



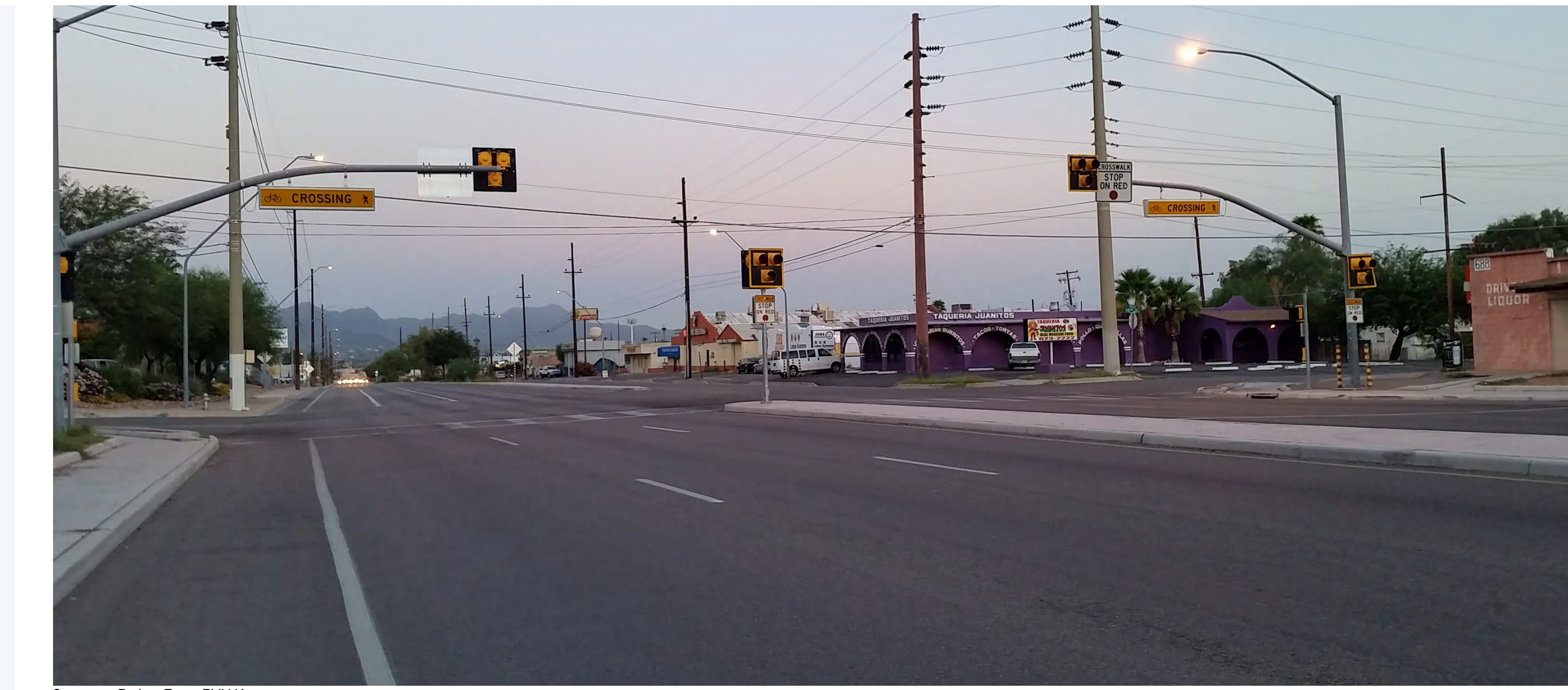
Safe Transportation for Every Pedestrian

Pedestrians accounted for **17%** of all roadway fatalities in the US in 2018.¹

74% of pedestrian fatalities occurred at non-intersection locations.¹

Pedestrian fatalities are on the rise compared to all traffic fatalities. To reduce pedestrian fatalities, the Federal Highway Administration (FHWA) is making an effort to reduce pedestrian fatalities and injuries at uncontrolled crossing locations through Safe Transportation for Every Pedestrian (STEP). FHWA's actions through the STEP program also promote Vision Zero efforts. Vision Zero aims to eliminate traffic fatalities by improving safety across all transportation systems. Vision Zero uses a Safe Systems approach, believing that humans make mistakes, and roadways should be designed in a way so that if a crash occurs as a result of these mistakes it would not result in a fatality. Additionally, Safe Systems encourages shared responsibility between roadway designers and users. Safe designs can promote safe behaviors.

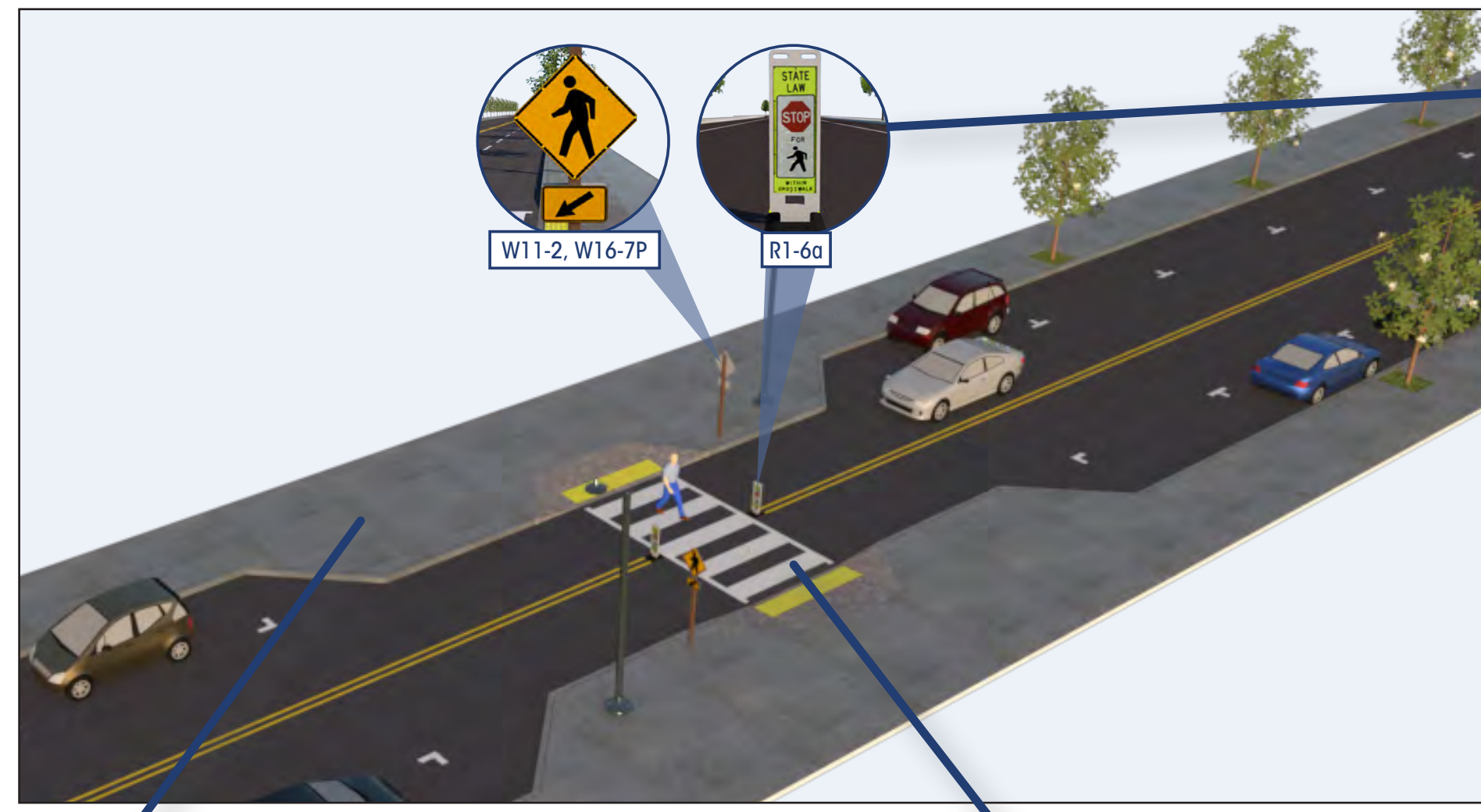
Most of the STEP countermeasures have been evaluated for their effectiveness to reduce pedestrian crash rates, which supports the Vision Zero approach. The Crash Reduction Factor (CRF) is reported for each countermeasure below, based on national transportation safety studies. The CRF is the expected percent reduction in the number of pedestrian crashes after implementing a countermeasure. CRFs on this poster are presented in terms of total crashes unless otherwise indicated. Please consult PEDSAFE, the Pedestrian Safety Guide and Countermeasure Selection System (<http://www.pedbikesafe.org>), for more information about CRFs and guidance for application of these countermeasures to various roadway and safety conditions.



Source: Peter Eun, FHWA

Proven Countermeasures

CROSSWALK VISIBILITY ENHANCEMENTS

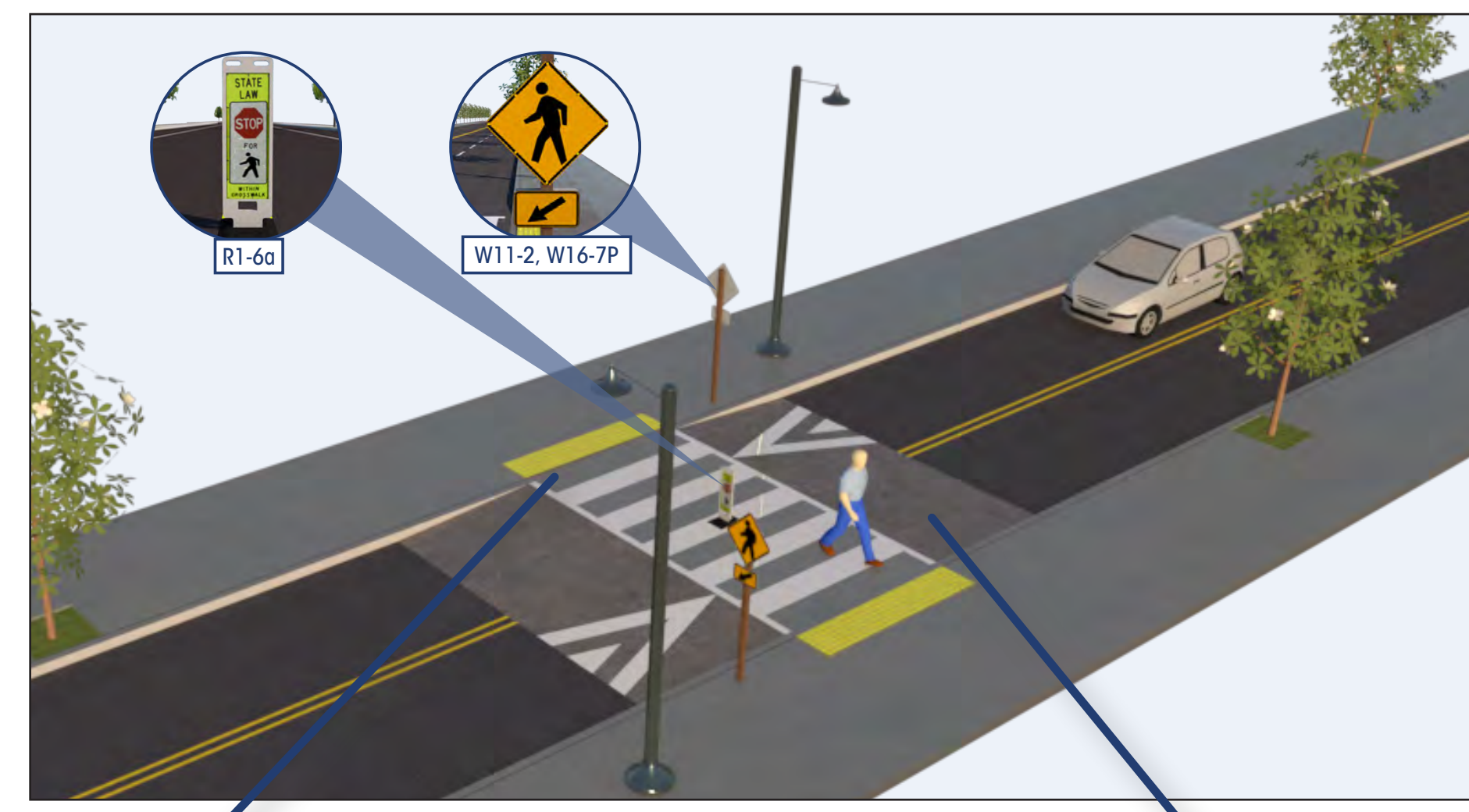


IN-STREET STOP OR YIELD SIGNS may improve driver yielding rates.

CURB EXTENSION visually narrows the travel lane, improves sight distance between drivers and pedestrians, and reduces the amount of time pedestrians are in the roadway.

HIGH-VISIBILITY MARKING improves visibility of the crosswalk, compared to the standard parallel lines.

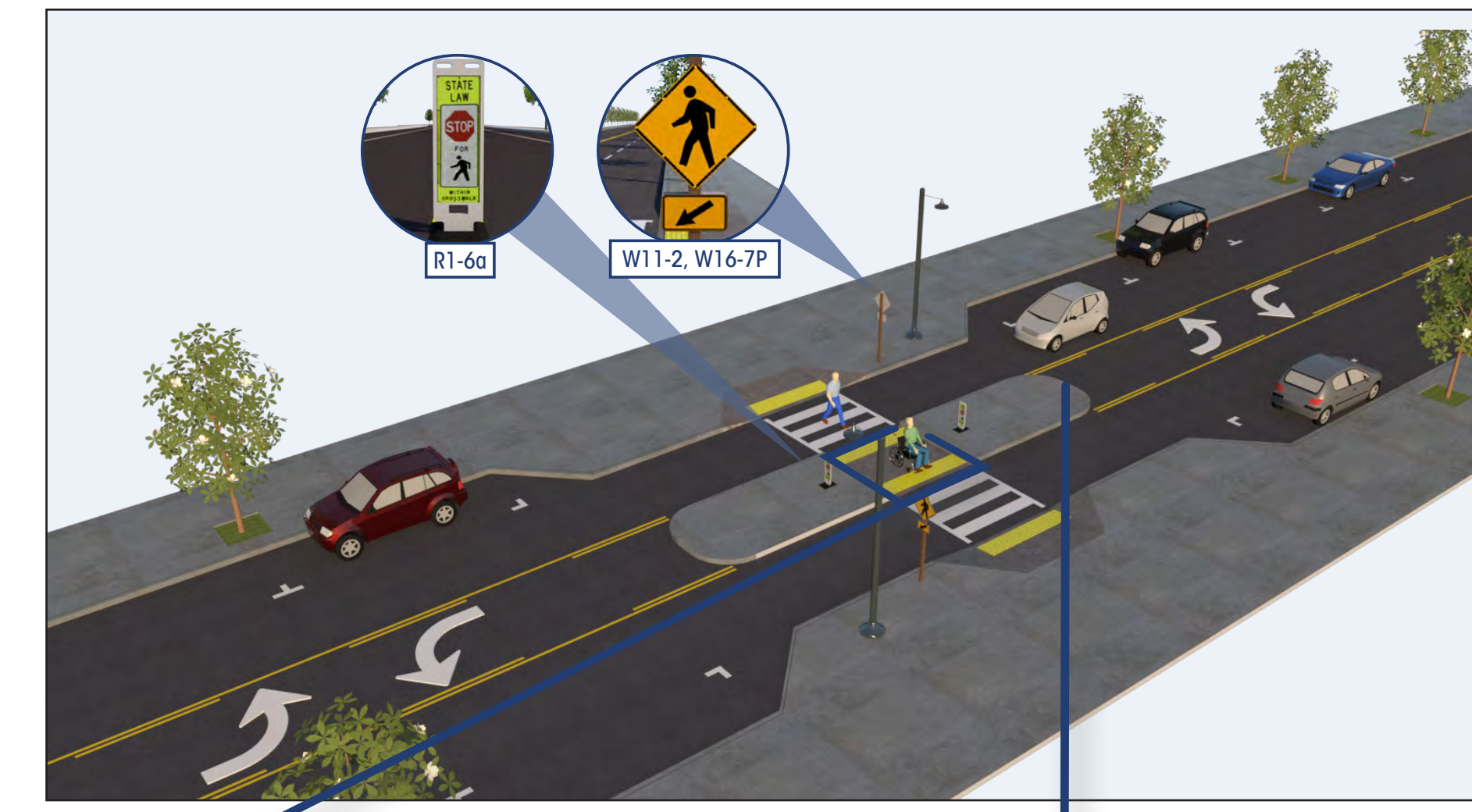
RAISED CROSSWALK



ELEVATED CROSSING makes the pedestrian more prominent in the driver's field of vision, and allows pedestrians to cross at grade with the sidewalk.

APPROACH RAMPs may reduce vehicle speeds and improve motorist yielding.

PEDESTRIAN REFUGE ISLAND



REFUGE AREA breaks up a complex crossing into two shorter pieces, providing a place to rest and reducing the amount of time a pedestrian is in the roadway.

MEDIAN can enhance visibility of the pedestrian crossing and reduce speed of approaching vehicles.

CROSSWALK VISIBILITY ENHANCEMENTS

CRF (see notes): **23-48%**²⁻⁷

Crosswalk visibility enhancements are added features that increase the prominence of crosswalks and pedestrians to oncoming drivers, such as lighting, warning signage, or varied crosswalk markings. Common examples include using a ladder design for the crosswalk markings (instead of two parallel lines) and installing in-street warning signage.

RAISED CROSSWALK

CRF (ped. crashes): **45%**⁸

Raised crosswalks span the width of a roadway at a crossing point, often at mid-block crossings. These raised speed tables calm vehicular traffic and create a level crossing at sidewalk height for pedestrians.

PEDESTRIAN REFUGE ISLAND

CRF (ped. crashes): **32%**³

Pedestrian refuge islands are islands within a street, located at intersections or mid-block crossings. Pedestrian refuge islands break up a complex crossing into two shorter crossings and separate motor vehicle and pedestrian crossing movements.

PEDESTRIAN HYBRID BEACON



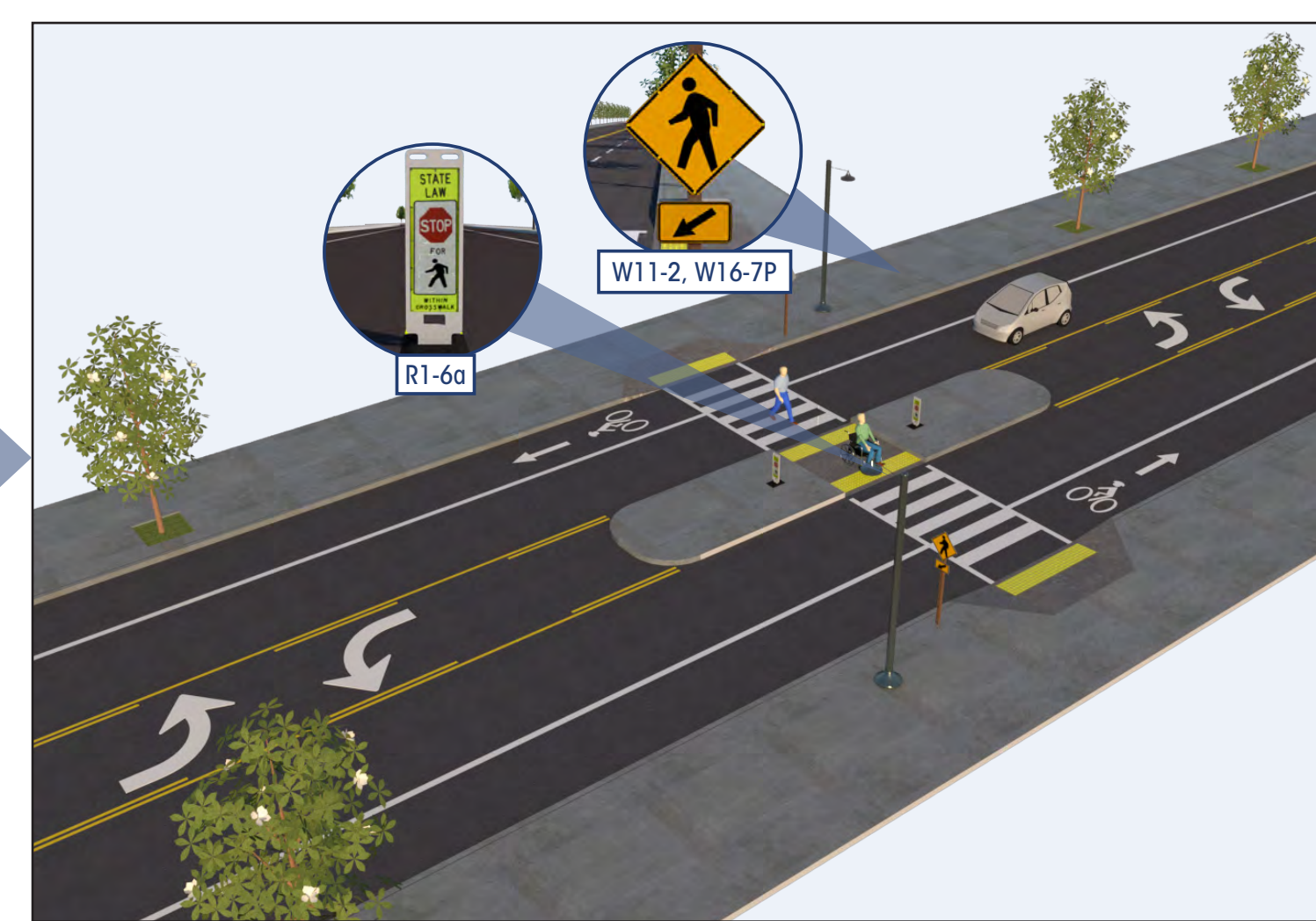
A **PEDESTRIAN HYBRID BEACON** is a traffic control device that stops all lanes of traffic, which can reduce pedestrian crashes.

ADVANCE YIELD OR STOP MARKINGS & SIGNS increase motorist yielding while reducing risk of a multiple-threat crash.

ROAD DIET—BEFORE



ROAD DIET—AFTER



ROAD DIETS narrow travel lane widths or reconfigure travel lanes, typically from a 4-to-3 lane cross section, to reduce pedestrian crossing distances and provide options for bicycle lanes or on-street parking.

PEDESTRIAN HYBRID BEACON (PHB)

CRF (ped. crashes): **55%**³

PHBs are pedestrian-activated warning devices designed for higher speed, multilane roadways. PHBs are typically installed at the side of the road or on most arms over uncontrolled midblock pedestrian crossings. When activated, the device displays a sequence of flashing yellow, steady yellow, solid red (pedestrians get a walk symbol; drivers must stop), and flashing red (pedestrians finish crossing; drivers stop and proceed once the roadway is clear).

ROAD DIET

CRF (total crashes): **19-47%**^{9,10,11}

Road Diets reconfigure the roadway to improve safety for all users. The most common type of Road Diet involves converting a four-lane, undivided roadway to two through lanes and a center two-way left-turn lane. This new configuration may include pedestrian refuge islands, curb extensions, sidewalks, or other features to improve conditions for pedestrians.

RECTANGULAR RAPID-FLASHING BEACON



LIGHTING illuminates the front of the pedestrian and avoids creating a silhouette.

TRAIL CROSSINGS are made more visible by RRFBs when coupled with crosswalk visibility enhancements and a refuge island. The PHB should be considered as an option to the RRFB along highways with high traffic volumes or speeds.

LEADING PEDESTRIAN INTERVAL



LEADING PEDESTRIAN INTERVAL is programmed into the WALK signal to give pedestrians a head start in the crosswalk, which can reduce conflicts with vehicles.

Illustrations not to scale

RECTANGULAR RAPID-FLASHING BEACON (RRFB)

CRF (ped. crashes): **47%**¹²

RRFBs are pedestrian-actuated conspicuity enhancements to improve safety at uncontrolled crossing locations. The device includes two rectangular-shaped yellow indications, each with an LED-array-based light source, that flash with high frequency and are used in tandem with a pedestrian crossing warning sign. RRFBs are installed on both sides of the roadway at the crosswalk, or on the right side and median (instead of the left side) of median-divided roadways. The flashing pattern is pedestrian-actuated by pushbuttons or automated detection and is unlit when not activated.

LEADING PEDESTRIAN INTERVAL (LPI)

CRF (ped. crashes): **13%**¹²

LPIs provide pedestrians a 3 to 7 second head start in a crosswalk during the WALK signal. Programmed into traffic signals, LPIs help reduce the number of conflicts between pedestrians and turning vehicles.



U.S. Department of Transportation
Federal Highway Administration



For more information contact:

Becky Crowe
FHWA Office of Safety
202-507-3699

Chimai Ngo
FHWA Office of Safety
202-366-1231

References:

- ¹NHTSA query (January 2020). <https://fdm.doi.gov/query>
- ²CRFs for each countermeasure component are as follows: Advance STOP or YIELD markings and signs: pedestrian crashes, 25%; High-visibility crosswalk markings: pedestrian crashes, 48%; Parking restrictions on crosswalk approaches: total crashes, 30%. The addition of overhead lighting: total injury crashes, 23%.
- ³Zogger, C., R. Srivastava, B. Lee, D. Carter, S. Smith, C. Svardstrom, N.J. Threlk, J. Zogger, C. Lyon, E. Ferguson, and R. Van Houten. (NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. NCHRP Transportation Research Board, Washington, DC, 2017.
- ⁴Hanley, D.L., R. Srivastava, J. Bank, F. Council, K. Eccles, N. Laffer, F. Grass, B. Persaud, C. Lyon, E. Hauer, and J. Bunneson. NCHRP Report 617: Accident Modification Factors for Traffic Engineering and ITS Improvements. NCHRP Transportation Research Board, Washington, DC, 2008.
- ⁵Chen, L., C. Chen, R. Ewing, C.E. Mouty, R. Srivastava, and M. Rose. "Safety Countermeasures and Crash Reduction in New York City—Experience and Lessons Learned." Accident Analysis and Prevention, 2012.
- ⁶Feldman, M., J. Marz, and M. Mitman. "An Empirical Bayesian Evaluation of the Safety Effects of High-Visibility School (Yellow) Crosswalks in San Francisco, California."

- ⁷Transportation Research Board. Journal of the Transportation Research Board, No. 2198. Transportation Research Board, Washington, D.C., 2010, pp. 6-14.
- ⁸Gan, A., J. Shen, and A. Rodriguez. "Update of Florida Crash Reduction Factors and Countermeasures to Improve the Development of District Safety Improvement Projects." Final report. Florida Department of Transportation, Tallahassee, FL, 2005.
- ⁹Evik, R., P. Christensen, and A. Amundsen. "Speed and Road Accidents: An Evaluation of the Power Model." Transportøkonomisk institutt, Oslo, Norway, 2004.
- ¹⁰CRF is 19% for urban areas (Pawlovich et al.) and 47% for suburban areas (Persaud et al.).
- ¹¹Threlk, N.J., D. Lyon, A. Campbell, and T. Welch. "New's Experience with Road Diet Measures—Use of Bayesian Approach to Assess Impacts on Crash Frequencies and Crash Rates." Transportation Research Board. Journal of the Transportation Research Board, No. 1953. Transportation Research Board, Washington, D.C., 2006.
- ¹²Persaud, B., B. Lee, C. Lyon, and B. Bhim. "Comparison of empirical Bayes and full Bayes approaches for before-after road safety evaluations." Accident Analysis & Prevention, Volume 42, Issue 1, 2010, pp. 38-43.
- ¹³Boughroos, E., Carter, D., Lyon, C., Persaud, B., Lee, B., Chen, P., Spitzer, K. "Safety Evaluation of Protected Left Turn Phasing and Leading Pedestrian Intervals on Pedestrian Safety." Federal Highway Administration, Report No. FHWA-HRT-18-044, Washington, D.C., 2018.