

Crosswalks

Crosswalks Safety Assessments



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pennsylvania
DEPARTMENT OF TRANSPORTATION
LOCAL TECHNICAL ASSISTANCE PROGRAM

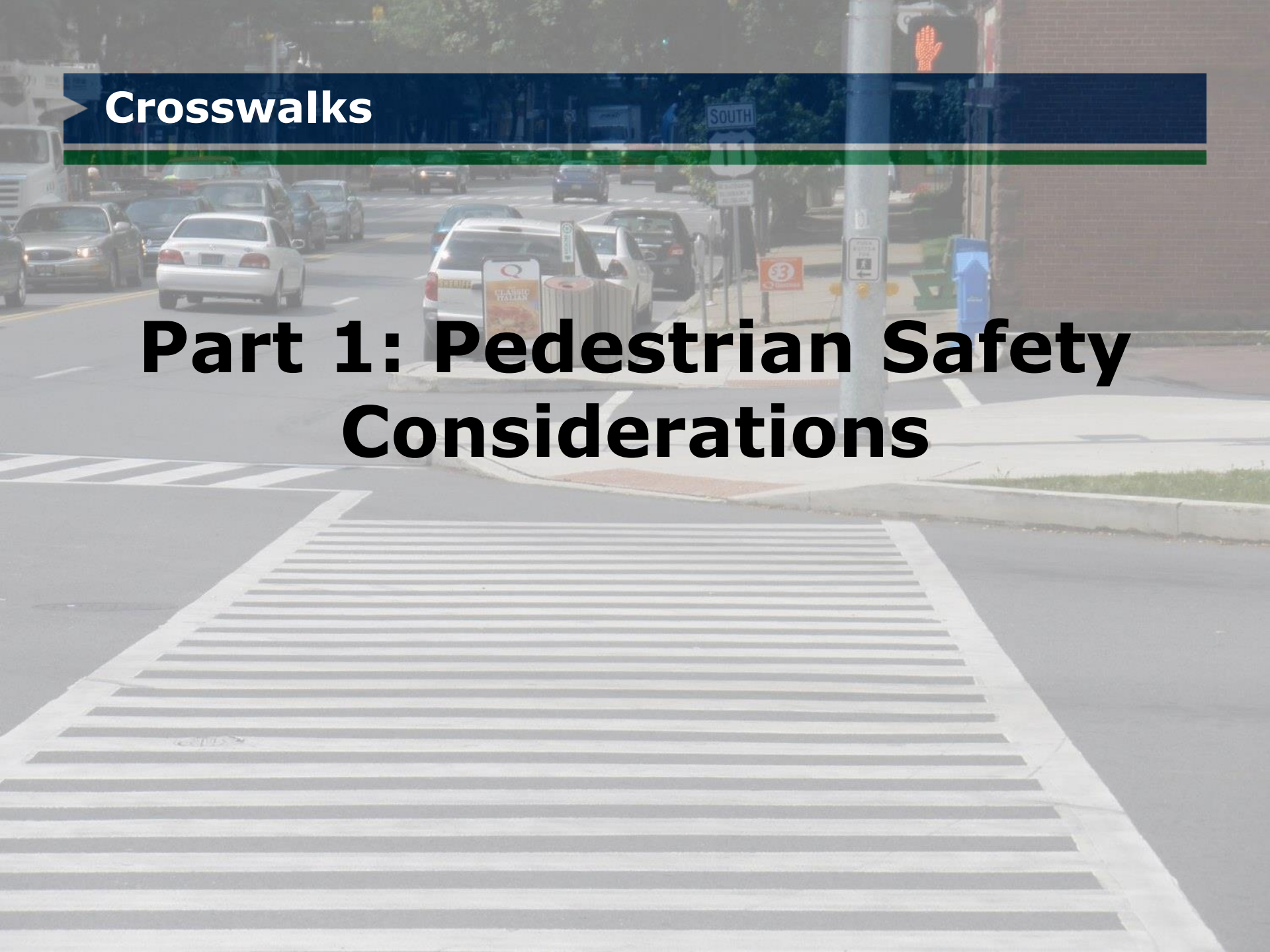
➤ Agenda

- 1. Pedestrian Safety Considerations**
- 2. Steps to Study a Crosswalk**
- 3. Safety Countermeasures**



Crosswalks

Part 1: Pedestrian Safety Considerations



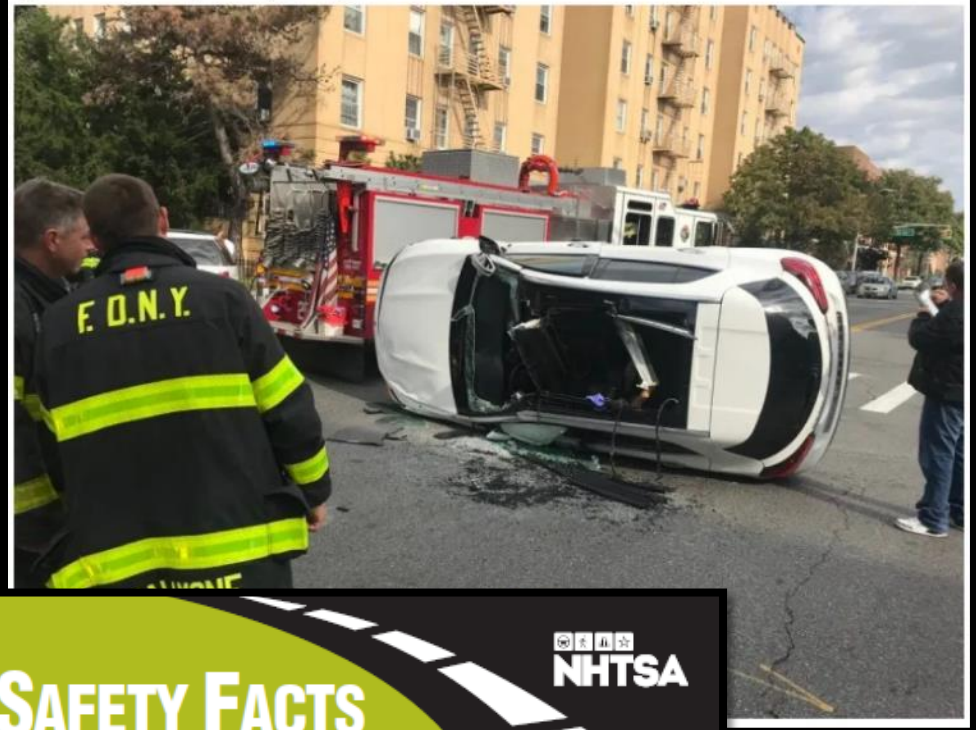
► Part 1: Pedestrian Safety

36,560
fatalities in
the USA

6,283
pedestrian
fatalities

Report: Drivers Get More Protection — The Rest of Us Get Slaughtered

By Gersh Kuntzman | Oct 22, 2019 | 0



U.S. Department
of Transportation
National Highway
Traffic Safety
Administration

TRAFFIC SAFETY FACTS

Research Note



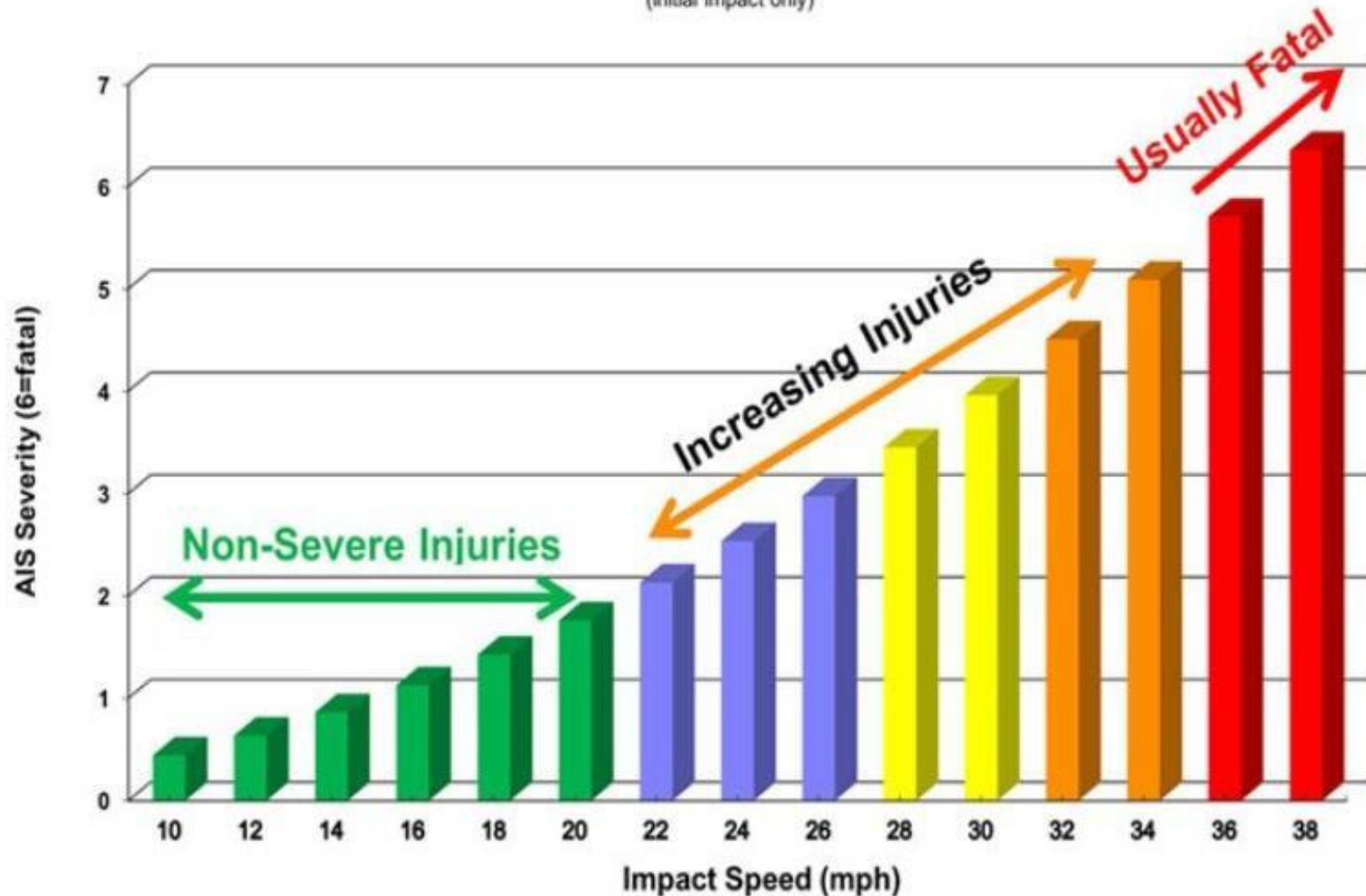
DOT HS 812 826

October 2019

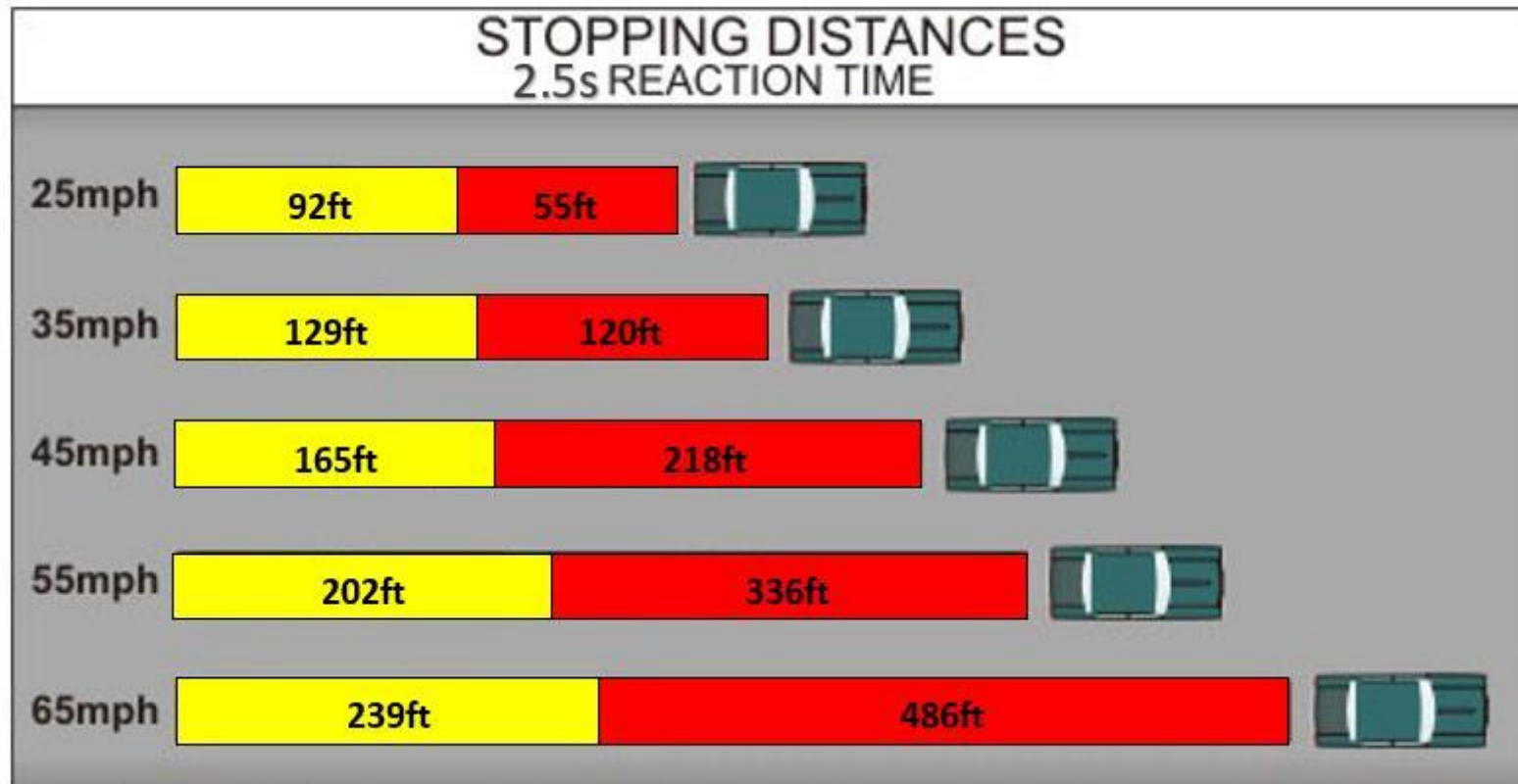
2018 Fatal Motor Vehicle Crashes: Overview

Part 1: Pedestrian Safety

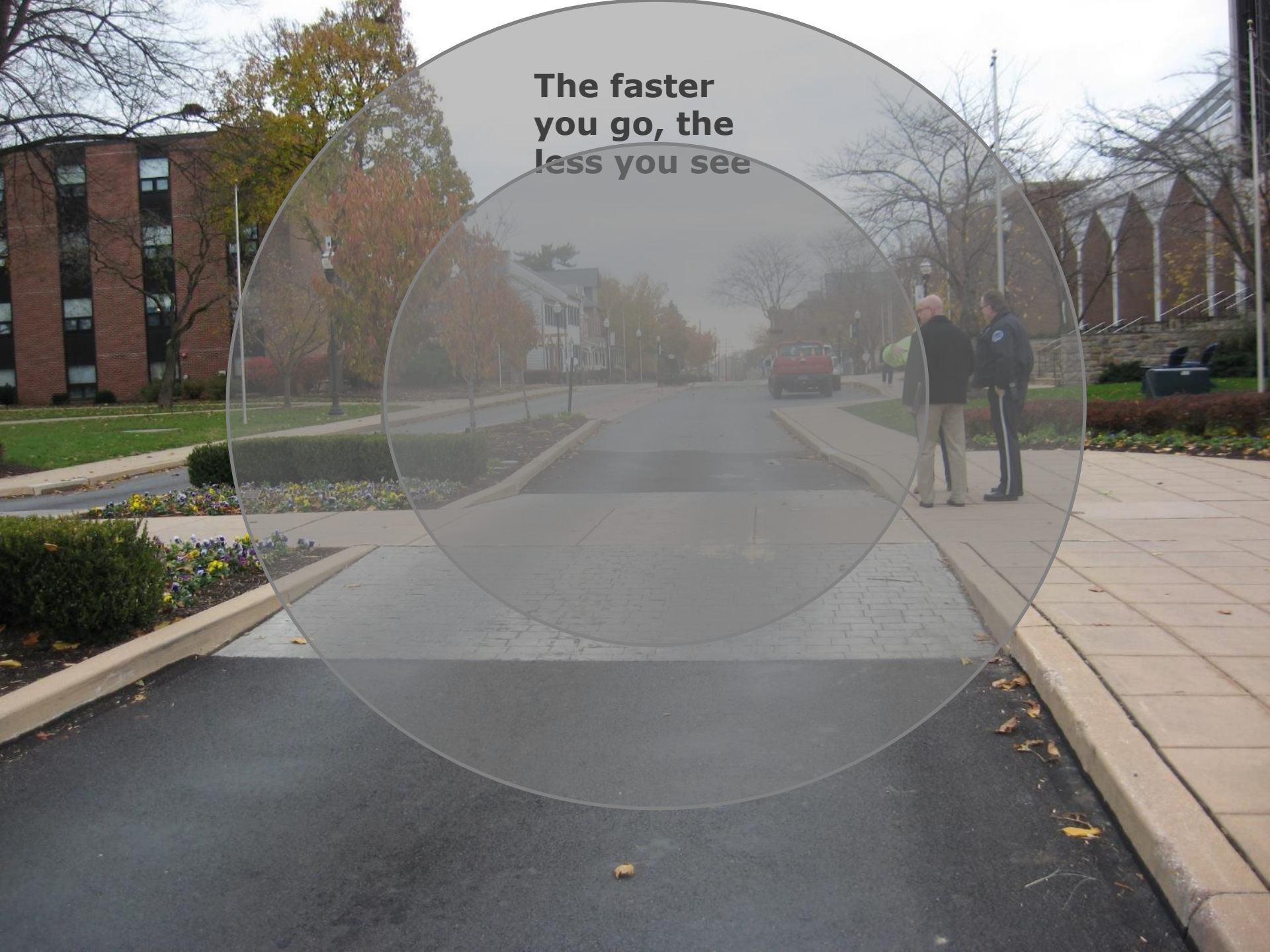
Vehicle Impact Speed vs. Pedestrian Injury
(initial impact only)



► Part 1: Pedestrian Safety



**The faster
you go, the
less you see**



Part 1: Pedestrian Safety



Source: 2016 FHWA.

Figure 8. Graphic. Relationship between vehicle speeds, pedestrian injury outcomes, and cone of vision.⁽²³⁾

Part 1: Pedestrian Safety



Part 1: Pedestrian Safety

Crossing distance

902

10th St



Part 1: Pedestrian Safety

Walking speed



Part 1: Pedestrian Safety

Shortest path



Part 1: Pedestrian Safety

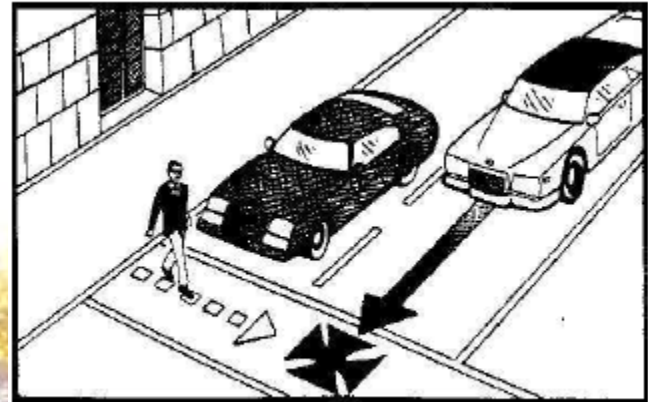


Figure 21. Illustration of multiple-threat pedestrian crash.

Number of lanes

Part 1: Pedestrian Safety

Turning vehicles



Part 1: Pedestrian Safety



Sight Distance

Part 1: Pedestrian Safety



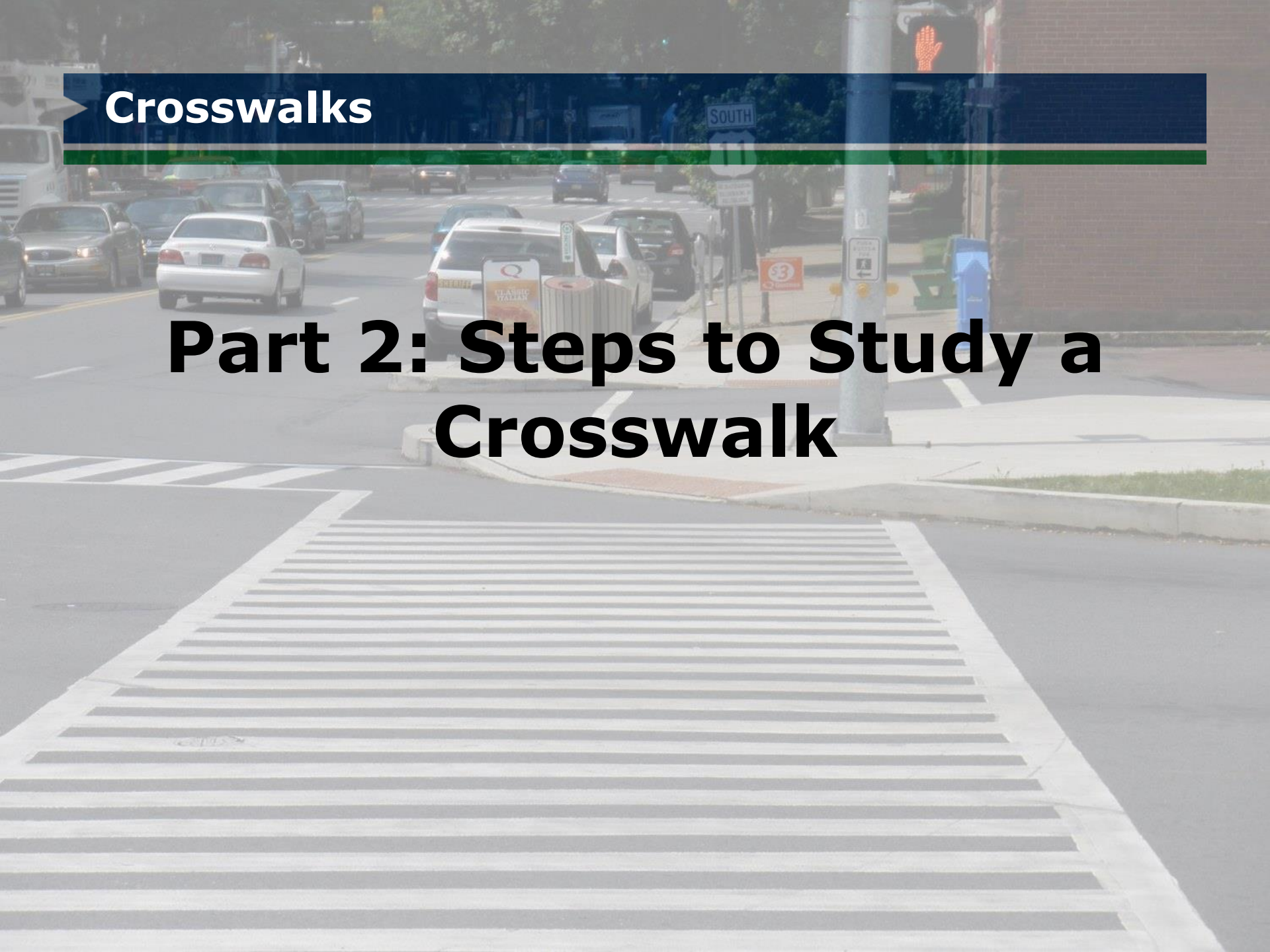
Nighttime Visibility

Part 1: Pedestrian Safety



Crosswalks

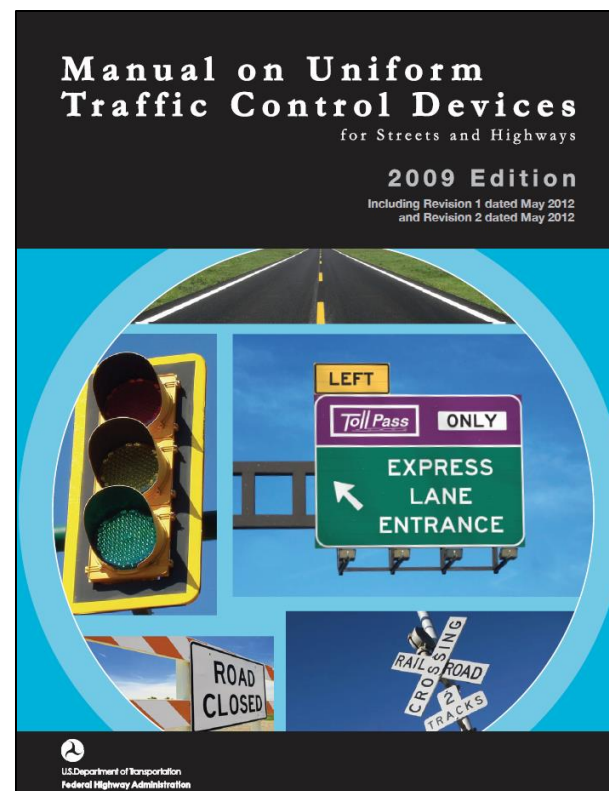
Part 2: Steps to Study a Crosswalk



► Part 2: Crosswalk Study

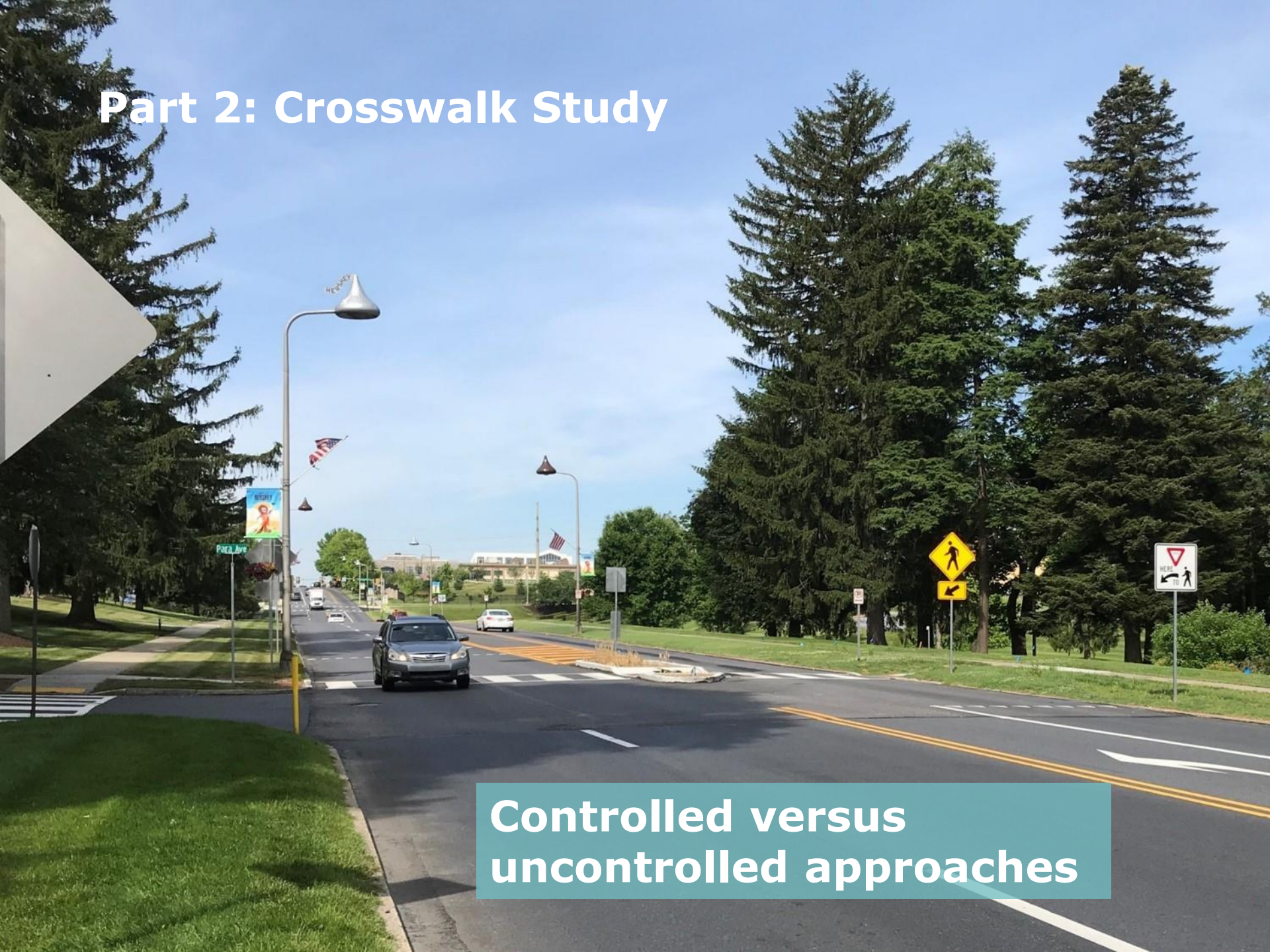
Choosing to mark a crosswalk:

- Crosswalks should not be marked indiscriminately
- A study should be performed before a crosswalk is marked on an uncontrolled approach



Section 3B.18

Part 2: Crosswalk Study



**Controlled versus
uncontrolled approaches**

► Part 2: Crosswalk Study

Traffic signals



➤ Part 2: Crosswalk Study

Marking crosswalks at controlled approaches



► Part 2: Crosswalk Study



**Mark this
crosswalk?**

► Part 2: Crosswalk Study

Marking crosswalks at uncontrolled approaches



Part 2: Crosswalks – Study Steps

Study Steps

1. Conduct field review
2. Collect data
3. Perform safety assessment
4. Assess walkability
5. Determine crosswalk markings
6. Consider signs and other features

Crosswalk Study	
Street Name	
Crosswalk Location	
Municipality	
County	
Date	
Driver/Recorder	
Weather	
Pavement Condition	
Comments	

Pedestrian Safety Study References	
<ul style="list-style-type: none">• Current edition of the 2009 Manual on Uniform Traffic Control Devices (MUTCD)• PennDOT Publications 13M, 46, 111, 236, and 383• Pennsylvania Title 67, Chapter 212, and Title 75• Establishing Procedures and Guidelines for Pedestrian Treatments at Uncontrolled Locations, FHWA-ICT-17-016, 2017• Guide to Improving Pedestrian Safety at Uncontrolled Crossing Locations, FHWA-SA-17-072, 2017• Pedestrian Road Safety Audit Guidelines and Prompt Lists, FHWA SA-07-007, July 2007• Improving Pedestrian Safety at Unsignalized Crossings, NCHRP Report 562, 2006• Pedbikeinfo.org, website for the Pedestrian and Bicycling Information Center• Small Town and Rural Area Multi-modal Guide, FHWA 2016 https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/small_towns/• PedSafe safety tool: http://www.pedbikesafe.org/pedsafe/• FHWA STEP program: https://www.fhwa.dot.gov/innovation/everdaycounts/edc/5/step2.cfm	

➤ Part 2: Crosswalks – Study Step 3

Step 3: Perform Safety Assessment



IIM-TE-384 – Attachment A

Unsignalized Marked Crosswalk Standards

52 Table 2. Recommendations for Considering Marked Crosswalks and Other Needed
53 Pedestrian Improvements Across Uncontrolled Approaches

Roadway Configuration	Roadway ADT and Speed Limit															
	1,500 to 9,000 VPD				9,000 to 12,000 VPD				12,000 to 15,000 VPD				More than 15,000 VPD			
	≤ 30 MPH	35 MPH	40 MPH	≥ 45 MPH	≤ 30 MPH	35 MPH	40 MPH	≥ 45 MPH	≤ 30 MPH	35 MPH	40 MPH	≥ 45 MPH	≤ 30 MPH	35 MPH	40 MPH	≥ 45 MPH
2 Lanes (undivided two-way street or two-lane one-way street)	A	A	B	B	A	A	B	B	A	A	B	B	B	B	B	C
3 Lanes with refuge island OR 2 Lanes with raised median*	A	A	B	B	A	B	B	B	A	A	B	B	B	B	B	C
3 Lanes (center turn lane)	A	A	B	B	A	B	B	B	A	B	B	C	B	C	C	C
4 Lanes (two-way street with no median)	A	B	C	C	B	B	C	C	B	C	C	D	C	C	C	D
5 Lanes with refuge island OR 4 lanes with raised median*	A	A	B	B	A	B	B	C	B	B	C	C	B	B	C	D
5 Lanes (center turn lane)	A	B	C	C	B	B	C	C	C	C	C	D	C	C	C	D
6 Lanes (two-way street with* or without median)	A	B	D	D	B	B	D	D	D	D	D	D	D	D	D	D

54 Source: Guidance for Installation of Pedestrian Crosswalks on Michigan State Trunkline Highways (Michigan Department of
55 Transportation, 2014)

56



S. Pine St.



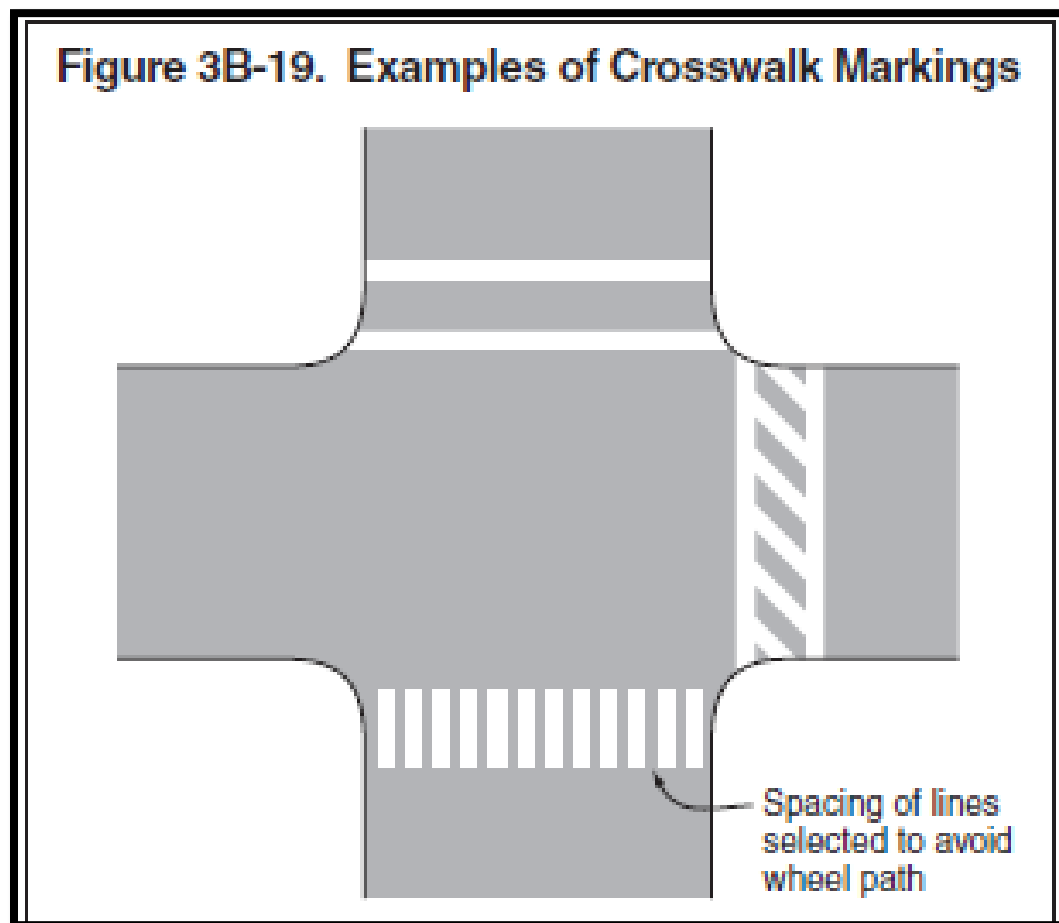
**Should we mark
this crosswalk?**

Richardson Ave.

10,000 vehicles per day
Posted at 35 MPH
Two lanes with a painted median,
uncontrolled approaches

➤ Part 2: Crosswalks – Study Step 5

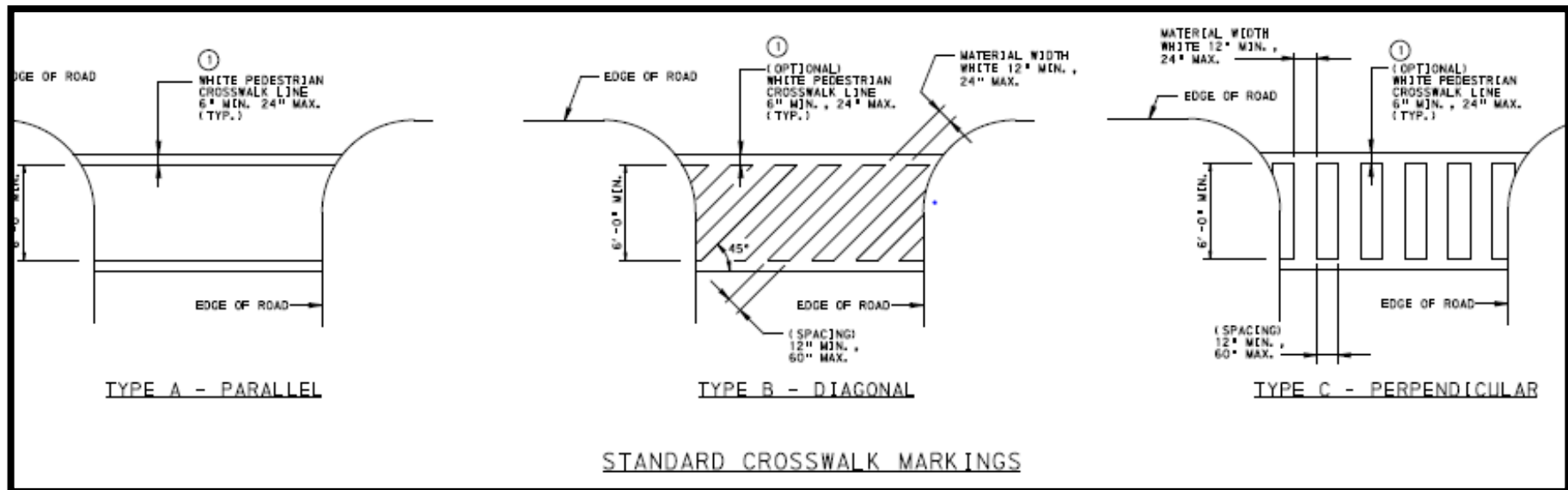
Step 5: Determine Marking



➤ Part 2: Crosswalks – Study Step 5

Critical components:

- Crosswalk minimum 6 feet wide
- Shall be white
- Curb ramps contained within crosswalk



Part 2: Crosswalks – Study Step 5



➤ Part 2: Crosswalks – Study Step 6

Step 6: Determine Signs and Other Features

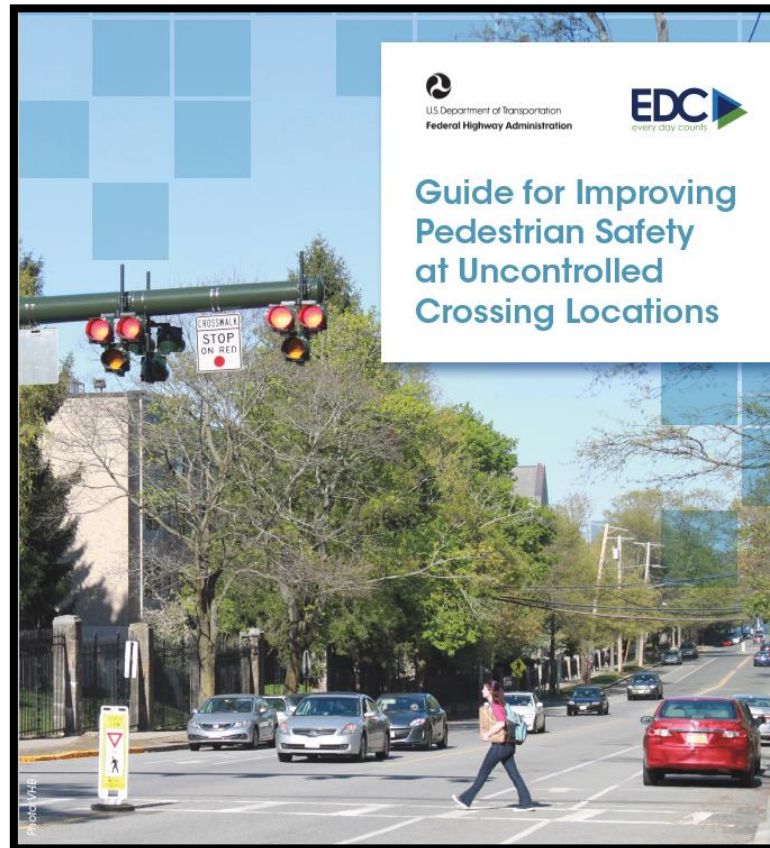


Table 1. Application of pedestrian crash countermeasures by roadway feature.

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
2 lanes (1 lane in each direction)	① 2 4 5 6	① 5 6 7 9	① 5 6 ⑦ ⑨	① 4 5 6 7 9	① 5 6 7 9	① 5 6 ⑦ ⑨	① 4 5 6 7 9	① 5 6 7 9	① 5 6 ⑨
3 lanes with raised median (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
3 lanes w/o raised median (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
4+ lanes with raised median (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
4+ lanes w/o raised median (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)**

An aerial photograph of a residential street intersection. A red circle highlights a specific area on the road. The image includes text labels for the streets, a north arrow, and a title box.

S. Pine St.



Devices?

Richardson Ave.

10,000 vehicles per day
Posted at 35 MPH
Two lanes with a painted median,
uncontrolled approaches

➤ Part 2: Crosswalks – Study Step 6

Based upon your input, the following countermeasures were found:

At Crossing Locations

Pedestrian Crossing Island

Curb Extension

Parking Restrictions

Transit

Access to Transit

Roadway Design

Raised Median

Traffic Management

Left Turn Prohibitions

PEDSAFE Tool

Countermeasure Selection Tool

Name of location: Market St and 22nd St Camp Hill

Your Performance Objective: Reduce Exposure for Pedestrians

Site Description Answers:

Type of Area: Urban CBD

Functional Class: Collector or Minor Arterial

Intersection or Midblock: Intersection

Volume: Low (10,000 ADT)

Speed: Low (<= 45 mph)

No. of Lanes: 2 or fewer lanes

Traffic Signal: Not present (Installation is not an option)

Transit Line/Route: Yes, the roadway is on a transit line/route.

School Zone/Crossing: No, the roadway is not in a school zone or a school crossing.

Railroad Crossing: No, the roadway does not contain a railroad crossing.

Work Zone: No, the roadway is not in a work zone.

Based upon your input, the following countermeasures were found:

At Crossing Locations

Pedestrian Crossing Island

Curb Extension

Parking Restrictions

Transit

Access to Transit

Roadway Design

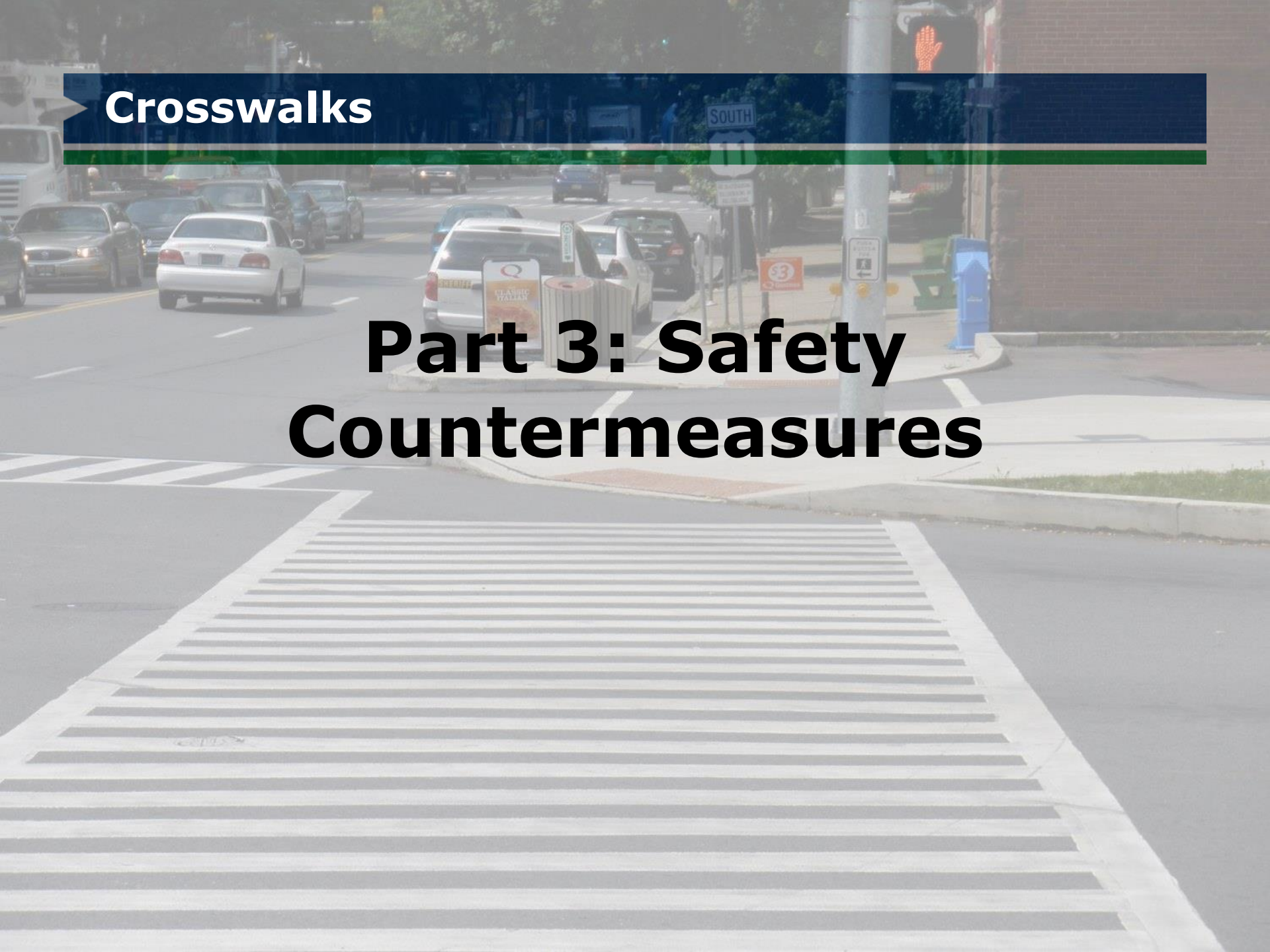
Raised Median

Traffic Management

Left Turn Prohibitions

Crosswalks

Part 3: Safety Countermeasures



➤ Part 3: Countermeasures

Types of Treatments

At-grade pedestrian-treatment categories	Example
Basic	Marked crosswalk with warning sign
Enhanced	Advanced stop line and sign
	In-street crossing sign
	Overhead crossing sign
Geometric	Curb extension
	Road diet
	Raised median
	Raised crosswalk
Warning beacon	FB
	RRFB
Control beacon	PHB

Part 3: Countermeasures



Signs and Sign Placement

Part 3: Countermeasures

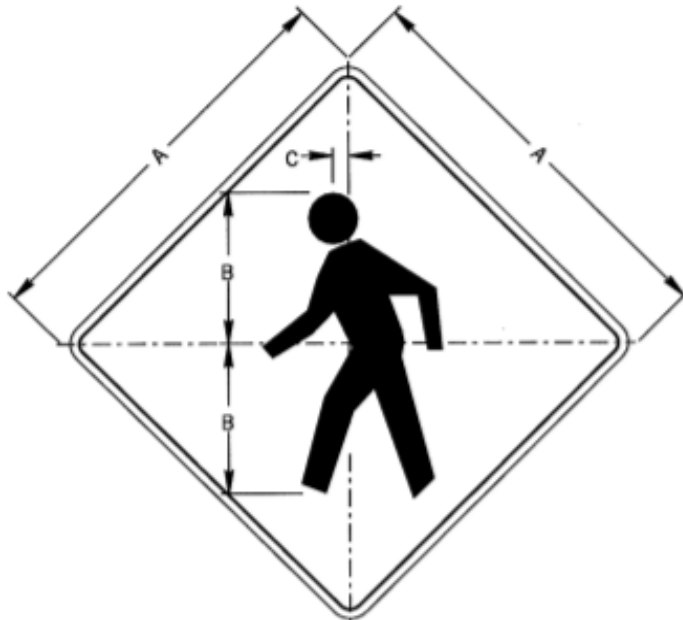
W11-2

PEDESTRIAN SIGN

The Pedestrian Sign (W11-2) may be used to warn of the unexpected hazard of pedestrians entering, or sharing the use of, or crossing the roadway. The W11-2 sign may be installed in advance of the crossing, in which case it may be supplemented with the Distance Ahead Plaque (W16-103P) or the Ahead Plaque (W16-9P).

If the sign is used at the crossing, the W11-2 sign shall be supplemented with a Diagonal Downward Pointing Arrow Plaque (W16-7P) showing the location of the crossing, which may or may not have crosswalk marking. If a W11-2 sign has been post-mounted at the crosswalk location where a Yield Here To Pedestrians sign (R1-5L or R1-5R) is used on the approach, the R1-5L or R1-5R sign shall not be placed on the same post as, or block the road user's view of, the W11-2 sign.

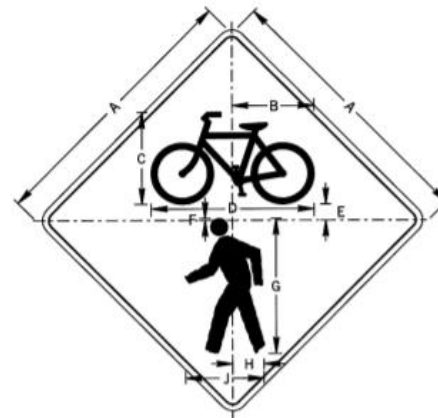
Fluorescent yellow-green background may be used for the W11-2 Sign, in which case all supplemental plaques shall be the same color.



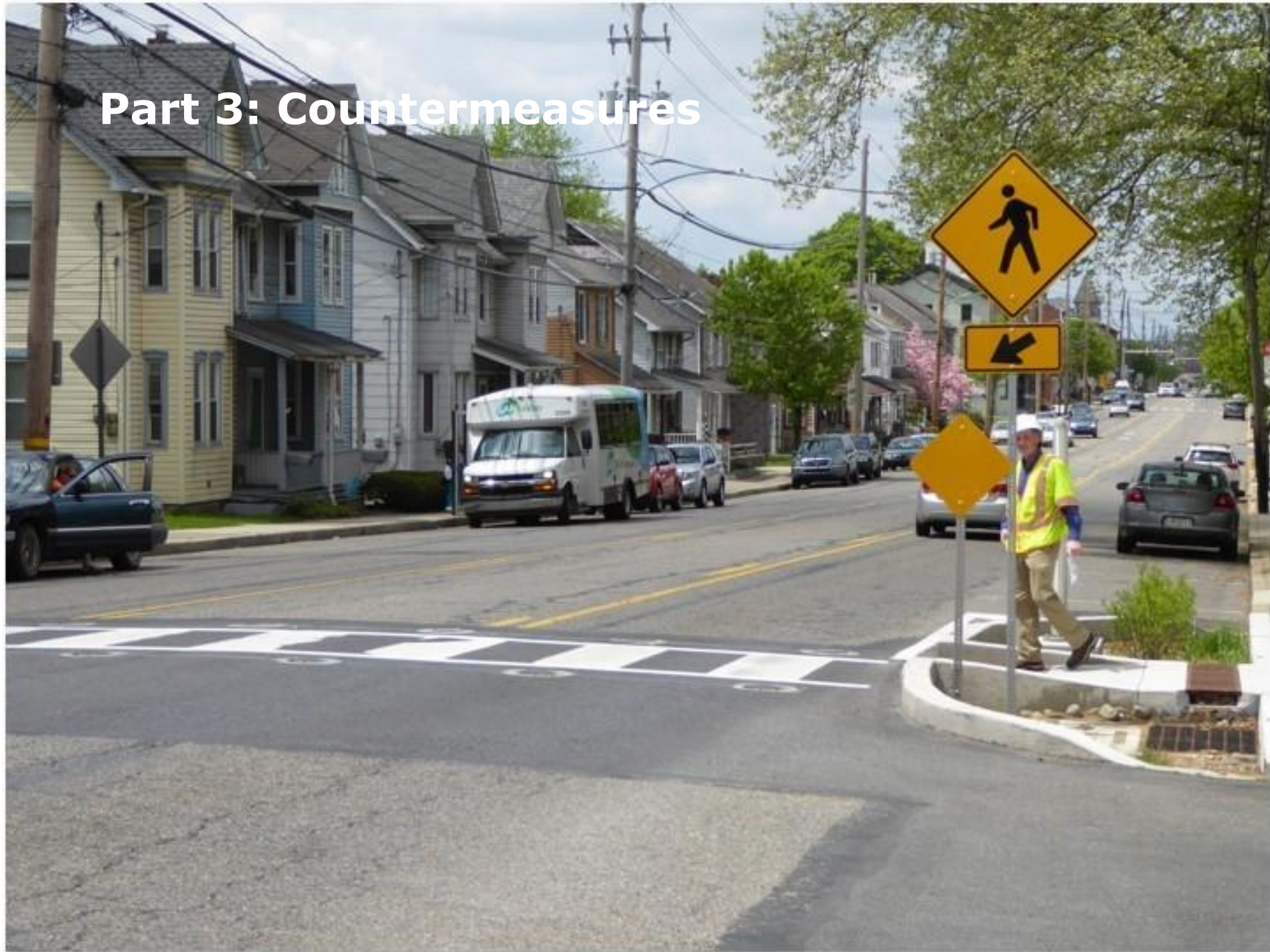
W11-15

COMBINED BICYCLE /PEDESTRIAN SIGN

The Combined Bicycle/Pedestrian (W11-15) sign may be used where both bicyclists and pedestrians might be crossing the roadway, such as at an intersection with a shared-use path. A Trail X-ing (W11-15P) supplemental plaque may be mounted below the W11-15 sign. If used in advance of a pedestrian and bicycle crossing, a W11-15 sign should be supplemented with an Ahead Plaque (W16-9P) or the Distance Ahead Plaque (W16-103P) to inform road users that they are approaching a point where crossing activity might occur. If a post-mounted W11-15 sign is placed at the location of the crossing point a Diagonal Downward Pointing Arrow Plaque (W16-7P) shall be mounted below the sign. If the W11-15 sign is mounted overhead, the W16-7P supplemental plaque shall not be used.



Part 3: Countermeasures



► Part 3: Countermeasures



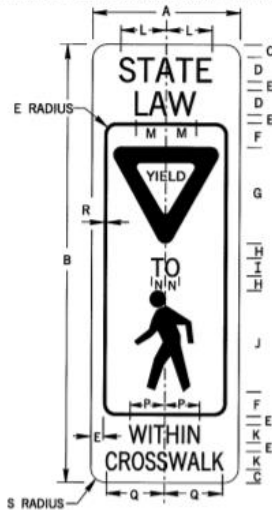
Part 3: Countermeasures

R1-6

IN-STREET PEDESTRIAN CROSSING SIGN

(a) Justification. The In-Street Pedestrian Crossing Sign (R1-6) is authorized for use on the face of a Yield to Pedestrian Channelizing Device which may be positioned on the centerline of low-speed roadways in a marked unsignalized crosswalk to remind drivers that they must legally yield the right of way to pedestrians in the crosswalk. The Yield to Pedestrian Device shall satisfy national breakaway requirements and the Department's specification, and be of a type approved by the Department and listed in Bulletin 15.

(b) Placement. When used, the R1-6 sign /Yield to Pedestrian Device shall be placed in the roadway at the crosswalk location on the center line, on a lane line, or on a median island. It should not be positioned on roadways with a speed limit greater than 35 mph or with a clear roadway width of less than 20 feet. In addition, it should not be used at locations where it will adversely affect the turning radius of motor vehicles.



► Part 3: Countermeasures

FHWA Safe Transportation for Every Pedestrian (STEP)



Rectangular Rapid Flashing Beacon



Leading Pedestrian Interval



Crosswalk Enhancements



Raised Crosswalks



Pedestrian Refuge Islands

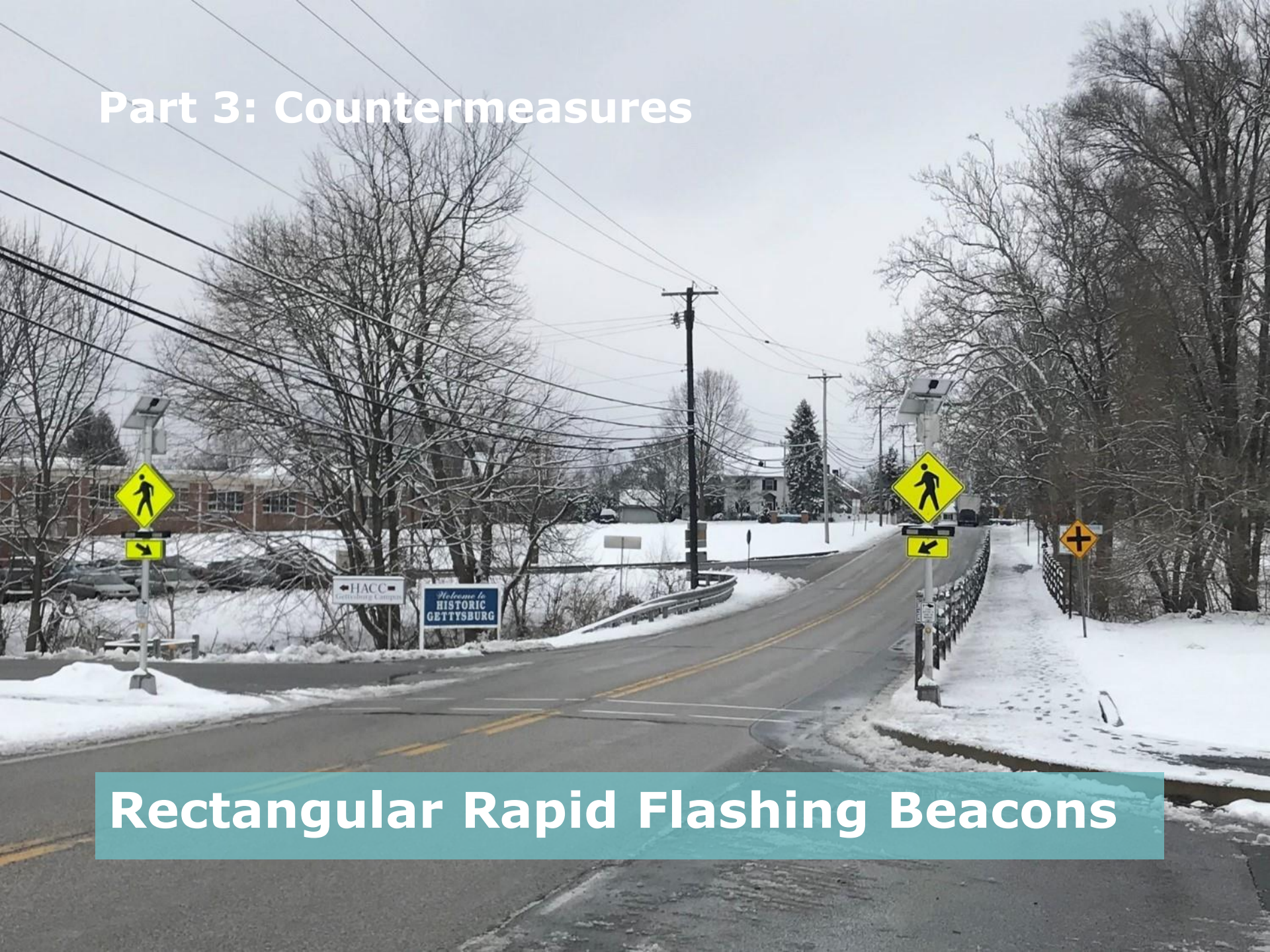


Pedestrian Hybrid Beacon (PHB)



Road Diet

Part 3: Countermeasures



Rectangular Rapid Flashing Beacons

Part 3: Countermeasures

Leading Pedestrian Interval



Part 3: Countermeasures

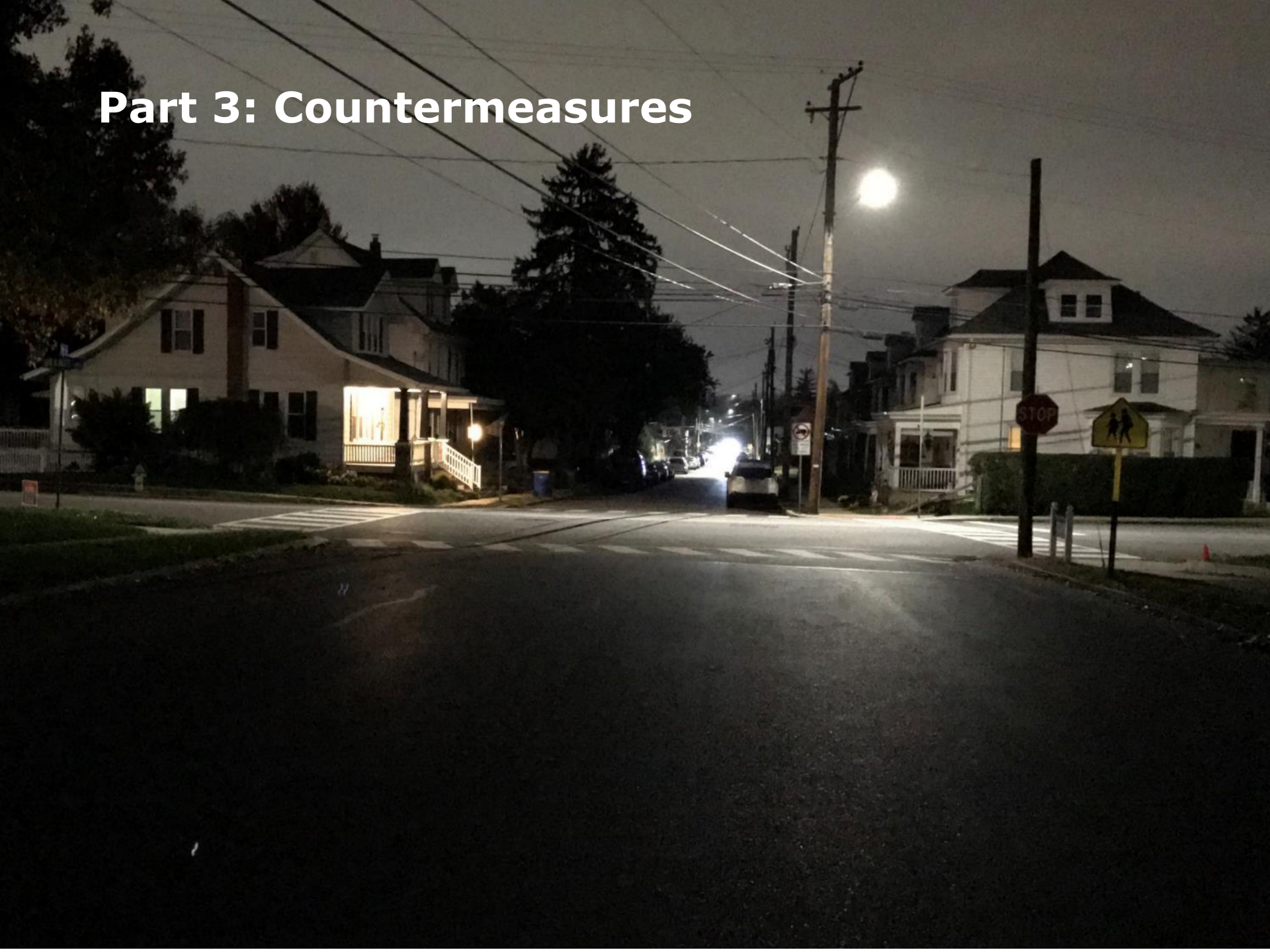
Crosswalk Enhancements



Part 3: Countermeasures



Part 3: Countermeasures



Mid-Block Crosswalk Lighting
Module 4, Slide 32



Illustration of a recommended lighting layout for a mid-block crosswalk.

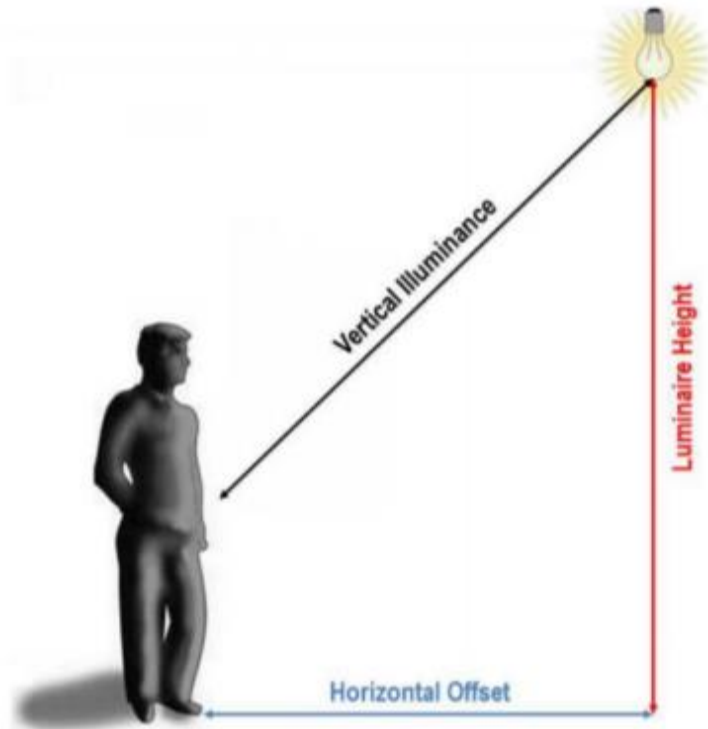
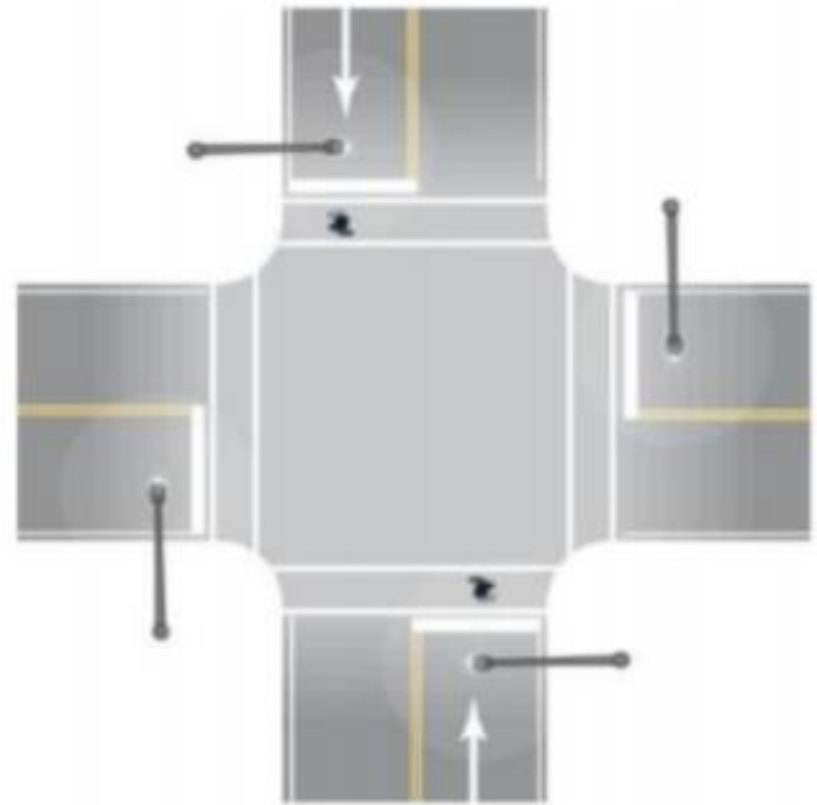


Illustration of vertical illumination on a pedestrian.

Intersection Crosswalk Lighting
Module 4, Slide 33



Part 3: Countermeasures

Raised Crosswalks



Part 3: Countermeasures

Pedestrian Refuge Islands



Part 3: Countermeasures



An aerial photograph of a city street intersection. A multi-lane road runs horizontally across the middle of the frame. A vertical road crosses it, marked with a striped crosswalk. Several cars are visible on the horizontal road. To the left of the intersection is a large, multi-story building. To the right is a grassy area with trees and a flagpole. In the foreground, there are more buildings and trees.

Part 3: Countermeasures

Road Diets/Lane Reallocation

Part 3: Countermeasures



Google earth

Part 3: Countermeasures

Other Physical Features



Part 3: Countermeasures



Part 3: Countermeasures



Temporary Features

THANK YOU!



pennsylvania

DEPARTMENT OF TRANSPORTATION

LOCAL TECHNICAL ASSISTANCE PROGRAM

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