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# Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations



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<b>16. ABSTRACT</b> This field guide helps agencies select pedestrian crash countermeasures based on criteria established in published literature, best practices, and national guidance. This guide includes a form that the agency may use to document roadway characteristics and pedestrian safety issues. It also includes tables that relate these documented conditions to a specific set of countermeasure options. A series of descriptions lead the agency through additional installation considerations for each countermeasure.  The January 2018 version of this document was updated to include the Rectangular Rapid-Flashing Beacon (RRFB). FHWA issued a new Interim Approval (IA-21) for the optional use of RRFBs in March 2018.					
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# Introduction

This field guide helps agencies select pedestrian crash countermeasures based on criteria established in published literature, best practices, and national guidance. This guide includes a form that the agency may use to document roadway characteristics and pedestrian safety issues. It also includes tables that relate these documented conditions to a specific set of countermeasure options. A series of descriptions lead the agency through additional installation considerations for each countermeasure. Practitioners should reference additional resources issued through the FHWA Safe Transportation for Every Pedestrian (STEP) program that further describe these countermeasures. Resources include a series of “tech sheets” including additional illustrations, crash reduction factors, and general construction costs.

## Countermeasure Selection Tables

The information in this field guide relates to the information in the *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* (FHWA-SA-17-072). That guide describes a comprehensive decision-making process for the installation of pedestrian crossing countermeasures and leads the agency through the following steps in the process:

1. Collect Data and Engage the Public
2. Inventory Conditions and Prioritize Locations
3. Analyze Crash Types and Safety Issues
4. Select Countermeasure(s)
5. Consult Design and Installation Resources
6. Identify Opportunities and Monitor Outcomes

This field guide expands upon the fourth step, *Select Countermeasures*, for agencies who have an established process for identifying priority locations for countermeasure installation. This step presents two tables for the agency to review to identify potential countermeasures. Table 1, “Application of pedestrian crash countermeasures by roadway feature,” compares roadway and vehicle speed characteristics to appropriate options. Table 2, “Safety issues addressed per countermeasure,” compares crash types and other observed safety issues to the countermeasures. This field guide contains both tables and instructions for their use.

## Countermeasure Descriptions

The field guide focuses on uncontrolled crossing types—where sidewalks or designated walkways intersect a roadway at a location where no traffic control (i.e., traffic signal or STOP sign) is present. The countermeasures described in the guide include the following:

- » Crosswalk Visibility Enhancements, including:
  - High-visibility crosswalk markings
  - Parking restriction on crosswalk approach
  - Overhead lighting
  - Advance Yield Here To (Stop Here For) Pedestrians sign and stop or yield line
  - In-Street Pedestrian Crossing sign
  - Curb extension
- » Raised crosswalk
- » Pedestrian refuge island
- » Pedestrian Hybrid Beacon (PHB)
- » Road Diet
- » Rectangular Rapid-Flashing Beacon (RRFB)

The field guide includes a description for each of the countermeasures. The descriptions present additional design and installation considerations, such as references to the *Manual on Uniform Traffic Control Devices* (MUTCD).

# Sample Inventory Form

On this example inventory form, the agency records information about roadway conditions and safety issues important to selecting countermeasures for uncontrolled crossing locations. The information added to this form is applied in Tables 1 and 2. Some information, such as pedestrian volume data, is used when reviewing MUTCD guidance for countermeasures such as the PHB.

## Roadway Conditions Inventory

### Speed Limit

≤ 30 mph     35 mph     ≥ 40 mph

### Total Vehicles per Day

Annual Average Daily Traffic (AADT): \_\_\_\_\_

Approximate Vehicles per Hour (VPH): \_\_\_\_\_

- AADT < 9,000
- AADT 9,000–15,000
- AADT > 15,000

### Travel Lane Configuration

- 2 lanes without raised median
- 3 lanes without raised median
- 3 lanes with raised median
- 4+ lanes without raised median
- 4+ lanes with raised median

Crosswalk Length (feet): \_\_\_\_\_

Approximate Total Pedestrians per Hour (PPH) Crossing the Roadway: \_\_\_\_\_

## Pedestrian Safety Issues Inventory

### Noted conflicts at crossing locations Yes   No

- » History of turning movement crashes
- » Observed conflicts at permitted crossings

### Excessive vehicle speed Yes   No

- » 85th percentile speeds, per speed study
- » History of speed-related crashes

### Inadequate conspicuity/visibility Yes   No

- » Dim or dark conditions for pedestrians in the crosswalk
- » Limited visibility of crosswalk due to roadway curvature or topography
- » Obstructions, such as on-street parking, vegetation, and signage

### Drivers not yielding to pedestrians in crosswalks Yes   No

- » Crash history in marked crosswalks

### Insufficient separation between pedestrians and traffic Yes   No

- » Long crossing distance
- » No buffer (e.g., landscape buffer, on-street parking, bike lanes)

# Table 1 Instructions

Table 1 provides initial countermeasure options for various roadway conditions. Each matrix cell indicates possibilities that may be appropriate for designated pedestrian crossings. Not all of the countermeasures listed in the matrix cell should necessarily be installed at a crossing.

For multi-lane roadway crossings with vehicle AADTs exceeding 10,000, a marked crosswalk alone is typically insufficient (Zegeer, 2005). Under such conditions, more substantial crossing improvements (such as the refuge island, PHB, and RRFB) are also needed to prevent an increase in pedestrian crash potential.

**1** Select the column that represents the target location's speed limit and vehicle AADT.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
<b>2 lanes</b> (2 lanes in each direction)	① 2	①	①	①	①	①	①	①	①
<b>2 lanes with raised median</b> (2 lanes in each direction)	① 2 3	① ③	① ③	① 3	① ③	① ③	① ③	① ③	① ③
<b>2 lanes w/o raised median</b> (2 lanes in each direction with a right-turn lane)	① 2 3	① ③	① ③	① 3	① ③	① ③	① ③	① ③	① ③
<b>4+ lanes with raised median</b> (2 or more lanes in each direction)	① ③	① ③	① ③	① ③	① ③	① ③	① ③	① ③	① ③
<b>4+ lanes w/o raised median</b> (2 or more lanes in each direction)	① ③	① ③	① ③	① ③	① ③	① ③	① ③	① ③	① ③

**2** Select the row that represents the target location's roadway configuration.

**3** The cell at the intersection of the column from step 1 and the row from step 2 contains numbers representing countermeasures.

Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.\*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

- 1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
- 2 Raised crosswalk
- 3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
- 4 In-Street Pedestrian Crossing sign
- 5 Curb extension
- 6 Pedestrian refuge island
- 7 Rectangular Rapid-Flashing Beacon (RRFB)\*\*
- 8 Road Diet
- 9 Pedestrian Hybrid Beacon (PHB)\*\*

**4** Refer to the table legend for a list of countermeasures. Numbers in a cell indicate candidate countermeasures for the specified conditions. Numbers in dark circles represent treatments that should be always be considered for those conditions. Hollow circles indicate that, for the specified conditions, crosswalk visibility enhancements should be supplemented by other countermeasures.

# Table 1: Application of Pedestrian Crash Countermeasures by Roadway Feature

Table 1 identifies suggested countermeasures for uncontrolled crossing locations according to roadway and traffic features. Review the corresponding worksheets for countermeasures considered for the site. The worksheets describe additional design and installation considerations for the countermeasures.

Table 1. Application of pedestrian crash countermeasures by roadway feature.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
<b>2 lanes</b> (1 lane in each direction)	① 2 4 5 6	① 5 6 7 9	① 5 6 ⑦ ⑨	① 4 5 6	① 5 6 7 9	① 5 6 ⑦ ⑨	① 4 5 6	① 5 6 7 9	① 5 6 ⑨
<b>3 lanes with raised median</b> (1 lane in each direction)	① 2 3 4 5	① ③ 5 7 9	① ③ 5 ⑦ ⑨	① 3 4 5 7 9	① ③ 5 ⑦ ⑨	① ③ 5 ⑦ ⑨	① ③ 4 5 7 9	① ③ 5 ⑦ ⑨	① ③ 5 ⑨
<b>3 lanes w/o raised median</b> (1 lane in each direction with a two-way left-turn lane)	① 2 3 4 5 6 7 9	① ③ 5 6 7 9	① ③ 5 6 ⑨	① 3 4 5 6 7 9	① ③ 5 6 ⑦ ⑨	① ③ 5 6 ⑨	① ③ 4 5 6 7 9	① ③ 5 6 ⑨	① ③ 5 6 ⑨
<b>4+ lanes with raised median</b> (2 or more lanes in each direction)	① ③ 5 7 8 9	① ③ 5 7 8 9	① ③ 5 8 ⑨	① ③ 5 7 8 9	① ③ 5 ⑦ 8 ⑨	① ③ 5 8 ⑨	① ③ 5 ⑦ 8 ⑨	① ③ 5 8 ⑨	① ③ 5 8 ⑨
<b>4+ lanes w/o raised median</b> (2 or more lanes in each direction)	① ③ 5 6 7 8 9	① ③ 5 ⑥ 7 8 9	① ③ 5 ⑥ 8 ⑨	① ③ 5 ⑥ 7 8 9	① ③ 5 ⑥ ⑦ 8 ⑨	① ③ 5 ⑥ 8 ⑨	① ③ 5 ⑥ ⑦ 8 ⑨	① ③ 5 ⑥ 8 ⑨	① ③ 5 ⑥ 8 ⑨

Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.\*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

- 1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
- 2 Raised crosswalk
- 3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
- 4 In-Street Pedestrian Crossing sign
- 5 Curb extension
- 6 Pedestrian refuge island
- 7 Rectangular Rapid-Flashing Beacon (RRFB)\*\*
- 8 Road Diet
- 9 Pedestrian Hybrid Beacon (PHB)\*\*

\*Refer to Chapter 4, 'Using Table 1 and Table 2 to Select Countermeasures,' for more information about using multiple countermeasures.

\*\*It should be noted that the PHB and RRFB are not both installed at the same crossing location.

This table was developed using information from: Zegeer, C.V., J.R. Stewart, H.H. Huang, P.A. Lagerwey, J. Feaganes, and B.J. Campbell. (2005). Safety effects of marked versus unmarked crosswalks at uncontrolled locations: Final report and recommended guidelines. FHWA, No. FHWA-HRT-04-100, Washington, D.C.; FHWA. Manual on Uniform Traffic Control Devices, 2009 Edition. (revised 2012). Chapter 4F, Pedestrian Hybrid Beacons. FHWA, Washington, D.C.; FHWA. Crash Modification Factors (CMF) Clearinghouse. <http://www.cmfclearinghouse.org/>; FHWA. Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE). <http://www.pedbikesafe.org/PEDSAFE/>; Zegeer, C., R. Srinivasan, B. Lan, D. Carter, S. Smith, C. Sundstrom, N.J. Thirsk, J. Zegeer, C. Lyon, E. Ferguson, and R. Van Houten. (2017). NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. Transportation Research Board, Washington, D.C.; Thomas, Thirsk, and Zegeer. (2016). NCHRP Synthesis 498: Application of Pedestrian Crossing Treatments for Streets and Highways. Transportation Research Board, Washington, D.C.; and personal interviews with selected pedestrian safety practitioners.

## Table 2 Instructions

1 Select the columns representing the priority safety issues at the location.

2 Use the rows to identify pedestrian crash countermeasures that address these safety issues at uncontrolled crossings.

Pedestrian Crash Countermeasure for Uncontrolled Crossings	Safety Issue Addressed				
	Conflicts at crossing locations	Excessive vehicle speed	Inadequate conspicuity/visibility	Drivers not yielding to pedestrians in crosswalks	Insufficient separation from traffic
<b>Crosswalk visibility enhancement</b>	🚶	🚶	🚶	🚶	🚶
High-visibility crosswalk markings*	🚶		🚶	🚶	
Parking restriction on crosswalk approach*	🚶		🚶	🚶	
Improved nighttime lighting*	🚶		🚶		
Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line*	🚶		🚶	🚶	🚶
<b>In-Street Pedestrian Crossing sign*</b>	🚶	🚶	🚶	🚶	
Curb extension*	🚶	🚶	🚶		🚶
<b>Raised crosswalk</b>	🚶	🚶	🚶	🚶	
Pedestrian refuge island	🚶	🚶	🚶		🚶
Pedestrian Hybrid Beacon	🚶	🚶	🚶	🚶	
Road Diet	🚶	🚶	🚶		🚶
Rectangular Rapid-Flashing Beacon	🚶		🚶	🚶	🚶

## Table 2: Safety Issues Addressed per Countermeasure

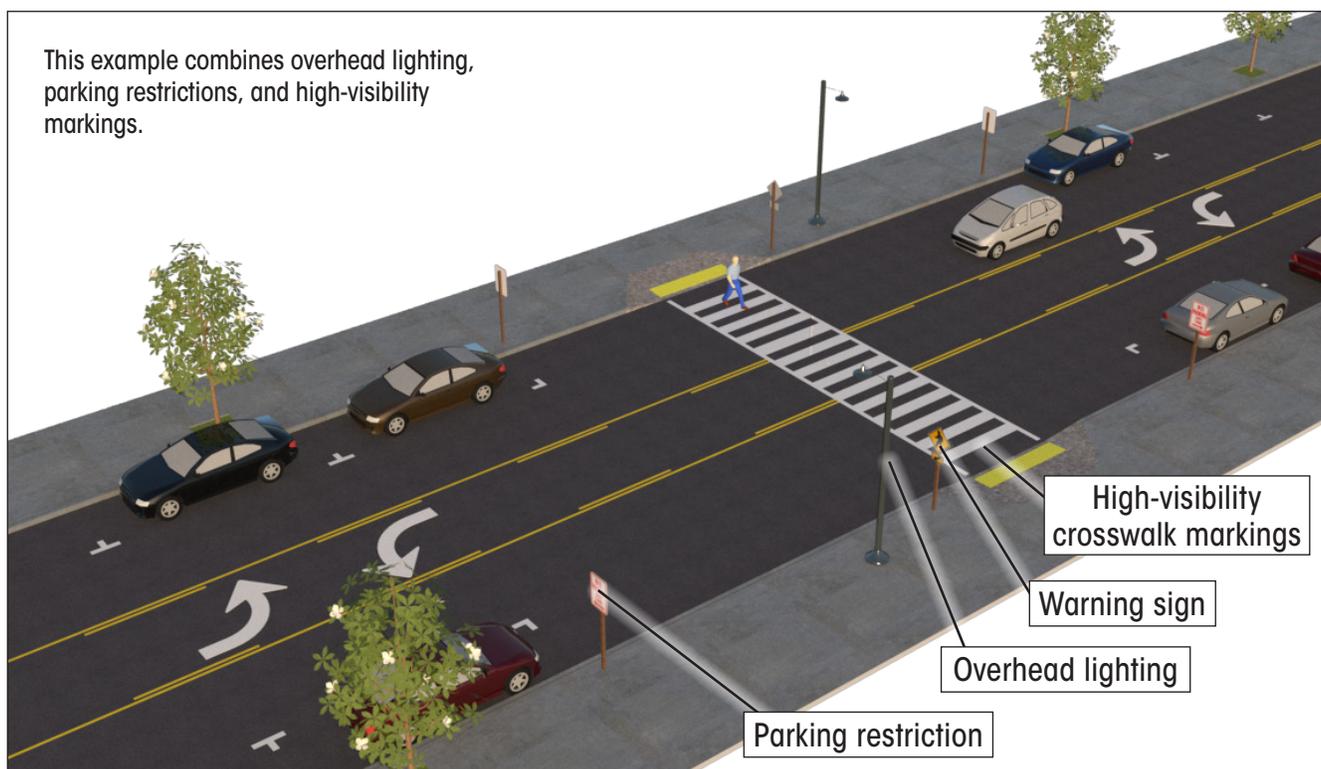
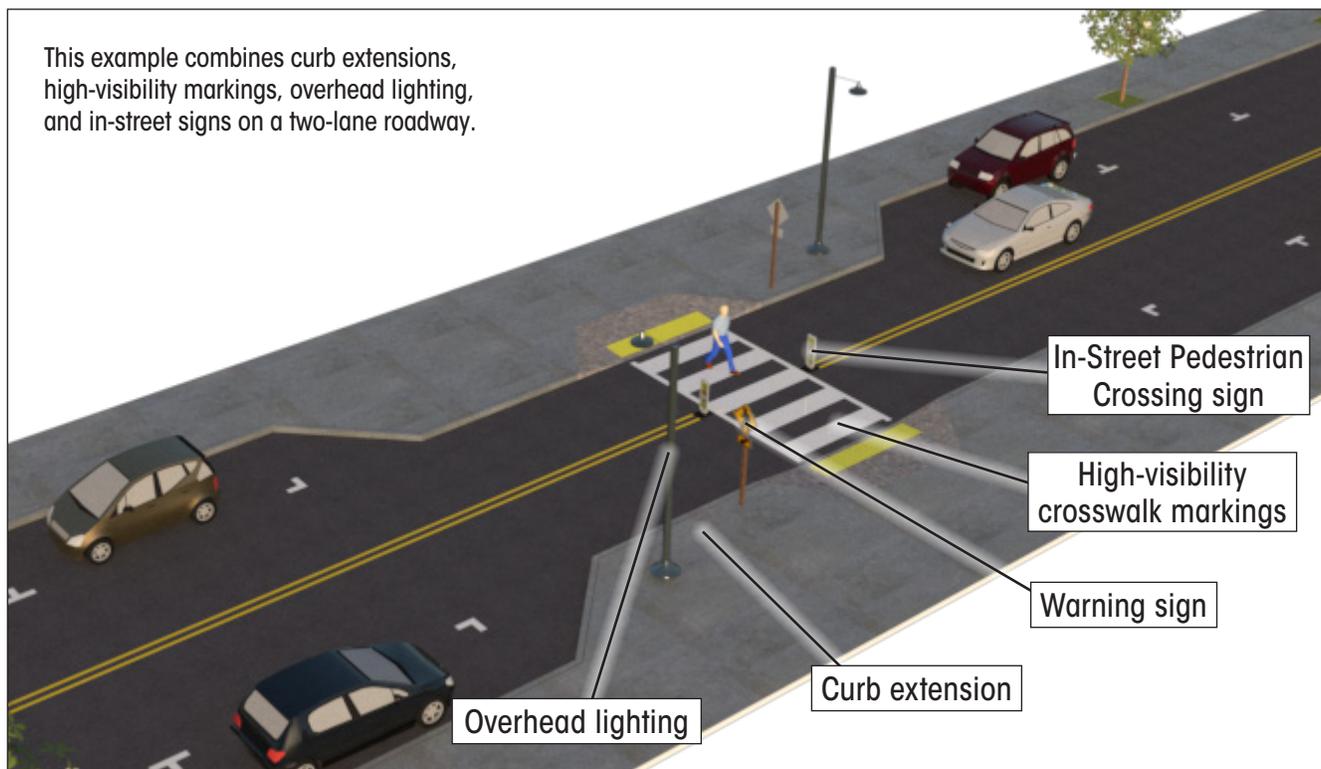
Table 2 identifies the safety issues that may be addressed by suggested countermeasures for uncontrolled crossing locations. Review the corresponding worksheets for countermeasures considered for the site. The worksheets describe additional design and installation considerations for the countermeasures.

Table 2. Safety issues addressed per countermeasure.

Pedestrian Crash Countermeasure for Uncontrolled Crossings	Safety Issue Addressed				
	Conflicts at crossing locations	Excessive vehicle speed	Inadequate conspicuity/visibility	Drivers not yielding to pedestrians in crosswalks	Insufficient separation from traffic
Crosswalk visibility enhancement					
High-visibility crosswalk markings*					
Parking restriction on crosswalk approach*					
Improved nighttime lighting*					
Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line*					
In-Street Pedestrian Crossing sign*					
Curb extension*					
Raised crosswalk					
Pedestrian refuge island					
Pedestrian Hybrid Beacon					
Road Diet					
Rectangular Rapid-Flashing Beacon					

\*These countermeasures make up the STEP countermeasure “crosswalk visibility enhancements.” Multiple countermeasures may be implemented at a location as part of crosswalk visibility enhancements.

## Countermeasure: Crosswalk Visibility Enhancements



## Definition

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This group of countermeasures includes high-visibility crosswalk markings, improved nighttime lighting, advance or in-street warning signage, curb extensions, and parking restrictions. These features may be used in combination to indicate preferred locations for people to cross, to increase visibility of the crossing location, and to help reinforce the driver requirement to yield the right-of-way to pedestrians at crossing locations. Refer to the Crosswalk Visibility Enhancements Tech Sheet for more information about this set of countermeasures.

## Roadway and Site Information

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*Strongly consider* the following countermeasures at all established midblock or intersection uncontrolled crossing locations:

- » High-visibility crosswalk markings
- » Overhead lighting
- » On-street parking restrictions or curb extensions

Note: On roadways with 4 or more lanes and more than 9,000 vehicles per day, the risk for pedestrian crashes could increase if marked crosswalks are not combined with other treatments, such as refuge islands or Pedestrian Hybrid Beacons.

*Strongly consider* adding advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line if the roadway(s) are described by one of the following sets of conditions:

- Any AADT + 4 or more lanes (with or without a raised median) + any speed limit
- Any AADT + any number of lanes +  $\geq 35$  mph speed limit

## Safety Issues and Behaviors

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This countermeasure may help address most traffic behaviors or safety issues but are most needed when the following are observed at the site:

- Drivers not yielding to pedestrians in crosswalks
- Inadequate conspicuity/visibility of the crosswalk and pedestrian
- Noted conflicts at crossing locations

## Additional Installation and Design Guidelines

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### Crosswalk Markings

- » High-visibility crosswalks may include a variety of crosswalk striping designs, such as ladder, continental, or bar pairs.
- » High-visibility markings may be supplemented with the pedestrian crossing warning signs (sign W11-2 in the MUTCD) on each approach to the crosswalk.
- » See MUTCD Section 2C.50 for more information about Non-Vehicular Warning Signs and Section 3B.18 for more information about crosswalk markings.
- » Adjacent bus stops should be placed downstream of the crosswalk and not on the crosswalk approach.

### **Overhead Lighting**

- » Overhead lights placed in advance of uncontrolled crossings on both approaches illuminate the front of the pedestrian and avoid creating a silhouette.
- » Consider placing the light fixtures 10 to 15 feet in advance of the crosswalk on both sides of the street.

### **Parking Restrictions and Curb Extensions**

- » Parking restrictions can include the removal of parking space markings or the installation of “no parking” signs or pavement markings.
- » The minimum setback for parking restrictions is 20 feet in advance of the crosswalk where speeds are 25 mph or less, and 30 feet in advance of the crosswalk where speeds are between 26 and 35 mph.
- » Curb extensions must not extend into travel lanes and should not block bicycle lanes.

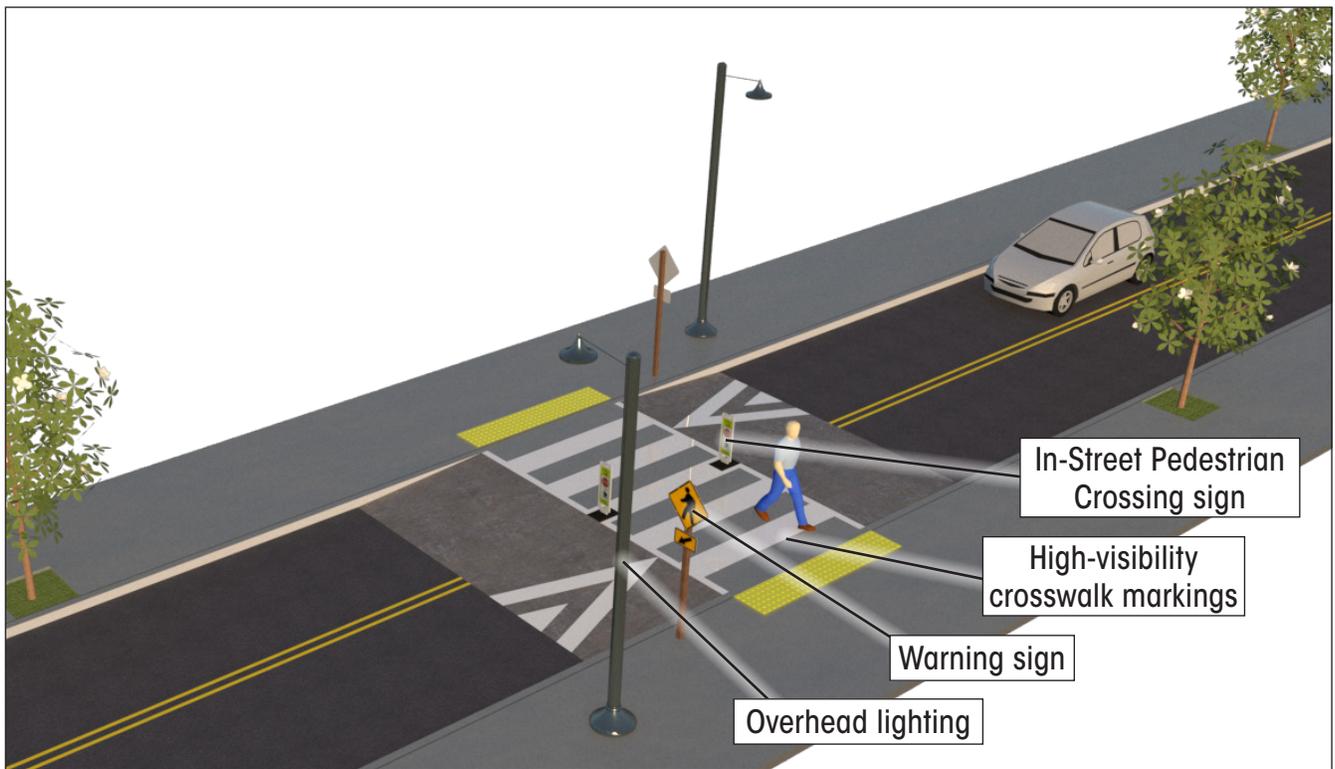
### **Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line**

- » The stop line or “shark’s teeth” yield line is placed 20 to 50 feet in advance of a marked crosswalk to indicate where vehicles are required to stop or yield in compliance with the accompanying Yield Here To (Stop Here For) Pedestrians sign.
- » Stop Here for Pedestrians signs should only be used where the law specifically requires that a driver must stop for a pedestrian in a crosswalk. Otherwise, Yield Here for Pedestrians signs should be used with shark’s teeth pavement markings.
- » See MUTCD Section 2B.11 for more information about Yield Here To (Stop Here For) Pedestrians signs and Section 3B.16 for more information about stop and yield lines.

### **In-Street Pedestrian Crossing Sign**

- » The In-Street Pedestrian Crossing sign can be placed in between travel lanes or in conjunction with a refuge island or raised median.
- » Consider maintenance and prompt replacement of damaged in-street (and all other) signs.
- » See MUTCD Section 2B.12 for more information about In-Street Pedestrian Crossing signs.

## Countermeasure: Raised Crosswalk



### Definition

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Raised crosswalks are ramped speed tables spanning the entire width of the roadway, often placed at midblock crossing locations. Refer to the Raised Crosswalks Tech Sheet for more information about this countermeasure.

### Roadway and Site Information

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Consider this countermeasure for 2 or 3 lane roadways also described by the following conditions:

- AADT < 9,000 + ≤ 30 mph speed limit

### Safety Issues and Behaviors

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This countermeasure may help address the following traffic behaviors or safety issues observed at the site:

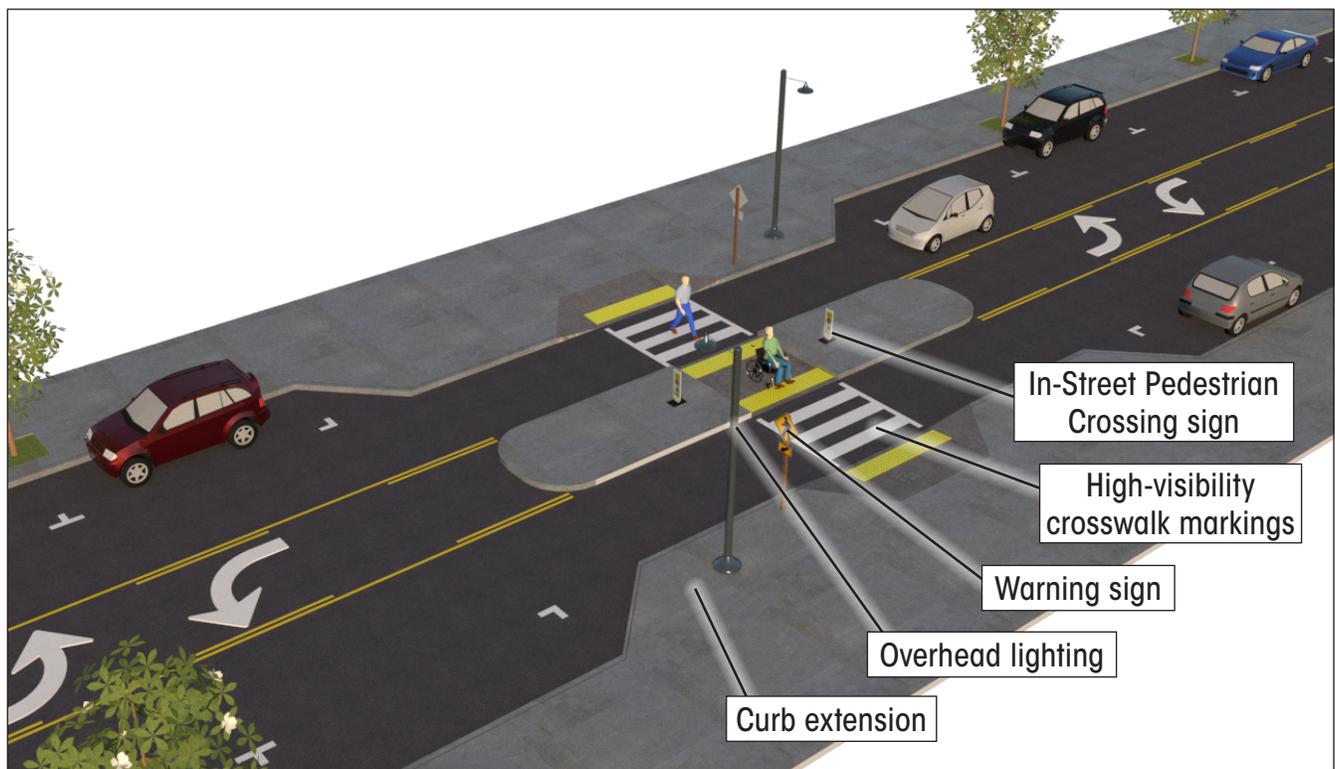
- Inadequate conspicuity/visibility
- Excessive vehicle speed

## Installation and Design Guidelines

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- » Raised crosswalks may be installed with curb extensions and on-street parking.
- » Raised crosswalks may also be used at intersections, particularly at the entrance of the minor street.
- » Raised crosswalks should be flush with the height of the sidewalk.
- » The crosswalk table is typically at least 10 feet wide and designed to allow the front and rear wheels of a passenger vehicle to be on top of the table at the same time.
- » Detectable warnings (truncated domes) and curb ramps should be installed at the street edge for pedestrians with impaired vision.
- » Raised crossings are generally avoided on arterial streets and primary routes for heavy trucks, bus transit, and emergency response vehicles.
- » Consider storm water drainage and snowplowing in the design of the raised crosswalk.
- » See MUTCD Section 3B.25 for information about Speed Hump Markings and other markings that can be used with raised crosswalks.

## Countermeasure: Pedestrian Refuge Island



### Definition

A pedestrian refuge island is a median with a refuge area that is intended to help protect pedestrians who are crossing the road. This countermeasure is sometimes referred to as a crossing island or pedestrian island. Refer to the Pedestrian Refuge Island Tech Sheet for more information about this countermeasure.

### Roadway and Site Information

Consider this countermeasure for established pedestrian crossings at all 2 or 3 lane roadways without a raised median.

*Strongly consider* this countermeasure if the roadway(s) are described by one of the following sets of conditions:

- AADT  $\geq 9,000$  + 4 or more lanes without a raised median + any speed limit
- Any AADT + 4 or more lanes without a raised median +  $\geq 35$  mph speed limit

## Safety Issues and Behaviors

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This countermeasure may help address all traffic behaviors or safety issues but is most effective where the following are observed at the site:

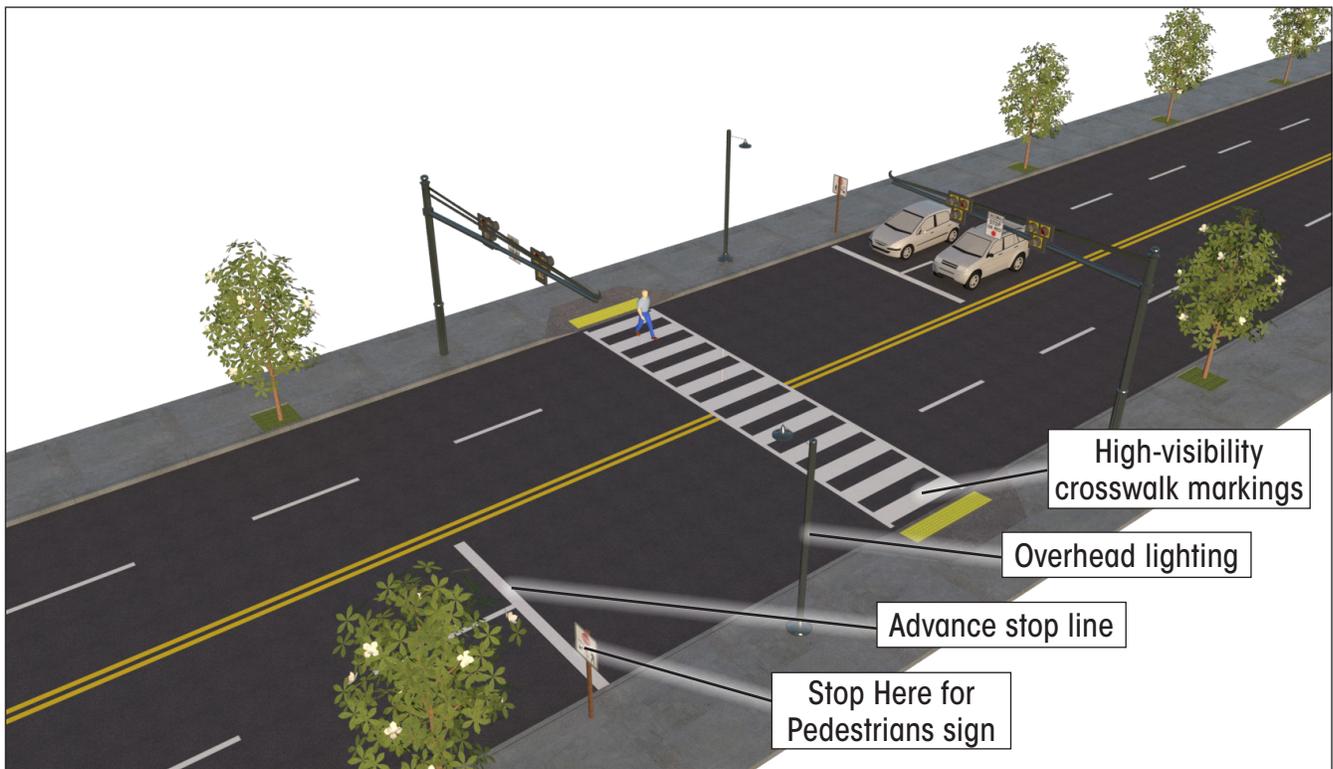
- Inadequate conspicuity/visibility
- Excessive vehicle speed
- Insufficient pedestrian separation from traffic

## Installation and Design Guidelines

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- » Consideration should be given to creating a two-stage crossing. The island can encourage pedestrians to cross one direction of traffic at a time and look towards oncoming traffic before completing the second part of the crossing.
- » Pedestrian refuge islands should be at least 4 feet wide (preferably 8 feet) and of adequate length to allow the anticipated number of pedestrians to stand and wait for gaps in traffic before crossing.
- » The cut-through of the island must include detectable warnings if island width is at least 6 feet.
- » Refuge islands should be illuminated or highlighted with street lights, signs, and/or reflectors to ensure that they are visible to motorists.
- » See MUTCD Section 3B for more information about the following for refuge islands:
  - Section 3B.10 - Approach Markings for Obstructions
  - Section 3B.18 - Crosswalk Markings
  - Section 3B.23 - Curb Markings
- » If applicable, evaluate the impact of the island on bicycle facility design.

## Countermeasure: Pedestrian Hybrid Beacon (PHB)



### Definition

A PHB is a hybrid beacon used to control traffic and 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 when pedestrians should cross and when it is safe for drivers to proceed. Refer to the PHB Tech Sheet for more information about this countermeasure.

### Roadway and Site Information

*Strongly consider* this countermeasure if the roadway(s) are described by one of the following sets of conditions:

- AADT  $\geq 15,000$  + 4 or more lanes + any speed limit
- AADT  $\geq 9,000$  + 3 or more lanes (with or without median) +  $\geq 35$  mph speed limit
- Any AADT + any number of lanes +  $\geq 40$  mph speed limit

### Safety Issues and Behaviors

This countermeasure may help address the following traffic behaviors or safety issues observed at the site:

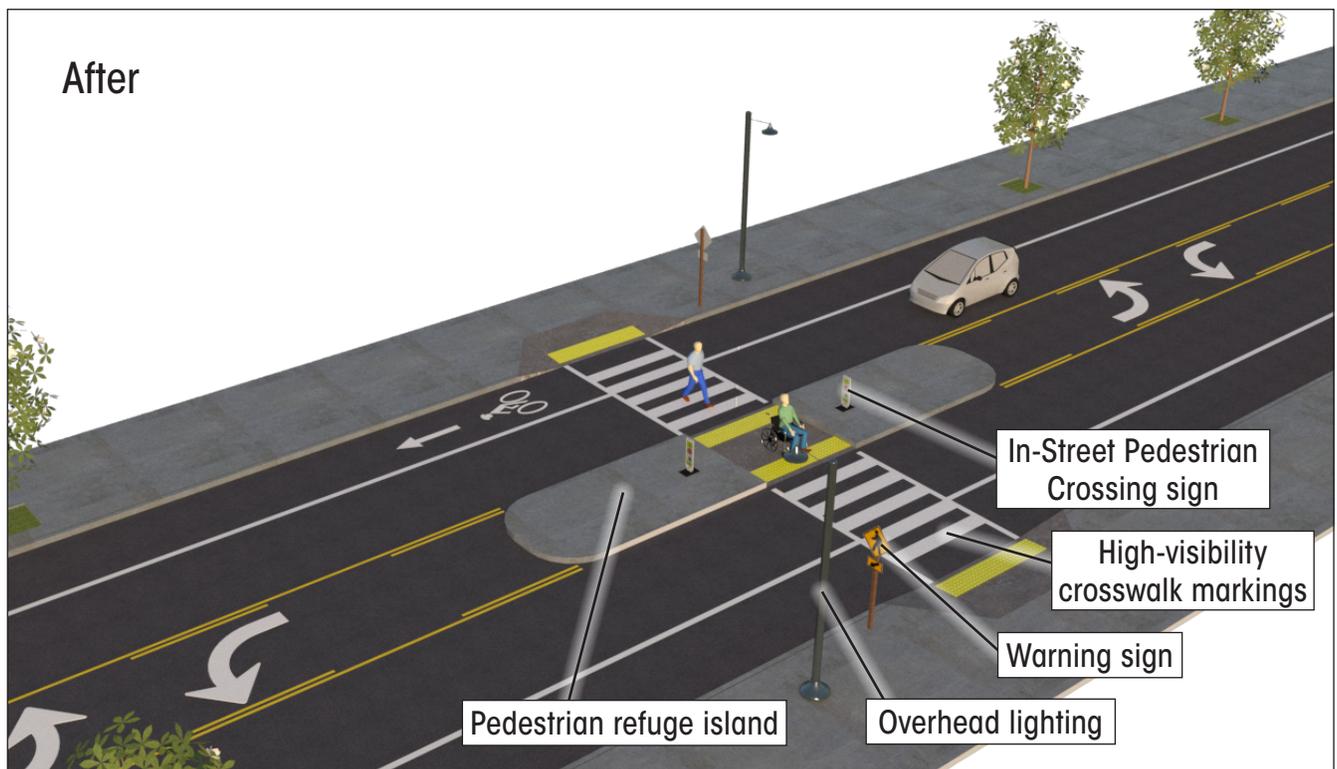
- Drivers not yielding to pedestrians in crosswalks
- Noted conflicts at crossing locations

### **Additional Installation and Design Guidelines**

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- » Use in conjunction with signs and pavement markings at locations where pedestrians enter or cross the roadway.
- » Only install a PHB at a marked crosswalk.
- » For roadways with speeds of 35 mph or less, see *MUTCD Figure 4F-1*. For roadways speeds greater than 35 mph, see *MUTCD Figure 4F-2*. These charts compare crosswalk length, approximate vehicles per hour (VPH, including both approaches), and pedestrians per hour (PPH). The MUTCD recommends installation of a PHB where these conditions meet minimum criteria.
- » The PHB should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs.
- » Parking should be prohibited and other sight obstructions should be removed at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk and PHB.
- » The PHB should be coordinated if within a signal system.
- » Review the MUTCD Part 4F for more information about the design and operation of the beacon face and the installation of optional signage.

## Countermeasure: Road Diet



## Definition

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A Road Diet is a roadway reconfiguration resulting in a reduction in the number of travel lanes, which is usually achieved by converting a four-lane undivided road to three lanes. The space gained by eliminating lanes is typically used for other uses and travel modes. Refer to the Road Diet Tech Sheet for more information about this countermeasure.

## Roadway and Site Information

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Consider this countermeasure for all roadways with four or more lanes without a raised median.

Typically, Road Diets are considered for roadways with current and future average daily traffic (ADT) equal to or less than about 20,000.

## Safety Issues and Behaviors

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This countermeasure may help address the following traffic behaviors or safety issues observed at the site:

- Conflicts at crossing locations
- Excessive vehicle speeds
- Insufficient pedestrian separation from traffic

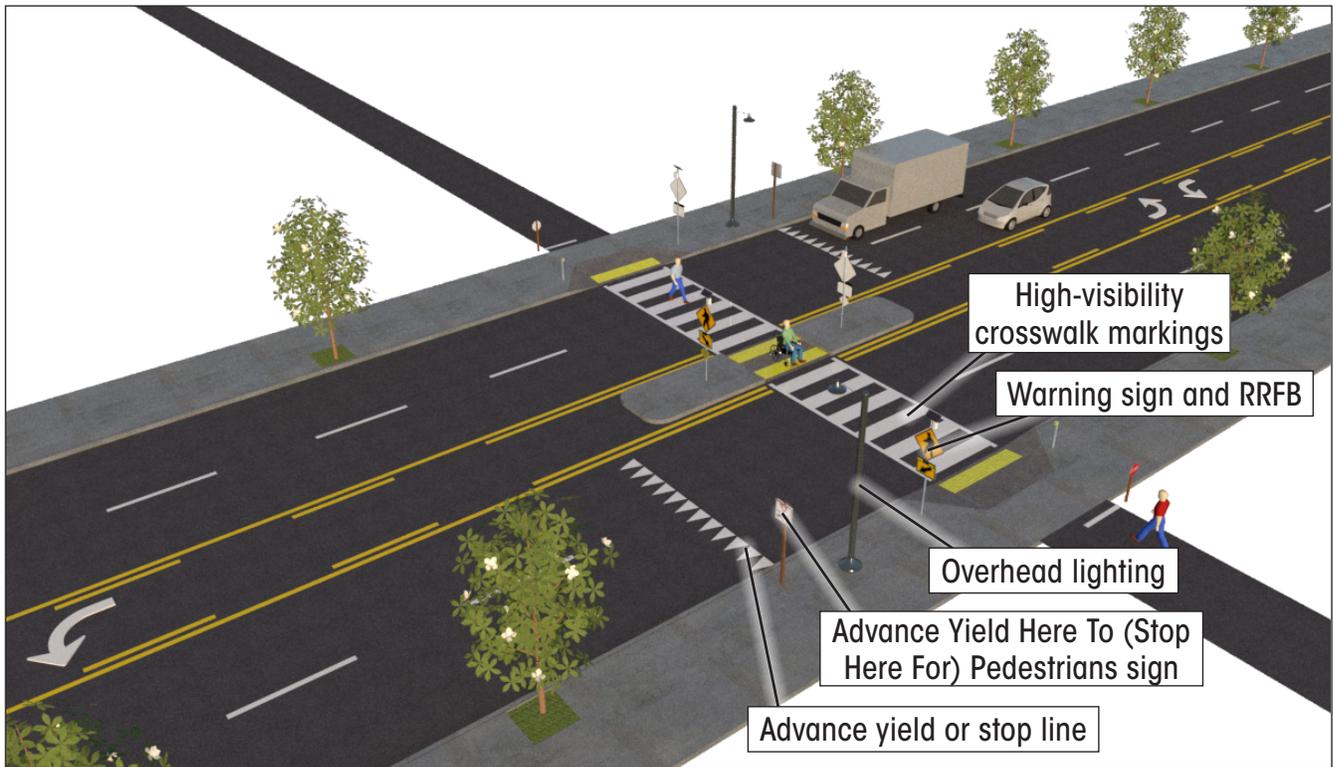
## Additional Installation and Design Guidelines

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Refer to the FHWA's Road Diet Informational Guide for a range of additional design considerations, including:

- » Vehicle speed
- » Level of Service (LOS)
- » Quality of Service
- » Operation and volume of pedestrians, bicyclists, transit, and freight
- » Peak hour and peak direction traffic flow
- » Vehicle turning volumes and patterns
- » Frequency of stopping and slow-moving vehicles
- » Presence of parallel roadways

## Countermeasure: Rectangular Rapid-Flashing Beacon (RRFB)



### Definition

An RRFB is a pedestrian-actuated conspicuity enhancement used in combination with a pedestrian, school, or trail crossing warning sign to improve safety at uncontrolled, marked crosswalks. The device includes two rectangular-shaped yellow indications, each with an LED-array-based light source, that flash with high frequency when activated.

### Roadway and Site Information

*Strongly consider* this countermeasure if the roadway(s) are described by one of the following sets of conditions:

- AADT  $\leq 15,000$  + 2 lanes or 3 lanes (with a raised median) +  $\geq 40$  mph speed limit
- AADT 9,000–15,000 + 3 or more lanes (with or without median) +  $\geq 35$  mph speed limit

In the following exceptions, *strongly consider* a PHB instead of the RRFB:

- AADT 9,000–15,000 + 3 lanes (without raised median) or more lanes +  $\geq 40$  mph speed limit

## Safety Issues and Behaviors

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This countermeasure may help address the following traffic behaviors or safety issues observed at the site:

- Noted conflicts at crossing locations
- Inadequate conspicuity/visibility of the crosswalk and pedestrian
- Insufficient pedestrian separation from traffic

## Additional Installation and Design Guidelines

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The RRFB is not currently included in the MUTCD. FHWA has issued interim approval for the optional use of the RRFB (Interim Approval 21 or IA-21). State and local agencies must request and receive permission to use this interim approval before they can use the RRFB. IA-21 provides additional information about the conditions of use, including dimensions, placement, accessibility features, and flashing requirements. IA-21 does not provide guidance or criteria based on number of lanes, speed, or traffic volumes.

RRFBs are placed on both ends of a crosswalk. If the crosswalk contains a pedestrian refuge island or other type of median, an RRFB should be placed to the right of the crosswalk and on the median (instead of the left side of the crosswalk).

An RRFB shall only be used to supplement the following warning signs, located at or immediately adjacent to an uncontrolled marked crosswalk:

- » Post-mounted W11-2, S1-1, or W11-15 crossing warning sign with a (W16-7P) plaque OR
- » An overhead-mounted W11-2, S1-1, or W11-15 crossing warning sign.

See MUTCD Section 2C.50 Non-Vehicular Warning Signs and Section 7B.08 School Sign (S1-1) for more information about signs that may be used with an RRFB.

