanes and no physical barrier is
22 present.

23 In mixed-use alignments the dynamic envelope markings may be continuous between intersections.

24 Dynamic envelope markings may be installed at all highway-light rail transit grade crossings, unless a
25 Four-Quadrant Gate system (see Section 10D.04) is used.

26 Pavement markings for adjacent travel or parking lanes may be used instead of dynamic envelope
27 markings if the lines are outside the dynamic envelope.

28

1 **CHAPTER 10D. HIGHWAY-LIGHT RAIL TRANSIT ACTIVE TRAFFIC CONTROL**
2 **GRADE CROSSING SYSTEMS**

3 **Section 10D.01 Introduction**

4 Support:

5 Active light rail transit traffic control systems inform ~~motorists, bicyclists, and pedestrians~~ road users of
6 the approach or presence of light rail transit vehicles at highway-light rail transit grade crossings. These
7 systems include four-quadrant gate systems, automatic gates, flashing-light signals, traffic control signals,
8 actuated blank-out and variable message signs, and other active traffic control devices.

9 Guidance:

10 Where both traffic control signals and flashing-light signals (with or without automatic gates) are in
11 operation at the same highway-light rail transit grade crossing, the operation of the devices should be
12 coordinated to avoid any display of conflicting signal indications.

13 If a pedestrian route is provided, sufficient clearance from supports, posts, and gate mechanisms should be
14 maintained for pedestrian travel.

15 ~~Option~~ **Standard:**

16 If flashing-light signals or traffic control signals are in operation at a crossing that is used by
17 pedestrians, bicyclists, and/or other non-motorized road users, audible devices ~~may~~ shall also be
18 provided and shall be operated in conjunction with the flashing lights or traffic control signals.

19 Support:

20 Light rail transit typically operates through grade crossings in semiexclusive and mixed-use alignments at
21 speeds between 16 km/h (10 mph) and 105 km/h (65 mph).

22 When light rail transit speed is cited in this Part, it refers to the maximum speed at which light rail transit
23 vehicles are permitted to traverse a particular grade crossing.

24 **Section 10D.02 Flashing-Light Signals**

25 Support:

26 Sections 8C.02 and 8C.03 contain additional details regarding flashing-light signals.

27 **Standard:**

28 **Highway-light rail transit grade crossings in semiexclusive alignments shall be equipped with**
29 **flashing-light signals where light rail transit speeds exceed 60 km/h (35 mph). Flashing-light signals**
30 **shall be clearly visible to motorists, pedestrians, and bicyclists.**

31 Guidance:

32 Where the crossing is at a location other than an intersection, ~~where and~~ edited to increase clarity light rail
33 transit speeds exceed 40 km/h (25 mph), flashing-light signals should be installed.

34 Option:

35 Traffic control signals may be used instead of flashing-light signals at highway-light rail transit grade
36 crossings within highway-highway intersections where light rail transit speeds do not exceed 60 km/h (35
37 mph). Traffic control signals or flashing-light signals may be used where the crossing is at a location other
38 than an intersection, where light rail transit speeds do not exceed 40 km/h (25 mph), and when the roadway is
39 a low-volume street where prevailing speeds do not exceed 40 km/h (25 mph).

40 **Section 10D.03 Automatic Gates**

41 Support:

42 An automatic gate is a traffic control device used ~~as an adjunct to~~ in conjunction with flashing-light
43 signals.

44 Section 8C.04 contains further details regarding automatic gates.

45 Guidance:

46 Highway-light rail transit grade crossings in semiexclusive alignments should be equipped with automatic
47 gates and flashing-light signals (see Section 10D.02) where light rail transit speeds exceed 60 km/h (35 mph).

48 Option:

1 Where the grade crossing is at a location other than an intersection, where light rail transit speeds exceed
2 40 km/h (25 mph), automatic gates and flashing-light signals may be installed.

3 Traffic control signals may be used instead of automatic gates at highway-light rail transit grade crossings
4 within highway-highway intersections where light rail transit speeds do not exceed 60 km/h (35 mph). Traffic
5 control signals or flashing-light signals without automatic gates may be used where the crossing is at a
6 location other than an intersection and where light rail transit speeds do not exceed 40 km/h (25 mph) and the
7 roadway is a low-volume street where prevailing speeds do not exceed 40 km/h (25 mph).

8 Automatic gates may be supplemented by cantilevered flashing-light signals (see Figure 8C-1) where
9 there is a need for additional emphasis or better visibility.

10 The effectiveness of gates may be enhanced by the use of channelizing devices or raised median islands to
11 discourage driving around lowered automatic gates.

12 **Section 10D.04 Four-Quadrant Gate Systems**

13 Option:

14 Four-Quadrant Gate systems may be installed to improve safety at highway-light rail transit grade
15 crossings based on an engineering study when less restrictive measures, such as automatic gates and
16 channelization devices, are not effective.

17 **Standard:**

18 A Four-Quadrant Gate system shall consist of a series of automatic gates used ~~as an adjunct to~~ in
19 conjunction with flashing-light signals to control traffic on all lanes entering and exiting the highway-
20 light rail transit grade crossing.

21 The Four-Quadrant Gate system shall consist of a drive mechanism and fully retroreflectorized
22 red- and white-striped gate arms with lights, and which in the down position extends individually across
23 the entrance and exit lanes of highway traffic as shown in Figure 8C-2. Standards contained in Section
24 10D.02 for flashing-light signals shall be followed for signal specifications, location, and clearance
25 distances.

26 In the normal sequence of operation, unless constant warning time or other advanced system
27 requires otherwise, the flashing-light signals and the lights on the gate arms (in their normal upright
28 positions) shall be activated immediately upon detection of the approaching light rail transit vehicle.
29 The gate arms for the entrance lanes of traffic shall start their downward motion not less than 3
30 seconds after the flashing-light signals start to operate and shall reach their horizontal position at least
31 5 seconds before the arrival of the light rail transit vehicle. Exit gate arm activation and downward
32 motion shall be based on timing requirements established by an engineering study of the individual site.
33 The gate arms shall remain in the down position as long as the light rail transit vehicle occupies the
34 highway-light rail transit crossing.

35 When the light rail transit vehicle clears the highway-light rail transit grade crossing, and if no
36 other light rail transit vehicle is detected, the gate arms shall ascend to their upright positions, following
37 which the flashing-light signals added to improve consistency and the lights on the gate arms shall cease
38 operation.

39 Gate arm design, colors, and lighting requirements shall be in accordance with the Standards
40 contained in Section 8C.04.

41 Except as noted in the Option below, the exit gate arms shall be designed to fail-safe in the up
42 position.

43 At locations where gate arms are offset a sufficient distance for vehicles to drive between the
44 entrance and exit gate arms, median islands shall be installed in accordance with the needs established
45 by an engineering study.

46 Guidance:

47 The gate arm should ascend to its upright position in not more than 12 seconds.

48 Four-Quadrant Gate systems should only be used in locations with constant-warning-time light rail transit
49 vehicle detection.

50 The operating mode of the exit gates should be determined based upon an engineering study, with input
51 from the affected transit agency.

1 If the Timed Exit Gate Operating Mode is used, the engineering study, with input from the affected transit
2 agency, should also determine the Exit Gate Clearance Time.

3 If the Dynamic Exit Gate Operating Mode is used, vehicle intrusion detection devices should be installed
4 to control exit gate operation based on vehicle presence within the minimum track clearance distance.

5 Regardless of which exit gate operating mode is used, the Exit Gate Clearance Time (see Section 8A.01)
6 should be considered when determining additional time requirements for the Minimum Warning Time.

7 If a Four-Quadrant Gate system is used at a location that is adjacent to an intersection that could cause
8 vehicles to queue within the minimum track clearance distance, the Dynamic Exit Gate Operating Mode
9 should be used unless an engineering study indicates otherwise.

10 If a Four-Quadrant Gate system is interconnected with a highway traffic signal, backup or standby power
11 should be considered for the highway traffic signal. Also, circuitry should be installed to prevent the highway
12 traffic signal from leaving the track clearance green interval until all of the gates are lowered.

13 At locations where sufficient space is available, exit gates should be ~~set back~~ located downstream from
14 the track a distance that provides a safety zone long enough to accommodate at least one design vehicle
15 between the exit gate and the nearest rail.

16 Four-Quadrant Gate systems should include remote health (status) monitoring capable of automatically
17 notifying light rail transit signal maintenance personnel when anomalies have occurred within the system.

18 Option:

19 Exit gate arms may fail in the down position if the highway-light rail transit grade crossing is equipped
20 with remote health (status) monitoring.

21 Four-Quadrant Gate system installations may include median islands between opposing lanes on an
22 approach to a highway-light rail transit grade crossing.

23 Guidance:

24 Where sufficient space is available, median islands should be at least 18 m (60 ft) in length.

25 Section 10D.05 Wayside Horn Systems

26 Option:

27 Wayside horn systems may be installed to provide directional audible warning at highway-light rail transit
28 grade crossings, including pedestrian or other non-motorized facility grade crossings or other applications, as
29 determined by a diagnostic team. Wayside horn systems may either be installed to provide supplemental
30 audible warning where the train-mounted horn is sounded or as an alternative to the sounding of a train-
31 mounted horn.

32 Standard:

33 A wayside horn system shall consist of a horn or series of horns used in conjunction with light rail
34 transit-activated warning systems to provide audible warning of an approaching train for traffic on the
35 highway approaches to the highway-light rail transit grade crossing.

36 The wayside horn system shall be designed using fail-safe principles. A means shall be employed to
37 verify the sound output from the wayside horn system.

38 If a wayside horn system is used at a highway-light rail transit grade crossing where the train-
39 mounted horn is not sounded, the highway-light rail transit grade crossing shall be equipped with
40 flashing-light signals and gates.

1 Wayside horn systems used at highway-light rail transit grade crossings where the train-mounted
2 horn is not sounded shall be equipped with a confirmation indicator and shall operate in conformance
3 with 49 CFR Part 222 where required. For other applications and where 49 CFR Part 222 is not
4 required, the wayside horn tone and minimum sound level shall be determined by a diagnostic team.

5 The wayside horn system shall produce sound output for a minimum of 15 seconds prior to the
6 train's arrival at the highway-light rail transit grade crossing, or simultaneously with the activation of
7 the flashing-light signals or the descent of the gate, and shall continue to produce sound output until the
8 lead vehicle of the train has traversed the crossing. Where multiple tracks are present, the wayside
9 horn system shall immediately reactivate when another train is detected before the previous train clears
10 the crossing.

11 The wayside horn system shall be directed toward approaching road users; however, directing the
12 wayside horn system toward approaching road users on adjacent roadways whose movement toward
13 the crossing is controlled by a STOP sign or traffic control signal shall not be required.

14 Guidance:

15 The highway-light rail transit grade crossing should be equipped with constant warning time train
16 detection circuitry unless conditions at the crossing would prevent the proper operation of the constant
17 warning time device. Where the use of constant warning time circuitry is not possible, train detection circuits
18 should be carefully reviewed to minimize the warning time provided by the wayside horn system.

19 Wayside horn systems should be installed to provide audible warning for each roadway approach to the
20 highway-light rail transit grade crossing. The same lateral clearance and roadside safety features should apply
21 to wayside horn systems as described in the Standards contained in Section 8C.01. Wayside horn systems,
22 when mounted on a separate pole assembly, should be installed no closer than 4.6 m (15 ft) from the center of
23 the nearest track and should be positioned to not obstruct the motorists' line of sight of the flashing-light
24 signals.

25 Prior to installing any wayside horn system, the responsibility for maintenance of the system and all of the
26 appurtenances, hardware, and software should be clearly established. The responsible agency should provide
27 for the maintenance of the system and the appurtenances to retain the proper functioning of the device.

28 Option:

29 Wayside horn systems may include a delay of 3 to 5 seconds after the activation of the flashing-light
30 signals before sounding.

31 Wayside horn systems may include remote health (status) monitoring capable of automatically notifying
32 maintenance personnel when anomalies have occurred within the system.

33 Wayside horn systems may be equipped with a back-up power system.

34 **Section ~~10D.05~~ 10D.06 Traffic Control Signals**

35 **Support:**

36 There are two types of traffic control signals for controlling vehicular and light rail transit movements at
37 interfaces of the two modes. The first is the standard traffic control signal described in Part 4, which is the
38 focus of this section. The other type of signal is referred to as a light rail transit signal and is discussed in
39 Section 10D.08.

40 **Standard:**

41 **The provisions of Parts 4 and 8 relating to traffic control signal design, installation, and operation,**
42 **including interconnection with nearby automatic gates or flashing-light signals, shall be applicable as**
43 **appropriate where traffic control signals are used at highway-light rail transit grade crossings.**

44 **Guidance:**

45 When a highway-light rail transit grade crossing equipped with a flashing-light signal system is located
46 within 60 m (200 ft) of an intersection or midblock location controlled by a traffic control signal, the traffic
47 control signal should be provided with preemption in accordance with Section 4D.27.

48 Coordination with the flashing-light signal system should be considered for traffic control signals located
49 more than 60 m (200 ft) from the crossing. Factors to be considered should include traffic volumes, vehicle
50 mix, vehicle and light rail transit approach speeds, frequency of light rail transit vehicles, and queue lengths.

51 If the highway traffic signal has emergency vehicle preemption capability, it should be coordinated with
52 light rail transit operation.

1 Where light rail transit operates in a wide median, vehicles crossing the tracks and being controlled by
2 both near and far side traffic signal faces should receive a protected left-turn green phase from the far side
3 signal face to clear vehicles from the crossing when light rail transit vehicles are approaching the crossing.

4 Option:

5 Green indications may be provided during light rail transit phases for vehicle, pedestrian, and bicycle
6 movements that do not conflict with light rail transit movements.

7 Traffic control signals may be installed in addition to four-quadrant gate systems and automatic gates at a
8 highway-light rail transit crossing if the crossing occurs within a highway-highway intersection and if the
9 traffic control signals meet the warrants described in Chapter 4C.

10 At a location other than an intersection, when light rail transit speeds are less than 40 km/h (25 mph),
11 traffic control signals alone may be used to control road users at highway-light rail transit grade crossings only
12 when justified by an engineering study.

13 Typical circumstances may include:

- 14 A. Geometric conditions preclude the installation of highway-light rail transit grade crossing warning
15 devices.
- 16 B. Light rail transit vehicles share the same roadway with road users.
- 17 C. Traffic control signals already exist.

18 Support:

19 ~~See~~ Section 4D.27 ~~for considerations~~ [contains information](#) regarding traffic control signals at or near
20 highway-light rail transit grade crossings that are not equipped with highway-light rail transit grade crossing
21 warning devices.

22 ~~Section 10D.06~~ [10D.07](#) Highway Traffic Signal Preemption Turning Restrictions

23 Guidance:

24 When a light rail transit grade crossing exists within a signalized intersection, consideration should be
25 given to providing separately controlled Protected Only Mode turn phases for the movements crossing the
26 tracks (see Section 4A.02).

27 **Standard:**

28 **Signal faces that are provided for separately controlled Protected Only Mode turn movements**
29 **toward the crossing shall display a [steady](#) red indication during the approach and/or passage of light**
30 **rail transit vehicles.**

31 Guidance:

32 When a signalized intersection that is located within 60 m (200 ft) of a highway-light rail transit grade
33 crossing is preempted, all existing turning movements toward the highway-light rail transit grade crossing
34 should be prohibited.

35 Support:

36 Part 4 contains information regarding signal phasing and timing requirements.

37 Option:

38 An activated blank-out or changeable message sign and/or an appropriate highway traffic signal display
39 may be used to prohibit turning movements toward the crossing during preemption (see Section 10C.09).

40 **Standard:**

41 **Messages on the activated blank-out or changeable message signs shall be visible only when the**
42 **highway-light rail transit intersection restriction is in effect.**

43 ~~Section 10D.07~~ [10D.08](#) Use of Traffic Control Signals for Control of Light Rail Transit 44 Vehicles at Grade Crossings

45 Guidance:

46 Light rail transit movements in semiexclusive alignments at nongated grade crossings that are equipped
47 with traffic control signals should be controlled by special light rail transit signal indications.

48 ~~Support:~~

49 ~~Examples of~~ Light rail transit traffic control signals, [that are](#) used to control light rail transit movements
50 only, ~~are shown~~ [should display the signal indications illustrated](#) in Figure 10D-1.

1 [Section 4D.27 contains information about the use of the signal indications shown in Figure 10D-1 for the](#)
2 [control of exclusive bus movements at “queue jumper lanes” and for the control of exclusive bus rapid transit](#)
3 [movements on semiexclusive or mixed-use alignments.](#)

4 Option:

5 Standard traffic control signals may be used instead of light rail transit traffic control signals to control the
6 movement of light rail transit vehicles (see Section 10D.06).

7 **Standard:**

8 **If a separate set of standard traffic control signal indications (red, yellow, and green circular and**
9 **arrow indications) is used to control light rail transit movements, the indications shall be positioned so**
10 **they are not visible to motorists, pedestrians, and bicyclists (see Section 4D.12).**

11 **If the light rail transit crossing control is separate from the intersection control, the two shall be**
12 **interconnected. The light rail phase shall not be terminated until after the light rail transit vehicle has**
13 **cleared the crossing.**

14 Option:

15 Light rail transit signals may be used at grade crossings and at intersections in mixed-use alignments in
16 conjunction with standard traffic control signals where special light rail transit signal phases are used to
17 accommodate turning light rail transit vehicles or where additional light rail transit clearance time is desirable.

18 Guidance:

19 Light rail transit signal faces should be separated vertically or horizontally from the nearest highway
20 traffic signal face for the same approach by at least 0.9 m (3 ft).

21 **Section ~~10D.08~~ [10D.09](#) Pedestrian and Bicycle Signals and Crossings**

22 Guidance:

23 Where light rail transit tracks are immediately adjacent to other tracks or a road, pedestrian signalization
24 should be designed to avoid having pedestrians wait between sets of tracks or between the tracks and the road.
25 If adequate space exists for a pedestrian refuge and is justified based on engineering judgment, additional
26 pedestrian signal ~~indicators~~ [heads](#), signing, and detectors should be installed (see Section 4E.08).

27 **Standard:**

28 **[When used at light rail transit crossings](#), pedestrian signal [heads](#) shall ~~be in accordance~~ [comply](#) with**
29 **[the provisions of](#) Section 4E.04.**

30 Guidance:

31 Flashing-light signals (see Figure 10D-2) with a Crossbuck (R15-1) sign [and an audible device](#) should be
32 installed at pedestrian and bicycle crossings where an engineering study has determined that the sight distance
33 is not sufficient for pedestrians and bicyclists to complete their crossing prior to the arrival of the light rail
34 transit vehicle at the crossing, or where light rail transit speeds exceed 60 km/h (35 mph).

35 If an engineering study shows that flashing-light signals ~~alone~~ [with a Crossbuck sign and an audible](#)
36 [device](#) would not provide sufficient notice of an approaching light rail transit vehicle, the LOOK (R15-8) sign
37 (see Figure 10D-2) and/or pedestrian gates should be considered (see Figures 10D-3, 10D-4, and 10D-5).

38 Support:

39 A pedestrian gate is similar to an automatic gate except the gate arm is shorter.

40 The swing gate alerts pedestrians to the light rail transit tracks that are to be crossed. Swing gates are
41 designed to open away from the tracks, requiring users to pull the gate open to cross, but permitting a quick
42 exit from the trackway, and to automatically close.

43 Option:

44 Swing gates may be installed across pedestrian and bicycle walkways (see Figure 10D-6).

45 Pedestrian barriers at offset crossings may be used at pedestrian and bicycle crossings as passive devices
46 that force users to face approaching light rail transit before entering the trackway (see Figures 10D-7 and 10D-
47 8).

48 [Section 10D.10 Highway-Light Rail Transit Grade Crossing\(s\) Within or In Close Proximity](#) 49 [to Roundabouts, Traffic Circles, or Circular Intersections](#)

50 [Support:](#)

1 At roundabouts, traffic circles, or circular intersections that include or are within close proximity to a
2 highway-light rail transit grade crossing, a queue of vehicular traffic could cause vehicles to stop on the
3 highway-light rail transit grade crossing.

4 **Standard:**

5 **Where roundabouts, traffic circles, or circular intersections include or are within close proximity to**
6 **a highway-light rail transit grade crossing, an engineering study shall be made to determine if queuing**
7 **could impact the highway-light rail transit grade crossing. If traffic queues impact the highway-light**
8 **rail transit grade crossing, provisions shall be made to clear highway traffic from the highway-light rail**
9 **transit grade crossing prior to the arrival of a train.**

10 **Guidance:**

11 Among the provisions that should be considered for keeping the crossing clear of traffic or for clearing
12 traffic from the crossing prior to the arrival of a train are the following:

- 13 A. Elimination of the roundabout,
- 14 B. Geometric design revisions,
- 15 C. Highway-light rail transit grade crossing warning devices,
- 16 D. Highway traffic signals,
- 17 E. Traffic metering devices,
- 18 F. Activated signs, or
- 19 G. A combination of these or other actions.

1 **CHAPTER 10E. QUIET ZONE TREATMENTS AT HIGHWAY-LIGHT RAIL TRANSIT**
2 **GRADE CROSSINGS**

3 **Section 10E.01 Introduction**

4 **Support:**

5 49 CFR Part 222 (Use of Locomotive Horns at Highway-Rail Grade Crossings; Final Rule) prescribes
6 Quiet Zone requirements and treatments.

7 **Standard:**

8 Any traffic control device and its application where used as part of a Quiet Zone shall comply with
9 all applicable provisions of the MUTCD.

10

CHAPTER 10F. PATHWAY-LIGHT RAIL TRANSIT GRADE CROSSINGS

Section 10F.01 Purpose

Support:

Traffic control for pathway-light rail transit grade crossings includes all signs, signals, markings, other warning devices, and their supports at pathway-light rail transit grade crossings and along pathway approaches to a grade crossing. The function of this traffic control is to promote safety and provide effective operation of both light rail transit and pathway traffic at pathway-light rail transit grade crossings.

Except as specifically noted in this Chapter, sidewalks are considered to be part of a highway-light rail transit grade crossing rather than a pathway-light rail transit grade crossing, and are not covered by this Chapter.

Section 10F.02 Use of Standard Devices, Systems, and Practices

Guidance:

The public agency with jurisdiction over the pathway and the regulatory agency with statutory authority, if applicable, should jointly determine the need and selection of devices at a pathway-light rail transit grade crossing.

The appropriate traffic control system to be used at a pathway-light rail transit grade crossing should be determined by a diagnostic team.

Section 10F.03 Pathway-Light Rail Transit Grade Crossing Signs and Markings

Standard:

Pathway-light rail transit grade crossing signs shall be standard in shape, legend, and color.

Traffic control devices mounted adjacent to pathways at a height of less than 2.4 m (8 ft) measured vertically from the bottom edge of the device to the elevation of the near edge of the pathway surface shall have a minimum lateral clearance of 0.6 m (2 ft) from the near edge of the device to the near edge of the pathway (see Figure 9B-1).

The minimum mounting height for post-mounted signs on pathways shall be 1.2 m (4 ft), measured vertically from the bottom edge of the sign to the elevation of the near edge of the pathway surface (see Figure 9B-1).

Pathway-light rail transit grade crossing traffic control devices shall be located a minimum of 3.7 m (12 ft) from the center of the nearest track.

The minimum sizes of pathway-light rail transit grade crossing signs shall be as shown in the shared-use path column in Table 9B-1.

When overhead traffic control devices are used on pathways, the clearance from the bottom edge of the device to the pathway surface directly under the sign or device shall be at least 2.4 m (8 ft).

Guidance:

If pathway users include those who travel faster than pedestrians, such as bicyclists or skaters, the diagnostic team should consider the use of warning signs and pavement markings in advance of the pathway-rail grade crossing (see Figure 9B-7).

Section 10F.04 Stop Lines and Detectable Warnings

Guidance:

If used at pathway-light rail transit grade crossings, the stop line should be a transverse line at the point where a pathway user is to stop. The stop line should be placed at least 0.6 m (2 ft) upstream from the gate or counterweight (if present), and at least 3.7 m (12 ft) from the nearest rail.

If used on pathway-light rail transit grade crossings or sidewalks at highway-light rail transit grade crossings, detectable warnings (see Section 3B.18) should extend across the full width of the pathway or sidewalk and should be 0.6 m (2 ft) wide in the pedestrian direction of travel. Detectable warnings should be placed at least 0.6 m (2 ft) upstream from the gate or counterweight (if present), and no closer than the stop line (if present) or 3.7 m (12 ft) from the nearest rail.

Section 10F.05 Passive Devices for Pathway-Light Rail Transit Grade Crossings

Standard:

1 Except as noted in the Option below, where active traffic control devices are not used, a Crossbuck
2 Assembly shall be installed on each approach to a pathway-light rail transit grade crossing.

3 Option:

4 The Crossbuck Assembly may be omitted at station crossings and on the approaches to a pathway-light
5 rail transit grade crossing that is located within 7.6 m (25 ft) of the traveled way at a highway-light rail transit
6 grade crossing.

7 Guidance:

8 The pathway user's ability to detect the presence of an approaching train should be considered in
9 determining the type and placement of traffic control devices or design features (such as fencing or swing
10 gates).

11 Nighttime visibility should be considered if design features (such as fencing or swing gates) are used to
12 channelize pathway users.

13 When automatic gates and swing gates are used, the pathway should be channelized to direct users to the
14 entrance to and exit from the pathway-light rail transit grade crossing.

15 Standard:

16 If used, swing gates shall open away from the track(s) and return to the closed position after use.

17 Option:

18 When used in conjunction with automatic gates at pathway-light rail transit grade crossings, swing gates
19 may be equipped with a latching device that permits the gate to be opened only by pedestrians who are on the
20 track side of the gate.

21 Refuge areas may be provided to provide a place for large numbers of pedestrians to congregate during
22 the passage of a train.

23 Guidance:

24 Where refuge areas are provided, fencing should be installed to limit access to only the pathway-light rail
25 transit grade crossing.

26 Section 10F.06 Active Traffic Control Systems for Pathway-Light Rail Transit Grade
27 Crossings

28 Standard:

29 If an active traffic control system is used at a pathway-light rail transit grade crossing, flashing-
30 light signals and a bell or other audible warning device shall be provided for each direction of the
31 pathway.

32 Support:

33 If a pathway-light rail transit grade crossing is located within 7.6 m (25 ft) of the traveled way at a
34 highway-light rail transit grade crossing equipped with an active traffic control system, a separate active
35 traffic control system for the pathway is usually not provided.

36 Standard:

37 If used at pathway-light rail transit grade crossings, flashing-light signals shall be alternately
38 flashing red lights that are aligned horizontally and the light units shall have a diameter of at least 100
39 mm (4 in). The mounting height for flashing red lights installed at pathway-light rail transit grade
40 crossings shall be a minimum of 1.2 m (4 ft), measured vertically from the bottom edge of the lights to
41 the elevation of the near edge of the pathway surface.

42 Option:

43 At station crossings where more than one track is present, additional traffic control devices may be
44 installed between the tracks as recommended by a diagnostic team.

45 Standard:

46 The mounting height for flashing red lights installed between the tracks at station crossings shall be
47 a minimum of 0.3 m (1 ft), measured vertically from the bottom edge of the lights to the elevation of the
48 near edge of the pathway surface.

49 Option:

50 Automatic gates may be used at pathway-light rail transit grade crossings as recommended by a diagnostic
51 team.

1 Guidance:

2 If used at a pathway-light rail transit grade crossing, each automatic gate should be installed to rest a
3 minimum of 0.9 m (3 ft) above the pathway when in the down position.

4 If used, the gate configuration should provide for full width coverage of the pathway on both approaches
5 to the track.

6 **Standard:**

7 **Where sidewalks are located between the edge of a roadway and active traffic control devices, the**
8 **location, placement, and height prescribed for roadway gates shall be used (see Section 10D.03).**

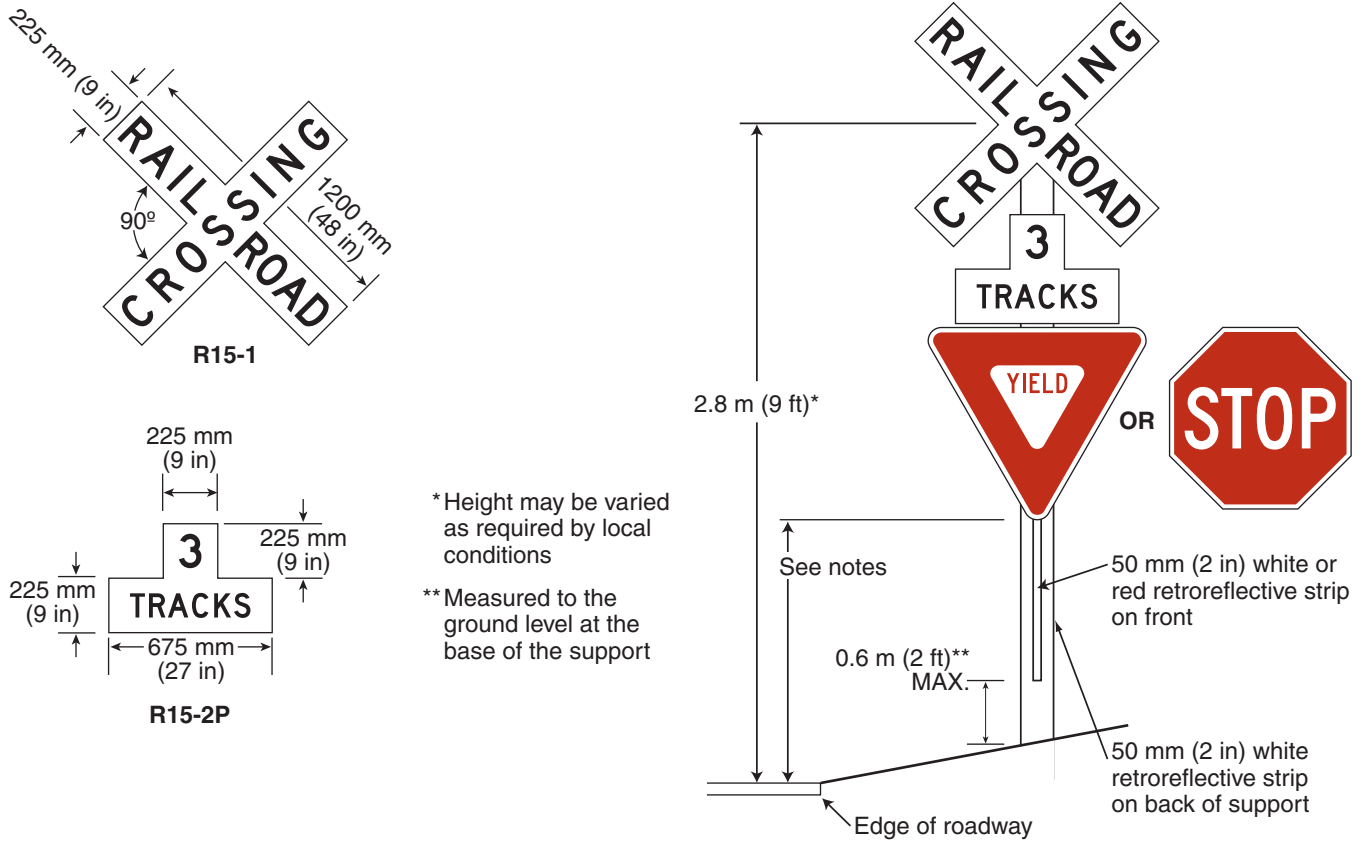
9 Guidance:

10 Separate automatic gates used at sidewalks should be installed to rest a minimum of 0.9 m (3 ft) above the
11 sidewalk when in the down position.

12 If separate automatic gates are used for a sidewalk, a separate gate mechanism should be provided for the
13 sidewalk gate, instead of a supplemental or auxiliary gate arm installed as a part of the same mechanism as the
14 vehicular gate, in order to prevent a pedestrian from raising the vehicular gate at a highway-light rail transit
15 grade crossing.

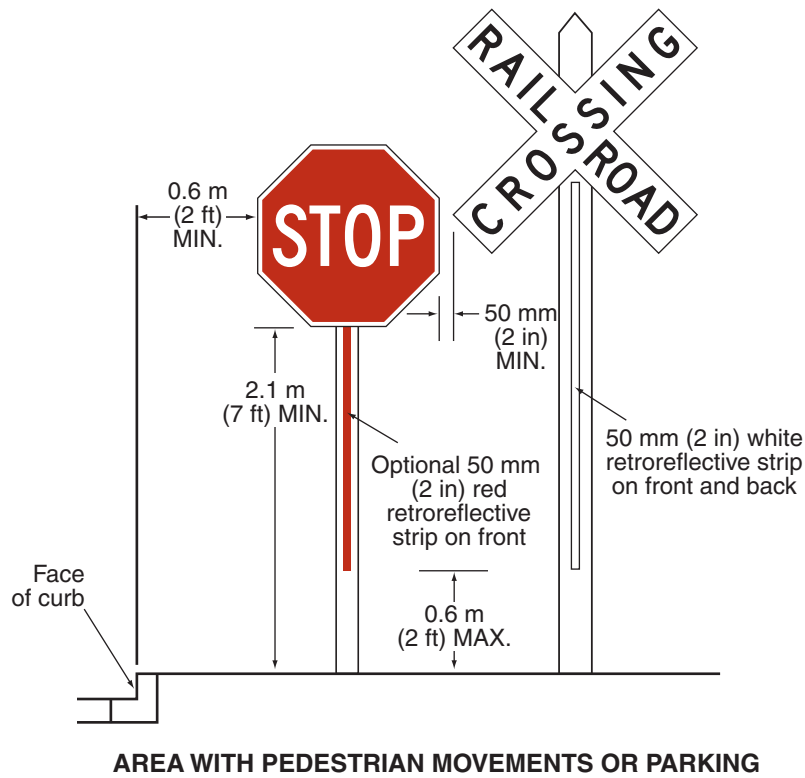
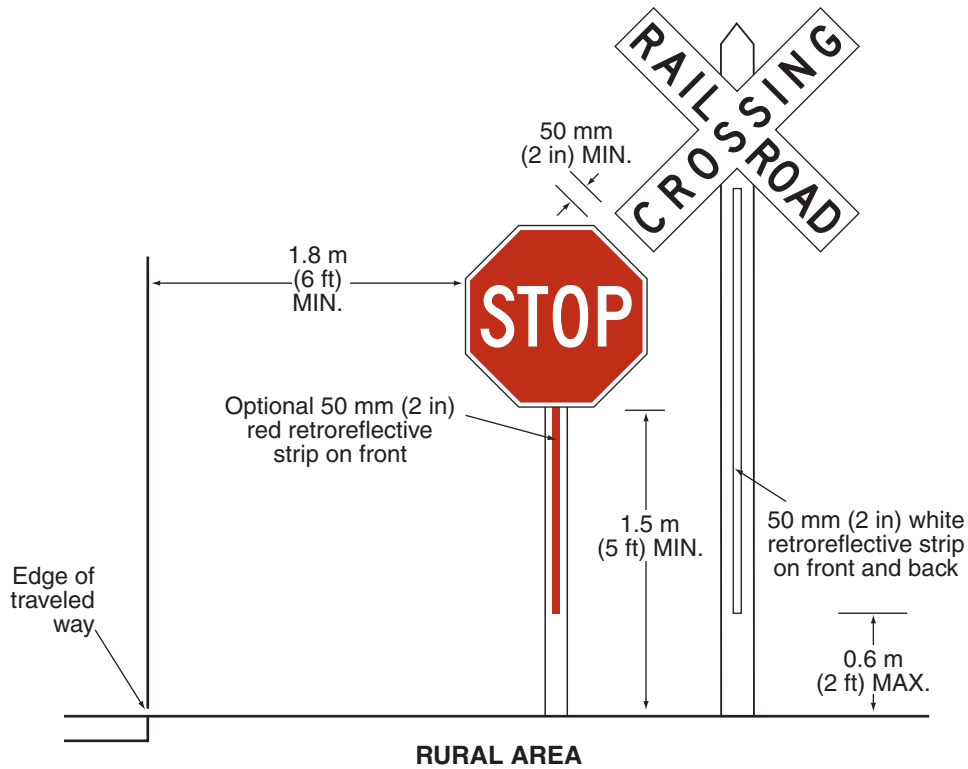
16

Figure 10C-1. Highway-Light Rail Transit Grade Crossing Regulatory Signs and Plaques



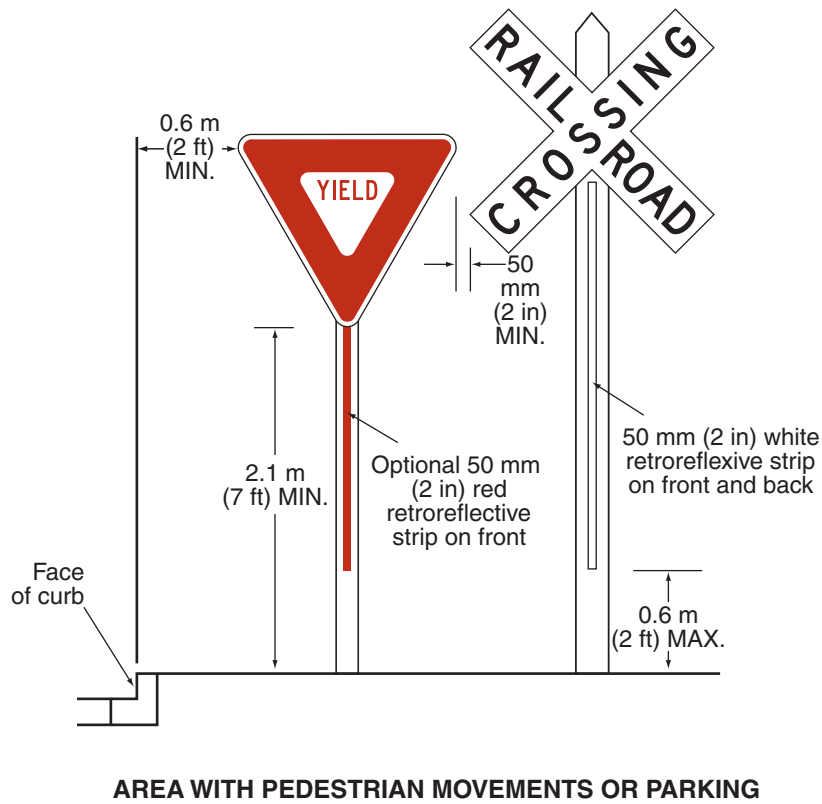
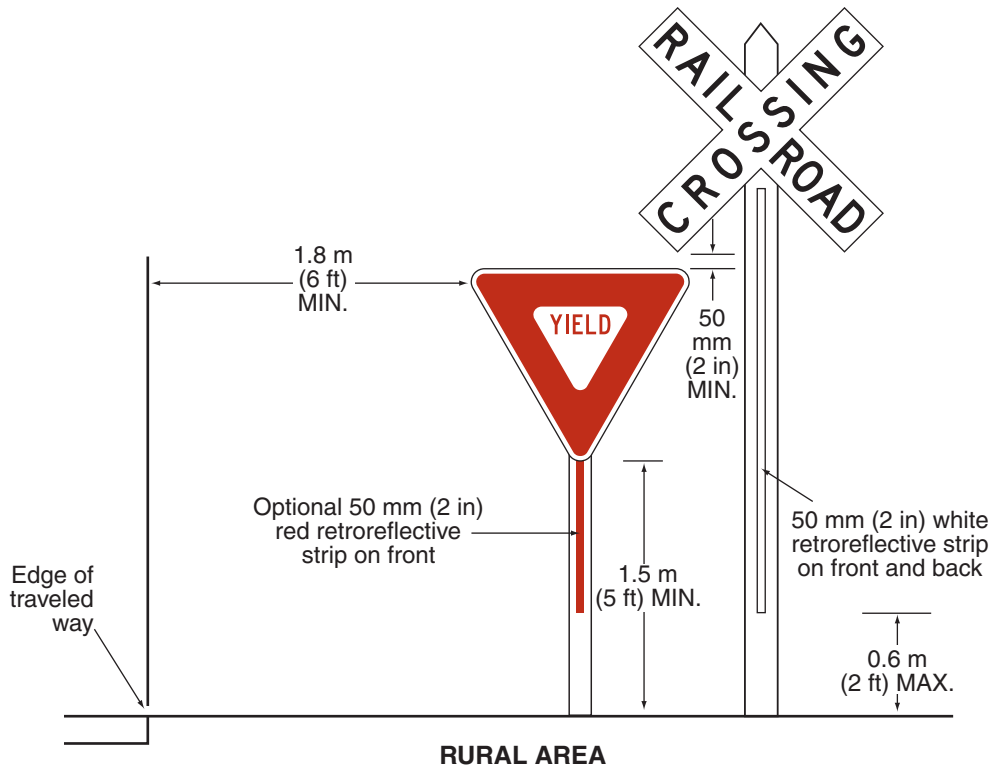
- Notes:
1. YIELD or STOP sign used only at passive crossings
 2. Mounting height of at least 1.2 m (4 ft) for installations of YIELD or STOP signs on existing Crossbuck sign supports
 3. Mounting height of at least 2.1 m (7 ft) in areas with pedestrian movements or parking

Figure 10C-2. Highway-Light Rail Transit Grade Crossing Regulatory Signs with Separate Posts (Sheet 1 of 2)



Note: Place the face of the signs in the same plane and place the STOP sign closest to the traveled way. Provide a 50 mm (2 in) minimum separation between the edge of the Crossbuck sign and the edge of the STOP sign.

Figure 10C-2. Highway-Light Rail Transit Grade Crossing Regulatory Signs with Separate Posts (Sheet 2 of 2)



Note: Place the face of the signs in the same plane and place the YIELD sign closest to the traveled way. Provide a 50 mm (2 in) minimum separation between the edge of the Crossbuck sign and the edge of the YIELD sign.

Figure 10C-3. Regulatory Signs and Plaques



R3-1a
Activated Blank-Out



R3-2a
Activated Blank-Out



R8-8



R8-9



R8-10



R10-6



R15-3P



R15-4a



R15-4b



R15-4c



R15-5



R15-5a



R15-6



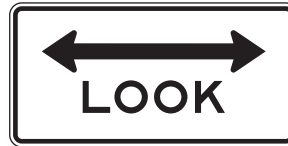
R15-6a



R15-7

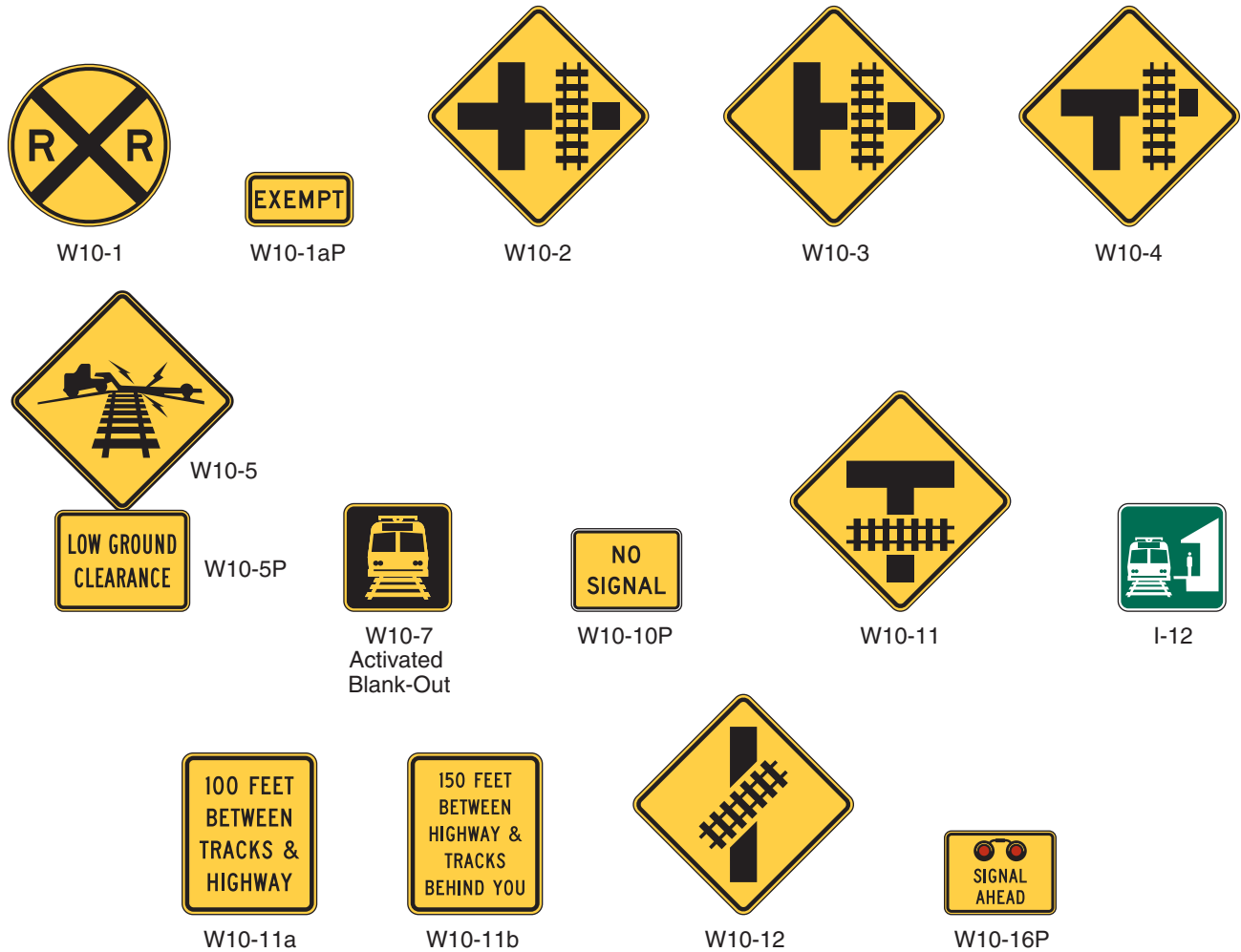


R15-7a



R15-8

Figure 10C-4. Warning Signs and Plaques and Light Rail Station Sign



Note: The W10-11 sign is a W10-3 sign modified for geometrics. Other signs can be oriented or revised as needed to satisfy the geometrics of the roadways and the light rail transit tracks.

Figure 10C-5. Example of Emergency Notification Sign



I-13

Figure 10C-6. Example of Placement of Warning Signs and Pavement Markings at Highway-Light Rail Transit Grade Crossings

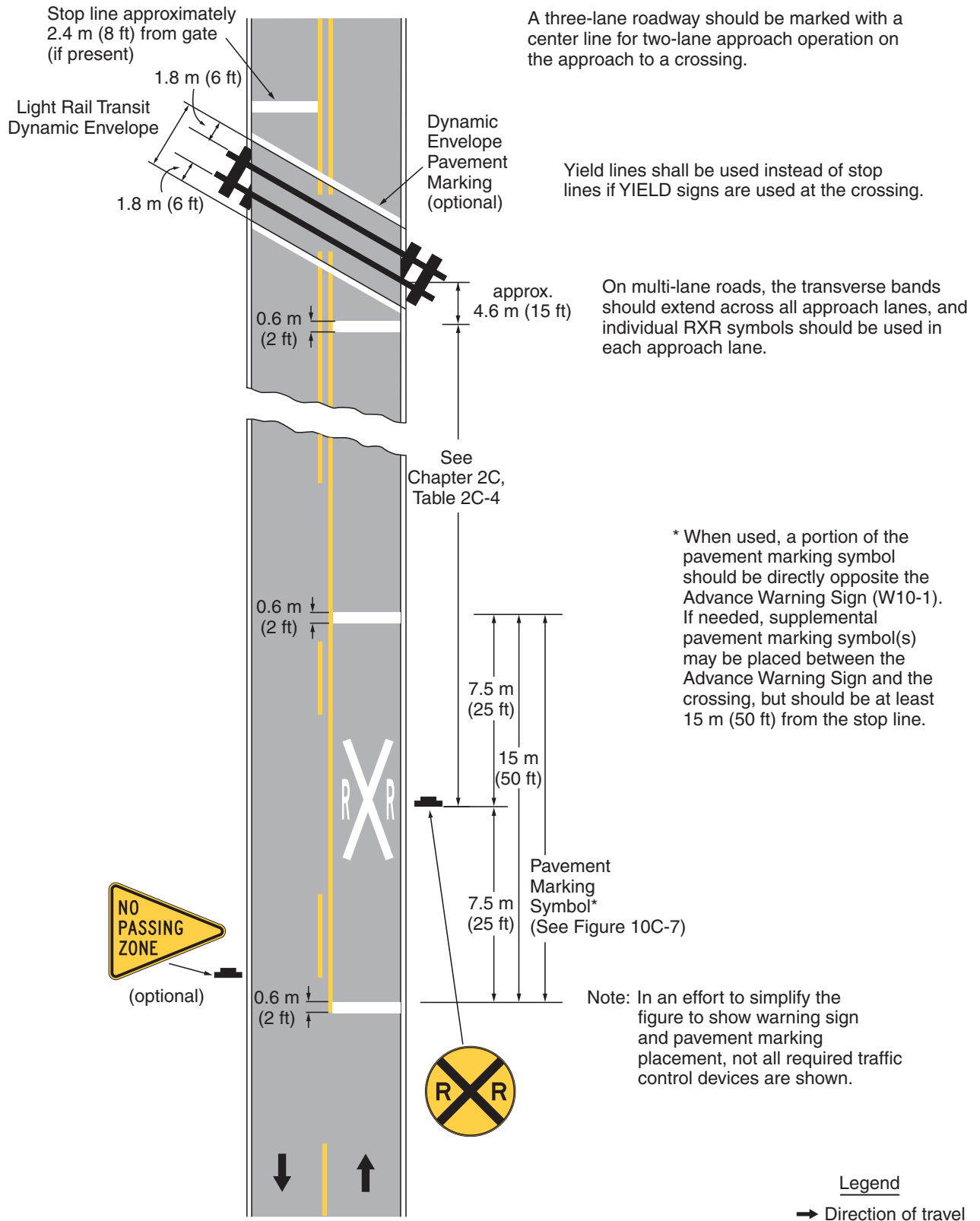
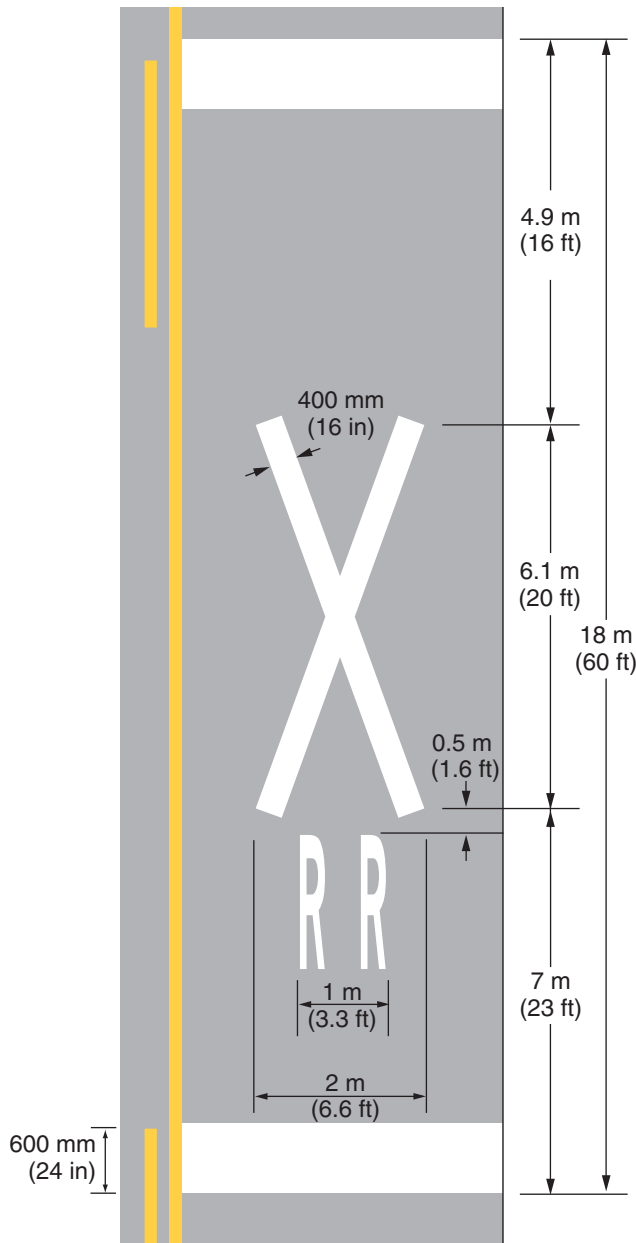
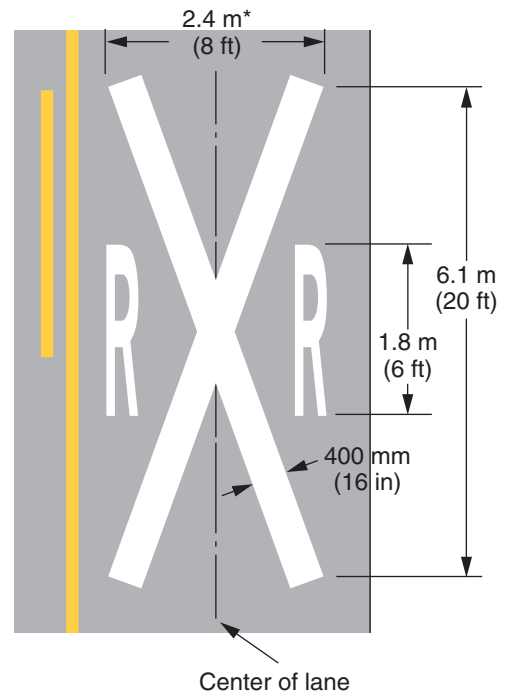


Figure 10C-7. Highway-Light Rail Transit Grade Crossing Pavement Markings



A - Highway-Light Rail Transit grade crossing alternative (narrow) pavement markings

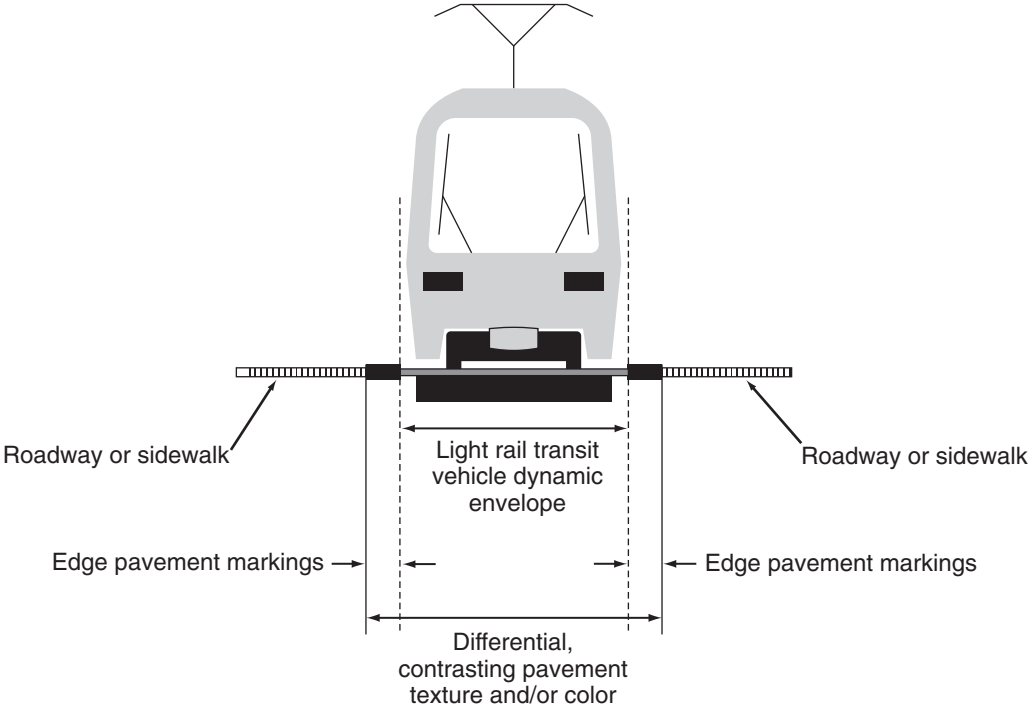
Note: Refer to Figure 10C-6 for placement



B - Highway-Light Rail Transit grade crossing pavement markings

*Width may vary according to lane width

Figure 10C-8. Light Rail Transit Vehicle Dynamic Envelope



**Figure 10C-9. Typical Light Rail Transit Vehicle
Dynamic Envelope Pavement Markings**

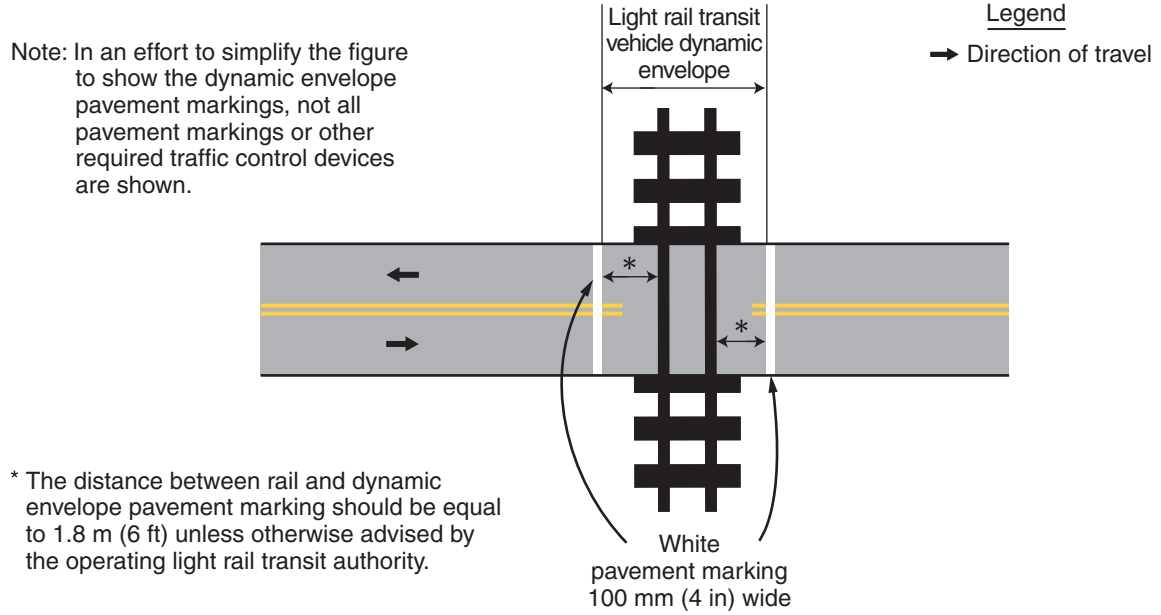
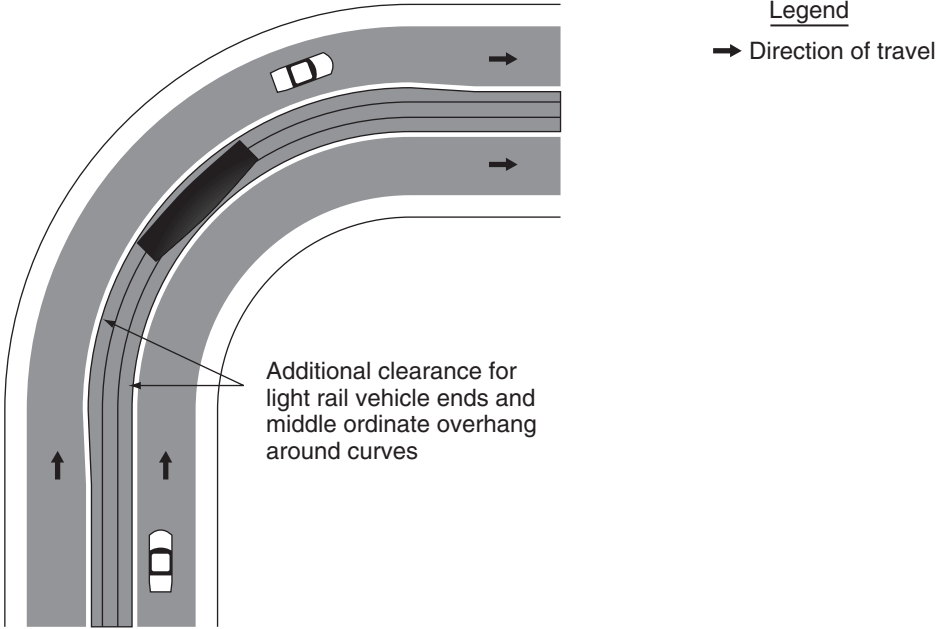


Figure 10C-10. Example of Light Rail Transit Vehicle Dynamic Envelope Pavement Markings



**Figure 10C-11. Example of Light Rail Transit Vehicle Dynamic Envelope
Contrasting Color and/or Texture**

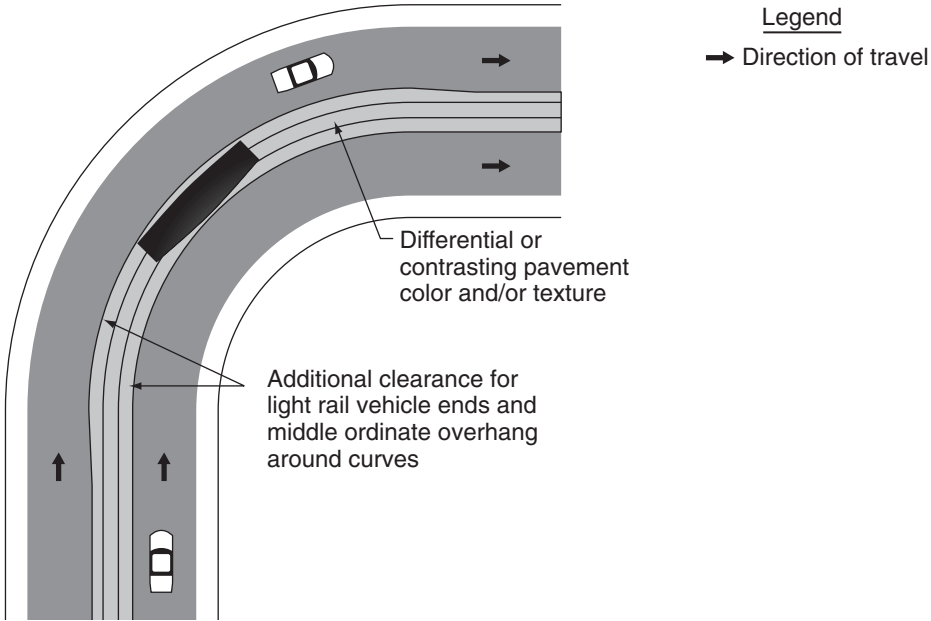


































Figure 10D-1. Light Rail Transit Signals

	Three-Lens Signal	Two-Lens Signal
<p>SINGLE LRT ROUTE</p> 	<p>STOP </p> <p>PREPARE TO STOP  <i>Flashing</i></p> <p>GO </p>	<p> STOP</p> <p>⁽²⁾ GO</p>
<p>TWO LRT ROUTE DIVERSION</p> 	<p></p> <p> <i>Flashing</i></p> <p> ⁽¹⁾</p>	<p></p> <p> ^{(1),(2)}</p>
	<p></p> <p><i>Flashing</i> </p> <p> ⁽¹⁾</p>	<p></p> <p> ^{(1),(2)}</p>
<p>THREE LRT ROUTE DIVERSION</p> 	<p></p> <p> <i>Flashing</i></p> <p>  ⁽¹⁾</p>	<p></p> <p>  ^{(1),(2)}</p>

Notes:

All aspects (or signal indications) are white.

(1) Could be in single housing.

(2) "Go" lens may be used in flashing mode to indicate "prepare to stop".

Figure 10D-2. Example of Light Rail Transit Flashing-Light Signal Assembly for Pedestrian Crossings

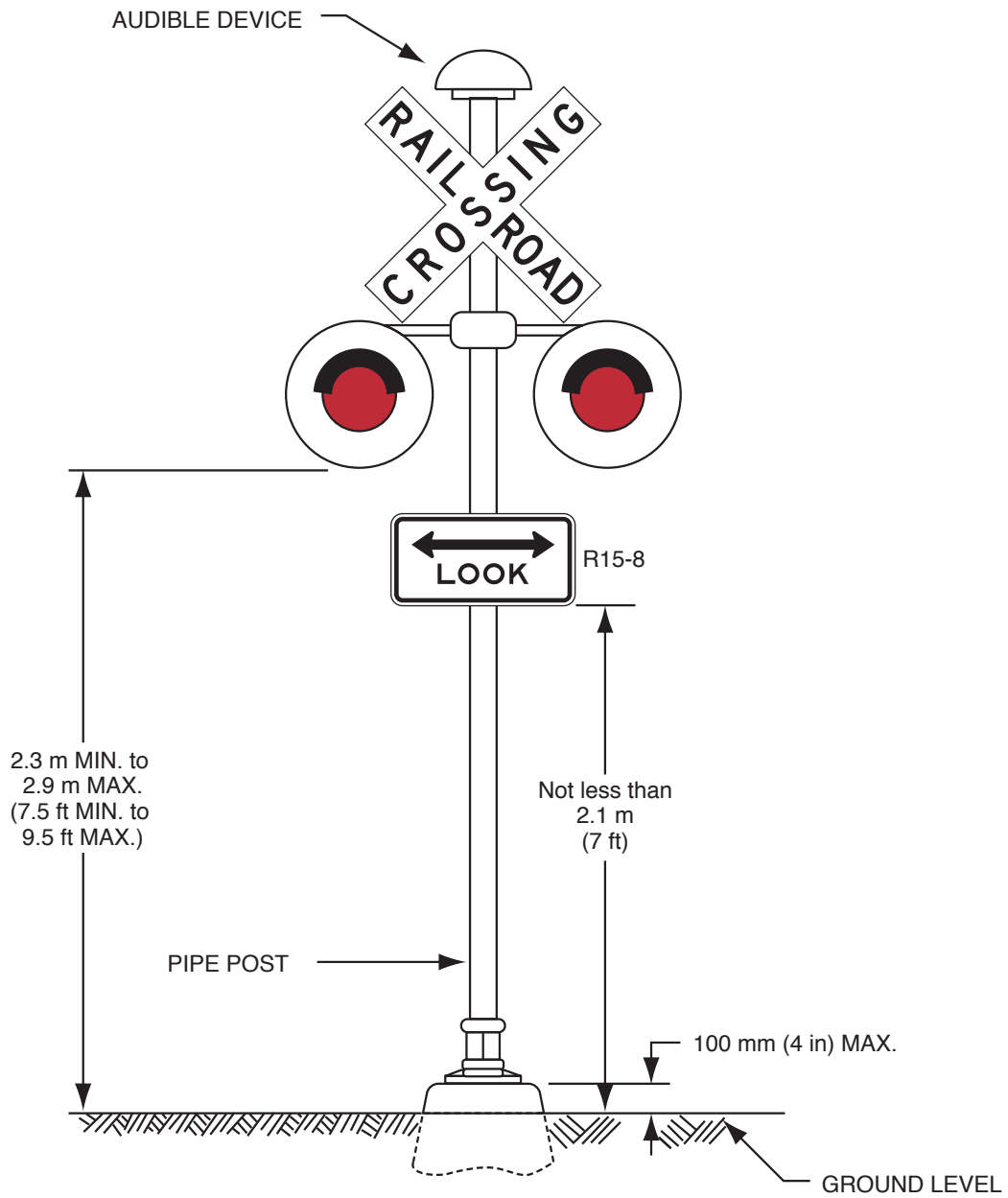


Figure 10D-3. Example of Pedestrian Gate Placement Behind the Sidewalk

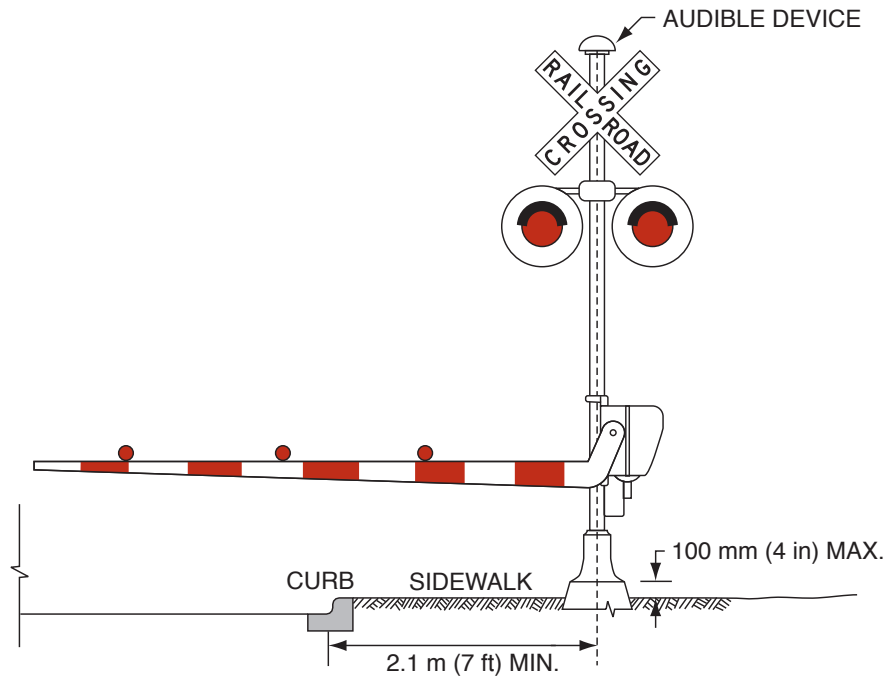
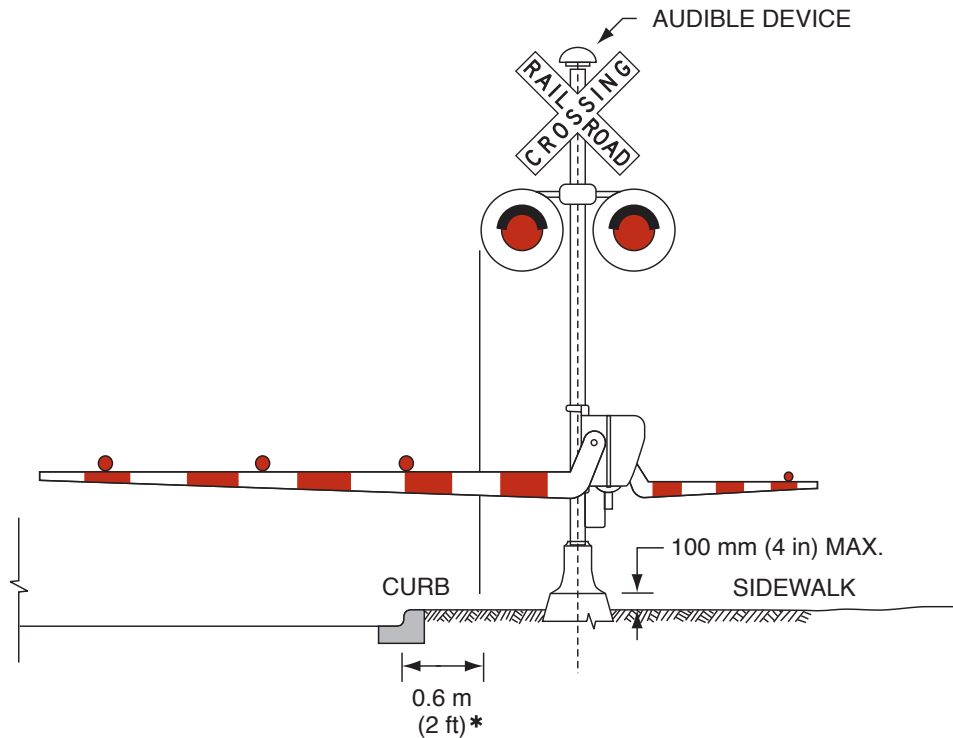


Figure 10D-4. Example of Pedestrian Gate Placement with Pedestrian Gate Arm



* For locating this reference line at other than curb section installation, see Section 8C.01.

Figure 10D-5. Examples of Placement of Pedestrian Gates

Legend

→ Direction of travel

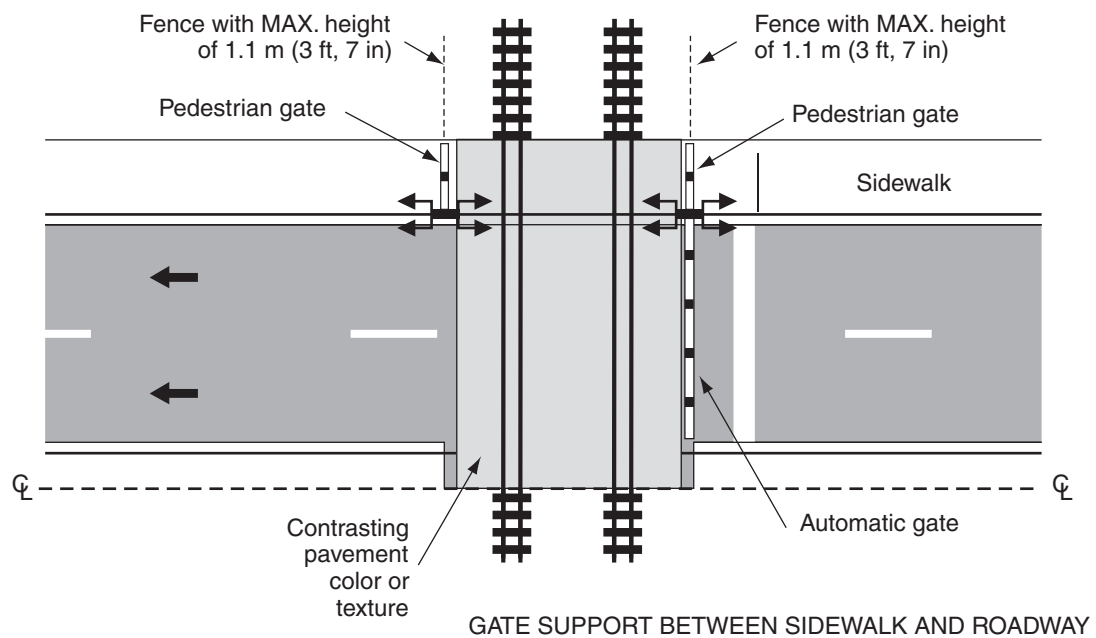
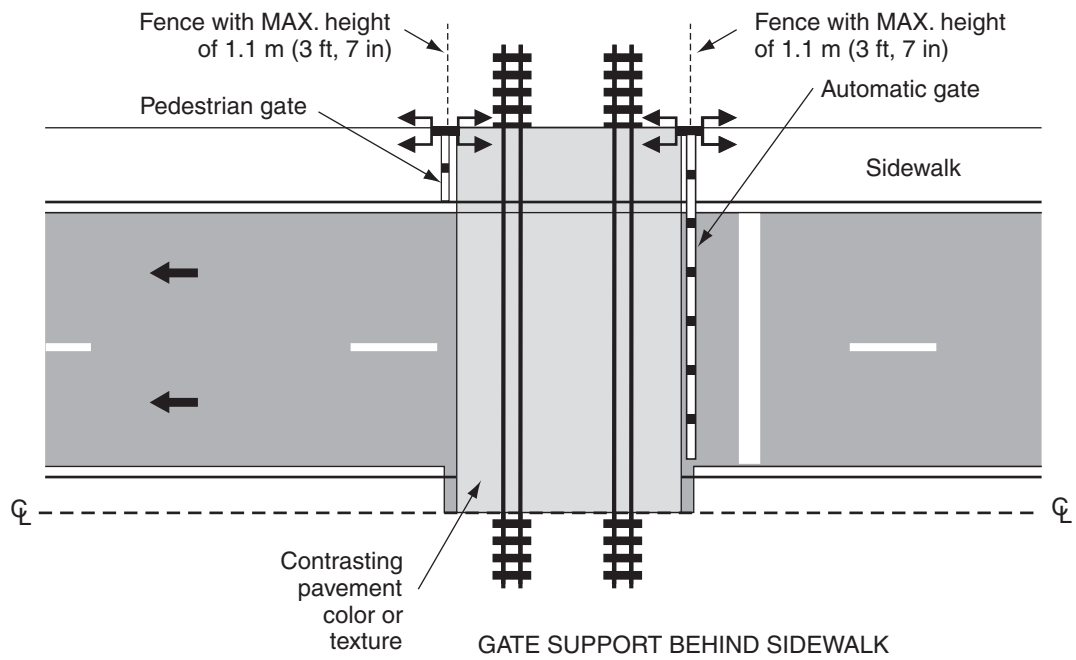


Figure 10D-6. Example of Swing Gates

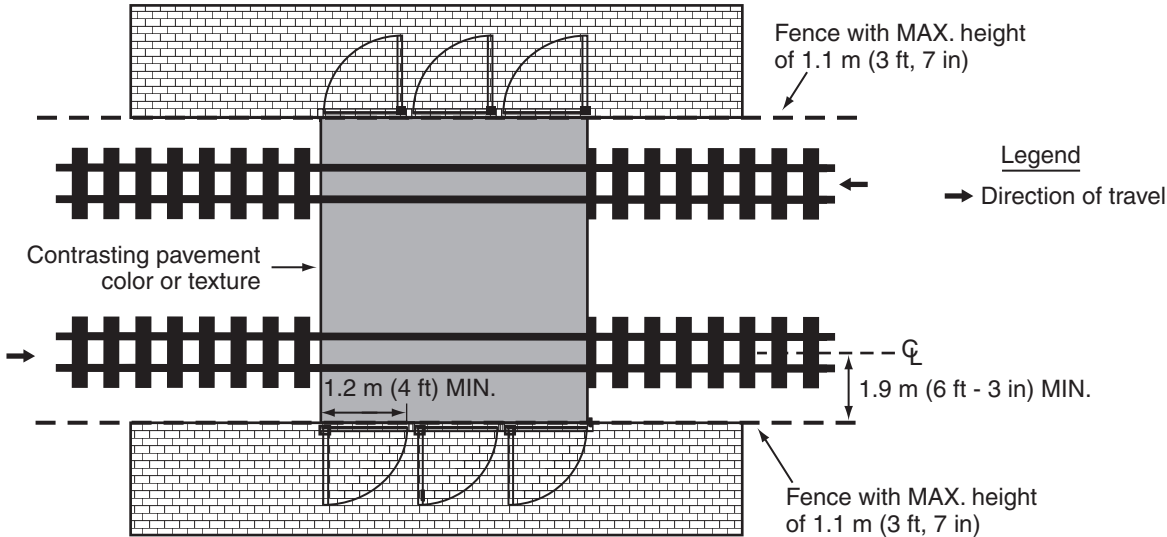


Figure 10D-7. Example of Pedestrian Barriers at an Offset Highway-Light Rail Transit Crossing

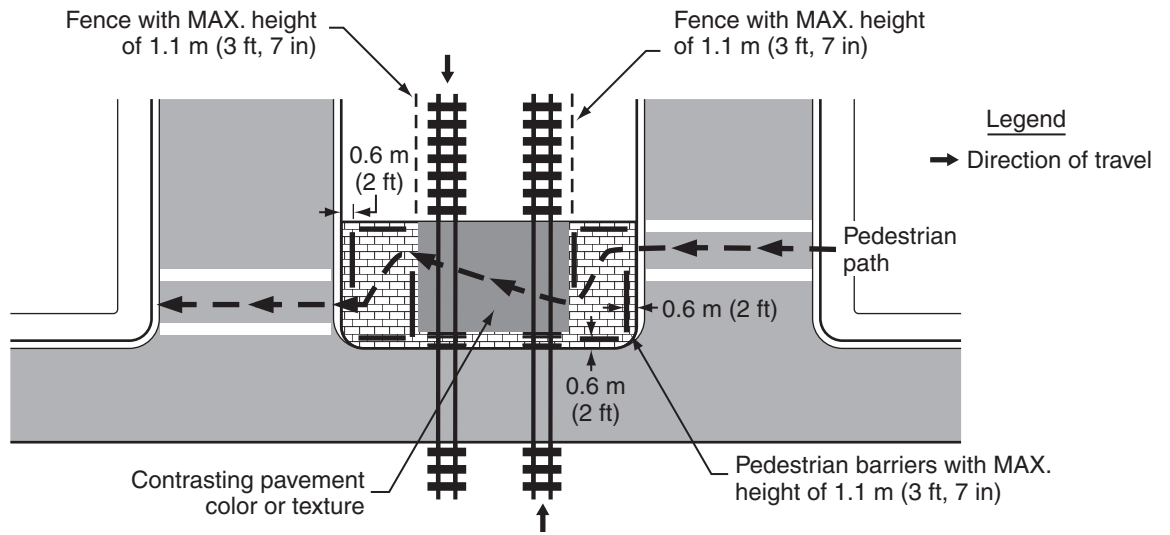


Figure 10D-8. Examples of Pedestrian Barrier Installation at an Offset Nonintersection Light Rail Transit Crossing

