



# FHWA 9 Proven Safety Countermeasures

## Florida's Story



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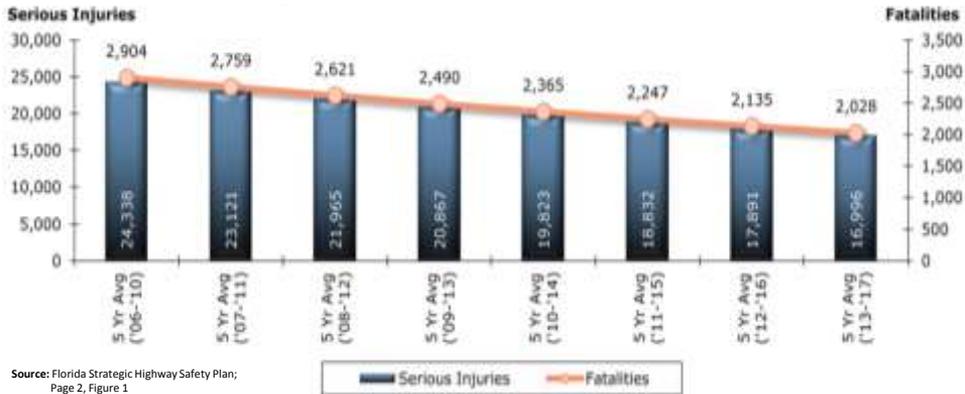
- Florida Strategic Highway Safety Plan and Performance Highlight
- Overview and Incorporation of FHWA Proven Safety Countermeasures
- Resources for implementation





# Strategic Highway Safety Plan 2012 SHSP

- Measures 5-year average fatalities and serious injuries, using 2006-2010 as baseline
- Overall goal is 5 percent reduction in 5-year moving average of fatalities and serious injuries



Source: Florida Strategic Highway Safety Plan; Page 2, Figure 1

The numbers are relative...  
2012 Fatalities

Connecticut	236	Miami-Dade County - 235
Utah	217	
Nebraska	212	
Montana	205	
Idaho	184	Broward County - 184
North Dakota	170	Hillsborough County - 178
Maine	164	
South Dakota	133	Palm Beach County - 137
Hawaii	126	
Wyoming	123	
Delaware	114	Duval County - 119

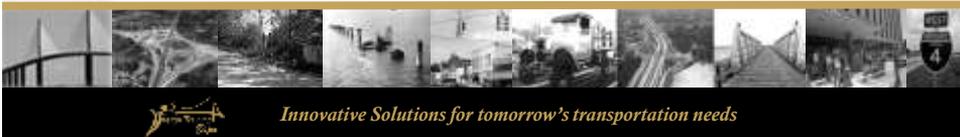




## 2012 Florida SHSP

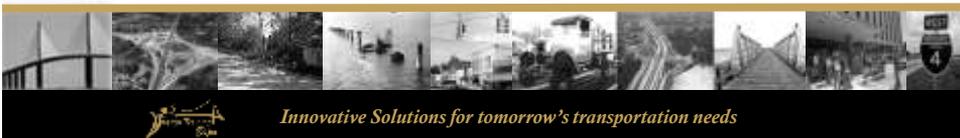
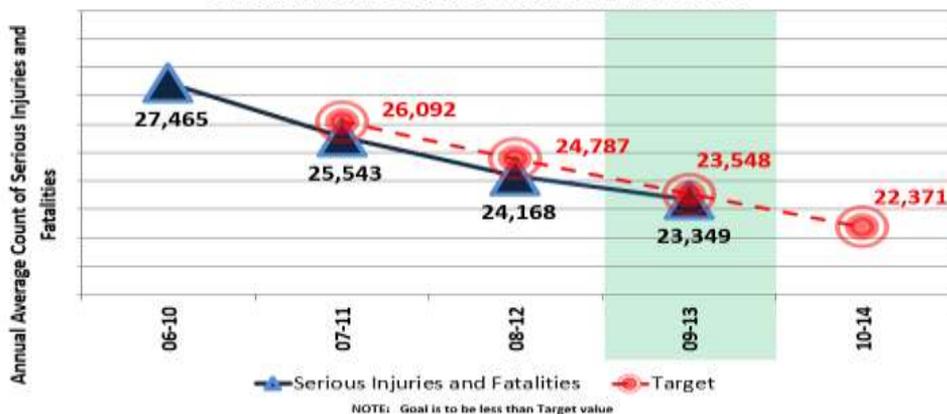
**Emphasis Areas – goals are to reduce by 5% the rolling 5 year average**

- Aggressive Driving (3-year average)
- Intersection Crashes
- Lane Departure Crashes (3-year average)
- Vulnerable Road Users (pedestrian, bicycle, motorcycle)
- At-Risk Drivers (young (15-19) and aging (65 and up) road users)
- Traffic Data
- Impaired Driving (suspected alcohol and suspected drug use)
- Distracted Driving (3-year average – baseline 2011-2013)



## SHSP Preliminary Performance 2013 Annual Averages

Data Source: Fatalities and Serious Injuries are from the FOOT State Safety Office Crash Analysis Reporting (CAR) database  
**Annual Average Serious Injuries and Fatalities**  
 Statewide for 2006-10, 2007-11, 2008-12 and 2009-13





## Introduction and Background

*“While States should still be considering the application of all of the countermeasures listed in the 2008 guidance, this memo supersedes the previous guidance.” – 2012 Countermeasure Guidance*

- FHWA Issued Nine Proven Countermeasures Guidance in 2008.
- Many of those countermeasures have been widely applied.
- FHWA is updating our previous guidance.
- We are taking into consideration the latest safety research.

*“...we encourage safety practitioners to consider a new set of countermeasures ...that are research-proven, but not widely applied on a national basis.” – 2012 Countermeasure Guidance*

# Countermeasure Selection Process

## 2008 Countermeasures

1. Rumble Strips and Rumble Stripes\*
2. Median Barriers
3. Walkways
4. Left and Right Turn Lanes at Stop-Controlled Intersections
5. Yellow Change Intervals
6. Roadway Safety Audit 1.27\*\*
7. Roundabouts 1.23
8. Medians and Pedestrian Refuge Areas 1.17
9. Safety Edge 1.15

## 2012 Countermeasures

1. Roundabouts
2. Safety Edge
3. Medians and Pedestrian Crossing Islands in Urban and Suburban Areas
4. Longitudinal Rumble Strips and Stripes on 2-lane Roads\*
5. Corridor Access Management
6. Backplates and Retroreflective Borders
7. Enhanced Delineation and Friction for Horizontal Curves
8. Pedestrian Hybrid Beacon
9. "Road Diets" (Roadway Reconfiguration)



\* Group decided to retain for two-lane roads only, based on application of countermeasure  
 \*\* Not a Countermeasure

## Data-Driven Safety Process

**"...countermeasure selection should continue to be based on appropriate analytical techniques..."**

- 2012 Countermeasure Guidance

Encourage States to Use Analytical Site-Specific Approaches (such as the Highway Safety Manual) and Systemic Planning Approaches to Make Safety Investment Decisions

- Conduct Appropriate Analysis of Quality Safety Data
- Use Evidence-Based Framework for Decision-Making
- Use the CMF Clearinghouse to Choose Appropriate Countermeasures
- Consider the Nine Countermeasures as Viable Options

# Florida Crash Data Sources

Florida Department of Highway Safety and Motor Vehicles

- Traffic Crash Facts - <http://www.flhsmv.gov/resource-center/crash-citation-reports/>

University of Florida – Geo Plan Center

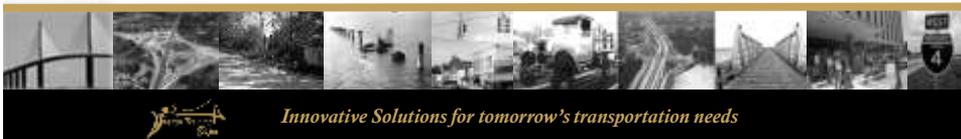
- Signal 4 Analytics - <https://s4.geoplan.ufl.edu/>

Florida Department of Transportation – State Safety Office

- Traffic Safety Portal - <http://www2.dot.state.fl.us/trafficsafetywebportal/index.aspx>
- State Safety Office GIS Portal - <http://www2.dot.state.fl.us/ssogis/>
- All Roads Crash Analysis - <http://www2.dot.state.fl.us/trafficsafetywebportal/FivePercent/FivePercentMain.aspx>

Florida Department of Transportation – Unified Basemap Repository (UBR)

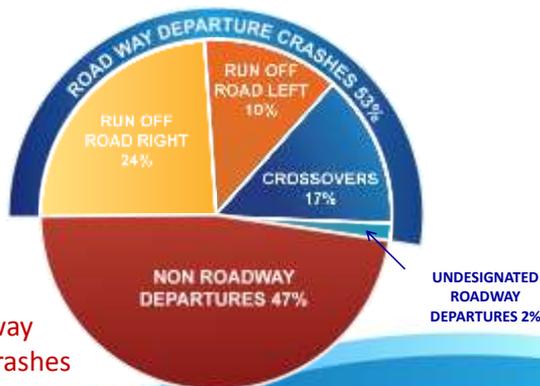
- Internal - <http://webapp01.dot.state.fl.us/unifiedbasemaprepository/Default.aspx>
- External - <https://www3.dot.state.fl.us/unifiedbasemaprepository/>



## Addressing the **Roadway**

### **Departure** Focus Area

- Longitudinal Rumble Strips and Stripes on 2-Lane Roads
- Enhanced Delineation and Friction for Horizontal Curves
- Safety Edge<sub>SM</sub>



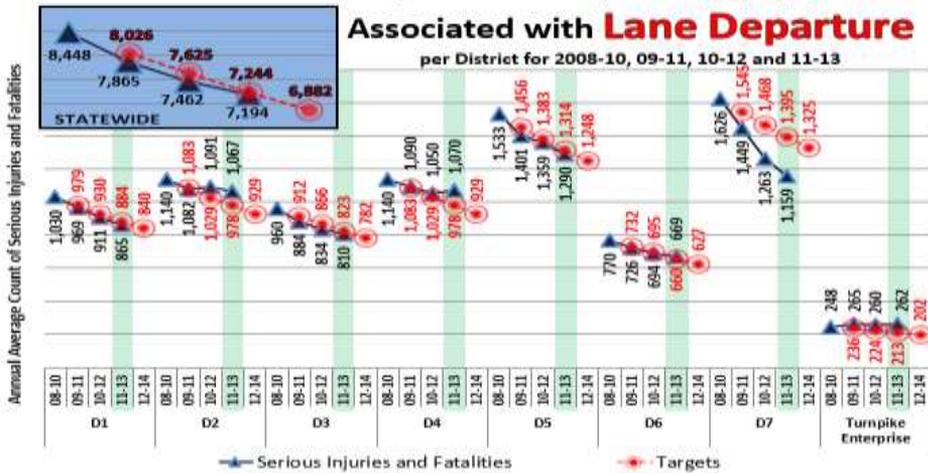
Roadway Departure  
Risk Management

1. Keep Vehicles on Roadway
2. Reduce Likelihood of Crashes
3. Minimize Severity



## SHSP Preliminary Performance Per District 2013 Annual Averages

Data Source: Fatalities and Serious injuries are from the FDOT State Safety Office Crash Analysis Reporting (CAR) database



## Longitudinal Rumble Strips and Stripes on 2-Lane Roads

- Alerts drivers with sound and vibration when vehicles cross the edge or center line.
- Reduction of Severe Crashes:
  - Rural Edge, Run Off Road: 36%
  - Rural Center, Head-ons: 44%
  - Urban Center, Head-ons: 64%



# Florida Longitudinal Rumble Strips and Stripes on 2-Lane Roads Info

- Florida Crash Modification Factor
  - REF. [http://www.dot.state.fl.us/research-center/Completed\\_Proj/Summary\\_SF/FDOT-BDK78-977-14-rpt.pdf](http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_SF/FDOT-BDK78-977-14-rpt.pdf)
- Plans Prep Manual
- Roadway Design Bulletins
- Design Index



Table 8-3: CMFs for Adding Shoulder Rumble Strips

Setting (Road Type)	Crash Type (Severity)	CMF	Std. Error
Rural/Urban (Two-lane undivided roadways)	All types (All severities)	<b>0.71</b>	<b>0.10</b>
	All types (Injury)	0.51	0.13
	SVROR (All severities)	<b>0.50</b>	<b>0.16</b>
	SVROR (Injury)	0.67	0.25
Rural (Two-lane undivided roadways)	All types (All severities)	<b>0.70</b>	<b>0.11</b>
	All types (Injury)	<b>0.78</b>	<b>0.12</b>
	SVROR (All severities)	<b>0.56</b>	<b>0.18</b>
	SVROR (Injury)	0.68	0.25

Note: The CMFs in bold are statistically significant at a 90% confidence level.  
The CMF for this treatment is not included in the HSM.



## Florida Longitudinal Rumble Strips and Stripes on 2-Lane Roads Info

- Plans Prep Manual
  - *PPM*, Volume 1, Chapter 7.
- Roadway Design Bulletin 15-03, Rumble Striping, 1/22/15
- Design Index
  - **Design Standards** Index 519 is only applicable for projects with dense graded friction course. For projects with open graded friction course use **Developmental Design Standards** Index D519.



## Enhanced Delineation and Friction for Horizontal Curves

- Low-cost treatments
- Includes signs and markings that help drivers safely negotiate curves or...
- Additional pavement friction to address geometric deficiencies

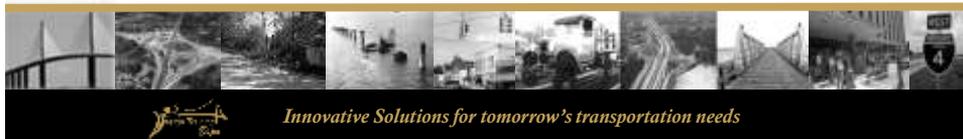


### Safety Impacts:

- Vary based on application
- Up to 43% reduction of all fatal crashes

# Florida Enhanced Delineation and Friction for Horizontal Curves

- HFST used in Florida since 2006 On 23 projects.
- Initial Pre and Post crash analysis has shown a 55% Reduction in total crash per year and a 84.2% reduction for wet weather crashes per year for curves, Curve Ramps, and Loop Ramps
- Existing Florida HFST Developmental Spec
  - <http://www.dot.state.fl.us/programmanagement/OtherFDOTLinks/Developmental/Files/Dev333.pdf>
- HFST Research and Guidelines being completed by Texas A&M Transportation Research Institute.

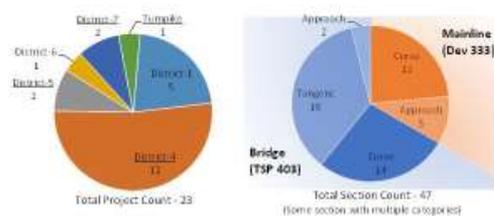


## Florida Friction for Horizontal Curves

- HFST used in Florida since 2006 On 23 projects.



Figure 2 – Map of all Florida HFST sections.



## Safety Edge<sub>SM</sub>

- Consolidating the pavement edge into 30° shape during paving to provide stability for vehicles recovering from a roadway departure
- 6% reduction of total crashes
- B/C range: 4 to 63
- Implement as a standard practice for paving and resurfacing projects



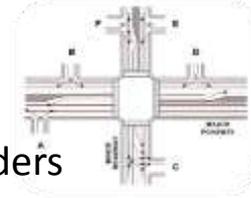
## The Safety Edge In Florida

- FDOT – Developmental Spec (Dev330SE)
  - 1/12 and forward
- Florida Greenbook (2013)
  - Provide a Safety Edge treatment adjacent to the travel lane on roadways without curb or paved shoulders and with posted speed 45 mph or greater.
- Note: Topic # 625-000-015 May - 2013 Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways



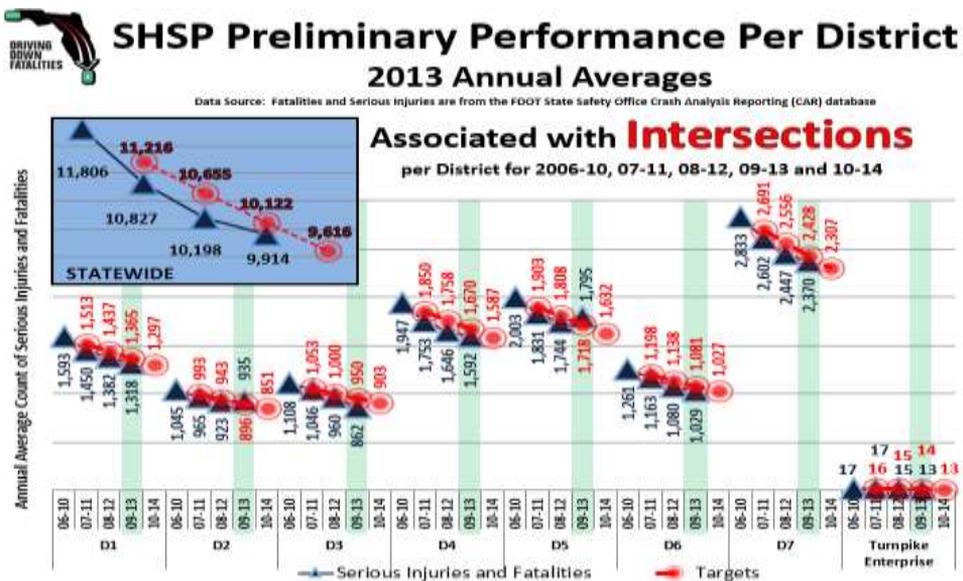
## Addressing the **Intersection** Focus Area:

- Roundabouts
- Corridor Access Management
- Backplates with Retroreflective Borders
- “Road Diet” (Roadway Reconfiguration)
- Pedestrian Hybrid Beacon



*“There are approximately 300,000 signalized intersections in the United States. About 1/3 of all intersection fatalities occur at these locations; resulting in roughly 2,300 people killed in a single year.”*

– Roundabouts Fact Sheet



## Roundabouts

- Modern designs are safer and more efficient than old circles and rotaries
- Can reduce crashes resulting in injury or fatality by nearly 80%<sup>1</sup>
- Should be considered as part of corridor or intersection improvement projects
- Highly adaptable, proven in both low-speed urban and high-speed rural environments



1. AASHTO Highway Safety Manual, Chapter 14

## 2. Florida Roundabout Info

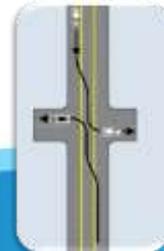
- 13 State Highway System
- 150-200 approx Local Road System
- Florida Intersection Design Guide
  - <http://www.dot.state.fl.us/rddesign/FIDG-Manual/FIDG.shtm>
  - FDOT Roundabout Screening Process
- Training with FHWA
- Research - [http://www.dot.state.fl.us/research-center/Completed\\_Proj/Summary\\_PL/FDOT-BDK77-977-22-rpt.pdf](http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_PL/FDOT-BDK77-977-22-rpt.pdf)



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## Corridor Access Management

- Involves the design, implementation and control of entry and exit points along a roadway
- Reducing access points along urban/suburban corridor can reduce injury and fatal crashes by about 25%<sup>1</sup>
- May be considered as a component of general corridor improvements or as its own project



1. AASHTO Highway Safety Manual, Chapter 14

## Florida Corridor Access Management

### MEDIAN OPENINGS AND ACCESS MANAGEMENT; Topic 625-010-021-h

#### • ACCESS MANAGEMENT DECISIONS IN DEPARTMENT IMPROVEMENT PROJECTS

- **3.1 Existing Features** - Existing medians, median openings, driveways, traffic signals, and adjacent highway features play a role in the decision on locating median openings during a Department roadway improvement project. Generally, existing features are allowed to remain in place. **However, a corridor analysis will be performed during the engineering and design phase of a Department project to determine if existing connection, median opening and signal spacing are in conformance or can be brought into conformance with Department standards.**



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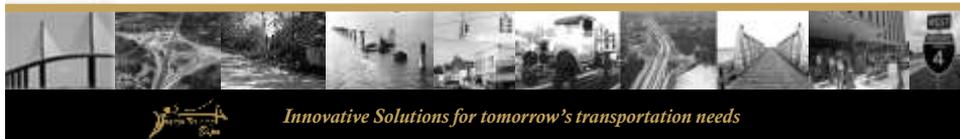
# Florida Corridor Access Management Info

- Florida CMF TWLTL to Raised Median
  - Ref. [http://www.dot.state.fl.us/research-center/Completed\\_Proj/Summary\\_SF/FDOT-BDK78-977-14-rpt.pdf](http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_SF/FDOT-BDK78-977-14-rpt.pdf)

**Table 5-23: Recommended CMFs for Converting a TWLTL to a Raised Median in Florida**

Severity/ Crash type	Before-After with CG		Before-After with EB (Full SPF)	
	CMF	SE	CMF	SE
Total Crashes	<b>0.53</b>	<b>0.02</b>	0.73	0.04
F+I	<b>0.67</b>	<b>0.04</b>	0.89	0.06
Head-on	<b>0.27</b>	<b>0.07</b>	0.49	0.15

Note: The values in bold are recommended CMFs for Florida.



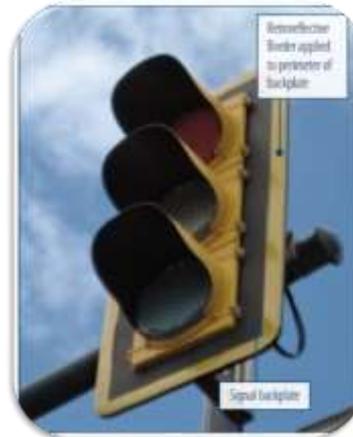
## 3. Florida Corridor Access Management Info

- Before-and-after crash summary statistics showed that four-lane urban arterials had a mere 4.7 percent reduction in total crash rate after conversion, while six-lane facilities experienced a 37.2 percent reduction. From these statistics, it could be inferred that conversions resulted in a greater overall safety benefit for six lane facilities compared to four-lane facilities.
- Ref. Before-and-After Safety Study of Roadways Where New Medians Have Been Added, FIU, 2012, [http://www.dot.state.fl.us/research-center/Completed\\_Proj/Summary\\_PL/FDOT-BDK80-977-18-rpt.pdf](http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_PL/FDOT-BDK80-977-18-rpt.pdf)



## Backplates with Retroreflective Borders

- Retroreflective strip added around the border of a signal backplate
- Documented 15% reduction in crashes of all types and severities at urban signalized intersections<sup>1</sup>
- Consider as standard treatment for new and modernized signal projects, or as a systemic retrofit safety improvement



1. CMF Clearinghouse

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## 4. Florida Backplates with Retroreflective Borders Info

- PPM Chapter 7, Section 7.4.16, Backplates
  - Louvered backplates shall be installed on all signal sections for all approaches. Retroreflective backplate borders are required for all backplates where the posted speed for the approach is 45 mph or greater. Retroreflective borders are encouraged on all backplates where the posted speed for the approach is less than 45 mph.

Ref.

<http://www.dot.state.fl.us/rddesign/PPMManual/2015/Volume1/Chap07.pdf>



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## “Road Diet” (Roadway Reconfiguration)

- Conversion of four-lane undivided roadway into three lanes with two through-lanes and a center two way left turn.
- Best on Roadways with ADT of 20,000 or less.

Safety results:

29% reduction in all roadway crashes



## Florida Lane Elimination (“Road Diet”)

Florida CMF - [http://www.dot.state.fl.us/research-center/Completed\\_Proj/Summary\\_SF/FDOT-BDK78-977-14-rpt.pdf](http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_SF/FDOT-BDK78-977-14-rpt.pdf)

Table 8-10: CMFs for Converting 4 to 3 Lanes

Setting (Road Type)	Traffic Volume (AADT)	Crash Type (Severity)	CMF	Std. Error
Urban (Undivided arterials)	2,000–28,500	All types (All severities)	<b>0.56</b>	0.15
		All types (Injury)	<b>0.63</b>	0.17

Note: The CMFs in bold are statistically significant at a 95% confidence level.



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# Florida Lane Elimination (“Road Diet”)

## FDOT Lane Elimination Guidance

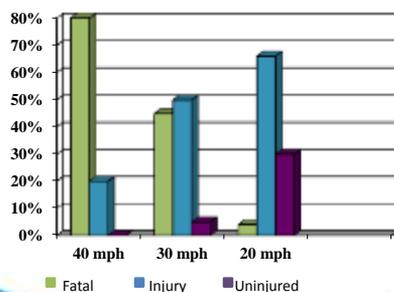
The links below are to documents intended to assist FDOT District staff in developing processes for reviewing State highway lane elimination re-quests.

- <http://www.dot.state.fl.us/rddesign/CSI/Files/Lane-Elimination-Guide-Part1.pdf>
- <http://www.dot.state.fl.us/rddesign/CSI/Files/Lane-Elimination-Guide-Part2.pdf>



## Addressing the **Pedestrian** Safety Focus Area

- Medians and Pedestrian Crossing Islands in Urban and Suburban Areas
- Pedestrian Hybrid Beacon
- “Road Diet” (Roadway Reconfiguration)



### Pedestrian Safety Facts:

- Pedestrians represent over 12% of Highway Fatalities.
- Midblock locations account for over 70% of pedestrian fatalities.
- Over 80% of pedestrian fatalities hit by vehicles traveling at 40 mph or faster will die, while less than 10% die when hit at 20 mph or less.



## SHSP Preliminary Performance Per District 2013 Annual Averages

Data Source: Fatalities and Serious Injuries are from the FDOT State Safety Office Crash Analysis Reporting (CAR) database



## Medians and Pedestrian Crossing Islands in Urban and Suburban Areas

- *Median* is between opposing lanes of traffic, excluding turn lanes (can be paint or concrete).
- Islands can be placed at intersections or midblock locations to separate crossing pedestrians from motor vehicles.
- Use in curbed sections of multi-lane roadways in urban areas with vehicular-pedestrian conflicts and med/high travel speeds.



Safety results:  
46% reduction in pedestrian crashes  
39% reduction in total crashes

## Pedestrian Hybrid Beacon

- Pedestrian-activated beacon located on the roadside or on mast arms over major approaches to an intersection.
- Follow guidance in MUTCD Chapter 4F.



Safety results:  
69% reduction in pedestrian crashes  
29% reduction in total crashes

## Florida Medians and Pedestrian Crossing Islands in Urban and Suburban Areas

- Plans Preparation Manual, Volume 1 , **Chapter 2, Design Geometrics and Criteria**
  - **2.2.2 Multilane Facility Median Policy**

All multilane SIS facilities shall be designed with a raised or restrictive median. All other multilane facilities shall be designed with a raised or restrictive median except four-lane sections with design speeds of 40 mph or less. Facilities having design speeds of 40 mph or less are to include sections of raised or restrictive median for enhancing vehicular and pedestrian safety, improving traffic efficiency, and attainment of the standards of the Access Management Classification of that highway system.



## Florida Medians and Pedestrian Crossing Islands in Urban and Suburban Areas

- [Traffic Engineering Manual, Section 3.8: Mid-Block Pedestrian Crosswalks](#)
- Purpose: To establish criteria for the installation and operation of mid-block pedestrian crosswalks
- Section defines mid-block crosswalks; ped attractors/generators; Ped hybrid beacons; RRFBs etc.
- Procedure notes that uncontrolled location on SHS shall be reviewed and approved by District Traffic Ops
- If available information supports the installation of a mid-block ped crosswalk based upon the criteria in Section 3.8.5, then a full engineering study may be conducted.

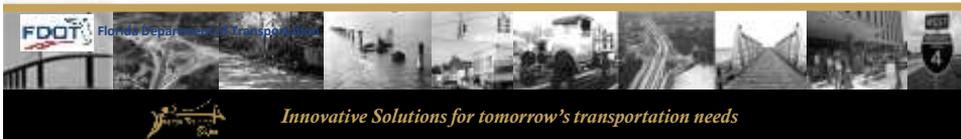


### Marked Crosswalks



### Procedure (3.8.4)

- Review by District Traffic Ops
- If review supports installation, an eng study must be conducted.
- Study criteria contained in 3.8.5
- If evaluation results in a decision NOT to consider the mid-block crosswalk, the reasons must be documented.
- Prior to approval, coordination between Traffic Ops and local agencies is needed to establish maintenance responsibility.



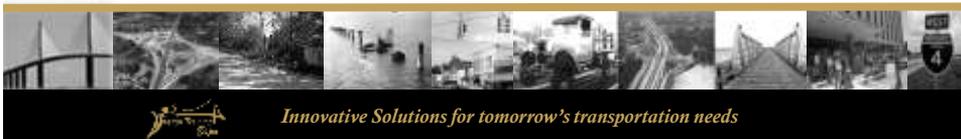
### Criteria and Considerations

- Factors to consider: Proximity to generators, ped demand, crash history, distance between crossing locations
- Sufficient demand needs:
  - Minimum 20 peds during an hour
  - Minimum 60 peds during any 4 hours of the day
- Location characteristics:
  - Minimum vehicular volume of 2,000 ADT
  - Min. distance to nearest crossing location = 300' (PPM; section 8.3.3.2)
  - If proposed location is between intersections, min. block length = 660' (PPM; section 8.3.3.2)



## TEM – Safety Considerations

- The location should be conducive to providing ped safety
- The location must provide adequate stopping sight distance; i.e., parking restrictions near the marked mid-block crosswalk required. (PPM, section 2.7)
- If sidewalks connecting the crosswalk to ped generators and attractors are not already present, they should be provided. (PPM, section 8.3.1)
- Crosswalk illumination shall be provided on all newly constructed mid-blocks or uncontrolled approach crosswalks except in environmentally sensitive areas or on facilities open during daylight hours only.
- When volumes exceed 12,000 ADT or where crossing distances exceed 60', a refuge island or raised median should be provided unless controlled by ped signal or ped hybrid beacon.
- Locations with nearby bus stops should be actively considered.



## TEM – Treatments

- 10-foot wide Special Emphasis Crosswalk markings [Std Index 17346](#).
- Curb extensions, raised crosswalks, speed reduction treatments, addl. S&PM, flashing beacons, or signal control may be considered.
- If ped volumes are high, ped bridge or tunnel in lieu of an at-grade marked mid-block crossing may be considered.
- Pedestrian Traffic Control Signal
- Pedestrian Hybrid Beacon
- Supplemental Beacons - Flashing Yellow Warning Beacons; RRFB
- In-Roadway Lighting; Supplemental Signing and Markings



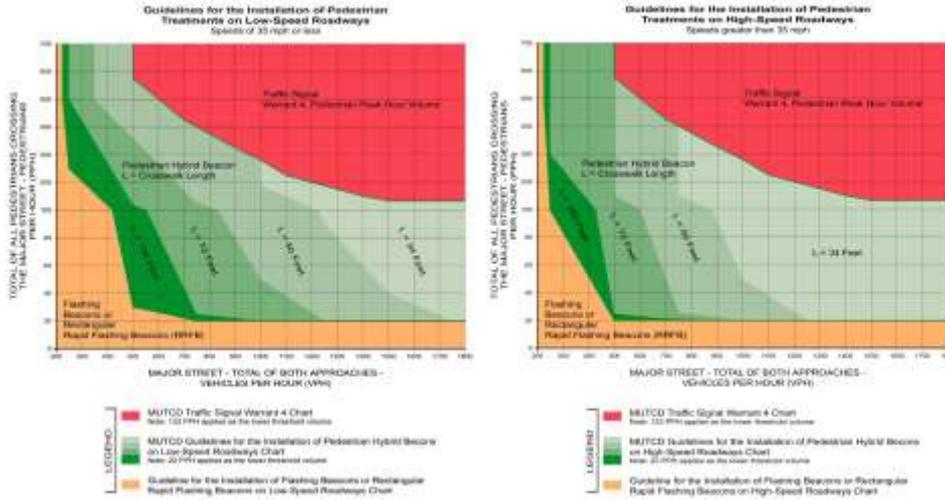
## Ped Hybrid Beacon and RRFB



## RRFB



## TEM – Guidance in Treatments



## Plans Prep Manual - Midblock Crosswalks

### 8.3.3.2 Midblock Crosswalks

Midblock crosswalks can be used to supplement the pedestrian crossing needs in an area between intersections. This can provide pedestrians with a more direct route to their destination. Midblock crosswalks should be illuminated, marked and signed in accordance with the [MUTCD Traffic Engineering Manual \(Section 8.8\)](#) and [Design Standards Index \(7.14\)](#). Pedestrian-activated, signalized midblock crosswalks may be appropriate at some locations, but the locations must meet the warrants established in the [MUTCD](#).

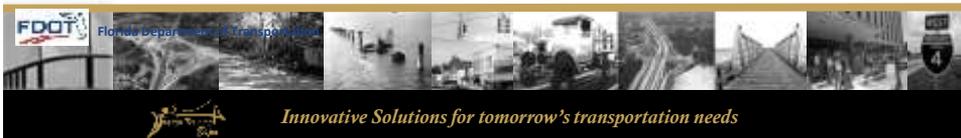
In addition to the requirements in Section 8.3.3.1, the following conditions also apply:

1. Midblock crosswalks should not be located where the spacing between adjacent intersections is less than 600 feet
2. Midblock crosswalks should not be located where the distance from the crosswalk to the nearest intersection (or crossing location) is less than 300 feet
3. Midblock crosswalks shall not be provided where the crossing distance exceeds 90 feet (unless a median or a crossing island is provided)
4. Midblock crosswalks shall not be provided where the sight distance for both the pedestrian and motorist is not adequate (stopping sight distance per Table 2.7.1)
5. Midblock crosswalks shall not be located where the ADA cross slope and grade criteria along the crosswalk cannot be met (per Section 8.3.2).

An engineering study is required before a marked midblock crosswalk is installed at an

uncontrolled location. This study shall examine such factors as sight distance for pedestrians and vehicles (stopping sight distance), traffic volume, turning volumes near proposed crosswalk location, roadway width, presence of a median, lighting, landscaping, signage, traffic speed, adjacent land use (pedestrian generators / destinations), pedestrian volume and existing crossing patterns. Midblock crosswalks should only be used in areas where the need truly exists, and the engineering study will help to determine if an uncontrolled midblock crosswalk is a viable option. Refer to the Department's [Manual on Uniform Traffic Signs and Signals](#).

If any problem areas are identified that would preclude the placement of a justified midblock crosswalk, additional features must be included in the design to remedy those problem areas before a midblock crosswalk can be placed at that location. Features like overhead signing can help alert motorists and be used to light the crossing. Curb extensions or bulb-outs can improve sight distance and decrease the crossing distance. Adjustment of the profile on the roadway crossing may be required to improve the cross slope of the crosswalk.



# Fact Sheets and Further Information

FHWA website:

<http://safety.fhwa.dot.gov/provencountermeasures>



## FHWA Contacts for Further Information

Please Contact your FHWA Division Office; or,

Intersection Countermeasures:

Jeffrey Shaw, [jeffrey.shaw@dot.gov](mailto:jeffrey.shaw@dot.gov), (708) 283-3524.

Roadway Departure Countermeasures:

Cathy Satterfield, [cathy.satterfield@dot.gov](mailto:cathy.satterfield@dot.gov), (708) 283-3552.

Pedestrian Countermeasures:

Tamara Redmon, [tamara.redmon@dot.gov](mailto:tamara.redmon@dot.gov), (202) 366-4077.

Countermeasure Performance Measure:

Heather Rothenberg, [heather.rothenberg2@dot.gov](mailto:heather.rothenberg2@dot.gov), (202) 366-2193

## Contact Mailer

- For updates related to Safety sign up for the FDOT Contact Mailer and check the box for Safety Publications and Safety Training
  - <https://www2.dot.state.fl.us/contactmanagement/Utilities/login.aspx?ReturnUrl=%2fcontactmanagement%2f>



## Questions?

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(850) 414-4097

