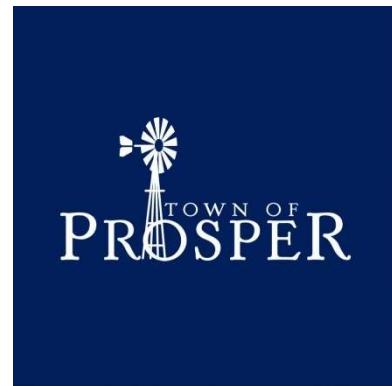
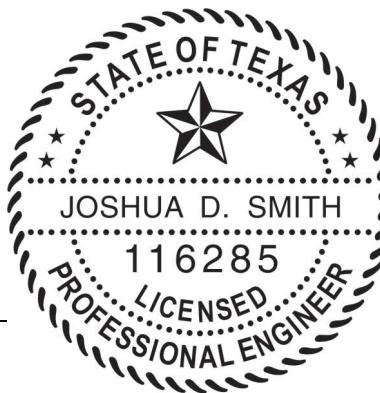


# Determining Whether and How to Mark Crosswalks and School Zones

Town of Prosper

August 20, 2024

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## Introduction

Throughout its recent growth and development, the Town of Prosper has prioritized the provision of sidewalks and shared use paths to benefit citizens for both transportation and recreation. This document provides guidance and direction on crosswalk signing and marking specific to the Town of Prosper. This document updates and expands the previous Town policy “School Zone Signs and Markings Policy” prepared by Lee Engineering in 2014 that was focused exclusively on school-related crossings.

Between 2000 and 2014, the population of the Town of Prosper increased over 400%. Since 2014, the Town’s population has continued to grow more than an additional 200% from just under 15,000 to a 2022-estimated population of 37,746. With this growth have come increased requests for enhanced multi-modal facilities, including more visible crossing locations.

The goal of this policy update is to develop a practice for signing and marking crosswalks that enables Town staff to apply consistent design standards that meet current engineering practice at both school-related and non-school related locations to meet the unique needs of Town of Prosper residents, and provide a safe environment for students, teachers, and parents.

Studies have shown that when a pedestrian is hit at 30 mph, the chance of an incapacitating or fatal injury is 40%. The Town of Prosper has adopted a 25-mph speed limit in residential neighborhoods in an effort to improve the safety of pedestrians within residential areas. By reducing speeds to 25 mph or less, the chances of incapacitating or fatal injury are reduced to less than 15%.

In this document, the term “crosswalk” may refer to a crosswalk either **with** or **without** markings. The term “marked crosswalk” is used to refer to a crosswalk designated with markings and “unmarked crosswalk” to a crosswalk without markings. The term “crossing” is used to refer to a location where pedestrians cross that may or may not be a crosswalk.

In general, crossings can be categorized as follows:

- **Grade-separated crossings** are those where pedestrians cross on either an overpass or underpass and are not exposed to conflicts with vehicular traffic. Grade-separated crossings are not considered “crosswalks” under state law.
- **Controlled crossings** are those where the street crossed is controlled at the crossing by a traffic signal, pedestrian hybrid beacon (PHB), or STOP sign. More information about pedestrian hybrid beacons can be found in the **Appendix**.
- **Uncontrolled crossings** are those where the street crossed is free-flowing (i.e., is not controlled by a traffic signal, PHB, or STOP sign).

## Part 1 - Laws and Standards

### Crosswalk Types and State Law

Texas state law defines crosswalks as follows:

- “(A) the portion of a roadway, including an intersection, designated as a pedestrian crossing by surface markings, including lines; or

(B) the portion of a roadway at an intersection that is within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or, in the absence of curbs, from the edges of the traversable roadway.”<sup>1</sup>

Texas state law identifies pedestrian right-of-way responsibilities at crosswalks as follows:

“(a) The operator of a vehicle shall stop and yield the right-of-way to a pedestrian crossing a roadway in a crosswalk if:

- (1) No traffic control signal is in place or in operation; and
- (2) The pedestrian is:

(A) On the half of the roadway in which the vehicle is traveling; or

(B) Approaching so closely from the opposite half of the roadway as to be in danger.

(b) Notwithstanding subsection (a), a pedestrian may not suddenly leave a curb or other place of safety and proceed into a crosswalk in the path of a vehicle so close that it is impossible for the vehicle operator to stop and yield.

(c) The operator of a vehicle approaching from the rear of a vehicle that is stopped at a crosswalk to permit a pedestrian to cross a roadway may not pass the stopped vehicle.”<sup>2</sup>

Texas state law stipulates that:

“(a) A pedestrian shall yield the right-of-way to a vehicle on the highway if crossing a roadway at a place:

- (1) other than in a marked crosswalk or in an unmarked crosswalk at an intersection; or
- (2) where a pedestrian tunnel or overhead pedestrian crossing has been provided.

(b) Between adjacent intersections at which traffic control signals are in operation, a pedestrian may cross only in a marked crosswalk.

(c) A pedestrian may cross a roadway intersection diagonally only if and in the manner authorized by a traffic control device.”<sup>3</sup>

Item (b) above implies that if both of the immediately adjacent intersections are traffic signal controlled, then the pedestrian may only cross at the intersection. However, if at least one of the immediately adjacent intersections is not controlled by a traffic signal, then a pedestrian may cross the street (when safe).

Note that the statutes apply equally to all crosswalks, whether they are marked or unmarked.

### **MUTCD Crosswalk Marking Provisions**

The *Texas Manual on Uniform Traffic Control Devices* (TMUTCD) provides standards for traffic control devices that are both in substantial conformance with nationwide federal standards and specific to unique circumstances in Texas. Compliance with the TMUTCD was maintained in the majority of this policy and,

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<sup>1</sup> Texas Statutes, §541.302

<sup>2</sup> Texas Statutes, §552-003

<sup>3</sup> Texas Statutes, §552-005

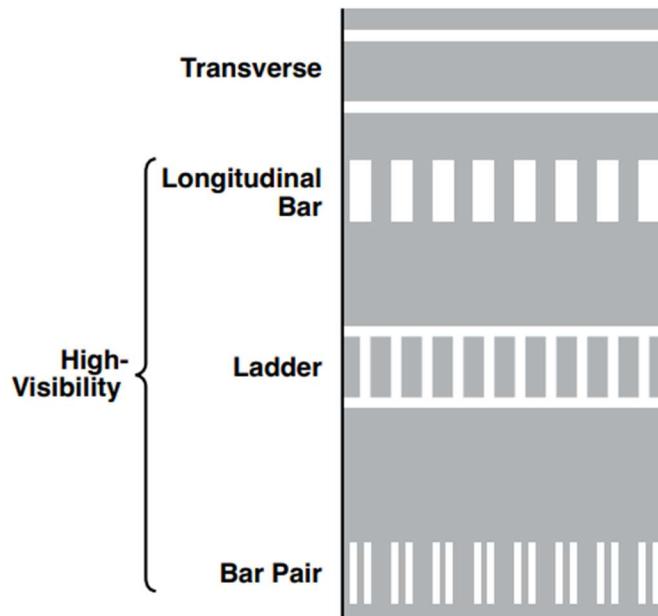
if this policy varies from the TMUTCD, justification is provided. The TMUTCD provides three levels of direction – Standard, Guidance, and Options. Items that are listed as a “Standard” shall be complied with at all times. Items listed in the “Guidance” and “Options” section of the TMUTCD should or may be considered for installation but are not required.

It is noted that this policy for the Town of Prosper is based on the 2011 version of the TMUTCD. The 11th Edition of the Federal MUTCD went into effect on January 18, 2024. Texas has up to two years from that date to adopt the Federal MUTCD, adopt the Federal MUTCD with a supplement, or adopt a new version of the state MUTCD that is in substantial conformance with the 11th Edition of the Federal MUTCD. This policy should be reviewed and updated as necessary when the State of Texas takes one of these actions.

The 11<sup>th</sup> Edition of the federal MUTCD distinguishes between “transverse” and “high-visibility” crosswalk markings (in specific ways that are anticipated to be adopted by the State of Texas in its approved version of the MUTCD) as follows:

- **Transverse** crosswalks consist of two parallel transverse solid white lines, required to be between 6 and 24 inches wide.<sup>4</sup>
- **High-visibility** crosswalks consist of longitudinal lines parallel to traffic flow with or without transverse lines to draw increased attention to the crosswalk. While several marking patterns are permissible, a frequent pattern involves longitudinal lines either added to or replacing the transverse lines used for transverse markings. Where longitudinal lines (perpendicular bars) are used to form high-visibility crosswalks, they should be 12 to 24 inches wide separated by gaps of 12 to 60 inches. However, the gap should not exceed 2.5 times the width of the lines, and the design should avoid vehicle wheel paths if possible.<sup>5</sup>

MUTCD Figure 3C-1, partially reproduced to the right, illustrates a transverse crosswalk and three methods of marking high-visibility crosswalks. Other methods of marking high-visibility crosswalks are also permitted by the current version of the TMUTCD, but for consistency, one method is recommended for use in the Town of Prosper that is consistent with both the current Texas and federal versions of the MUTCD, as discussed on pages 22-23.



The following provisions in the TMUTCD apply to crosswalk markings:

- Crosswalks should be at least 6 feet wide.<sup>6</sup>

<sup>4</sup> MUTCD Sec. 3C.03, paragraph 02, [https://mutcd.fhwa.dot.gov/pdfs/11th\\_Edition/mutcd11thedition.pdf](https://mutcd.fhwa.dot.gov/pdfs/11th_Edition/mutcd11thedition.pdf).

<sup>5</sup> TMUTCD Sec. 3B.18, paragraph 15, <https://ftp.txdot.gov/pub/txdot-info/trf/tmutcd/2011-rev-2/revision-2.pdf>.

<sup>6</sup> TMUTCD Sec. 3B.18, paragraph 05.

- Crosswalk markings should extend across the full width of the pavement or to the edge of the intersecting crosswalk.<sup>7</sup>
- Warning signs should be installed for all marked non-intersection crosswalks.<sup>8</sup>
- Crosswalk markings should be located so the curb ramps are entirely within the extension of the crosswalk markings.<sup>9</sup>

Chapter 7 of the TMUTCD provides direction on school traffic control.

#### **Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG)**

The United States Access Board issued its final rule on Accessibility Guidelines for Pedestrian Facilities in the Public Right of Way (PROWAG) on August 8, 2023. The rule applies to all new construction and alterations in the public right-of-way.<sup>10</sup> While adopted by the Access Board, PROWAG does not officially go into effect until adopted by the United States Department of Justice (USDOJ) and the United States Department of Transportation's Federal Highway Administration (USDOT FHWA) through an official rulemaking process. These actions may occur as early as 2024. Regardless, agencies should strive to meet those standards and guidelines adopted by the Access Board.

While PROWAG is a complicated document and should be consulted separately from this policy to ensure all its provisions are met, in general it includes the following requirements relevant to the Town's crosswalk policy:

- Consistent with the MUTCD definition, PROWAG indicates that a crosswalk is present wherever there is a pedestrian circulation path [sidewalk or other prepared surface provided for pedestrian use] on one side of a street that approaches the roadway at an angle such that the path would cross the street if the lateral lines of the path were continued (regardless of whether it is marked or unmarked), or where pavement markings indicate a crosswalk.<sup>11</sup>
- Curb ramps must be provided at each end of all marked crosswalks, with one ramp per intersection corner per crosswalk (i.e. two ramps per corner where two crosswalks are present) unless technically infeasible for alterations.
- Curb ramps must also be provided at each end of all unmarked crosswalks.
- Curb ramps must not be provided on either side of the street where an unmarked crosswalk is not intended.
- To indicate an unmarked crosswalk is not present and pedestrian crossings are prohibited at an intersection or are not intended at a roundabout or mid-block location, a grass strip, landscaping buffer or other properly designed physical barrier should be provided to separate the sidewalk from the roadway as a cue to both sighted and vision-impaired pedestrians to avoid crossing at the location.<sup>12</sup> This can be challenging to accomplish where sidewalk is adjacent to the curb.

More information about applying PROWAG to crosswalk decisions is provided at the end of Part 2.

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<sup>7</sup> TMUTCD Sec. 3B.18, paragraph 06.

<sup>8</sup> TMUTCD Sec. 3B.18, paragraph 11.

<sup>9</sup> TMUTCD Sec. 3B.18, paragraph 17.

<sup>10</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149>

<sup>11</sup> See PROWAG (R104), Federal Register, <https://www.federalregister.gov/d/2023-16149/p-579>

<sup>12</sup> See PROWAG (R203.6.1.1-2 & R306.4.1.1), Federal Register, <https://www.federalregister.gov/d/2023-16149/p-644>, <https://www.federalregister.gov/d/2023-16149/p-646>, <https://www.federalregister.gov/d/2023-16149/p-804>,

## Part 2 – Deciding Whether to Mark Crosswalks

### Deciding Whether to Mark Controlled Crossings

**Controlled** crosswalks may be either marked or unmarked according to engineering judgment; no engineering study is required to install markings at controlled crosswalks, but a study may be conducted to supplement engineering judgment if needed.

At signalized intersections and pedestrian hybrid beacons (PHBs), crosswalks must be marked for new and altered facilities where a pedestrian access route such as a sidewalk or shared use path is present. At these locations, crosswalks must also have curb ramps, pedestrian signals and accessible pedestrian pushbuttons (APS).

At yield-controlled crossings across an off-ramp junction or a channelized right turn lane, marked crosswalks should be provided. Alternative designs with smaller turn radii to discourage high-speed turning movements should be considered and used, if possible, to encourage slower turning speeds near pedestrians at such locations. Examples of such designs are found in the **Appendix**.

The use of crosswalk markings at stop-controlled crossings is optional. Jurisdictions typically have hundreds or thousands of stop-controlled crossings, and it is not necessary or practical to mark most of these. Markings are typically not needed for stop-controlled approaches of local streets to local streets unless the crossing is part of a designated student walking route within  $\frac{1}{4}$  mile of a school. At intersections involving collector or arterial streets, crossings of stop-controlled approaches are typically not marked, but may be marked if one or more of the following conditions exist:

- The crossing is part of a walking route within  $\frac{1}{4}$  mile of a major park, large playground, or other major pedestrian generator.
- The crossing involves a multi-use path (MUP).
- The crossing is in the Old Town District or other pedestrian-oriented development that is expected to generate significant pedestrian travel demand.
- Sidewalk or pedestrian generators exist on both sides of the street at an all-way stop-controlled intersection approach.
- The crossing is longer than 36 feet, increasing the amount of pedestrian exposure to conflicting traffic and desire for improved driver awareness of the crosswalk.
- Stopped vehicular queues often block or are likely to block pedestrian travel at the crossing.
- Two-way vehicular traffic conflicting with the minor street pedestrian crossing at a one-way or two-way stop-controlled intersection exceeds or is projected to exceed 1,500 average daily traffic (ADT) or 150 vehicles/hour in the peak hour *and* the following pedestrian volume thresholds<sup>13</sup> are also met or considered likely to be met based on engineering judgment:
  - $\geq 20$  pedestrians per hour in any one hour
  - $\geq 18$  pedestrians per hour in any two hours
  - $\geq 15$  pedestrians per hour in any three hours

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<sup>13</sup> Elderly, disabled or child pedestrians may count for 2 pedestrians each when evaluating these thresholds. People riding bicycles, scooters, skateboards, or other assisted mobility devices may be counted as pedestrians. People riding golf carts do not qualify as pedestrians for this evaluation.

Markings may be omitted at stop-controlled approaches without sidewalks on one or both corners.

### Deciding Whether to Mark Uncontrolled Crossings

Uncontrolled pedestrian crossing locations include intersections and midblock crossings not controlled by a traffic signal or STOP sign. In general, uncontrolled pedestrian crossing locations correspond to higher pedestrian crash rates compared to controlled locations, often due to inadequate pedestrian crossing accommodations.<sup>14</sup> According to the Fatality Analysis Reporting System (FARS), pedestrians accounted for approximately 17 percent of all roadway fatalities nationally in 2019. Additionally, pedestrians are most vulnerable at non-intersection locations, where 72 percent of pedestrian fatalities occur.<sup>15</sup>

**Uncontrolled** crossings should be marked only after review and application of these guidelines. The federal MUTCD states that “*at uncontrolled approaches, an engineering study should be performed before a marked crosswalk is installed.*”<sup>16</sup> The study should consider:

- Total number of approach lanes,
- Presence of a median,
- Distance from adjacent signalized intersections or other controlled crossings,
- Projected pedestrian and bicyclist volumes,
- Pedestrian and bicyclist paths of travel,
- Pedestrian ages and abilities,
- Pedestrian and bicyclist delays,
- Location of frequency of public transit stops,
- Average daily traffic (ADT),
- Speed limit or the 85th-percentile speed,
- Horizontal and vertical geometry of the crossing location,
- Possible consolidation of multiple crossing points,
- Availability of street lighting, and
- Other appropriate factors

The MUTCD continues, “*The installation of other traffic control devices and other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should be considered in addition to a new marked crosswalk and signs across an uncontrolled roadway where any of the following conditions exist:*

- A. The roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater; or*
- B. The roadway has four or more lanes of travel with a raised median or pedestrian refuge island and an ADT of 15,000 vehicles per day or greater, or*
- C. The posted speed limit is 40 mph or greater, or*
- D. A crash study reveals that multiple-threat crashes are the predominant crash type on a multi-lane approach, or*
- E. When adequate visibility cannot be provided by parking prohibitions.*<sup>17</sup>

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<sup>14</sup> FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

<sup>15</sup> National Highway Traffic Safety Administration, “FARS Data Query: 2019 Data.” Fatality Analysis Reporting System (FARS) National Statistics. (2019). <https://www-fars.nhtsa.dot.gov/Main/index.aspx>. Presumably, most non-intersection locations are uncontrolled, though some could represent signalized mid-block crossings. 17.5% of pedestrian fatalities are intersection related, though the data does not categorize these into controlled versus uncontrolled crossings. The remaining 10.5% of pedestrian fatalities were at unknown locations.

<sup>16</sup> MUTCD Sec. 3C.03, paragraphs 03-04, [https://mutcd.fhwa.dot.gov/pdfs/11th\\_Edition/mutcd11thedition.pdf](https://mutcd.fhwa.dot.gov/pdfs/11th_Edition/mutcd11thedition.pdf).

<sup>17</sup> MUTCD Sec. 3C.03, paragraph 06

Research has also shown that on some streets, crosswalk markings *alone* may not improve pedestrian safety at uncontrolled crossings.<sup>18</sup> These guidelines were developed in accordance with the above requirements and the most recent available pedestrian safety research to ensure that crosswalk markings, where used, have positive safety effects.

### Steps in the Uncontrolled Crossing Decision Process

The following steps should be taken to decide whether to install markings at an uncontrolled crossing:

- **Step 1** involves assessing the crossing using the *Uncontrolled Crossing Flowcharts* on pages 12 and 13. The Step 1A chart is for uncontrolled crossings, while the Step 1B chart is for school-related uncontrolled crossings.
- If directed to proceed to Step 2 by the flowchart, **Step 2** involves evaluating the crossing using the *Uncontrolled Crossing Evaluation Worksheet*, on pages 14-15.
- If directed to proceed to Step 3 by the flowchart or the worksheet, **Step 3A** involves determining the Tier number of the crossing and associated traffic control devices according to the *Uncontrolled Crossing Tier Matrix* on page 16.
- **Step 3B** involves determining the specific traffic control devices associated with each tier in combination with other characteristics of the crossing as listed in the matrix on page 17. Signs described in the Step 3B matrix are shown in the details for each tier that are found in the **Appendix** for reference.
- If the Step 3B selection involves a **PHB** or **traffic signal**, this will convert the crossing from an uncontrolled crossing to a controlled crossing. All requirements identified previously for controlled crossings then apply. Additionally, **MUTCD guidelines** for the installation of PHB's (found in the **Appendix**) should be met before installing a PHB. An engineering study to evaluate **MUTCD signal warrants** (see MUTCD Chapter 4C, excerpts of which are included in the **Appendix**) shall be conducted before installing a signal.

If this three-step process indicates that crosswalk markings should be considered, then markings should *only* be installed along with other traffic control devices recommended for the applicable tier number. Crosswalk markings should not be installed before (or without) other devices recommended for that tier.

### Additional Information

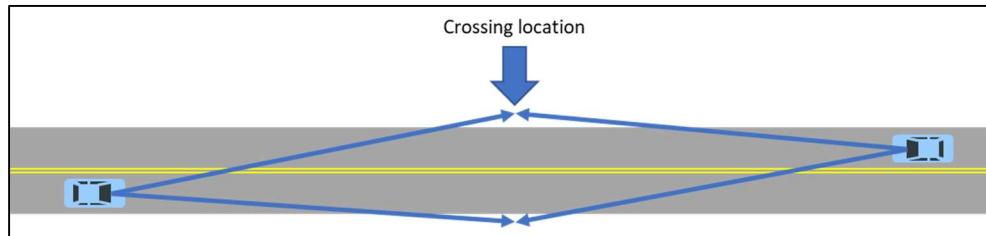
Following is additional information about two questions in the Step 1 flowchart:

- **Does the crossing provide critical pedestrian connectivity?** The purpose of this question is to assess whether crosswalk markings are desirable regardless of other site characteristics and pedestrian activity. For instance, crossings that are important for connectivity may be the only available crossing point, or the most logical crossing point, between a pedestrian generator (such as a park or retail center) and a residential neighborhood.
- **Is sight distance sufficient?** Available sight distance at the crossing should be measured in four ways, as shown in the figure below, involving all combinations of motorist travel direction and

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<sup>18</sup> Safety Effects of Marked vs Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines (FHWA-RD-01-075)

pedestrian travel direction. Sight distance is measured along the length of the roadway. The *shortest* of these four sight lines should be used for analysis purposes.



Two different sight distance criteria are relevant:

- *Stopping Sight Distance (SSD)*: Motorists approaching a marked crosswalk must have enough time to stop after seeing a crossing pedestrian and before reaching the crosswalk. SSD must comply with the equation below (the table that follows indicates the results of the equation for common approach speeds):

$$SSD = (1.47 * S * 2.5) + 1.075 * \left(\frac{S^2}{11.2}\right)$$

<b><i>Speed Limit (S), in mph</i></b>	<b><i>Minimum Required Stopping Sight Distance (SSD), in feet</i></b>
25 or less	155
30	200
35	250
40	305
45	360
50	425
55	495

- *Crossing Sight Distance (CSD)*: Ideally, pedestrians should be able to see a sufficient distance along the road to identify an appropriate gap in traffic before beginning to cross the street. CSD should comply with the equation below. The table that follows gives the appropriate minimum crossing distances for common combinations of speed limit and crossing length.

The crossing length should be measured between faces of curb, edge lines, or edges of pavement on opposite sides of the crossing; however, the crossing length can be limited to the median if the median is raised and at least 6 feet wide for speed limits 35 mph and below, or at least 8 feet wide for speed limits 40 mph and above.

When the crossing length is limited to the median, a cut-through median refuge with detectable warning surfaces is preferable for accessibility and should be constructed if not already present.<sup>19</sup> Otherwise, the crossing length in the table above should be

<sup>19</sup> PROWAG Sect. R205.3, R305.1, R305.1.4, paragraph B

measured from the outside curbs without assuming the benefit of a two-stage crossing using the median.

$$CSD = 1.47 * S * (2.5 + \frac{CL}{3.5})$$

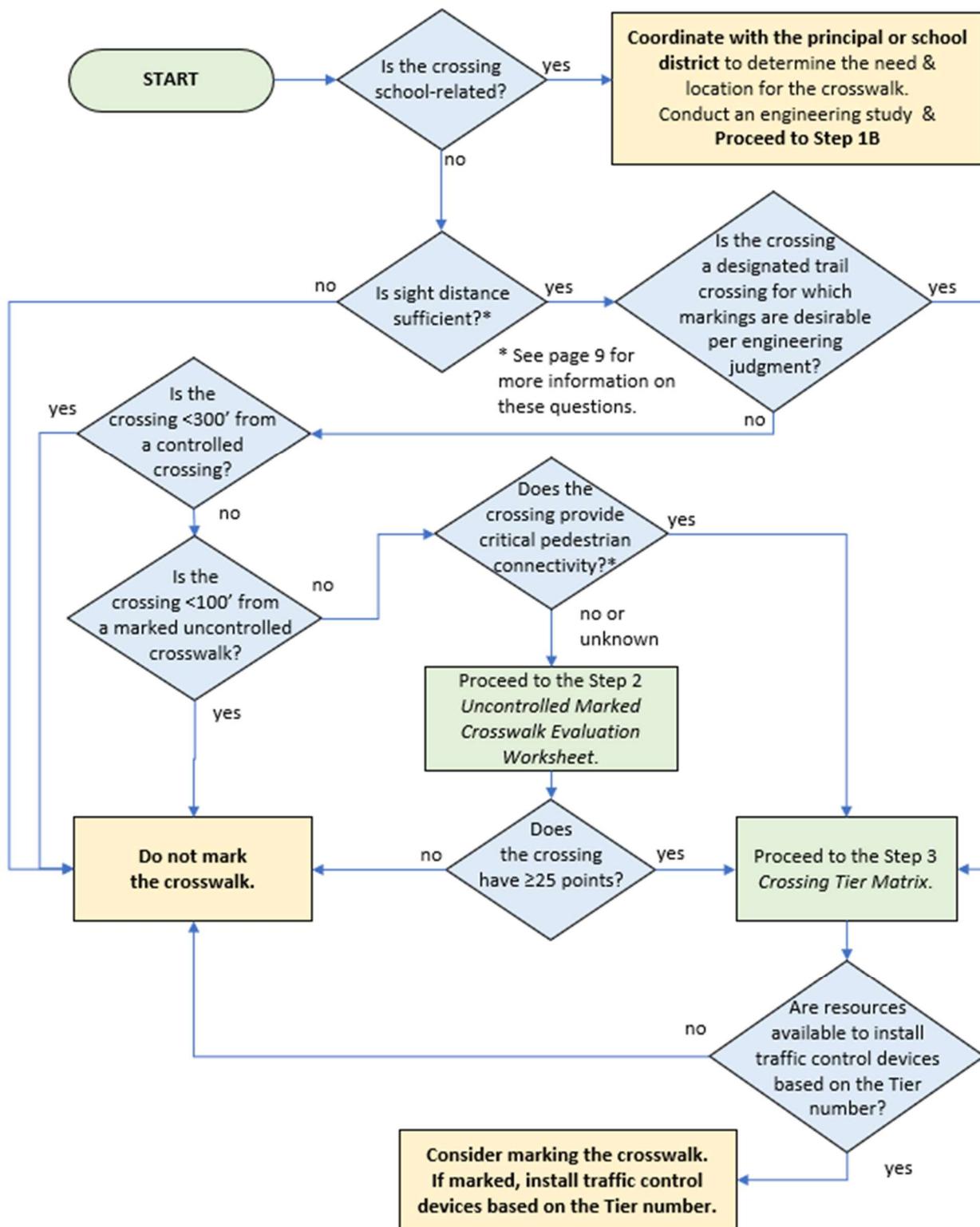
Speed Limit (S) in mph	<b>Minimum Crossing Sight Distance (CSD), in feet</b>									
	<b>Crossing Length (CL) in feet</b>									
	<b>10</b>	<b>12</b>	<b>20</b>	<b>24</b>	<b>30</b>	<b>36</b>	<b>40</b>	<b>48</b>	<b>50</b>	<b>60</b>
25 or less	200	220	305	345	410	470	515	600	620	725
30	240	265	365	415	490	565	615	720	745	870
35	280	310	425	485	570	660	720	835	865	1015
40	315	350	485	555	655	755	820	955	990	1155
45	355	395	545	620	735	850	925	1075	1115	1300
50	395	440	605	690	815	940	1025	1195	1235	1445
55	435	480	665	760	900	1035	1130	1315	1360	1590

At marked crosswalks, it is essential that the sight distance available to a motorist exceeds the minimum SSD. Motorists must have sufficient time to stop upon seeing a pedestrian. If SSD is not sufficient, the crosswalk should not be marked. Strong consideration should be given to posting "No Pedestrian Crossing (symbol)" (R9-3) signs at such locations facing pedestrian approaches in both directions.

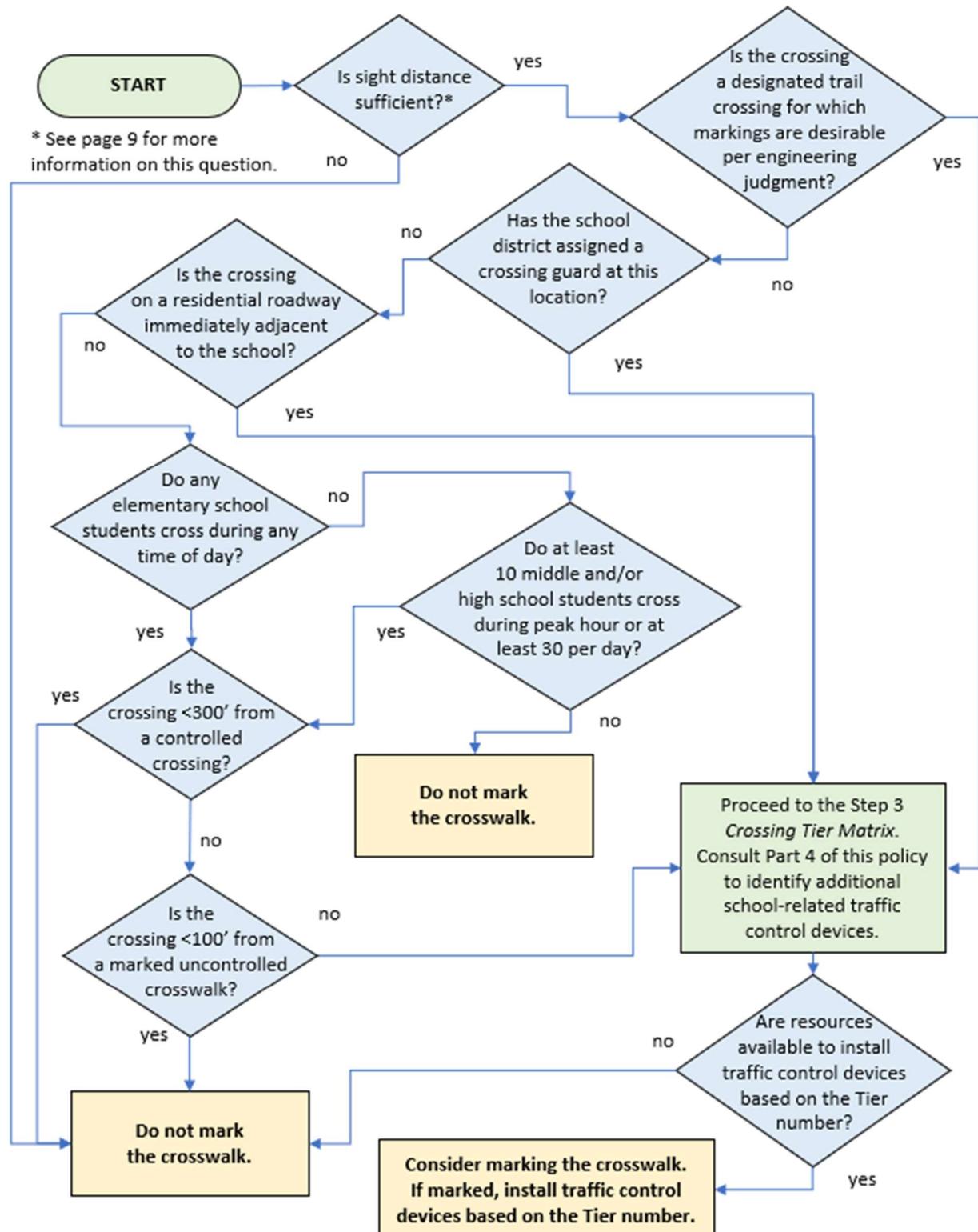
It is also ideal if the sight distance available to a pedestrian exceeds the minimum CSD, but consideration should be given to the walking distance to and from the nearest available controlled or otherwise enhanced crossings in deciding whether to consider meeting the SSD alone as sufficient.

## Step 1: Uncontrolled Crossing Flowcharts

### Step 1A: Determining Whether to Mark Uncontrolled Crosswalks



## Step 1B: Determining Whether to Mark Uncontrolled School Crosswalks



## Step 2: Uncontrolled Marked Crosswalk Evaluation Worksheet

**Note:** This worksheet should only be used if directed by the Step 1A flowchart on page 12

1. <b>Pedestrian Generators.</b> Add 2 points for each pedestrian generator within 300 feet of the crossing, to a maximum of 6 points. Pedestrian generators include parks, swimming pools, grocery stores, convenience stores, apartment complexes, community centers, bus stops, etc.		Points: _____	
2. <b>Crash History.</b> Add 6 points for each pedestrian or bicyclist crash within 300 feet of the crossing in the past 60 months. <sup>20</sup>		Points: _____	
Add 5 additional points for any crashes counted above that resulted in fatal or serious injury. <sup>21</sup>		Points: _____	
3. <b>Speed Limit</b>		Points: _____	
25 mph or below			0 points
30 mph			2 points
35 mph			4 points
40 mph or above		6 points	
4. <b>Daily Traffic Volume</b>		Points: _____	
3,000 vehicles per day (vpd) or less			0 points
3,001 to 9,000 vpd			2 points
9,001 to 15,000 vpd			4 points
15,001 vpd or more			6 points
5. <b>Proximity to Nearest Controlled or Grade-Separated Crossing</b>		Points: _____	
300 to 500 feet			3 points
500 to 750 feet			5 points
751 to 1000 feet			7 points
1001 feet or more			9 points
6. <b>Number of Through Lanes Crossed</b>		Points: _____	
2 lanes or fewer			0 points
3 lanes			3 points
4 lanes			5 points
5 lanes			7 points
6 lanes or more		10 points	
Step 2, Parts 1-6 Subtotal		Points: _____	

<sup>20</sup> If less than 60 months of crash data are available (such as with recently constructed streets), consider using 6 points per crash times 60, divided by the number of months of available crash data.

<sup>21</sup> If less than 60 months of crash data are available, consider using 5 additional points per serious injury or fatal crash times 60, divided by the number of months of available crash data.

- If the subtotal for Step 2, Parts 1-6 is 25 points or greater, the crossing is considered eligible for a marked crosswalk. Designers should refer to Step 3, the *Uncontrolled Crossing Tier Matrix*, to determine appropriate traffic control devices.
- If the subtotal for Step 2, Parts 1-6 is less than 10 points, the crossing is not considered eligible for a marked crosswalk.
- If the subtotal for Step 2, Parts 1-6 is between 10 and 24 points, a pedestrian count should be conducted to determine additional points, as follows in Step 2, Part 7:

7. Pedestrian & bicyclist crossing volume within 300 feet of crossing. <sup>22</sup>				Points: _____	
Peak Hour		12-Hour Total			
< 10 crossings	Do Not Install	< 50 crossings	Do Not Install		
10 to 19 crossings	5 points	50 to 79 crossings	5 points		
20 to 29 crossings	10 points	80 to 109 crossings	10 points		
≥ 30 crossings	15 points	≥ 110 crossings	15 points		

Crossing counts should be collected during peak pedestrian and bicyclist crossing times for a minimum of two hours. Peak pedestrian and bicyclist crossing hours may not coincide with peak motor vehicle traffic hours. If the peak crossing hours are unknown, it is desirable to conduct a 12-hour count of crossing activity to determine the peak times. The peak crossing hours for some locations (such as parks or athletic fields) may occur on the weekend.

Step 2, Parts 1-7 Total	Points: _____
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- If the total is 25 points or greater, the crossing is considered eligible for a marked crosswalk. Designers should refer to Step 3, the *Uncontrolled Crossing Tier Matrix*, to determine appropriate traffic control devices.
- If the total is less than 25 points, the crossing is not eligible for a marked crosswalk (except if otherwise indicated on the Step 1 flowchart).

<sup>22</sup> Each elderly, disabled, or child pedestrian may be considered to count for two crossings. People riding bicycles, scooters, skateboards, or other assisted mobility devices may be counted as pedestrians. People riding golf carts do not qualify as pedestrians for this evaluation.

## Step 3: Uncontrolled Crossing Tier Matrices

**Note:** This matrix should only be used if directed by the Step 1 Flowchart or the Step 2 Worksheet.

This matrix only applies to uncontrolled pedestrian crossings.

### Step 3A: Determine the Tier Number

Street Functional Classification	Total Number of Through Lanes Crossed in Both Directions	Type of Median	Vehicle ADT < 9,000			Vehicle ADT 9,000 to < 12,000			Vehicle ADT 12,000 to < 15,000			Vehicle ADT ≥ 15,000		
			Speed limit (mph)											
			≤ 30	35	≥ 40	≤ 30	35	≥ 40	≤ 30	35	≥ 40	≤ 30	35	≥ 40
Local	1 or 2	Any	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Collector or Arterial	1 or 2	No median or raised median	5	5	3*	5	4	3*	5	4	3*	4	4	3*
	1 or 2	TWLTL or left-turn lane	5	5	3*	5	4	3	4	4	2	4	4	2
	3 or 4	Raised	5	4	3*	4	3*	2	4	3*	2	3	2	1
	3 or 4	Not raised or no median	3	2	1	3	2	1	3	2	1	2	1	1
	≥ 5	Any	3	2	1	2	2	1	2	1	1	1	1	1

\* Consider Tier 2, especially when ≥ 40 mph or ≥ 15,000 ADT

Notes:

ADT = Average Daily Traffic.

TWLTL = Two-way left-turn lane.

A TWLTL does not constitute a raised median.

To provide sufficient pedestrian refuge, a raised median must be at least the following width:

- For speed limits 35 mph or less: 6 feet (8 feet for bicycle/trail crossings)
- For speed limits 40 mph or more: 10 feet

Speed limit thresholds used in this table are based on the FHWA *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations*

For reduced speed school zones (typically 20 mph) that are effective only during school arrival and dismissal times, the speed limit selected for the Step 3A chart should be the regular (higher) speed limit effective at other times of day to account for student or other pedestrians crossing earlier or later, such as for before/after school sports and other activities.

**Note: This matrix should only be used if directed by the Step 1 Flowchart or the Step 2 Worksheet.**

**This matrix only applies to uncontrolled pedestrian crossings.**

**Step 3B: Determine the Devices to Use Based on the Tier Number**

Tier	Crosswalk markings	W11-2 (or W11-15 or S1-1) and W16-7P warning signs at crossing <sup>2</sup>	W11-2 (or W11-15 or S1-1) and W16-9P advance warning signs <sup>2</sup>	Stop lines and STOP HERE FOR PEDESTRIANS signs	R1-6a In-Street Pedestrian Crossing Signs	PED XING or SCHOOL pavement word markings	Raised median or crossing island	Rectangular Rapid-Flashing Beacon (RRFB)	Pedestrian Hybrid Beacon (PHB)	Traffic Signal
Tier 1	High-Visibility	Yes	Optional <sup>3</sup>	Yes	No	Optional <sup>3</sup>	Optional	No	Optional in lieu of Traffic Signal <sup>5</sup>	Yes, if warranted <sup>6</sup>
Tier 2	High-Visibility	Yes	Yes for RRFB, optional for PHB <sup>3</sup>	On multilane approaches	No	Optional <sup>3</sup>	Recommended if RRFB is used <sup>4</sup>	Optional in lieu of PHB	Yes <sup>5</sup>	Optional in lieu of PHB if warranted <sup>6</sup>
Tier 3	High-Visibility	Yes	Yes	On multilane approaches	No	Optional <sup>3</sup>	Recommended if practicable <sup>4</sup>	Yes	No	No
Tier 4	High-Visibility	Yes	Yes	On multilane approaches	Optional for 2-lane & ≤ 30 mph in school zones. No for all other crossings	No <sup>3</sup>	Optional	No <sup>3</sup>	No	No
Tier 5	High-Visibility	Yes	No***	No		No <sup>3</sup>	No	No <sup>3</sup>	No	No
Tier 6	Transverse <sup>1</sup>	Yes if midblock, Optional otherwise	No***	No		No <sup>3</sup>	No	No <sup>3</sup>	No	No

<sup>1</sup> At intersection locations only. High-Visibility markings should be provided at non-intersection locations.

<sup>2</sup> For school zone crossings, use S1-1 signs instead of W11-2 signs. For crossings of trails with shared bicycle and pedestrian traffic, use W11-15 signs instead of W11-2.

<sup>3</sup> Recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD).

<sup>4</sup> Consider a raised median **before** evaluating other devices. In some cases, it may be possible to retrofit a raised median on the roadway without affecting needed left-turn access. If a raised median is feasible, re-evaluate the crossing according to its tier number with a raised median.

<sup>5</sup> If MUTCD guidelines in Figures 4J-1 or 4J-2 (see Appendix) are met for the appropriate speed.

<sup>6</sup> See Chapter 4C of MUTCD for traffic signal warrant study requirements.

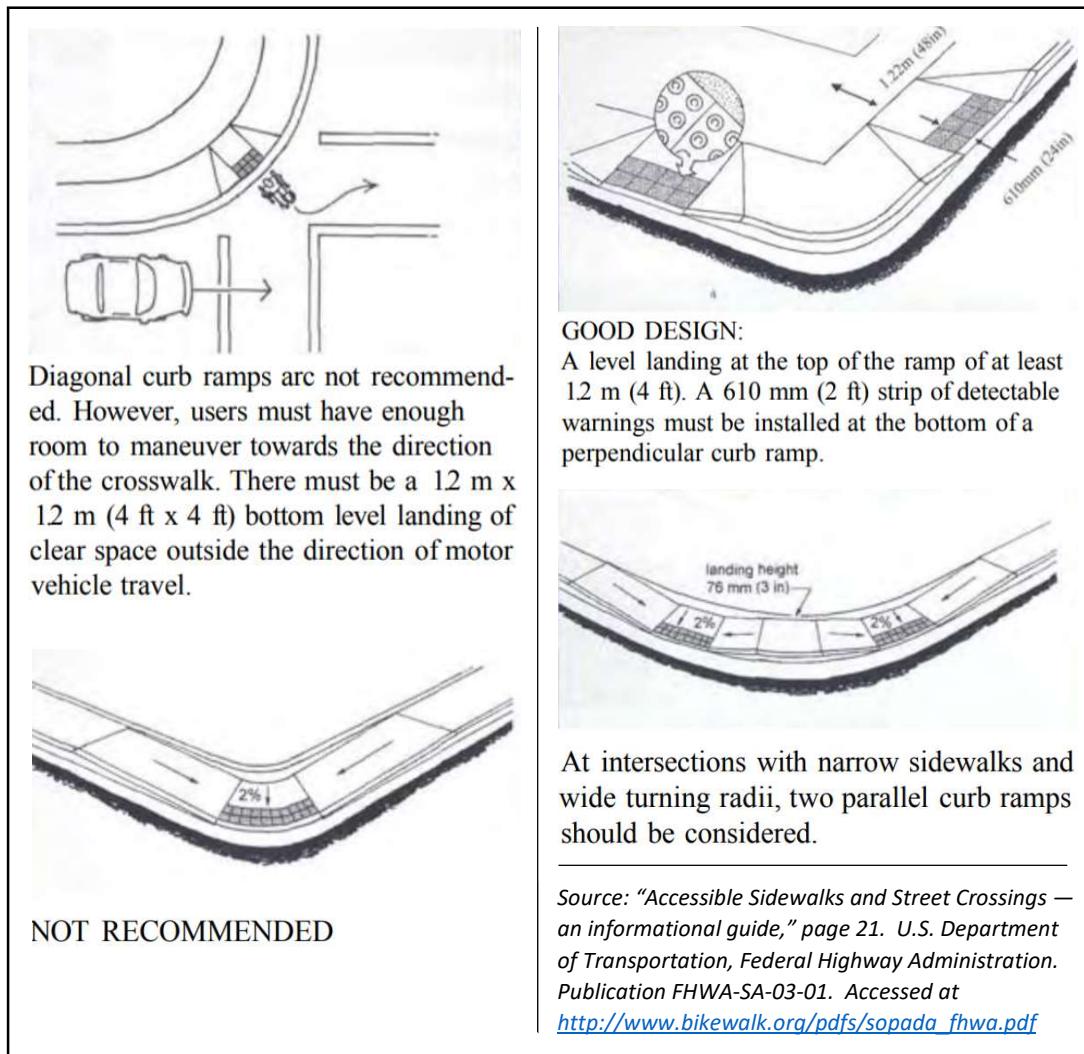
**Notes:**

- **Streetlights** should be provided for marked crosswalks on collector or arterial streets where nighttime or early morning crossings are prevalent. If the street is wider than 40 feet, streetlights should be installed on both sides of the crosswalk (if possible).
- For multilane approaches, the lane lines on the approach to a marked crosswalk should be **converted to solid lines** for 200 feet (5 skip stripes) for posted speeds of 35 mph or less, and for 280 feet (7 skip stripes) for posted speeds of 40 mph or greater.
- **Lane repurposing** to reduce the number of through lanes should be considered for streets with 2 or more approach lanes where excess vehicular capacity exists. (See Appendix)
- For streets with raised medians, **supplemental left-side warning signs** in the median should be considered.
- Crosswalks should not be newly marked without the supplementary traffic control devices and lighting identified for the appropriate tier.
- Additional devices beyond those in the Step 3B table may be used based on engineering judgment.

## Deciding Whether to Provide Curb Ramps

Curb ramps must be provided for all marked and unmarked crosswalks. Therefore, when it is required to prohibit pedestrian crossings at an intersection or mid-block location due to sight distance or other concerns, measures must be taken to ensure it is clear to all potential sidewalk and shared-use path users that crossings are not permitted.

In the section-by-section analysis for Section R203.6 in the supplementary information provided with PROWAG, the Access Board explains, “The final rule maintains the requirement that one curb ramp or blended transition be provided for each crosswalk at an intersection corner, and alternatively allows a blended transition to span all crosswalks at an intersection corner. Use of a single curb ramp at the apex of an intersection corner is permitted in alterations where existing physical constraints make compliance technically infeasible. Diagonal curb ramps often route users into the roadway, not within a crosswalk.”<sup>23</sup> The figure below illustrates these principles.”



<sup>23</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-180>

"To provide equity to persons with disabilities in the public right-of-way, PROWAG must ensure that a person in a wheelchair who requires a curb ramp to cross a street is afforded the same opportunity to stay within the safety of a crosswalk as a person who is able to step off the curb directly into a crosswalk. Thus, unless there are existing physical constraints that prohibit the provision of a curb ramp for each crosswalk, one curb ramp per crossing that is contained within the crosswalk must be provided."<sup>24</sup>

The analysis continues in the same section: "A curb ramp or blended transition must be provided at each end of a crosswalk at an intersection corner, a midblock crossing, and a roundabout crossing. These provisions further clarify that where crossing is prohibited at an intersection or not intended midblock or at a roundabout, jurisdictions must take care to ensure that there is no crosswalk, no curb ramp, and the pedestrian circulation path [sidewalk] is separated from the roadway."<sup>25</sup>

"Equity in the public right-of-way requires that persons with disabilities have equal access to crosswalks and information about whether a crosswalk is present. Where pedestrian crossing is permitted, curb ramps must be provided so that persons who use wheelchairs can access them. Where pedestrian crossing is prohibited at an intersection or is not intended midblock or at a roundabout, cane-detectable features must indicate to persons who are blind that this is not a place to cross... Jurisdictions have options for ensuring that they do not create a crosswalk where crossing is prohibited or not intended. This includes options, such as grass strips and landscaping, that can be used where a jurisdiction is concerned that a sign or barrier might obstruct motorists' sightlines."<sup>26</sup>

Single curb ramps at the apex of intersection corners are currently common throughout Prosper. This configuration does not always provide clear guidance to vision-impaired persons about the intended direction of the crosswalk, and may put users of wheelchairs, bicycles, strollers, and other assistive devices on an alignment that communicates that crossing either adjacent leg of the intersection is acceptable. Therefore, alterations of any intersections where crosswalks (marked or unmarked) are intended for crossing the minor street only but not the major street should have single-corner curb ramps removed and replaced with curb ramps oriented perpendicular to the minor street only. "No Pedestrian Crossing (symbol)" (R9-3) signs and grass buffers or landscaping should be added to the major street crossing leg to clarify the prohibition.

Prosper's current curb ramp detail drawing is in some ways like a blended transition, with just one opening at the corner. In other ways, it functions as two perpendicular ramps in that the ramp for each direction has slopes parallel to the directions of the sidewalk rather than perpendicular to the curb, with a shared clear area at the bottom of the ramps that is entirely outside of the travel lanes. Since each ramp provides access to both streets and has landings (with slopes <1:48/2.1%) at the top and bottom, they might be considered in some ways both perpendicular and parallel ramps as per Sections R104.3<sup>27</sup>, R304.2<sup>28</sup>, and R304.3<sup>29</sup> of PROWAG.

The configuration allows running slopes of up to 8.3%, greater than the maximum allowable 1:48 (2.1%) without providing a pedestrian access route as a bypass as required by R304.4.3 for blended transitions<sup>30</sup>. However, if the intent of the bypass is to allow for a level area so wheelchair users do not experience too great a cross slope as they turn the corner without attempting to cross the street, risking tipping or

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<sup>24</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-180>

<sup>25</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-183>

<sup>26</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-184>

<sup>27</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-130>

<sup>28</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-743>

<sup>29</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-753>

<sup>30</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-762>

necessitating excessive effort to stay balanced, then in the configuration of Prosper's current ramp detail, there's little if any risk of tipping or need for excessive effort. The wheelchair user would proceed down the 1:12 max slope, use the level landing area at the bottom to turn 90 degrees, and then proceed up the 1:12 max slope. Regardless, PROWAG does not differentiate between reasons that a pedestrian turning the corner may have for wanting to bypass the blended transition. It only requires that a bypass area be provided rather than allowing for the blended transition to be traversable when turning the corner. Therefore, it is recommended that the Town ensure that curb ramps are constructed to meet the required bypass as per R304.4.3.

Note that PROWAG applies only to new facilities and alterations of existing facilities. The PROWAG guidelines will become enforceable once they are adopted, with or without modifications, as mandatory standards by the U.S. Department of Justice (DOJ) and the U.S. Department of Transportation (USDOT).<sup>31</sup> The USDOJ may determine in the near future that PROWAG should apply to existing facilities as well, in which case the upgrading of existing facilities including curb ramps may need to be included in the Town's ADA transition plan.<sup>32</sup>

## Part 3 - Recommended Crosswalk Design Features

This section is applicable **only** to crosswalks where markings have been determined to be desirable using the earlier methodology.

### Crosswalk Signs

The goal of traffic signs is to provide a clear message to drivers. Sign size, color, and placement should comply with the TMUTCD. Two types of signs are used in conjunction with marked crosswalks – regulatory and warning. Regulatory signs are black, white, and/or red. Regulatory signs can be enforced by law enforcement and citations can be issued for violation. Warning signs for general pedestrian conditions are usually fluorescent yellow with a black legend. School warning signs are required to have a fluorescent yellow-green background with a black legend. These signs are used to warn road users of a roadway condition that might not be readily apparent.

The installation of traffic signs should only be completed after necessary engineering studies support the need for additional traffic control.

The Step 3A and 3B matrices on pages 16 and 17 should be used to select the traffic control devices associated with the marked crosswalk. The traffic control device layouts in the **Appendix** can assist with visualizing the options. However, the notes on the layout sheets indicate that more options and combinations of devices are possible than are illustrated.

Standardized sign sizes for typical crosswalk installations should be as shown in the following table:

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<sup>31</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-15>

<sup>32</sup> See Federal Register, <https://www.federalregister.gov/d/2023-16149/p-563>

**Sign Sizes<sup>1</sup>**

<b>Sign</b>	<b>Sign Designation</b>	<b>Conventional<sup>2</sup></b>
Pedestrian Sign	W11-2	36 x 36
Bicycle/Pedestrian Sign	W11-15	36 x 36
In-Street Pedestrian Signs	R1-6a	12 x 36
Crosswalk Stop on Red	R10-23	24 x 30
Stop Here for Pedestrians	R1-5b	36 x 36
Diagonal Arrow plaque	W16-7P	24 x 12
“AHEAD” plaque	W16-9P	24 x 12

<sup>1</sup> Tables 2B-1 and 2C-2 (TMUTCD)

<sup>2</sup> Dimensions are shown in inches and are shown as width x height

### Crosswalk Sign Spacing

The size of regulatory signs is defined in Table 2B-1 of Section 2 of the TMUTCD and is based on the roadway type, but no clear direction is provided on the sign spacing for regulatory signs. The size of warning signs is defined in Table 2C-2. The placement of warning signs is defined in Table 2C-4, but the spacing is dependent upon drivers' need to respond.

TxDOT developed a recommended sign spacing based on research through TTI.<sup>33</sup> By utilizing a sign spacing based on the speed limit, sign installation will be consistent throughout the Town of Prosper.

“Stop Here for Pedestrians” (R1-5b) regulatory signs and their associated stop lines on multi-lane approaches should be placed 20 to 50 feet in advance of crosswalks as per Figure 3B-17 of the TMUTCD. This distance allows for clear sight triangles around stopped vehicles between crossing pedestrians and drivers approaching at full speed who may not otherwise stop. Absent other sight distance or speed studies specific to the site, the spacing of “Stop Here for Pedestrians” (R1-5b) signs and their associated stop lines in advance of the crosswalk should be as shown in the following table:

**Stop Here for Pedestrians Sign Spacing**

Speed Limit (mph)	Sign Spacing
25	20'
30	25'
35	30'
40	35'
45	40'
50	45'
55	50'

The advanced placement distance for warning signs prior to a crosswalk will be a factor of the posted speed limit of the road (and at school crosswalks using the regular speed limit during nonreduced speed school zone times). The following table defines the proposed warning sign spacing for advanced warning signing.

<sup>33</sup> “Speeds in School Zones”, Texas Transportation Institute, February 2009.

<https://static.tti.tamu.edu/tti.tamu.edu/documents/0-5470-1.pdf>

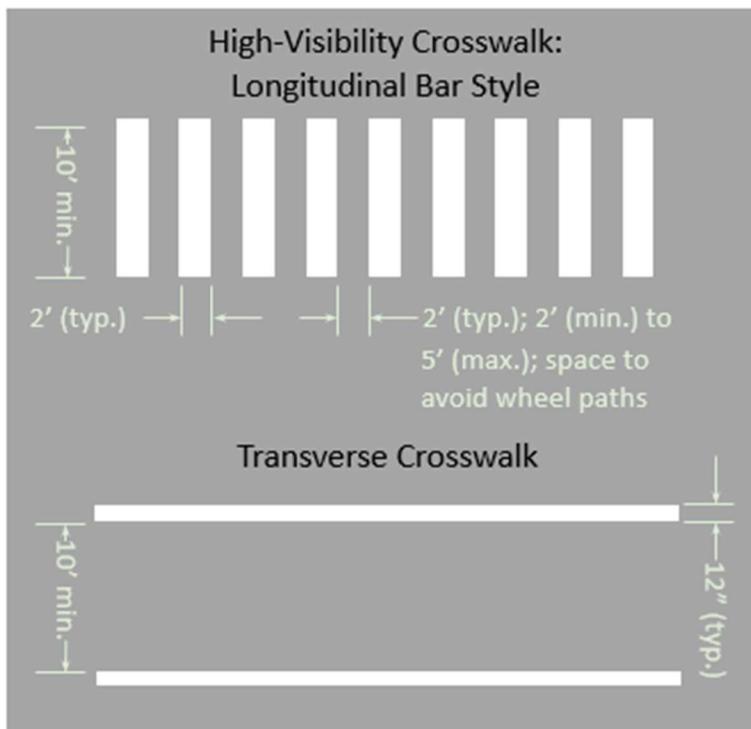
**Warning Sign Spacing**

Speed Limit (mph)	Sign Spacing
25	100'
30	120'
35	160'
40	240'
45	320'
50	400'
55	500'

## Crosswalk Markings

For both controlled and uncontrolled crosswalks, the following design features are recommended, as illustrated in the figure to the right:

- High-visibility crosswalks should be installed for all crosswalks at non-intersection locations.
- Added visibility should be provided by parking prohibitions on the approach to marked crosswalks at non-intersection locations.
- The recommended minimum crosswalk width is 10 feet for streets with 35 mph or higher speed limits. For lower speed limits, transverse crosswalks as narrow as 6 feet may be considered, if necessary, but 10 feet is still preferred.
- If the pedestrian facility approaching the crosswalk is wider than the recommended crosswalk width, the crosswalk width should be increased to match the width of the sidewalk, path, or trail.
- Wider crosswalks may also be used in other locations with high pedestrian crossing volumes.
- Where transverse crosswalks are used, the width of the transverse line markings should be 12 inches.
- Where high-visibility crosswalks are used:
  - Longitudinal lines (bars) 24 inches wide should be used parallel to the major path of approaching vehicular traffic.



- The gaps between longitudinal lines should be 24 inches wide minimum (as shown), and a maximum of 60 inches. Where possible, gaps should be aligned with vehicle wheel paths.

Note: Marked and unmarked crosswalks also must comply with the Americans with Disabilities Act (ADA), which requires features such as curb ramps and detectable warning surfaces (DWS) at each end of the crossing. Designers should consult the U.S. Access Board's Public Right-of-Way Accessibility Guidelines (PROWAG) final rule<sup>34</sup> for required ADA provisions.

### Median Refuge Areas

Where raised medians are provided, the width of the median must be at least six feet wide to function as a pedestrian refuge. A width of eight feet is needed for bicycle/trail crossings, and 10 feet must be provided for speeds of 40 mph or more on the street being crossed.

The TxDOT Roadway Design Manual provides an option for offset crossing ("Z-style") median islands<sup>35</sup>:

"At uncontrolled locations (intersection or midblock), designers may consider a Z-style PAR [pedestrian access route] configuration within the median island. This configuration reorients the pedestrian to face oncoming traffic, creating staggered crosswalks on either side of the island. Islands should be at least 12-ft wide to accommodate an accessible route in both directions and maintain maneuverability and passing distance for pedestrians using mobility devices. When used along a shared use path alignment, the design should also consider maneuverability for bicyclists, including bicycles with trailers or long wheel cargo bikes. This treatment is most appropriate in rural and suburban areas."

The decision of whether to include a the "Z-style" layout in the median can be made independently of the type of traffic control installed. The layouts in the Appendix of the policy are intended to illustrate the differences between the tiers and not to show every feature of a design that might be best to include based on engineering judgment. At locations without signals or pedestrian hybrid beacons, the "Z" layout should be given extra consideration where sufficient width exists, since it helps turn pedestrians to face oncoming traffic for a moment before they cross the second half of the roadway. It encourages them to find gaps in traffic and confirm that drivers are slowing down to stop, an important behavior even with RRFB's present, since they are only warning devices and have lower effective yielding rates than do PHB's.

At PHB's or mid-block signals, the "Z" layout in the median may still be desirable if there's a timing or capacity need to compel pedestrians to cross only half the street at a time and then wait for the next signal/beacon cycle to cross the other half. This must be applied carefully and designed with pedestrian signals and pushbuttons in the median that are aligned properly to not inadvertently convey a message that the timing is sufficient for crossing the entire roadway in one cycle.

### Special Considerations for School Crosswalks

Over 35 percent of Prosper's residents are below 18 years of age, according to 2022 census estimates. With such a young population and continued growth forecast, the Town of Prosper knows that new schools will be built, and attendance boundaries will be changing frequently in the future.

The goal of effective traffic control is to consistently apply a standard so that the driver understands the expectations of the roadway. However, engineering alone cannot make school routes safe. The Safe

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<sup>34</sup> [Federal Register :: Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way](#)

<sup>35</sup> <http://onlinemanuals.txdot.gov/txdotmanuals/rdw/rdw.pdf>, Page 7-48.

Routes to School program advocates the “5 E’s” - education, encouragement, enforcement, engineering, and evaluation to promote safety near schools. The goal of this policy is to establish uniform standards for the Town of Prosper but is not intended to be the only method of improving safety around schools. School officials and law enforcement will be key partners in developing a safe school environment.

Where children need to cross a busy street to access a school but there is not a safe place or no crossing guard, the school district should consider providing busing. The Prosper Independent School District currently has a policy that students who live within two miles of their designated campus are not eligible for transportation services, though bus transportation is provided across four-lane or wider arterials for elementary school students. Exemptions to this policy should be sought when appropriate.

The chances of a pedestrian/vehicular conflict dramatically increase adjacent to schools due to the increased traffic. The installation of a reduced speed school zone increases driver awareness of their surroundings and decreases the probability of a pedestrian-vehicular conflict. In addition, studies have shown that the chances of an incapacitating or fatal injury are reduced to less than 10% by reducing the *prima facie* speed limit to 20 mph.

School crosswalks that are uncontrolled have different criteria for establishment in Step 1 than for crosswalks serving the general public. However, once a decision has been made to mark a school crosswalk, it should be marked and signed with traffic control devices that are consistent with the context of its location (speed, traffic volume, number of lanes crossed) as per the matrix criteria in Step 3.

On major/minor thoroughfares and collectors designated on the Town's Thoroughfare Plan, school crosswalks should only be installed after an engineering study is completed. The study may be conducted by Town engineering staff based on this policy. The study may be limited to an evaluation of the Step 1B flowchart on page 13 if other relevant factors are not identified after consulting with the principal and school district.

The location of present and future school attendance boundaries should be considered when installing a traffic signal or PHB primarily based on student crossing needs. Town staff should coordinate with the school district to help ensure, if possible, that bus service is provided and attendance boundaries are drawn to eliminate or reduce the number of students crossing high-speed and/or high-volume roadways. When this cannot be avoided, Town staff should seek agreement with the school district that attendance boundaries will not be realigned in the near future in such a way that would eliminate the need for a marked crosswalk in conjunction with a PHB or traffic signal soon after these higher-cost traffic control devices are constructed.

For school crosswalks across uncontrolled approaches, the speed limit selected in the Step 3A table should be the roadway's regular speed limit since pedestrian traffic may also be expected to use the crosswalk at times when a reduced speed zone is not in effect.

If a school crosswalk is installed, a reduced speed school zone should be established (see Part 4), and signs and markings installed in accordance with the Step 3 tier matrices on pages 16 and 17 of this policy.

All school crosswalks crossing major/minor thoroughfares and collectors should be monitored annually to ensure the pedestrian volume requirements in Step 1B are met. Consideration should be given to removing marked crosswalks where traffic volumes fall below the threshold for consecutive years.

The current ITE recommended practice states crosswalks should be installed “where a marked crosswalk can concentrate or channelize multiple pedestrian crossings to a single location.”<sup>36</sup> By restricting access to being adjacent to schools and limiting the number of crossings of collectors and arterials, the pedestrians can be directed to the most appropriate crossing locations.

Chapter 7D.02 of the MUTCD notes that “Adult crossing guards shall not direct traffic in the usual law enforcement regulatory sense. In the control of traffic, they shall pick opportune times to create a sufficient gap in the traffic flow. At these times, they shall stand in the roadway to indicate that pedestrians are about to use or are using the crosswalk, and that all vehicular traffic must stop.” Thus, for crossing higher speed or higher volume roadways where opportune times to stop traffic may be few during peak times or more difficult to judge, adult crossing guards should not be relied upon alone to stop traffic. Rather, the appropriate traffic control devices should be selected based on the Step 3A and 3B matrices, with adult crossing guards provided to supplement safety and assist students in identifying when it is safe to cross.

### [Removal of Marked Crosswalks](#)

Crosswalk markings and associated traffic control devices may be removed if they no longer serve a purpose due to a change in the traffic or pedestrian conditions.

Uncontrolled marked crosswalks should be reevaluated in conjunction with street reconstruction projects that will obliterate the crosswalk markings.

In the absence of a street reconstruction project, the following factors might be sufficient to justify reevaluating the presence of marked uncontrolled crosswalks:

- Changes in land use
- Changes in a school’s walking or attendance boundary
- Closing of a school or other pedestrian generator that prompted the installation of the crosswalk markings
- Multiple resident requests for removal or relocation of the marked crosswalk
- Observed inappropriate pedestrian or driver behavior
- Adverse pedestrian or bicyclist crash history
- Changes (increases or decreases) in traffic volumes or speeds
- Changes in roadway lane configuration, or addition or removal of a median refuge
- Road widening or narrowing

The removal or relocation of school-related marked crosswalks should be coordinated with the principal or school district.

Note that guidelines from PROWAG outlined in the preceding section “Deciding Whether to Provide Curb Ramps” will apply regarding curb ramps if it is decided that a crosswalk needs to be removed entirely rather than simply converted from a marked to an unmarked crosswalk.

### [Crosswalk Maintenance](#)

Once a crosswalk is marked, its location should be recorded in an inventory for future monitoring and maintenance. Crosswalk markings should be maintained to ensure that the markings remain in serviceable

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<sup>36</sup> Design and Safety of Pedestrian Facilities: A Recommended Practice of the Institute of Transportation Engineers, March 1998, p. 55. [https://safety.fhwa.dot.gov/ped\\_bike/docs/designsafety.pdf](https://safety.fhwa.dot.gov/ped_bike/docs/designsafety.pdf)

condition, sufficiently visible both day and night. Crosswalk markings (as with other pavement markings) normally need to be refreshed at regular intervals. The frequency of maintenance is related to the amount of traffic wear and the type of marking material (paint versus thermoplastic or other longer-lasting material).

## Part 4 –Reduced Speed School Zones

TxDOT guidance states that “Pedestrian crossing activity should be the primary basis for reduced speed school zones.”<sup>37</sup> Furthermore, it says that “School zones in urban areas where speeds are 30 mph or less may have school zones as short as 200 to 300 feet.”<sup>38</sup>

Operating speeds increase as the distance from the beginning of the school zone increases. For every quarter mile (1,320 feet) of school zone length, speeds can be expected to increase almost 2.5 mph. Studies have shown that compliance is highest in the first 350 feet of school zone. By limiting the reduced speed school zone to 400 feet maximum, compliance to the 20-mph speed limit should be higher.<sup>39</sup>

The following policies regarding reduced speed school zones will be followed in the Town of Prosper:

1. Reduced speed school zones should begin 30 minutes before school begins and end 15 minutes after school begins. In the afternoon, reduced speed school zones should begin 15 minutes before school ends and end 30 minutes after school ends.
2. All reduced speed school zones should be designated as 20 mph on Town controlled roadways. On State controlled roadways (i.e., Preston Road), the posted speed limit in a reduced speed school zone is typically limited to 15 mph below the posted speed limit. For example, a roadway with a 50-mph speed limit can only be reduced to 35 mph during the reduced speed school zone. Each location on a State controlled roadway should be evaluated in coordination with the Texas Department of Transportation (TxDOT).
3. Studies have shown that as the length of school zones increases, the compliance rate for reduced speed school zones decreases. Therefore, the length of school zones should be kept to a minimum. The table on the following page shows the recommended advance distance between the beginning of a reduced speed school zone to the first critical location in the zone, for roadways with posted speed limits of 25 mph or higher. This critical location is usually the first crosswalk leading to the school, but in the absence of crosswalks may be the school property line or other conflict point such as a driveway.

In a reduced speed school zone, the location at which the speed zone should begin as per the table above may be very close to the distance recommended for school advanced crossing assembly signs (S1-1/W16-9P) by the warning sign spacing table presented previously on page 22. In such cases, it is usually advisable to omit the school advanced crossing assembly signs (S1-1/W16-9P) inside the reduced speed zone so long as S1-1 signs (without W16-9P's) are installed in advance of the beginning of the reduced speed zone as required by the MUTCD in either case.

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<sup>37</sup> “Procedures for Establishing Speed Zones Manual”, Texas Department of Transportation, Page 2-13.  
<http://onlinemanuals.txdot.gov/txdotmanuals/szn/szn.pdf>

<sup>38</sup> “Procedures for Establishing Speed Zones Manual”, Texas Department of Transportation, Page 3-17.  
<http://onlinemanuals.txdot.gov/txdotmanuals/szn/szn.pdf>

<sup>39</sup> “Speeds in School Zones”, Texas Transportation Institute, February 2009, Page 98.  
<https://static.tti.tamu.edu/tti.tamu.edu/documents/0-5470-1.pdf>

**Recommended Reduced Speed School Zone Advance Distance**

<b>Speed Limit (mph)</b>	<b>Recommended Advance Distance</b>
25	200'
30	200'
35	200'
40	300'
45	300'
50	400'
55	400

Though optimal to keep the length of the reduced speed zone short, the distances in the table above can also be increased slightly if needed to provide school advanced crossing assembly signs inside the reduced speed zone. In this case, consecutive signs should be spaced no less than 100 feet apart.

4. On residential roadways, reduced speed school zones should be established adjacent to each public-school campus and at school crosswalks installed to indicate the presence of pedestrians in accordance with this policy.
5. On major/minor thoroughfares and collectors designated on the Town's Thoroughfare Plan, reduced speed school zones should be installed at school crosswalk conflict points in accordance with this policy and where public-school driveways intersect the roadway.
6. On major/minor thoroughfares designated on the Town's Thoroughfare Plan, a supplemental flashing beacon and radar speed board should be installed on the initial reduced speed school zone sign for each approach. On a divided roadway, a supplemental flashing beacon and radar speed board will be provided on the right side of the roadway only. A static sign should be installed on the left side of the roadway.
7. Reduced speed school zones should be monitored annually for pedestrian activity. A reduced speed school zone may be modified or removed together with the associated school crosswalk(s) as necessary to accommodate changes in school boundaries and pedestrian activity.
8. Engineering judgment may necessitate a deviation from these standards. Any variance to this policy will be approved by the Director of Engineering Services.

**Sign Details**

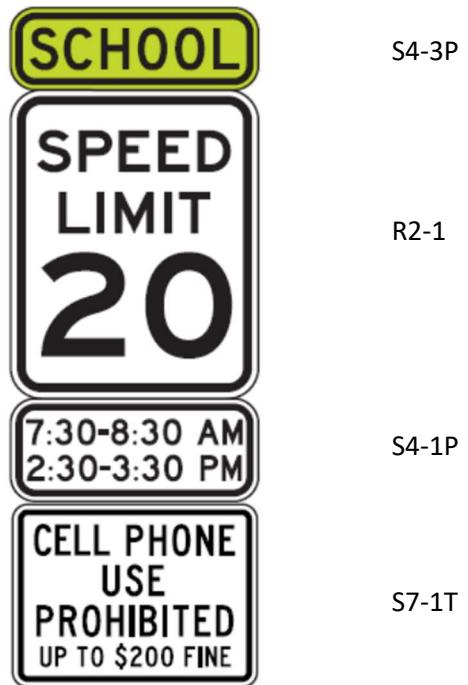
The Town of Prosper will follow the current recommended practice in the TMUTCD in sign placement. The following signs are recommended for use in reduced speed school zones in Prosper:

1. A school advance crossing assembly consisting of a school sign (S1-1) and "AHEAD" plaque (SW16-9P) or a stand-alone school sign (S1-1 only) shall be installed in advance of all reduced speed school zones as shown in **Figure 1**. The advance placement of this assembly should be as shown in the table on page 22.



**Figure 1: School Advance Crossing Assembly**

2. A school speed limit assembly shall consist of a school plaque (S4-3P), a speed limit sign (R2-1), a time limit plaque (S4-1P), and an electronic device restriction (S7-1T) as shown in **Figure 2**.



**Figure 2: School Speed Limit Assembly**

Supplemental flashing beacons and radar speed boards may be installed in accordance with Policy Item 6 on the previous page. A school speed limit assembly shall be installed at the beginning of all reduced speed school zones. Additional school speed limit assemblies may be installed in continuous school zones that extend beyond 1,000 feet or in locations where a reduced speed

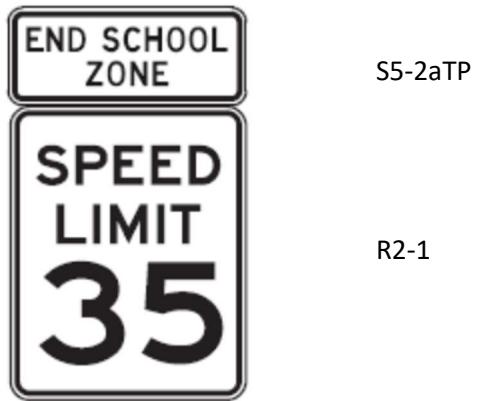
school extends through a major intersection. The placement of this sign assembly should be according to the table on page 26.

3. A school crossing assembly consisting of a school sign (S1-1) and a supplemental down arrow plaque (SW16-7P) as shown in **Figure 3** shall be installed at each school crosswalk established in accordance with this policy. This assembly should only be installed on uncontrolled approaches where a crosswalk is installed to indicate student crossing. This sign shall not be installed on stop-controlled approaches.



**Figure 3: School Crossing Assembly**

4. An end school zone assembly consisting of an "END SCHOOL ZONE" plaque (S5-2aTP) and a speed limit sign (R2-1) as shown in **Figure 4** should be installed at the end of each reduced speed school zone.



**Figure 4: End School Zone Assembly**

The End School Zone Assembly may be located at the same position as the school speed limit assembly for the opposite direction of travel for convenience of installation and enforcement. However, it may also be located as soon as possible downstream of the conflicting crosswalk to avoid unnecessary delay to drivers.

5. As shown in **Figure 5**, In-Street Pedestrian Crossing signs (R1-6a) may be installed to supplement existing school traffic control. In Prosper, an in-street pedestrian sign should be a portable sign maintained by the school district, and the use of such signs will be limited to arrival and dismissal times. When used at school-related crosswalks, the border of the sign shall be fluorescent yellow-green in color rather than fluorescent yellow as allowed at non-school locations in other jurisdictions. Per the TMUTCD, the maximum height of this sign should be 4 feet above the adjacent pavement surface.



**Figure 5: In-Street Pedestrian Signs (R1-6a)**

In-Street Pedestrian Crossing signs can be used to identify pedestrian crossings; however, Section 7B.12, paragraph 7 of the TMUTCD states, “the sign support shall comply with the mounting height and special mounting support requirements for In-Street Pedestrian Crossing (R1-6) signs” in Section 2B.12. Section 2B.12 of the TMUTCD states that “The In-Street Pedestrian Crossing sign shall not be post-mounted on the left-hand or right-hand side of the roadway.”<sup>40</sup>

6. The size of school signs should match the required sizes for conventional roads. The following table defines the size for each sign:

Sign Sizes <sup>1</sup>		
Sign	Sign Designation	Conventional <sup>2</sup>
School Sign	S1-1	36 x 36
End School Zone	S5-2aTP	24 x 10
In-Street Pedestrian Signs	R1-6a	12 x 36
Speed Limit sign	R2-1	24 x 30
Time Limit Plaque	S4-1P	24 x 10
“SCHOOL” plaque	S4-3P	24 x 8
Electronic Device Restriction	S7-1T	24 x 18
Advance Turn Arrow	SW16-6P	24 x 18
Diagonal Arrow plaque	SW16-7P	24 x 12
“AHEAD” plaque	SW16-9P	24 x 12

<sup>1</sup> Table 7B-1 (TMUTCD)

<sup>2</sup> Dimensions are shown in inches and are shown as width x height

<sup>40</sup> See TMUTCD, Section 2B.12, paragraph 3.

## Pavement Markings

In school areas, pavement markings can include pavement and curb markings, delineators, and channelization devices. Pavement markings are used to supplement traffic signs and/or signals.

The Town of Prosper will follow the current recommended practice in the TMUTCD. However, around schools, the following pavement markings will become standard:

A 12" transverse white line should be provided across the full pavement width to mark the beginning and end of a reduced speed school zone installed in accordance with this policy.

The details for each tier of traffic control devices in the **Appendix** also include notes with options for word markings such as the SCHOOL word marking shown in Figure 7C-1 of the MUTCD, reproduced below. These markings should be given special consideration when the minimum stopping sight distance is provided but the ideal crossing sight distance is not provided, as outlined on pages 9-11 previously.

**Figure 7C-1. Two-Lane Pavement Marking of “SCHOOL”**



## Part 5 - Development Review

Town staff should review future development proposals to ensure that land use and transportation decisions are coordinated to ensure pedestrian safety and convenience is maximized. Marked crosswalks, along with other necessary traffic signs, pavement markings, and other traffic control devices appropriate for the context of the location, should be required within and adjacent to new developments or in conjunction with other roadway improvements in accordance with this policy.

Wide, multi-lane roadways that encourage higher speeds and pose barriers to pedestrian travel should be discouraged where not required by the Town's Master Thoroughfare Plan. If such streets are provided as part of proposed development, consideration should be given to building grade-separated pedestrian underpasses or overpasses near major generators of pedestrian trips such as schools, parks, swimming pools, grocery stores, convenience stores, apartment complexes, community centers, bus stops, etc. Underpasses must be designed with abundant lighting to overcome potential safety concerns.

If pedestrian grade separations are not practical, locations for pedestrian generators should be selected where possible near intersections that meet signal or all-way stop control warrants or are likely to meet them in the near future. Where these measures are not possible, proposed uncontrolled crosswalks near pedestrian generators should be provided with adequate pedestrian crossing sight distance as per the table on page 11. Roadway design geometry, landscaping, monument signing and other features should be checked relative to the sight triangles at intersection corners to ensure that pedestrian crossing sight distance is provided.

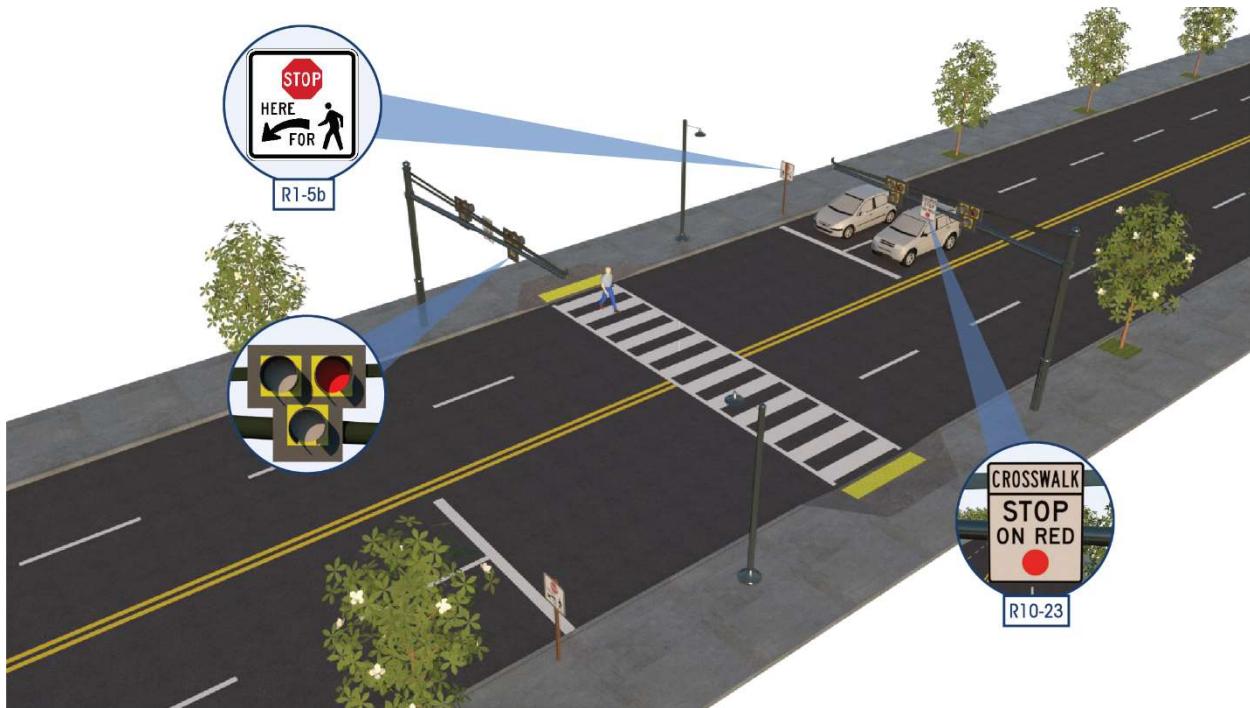
Two pedestrian ramps should generally be provided on each corner of every intersection within and adjacent to a development for the reasons outlined on pages 18-20. Pedestrian ramps should also generally be provided across each leg of T-intersections and not only where there are actual "corners." Otherwise, a series of staggered T-intersections along a collector or arterial roadway can present a wheelchair-bound pedestrian or user of a bicycle or stroller without accessible options for crossing the collector or arterial. Where exceptions are needed due to sight distance, vehicular queuing or other factors, pedestrian crossings should be expressly prohibited with "No Pedestrians" regulatory signs, by omitting pedestrian ramps crossing the leg of the intersection in question, and by including landscaping or other specially-designed barriers that can be detected by vision-impaired pedestrians.

Pedestrian connectivity to adjacent developable land should be preserved during site planning even where street connectivity is not provided. An example would be sidewalk connections through fences at the end of cul-de-sacs at the edges of residential developments. In particular, such pedestrian cut-throughs should be provided adjacent to schools to minimize the distances students need to walk or bike to school and remove student pedestrian travel as much as possible from along arterial and collector roadways. Furthermore, students should not have to access a school campus via a driveway shared with vehicles, and the crossing of active school driveways should be discouraged or eliminated if possible.

## Appendix

### Pedestrian Hybrid Beacons

A pedestrian hybrid beacon (PHB), often referred to as (HAWK) is a pedestrian crossing treatment that was introduced in the 2009 edition of the *Manual on Uniform Traffic Control Devices* (MUTCD). The following graphics illustrate a typical PHB and its operation.<sup>41</sup>



According to the Federal Highway Administration, PHB's "can warn and control traffic at unsignalized locations and assist pedestrians in crossing a street or highway at a marked crosswalk. A PHB should be installed in conjunction with the following:

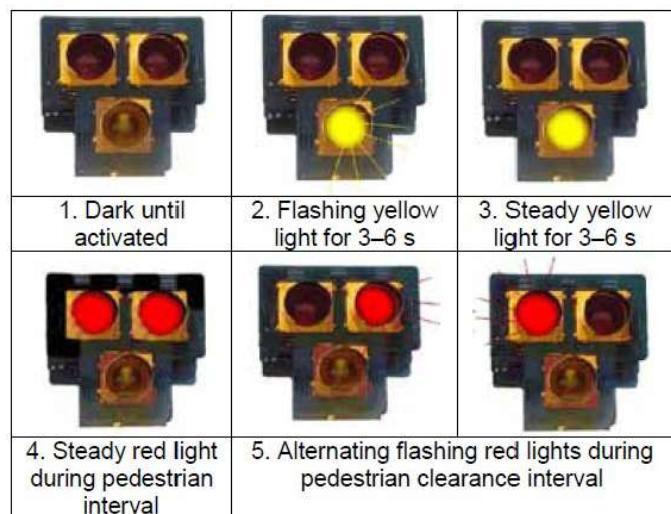
- Overhead beacons with three sections (circular yellow signal indication centered below two horizontally aligned circular red signals) facing both directions on the major street.
- Overhead signs labeled "CROSSWALK STOP ON RED" to indicate that the location is associated with a pedestrian crosswalk.
- A marked crosswalk on the major street.
- Countdown pedestrian signal heads to control pedestrian crossings at the crosswalk."
- Accessible pedestrian signal (APS) pushbuttons.

"Unlike a traffic signal, the PHB rests in dark until a pedestrian activates it via pushbutton or other form of detection. When activated, the beacon displays a sequence of flashing and solid lights that indicate the pedestrian walk interval and when it is safe for drivers to proceed. A solid red light requires drivers to stop while pedestrians have the right-of-way to cross the street. The overhead beacon flashes red when the pedestrian signals display a flashing DONT WALK indication. Drivers may proceed if the crosswalk is clear."

<sup>41</sup> Sources for narrative and graphics: Federal Highway Administration, [pedbikesafe.org](http://pedbikesafe.org/pedsafe/countermeasures_detail.cfm?CM_NUM=53) ([http://www.pedbikesafe.org/pedsafe/countermeasures\\_detail.cfm?CM\\_NUM=53](http://www.pedbikesafe.org/pedsafe/countermeasures_detail.cfm?CM_NUM=53))

"The PHB is often considered for installation at locations where pedestrians need to cross and vehicle speeds or volumes are high, but traffic signal warrants are not met. These devices have been successfully used at school crossings, parks, senior centers, and other pedestrian crossings on multilane streets. PHBs are typically installed at the side of the road or on mast arms over midblock pedestrian crossings."

The FHWA recommends the following be considered in conjunction with PHB installation:



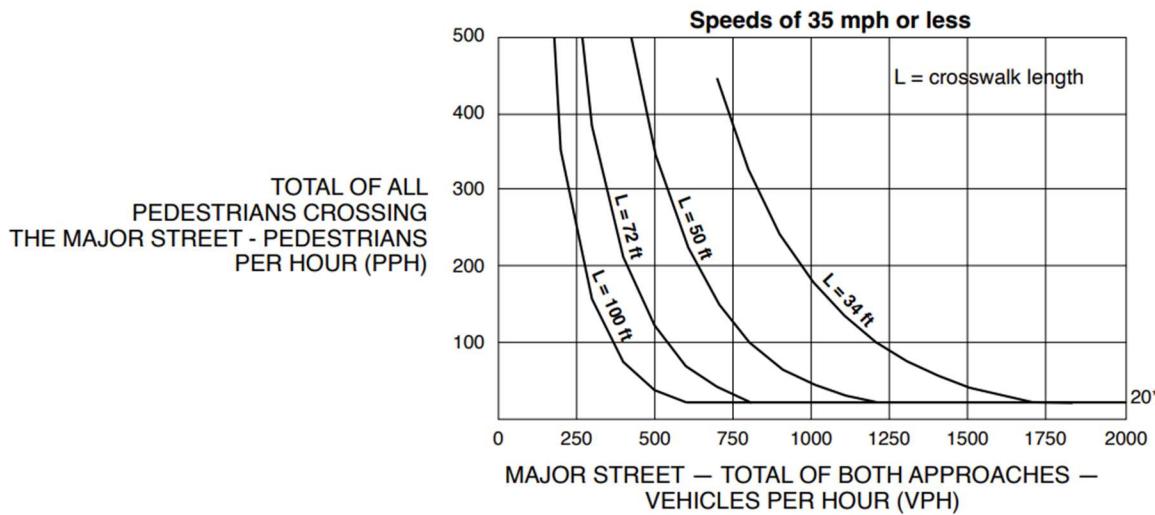
- "PHBs are a candidate treatment for roads with three or more lanes that generally have annual average daily traffic (AADT) above 9,000."
- Strongly consider a PHB for all midblock and intersection crossings where the roadway speed limits are equal to or greater than 40 miles per hour.
- The MUTCD provides guidance on the pedestrian volume warrants, design features, and restrictions associated with the PHB.
- Can be used at both intersections and midblock locations.
- Works well to counteract multiple threat crashes."

Signal Interval	Vehicle Signal	Pedestrian Signal	Signal Interval	Vehicle Signal	Pedestrian Signal
1			4		
2			5		
3			6		

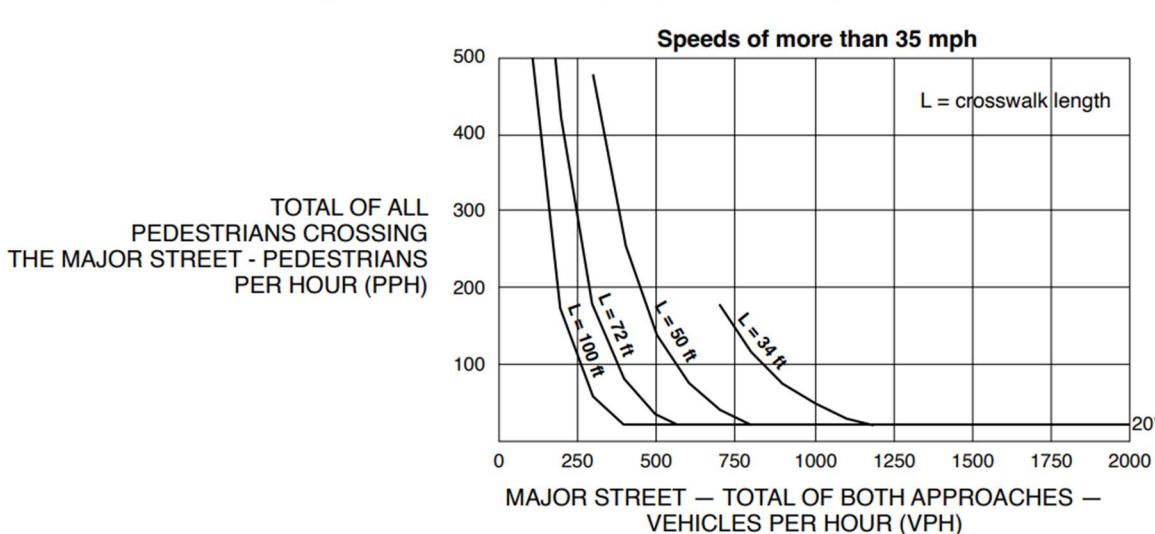
The MUTCD (Section 4F) provides guidance on the installation of PHBs based on hourly pedestrian crossings, vehicle volume, crossing distance, and vehicle speeds. The MUTCD provides two nomographs that were established based on vehicle speeds of 35 mph or less and for speeds greater than 35 mph. The recommended minimum number of pedestrian crossings to justify the installation of a PHB are lower for the higher speed conditions. A minimum volume of 20 pedestrian crossings per hour is recommended to justify the installation of a PHB using both nomographs under the highest pedestrian and vehicle volume and longest crossing conditions. Where current conditions inhibit pedestrian crossings, latent pedestrian demand estimates may be considered.

The following nomographs reproduced from the MUTCD provide guidance on the pedestrian and vehicular volumes required to consider PHB installation for different traffic speeds and crosswalk lengths. Refer to the MUTCD for full details.

**Figure 4J-1. Guidelines for the Installation of Pedestrian Hybrid Beacons on Low-Speed Roadways**



**Figure 4J-2. Guidelines for the Installation of Pedestrian Hybrid Beacons on High-Speed Roadways**



### Channelized Right Turn Lanes

Channelized right turn lanes are often provided to accommodate the swept paths for large trucks to turn right while providing a pedestrian refuge area adjacent to the through lanes where pedestrians cross. This shortens the crossing distance for pedestrians, but typically leaves the crossing of the right turn lane uncontrolled where turning vehicles (passenger cars or trucks) may move at relatively high speeds if not designed specifically to optimize pedestrian safety.

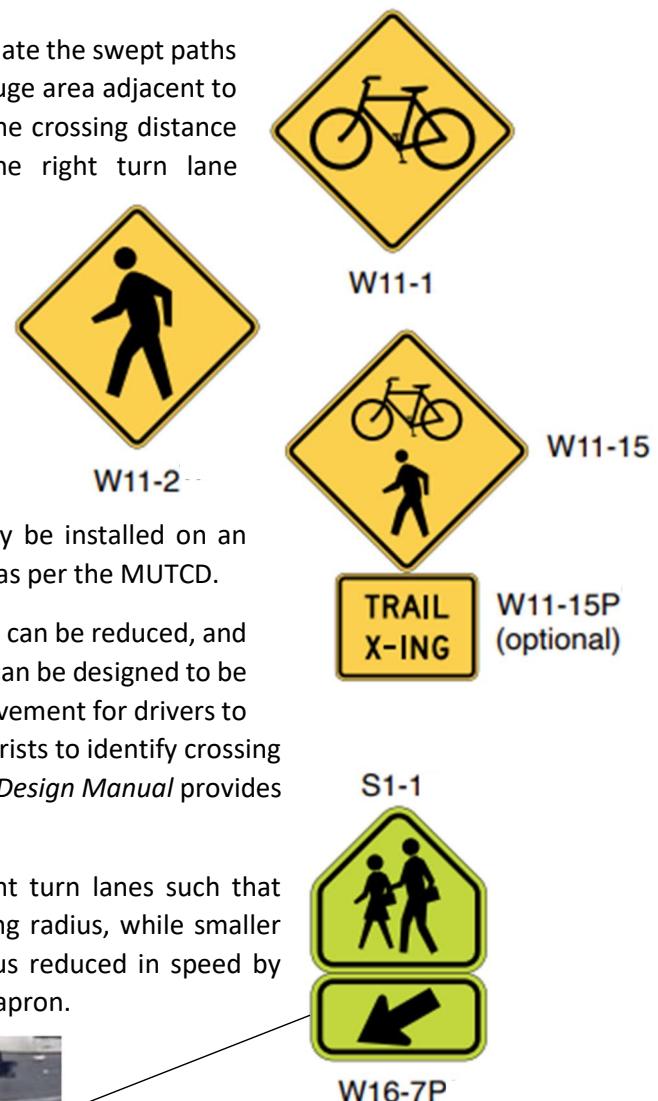
Crosswalks across channelized right turn lanes should be marked with high visibility crosswalks. At signalized or stop-controlled intersections where yield control is in effect, crosswalks should be located at least 20 feet in advance of the yield point so that bicycle, pedestrian, or school warning signs (W11-1, W11-2, W11-15, or S1-1) may be installed on an approach to the channelized right turn lane at the crosswalk as per the MUTCD.

For improved pedestrian safety at such locations, corner radii can be reduced, and the angle of entry between the slip lane and the cross street can be designed to be about 70 degrees to slow motorists, reduce head-turning movement for drivers to look for gaps in oncoming traffic, and make it easier for motorists to identify crossing pedestrians. Appendix D of TxDOT's updated 2022 *Roadway Design Manual* provides design information and details for such treatments.

Other jurisdictions have implemented truck aprons for right turn lanes such that trucks moving at slow speeds have a longer effective turning radius, while smaller vehicles are constrained to a tighter turning radius and thus reduced in speed by avoiding the discomfort associated with driving on the truck apron.



Sources: FHWA, Google Earth;  
Location: Bend, Oregon



## Pedestrian Signals

Following is additional information about MUTCD traffic signal Warrants 4 and 5 for pedestrians and schoolchildren, which are mentioned in the Step 3 matrix. The full MUTCD Chapter 4C should be consulted for additional standards, support, and guidance. (Note below that the edits in red correcting Figures 4C-7 and 4C-8 to reference 35 mph speeds instead of 40 mph speeds are based on known errors<sup>42</sup> that the MUTCD team intends to correct in a future rulemaking action.)

### Section 4C.05 Warrant 4, Pedestrian Volume

#### Support:

01 The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

#### Guidance:

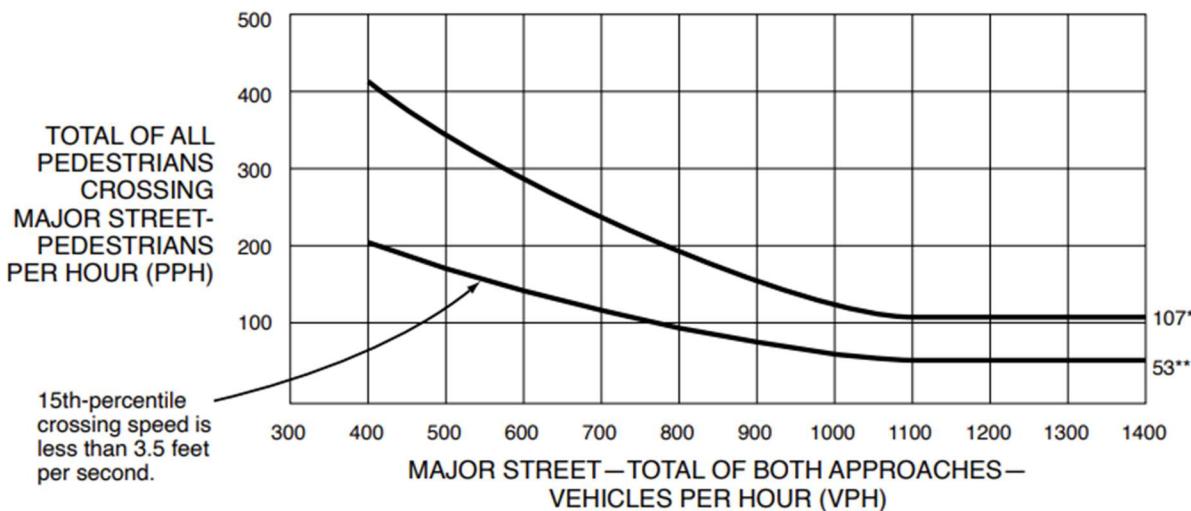
02 *The need for a traffic control signal at an intersection or midblock crossing should be considered if an engineering study finds that one of the following criteria is met:*

- A. *For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or*
- B. *For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-6.*

#### Option:

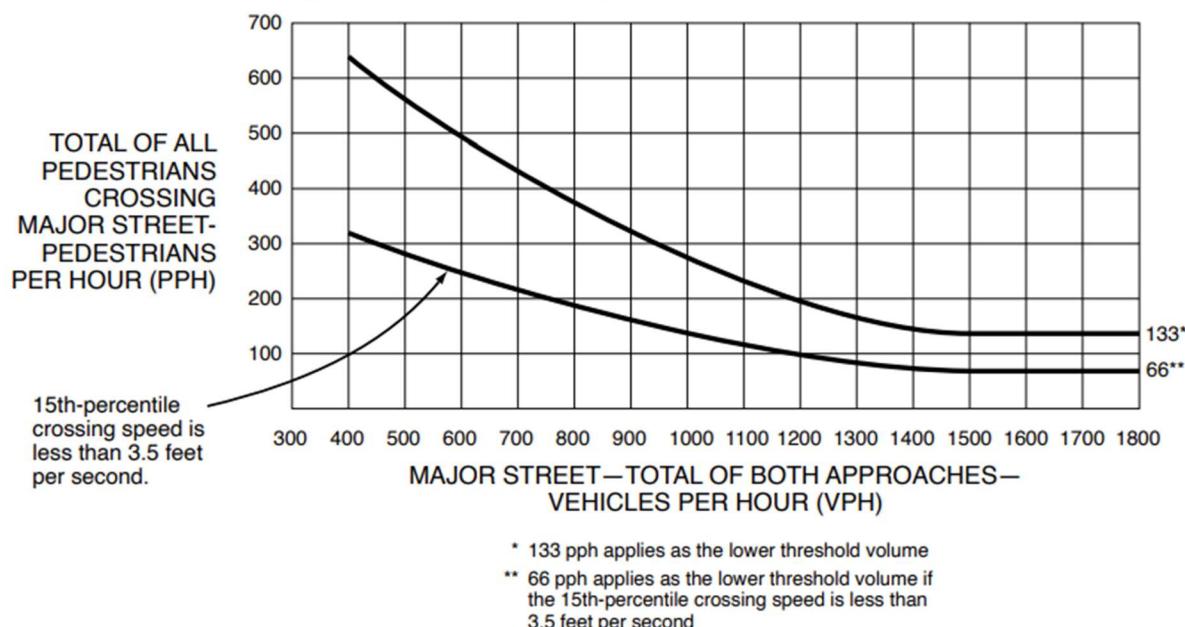
03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 35 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-7 may be used in place of Figure 4C-5 to evaluate Item A in Paragraph 2 of this Section, and Figure 4C-8 may be used in place of Figure 4C-6 to evaluate Item B in Paragraph 2 of this Section.

**Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume**



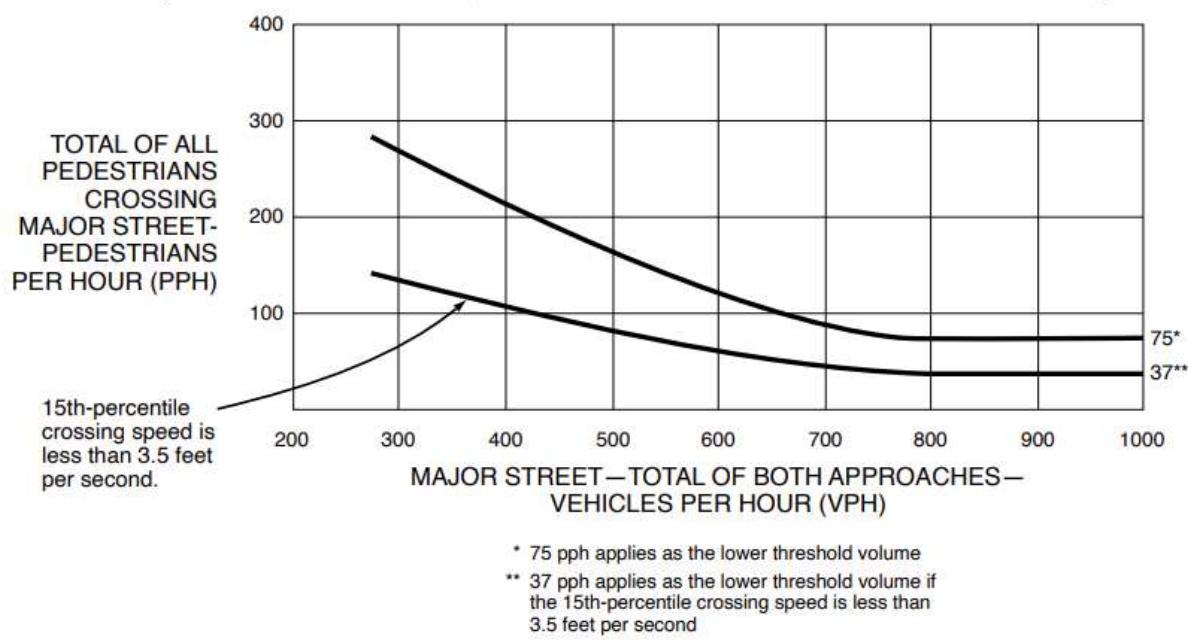
<sup>42</sup> [MUTCD 11th Edition Known Errors As of December 20, 2023 - FHWA - MUTCD \(dot.gov\)](https://mutcd.fhwa.dot.gov/htm/11th/errors.htm)  
(<https://mutcd.fhwa.dot.gov/htm/11th/errors.htm>)

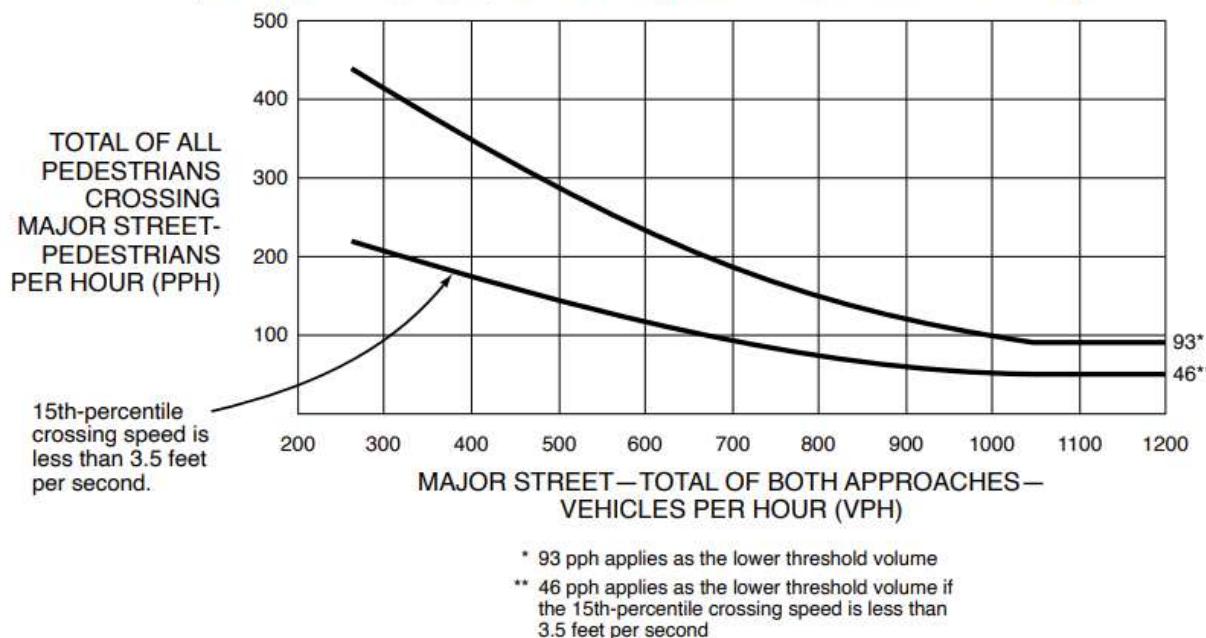
**Figure 4C-6. Warrant 4, Pedestrian Peak Hour**



**Figure 4C-7. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)**

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE ~~35~~ <sup>35</sup> MPH ON MAJOR STREET)



**Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)**(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE ~~40~~<sup>35</sup> MPH ON MAJOR STREET)

04 Where there is a divided street having a median of sufficient width for pedestrians to wait, the criteria in Items A and B of Paragraph 2 of this Section may be applied separately to each direction of vehicular traffic.

**Guidance:**

05 *The Pedestrian Volume warrant should not be applied at locations where the distance to the nearest traffic control signal or STOP sign controlling the street that pedestrians desire to cross is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.*

**Standard:**

06 **If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4I.**

**Guidance:**

07 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

- If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.*
- If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.*
- Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.*

**Option:**

08 The criterion for the pedestrian volume crossing the major street may be reduced as much as 50 percent if the 15th-percentile crossing speed of pedestrians is less than 3.5 feet per second (see Figures 4C-5 through 4C-8).

09 A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street.

## **Section 4C.06 Warrant 5, School Crossing**

### **Support:**

01 The School Crossing signal warrant is intended for application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word "schoolchildren" includes elementary through high school students.

### **Guidance:**

02 *The need for a traffic control signal should be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period and there are a minimum of 20 schoolchildren during the highest crossing hour.*

03 *Before a decision is made to install a traffic control signal, consideration should be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.*

04 *The School Crossing signal warrant should not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.*

### **Standard:**

05 **If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4I.**

### **Guidance:**

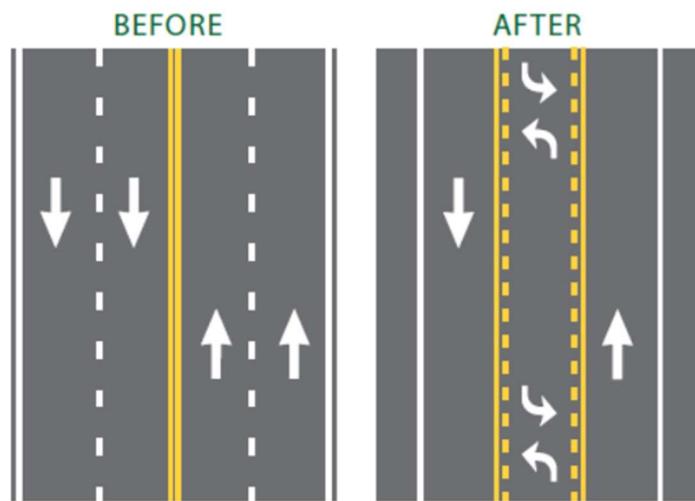
06 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

- A. *If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.*
- B. *If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.*
- C. *Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.*

## Lane Repurposing

The following is additional information about lane repurposing, which is mentioned in the Step 3 matrix.

Lane repurposing refers to reconfiguring the lanes of a roadway, usually to eliminate one or more lanes, to provide space for other uses of the pavement. Lane repurposing can provide space for building curb bump-outs, which shorten the crossing distance for pedestrians and in turn reduce exposure and/or allow for safer crossings where sight distance is limited. Other uses might include on-street parking, two-way left-turn lanes, shoulders, bicycle lanes, paved sidewalk, and/or raised landscaped medians. A typical lane repurposing change involves converting a four-lane undivided roadway to a three-lane road with one lane and a bike lane in each direction separated by a center two-way-left-turn lane, as shown below. There are many other possible configurations of lane repurposing projects.



*Image source: FHWA*

Among the many benefits of lane repurposing changes is a considerable increase in pedestrian crossing comfort and safety. A four-lane undivided road is more difficult to cross because a pedestrian must find gaps in all four travel lanes simultaneously, looking in both directions. A three-lane road (especially one with a raised median, pedestrian crossing island and/or curb extensions) is much easier to cross because a pedestrian must only find a gap in one lane at a time, waiting in the refuge area if necessary, before completing their crossing.

Painted left turn lanes such as the one shown above provide a smaller improvement in comfort and safety since they do less to discourage aggressive drivers from using them for passing or other erratic maneuvers. Furthermore, they do not provide the detectable warning surfaces necessary to enable two-stage crossing maneuvers for pedestrians with partially impaired vision.

Traffic engineering analysis is necessary to determine the feasibility of a lane repurposing change on a case-by-case basis. However, as a rule of thumb, the lane repurposing illustrated above is typically feasible when the amount of traffic using the roadway is below about 20,000 vehicles per day.<sup>43</sup>

If lane repurposing is feasible and planned to be implemented, the crossing should be reevaluated, starting from Step 1, to determine whether and how it should be marked after the change is in place.

<sup>43</sup> *Road Diet Informational Guide* (FHWA-SA-14-028), Federal Highway Administration, November 2014, p. 17.

### Sign Images

The following sign images are provided for reference. The sign codes correspond to those in the Step 3B table. Warning signs at uncontrolled crossings are permitted to use standard yellow, fluorescent yellow, or fluorescent yellow-green background color. Fluorescent yellow is recommended due to its higher conspicuity. School warning signs are required to use fluorescent yellow-green backgrounds, but other warning signs may use conventional yellow, fluorescent yellow or fluorescent yellow-green backgrounds. Both fluorescent colors are shown below where applicable.

W11-2



W16-7P



W16-9P



W11-15



S1-1



## Traffic Control Device Layouts

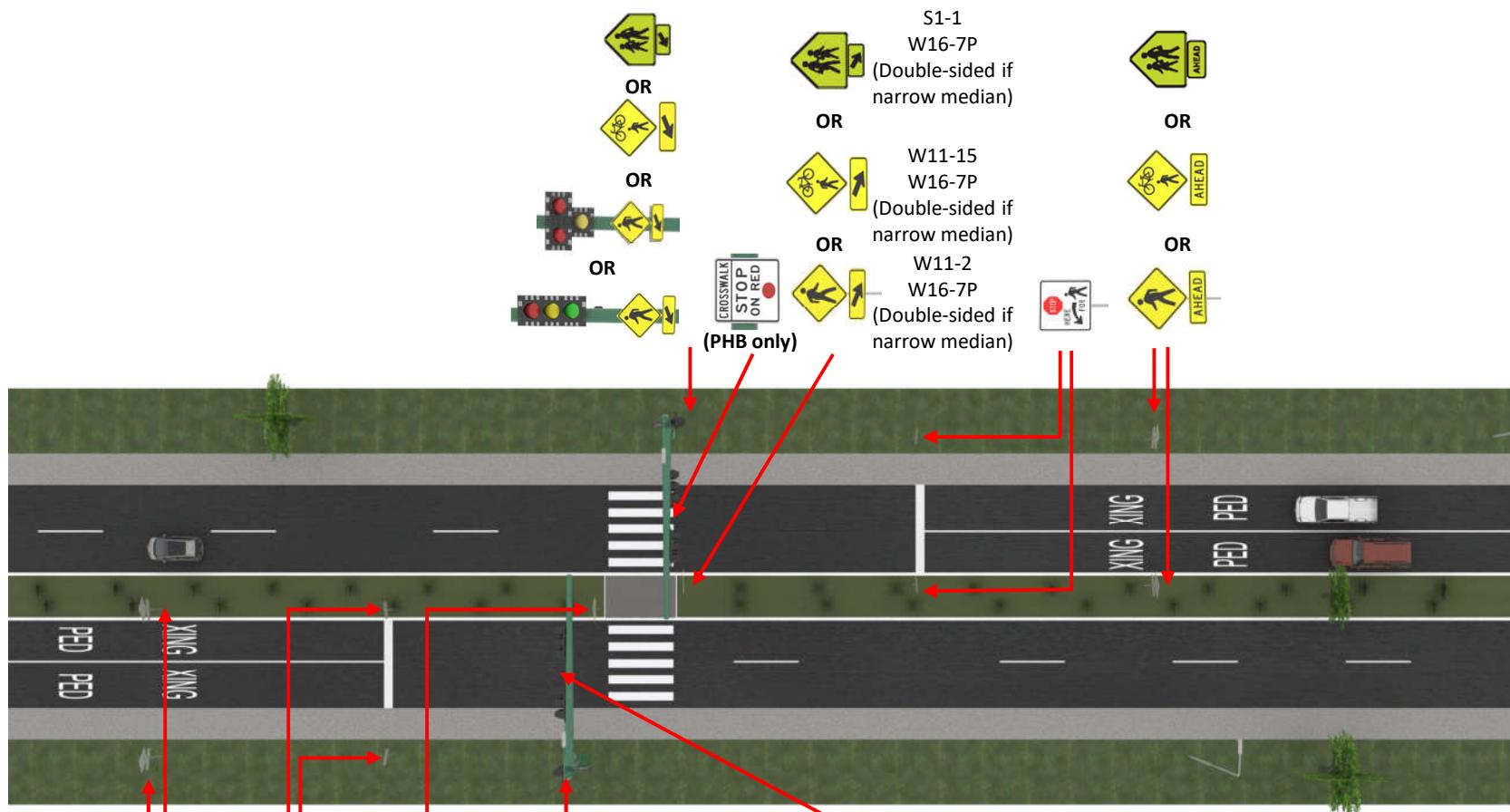
## Tier 1 Traffic Control Devices



### Notes:

- Pedestrian hybrid beacon is optional in lieu of signal (See Tier 2).
- W11-2 (or W11-15) and W16-9P advance warning signs, PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, optional.
- S1-1 sign (without W16-9P) is mandatory in advance of any reduced speed school zone (not shown – see MUTCD).
- Raised median or crossing island is optional.
- Minimum 2 beacon/signal faces required in each direction. For speeds > 35 mph, a minimum of 2 of the beacons/signal faces should be installed overhead.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

## Tier 1 Traffic Control Devices



W11-2  
W16-9P

R1-5b

OR

R10-23  
(PHB only)

W11-15  
W16-9P

OR

OR

S1-1  
W16-9P

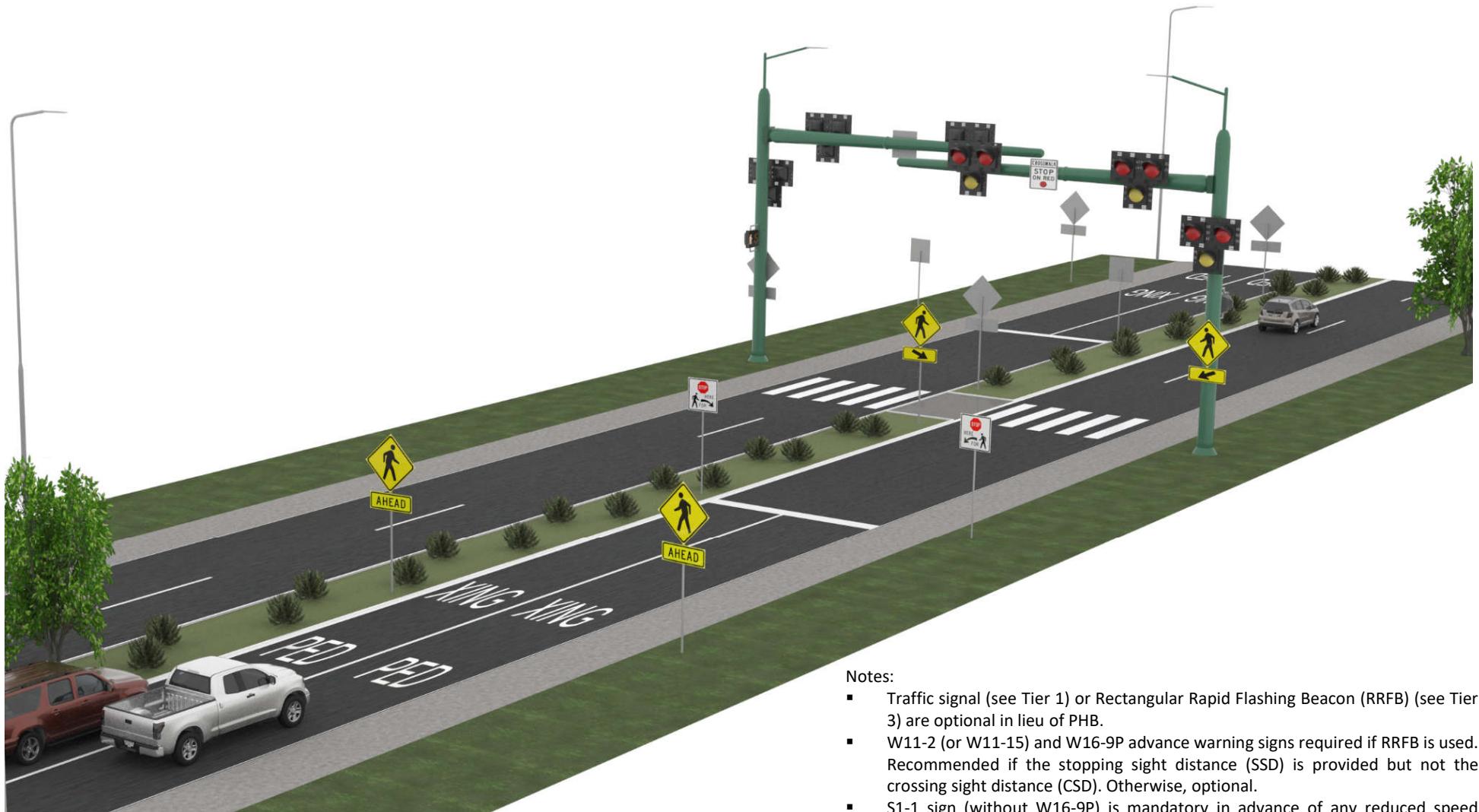
OR

OR

### Notes:

- Pedestrian hybrid beacon is optional in lieu of signal (See Tier 2).
- W11-2 (or W11-15) and W16-9P advance warning signs, PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, optional.
- S1-1 sign (without W16-9P) is mandatory in advance of any reduced speed school zone (not shown – see MUTCD).
- Raised median or crossing island is optional.
- Minimum 2 beacon/signal faces required in each direction. For speeds > 35 mph, a minimum of 2 of the beacons/signal faces should be installed overhead.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

## Tier 2 Traffic Control Devices

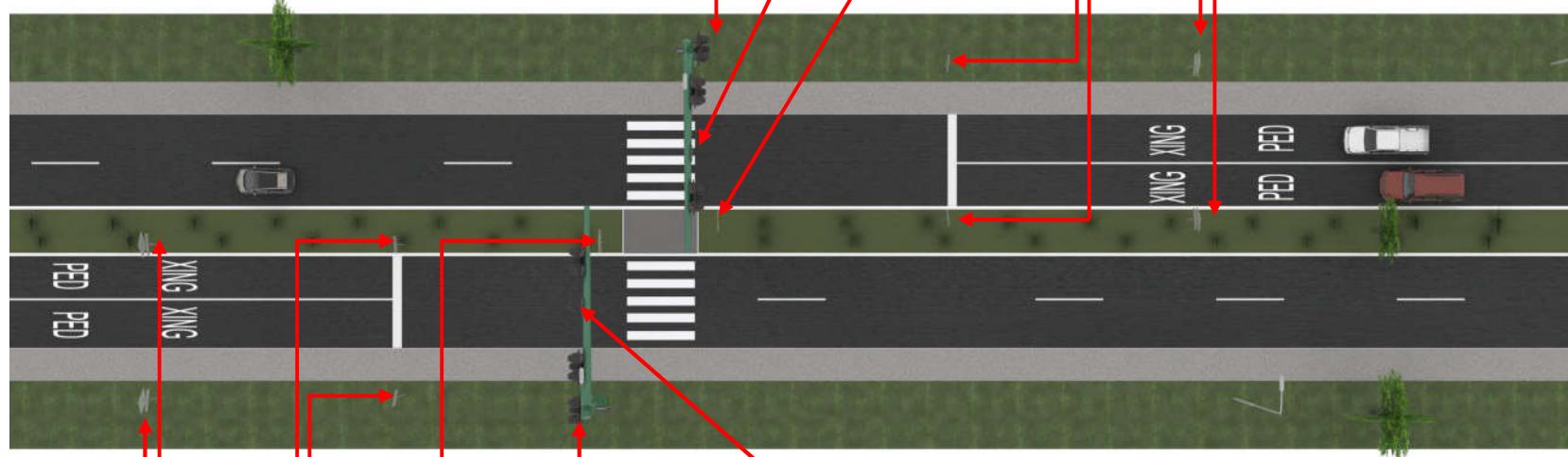
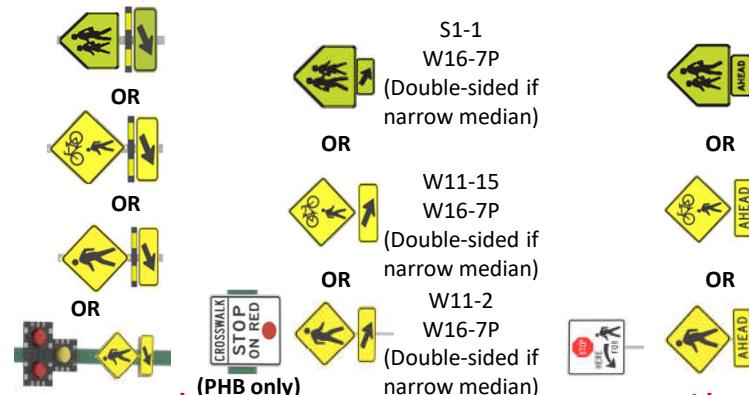


### Notes:

- Traffic signal (see Tier 1) or Rectangular Rapid Flashing Beacon (RRFB) (see Tier 3) are optional in lieu of PHB.
- W11-2 (or W11-15) and W16-9P advance warning signs required if RRFB is used. Recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, optional.
- S1-1 sign (without W16-9P) is mandatory in advance of any reduced speed school zone (not shown – see MUTCD).
- PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, optional.
- Raised median or crossing island is recommended if RRFB is used.
- Minimum 2 beacon/signal faces installed overhead for speeds > 35 mph.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

## Tier 2 Traffic Control Devices

(No RRFB beacons or any sign for PHB)



W11-2  
W16-9P

W11-15  
W16-9P

S1-1  
W16-9P

R1-5b

4

4

OR



W11-2

W16-7P

OR

(No RRFB beacons or  
any sign for PHB)

## Notes

Notes:

- Traffic signal (see Tier 1) or Rectangular Rapid Flashing Beacon (RRFB) (see Tier 3) are optional in lieu of PHB.
- W11-2 (or W11-15) and W16-9P advance warning signs required if RRFB is used. Recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, optional.
- S1-1 sign (without W16-9P) is mandatory in advance of any reduced speed school zone (not shown – see MUTCD).
- PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, optional.
- Raised median or crossing island is recommended if RRFB is used.
- Minimum 2 beacon/signal faces installed overhead for speeds > 35 mph.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

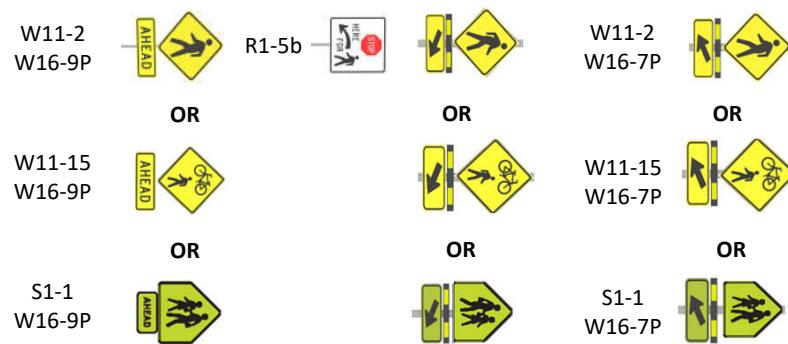
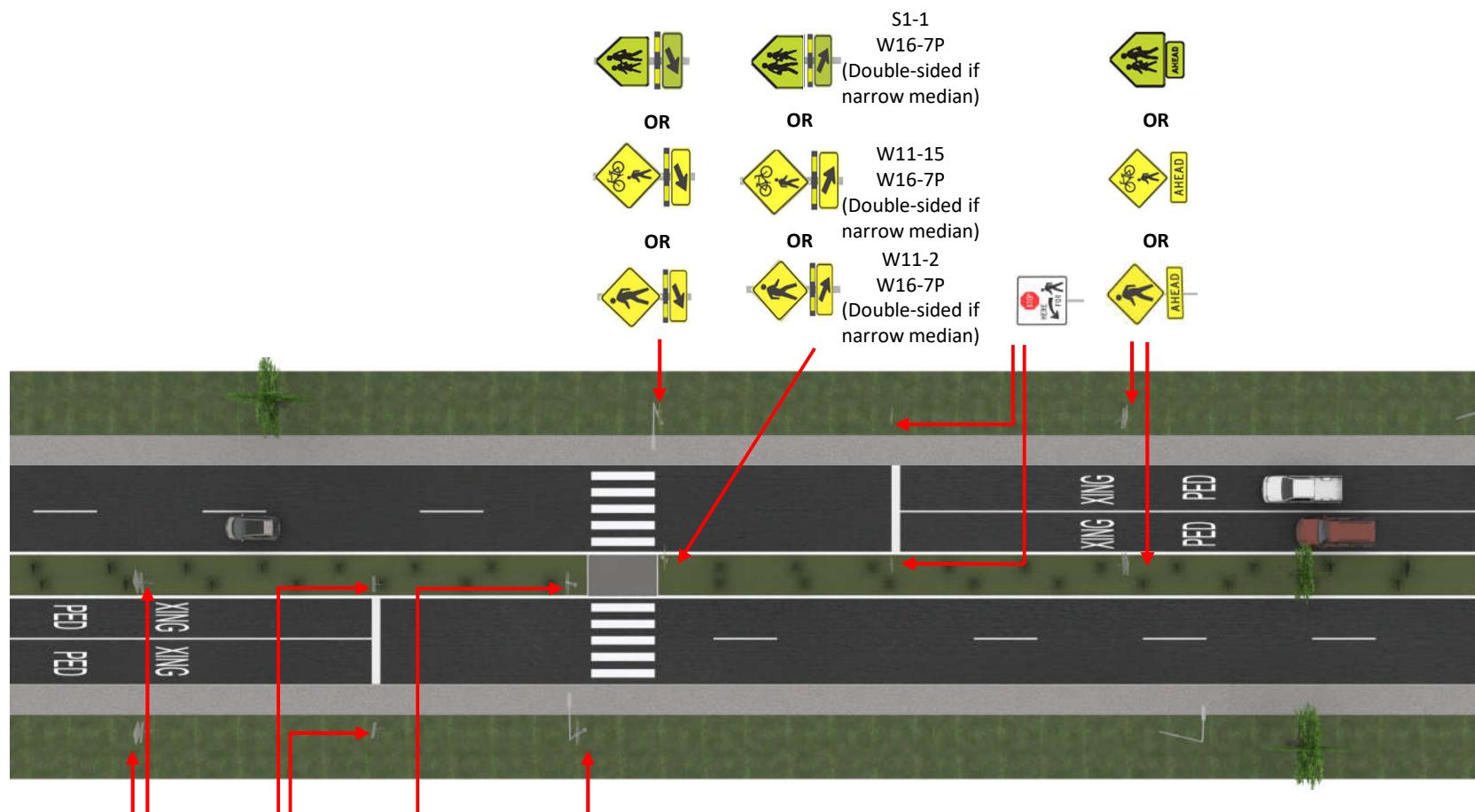
## Tier 3 Traffic Control Devices



### Notes:

- PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, optional.
- Raised median or crossing island is recommended if practicable for undivided roadways as well since left-hand signs are not optional. If median or island is not available, mount left-hand sign on left-hand side of roadway.
- Install stop lines and STOP HERE FOR PEDESTRIANS signs on multilane approaches. Omit for single-lane approaches.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

## Tier 3 Traffic Control Devices



### Notes:

- PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, optional.
- Raised median or crossing island is recommended if practicable for undivided roadways as well since left-hand signs are not optional. If median or island is not available, mount left-hand sign on left-hand side of roadway.
- Install stop lines and STOP HERE FOR PEDESTRIANS signs on multilane approaches. Omit for single-lane approaches.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

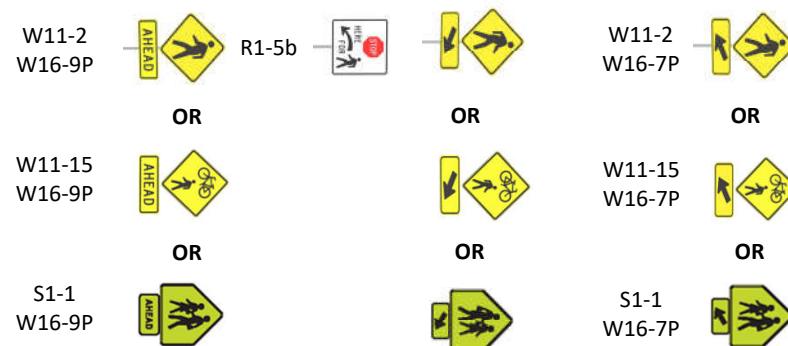
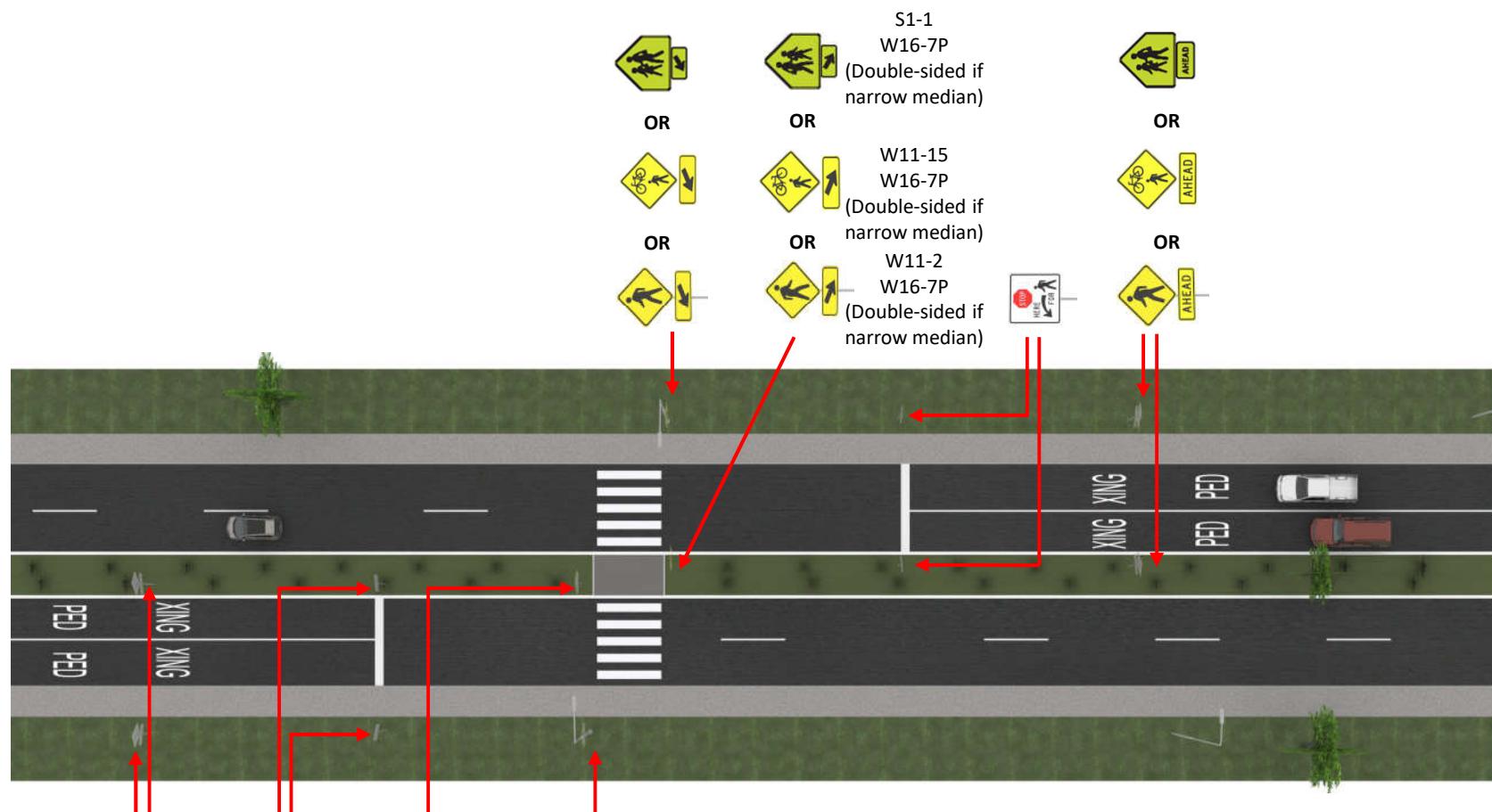
## Tier 4 Traffic Control Devices (4-lane)



### Notes:

- PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, omit.
- Raised median or crossing island is optional.
- Install stop lines and STOP HERE FOR PEDESTRIANS signs on multilane approaches. Omit for single-lane approaches.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

## Tier 4 Traffic Control Devices (4-lane)



### Notes:

- PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, omit.
- Raised median or crossing island is optional.
- Install stop lines and STOP HERE FOR PEDESTRIANS signs on multilane approaches. Omit for single-lane approaches.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

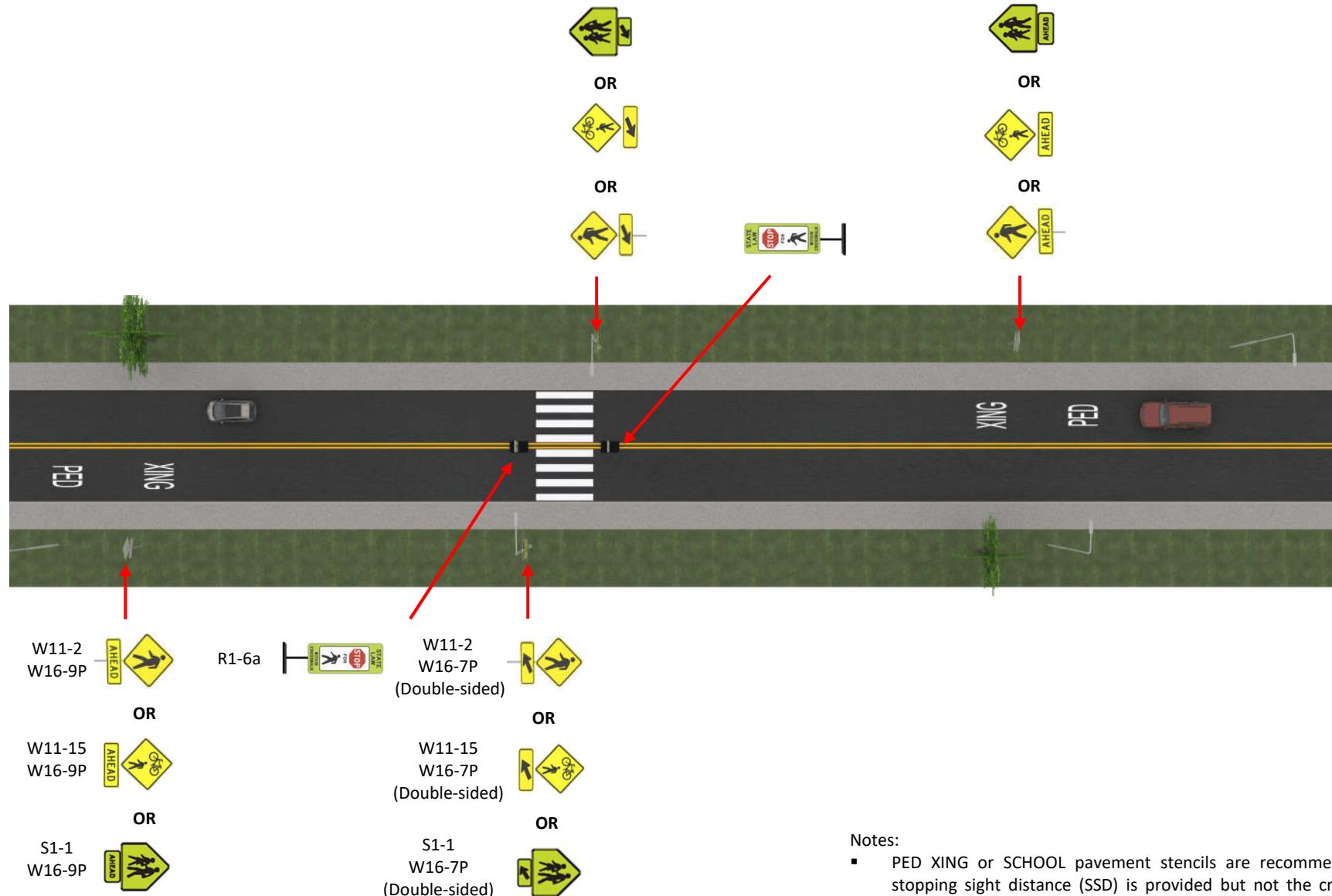
## Tier 4 Traffic Control Devices (2-lane)



### Notes:

- PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, omit.
- R1-6a in-street pedestrian crossing signs are optional for speeds 30 mph or less. Do not use for multi-lane or higher speeds.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

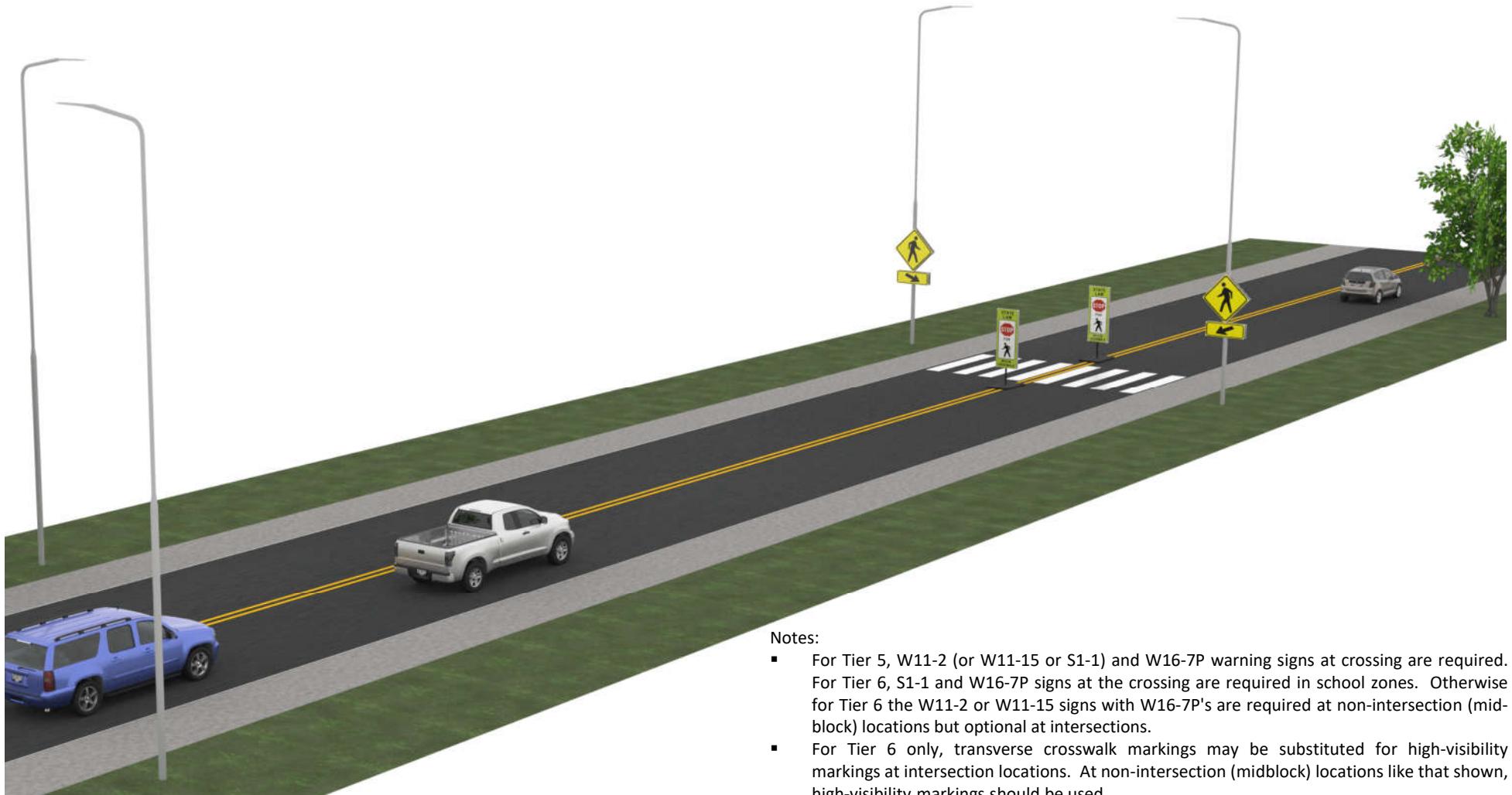
## Tier 4 Traffic Control Devices (2-lane)



### Notes:

- PED XING or SCHOOL pavement stencils are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, omit.
- R1-6a in-street pedestrian crossing signs are optional for speeds 30 mph or less. Do not use for multi-lane or higher speeds.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

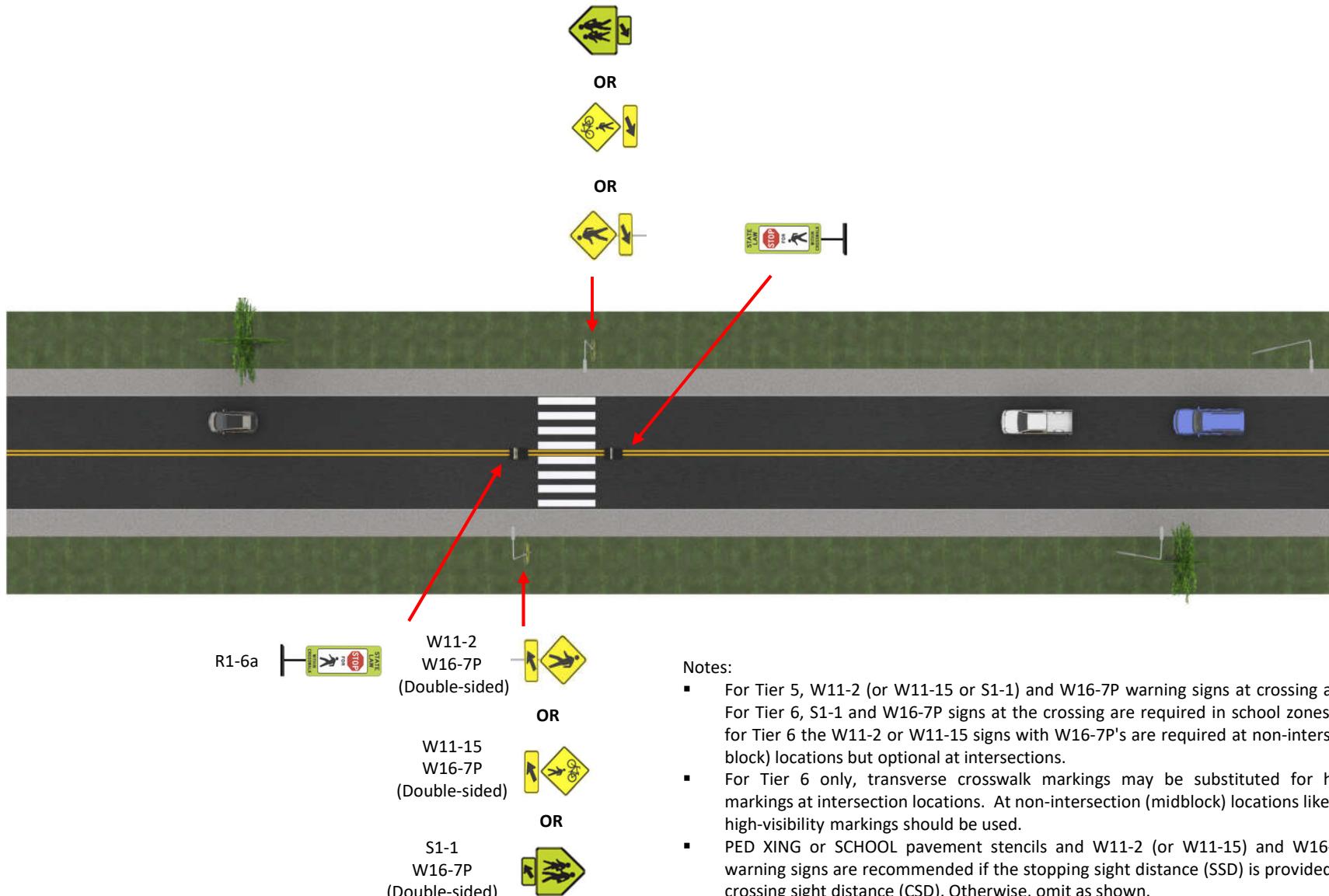
## Tier 5 & 6 Traffic Control Devices



### Notes:

- For Tier 5, W11-2 (or W11-15 or S1-1) and W16-7P warning signs at crossing are required. For Tier 6, S1-1 and W16-7P signs at the crossing are required in school zones. Otherwise for Tier 6 the W11-2 or W11-15 signs with W16-7P's are required at non-intersection (mid-block) locations but optional at intersections.
- For Tier 6 only, transverse crosswalk markings may be substituted for high-visibility markings at intersection locations. At non-intersection (midblock) locations like that shown, high-visibility markings should be used.
- PED XING or SCHOOL pavement stencils and W11-2 (or W11-15) and W16-9P advance warning signs are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, omit as shown.
- S1-1 sign (without W16-9P) is mandatory in advance of any reduced speed school zone (not shown - see MUTCD).
- R1-6a in-street pedestrian crossing signs are optional for speeds 30 mph or less. Do not use for multi-lane or higher speeds.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.

## Tier 5 & 6 Traffic Control Devices



### Notes:

- For Tier 5, W11-2 (or W11-15 or S1-1) and W16-7P warning signs at crossing are required. For Tier 6, S1-1 and W16-7P signs at the crossing are required in school zones. Otherwise for Tier 6 the W11-2 or W11-15 signs with W16-7P's are required at non-intersection (mid-block) locations but optional at intersections.
- For Tier 6 only, transverse crosswalk markings may be substituted for high-visibility markings at intersection locations. At non-intersection (midblock) locations like that shown, high-visibility markings should be used.
- PED XING or SCHOOL pavement stencils and W11-2 (or W11-15) and W16-9P advance warning signs are recommended if the stopping sight distance (SSD) is provided but not the crossing sight distance (CSD). Otherwise, omit as shown.
- S1-1 sign (without W16-9P) is mandatory in advance of any reduced speed school zone (not shown - see MUTCD).
- R1-6a in-street pedestrian crossing signs are optional for speeds 30 mph or less. Do not use for multi-lane or higher speeds.
- This diagram is for illustrative purposes only. Actual designs may vary based on site-specific conditions and engineering judgment. Consult MUTCD for additional requirements.