

STEP Safe Transportation for Every Pedestrian



Guidance for Improving Pedestrian Safety at Uncontrolled Crossings



U.S. Department of Transportation
Federal Highway Administration



“On average, a pedestrian was killed nearly every 1.5 hours in traffic crashes in 2016.” NHTSA

Source: North Carolina Vision Zero, ncvisionzero.org



72% of pedestrian fatalities occur at non-intersection locations

16% of traffic fatalities are pedestrians

Pedestrian Networks

Interconnected
pedestrian
transportation facilities
that allow people of all
ages and abilities to
safely and
conveniently get
where they want to go.

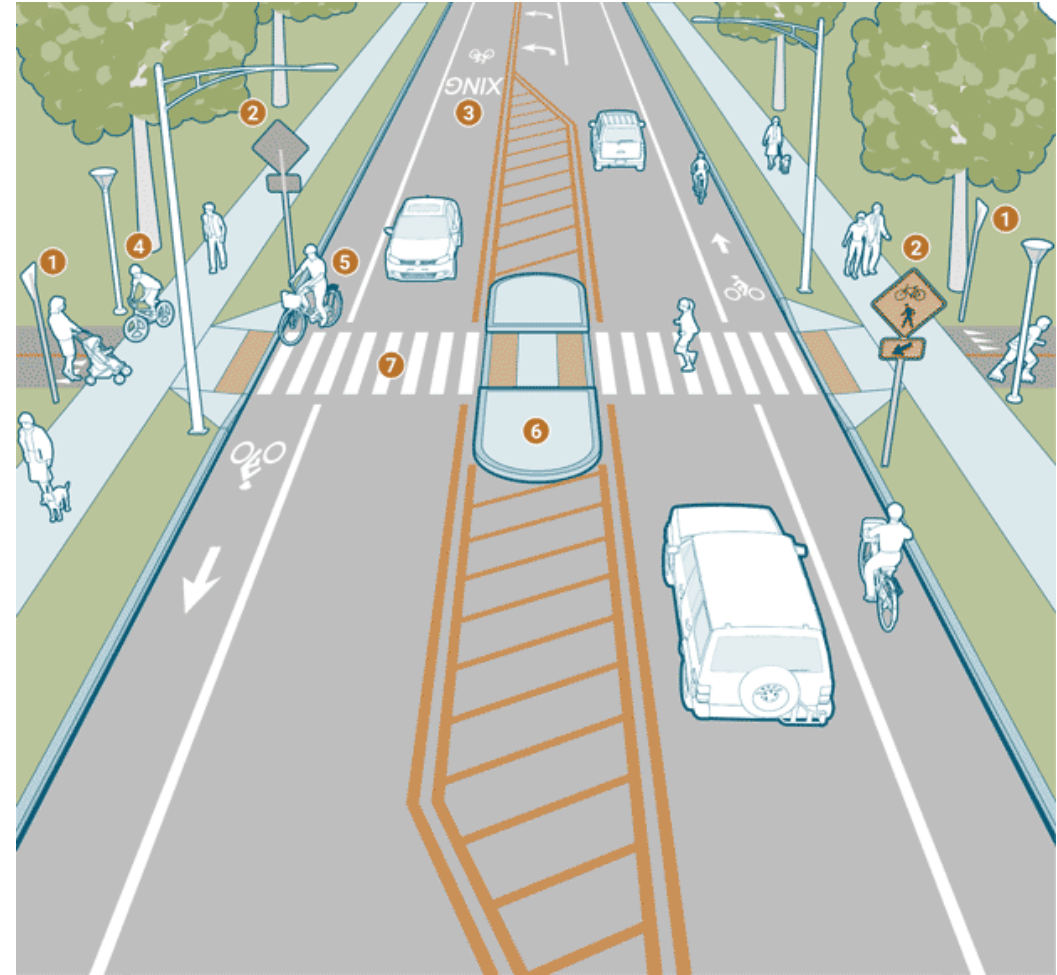


Image Source: FHWA *Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts*



Planning for Crosswalks



Common Crosswalk Myths

MYTH: There is an MUTCD pedestrian volume warrant for marked crosswalks.

REALITY: There is no pedestrian volume requirement to mark a crosswalk in the MUTCD.

MYTH: Research supports the removal of crosswalks.

REALITY: Marked crosswalks should not be removed without a plan for improving safety.

MYTH: Not marking a crosswalk is safer than marking a crosswalk.

REALITY: Pedestrians can be expected to cross most types of roadways, with or without marked crosswalks. Research demonstrates that marked crosswalks alone along high-volume or high-speed roadways are generally not sufficient to improve pedestrian safety.

The Spectacular Six

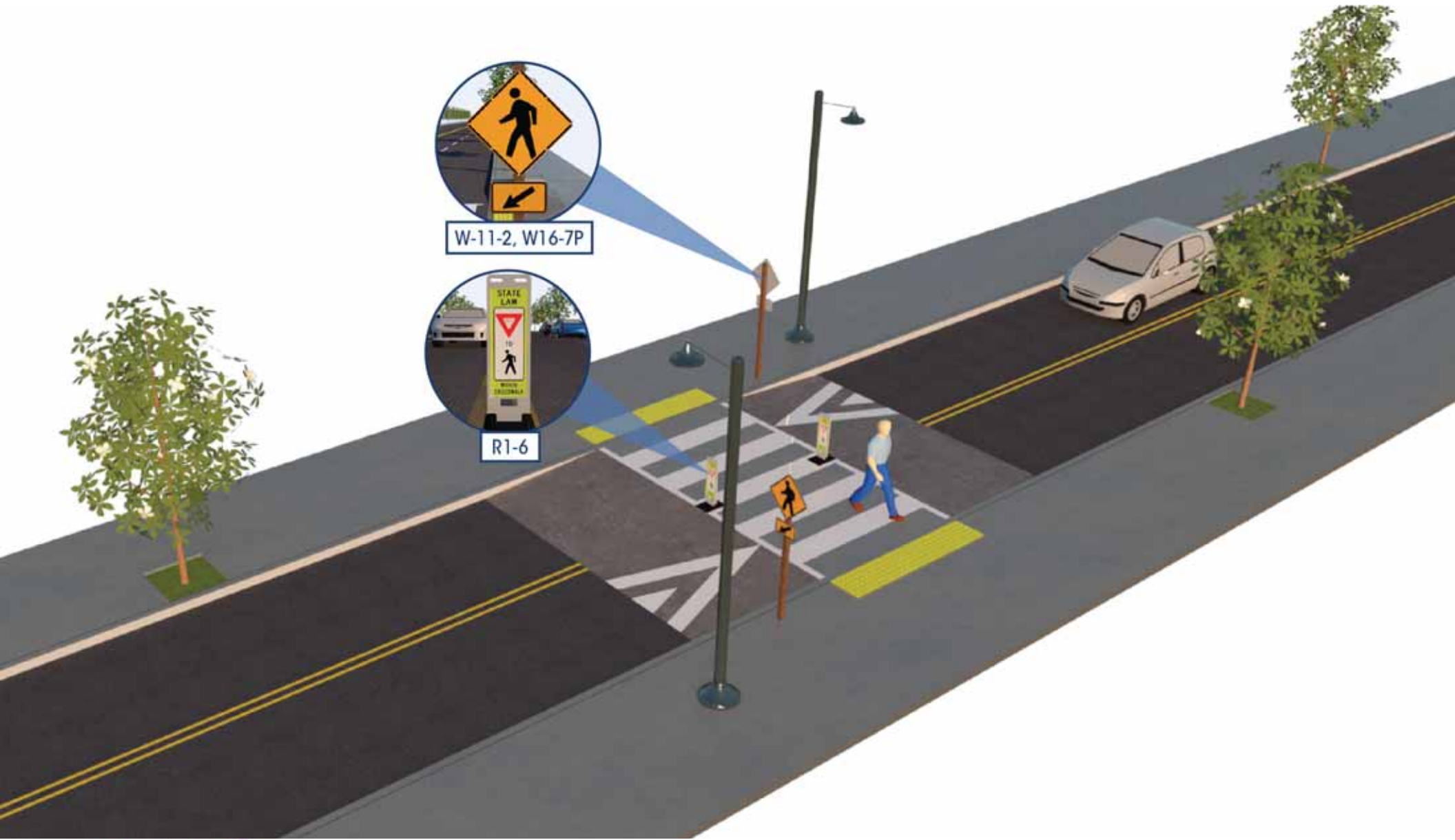
- Crosswalk Visibility Enhancements
- Raised Crosswalks
- Pedestrian Refuge Island
- RRFB
- PHB
- Road Diets



Crosswalk Visibility Enhancements



Raised Crosswalks



Pedestrian Refuge Islands



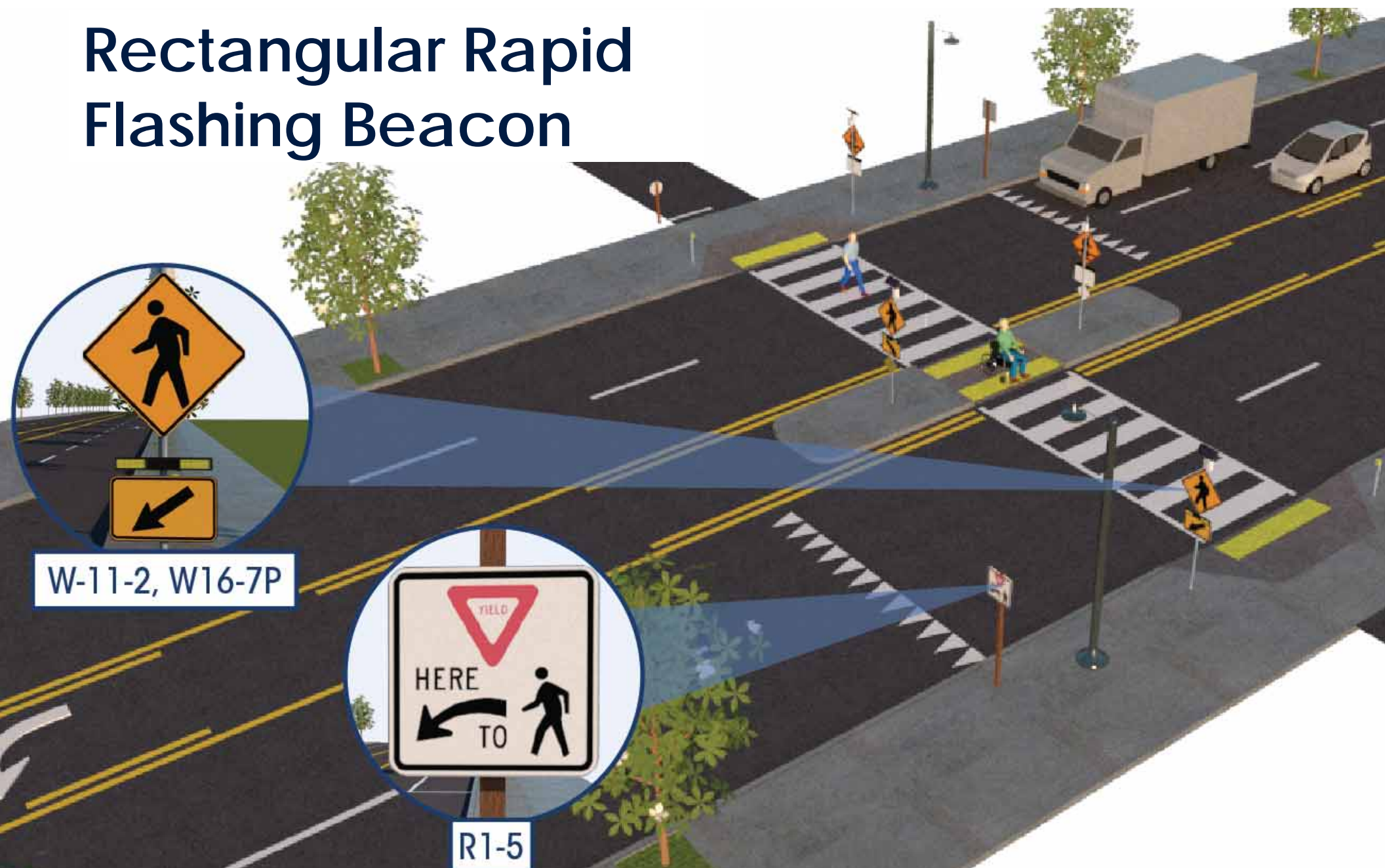
R1-6



W-11-2, W16-7P



Rectangular Rapid Flashing Beacon



W-11-2, W16-7P



R1-5

Pedestrian Hybrid Beacons (PHB)



Road Diet: Before



Road Diet: After

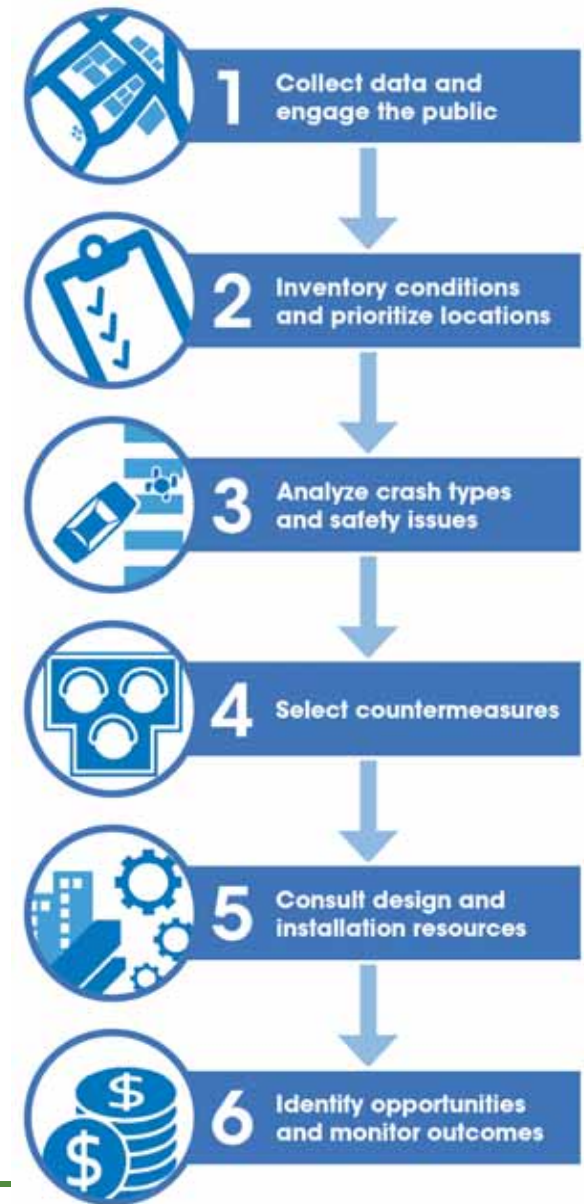


Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

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”

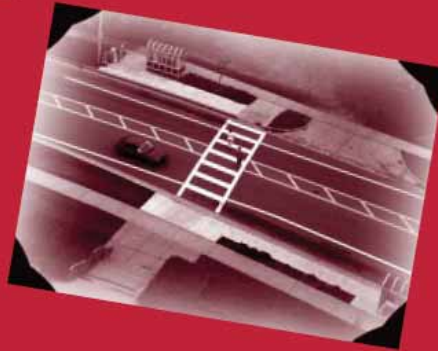
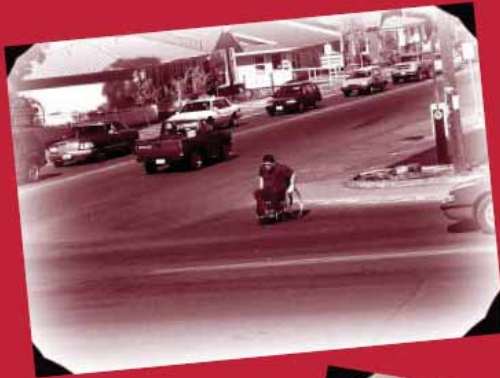


Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations

Final Report and
Recommended Guidelines

FHWA PUBLICATION NUMBER: HRT-04-100

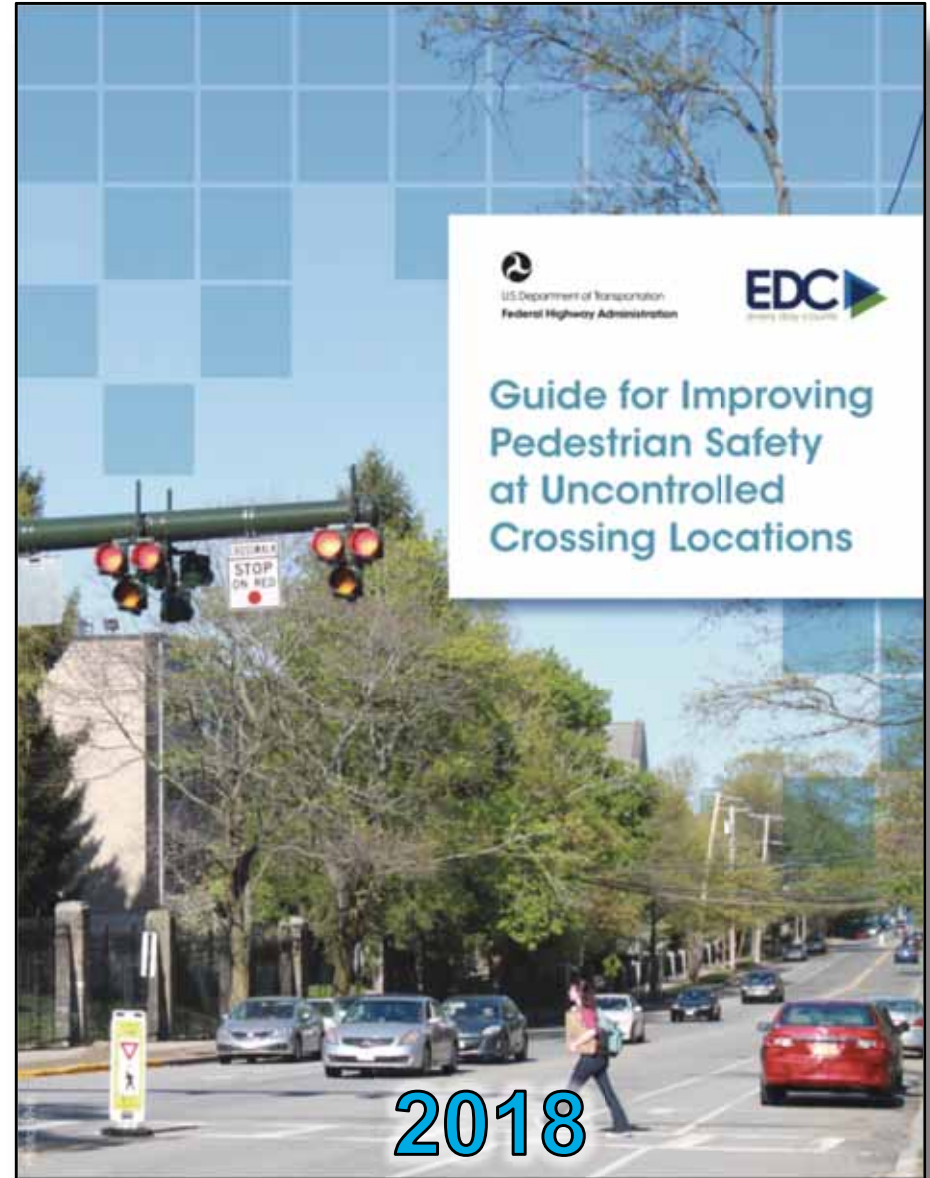
SEPTEMBER 2005




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


EDC
Economic Development Corporation

Guide for Improving
Pedestrian Safety
at Uncontrolled
Crossing Locations

2018



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

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>

Marked crosswalks alone (i.e., without signals or other substantial crossing improvements) are insufficient and should not be installed under the following conditions:

- Where the speed limit exceeds 40 mph
- On a roadway with 4+ lanes without a raised median; ADT of 12,000 or greater
- On a roadway with 4+ lanes with a raised median; ADT of 15,000 or greater



3 Analyze crash types and safety issues

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

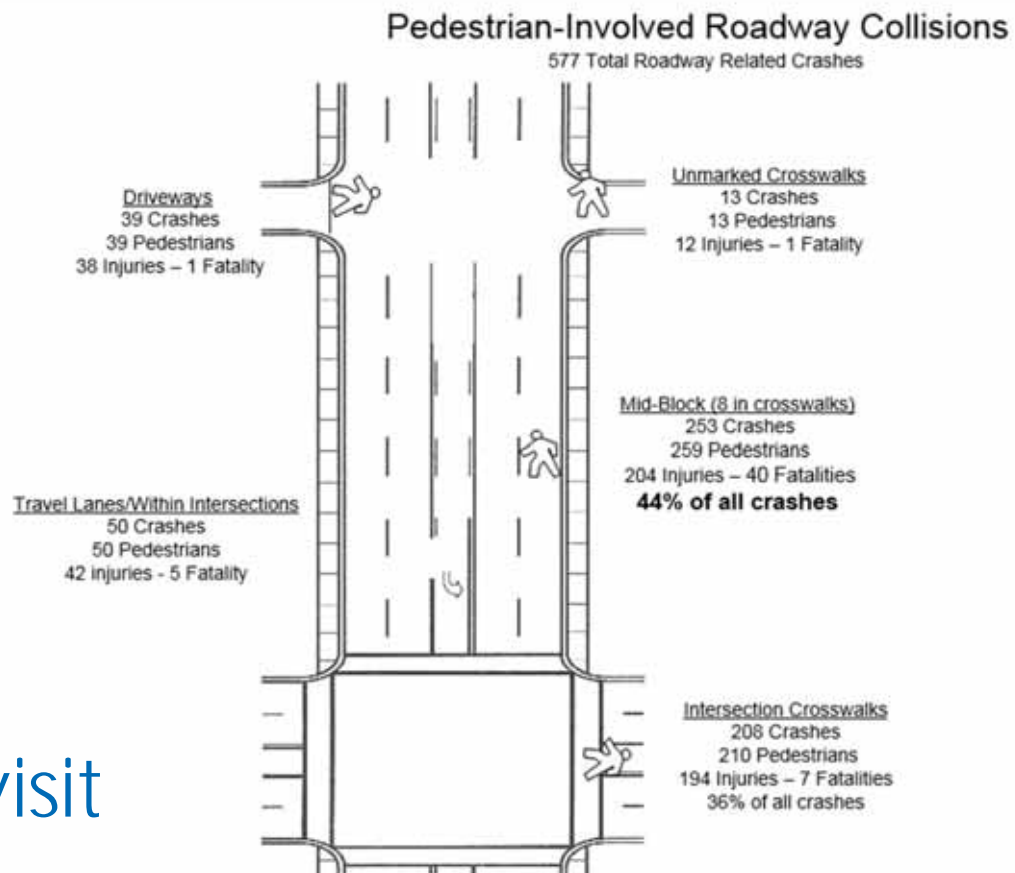


Image Source: City of Phoenix, Arizona



4 Select countermeasures

July 2018 version includes RRFB

Highlights situations where a marked crosswalk *alone* is not sufficient

Presents *options* for countermeasure selection

Does not substitute MUTCD requirements or guidance

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 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 7 9	① 5 6 7 9	① 5 6 ⑦ ⑨
3 lanes with raised median (1 lane in each direction)	① 2 3 4 5	① ③ 5 ⑦	① ③ 5 ⑦	① ③ 4 5	① ③ 5 ⑦	① ③ 5 ⑦	① ③ 4 5 7 9	① ③ 5 ⑦	① ③ 5 ⑦
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 ⑦ ⑨	① ③ 4 5 6 7 9	① ③ 5 6 ⑦ ⑨	① ③ 5 6 ⑦ ⑨	① ③ 4 5 6 7 9	① ③ 5 6 ⑦ ⑨	① ③ 5 6 ⑦ 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 ⑦ 8 ⑨	① ③ 5 ⑦ 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 ⑦ 8 ⑨	① ③ 5 ⑥ ⑦ 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, park crosswalk approach, adequate nighttime lighting levels, and crossing warning sign

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.
 **The PHB and RRFB are not both installed at the same crossing location.

Considers additional observed behaviors or crash trends

Further focuses options for countermeasure selection

Consult crash types and field data

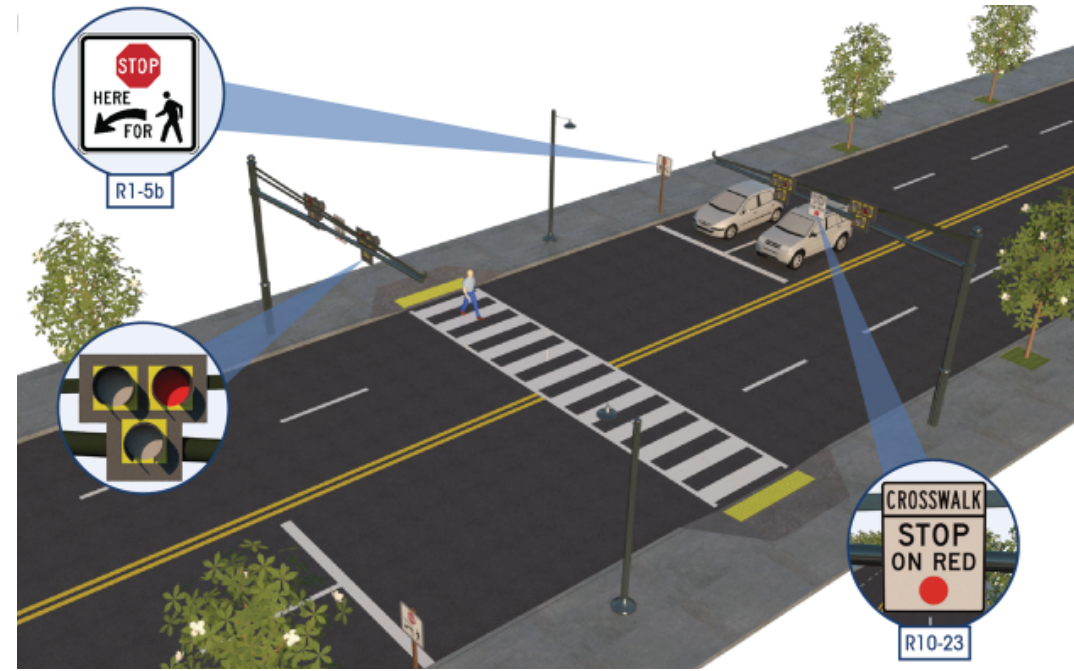
Table 2. Safety issues addressed per countermeasure.

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	🚶		🚶	🚶	🚶



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

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
RRFB	47%	0.53	Pedestrian crashes	Zegeer, et. al. 2017

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	Travel Lane Configuration
<input type="checkbox"/> ≤ 30 mph <input type="checkbox"/> 35 mph <input type="checkbox"/> ≥ 40 mph	<input type="checkbox"/> 2 lanes without raised median <input type="checkbox"/> 3 lanes without raised median <input type="checkbox"/> 3 lanes with raised median <input type="checkbox"/> 4+ lanes without raised median <input type="checkbox"/> 4+ lanes with raised median
Total Vehicles per Day	Crosswalk Length (feet): _____
Annual Average Daily Traffic (AADT): _____	Approximate Total Pedestrians per Hour (PPH) Crossing the Roadway: _____
Approximate Vehicles per Hour (VPH): _____	
<input type="checkbox"/> AADT < 9,000 <input type="checkbox"/> AADT 9,000-15,000 <input type="checkbox"/> AADT > 15,000	
Pedestrian Safety Issues Inventory	
Noted conflicts at crossing locations	<input type="checkbox"/> Yes <input type="checkbox"/> No
<ul style="list-style-type: none">› History of turning movement crashes› Observed conflicts at permitted crossings	
Excessive vehicle speed	<input type="checkbox"/> Yes <input type="checkbox"/> No
<ul style="list-style-type: none">› 85th percentile speeds, per speed study› History of speed-related crashes	
Inadequate conspicuity/visibility	<input type="checkbox"/> Yes <input type="checkbox"/> No
<ul style="list-style-type: none">› 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	<input type="checkbox"/> Yes <input type="checkbox"/> No
<ul style="list-style-type: none">› Crash history in marked crosswalks	
Insufficient separation between pedestrians and traffic	<input type="checkbox"/> Yes <input type="checkbox"/> No
<ul style="list-style-type: none">› Long crossing distance› No buffer (e.g., landscape buffer, on-street parking, bike lanes)	

Local Success Story: Austin, TX PHBs

The city has installed 55 PHBs since 2009, and evaluates up to 10 locations a year.

The public can submit requests on the **Signal Request Dashboard**, City staff then evaluate and prioritize each request.

Evaluation criteria include:

- Speed limit
- Number of lanes
- Distance to nearest crossing
- Ped crash history



Source: City of Austin, Texas

Local Success Story: Austin, TX PHBs

2014 Research by Texas A&M
Transportation Institute
evaluated 8 PHB sites in Austin.

Sites were on four-lane roads
with ADT of 14,000-28,000.

Drivers on average **yielded 96%**
of the time for all 20 PHB
locations.



Source: City of Austin, Texas

Center for Accelerating Innovation

U.S. Department of Transportation
Federal Highway Administration

About Programs Resources Briefing Room Contact Search FHWA

Search Accelerating Innovation

Home / CAAI / Accelerating Innovation / Every Day Counts / EDC-4: Safe Transportation for Every Pedestrian (STEP)

CAI Home | **Every Day Counts** | STIC Network | AID Demonstration | Resources

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.

Contacts

Becky Crowe
FHWA Office of Safety
(804) 775-3381
Rebecca.Crowe@dot.gov

Peter Eun
FHWA Resource Center
(360) 753-9551
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 pose challenges for the crossing of road locations.

With each city, at road locations or intersections, it is critical to evaluate the safety of the location.

EDC

Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

EDC

Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations





U.S. Department of Transportation
Federal Highway Administration



FHWA EVERY DAY COUNTS / STEP

For Additional Information Contact:

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

**STEP is
continuing
through 2021
as part of EDC-
5!**

Becky Crowe
FHWA Office of Safety
(804) 775-3381
Rebecca.Crowe@dot.gov

Peter Eun
FHWA Resource Center
(360) 753-9551
Peter.Eun@dot.gov

30

Stephen Ratke
FHWA TX Division
Stephen.Ratke@dot.gov