FDOT TRANSPORTATION SYMPOSIUM 2019

Safe Transportation for Every Pedestrian (STEP) Efforts in Florida

Joe Santos, Kevin Burgess (FHWA), Gevin McDaniel, Maria Overton,
Alan El-Urfail, DeWayne Carver, Mary O'Brien

EDC

FDOT

Presenters

Federal Highway Administration

- Kevin Burgess, PE, Florida Division Safety Engineer

Florida Department Of Transportation

- Joseph Santos, PE, State Safety Engineer, Safety Office
- Alan El-Urfali, PE, State Traffic Services Program Engineer, Traffic Operations Office
- Gevin McDaniel, PE, Roadway Design Criteria Administrator, Roadway Design Office
- DeWayne Carver, AICP, State Complete Streets Program Manager, Roadway Design Office
- Mary O'Brien, AICP, CPH, State Bicycle Pedestrian Coordinator, Roadway Design Office
- Maria Overton, PE, Systems Management Manager, Systems Implementation Office

Outline

a. Welcome, Why STEP, Spectacular 7 Countermeasures – Joe Santos
b. EDC Overview and FHWA Perspective – Kevin Burgess
c. Intro to FDOT standards (FDM, AASHTO Green Book, TEM, MUTS, Standard Plans) – Joe Santos
d. STEP 1: Visibility Enhancements – Gevin McDaniel / Dewayne Carver / Alan El-Urfali
e. STEP 2: Raised Crosswalks – DeWayne Carver
f. STEP 3: Pedestrian Refuge – Mary OBrien
g. STEP 4: RRFB – Alan El-Urfali
h. STEP 5: HAWK – Alan El-Urfali
i. STEP 6: Road Diets – Maria Overton
j. STEP 7: LPI – Alan El-Urfali
k. Wrap-up/ Q&A: Joe Santos

Agenda

Introduction

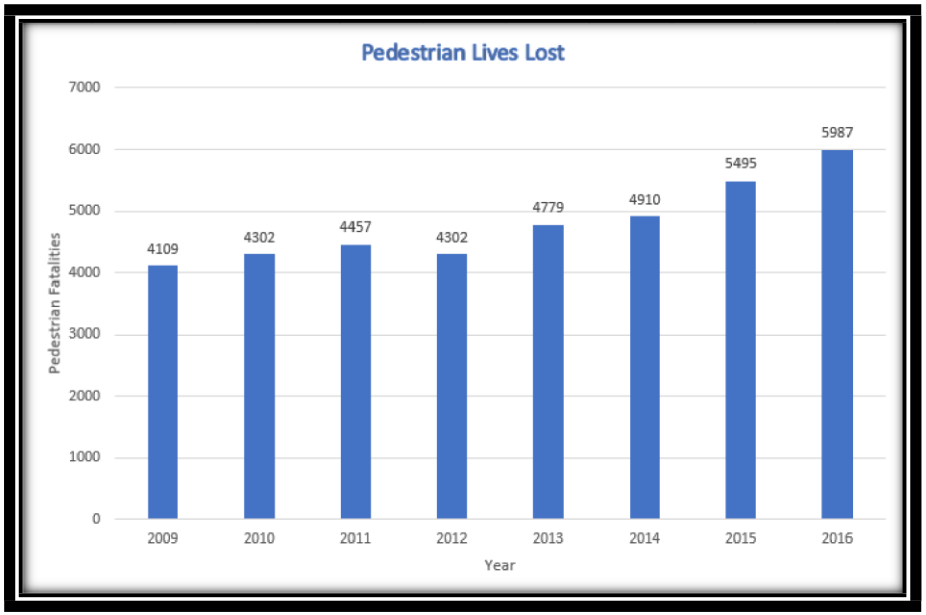
STEP Spectacular 7

Resources

Questions

Why is pedestrian safety and accessibility important?

Too many people dying on our roadways



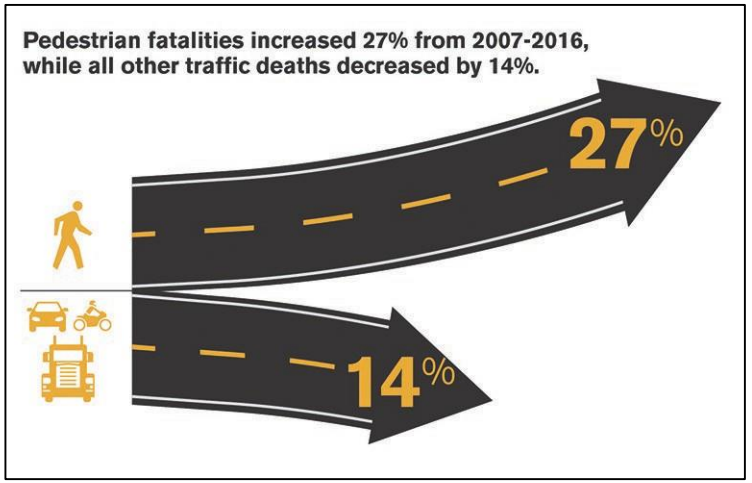


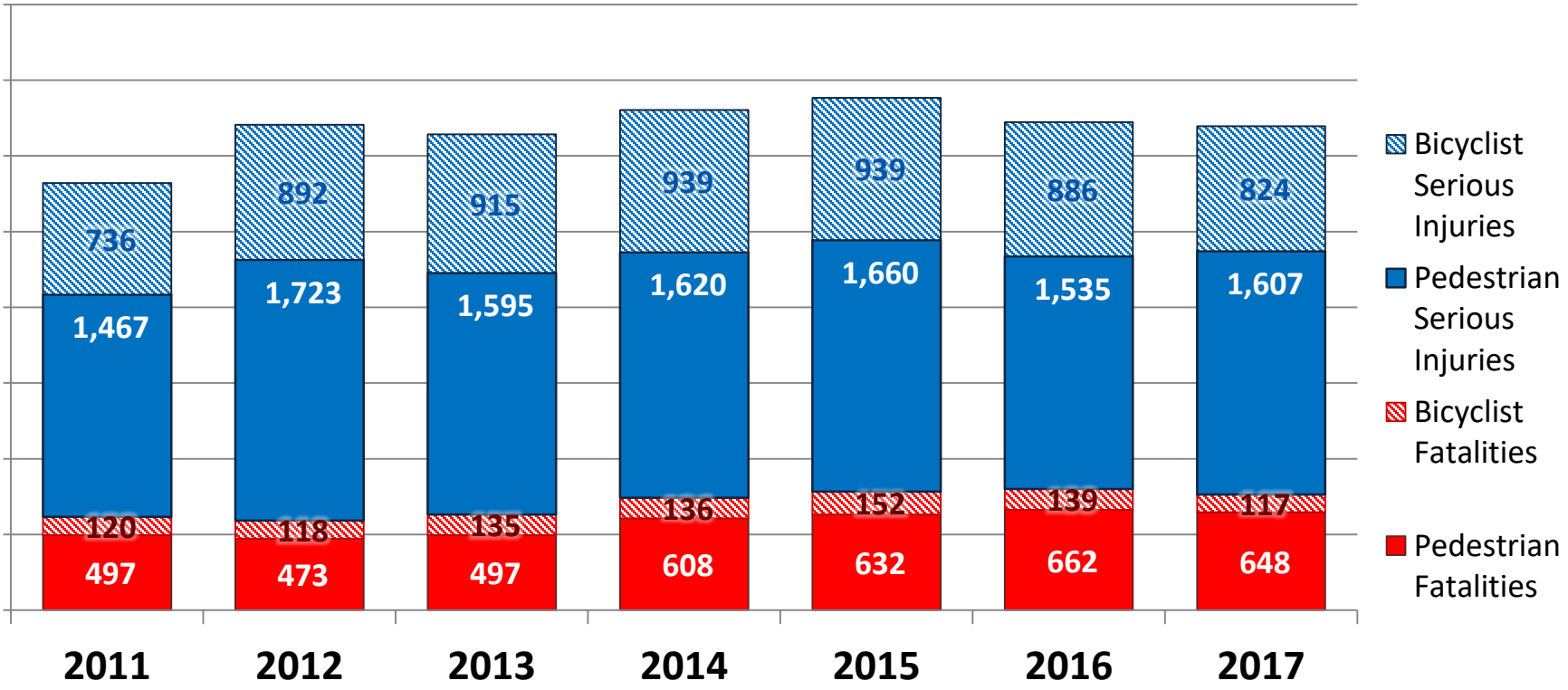
Photo Credit: GHSA

Pedestrians now account for a larger proportion of traffic fatalities (16%) than they have in the past 33 years

Florida Data - Pedestrians and Bicyclists

Florida Annual Fatalities and Serious Injuries to Pedestrians and Bicyclists

Statewide for 2011 through 2017



Counts from FDOT State Safety Office Crash Analysis and Reporting (CAR) system

Why?

Because many people do not drive

Why?

Because other modes depend on walking

Why?

Because it's good for business – people walk into stores

Why?

Because walking is healthy exercise

Why?

Because we are all pedestrians





STEP's Spectacular Seven

Spectacular Seven

- Crosswalk Visibility Enhancements
- Raised Crosswalks
- Pedestrian Refuge Islands
- Rectangular Rapid Flashing Beacon
- Pedestrian Hybrid Beacon (PHB)
- Road Diets
- Leading Pedestrian Interval (LPI)

Spectacular Seven

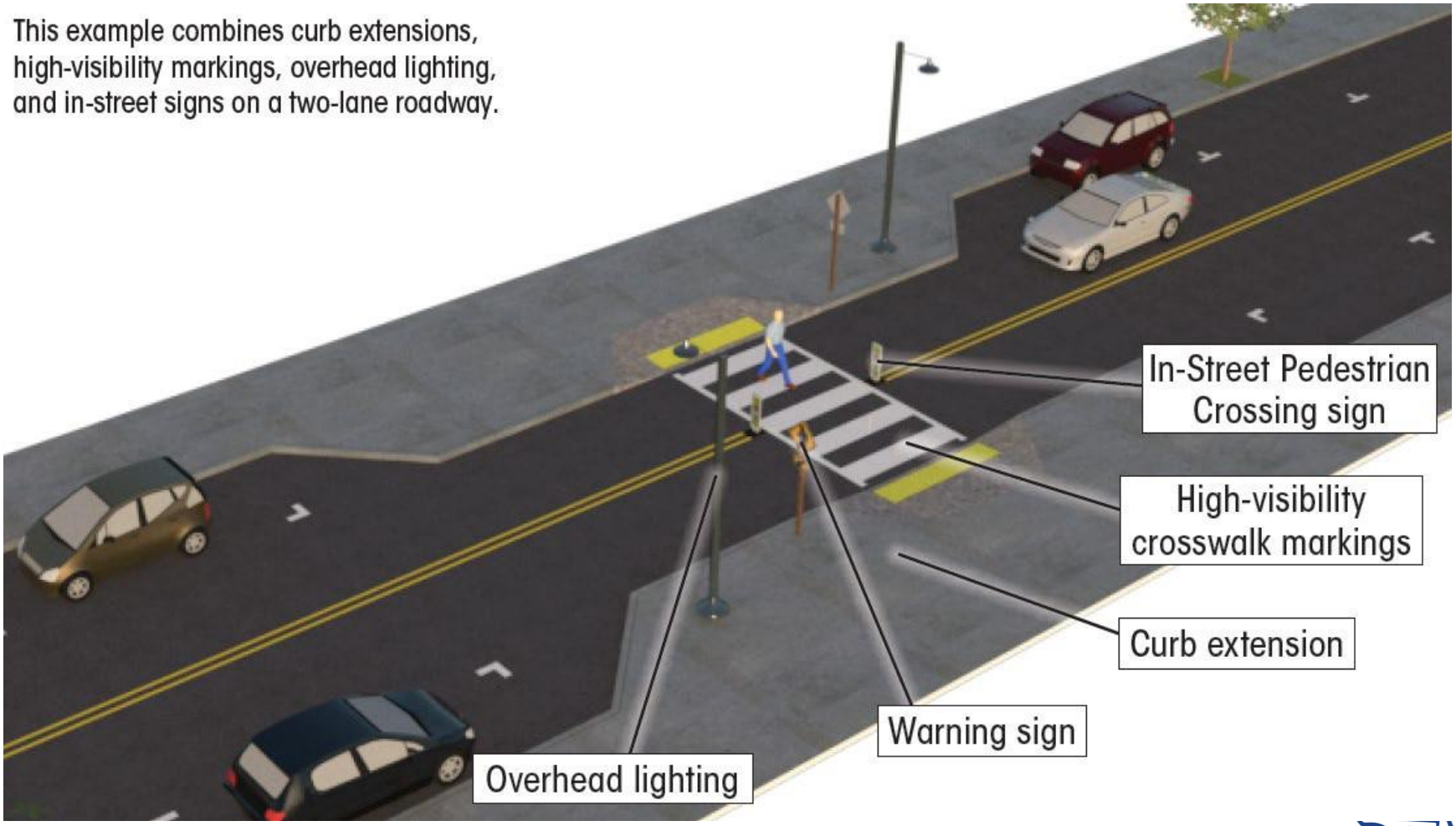
- **Crosswalk Visibility Enhancements**
- Raised Crosswalks
- Pedestrian Refuge Islands
- RRFB
- PHB
- Road Diets
- LPI

Crosswalk Visibility Enhancements

- Crosswalk Marking Style
- Advance Stop or Yield Lines with Signs (e.g., "Stop Here for Crosswalk")
- Lighting
- Curb Extensions
- Parking Restrictions on Crosswalk Approach
- Pedestrian Warning Signs on Approach and at Crosswalk
  - Size and Placement
  - Enhanced Conspicuity (flashing beacons, embedded LEDs)
- In-Street Pedestrian Crossing Signs

Crosswalk Visibility Enhancements

This example combines curb extensions, high-visibility markings, overhead lighting, and in-street signs on a two-lane roadway.

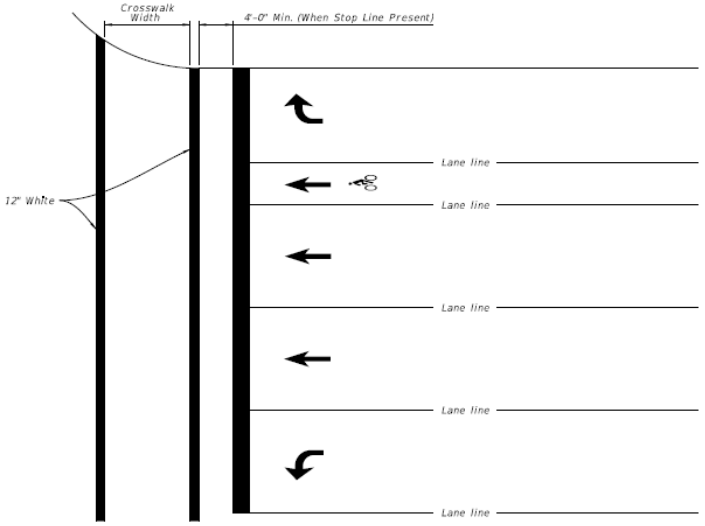


Crosswalk Markings – FDOT Design Manual

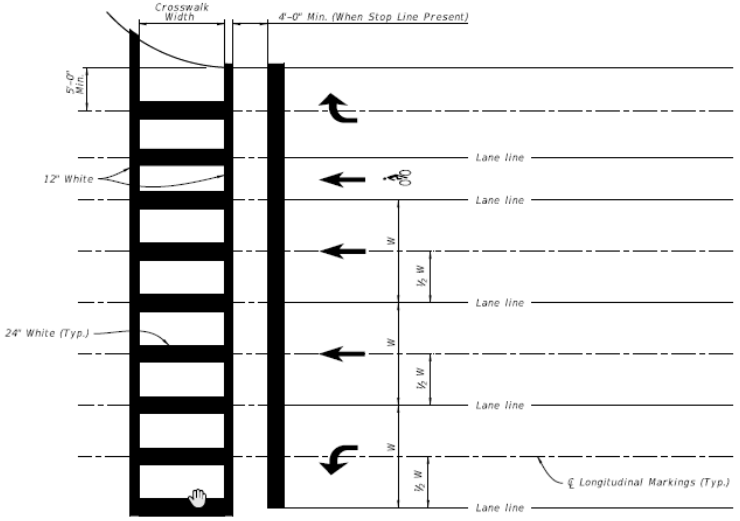
FDM 222 (Pedestrian Facilities) provides criteria and guidance for crosswalks

- Criteria for:
  - Signalized Intersections
  - Roundabouts
  - Stop and Yield Controlled Intersections
  - Midblock Crosswalks
- References to other publications for critical information
  - Standard Plans for construction details
  - Traffic Engineering Manual 3.8
  - Speed Zoning Manual for School Zone Crossings

Crosswalk Markings – FDOT Standard Plans



STANDARD CROSSWALK DETAILS



SPECIAL EMPHASIS CROSSWALK DETAILS

NOTES:

1. For crosswalk width, exceed width of the adjacent sidewalk, but do not make width less than 6' for intersection crosswalks and 10' for midblock crosswalks. Measure width from the inside of the transverse crosswalk markings.
2. When the Special Emphasis Crosswalk is not perpendicular to the lane lines, make the longitudinal markings parallel to the lane lines.
3. Refer to Index 522-002 when Curb Ramps are present.

LAST REVISION 11/01/18	REVISION DESCRIPTION:	FDOT FY 2019-20 STANDARD PLANS	PAVEMENT MARKINGS	INDEX 711-001	SHEET 10 of 13

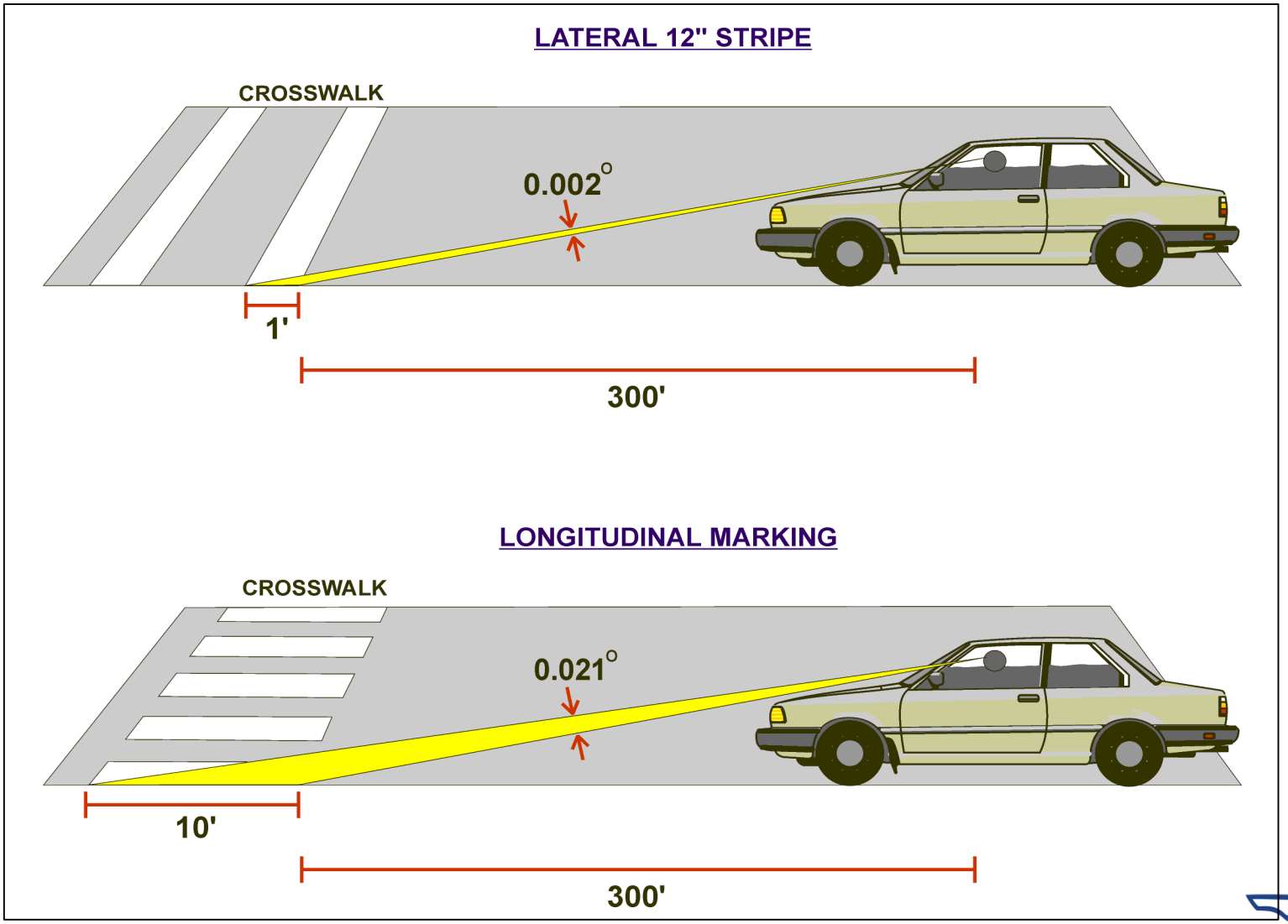
Crosswalk Visibility Enhancements
High Visibility Crosswalk

What Pedestrians See

Photo Source all 4: Michael Ronkin

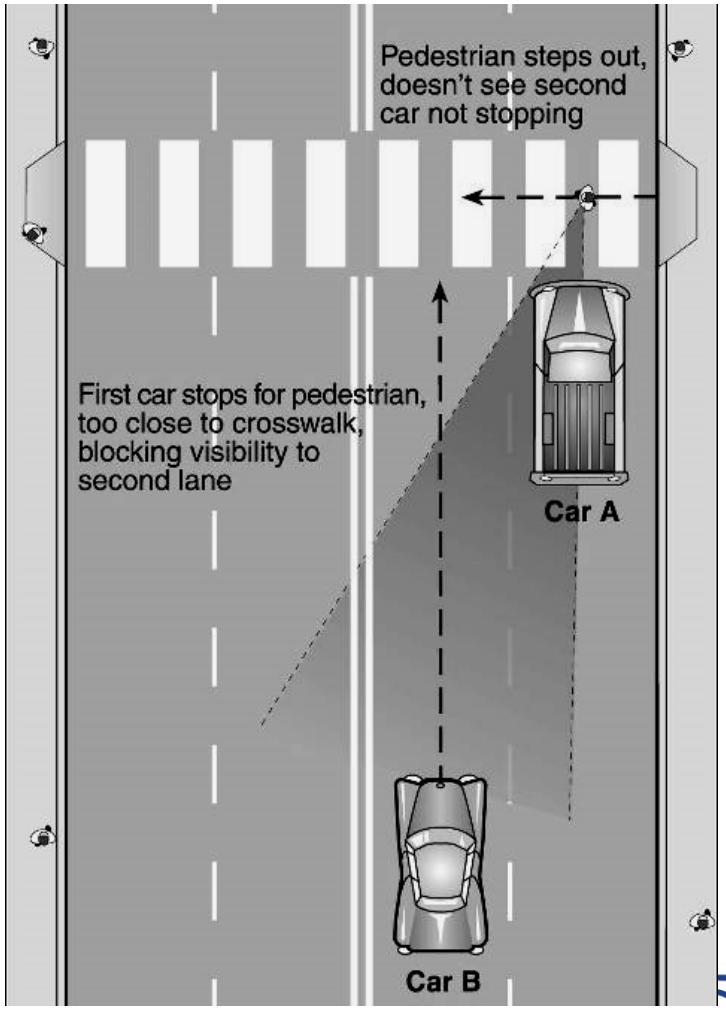
What Drivers See

Crosswalk Visibility Study



Multiple Threat Crash Problem

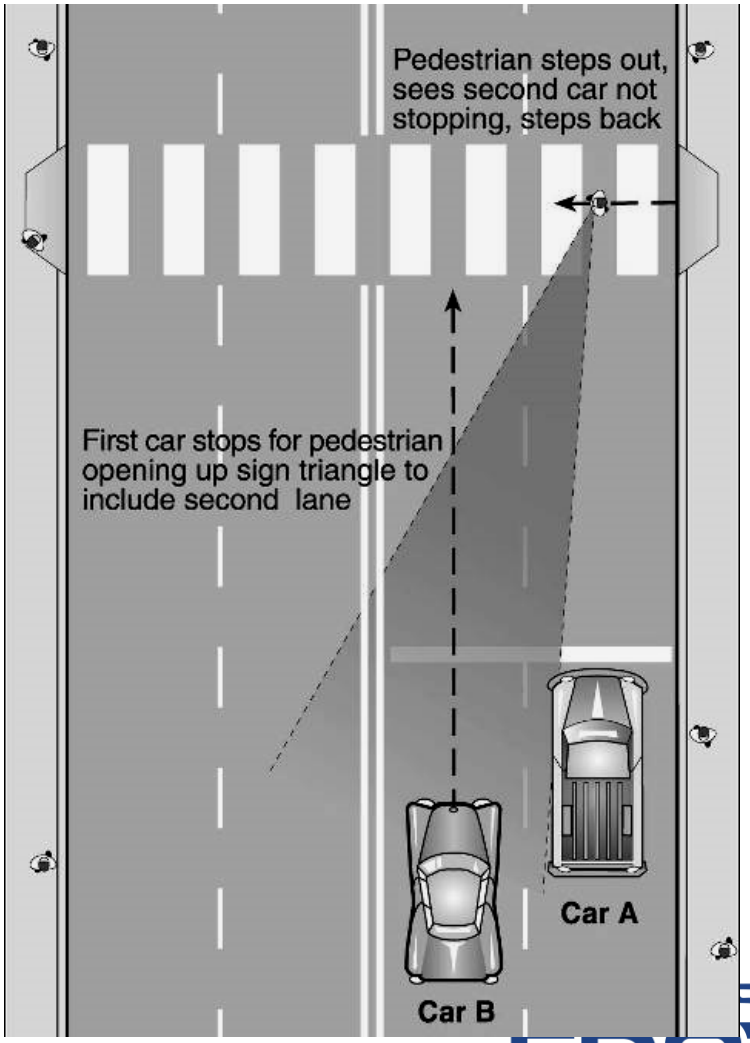
- 1st car stops to let pedestrian cross, blocking sight lines
- 2nd car doesn't stop, hits pedestrian at high speed



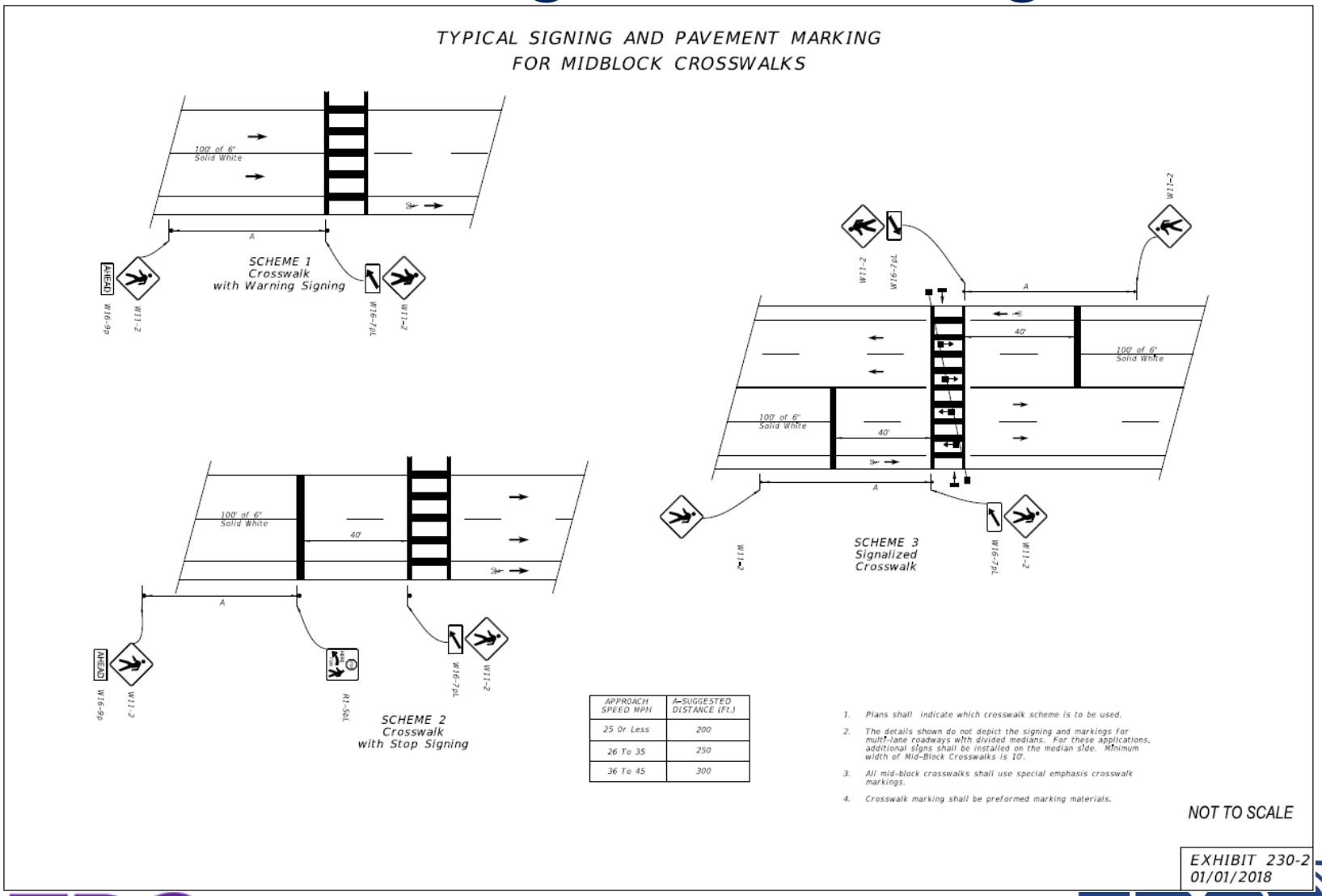
Multiple Threat Crash Solution

Advance stop or yield line

- 1st car stops further back, opening up sight lines
- 2nd car can be seen by pedestrian



Crosswalk Markings – FDOT Design Manual



Crosswalk Markings – Draft 2018 Florida Greenbook

Figure 3 – 12 Pedestrian Crossing with Refuge Island (Yield Condition)

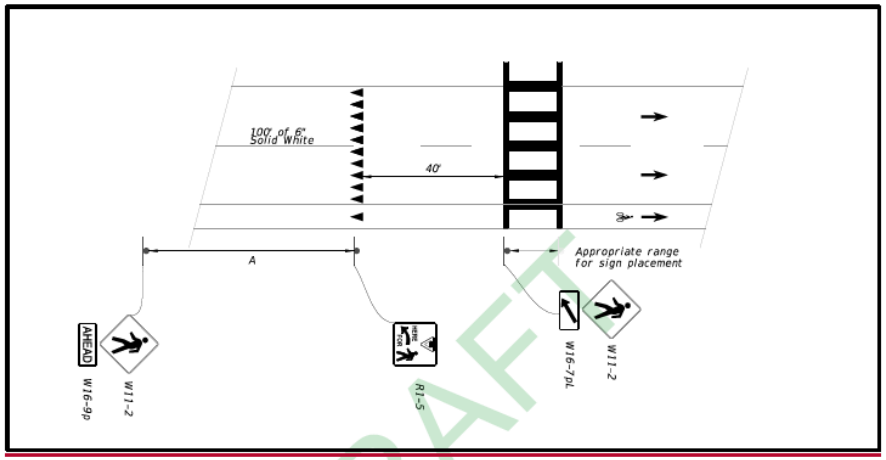
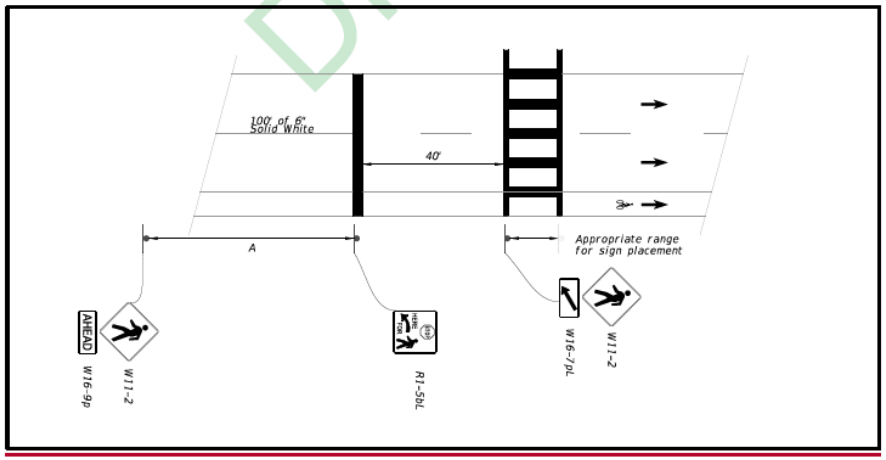


Figure 3 – 13 Pedestrian Crossing with Refuge Island (Stop Condition)



Option to use either yield or stop conditions

Crosswalk Visibility Enhancements
Crosswalk Lighting

Photo source: Youtube screen capture SWARCO

- CRF 42% to 59%
  - Lighting at intersections
  - 4 star rating
  - Vehicle/ped crashes

Lighting Over Crosswalks

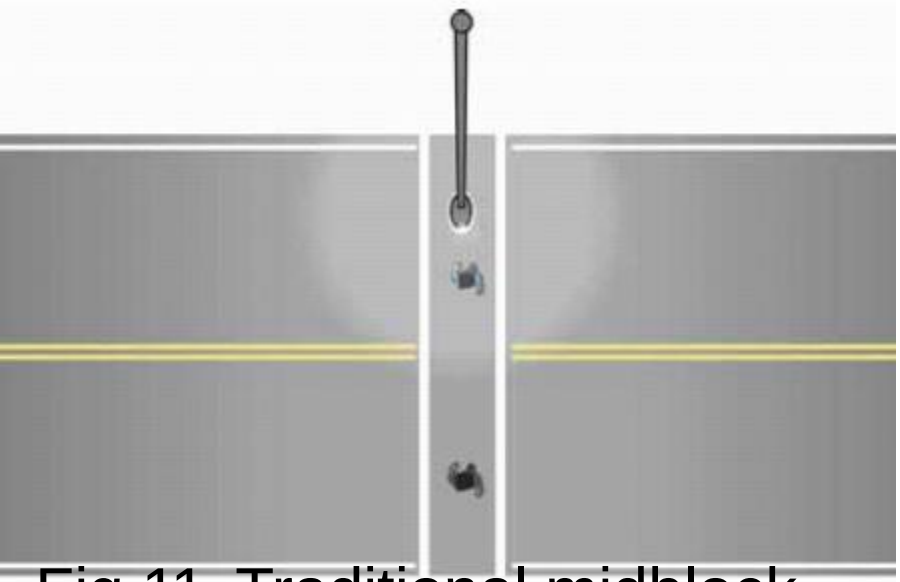


Fig 11. Traditional midblock crosswalk lighting layout

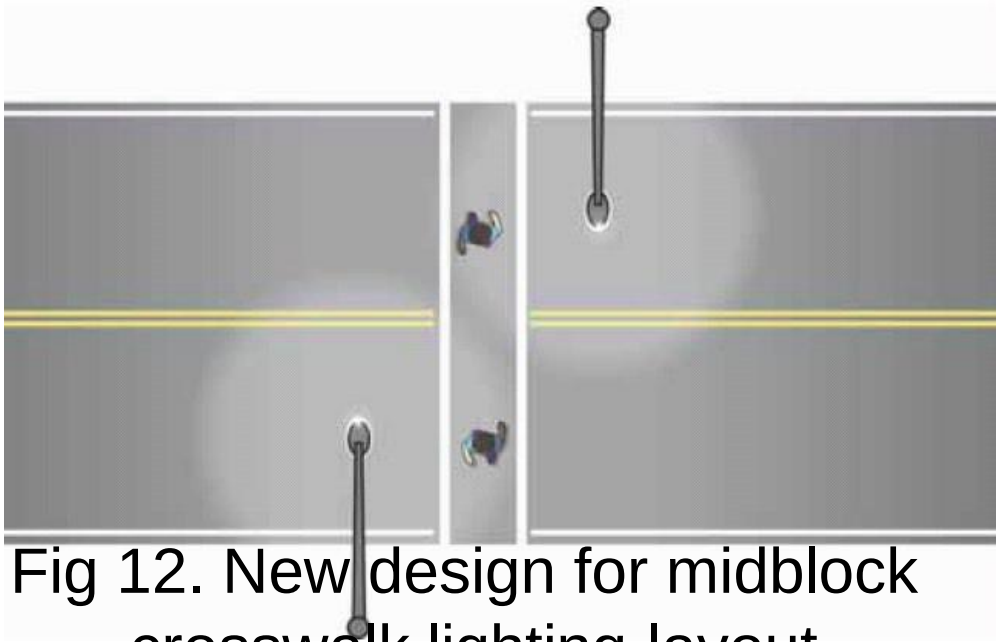


Fig 12. New design for midblock crosswalk lighting layout

Recommended lighting level: 20 lux at 5’ above pavement

Crosswalk Lighting - FDOT Design Manual

Table 231.2.1 Lighting Initial Values

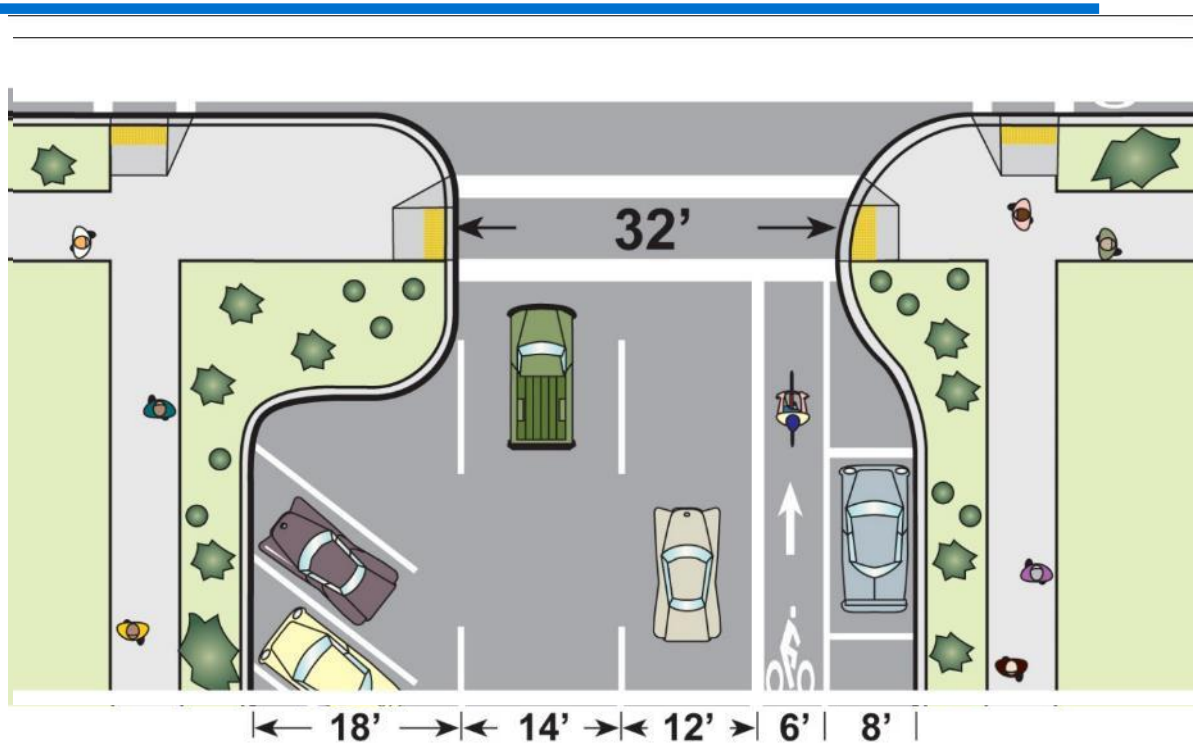
Roadway Classification	Illumination Level Average Foot Candle		Illumination Uniformity Ratios		Veiling Luminance Ratio
Or Project Type	Horizontal (H.F.C.)	Vertical (V.F.C.)	Avg./Min.	Max./Min.	$L_{V(MAX)}/L_{AVG}$
Signalized Intersection Lighting					
New Reconstruction	3.0	2.3	4:1 or Less	10:1 or Less	N/A
Lighting Retrofit	1.5 Std. 1.0 Min.	1.5 Std. 1.0 Min.			
Midblock Crosswalk Lighting					
Low Ambient Luminance	N/A	2.3	N/A	N/A	N/A
Medium & High Ambient Luminance		3.0			

1 **foot-candle** = 10.764 **lux**

Crosswalk Visibility Enhancements
Curb Extensions

Curb extensions

Most focus is on reduced crossing distance

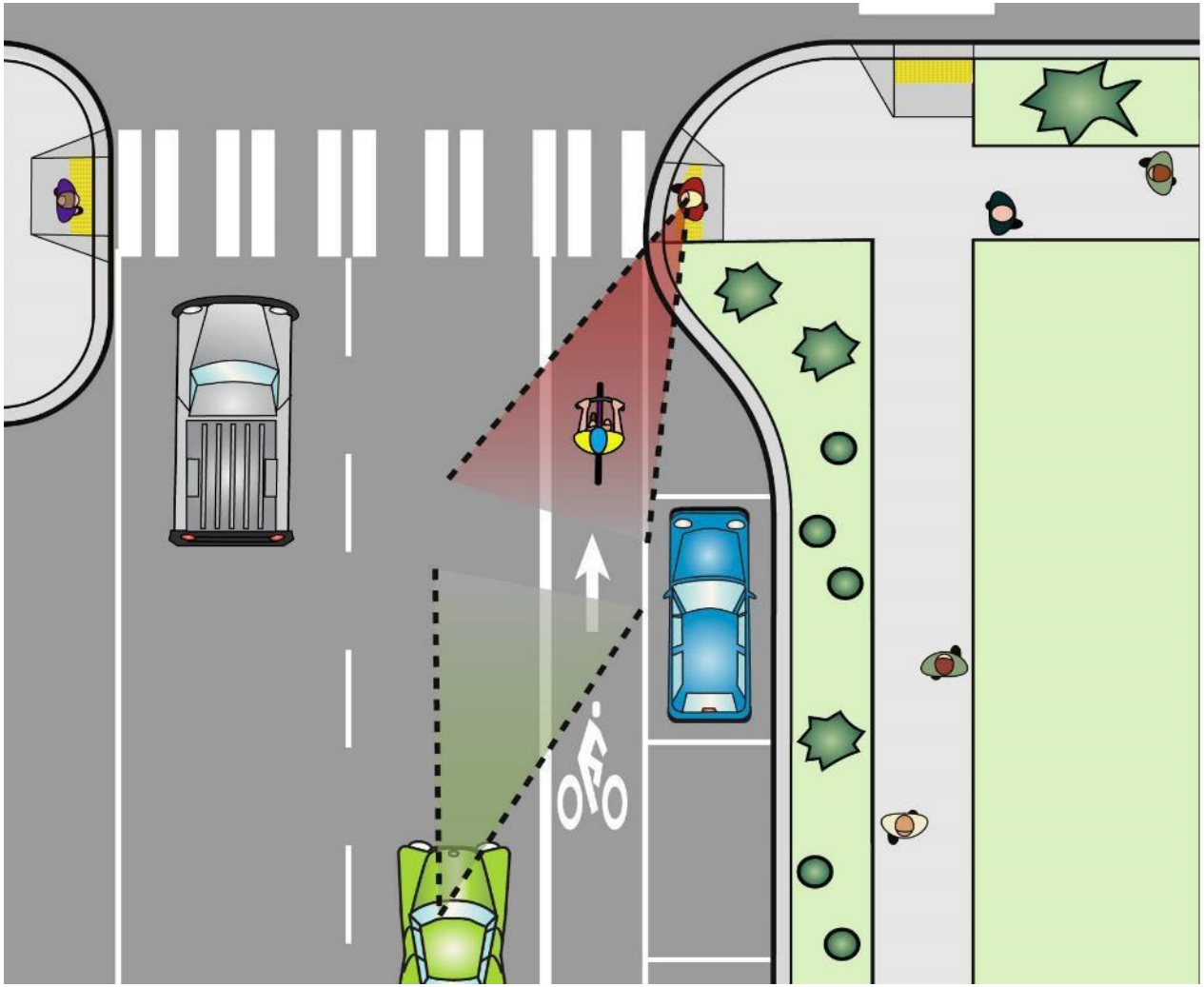


Other advantages:

- Better visibility between peds and motorists
- Traffic calming

Curb extensions should be the width of the parking lane and not encroach on bike lanes or travel lanes

Better Visibility



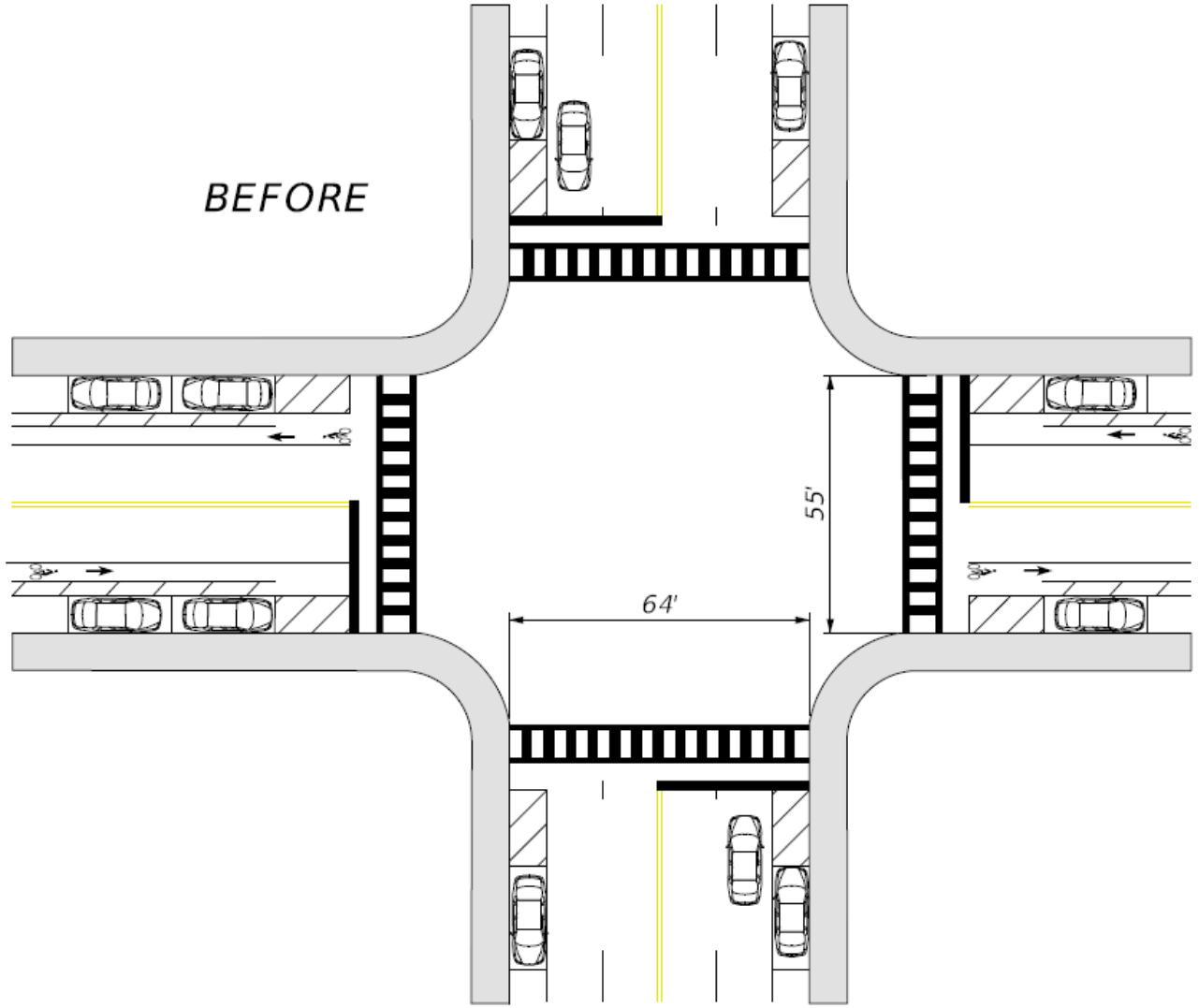
Curb Extensions – FDOT Design Manual

222.2.6 Curb Extensions (Bulb-Outs)

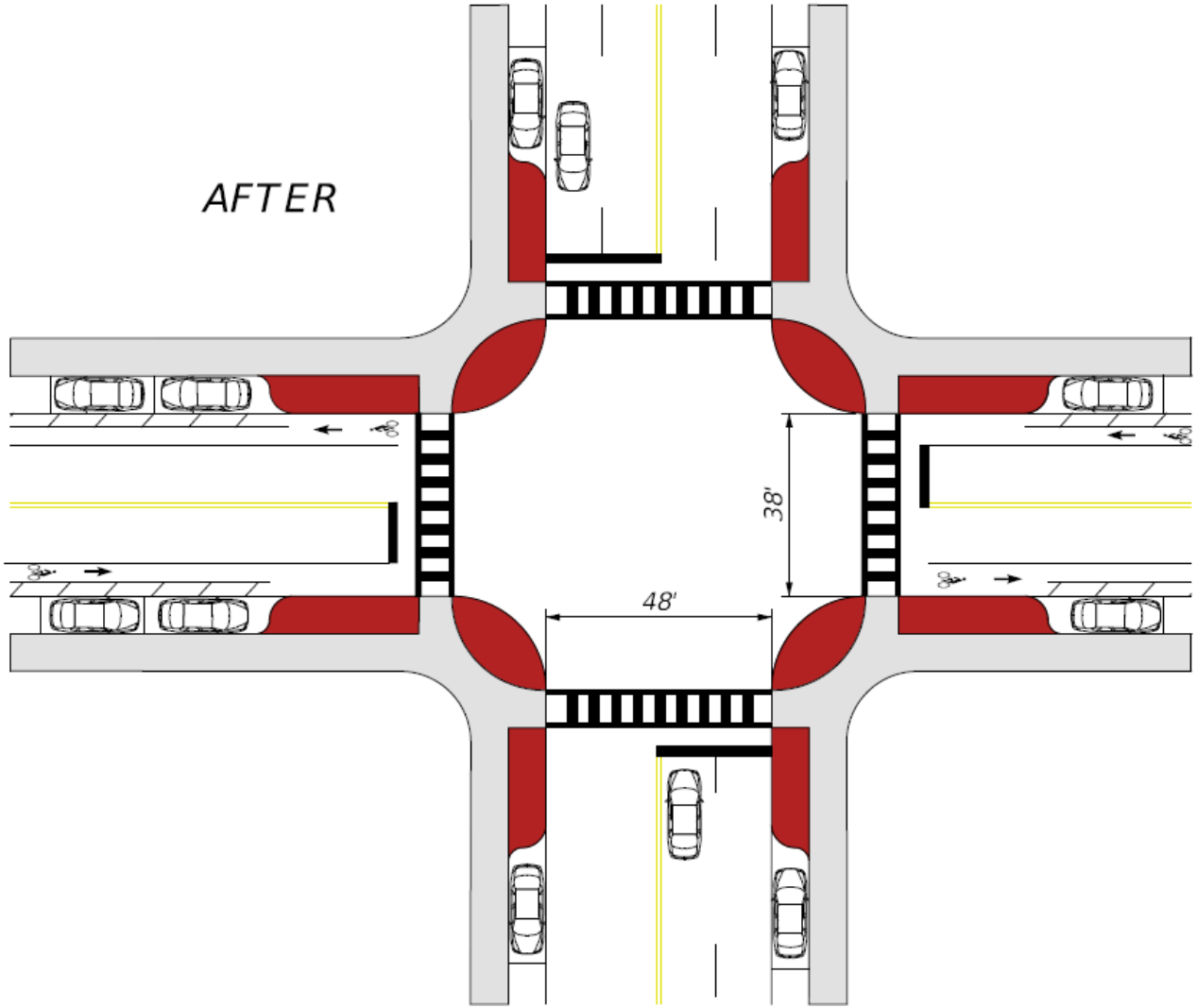
Curb extensions (a.k.a., bulb-outs) may be used in conjunction with on-street parking at intersections or midblock locations where there is a crosswalk, provided there is adequate width for existing traffic movements. Curb extensions shorten the crossing distance, and provide additional space at intersections, allowing pedestrians to see and be seen before entering a crosswalk.

The design of curb extensions must take into consideration the needs of transit vehicles, drainage, and bicyclists. See ***Figure 222.2.3***.

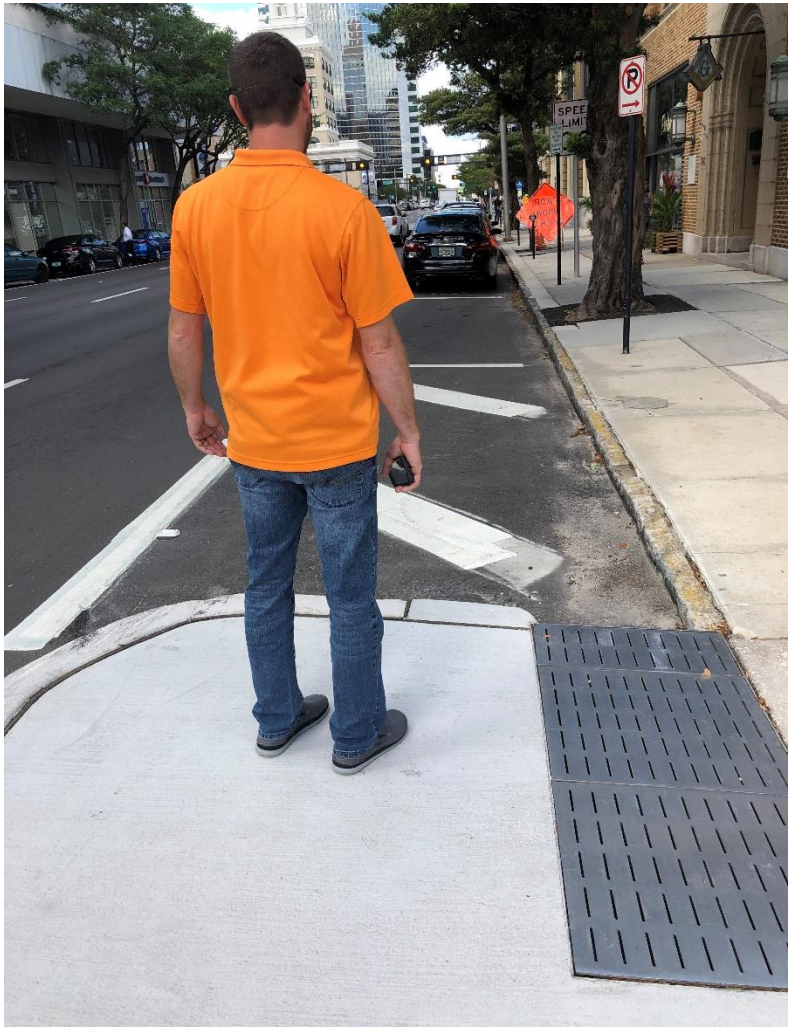
Curb Extensions – FDOT Design Manual



Curb Extensions – FDOT Design Manual



Drainage solutions: Additional inlet



Drainage solutions for retrofits

Pedestrian Warning Signs – MUTCD 2C.50

"… may be used to alert road users in advance of locations where unexpected entries into the roadway might occur or where shared use of the roadway by pedestrians, animals, or equestrians might occur."

Guidance:

If used in advance of a pedestrian, snowmobile, or equestrian crossing, the W11-2, W11-6, W11-7, and W11-9 signs should be supplemented with plaques (see Section 2C.55) with the legend AHEAD or XX FEET to inform road users that they are approaching a point where crossing activity might occur.

W11-2★

★ A fluorescent yellow-green background color may be used for this sign or plaque.

Guidance:

When a fluorescent yellow-green background is used, a systematic approach featuring one background color within a zone or area should be used. The mixing of standard yellow and fluorescent yellow-green backgrounds within a selected site area should be avoided.

Embedded LED's in Signs

- STOP Sign
  - 28.9% reduction number of vehicles not fully stopping
  - 52.9% reduction number of vehicles moving through intersection w/o significantly slowing

https://safety.fhwa.dot.gov/intersection/conventional/unsignalized/tech_sum/fhwasa09006/

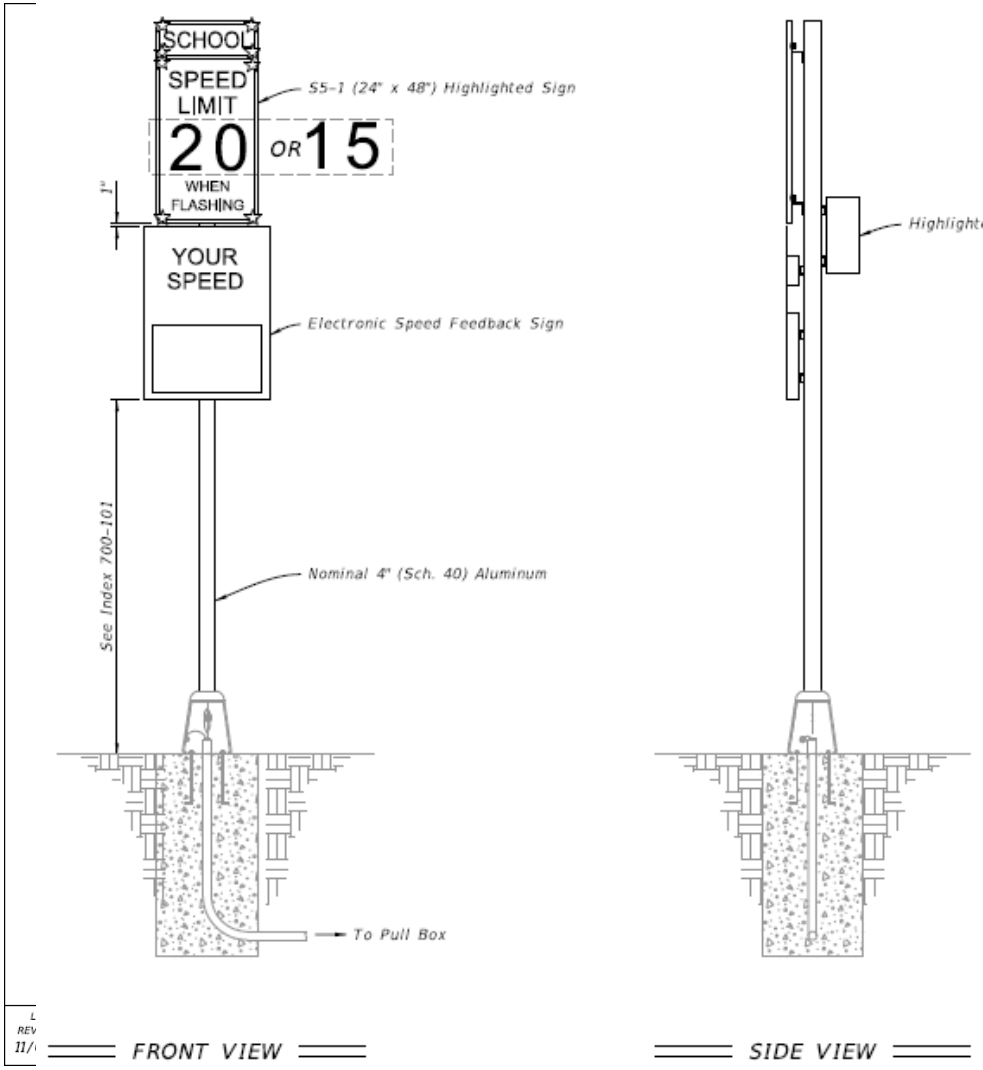
Figure 3: Example of pedestrian crossing warning sign with embedded LEDs and solar unit.

Figure 1: Example of stop sign with embedded LEDs and solar unit.

Figure 2: LEDs are embaded in the symbols and lettering on this truck warning sign.

2009 MUTCD Section 2A.07 Retroreflectivity and Illumination
https://mutcd.fhwa.dot.gov/htm/2009r1r2/part2/part2a.htm#section2A07

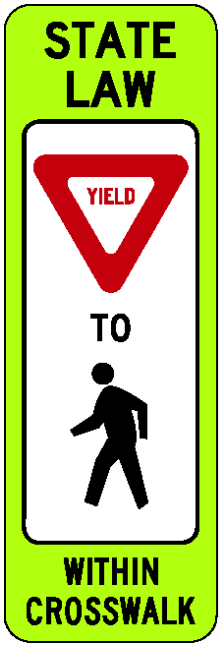
Highlighted Signs – FDOT Standard Plans



NOTES:

1. Type A5 Assembly (conventionally-powered) is shown. Type B5 Assemblies (solar-powered) similar.
2. Use electronic speed feedback sign with 15" high numerals for posted speed of 45 mph or less, and 18" high numerals for posted speeds greater than 45 mph.

In-street pedestrian crossing signs



R1-6 R1-6a

MUTCD signs

Yield or Stop depends on state law

2009 MUTCD Section 2B.12 and Figure 2B-2

Gateway Treatment, Three–Lane Configuration Without Refuge Island	
Travel Lanes **Passing/Turn Lanes**	2 1
R1-6 Signs	4
Flexible Delineators	0
Yielding Compliance	Between 60% and 90% compliance rate if speed limit is 30mph or less for ADT up to 25,000. If the speed limit is 35 mph expect similar results if ADT is 12,000 or less. UNKNOWN above 12,000 ADT.
Approximate Cost	$1,200 for materials 20-minute installation 8 minutes to remove for winter 8 minutes to reinstall in spring

Figure 6a

General Description:

Note: By installing the gateway on the near side of the intersection, both crosswalks are covered with only four signs. Data show that a gateway at the near side crosswalk continues to be effective for the far side of the intersection, as the motorist on the far side has already passed through a gateway on the near side.

The signs on the curb side in the gutter pan would have a better chance of survival if they are moved placed between 3 and 50 feet in Advance of the crosswalk markings. This would reduce the chance of the sign being struck by a turning vehicle. Figure 6b shows a typical installation.

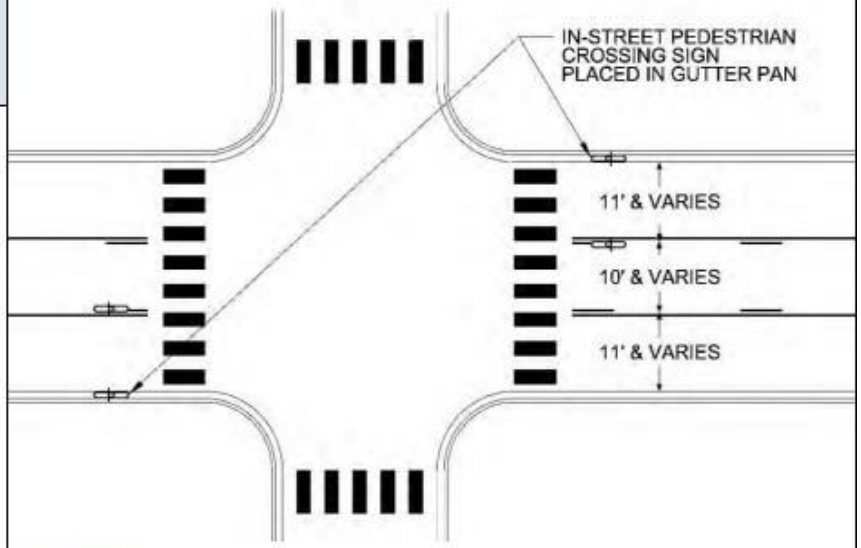
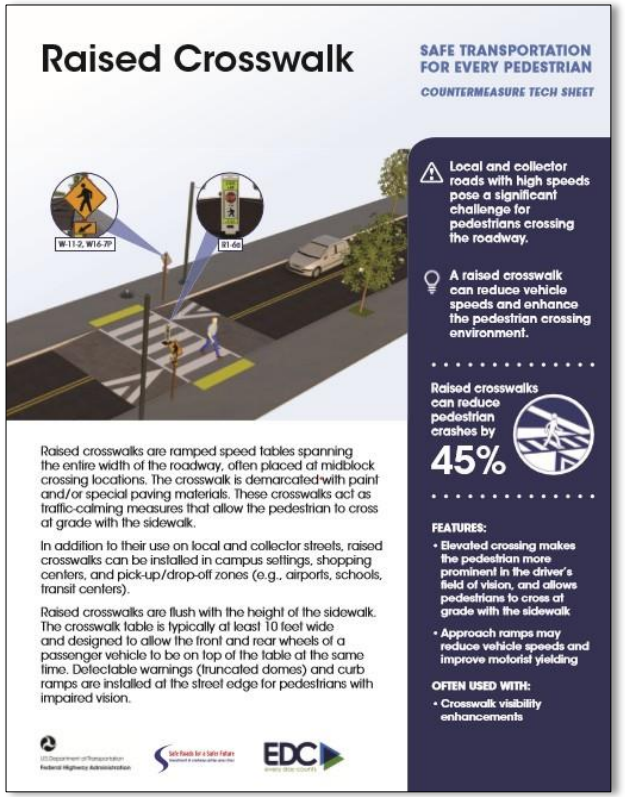


Figure 6b

Spectacular Seven

- Crosswalk Visibility Enhancements
- **Raised Crosswalks**
- Pedestrian Refuge Islands
- RRFB
- PHB
- Road Diets
- LPI



Raised Crosswalks

May be appropriate for roads with:

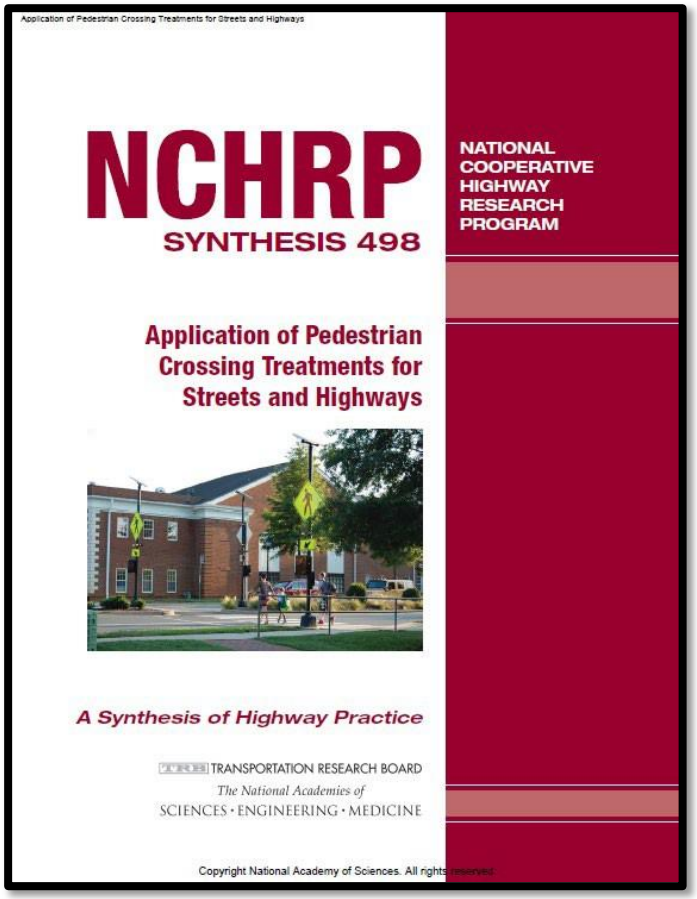
- Two or three lanes
- Speed limits of 30 mph or less
- AADT below 9,000

Photo Source: SRTS Guide

Raised Crosswalks
NCHRP Synthesis 498 (December 2016)

Key Measured Effects

- Lower speeds
- Improved motorist yielding at some locations
- 30% CRF for all crashes
- 36% CRF for all fatal injury crashes



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

Considerations

- May not be appropriate if street is a bus route or emergency route
  - Emergency services consulted
  - Snow plowing public works consulted
- ADA – Truncated domes for visually impaired
- Drainage
- May be inappropriate for crossings on curves or steep roadway grades
- Several raised crossings in succession may be disruptive

Raised Crosswalk

Traffic Calming ePrimer

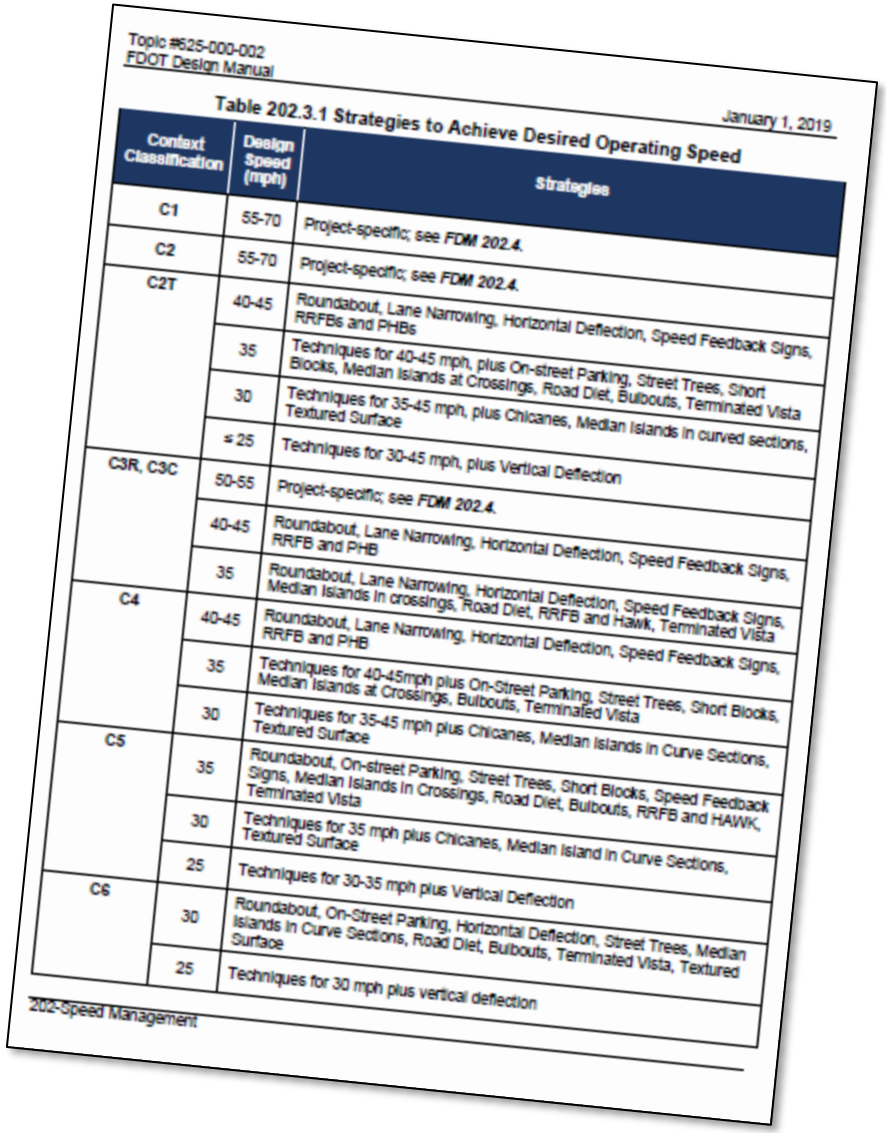
- https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

Figure 3.14.6. Raised Crosswalk with Bicycle Lane
(Source: Scott Batson)

Figure 3.14.4. Raised Crosswalk at Intersection
(Source: City of Cambridge, Massachusetts)

FDM 202

Table 2.3.1 25 mph Desired Operating Speed



Topic #625-000-002
FDOT Design Manual

January 1, 2019

Table 202.3.1 Strategies to Achieve Desired Operating Speed

Context Classification	Design Speed (mph)	Strategies
C1	55-70	Project-specific; see *FDM 202.4.*
C2	55-70	Project-specific; see *FDM 202.4.*
C2T	40-45	Roundabout, Lane Narrowing, Horizontal Deflection, Speed Feedback Signs, RRFBs and PHBs
	35	Techniques for 40-45 mph, plus On-street Parking, Street Trees, Short Blocks, Median Islands at Crossings, Road Diet, Bulbouts, Terminated Vista
	30	Techniques for 35-45 mph, plus Chicanes, Median Islands in curved sections, Textured Surface
	≤ 25	Techniques for 30-45 mph, plus Vertical Deflection
C3R, C3C	50-55	Project-specific; see *FDM 202.4.*
	40-45	Roundabout, Lane Narrowing, Horizontal Deflection, Speed Feedback Signs, RRFB and PHB
	35	Roundabout, Lane Narrowing, Horizontal Deflection, Speed Feedback Signs, Median Islands in crossings, Road Diet, RRFB and Hawk, Terminated Vista
C4	40-45	Roundabout, Lane Narrowing, Horizontal Deflection, Speed Feedback Signs, RRFB and PHB
	35	Techniques for 40-45mph plus On-Street Parking, Street Trees, Short Blocks, Median Islands at Crossings, Bulbouts, Terminated Vista
	30	Techniques for 35-45 mph plus Chicanes, Median Islands in Curve Sections, Textured Surface
C5	35	Roundabout, On-street Parking, Street Trees, Short Blocks, Speed Feedback Signs, Median Islands in Crossings, Road Diet, Bulbouts, RRFB and HAWK, Terminated Vista
	30	Techniques for 35 mph plus Chicanes, Median Island in Curve Sections, Textured Surface
	25	Techniques for 30-35 mph plus Vertical Deflection
C6	30	Roundabout, On-Street Parking, Horizontal Deflection, Street Trees, Median Islands in Curve Sections, Road Diet, Bulbouts, Terminated Vista, Textured Surface
	25	Techniques for 30 mph plus vertical deflection

202-Speed Management

FDM 202

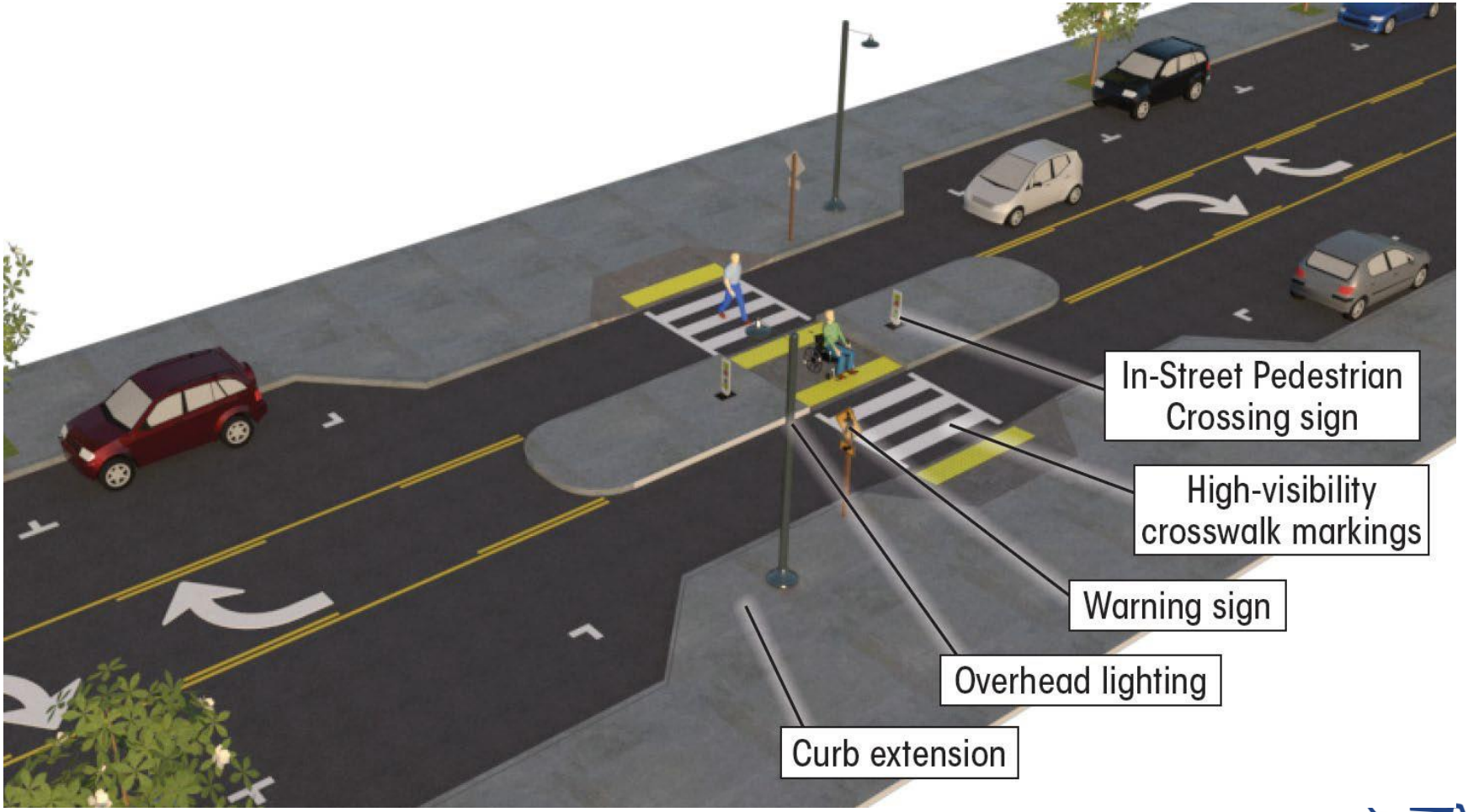
202.3.8 Vertical Deflection

Like horizontal deflection, vertical deflection is a well-proven technique for speed management. Speed tables and raised intersections may be considered only for design speed 25 mph or less. High levels of engagement with local public works and emergency services is required when vertical deflection is proposed.

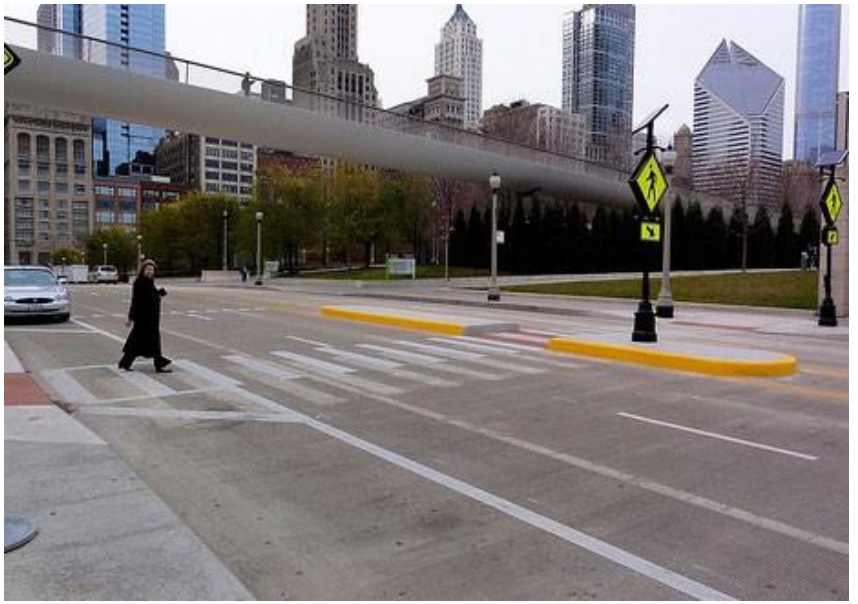
Spectacular Seven

- Crosswalk Visibility Enhancements
- Raised Crosswalks
- **Pedestrian Refuge Islands**
- Rectangular Rapid Flashing Beacon
- Pedestrian Hybrid Beacon (PHB)
- Road Diets

Pedestrian Refuge Islands

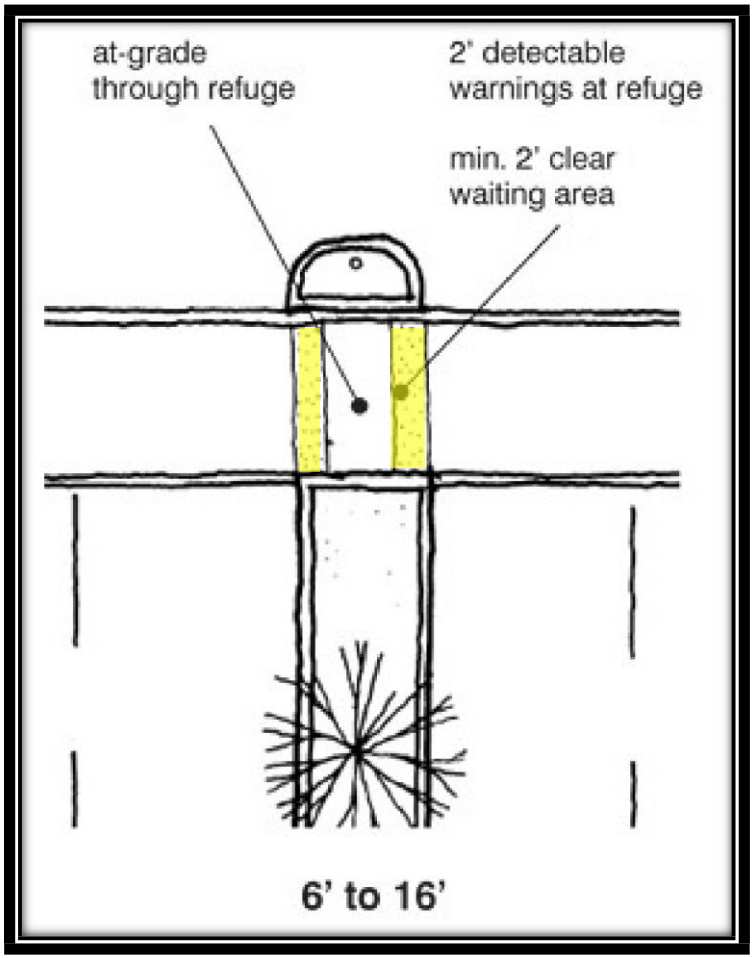


Pedestrian Refuge Islands



Medians between 6 and 16 feet wide

- Pathway & waiting area should be at street grade
- 2 foot wide detectable warning strips on each end
- 2 foot wide clear zone (min.) in the center



Graphic: San Francisco Better Streets Guide

FDOT Resources for Pedestrian Refuge Islands:

FDM 212: Intersections.

212.13 Islands

Figure 212.13.1

Figure 212.13.2

FDM 213: Modern Roundabouts.

213.3.5 Splitter Islands

Exhibit 213-3

Exhibit 213-4

Exhibit 213-5

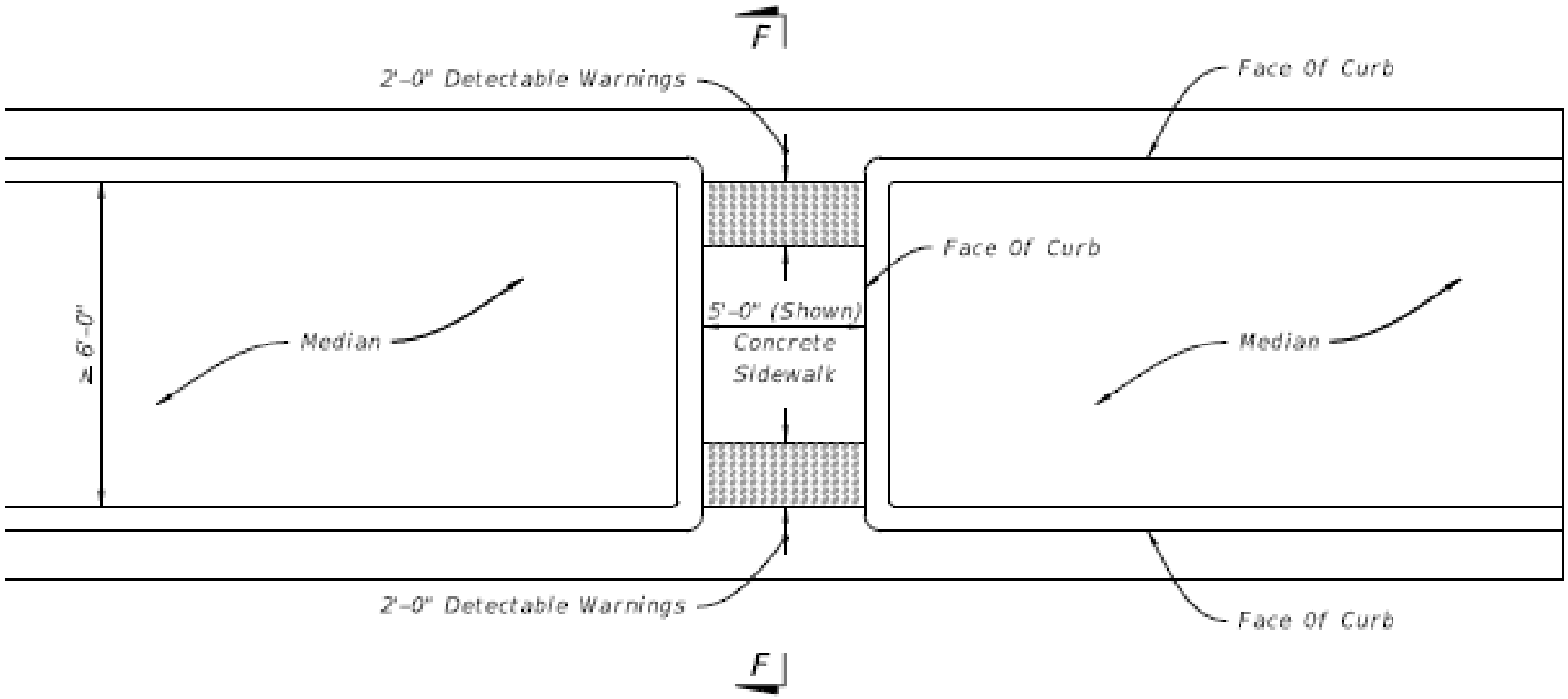
Standard Plans

Index 711-001 Pavement Markings. Sheet 8

Index 522-002 Detectable Warnings and Sidewalk Curb Ramps. Sheet 7

Developmental Standard Plans

Index D550-804 Pedestrian Channelization Barrier



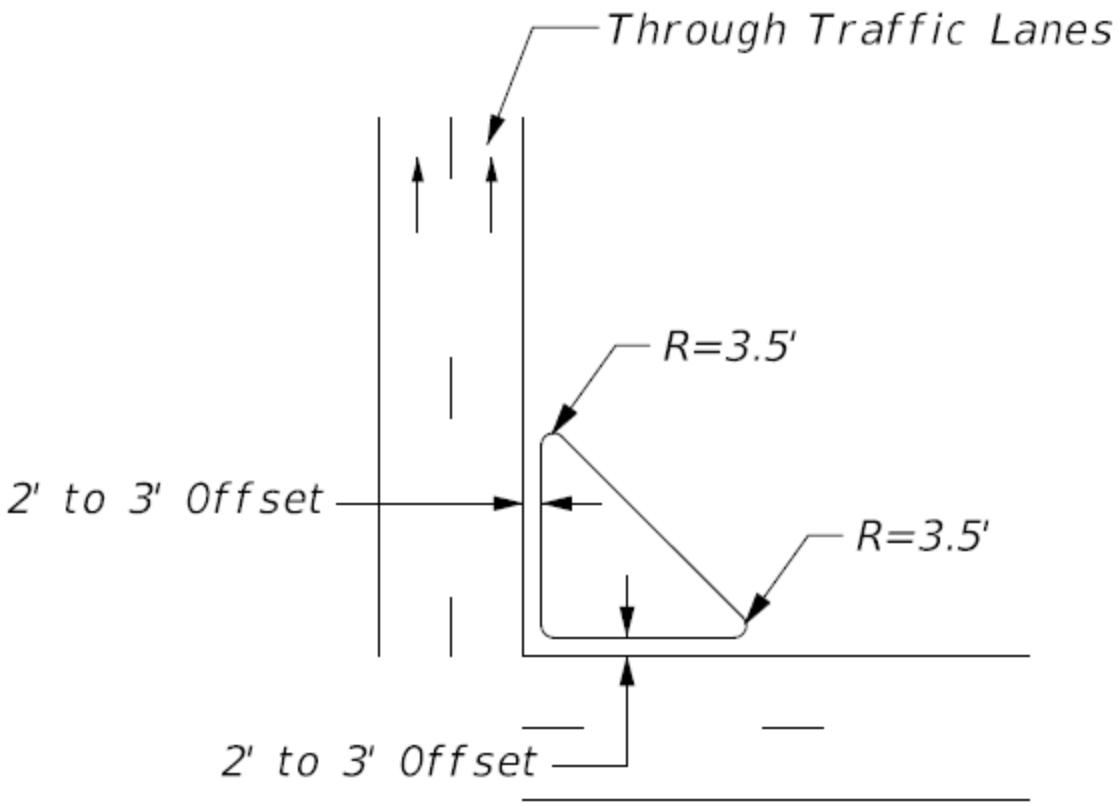
DEPRESSED SIDEWALK

1/28/2019

MEDIAN CROSSING

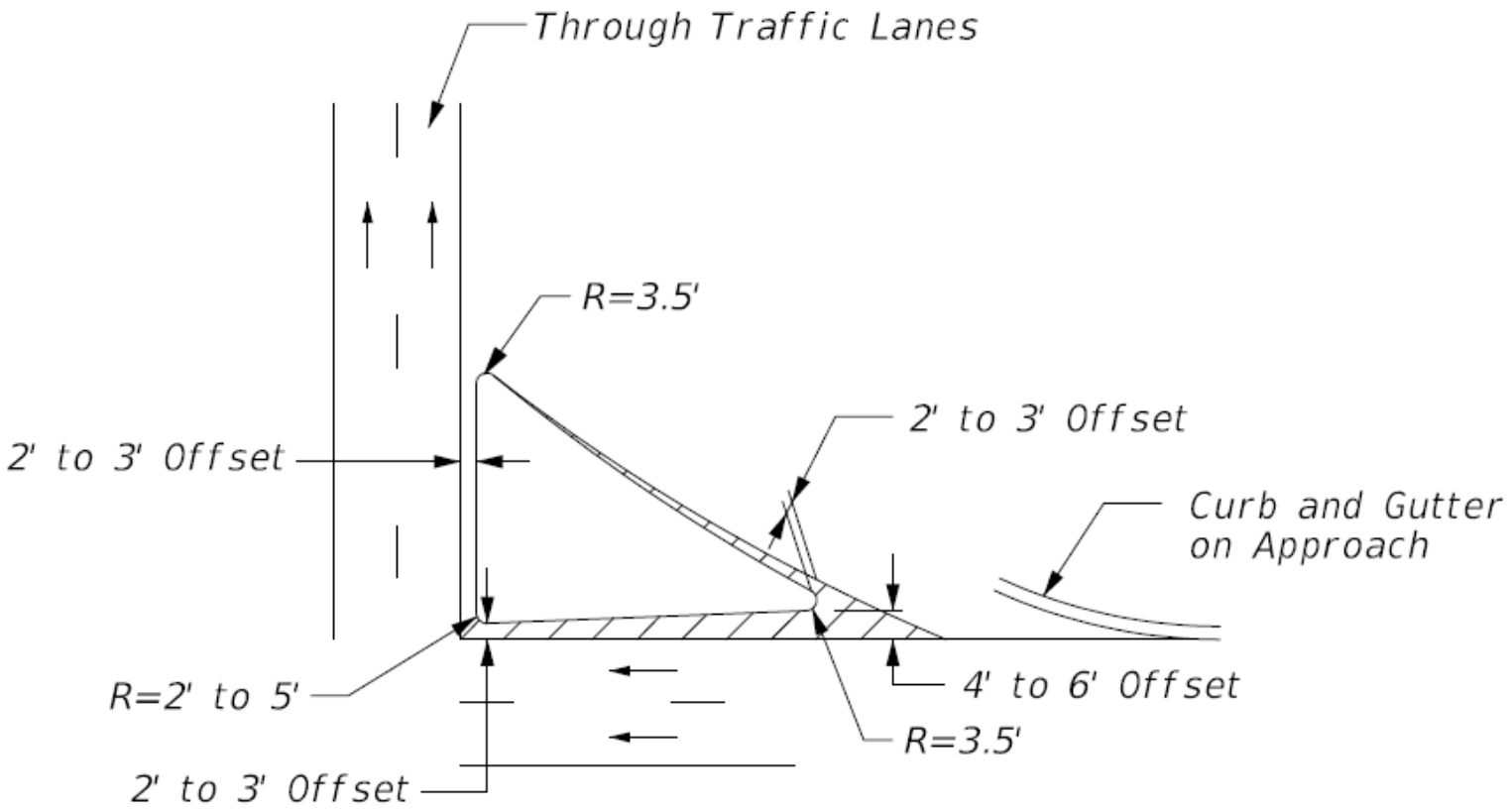
LAST REVISION	REVISION	DESCRIPTION:	FDOT	FY 2019-20 STANDARD PLANS	DETECTABLE WARNINGS AND SIDEWALK CURB RAMPS	INDEX	SHEET
11/01/17						522-002	7 of 8

Figure 212.13.1 Typical Small Curbed Island

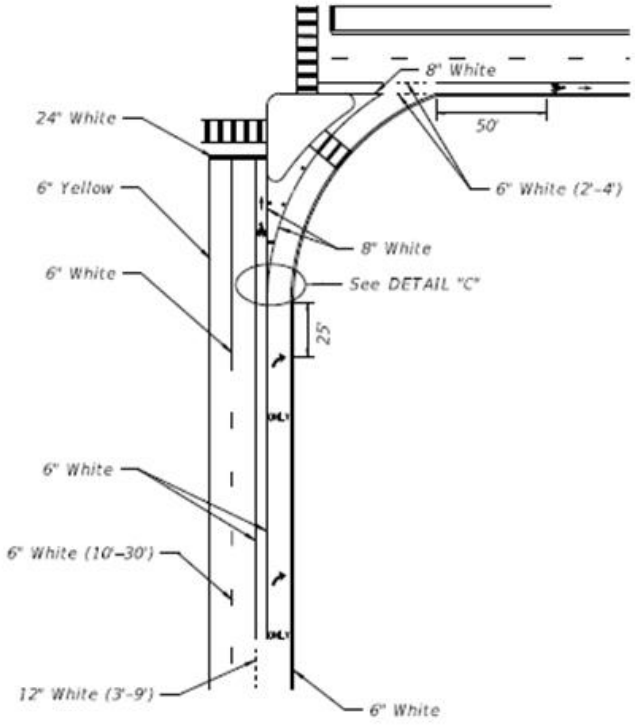


SMALL ISLAND

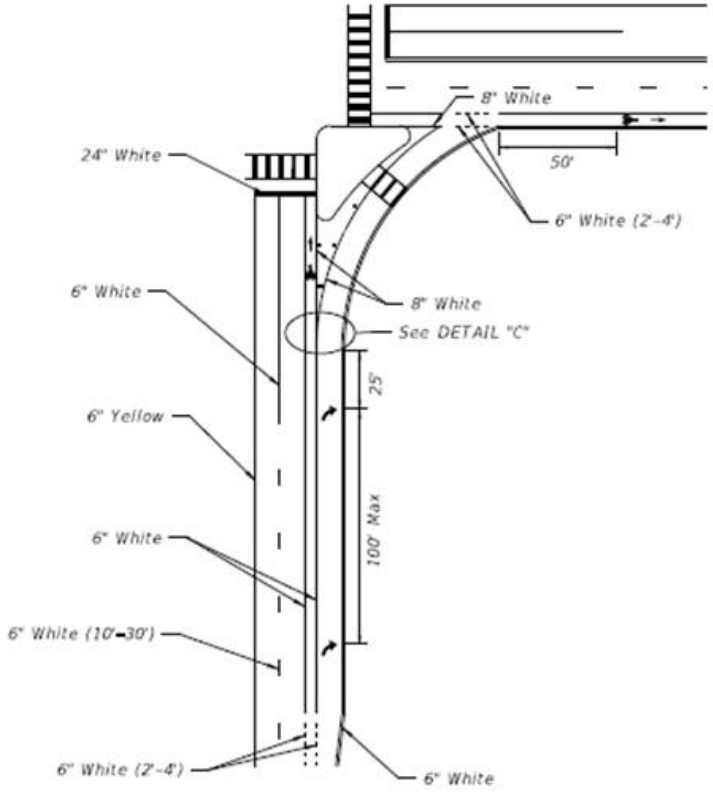
Figure 212.13.2 Typical Large Curbed Island



LARGE ISLAND



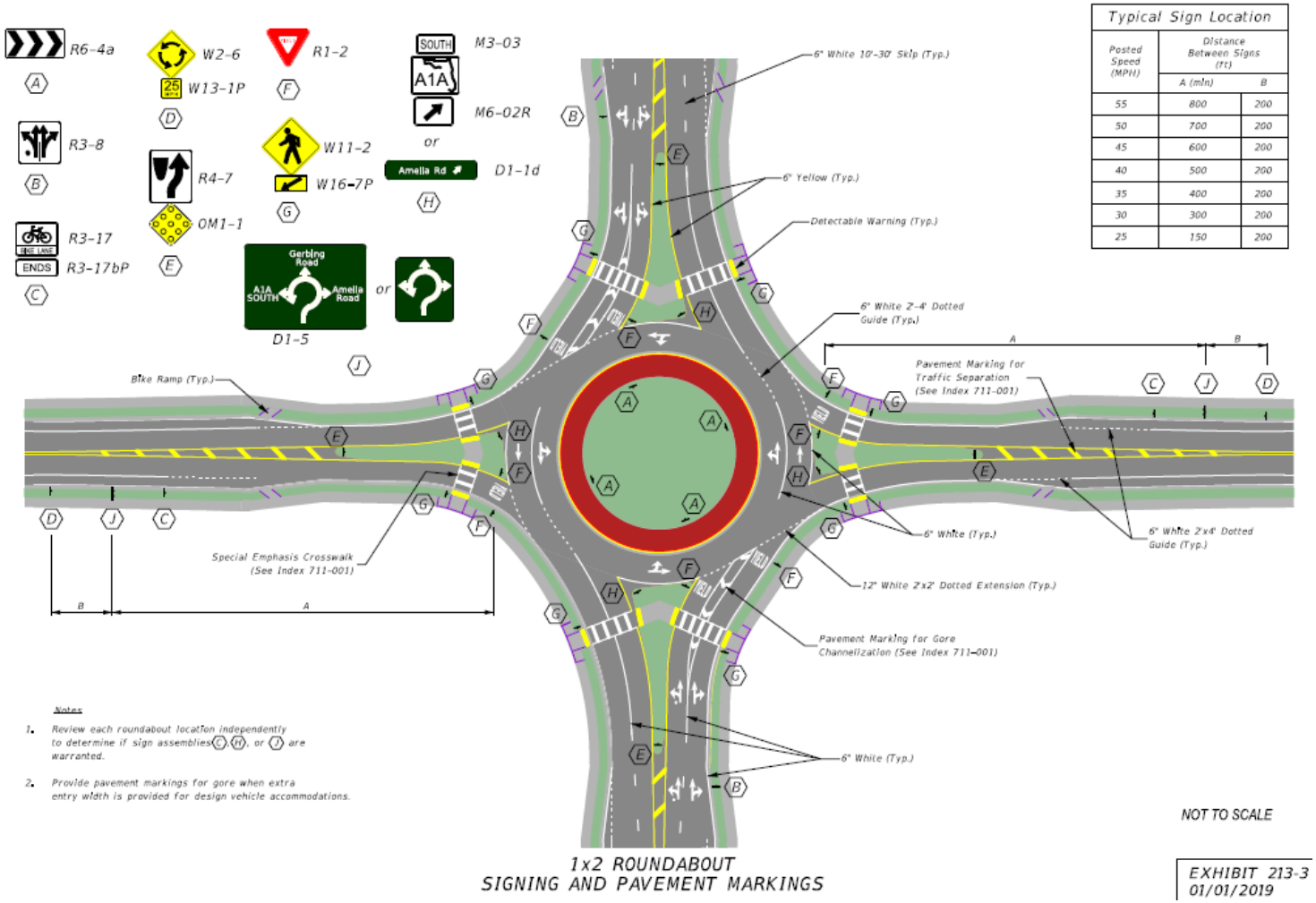
RIGHT TURN LANE DROP AND ISLAND DETAILS
LEFT TURN LANE DROP IS MIRROR IMAGE



RIGHT TURN LANE AND ISLAND DETAILS

LAST REVISION 11/01/18	REVISION	DESCRIPTION:	FDOT FY 2019-20 STANDARD PLANS	PAVEMENT MARKINGS	INDEX 711-001	SHEET 8 of 13

FDM 213: Modern Roundabouts



Typical Sign Location		
Posted Speed (MPH)	Distance Between Signs (ft)	
	A (min)	B
55	800	200
50	700	200
45	600	200
40	500	200
35	400	200
30	300	200
25	150	200

Notes

1. Review each roundabout location independently to determine if sign assemblies (C), (H), or (J) are warranted.
2. Provide pavement markings for gore when extra entry width is provided for design vehicle accommodations.

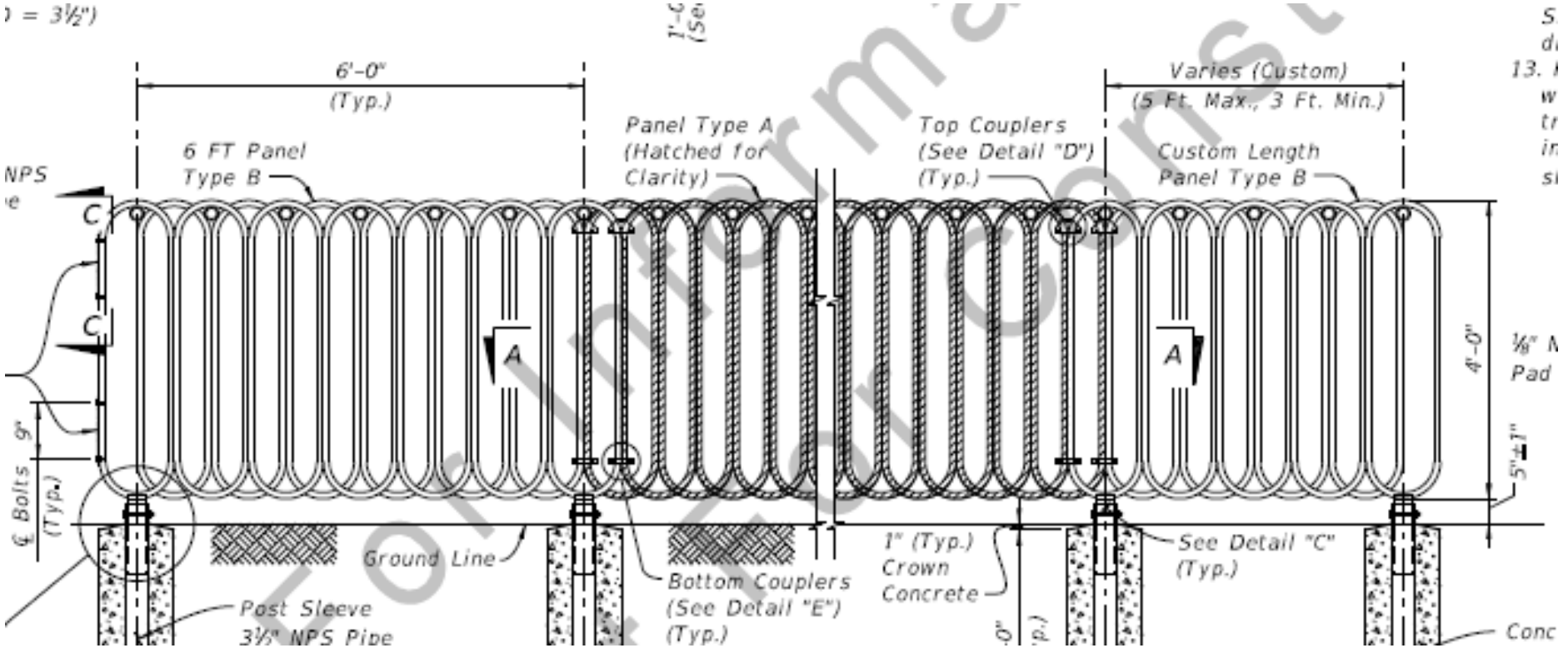
NOT TO SCALE

1x2 ROUNDABOUT
SIGNING AND PAVEMENT MARKINGS

EXHIBIT 213-3
01/01/2019

Phoenix, AZ

After: Raised median with stagger, Advance stop lines (not visible), Location near destination



LAST REVISION 10/10/14	REVISION	DESCRIPTION:	FDOT DEVELOPMENTAL STANDARD PLANS	PEDESTRIAN CHANNELIZATION BARRIER	INDEX D550-804	SHEET 1 of 4


STOP
ON RED
DO NOT
BLOCK


golden corral

Spectacular Seven

- Crosswalk Visibility Enhancements
- Raised Crosswalks
- Pedestrian Refuge Islands
- **Rectangular Rapid Flashing Beacon**
- PHB
- Road Diets
- LPI

Rectangular Rapid Flashing Beacon
New IA-21

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Correction issued 3/21/2018

Subject: **INFORMATION:** MUTCD – Interim Approval for Optional Use of Pedestrian-Actuated Rectangular Rapid-Flashing Beacons at Uncontrolled Marked Crosswalks (IA-21)

Date: MAR 20 2018

From: Martin C. Knopp
Associate Administrator for Operations

In Reply Refer To: HOTO-1

To: Federal Lands Highway Division Directors
Division Administrators

https://mutcd.fhwa.dot.gov/res-interim_approvals.htm#valid09

Figure 1. Example of an RRFB dark (left) and illuminated during the flash period (center and right) mounted with W11-2 sign and W16-7P plaque at an uncontrolled marked crosswalk.

- Must request and receive permission to use this new Interim Approval (1A-21) even if prior approval had been given for Interim Approval 1A-11
- A State may request Interim Approval for all jurisdictions in that State.

Interim Approval – Allowable Uses

- Function as pedestrian-actuated conspicuity enhancement
- Shall only be used to supplement post-mounted Pedestrian, School, Trail Crossing warning sign with diagonal downward arrow, plaque, or overhead-mounted warning sign located at or immediately adjacent to an uncontrolled marked crosswalk
- If deemed necessary by the engineer, in event of sight distance, additional RRFB may be installed in advance of crosswalk. Shall supplement not replace.

St. Petersburg FL

IA-21 3.a For any approach two RRFB required, One on right-hand and one on left-hand of roadway. If divided highway left-hand should be installed on median if practical rather than far left-hand.

IA-21 Accessible Pedestrian Features

7. a. - If speech pushbutton information message is used locator tone shall be provided

7. b. - If speech pushbutton information message is used, the audible information device shall not use vibrotactile indications or percussive indications

7. c. - Speech pushbutton message "Yellow lights are flashing". Message should be spoken twice.

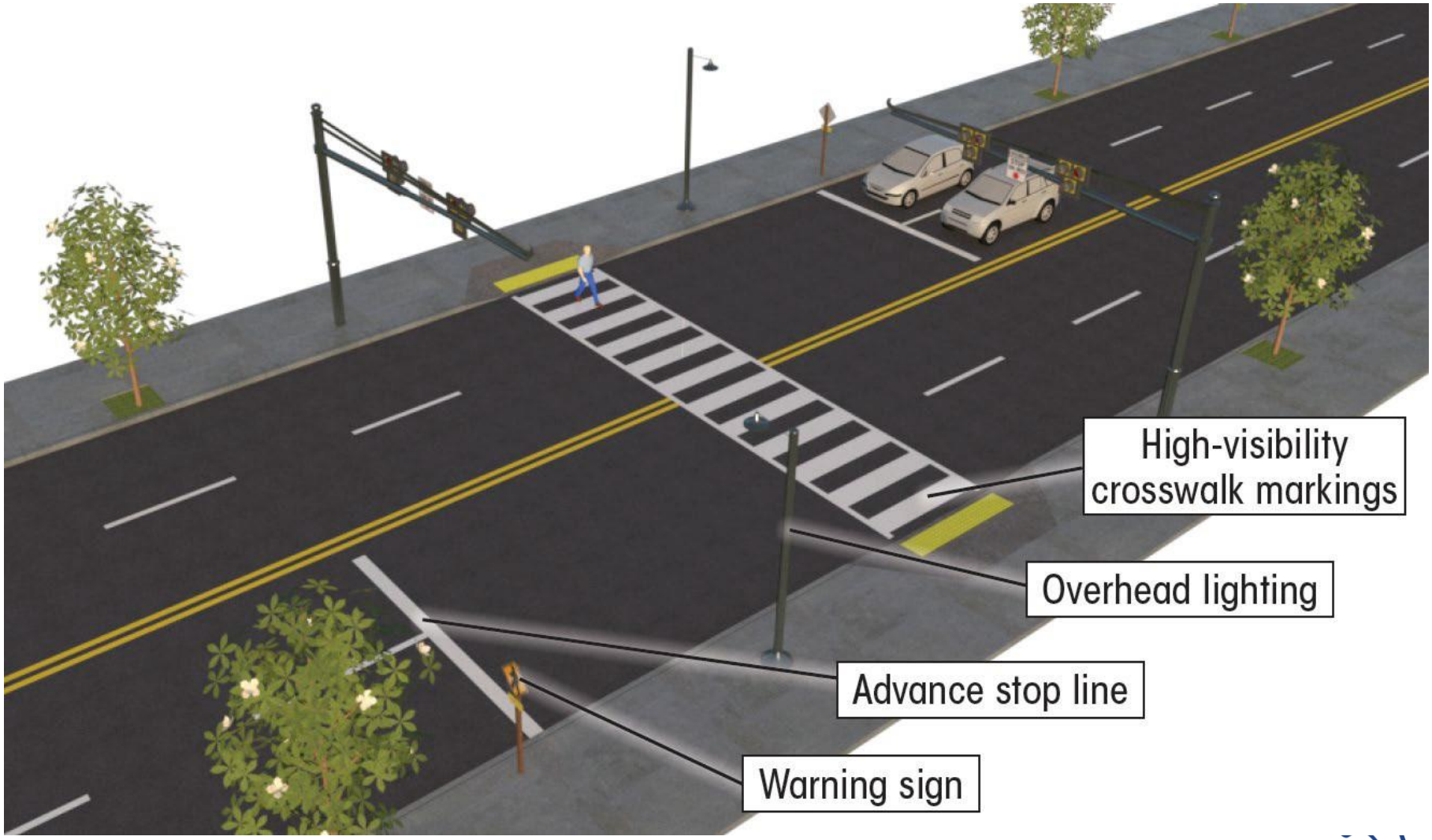
Rectangular Rapid Flash LED Beacon

- Studies indicate motorist yield rates increased from about 20% to 80%
- Higher yielding rates sustained even after two years of operation and no identifiable negative effects
  - St. Petersburg FL research report 2008

Spectacular Seven

- Crosswalk Visibility Enhancements
- Raised Crosswalks
- Pedestrian Refuge Islands
- RRFB
- **Pedestrian Hybrid Beacon (PHB)**
- Road Diets
- LPI

Pedestrian Hybrid Beacon

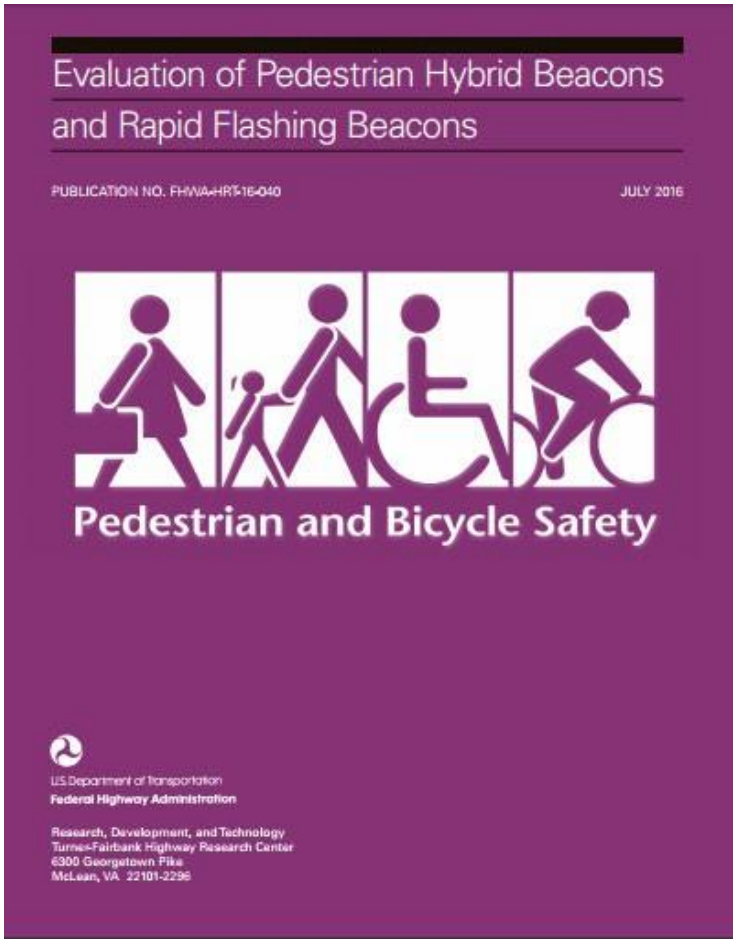


Pedestrian Hybrid Beacons (PHB)

CRF: Vehicle/Pedestrian 69%

Research of PHB

- 20 PHB sites open-road study
- Driver yielding to pedestrians avg. 96%
- Overall, 91% pedestrians pushed pushbutton to activate the PHB in the crosswalk
- A greater percentage of pedestrians activated the device when on 45 mph posted speed limit roads as compared to roads with posted speed limits of 40 mph or less

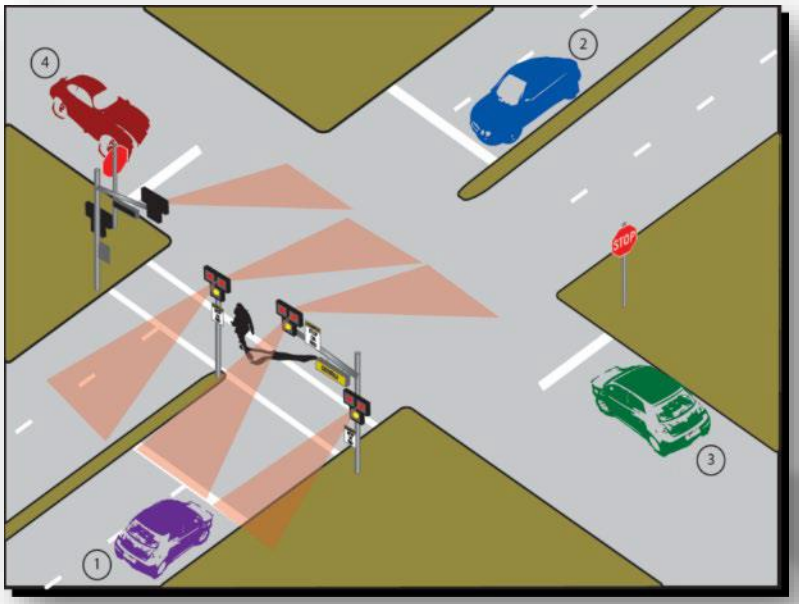


https://www.fhwa.dot.gov/publications/research/safety/16040/16040.pdf

One or Two crossing(s) at intersections

If used at an intersection or driveway, the PHB crossing and signal equipment should only control one crossing

- ITE Traffic Control Devices Handbook



Spectacular Seven

- Crosswalk Visibility Enhancements
- Raised Crosswalks
- Pedestrian Refuge Islands
- RRFB
- PHB
- **Road Diets**
- LPI

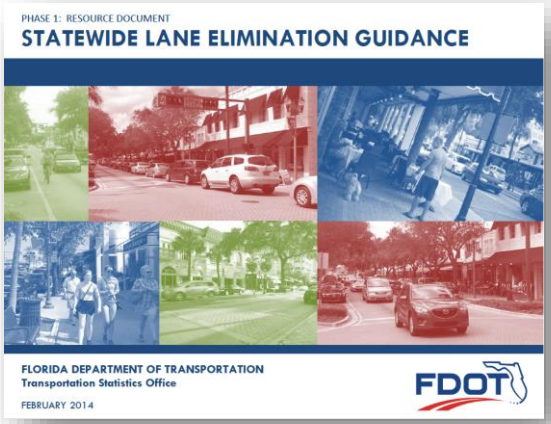
Road Diet / Lane Elimination

Lane elimination projects (a.k.a., "road diets" or "lane reductions") are intended to reduce the number of travel lanes and effective width of the road to achieve systemic improvements.

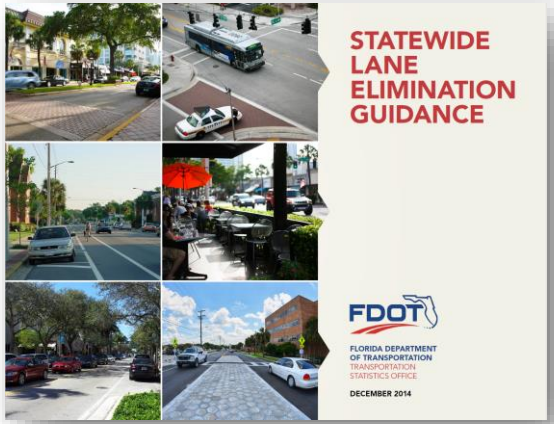
Road Diet / Roadway Reconfiguration

- Livable environment
- Traffic calming
- Bike lanes
- Buffer sidewalk from travel lanes (parking or bike lane)

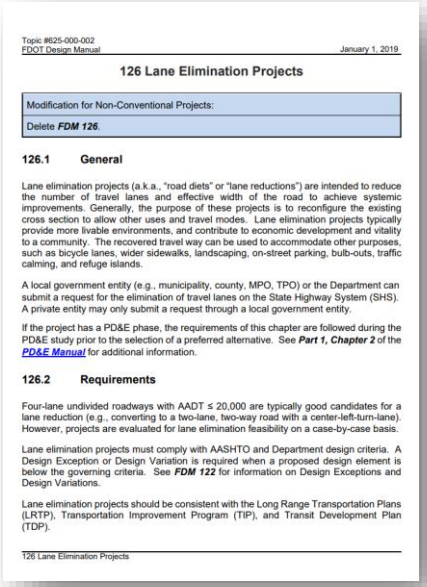
Resources



Phase 1: FDOT's compilation of lane elimination examples and sample analysis processes



Phase 2: FDOT's internal guidance for implementing lane elimination projects on the State System



Topic #625-000-002
FDOT Design Manual
January 1, 2019

126 Lane Elimination Projects

Modification for Non-Conventional Projects:
Delete ***FDM 126***.

126.1 General

Lane elimination projects (a.k.a., "road diets" or "lane reductions") are intended to reduce the number of travel lanes and effective width of the road to achieve systemic improvements. Generally, the purpose of these projects is to reconfigure the existing cross section to allow other uses and travel modes. Lane elimination projects typically provide more livable environments, and contribute to economic development and vitality to a community. The recovered travel way can be used to accommodate other purposes, such as bicycle lanes, wider sidewalks, landscaping, on-street parking, bulb-outs, traffic calming, and refuge islands.

A local government entity (e.g., municipality, county, MPO, TPO) or the Department can submit a request for the elimination of travel lanes on the State Highway System (SHS). A private entity may only submit a request through a local government entity.

If the project has a PD&E phase, the requirements of this chapter are followed during the PD&E study prior to the selection of a preferred alternative. See ***Part 1, Chapter 2*** of the ***PD&E Manual*** for additional information.

126.2 Requirements

Four-lane undivided roadways with AADT ≤ 20,000 are typically good candidates for a lane reduction (e.g., converting to a two-lane, two-way road with a center-left-turn-lane). However, projects are evaluated for lane elimination feasibility on a case-by-case basis.

Lane elimination projects must comply with AASHTO and Department design criteria. A Design Exception or Design Variation is required when a proposed design element is below the governing criteria. See ***FDM 122*** for information on Design Exceptions and Design Variations.

Lane elimination projects should be consistent with the Long Range Transportation Plans (LRTP), Transportation Improvement Program (TIP), and Transit Development Plan (TDP).

126 Lane Elimination Projects

FDOT Design Manual Chapter 126: Lane Elimination
Chapter 103 Standard Forms

Applicant

- A local government entity (e.g., municipality, county, MPO, TPO) or the Department.
- Private entity may only submit a request through a local government entity.

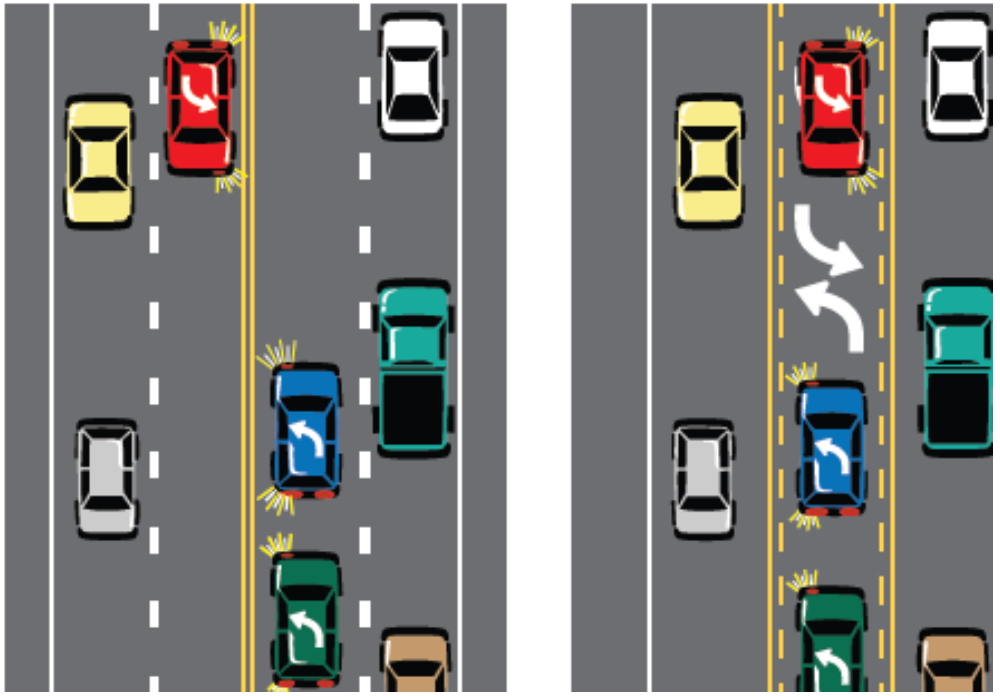
Requirements

- Comply with AASHTO and FDOT design criteria
- Follow the National Environmental Policy Act (NEPA) when using federal funding
- If project has a PD&E phase, the requirements of this chapter are followed during the PD&E study prior to the selection of a preferred alternative
- Design Exception or Design Variation

Requirements (*FDM 126*)

- Four-lane undivided roadways with AADT ≤ 20,000
- Consistent with the LRTP, TIP, and TDP
- Impacts in different areas
- Conduct public involvement activities in accordance with FDOT's ***Public Involvement Handbook***.

A 4-lane roadway may already operate like a 3-lane road



Road Diet CMF = 0.47 & 0.71
CRF = 53% & 29%

▼ Countermeasure: Converting four-lane roadways to three-lane roadways with center turn lane (road diet)

CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
0.47	53	★★★★☆	All	All	Suburban	Persaud et. al, 2010	

▼ Countermeasure: Road diet (Convert 4-lane undivided road to 2-lanes plus turning lane)

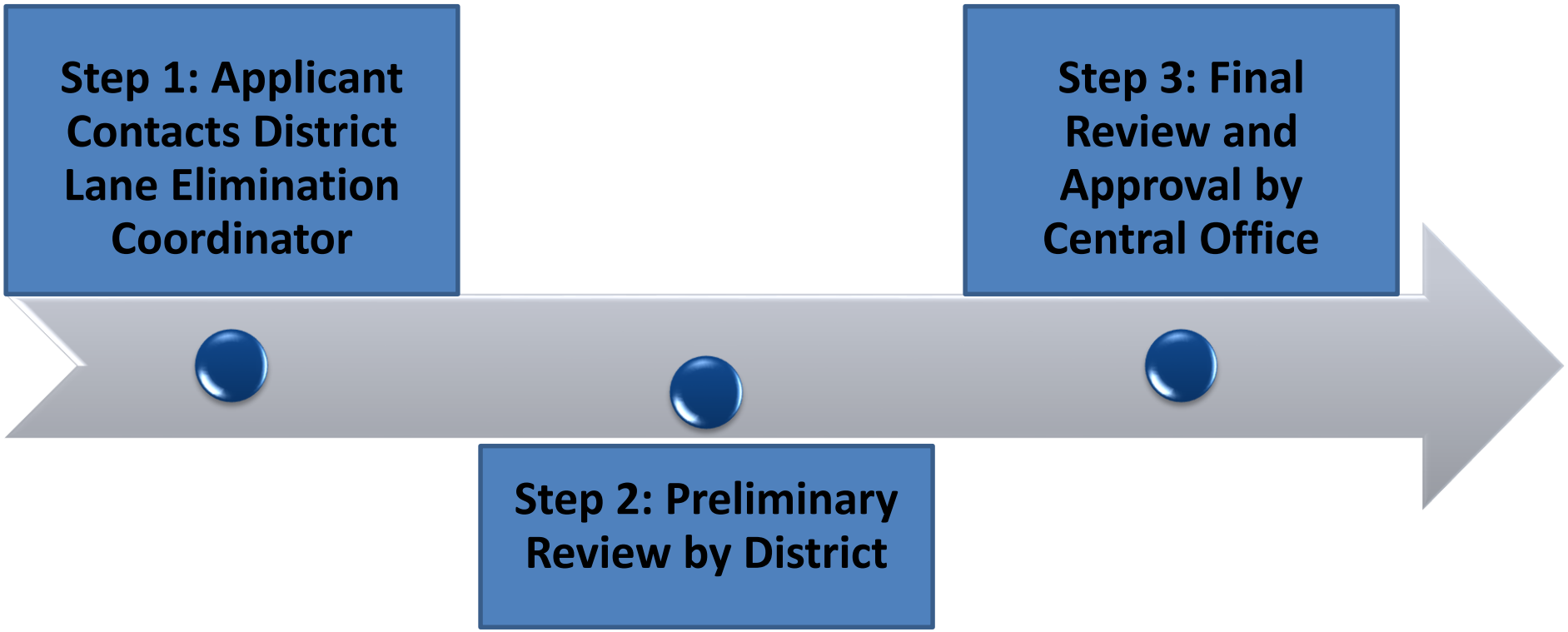
CMF	CRF (%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
0.71 [B]	29	★★★★★	All	All	Urban	Harkey et al., 2008	

Source: CMF Clearinghouse www.cmfclearinghouse.org

Implementing Road Diets in New Jersey video

Application Process

FDM 126



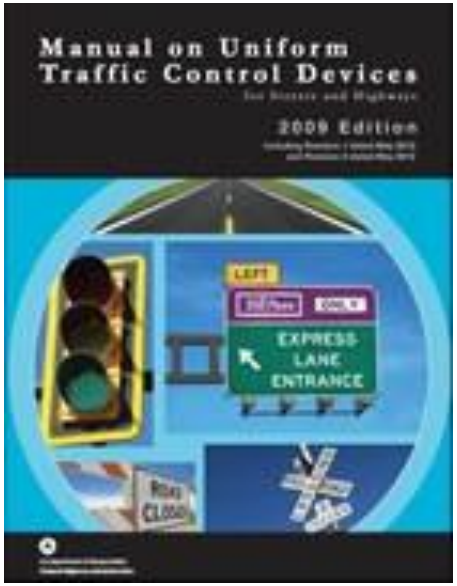
Required Forms (FDM 103)

- 126-A: Initial Meeting Checklist
- 126-B: Methodology Checklist
- 126-C: Lane Elimination Initial Notice to CO
- 126-D: Lane Elimination Final Review and Approval Notice to CO

Note: Resubmittals must include an updated and signed Form 126-D

Spectacular Seven

- Crosswalk Visibility Enhancements
- Raised Crosswalks
- Pedestrian Refuge Islands
- RRFB
- PHB
- Road Diets
- **Leading Pedestrian Interval**



MUTCD Sec. 4E.06, paragraphs 19-23

LPI : WALK comes on at least 3 seconds prior to the green vehicular signal; pedestrians enter crosswalk before turning vehicles start moving into their path.

Benefits

- Ease of implementation
- Immediate results
- Minimal impact to vehicular timing plans, MOEs
- Up to 60% reduction in conflicts
- High B/C ratio
- May be systemically applied

- May be coupled for bicyclists benefit
- Stand alone treatment or combined with other pedestrian improvement strategies

On-Ramp to Innovation
every day counts

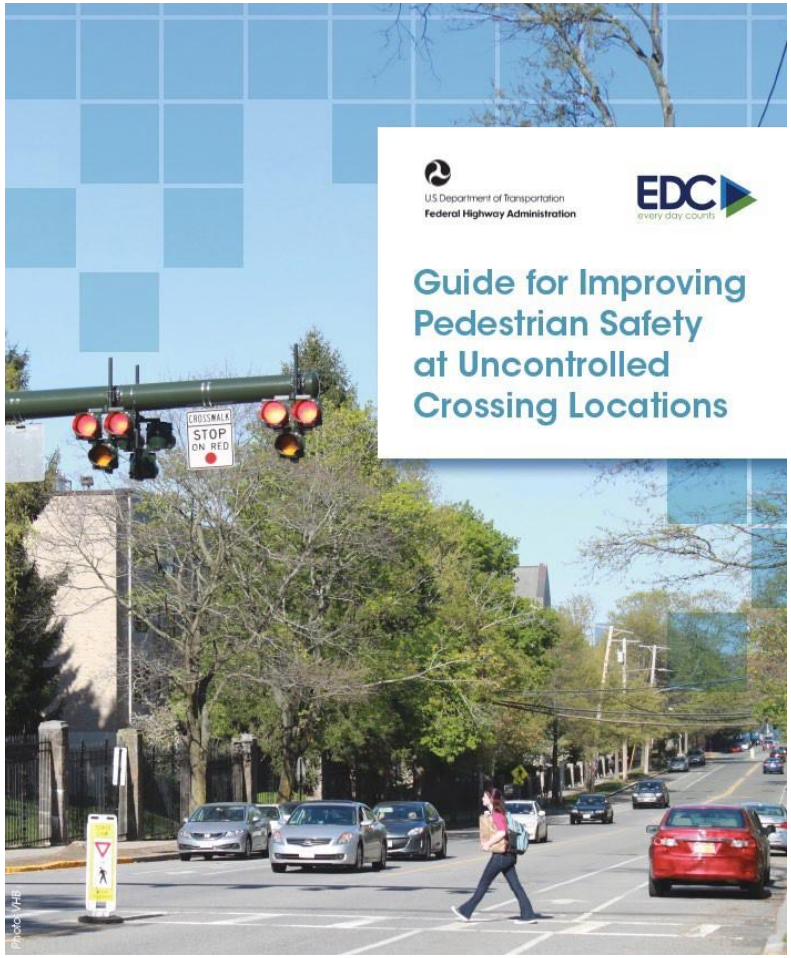




Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

FHWA Guide

- Provides guidance and suggested process for selecting countermeasures
- Assists agencies in developing a policy to support the installation of countermeasures at uncontrolled crossing locations



www.fhwa.dot.gov/innovation/everydaycounts/edc_4/guide_to_improve_uncontrolled_crossings.pdf

Countermeasure Selection Process

Following the process suggested in the guide offers countermeasure options based on road conditions, crash causes, and pedestrian safety issues.

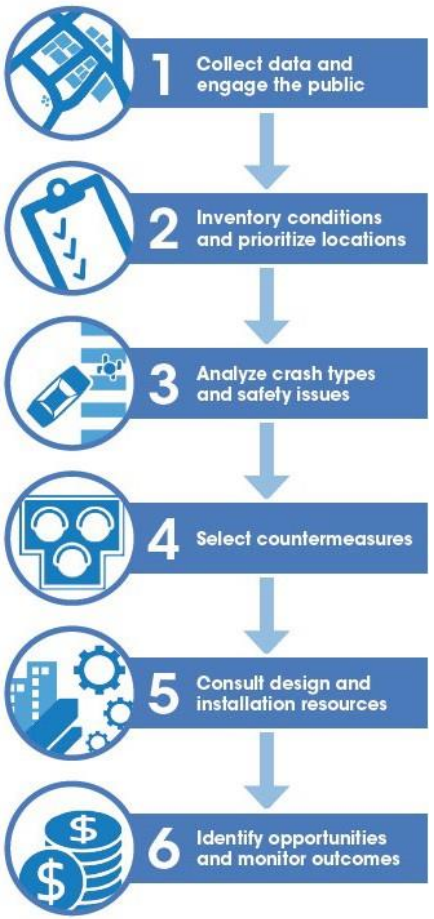


Figure 1. Process diagram for selecting countermeasures at uncontrolled pedestrian crossing locations.

4 Select 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
2 lanes (1 lane in each direction)	❶ 2 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6 7 9	① 5 6 7 9	① 5 6 ❾
3 lanes with raised median (1 lane in each direction)	❶ 2 3 4 5	❶ ❸ 5 7 9	① ❸ 5 ❼ ❾	① 3 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❼ ❾	① ❸ 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❾
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	❶ 2 3 4 5 6 7 9	❶ ❸ 5 6 7 9	① ❸ 5 6 ❾	① 3 4 5 6 7 9	① ❸ 5 6 ❼ ❾	① ❸ 5 6 ❾	① ❸ 4 5 6 7 9	① ❸ 5 6 ❾	① ❸ 5 6 ❾
4+ lanes with raised median (2 or more lanes in each direction)	❶ ❸ 5 7 8 9	❶ ❸ 5 7 8 9	① ❸ 5 8 ❾	① ❸ 5 7 8 9	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 ❼ 8 9	① ❸ 5 8 ❾	① ❸ 5 8 ❾
4+ lanes w/o raised median (2 or more lanes in each direction)	❶ ❸ 5 6 7 8 9	① ❸ 5 6 7 8 9	① ❸ 5 6 8 ❾	① ❸ 5 6 7 8 9	① ❸ 5 6 ❼ 8 ❾	① ❸ 5 6 8 ❾	① ❸ 5 6 ❼ 8 9	① ❸ 5 6 8 ❾	① ❸ 5 6 8 ❾

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 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.

Questions

On-Ramp to Innovation
every day counts





Resources

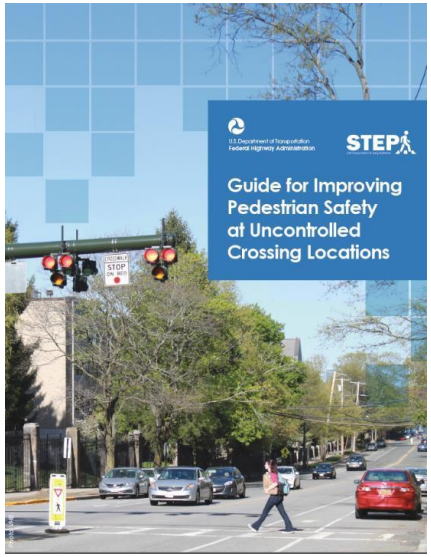
EDC

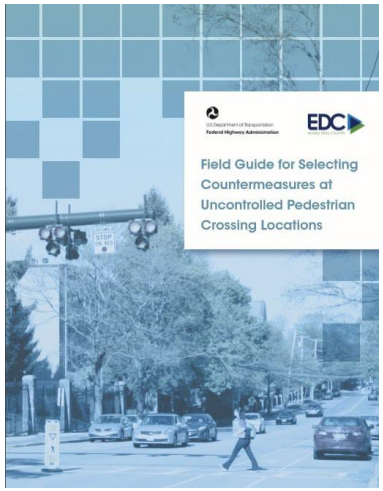
FDOT

Resources

- EDC4 STEP Website
  - https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm
- EDC5 STEP website
  - https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/step2.cfm
- FHWA Pedestrian Safety Website
  - https://safety.fhwa.dot.gov/ped_bike/
- PBIC Website
  - www.pedbikeinfo.org
- CMF Clearinghouse
  - http://www.cmfclearinghouse.org/

STEP Guides and Tech Sheets





https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step_tech_sheet.pdf

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.

Roadway Configuration	Speed Limit								
	≤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*	❶ 2 3 4 5 6	❶ ❸ 5 6 7	❶ ❸ 5 6 ❼	❶ 3 4 5 6	❶ ❸ 5 6 7	❶ ❸ 5 6 ❼	❶ 3 4 5 6 7	❶ ❸ 5 6 7	❶ ❸ 5 6 ❼
3 lanes with raised median*	❶ 2 3 4 5	❶ ❸ 5 7	❶ ❸ 5 ❼	❶ 3 4 5 7	❶ ❸ 5 ❼	❶ ❸ 5 ❼	❶ ❸ 4 5 7	❶ ❸ 5 ❼	❶ ❸ 5 ❼
3 lanes w/o raised median†	❶ 2 3 4 5 6 7	❶ ❸ 5 6 7	❶ ❸ 5 6 ❼	❶ 3 4 5 6 7	❶ ❸ 5 6 ❼	❶ ❸ 5 6 ❼	❶ ❸ 4 5 6 7	❶ ❸ 5 6 ❼	❶ ❸ 5 6 ❼
4+ lanes with raised median‡	❶ ❸ 5	❶ ❸ 5 7	❶ ❸ 5 ❼	❶ ❸ 5 7	❶ ❸ 5 ❼	❶ ❸ 5 ❼	❶ ❸ 5 ❼	❶ ❸ 5 ❼	❶ ❸ 5 ❼
4+ lanes w/o raised median‡	❶ ❸ 5 6 7 8	❶ ❸ 5 ❻ 7 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ 7 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ ❼ 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,

❶ 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

This table was developed using information from: Zegeer, C. V., Stewart, J. R., Huang, H. H., Lagerway, 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/).

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.

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.

Resources

PEDSAFE http://www.pedbikesafe.org/PEDSAFE/index.cfm

Links in PEDSAFE to specific countermeasures

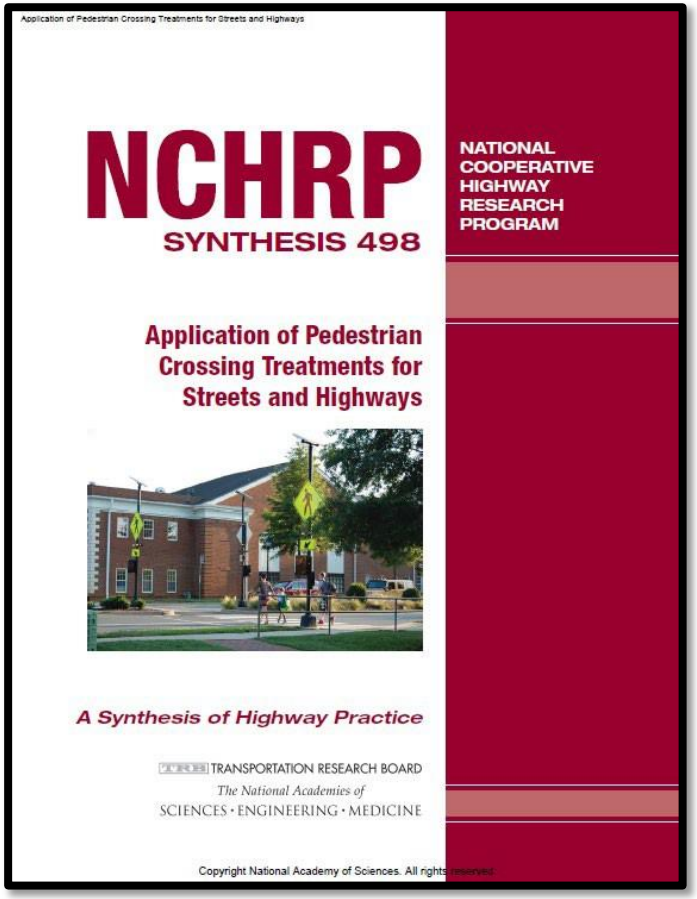
- Marked Crosswalks and Enhancements
  - http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=4
- Lighting and Illumination
  - http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=8
- Crossing Islands
  - http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=6
- Raised Pedestrian Crossings/ Raised Crosswalks
  - http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=7
- Raised Medians
  - http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=22
- RRFB
  - http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=54
- Pedestrian Hybrid Beacon
  - http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=53
- Road Diets (Lane Reduction)
  - http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=19
- Leading Pedestrian Interval (LPI)
  - http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=12

Costs of Treatments http://www.pedbikeinfo.org/cms/downloads/Countermeasure%20Costs_Report_Nov2013.pdf

NCHRP Synthesis 498 (December 2016)

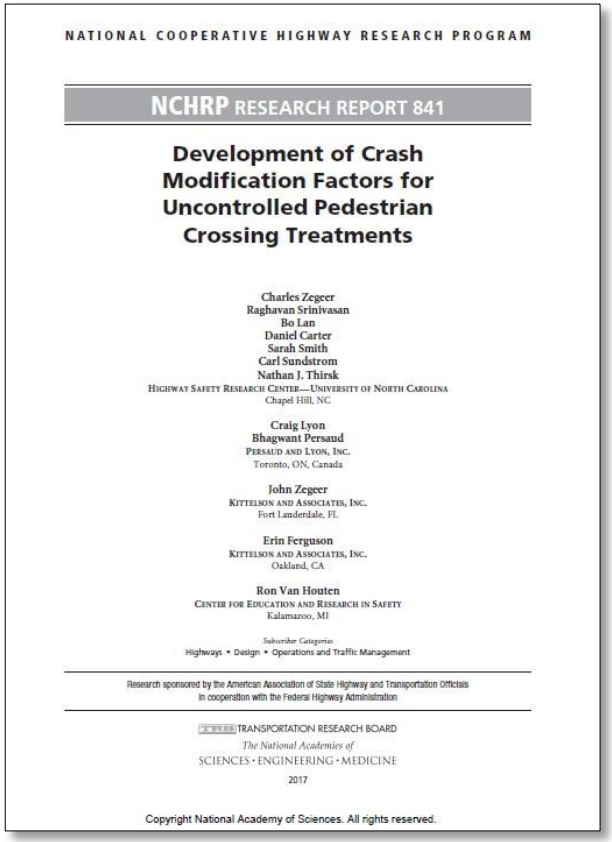
Developed by

1. Surveying State DOT's, Local Transportation Agencies
2. Identifying & synthesizing effective practices and policies
3. Comprehensive literature review of safety evidence for more than 25 pedestrian crossing treatments



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

NCHRP 841 Development of CMF for Uncontrolled Pedestrian Crossing Treatments



NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP RESEARCH REPORT 841

Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments

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Table S-1. Recommended CMFs.

Treatment	Crash Type	Recommended CMF		Study Basis
		Estimate	Standard Error	
Refuge Island	Pedestrian	0.685	0.183	Median from two studies
	Total	0.742	0.071	Cross-section
	All Injury	0.714	0.082	Cross-section
	Rear-End/Sideswipe Total	0.741	0.093	Cross-section
	Rear-End/Sideswipe Injury	0.722	0.106	Cross-section
Advanced YIELD or STOP Markings and Signs	Pedestrian	0.750	0.230	Median from two studies
	Total	0.886	0.065	Before-after
	Rear-End/Sideswipe Total	0.800	0.076	Before-after
PHB	Pedestrian	0.453	0.167	Median from two studies
PHB + Advanced YIELD or STOP Markings and Signs	Pedestrian	0.432	0.134	Median from two studies
	Total	0.820	0.078	Before-after
	Rear-End/Sideswipe Total	0.876	0.111	Before-after
RRFB	Pedestrian	0.526	0.377	Cross-section

http://www.trb.org/Main/Blurbs/175381.aspx

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Thank You