

STEP

Safe Transportation for
Every Pedestrian



Selecting Countermeasures for Uncontrolled Crossing Locations

Presenters:

Gabe Rousseau, FHWA

Lauren Blackburn, VHB

Charlie Zegeer, UNC Highway Safety Research Center



U.S. Department of Transportation

Federal Highway Administration

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The screenshot shows the PBIC website's 'Webinars' page. The header includes the PBIC logo and navigation links: Data & Resources, Community Support, Planning & Design, Training & Events, and Behavior Change. The main content area is titled 'Webinars' and includes a brief description of the center's offerings. It features three sections: 'Upcoming Webinars' with a link to a 04/18/2017 webinar on Vision Zero, 'Designing for Bicyclist Safety Webinar Series', and 'Recently Delivered Webinars' with a link to a 03/14/2017 webinar on education and enforcement efforts. A sidebar on the left lists other resources like 'University Courses' and 'In Person Training'.

The screenshot shows the Facebook page for the Pedestrian and Bicycle Information Center. The page header features the PBIC logo and the text 'Pedestrian and Bicycle Information Center' with the website URL 'www.pedbikeinfo.org'. Below the header is a navigation bar with 'Like', 'Share', 'Suggest Edits', and 'Send Message' buttons. The main content area displays a post titled 'VISION ZERO STRATEGIES SERIES' with a photo of a person on a bicycle. The post includes a description of the center's mission and engagement statistics: '3,539 people like this and 3,446 people follow this'. The page also shows a sidebar with navigation links (Home, About, Photos, Likes, Videos, Posts, Events) and a 'Create a Page' button.

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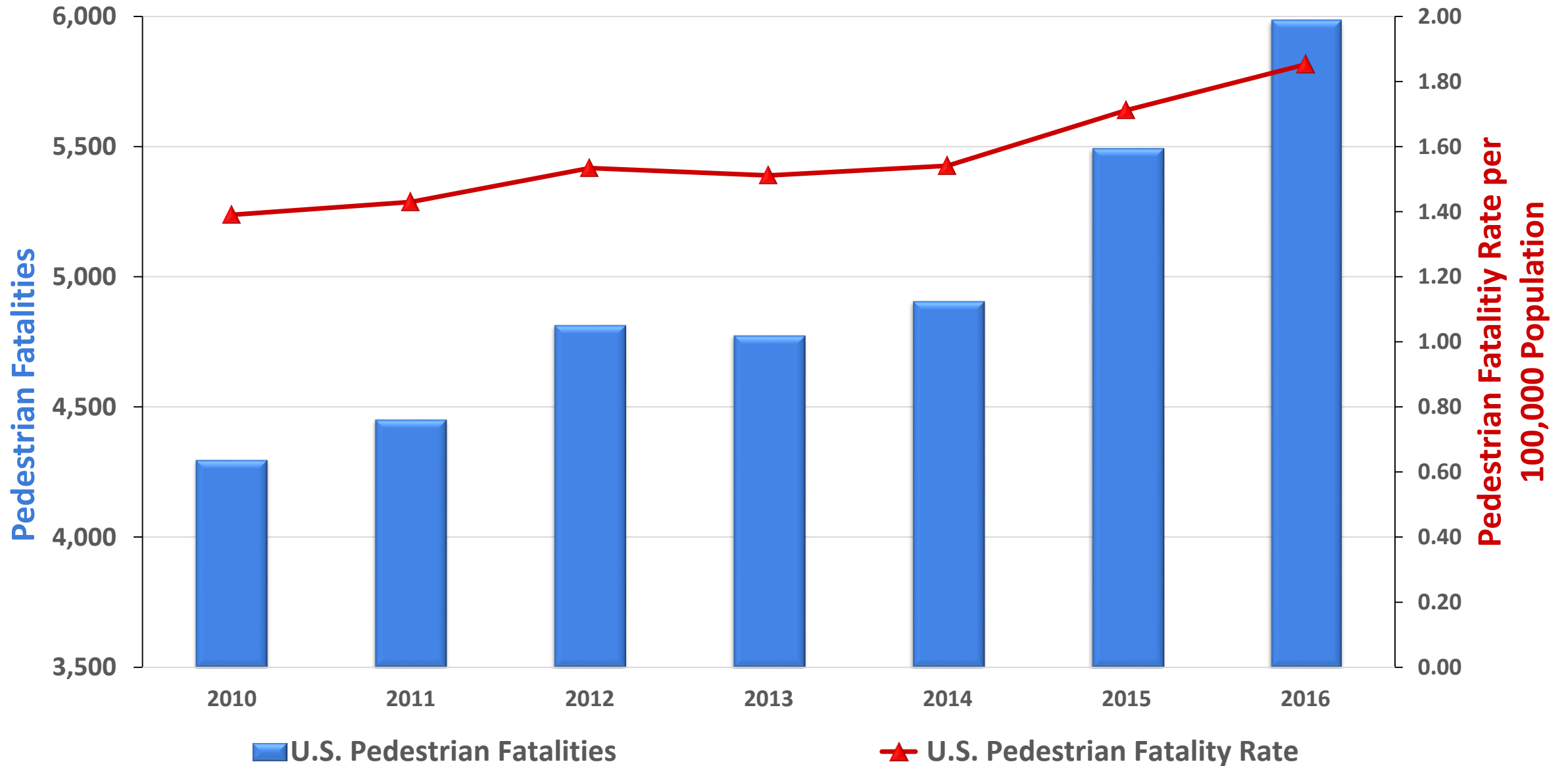
Charlie Zegeer, UNC Highway Safety Research Center



U.S. Department of Transportation

Federal Highway Administration

Pedestrian Fatalities





Why STEP?

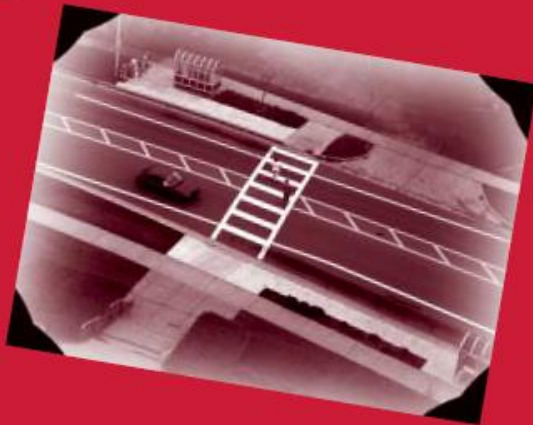
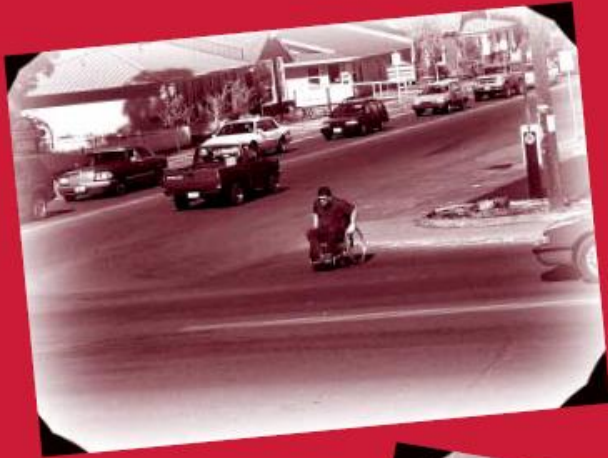
72% of pedestrian fatalities occur at non-intersection locations

Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations

Final Report and
Recommended Guidelines

FHWA PUBLICATION NUMBER: HRT-04-100

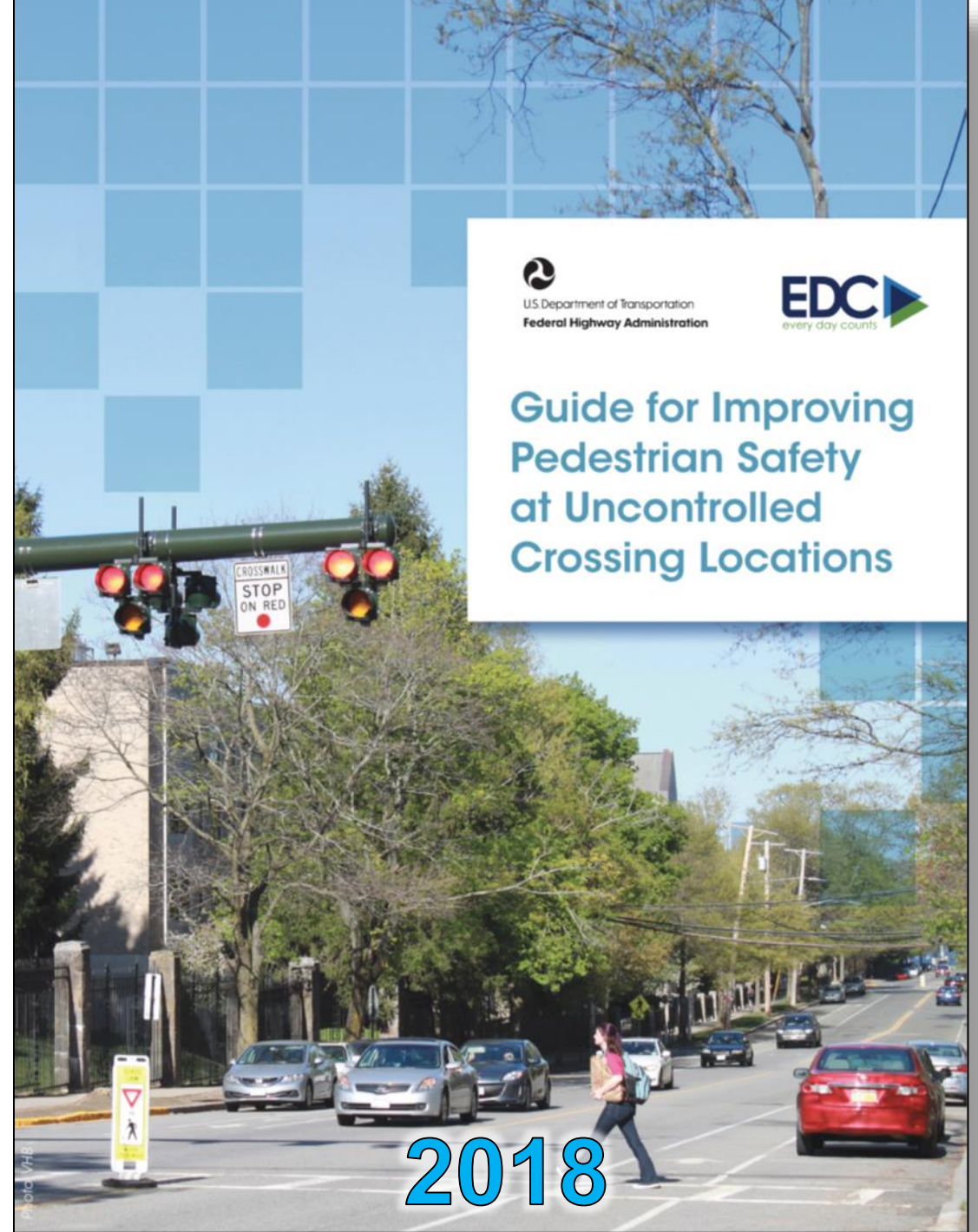
SEPTEMBER 2005



U.S. Department of Transportation
Federal Highway Administration

Research, Development, and Technology
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, VA 22101-2296

2005



U.S. Department of Transportation
Federal Highway Administration



Guide for Improving
Pedestrian Safety
at Uncontrolled
Crossing Locations

2018

The Fabulous Five: STEP Countermeasures



Crosswalk Visibility Enhancements



Raised Crosswalk



Pedestrian Refuge Island



Pedestrian Hybrid Beacon (PHB)



Road Diet

Crosswalk Visibility Enhancements



W-11-2, W16-7P



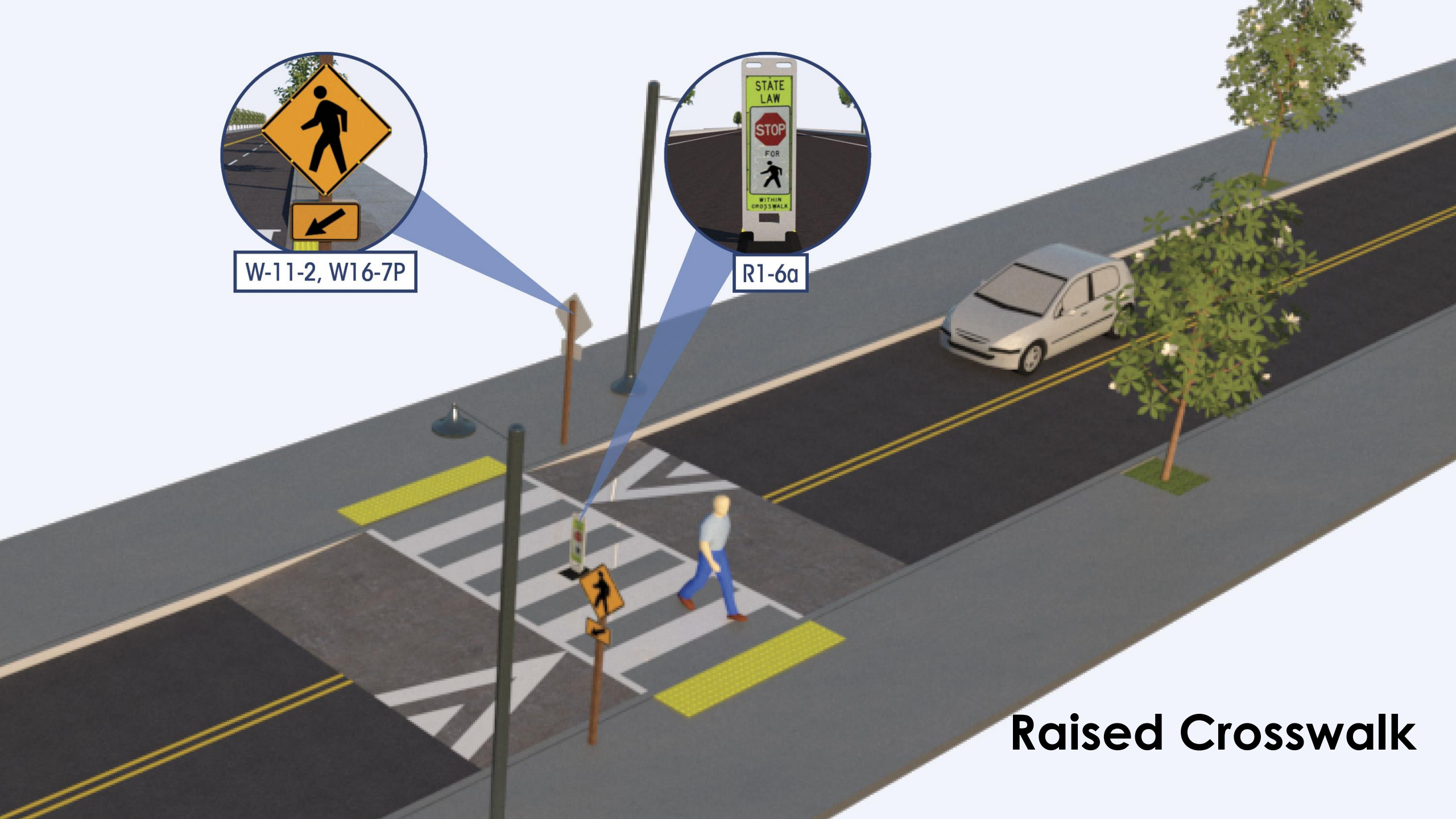
R1-6a



W-11-2, W16-7P



R1-6a



Raised Crosswalk



R1-6a



W-11-2, W16-7P

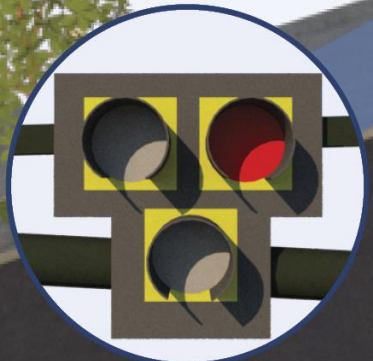


Refuge Island

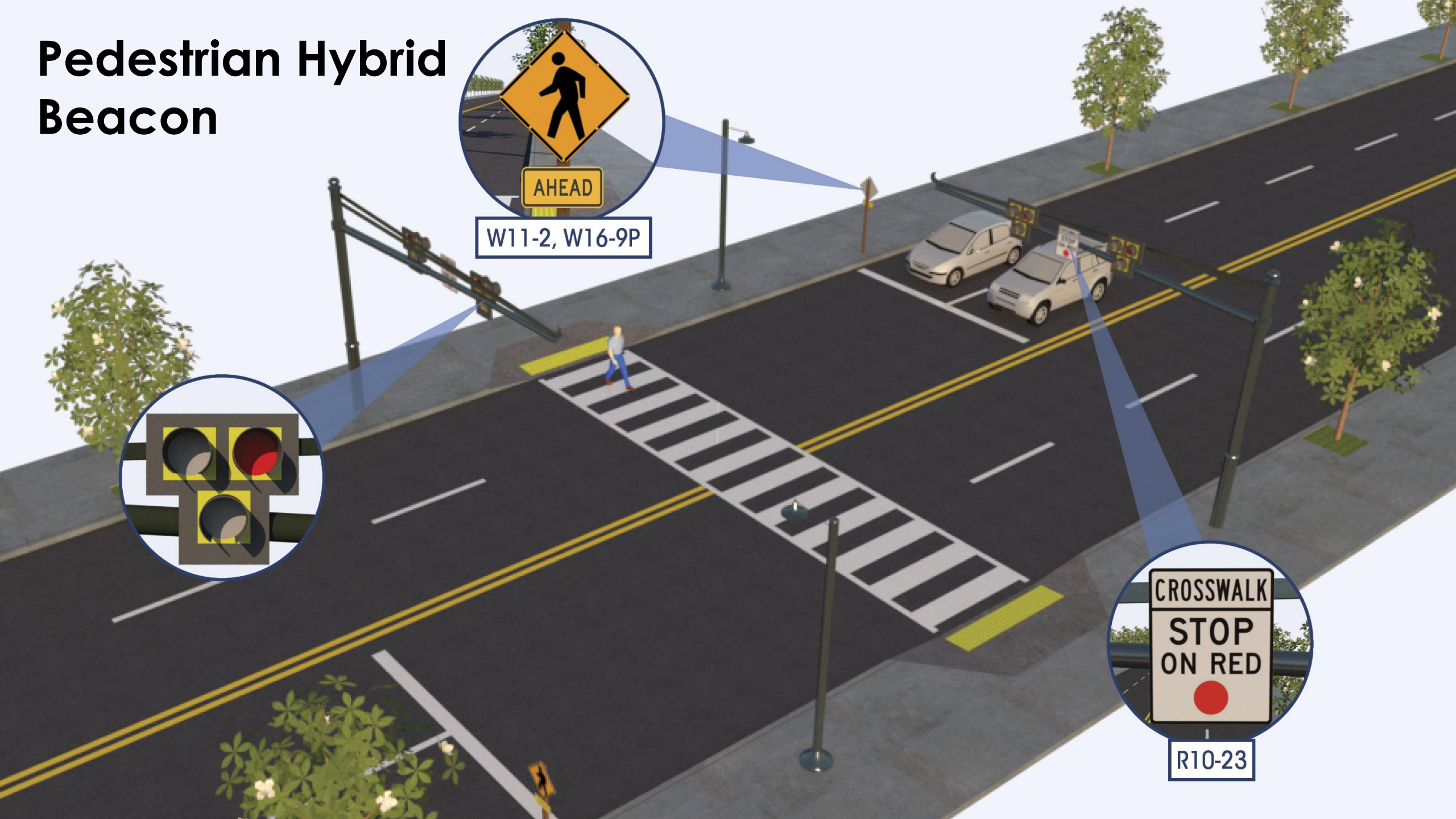
Pedestrian Hybrid Beacon

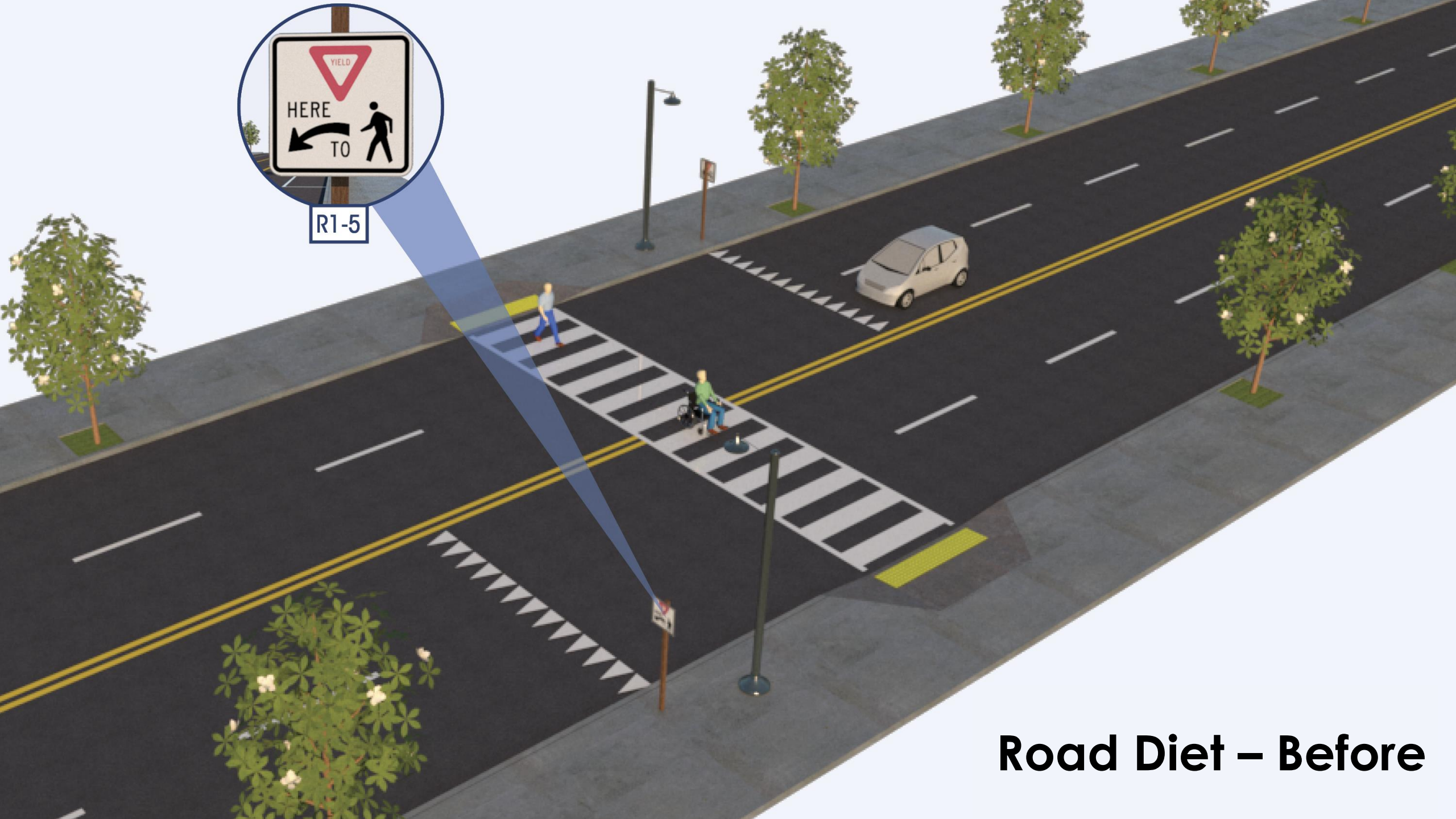


W11-2, W16-9P



R10-23





R1-5

Road Diet – Before



W-11-2, W16-7P

R1-6a

**Road Diet
After**

Pedestrian Hybrid Beacon (PHB)

SAFE TRANSPORTATION
FOR EVERY PEDESTRIAN
COUNTERMEASURE TECH SHEET



3 High speeds and multiple lanes of traffic create challenges for pedestrians crossing at unsignalized locations.

4 PHBs can warn and control traffic at unsignalized locations and assist pedestrians in crossing a street or highway at a marked crosswalk.

5 PHBs can reduce total crashes by **55%**

FEATURES:

- Beacons stop all lanes of traffic, which can reduce pedestrian crashes.

OFTEN USED WITH:

- High-visibility crosswalk markings
- Raised islands
- Advance STOP or YIELD signs and markings

6

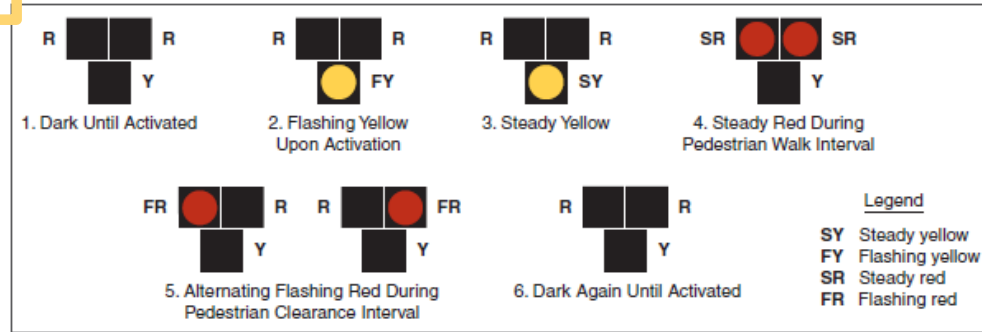
A Pedestrian Hybrid Beacon head consists of two red lenses above a single yellow lens. Unlike a traffic signal, the PHB rests in dark until a pedestrian activates it via pushbutton or other form of detection. When activated, the beacon displays a sequence of flashing and solid lights that indicate the pedestrian walk interval and when it is safe for drivers to proceed (see figure on back page).

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.

STEP Tech Sheets: Page 1

- 1 - Countermeasure Graphic
- 2 - Signage and Marking Guidance
- 3 - Related Safety Challenge
- 4 - Key Safety Benefits
- 5 - Crash Reduction Factor
- 6 - Complimentary Countermeasures & Design Features

1 Figure 4F-3. Sequence for a Pedestrian Hybrid Beacon from FHWA's *Manual on Uniform Traffic Control Devices*, 2009 Edition, p. 511



When a pedestrian activates a PHB, a flashing yellow light is followed by a solid yellow light, alerting drivers to slow. A solid red light requires drivers to stop while pedestrians have the right-of-way to cross the street. When the pedestrian signals display a flashing DON'T WALK indication, the overhead beacon flashes red, and drivers may proceed if the crosswalk is clear.

1 - Illustration or Photo

CONSIDERATIONS

PHBs are a candidate treatment for roads with three or more lanes that generally have annual average daily traffic (AADT) above 9,000. PHBs should be strongly considered for all midblock and intersection crossings where the roadway speed limits are equal to or greater than 40 miles per hour (mph). The PHB should meet the application guidelines provided in the *Manual on Uniform Traffic Control Devices* for existing or projected pedestrian volumes.

PHBs are intended for installation at midblock locations, but can be installed at intersections. They should only be installed

in conjunction with marked crosswalks and pedestrian countdown signals.

When PHBs are not in common use in a community, consider conducting an outreach effort to educate the public and law enforcement officers on the PHBs' purpose and use.

COST

The PHB is often less expensive than a full traffic signal installation. The costs range from \$21,000 to \$128,000, with an average per unit cost of \$57,680.

References

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.

Federal Highway Administration. (2013). "Pedestrian Hybrid Beacon" in PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System. Available: http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=53

Bushell, M., Poole, B., Zegeer, C., & Rodriguez, D. (2013). Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public. *Pedestrian and Bicycle Information Center*.

2 - Design Considerations

3 - Typical Costs

4 - Sources Cited



Safe Transportation for Every Pedestrian (STEP)

Cost-effective countermeasures with known safety benefits can help reduce pedestrian fatalities at uncontrolled crossing locations and un-signalized intersections.

Pedestrians account for over 17.5 percent of all fatalities in motor vehicle traffic crashes, and the majority of these deaths occur at uncontrolled crossing locations such as mid-block or un-signalized intersections. These are among the most common locations for pedestrian fatalities generally because of inadequate pedestrian *crossing facilities* and insufficient or inconvenient *crossing opportunities*, all of which create barriers to safe, convenient, and complete pedestrian networks.

Expecting pedestrians to travel significantly out of their way to cross a roadway to reach their destination is unrealistic and counterproductive to encouraging healthier transportation options. By focusing on uncontrolled locations, agencies can address a significant national safety problem and improve quality of life for pedestrians of all ages and abilities.

Pedestrian Safety Countermeasures

FHWA is promoting the following pedestrian safety countermeasures through the fourth round of Every Day Counts (EDC-4):

- **Road Diets** can reduce vehicle speeds and the number of lanes pedestrians cross, and they can create space to add new pedestrian facilities.
- **Pedestrian hybrid beacons (PHBs)** are a beneficial intermediate option between RRFBs and a full pedestrian signal. They provide positive stop control in areas without the high pedestrian traffic volumes that typically warrant signal installation.
- **Pedestrian refuge islands** allow pedestrians a safe place to stop at the midpoint of the roadway before crossing the remaining distance. This is particularly helpful for older pedestrians or others with limited mobility.
- **Raised crosswalks** can reduce vehicle speeds

Contacts

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Peter.Eun@dot.gov

Resources

Fact Sheet

STEP Tech Sheets

Guide to Improve Uncontrolled Crossings

- Pocket version
- Process Graphic

Webinars/Videos

STEP for Local Transportation Agencies

Resources

Fact Sheet

STEP Tech Sheets

Guide to Improve Uncontrolled Crossings

- Pocket version
- Process Graphic

Pedestrian Hybrid Beacon (PHB)

SAFE TRANSPORTATION FOR EVERY PEDESTRIAN
COUNTERMEASURE TECH SHEET

High speeds and multiple lanes of traffic challenges for pedestrians crossing at uncontrolled locations.

Warm and traffic at uncontrolled locations for pedestrians crossing a street or at a marked intersection.

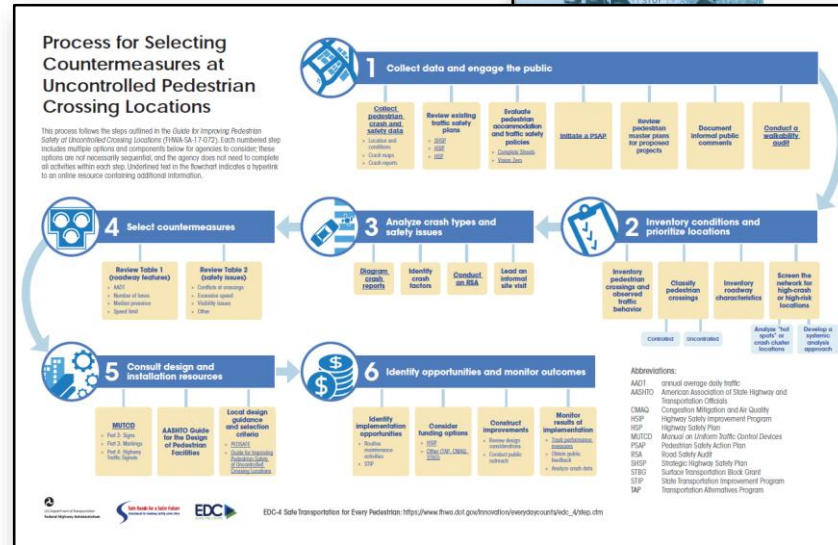


On all lanes of traffic can reduce crashes.

WITH: Pedestrian crossing facility crosswalk, Stop sign, Yield markings



Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations



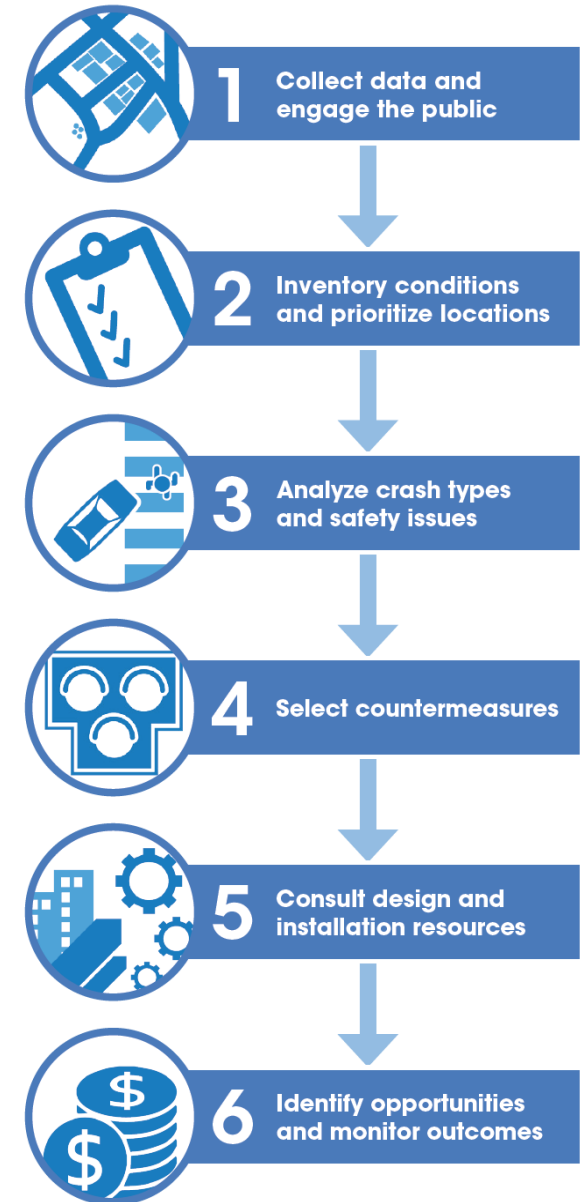
Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

January 2018

Follows a 6-step process

Guides the selection of countermeasures to improve pedestrian safety

Supported by a “Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations”

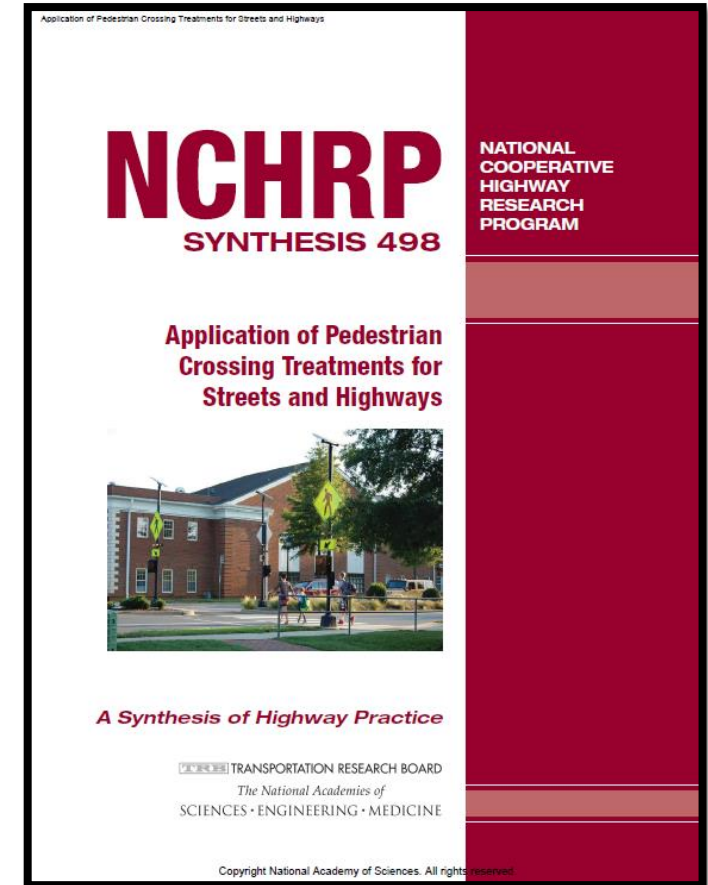


Resources Referenced

- Manual on Uniform Traffic Control Devices (MUTCD)
- Local and State agency countermeasure selection policies
- Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE)
- Crash Modification Factors (CMF) Clearinghouse
- National Cooperative Highway Research Program (NCHRP) and FHWA Reports

Recent Research Cited

- NCHRP Synthesis 498: *Application of Pedestrian Crossing Treatments for Streets and Highways*
- NCHRP Report 841: *Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments*



<http://www.trb.org/Publications/Blurbs/175419.aspx>



1

Collect data and
engage the public

- Collect pedestrian crash and safety data
- Evaluate pedestrian accommodation policies
- Initiate a Pedestrian Safety Action Plan
- Review pedestrian and traffic safety plans
- Conduct a walkability audit



2 Inventory conditions and prioritize locations

- Inventory pedestrian crossings and observed traffic behavior
- Classify pedestrian crossings: controlled vs uncontrolled
- Inventory roadway characteristics
- Screen the network for high-crash or high-risk locations



3 Analyze crash types and safety issues

- Diagram crash reports
- Identify crash factors
- Lead an informal site visit
- Conduct an Road Safety Audit

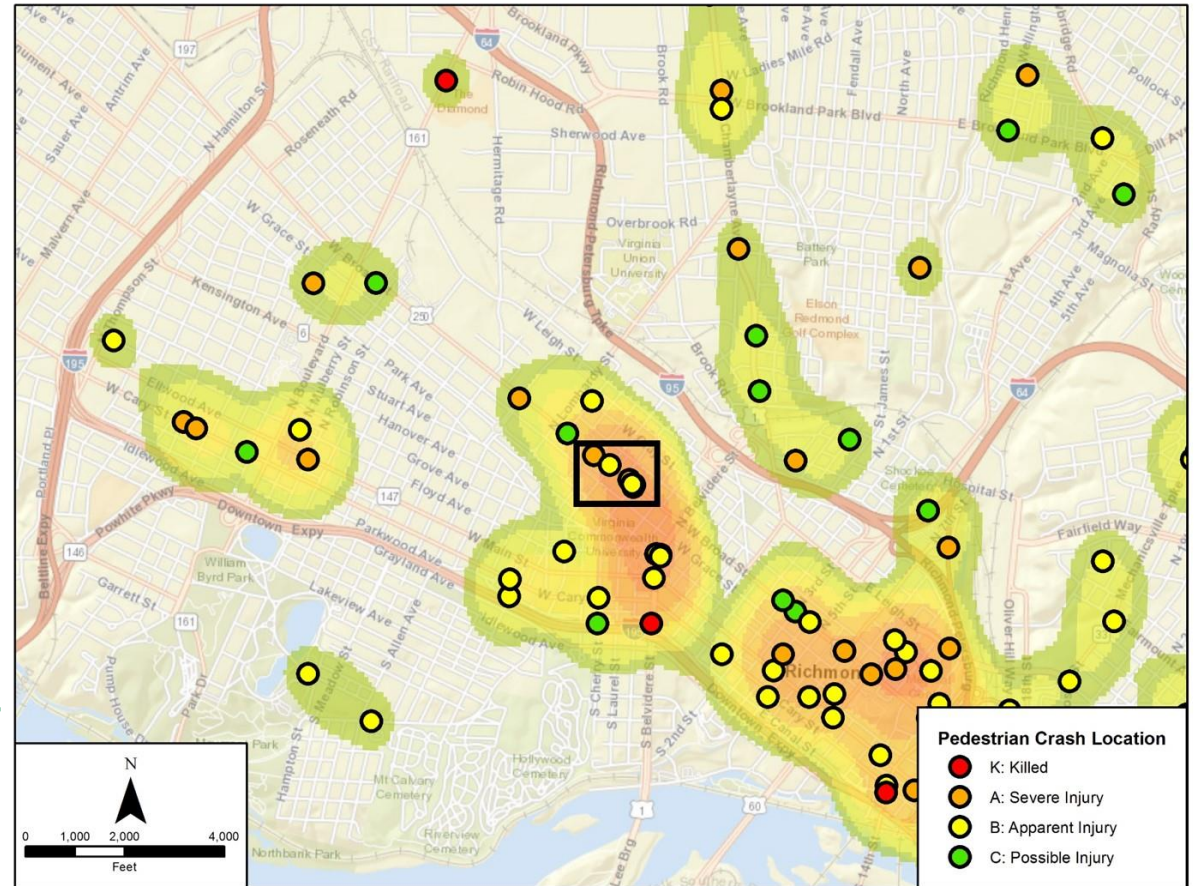


Image Source: VDOT

2005 Zegeer Study

“Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations: Final Report and Recommended Guidelines”

<https://www.fhwa.dot.gov/publications/research/safety/04100/04100.pdf>

Table 11. Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations.*

| Roadway Type (Number of Travel Lanes and Median Type) | Vehicle ADT ≤ 9,000 | | | Vehicle ADT >9,000 to 12,000 | | | Vehicle ADT >12,000–15,000 | | | Vehicle ADT > 15,000 | | |
|---|--------------------------------|------------------------------|------------------------------|---------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------|------------------------------|
| | Speed Limit** | | | | | | | | | | | |
| | ≤ 48.3 km/h (30 mi/h) | 56.4 km/h (35 mi/h) | 64.4 km/h (40 mi/h) | ≤ 48.3 km/h (30 mi/h) | 56.4 km/h (35 mi/h) | 64.4 km/h (40 mi/h) | ≤ 48.3 km/h (30 mi/h) | 56.4 km/h (35 mi/h) | 64.4 km/h (40 mi/h) | ≤ 48.3 km/h (30 mi/h) | 56.4 km/h (35 mi/h) | 64.4 km/h (40 mi/h) |
| Two lanes | C | C | P | C | C | P | C | C | N | C | P | N |
| Three lanes | C | C | P | C | P | P | P | P | N | P | N | N |
| Multilane (four or more lanes) with raised median*** | C | C | P | C | P | N | P | P | N | N | N | N |
| Multilane (four or more lanes) without raised median | C | P | N | P | P | N | N | N | N | N | N | N |



4 Select countermeasures

| Roadway Configuration | Speed Limit | | | | | | | | |
|------------------------------|---------------------|----------------|----------------|---------------------------|--------------|--------------|----------------------|----------------|----------------|
| | ≤30 mph | | | 35 mph | | | ≥40 mph | | |
| | Vehicle AADT <9,000 | | | Vehicle AADT 9,000–15,000 | | | Vehicle AADT >15,000 | | |
| 2 lanes* | 1 2 3 4 5 6 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 |
| 3 lanes with raised median* | 1 2 3 4 5 | 1 3 5 7 | 1 3 5 7 | 1 3 4 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 4 5 7 | 1 3 5 7 | 1 3 5 7 |
| 3 lanes w/o raised median† | 1 2 3 4 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 |
| 4+ lanes with raised median‡ | 1 3 5 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 |
| 4+ lanes w/o raised median‡ | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 |

Given the set of conditions in a cell,


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 the countermeasure is a candidate treatment at a marked uncontrolled crossing location.

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 restriction on crosswalk approach, adequate nighttime lighting levels
- 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 Pedestrian Hybrid Beacon
- 8 Road Diet

Table 1: Application of Pedestrian Crash Countermeasures by Roadway Feature

| 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 |  |  |  | |  |

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

Table 2: Safety Issues Addressed per Countermeasure

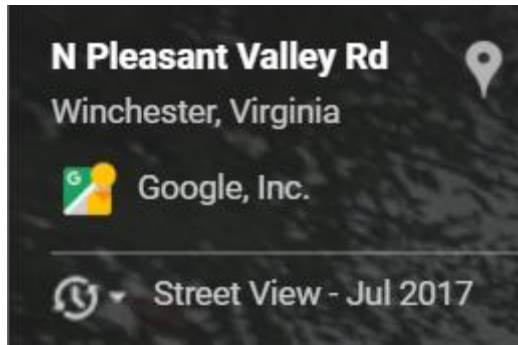
Example #1

Crash History & Safety Issues

- 2 out of 5 crashes involved improper or illegal action by the driver.
- 3 out of 5 crashes occurred during the daylight.

Roadway Conditions

- 35 mph speed limit on main corridor
- 19,000 AADT
- 4-lane, undivided roadway



| Roadway Configuration | Speed Limit | | | | | | | | |
|------------------------------|---------------------|----------------|----------------|---------------------------|----------------|----------------|----------------------|----------------|----------------|
| | ≤30 mph | | | 35 mph | | | ≥40 mph | | |
| | ≤30 mph | 35 mph | ≥40 mph | ≤30 mph | 35 mph | ≥40 mph | ≤30 mph | 35 mph | ≥40 mph |
| | Vehicle AADT <9,000 | | | Vehicle AADT 9,000–15,000 | | | Vehicle AADT >15,000 | | |
| 2 lanes* | 1 2 3 4 5 6 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 |
| 3 lanes with raised median* | 1 2 3 4 5 | 1 3 5 7 | 1 3 5 7 | 1 3 4 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 4 5 7 | 1 3 5 7 | 1 3 5 7 |
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| 4+ lanes with raised median‡ | 1 3 5 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 |
| 4+ lanes w/o raised median‡ | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 |

*One lane in each direction

†One lane in each direction with two-way left-turn lane

‡Two or more lanes in each direction

Given the set of conditions in a cell,








































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This table was developed using information from: Zegeer, C. V., Stewart, J. R., Huang, H. H., Lagerwey, P. A., Feaganes, J., & Campbell, B. J. (2005), Safety effects of marked versus unmarked crosswalks at uncontrolled locations: Final report and recommended guidelines (No. FHWA-HRT-04-100); Manual on Uniform Traffic Control Devices, 2009 Edition, Chapter 4F. Pedestrian Hybrid Beacons; the Crash Modification Factors (CMF) Clearinghouse website (<http://www.cmfclearinghouse.org/>); and the Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE) website (<http://www.pedbikesafe.org/PEDSAFE/>).

| Pedestrian Crash Countermeasure for Uncontrolled Crossings | Safety Issue Addressed | | | | |
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| 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 |  |  |  | |  |

*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 Options

- High visibility crosswalks
- Advance stop/yield signage
- Pedestrian refuge island
- Pedestrian Hybrid Beacon



N Pleasant Valley Rd

Winchester, Virginia

Google, Inc.

Street View - Jul 2017

Image capture: Jul 2017 © 2018 G

Example #2

Crash History & Safety Issues

- 3 out of 6 crashes involved improper or illegal action by the driver.
- 3 out of 6 crashes occurred during daylight hours.

Roadway Conditions

- 2 travel lanes, undivided roadways
- 25 mph speed limit
- 7,500 AADT



Roanoke, Virginia

 Google, Inc.

 Street View - Jun 2017

Image capture: Jun 2017

© 2018 Google

United States

[Terms](#)

| Roadway Configuration | Speed Limit | | | | | | | | |
|------------------------------|---------------------|----------------|----------------|---------------------------|----------------|----------------|----------------------|----------------|----------------|
| | ≤30 mph | | | 35 mph | | | ≥40 mph | | |
| | ≤30 mph | 35 mph | ≥40 mph | ≤30 mph | 35 mph | ≥40 mph | ≤30 mph | 35 mph | ≥40 mph |
| | Vehicle AADT <9,000 | | | Vehicle AADT 9,000–15,000 | | | Vehicle AADT >15,000 | | |
| 2 lanes* | 1 2 3 4 5 6 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 |
| 3 lanes with raised median* | 1 2 3 4 5 | 1 3 5 7 | 1 3 5 7 | 1 3 4 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 4 5 7 | 1 3 5 7 | 1 3 5 7 |
| 3 lanes w/o raised median† | 1 2 3 4 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 | 1 3 4 5 6 7 | 1 3 5 6 7 | 1 3 5 6 7 |
| 4+ lanes with raised median‡ | 1 3 5 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 | 1 3 5 7 |
| 4+ lanes w/o raised median‡ | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 | 1 3 5 6 7 8 |

*One lane in each direction

†One lane in each direction with two-way left-turn lane

‡Two or more lanes in each direction

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- 8 Road Diet

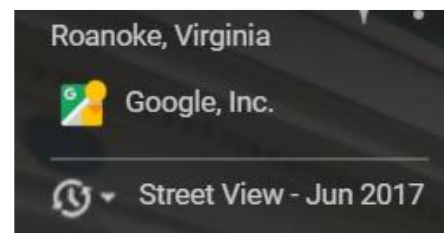
This table was developed using information from: Zegeer, C. V., Stewart, J. R., Huang, H. H., Lagerwey, P. A., Feaganes, J., & Campbell, B. J. (2005), Safety effects of marked versus unmarked crosswalks at uncontrolled locations: Final report and recommended guidelines (No. FHWA-HRT-04-100); Manual on Uniform Traffic Control Devices, 2009 Edition, Chapter 4F. Pedestrian Hybrid Beacons; the Crash Modification Factors (CMF) Clearinghouse website (<http://www.cmfclearinghouse.org/>); and the Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE) website (<http://www.pedbikesafe.org/PEDSAFE/>).

| 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 |  |  |  | |  |

*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 Options

- High visibility crosswalks
- Advance stop/yield signs
- In-Street Yield signs
- Raised crosswalks
- Curb extensions
- Parking restrictions





5 Consult design and installation resources

- Manual on Uniform Traffic Control Devices (MUTCD)
- AASHTO Guide for the Design of Pedestrian Facilities
- Local design guidance and selection criteria



Pedestrian Hybrid Beacon



6

Identify opportunities
and monitor outcomes

- Construct improvements
- Monitor results of implementation
- Consider funding options
- Identify implementation opportunities



Raised Crosswalk

Safety Research Terms

Crash Modification Factor (CMF)

A multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure. If available, calibrated or locally developed State estimates may provide a better estimate of effects for the State. (Crash Modification Factors Clearinghouse.)

Crash Reduction Factor (CRF)

The percentage crash reduction that might be expected after implementing a given countermeasure at a specific site.

[CMF Clearinghouse http://www.cmfclearinghouse.org/](http://www.cmfclearinghouse.org/)

CRF and CMF Summary Table

| Countermeasure | CRF | CMF | Basis | Reference |
|---|-----|------|---------------------------------|--------------------------|
| Crosswalk visibility enhancement ¹ | — | — | — | — |
| Advance STOP/YIELD signs and markings | 25% | 0.75 | Pedestrian crashes ² | Zegeer, et. al. 2017 |
| Add overhead lighting | 23% | 0.77 | Total injury crashes | Harkey, et. al. 2008 |
| High-visibility marking ³ | 48% | 0.52 | Pedestrian crashes | Chen, et. al., 2012 |
| High-visibility markings (school zone) ³ | 37% | 0.63 | Pedestrian crashes | Feldman, et. al. 2010 |
| Parking restriction on crosswalk approach | 30% | 0.70 | Pedestrian crashes | Gan, et. al., 2005 |
| In-street Pedestrian Crossing sign | UNK | UNK | N/A | N/A |
| Curb extension | UNK | UNK | N/A | N/A |
| Raised crosswalk (speed tables) | 45% | 0.55 | Pedestrian crashes | Elvik, et. al., 2004 |
| | 30% | 0.70 | Vehicle crashes | |
| Pedestrian refuge island | 32% | 0.68 | Pedestrian crashes | Zegeer, et. al., 2017 |
| PHB | 55% | 0.45 | Pedestrian crashes | Zegeer, et. al., 2017 |
| Road Diet – Urban area | 19% | 0.81 | Total crashes | Pawlovich, et. al., 2006 |
| Road Diet – Suburban area | 47% | 0.53 | Total crashes | Persaud, et. al., 2010 |

¹This category of countermeasure includes treatments which may improve the visibility between the motorist and the crossing pedestrian.

²Refers to pedestrian street crossing crashes, and does not include pedestrians walking along the road crashes or “unusual” crash types.

³The effects of high-visibility pavement markings (e.g., ladder, continental crosswalk markings) in the “after” period is compared to pedestrian crashes with parallel line markings in the “before” period.

Field Guide

Sample Inventory Form

Worksheets for each countermeasure:

- Definition
- Roadway conditions checklist
- Safety issues checklist
- Installation guidelines and MUTCD references

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)



Technical Assistance Offered through STEP

Case Studies

Informational Videos

Action Plan Meetings

Webinars and Workshops (Spring 2018)

Road Safety Audits



U.S. Department of Transportation
Federal Highway Administration



FHWA EVERY DAY COUNTS 4 / STEP

For Additional Information Contact:

https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm

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⇒ **Archive at www.pedbikeinfo.org/webinars**