FDOT TRANSPORTATION SYMPOSIUM 2019

Statewide Intersection and Lane Departure Safety Efforts

Joe Santos, Alan El-Urfali, and Gevin McDaniel

Statewide Intersection and Lane Departure Efforts

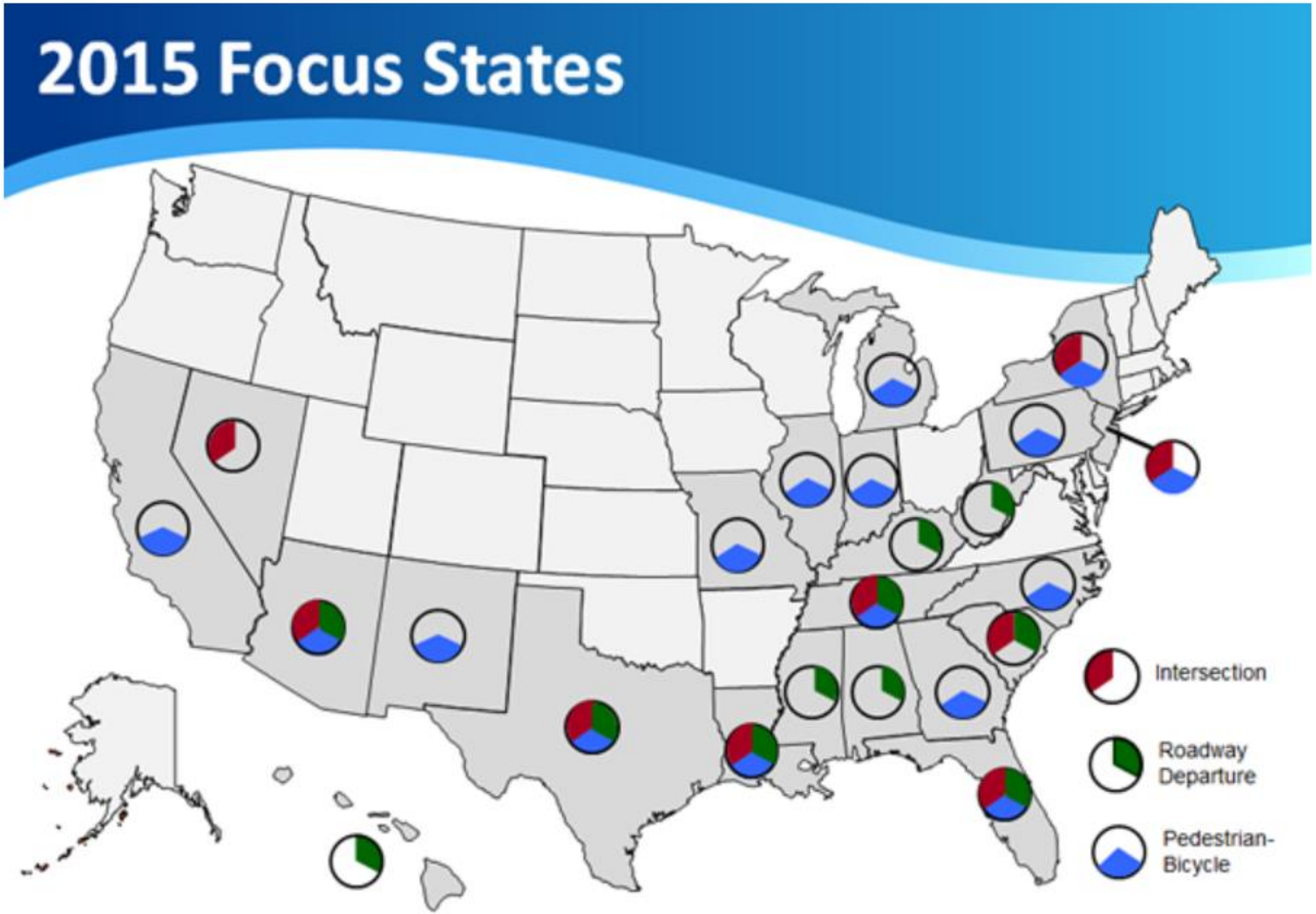
Presenters

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

Statewide Intersection and Lane Departure Efforts

- Recap of why we are doing this
  - Background (Joe)
- What has been accomplished to date
  - Short Term (Joe)
    - Project Screening & Selection
  - Long Term
    - Lane Departure (Gevin)
    - Intersection (Alan)
- Story Map (Joe)
- Q&A



FHWA Focused Initiative

Provides technical assistance such as data analysis and action plan development from initiation to implementation; training and associated materials in a variety of formats, including classroom-based workshops or online webinars.

Florida Fatalities and Serious Injuries by Strategic Highway Safety Plan (SHSP) Emphasis Area

Serious Injuries	2011-2015	Fatalities
34,276	Lane Departure Crashes	5,940
7,252	Impaired Driving Crashes	4,030
12,499	Pedestrians and Bicyclists	3,365
34,183	Intersection Crashes	3,053
9,456	Unrestrained Occupants	2,932
12,093	Motorcyclists	2,402
12,228	Aging Drivers	2,320
7,190	Speeding and Aggressive Driving Crashes	1,873
7,247	Commercial Motor Vehicle Crashes	1,411
12,741	Teen Driver Crashes	1,148
15,236	Distracted Driving Crashes	994
2,099	Work Zone Crashes	340

Note: Multiple factors are involved in almost every crash.

Source: Department of Highway Safety and Motor Vehicles (2016).

This graphic is from the Florida Strategic Highway Safety Plan October 2016, page 8.

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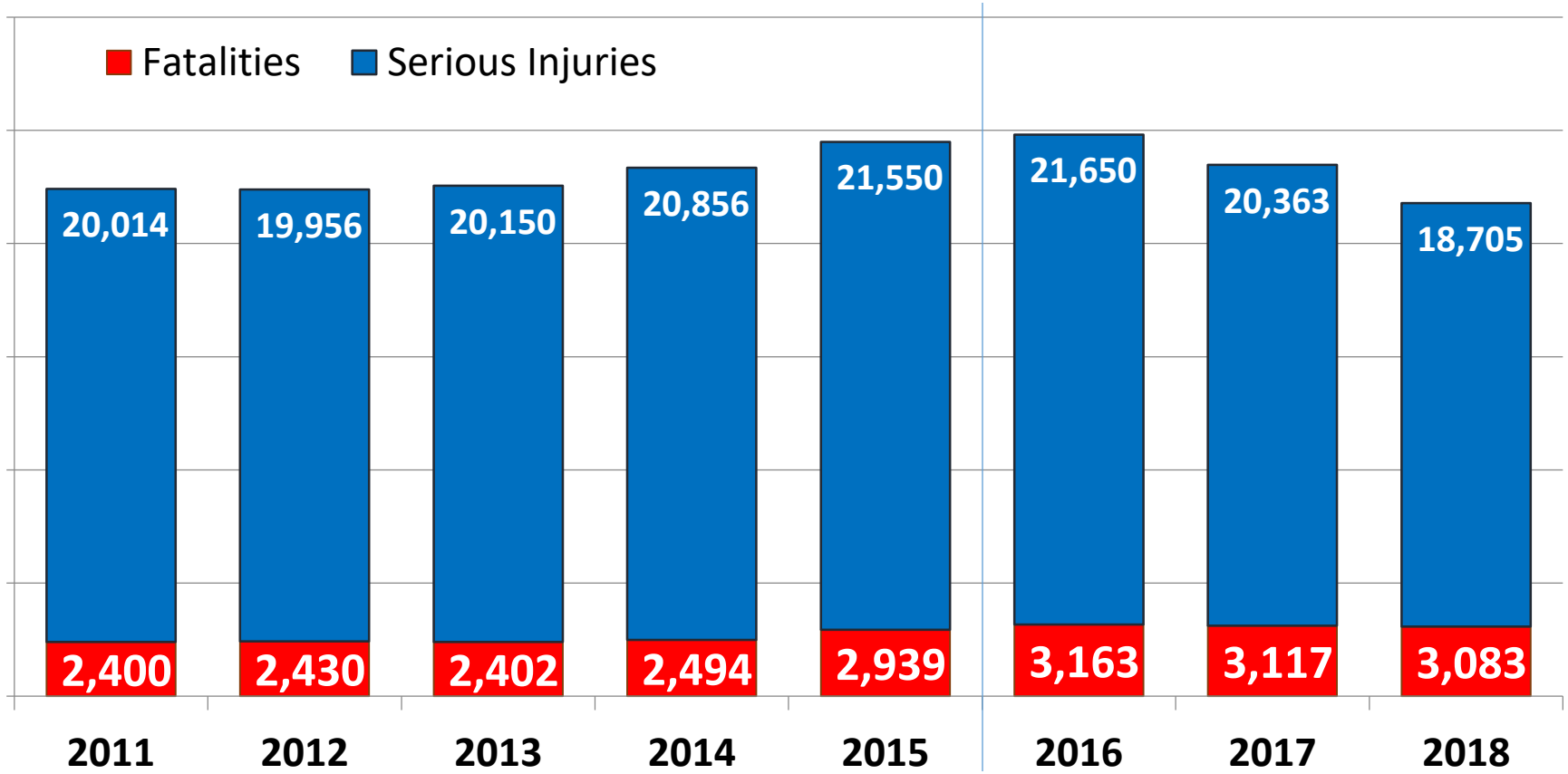
Serious Injuries and Fatalities

Florida Annual Serious Injuries and Fatalities

Statewide for 2011 through 2018

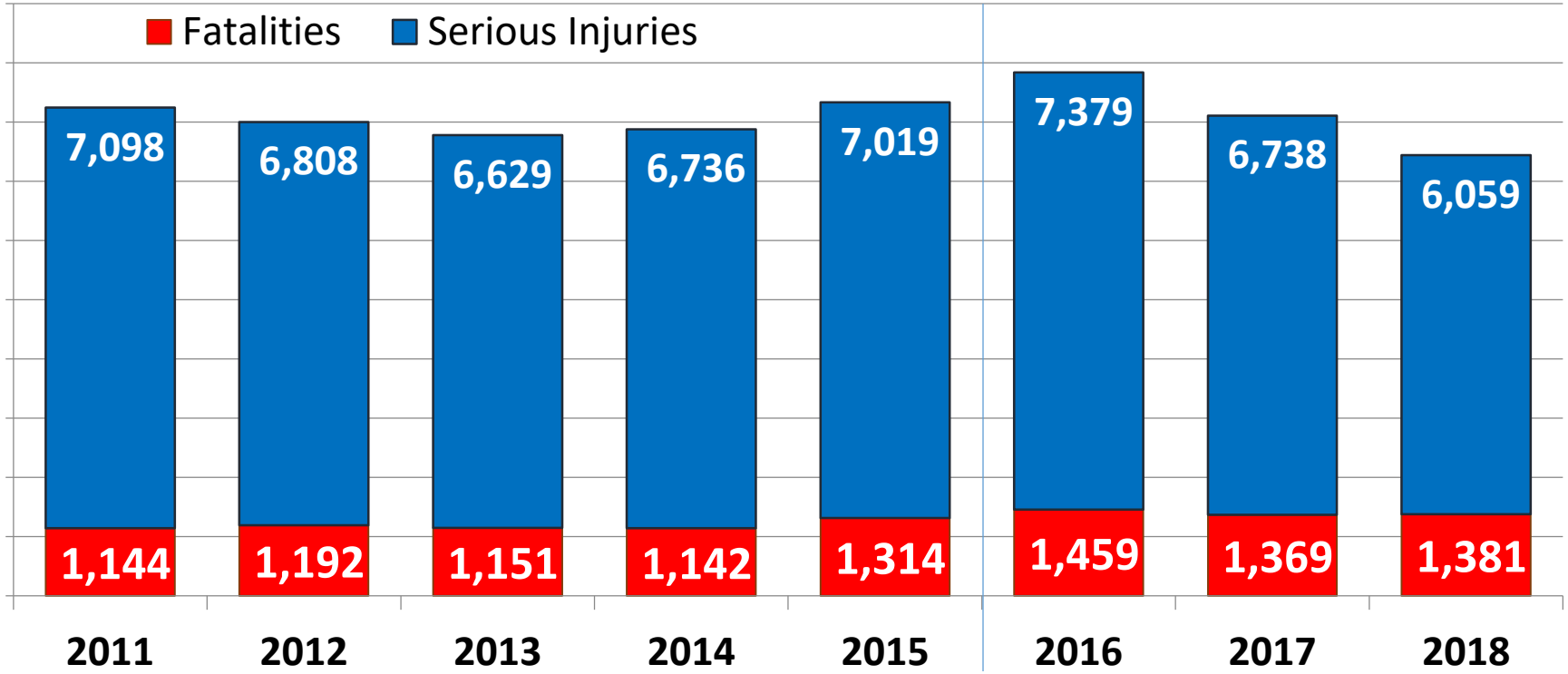


Counts from FDOT State Safety Office Crash Analysis and Reporting (CAR) system

Lane Departure

Florida Annual Fatalities and Serious Injuries Involving Lane Departure

Statewide for 2011 through 2018

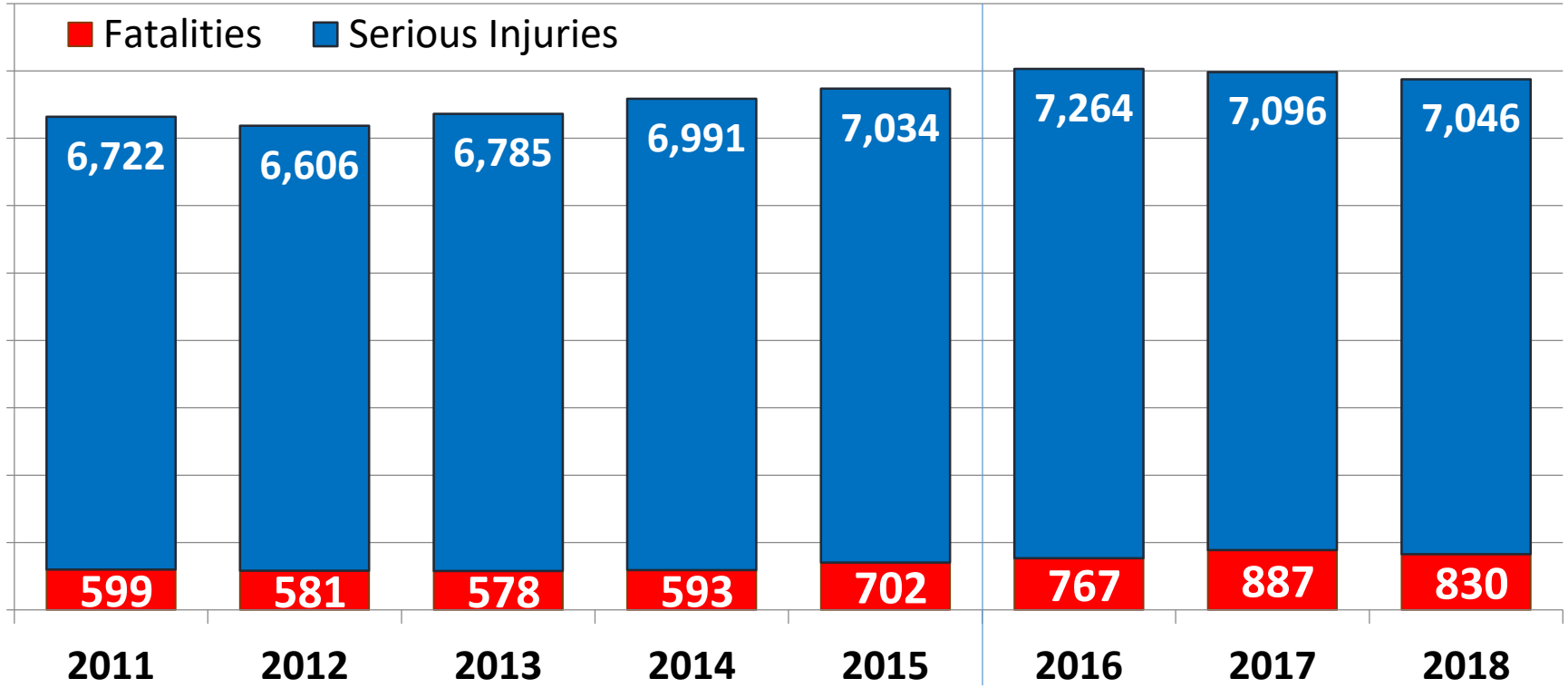


Counts from FDOT State Safety Office Crash Analysis and Reporting (CAR) system

Intersection

Florida Annual Fatalities and Serious Injuries At or Influenced by Intersections

Statewide for 2011 through 2018

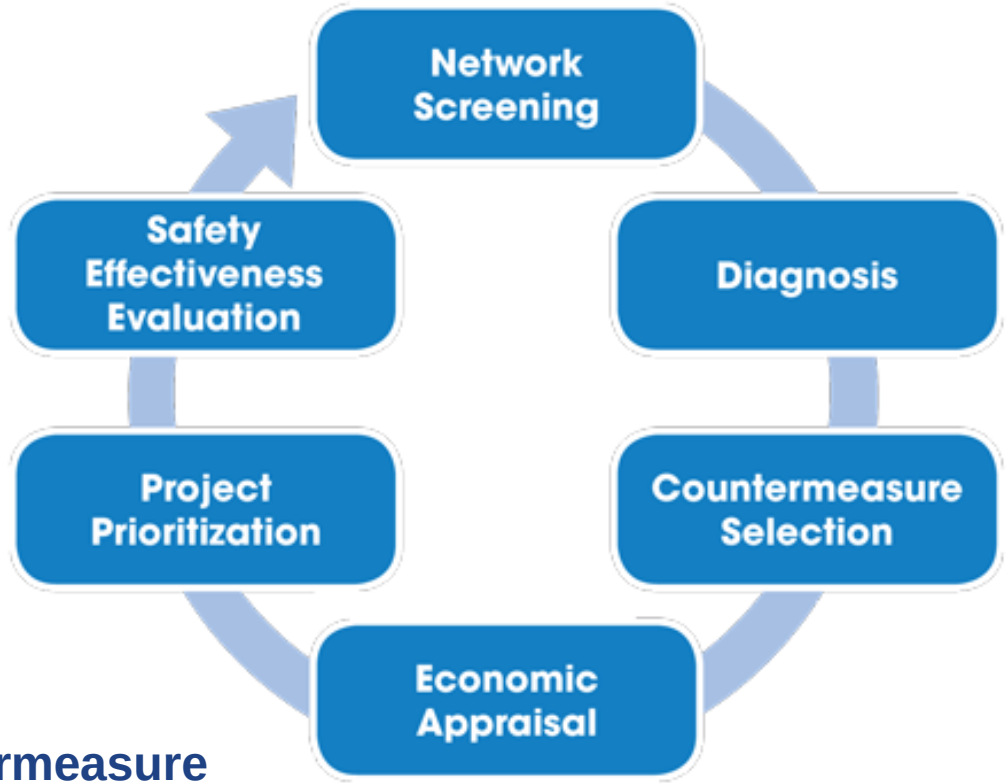


Counts from FDOT State Safety Office Crash Analysis and Reporting (CAR) system

Funding & Implementation

Project Screening & Selection Process – FHWA Model

"Where" are the Crashes
(Ph. 1 On-System Complete)
(Ph. 2 Off –System Complete)



Verify Program Effectiveness (Start FY22-)

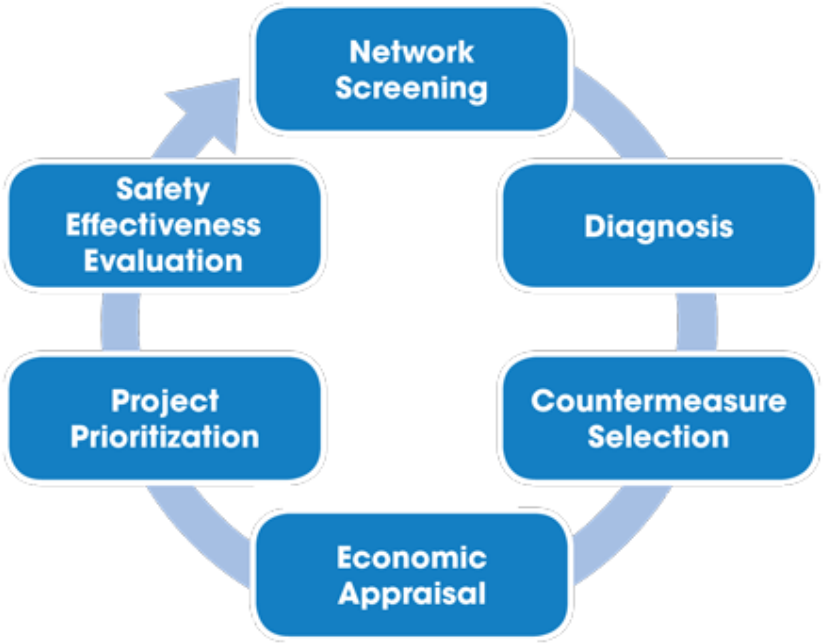
"What" is Happening *(Ph. 1 and 2 Complete)*

Finalize Locations *(Ph 1 Complete; Ph. 2 : Ongoing)*

Select Systemic Countermeasure Options *(Ph. 1 and 2 Complete)*

Countermeasure Locations for Districts *(Ph. 1 Complete; Ph. 2 Ongoing)*

Intersection Safety Overview



Lane Departure and Intersection Safety

Intersection Network Screening

- Screening based on three methods combined:

  1) ***Historical Crashes -*** Fatal and Serious Injury Crash Hot Spots (Provided through FHWA) 2011-2014

     a) 815 Top Intersections for Fatal and Serious Injury.
     b) 143 for Fatal alone.

Lane Departure and Intersection Safety

Intersection Network Screening

- Screening based on three methods combined:

  2) ***Highway Safety Manual Network Screening (State System) using Safety Analyst*** for Fatal & Injury (F & I) Excess Expected Crash Frequency

  - Potential RCUT, Roundabout and/or Turn Lanes locations

District	Count of Intersection
1	7
2	14
3	9
4	6
5	10
6	2
7	14
Total	62

Intersection Type	Count
Int/Urb; 3-leg signalized	11
Int/Urb; 4-leg signalized	37
Rural Four-leg Unsignalized Intersection	1
Urban Four-leg Unsignalized Intersection	1
Urban Three-leg Unsignalized Intersection	12
Grand Total	62

Lane Departure and Intersection Safety

Intersection Network Screening

- Screening based on three methods combined:

  3) Highway Safety Manual (HSM) Network Screening for Excess Expected using GIS and RCI (2011-2015)

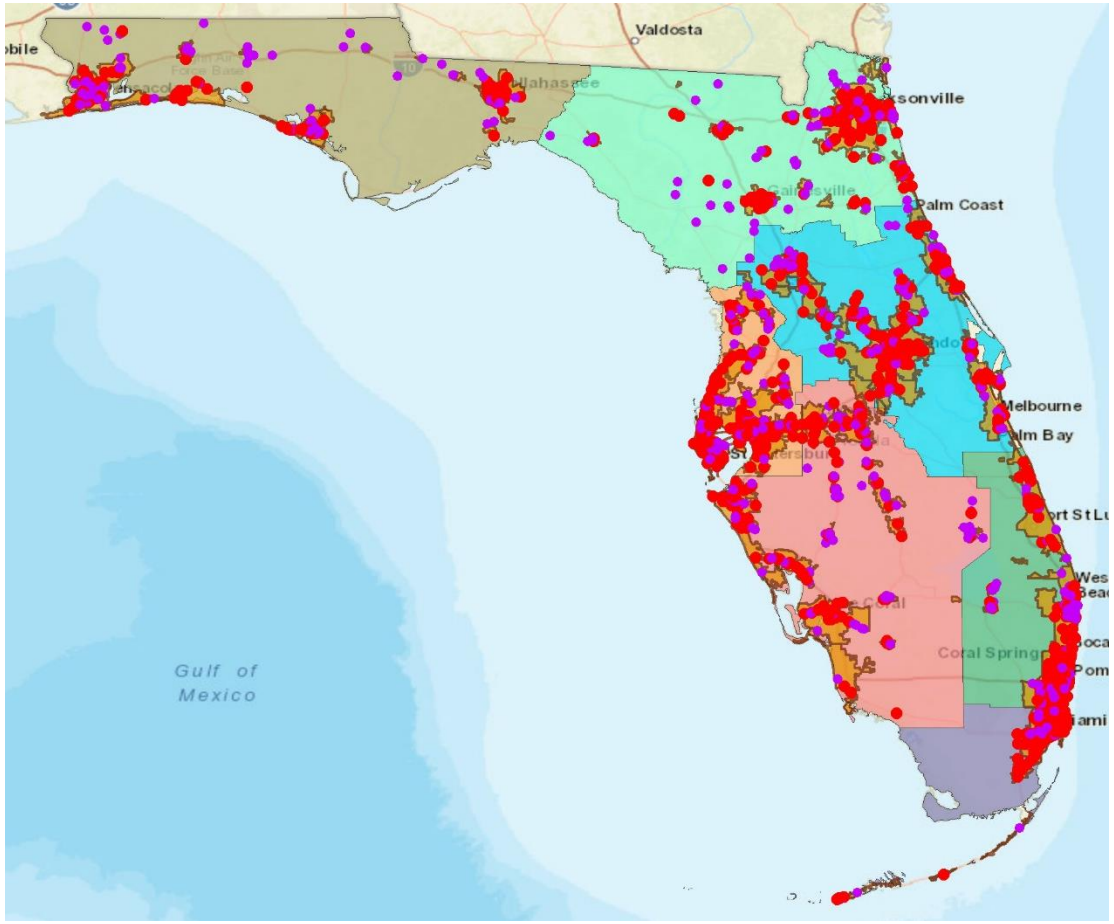
  1) On-System
     - 4,700+ Intersections Screened
     - 2,000+ Intersections Targeted for specific countermeasures

  2) Off-system
     - 9,700+ Intersections Screened
     - xxx+ Intersections Targeted for specific countermeasures

Lane Departure and Intersection Safety

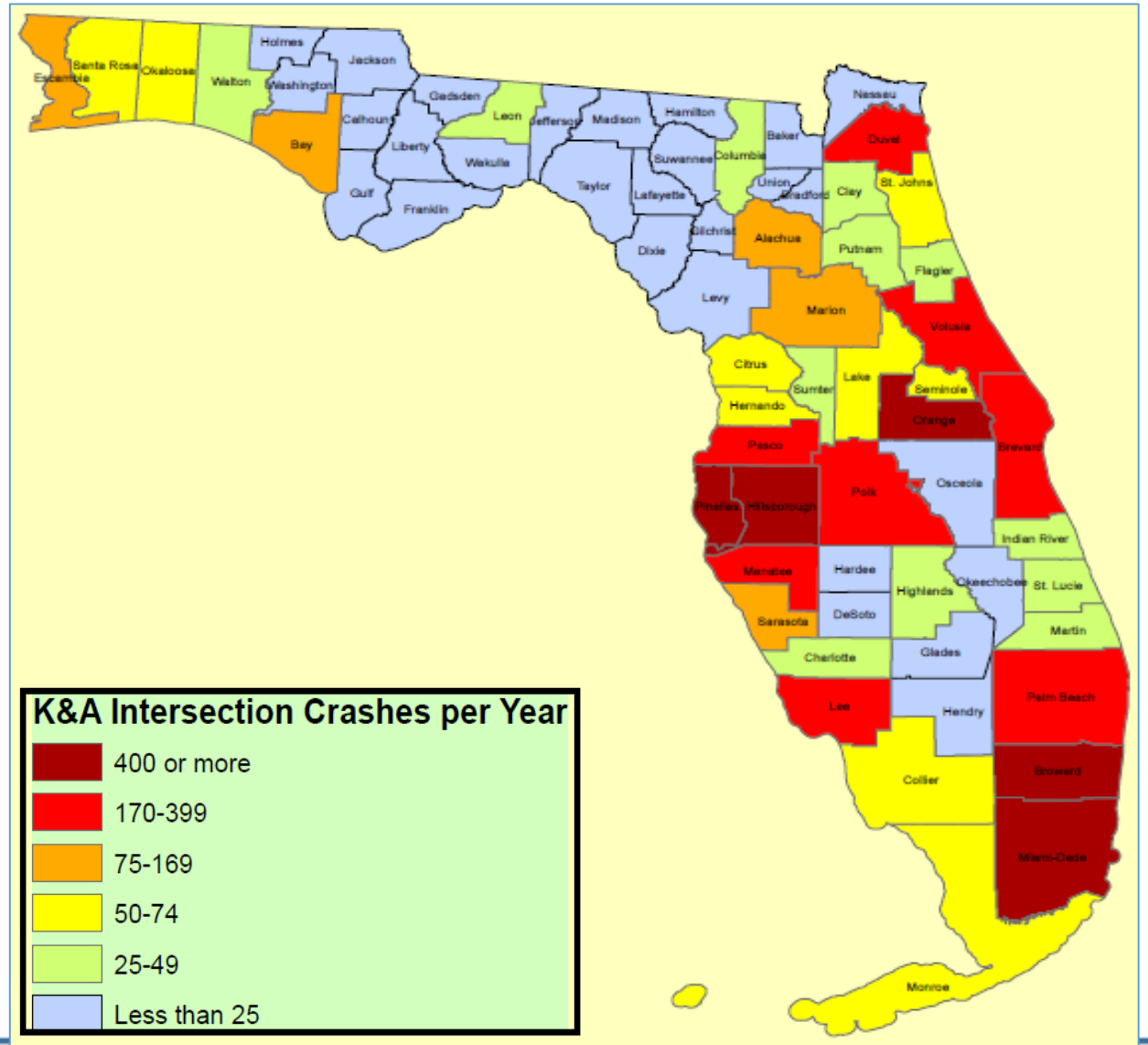
Intersection Network Screening

3) ***HSM*** procedure for Excess Expected – On System



Lane Departure and Intersection Safety

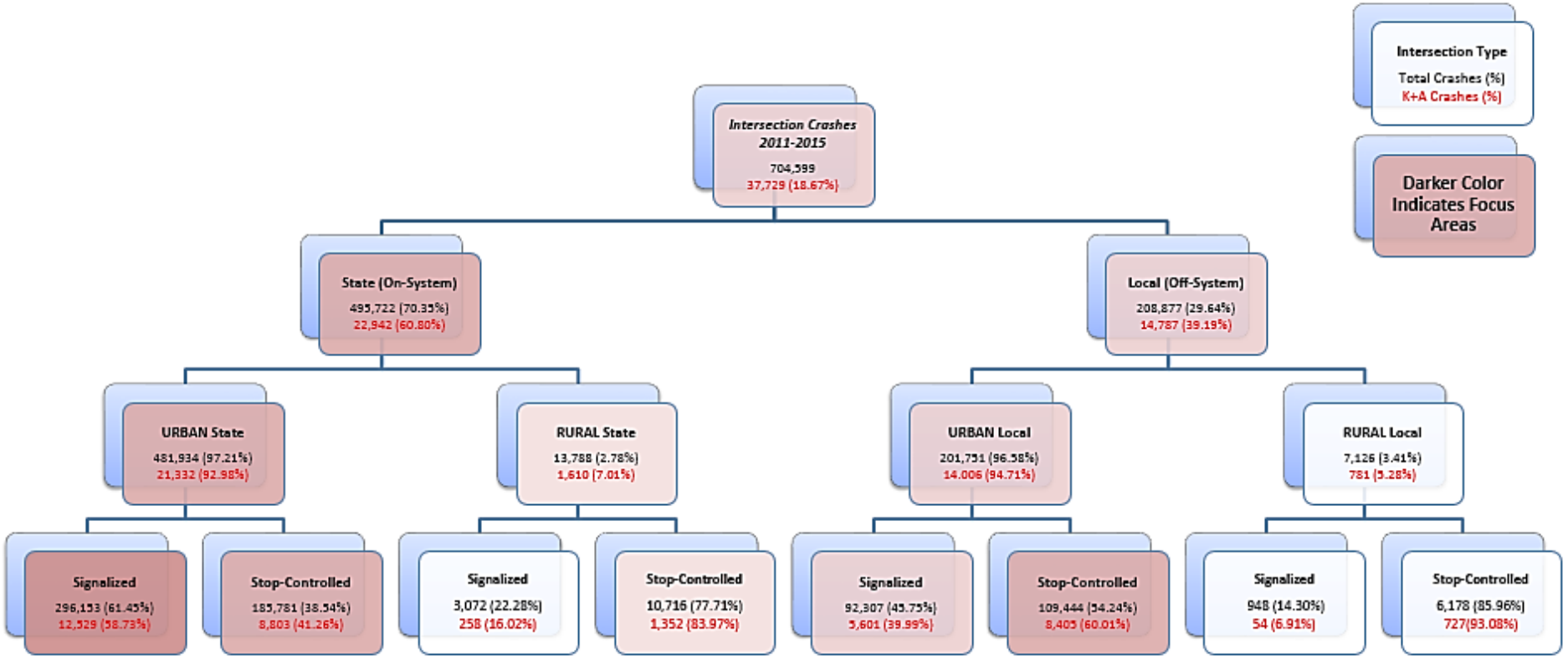
Intersection Screening Summary



Lane Departure and Intersection Safety

Intersection Diagnostics Crash Tree

Figure 1. Florida Intersection Crashes (2011 – 2015)



FDOT TRANSPORTATION SYMPOSIUM

Lane Departure and Intersection Safety

Intersection Diagnostics Summary Table

Diagnostics Summary		Urban		Rural	
		Signalized	Stop-Control	Signalized	Stop-Control
State (On-System)	*Quantity FLAGS*	12,529 KA; D4, D5, D7 ≥ 18% 509 Bike KA; 1,166 Ped KA	8,803 KA; D1, D5, D7 ≥ 14% 448 Bike KA; 801 Ped KA	258 KA; D2, D3 ≥ 23%; D5 = 15% 1 Bike KA; 4 Ped KA	1,352 KA; D1, D2, D3 ≥ 17% 7 Bike KA; 30 Ped KA
		4,649 Angle KA; 3,400 Rear End KA	3,478 Angle KA; 1,796 Rear End KA	137 Angle KA; 62 Rear End KA	312 Angle KA; 235 Rear End KA
	% Distribution FLAGS	Bike; Ped; Rear End	Bike; Ped; Angle	Angle; Rear End; Head On; KA Crash Rate per 100 Total Crashes	Overturn; Ran Off Road; Single Veh; KA Crash Rate per 100 Total Crashes
	Focus Areas	Bike; Ped; Angle; Rear End	Bike; Ped; Angle; Rear End	Angle; Rear End	Angle, Rear End, Single Vehicle
Local (Off-System)	*Quantity FLAGS*	5,601 KA; D4, D5, D7 ≥ 21% 229 Bike KA; 327 Ped KA	8,405 KA; D5, D7 ≥ 24% 536 Bike KA; 534 Ped KA	54 KA; D1, D5 ≥ 22% 0 Bike KA; 1 Ped KA	727 KA; D1, D2, D3, D5, D7 ≥ 15% 13 Bike KA; 14 Ped KA
		2,910 Angle KA; 980 Rear End KA	4,225 Angle KA; 880 Rear End KA	17 Angle KA; 12 Rear End KA	85 Angle KA; 63 Rear End KA
	KABCO % FLAGS	Bike; Ped; Angle; Rear End	Bike; Ped; Angle	Angle; Rear End; Head On	Overturn; Ran Off Road; Single Veh; KA Crash Rate per 100 Total Crashes
	Focus Areas	Bike; Ped; Angle; Rear End	Bike; Ped; Angle; Rear End	Angle; Rear End	Angle, Rear End, Single Vehicle
NOTE: 'KA' refers to Fatal (K) and Serious/Incapacitating Injury (A) Crashes Only					

Lane Departure and Intersection Safety

Intersection Countermeasures

Low Cost:

- Backplates (Signalized)
- Basic and Enhanced signal, sign and/or marking improvements (Systemic Packages)
- Pedestrian/Bicycle Treatments

High Cost:

- Intersection Lighting
- High Friction Surface Treatment on approaches
- Pedestrian Enhancements
- J-Turn/RCUT (Stop-controlled)
- Corridor Identification

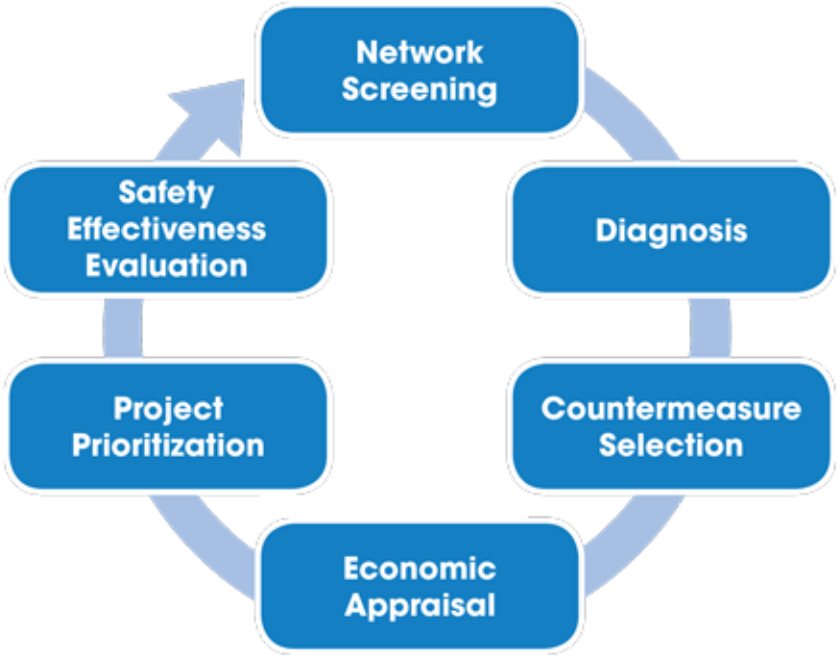
Lane Departure and Intersection Safety

Intersection Countermeasures

HSID Countermeasure and Emphasis Flag Breakdown - Statewide

District	FLAG Consider Alternative Intersection	FLAG Rural (RST) Systemic Basic	FLAG Rural (RST) Systemic Enhanced	FLAG Urban (USG) Systemic Basic	FLAG Urban (USG) Systemic Enhanced	FLAG Angle	FLAG Rear End	FLAG HFST	FLAG Install/ Upgrade Lighting	FLAG Pedestrian	FLAG Bicycle	FLAG FHWA 143 KA List	TOTALS
1	9	32	8	144	43	113	75	20	9	61	41	6	561
2	12	120	14	136	32	110	76	46	5	67	33	4	655
3	14	113	21	140	29	127	75	42	5	57	21	3	647
4	6	4	2	218	107	81	107	37	12	158	79	11	822
5	15	17	13	239	81	126	157	46	11	148	80	8	941
6	5	0	0	101	57	42	31	15	10	77	23	5	366
7	16	4	3	250	112	168	147	25	17	163	93	11	1009
TOTALS	77	290	61	1228	461	767	668	231	69	731	370	48	5001

Lane Departure Overview



Lane Departure and Intersection Safety

Lane Departure Network Screening

- Network Screening based on:
  1) ***Safety Analyst*** Excess Expected with Lane Departure crash type focus
     a) 5,000+ potential On-System candidates identified
  2) ***Historical*** Fatal and Serious Injury Lane Departure
     a) Off-System candidates using Sliding Window method (HSM-based)

Lane Departure and Intersection Safety

Lane Departure Safety

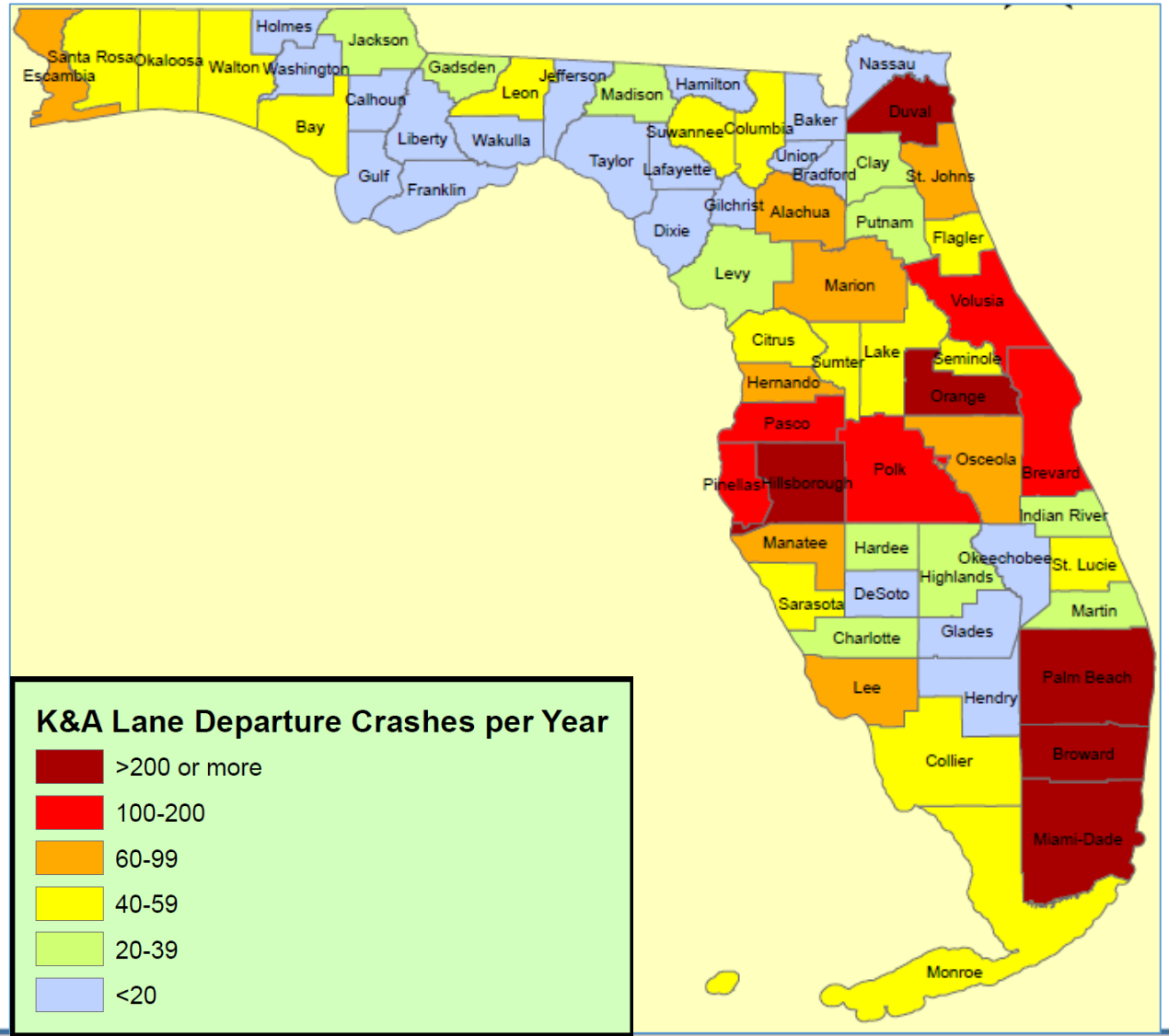
Safety Analyst method for Fatal & Injury (F & I) Excess Expected Crash Frequency using the Systemic Site Selection Module (2011-2014 data)

District	Count of Segments
1	530
2	637
3	499
4	855
5	1009
6	665
7	994
Grand Total	5189

Segment Countermeasures	Count of Segments
Highway Lighting	340
Centerline Rumble Strips	340
Shoulder Rumble Strips	286
Curve Warning and Advisory Speed Signs	340

Lane Departure and Intersection Safety

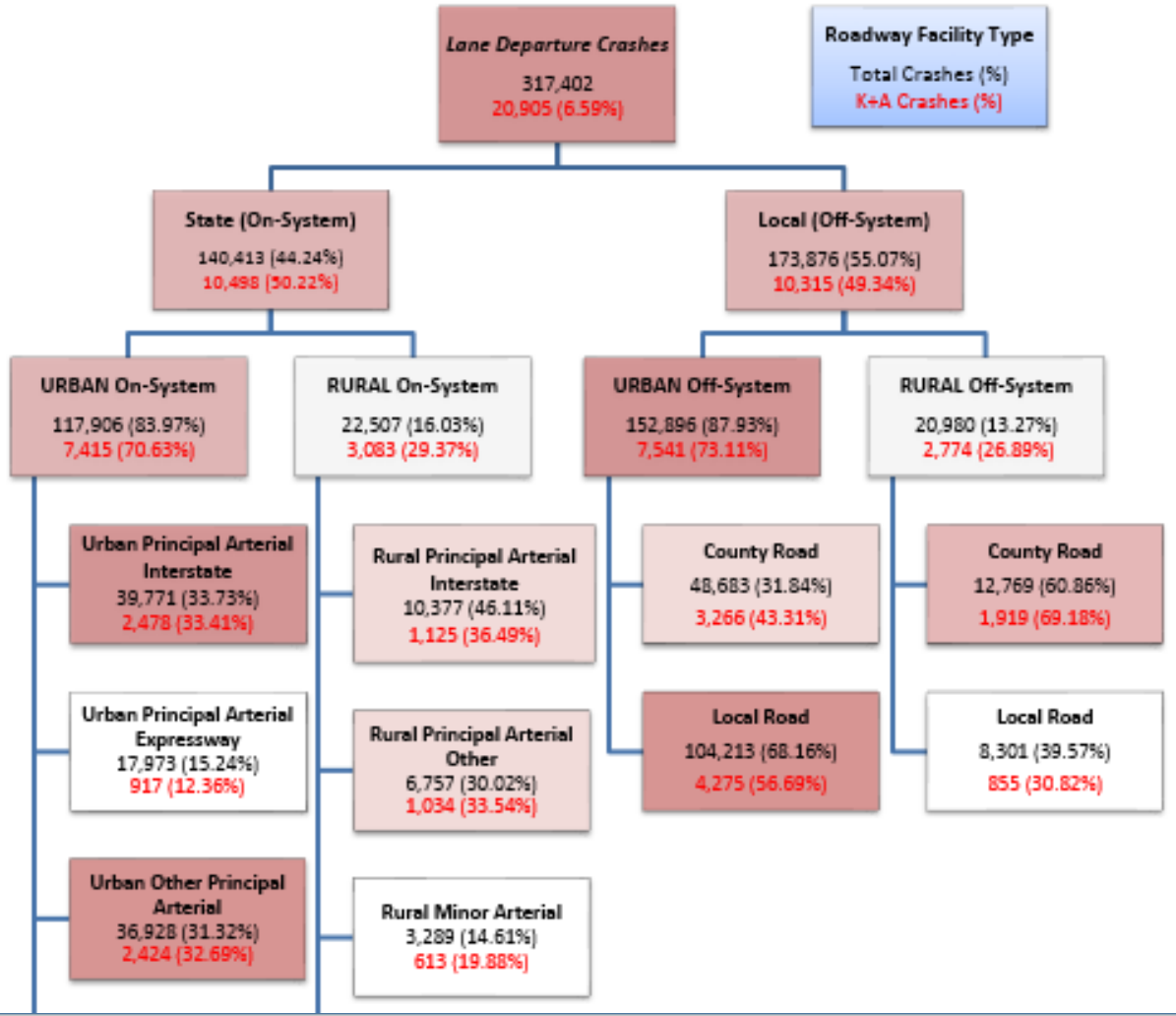
Lane Departure Screening Summary



Lane Departure and Intersection Safety

Lane Departure Diagnostics Crash Tree

Florida LD Crashes by Roadway Functional Class (2011 – 2015)



Lane Departure and Intersection Safety

Lane Departure Diagnostics Summary:

- Grass/Lawn shoulder has majority of Lane Departure KA crashes On System
- Segments needing Audible and Vibratory Treatments Identified
- Address Curve Compliance (Issues with Lane Departure in Curves)
- Weather related surface treatment needed for areas with Road Surface crashes
- Reduce roadside hazards to minimize severity once Lane Departure occurs
- Illuminate Roadway and edge for nighttime crashes

Lane Departure and Intersection Safety

HSID Implementation:

Countermeasure Name	Approach	Crash Thresholds	Cost per Intersection (Average)	Estimated No. of Intersections*	Estimated Program Costs
Intersection Control Evaluation (ICE) Alternative Intersections: 1-2 per District	Site Specific	n/a	$2,298,208	12	$27,578,500
Signing/Marking Rural Stop-Controlled (Basic)	Partial Systemic	≥ 2 Total Crash OR 1 KA Crash	$17,160	160	$2,750,748
Signing/Marking Rural Stop-Controlled (Enhanced)	Partial Systemic	≥ 2 KA Crashes	$56,480	23	$1,304,688
Signal/Signing/Marking Urban Signalized (Basic)	Partial Systemic	≥ 2 KA Crash	$36,010	614	$22,110,140
Signal/Signing/Marking Urban Signalized (Enhanced)	Partial Systemic	≥ 30 Total Crash; ≥ 2 KA Crash; ≥ 1 K Crash	$210,000	138	$29,043,000
Alternative Intersection modifications on high-speed Rural Arterials - Stop-Controlled	Site Specific	≥ 2 Angle KA; ≥ 6 Total Crashes	$805,000	8	$6,762,000
Alternative Intersection modifications on Urban Arterials - Stop-Controlled	Site Specific	≥ 35% Angle Crashes; ≥ 5 Angle KA	$805,000	3	$2,173,500
Add/Upgrade Intersection Lighting - Urban Stop-Control	Partial Systemic	≥ 5 Nighttime Crashes; ≥ 2 Nighttime KA Crash	$52,337	52	$2,708,463
High Friction Surface Treatment on Approach	Partial Systemic	≥ 20 Total Crash; ≥ 25% Wet; OR ≥ 4 Wet KA Crashes	$64,124	81	$5,194,044

Lane Departure and Intersection Safety

HSLD Implementation:

Countermeasure Name	Crash Thresholds	Estimated Program Costs
Install Rumble Striping - Arterials/Collectors w/ 55MPH or greater.	Total Excess Expected using Safety Analyst	$3,400,000
Removal of Roadside Hazards	Total Excess Expected using Safety Analyst	$5,000,000
Curve Signing and Marking Enhancements	Total Excess Expected using Safety Analyst	$10,000,000
Highway Lighting	Total Excess Expected using Safety Analyst	$55,000,000
HFST	Total Excess Expected using Safety Analyst	$1,500,000

Lane Departure and Intersection Safety

HSLD Implementation:

Countermeasure Name	Crash Thresholds	Estimated Program Costs
Systemic Improvements - Urban Off-System	HSM Sliding Window	$20,000,000
Systemic Improvements - Rural Off-System	HSM Sliding Window	$13,000,000
Highway Lighting Off-System	HSM Sliding Window	$44,500,000
HFST Off-System	HSM Sliding Window	$1,500,000

Lane Departure and Intersection Safety

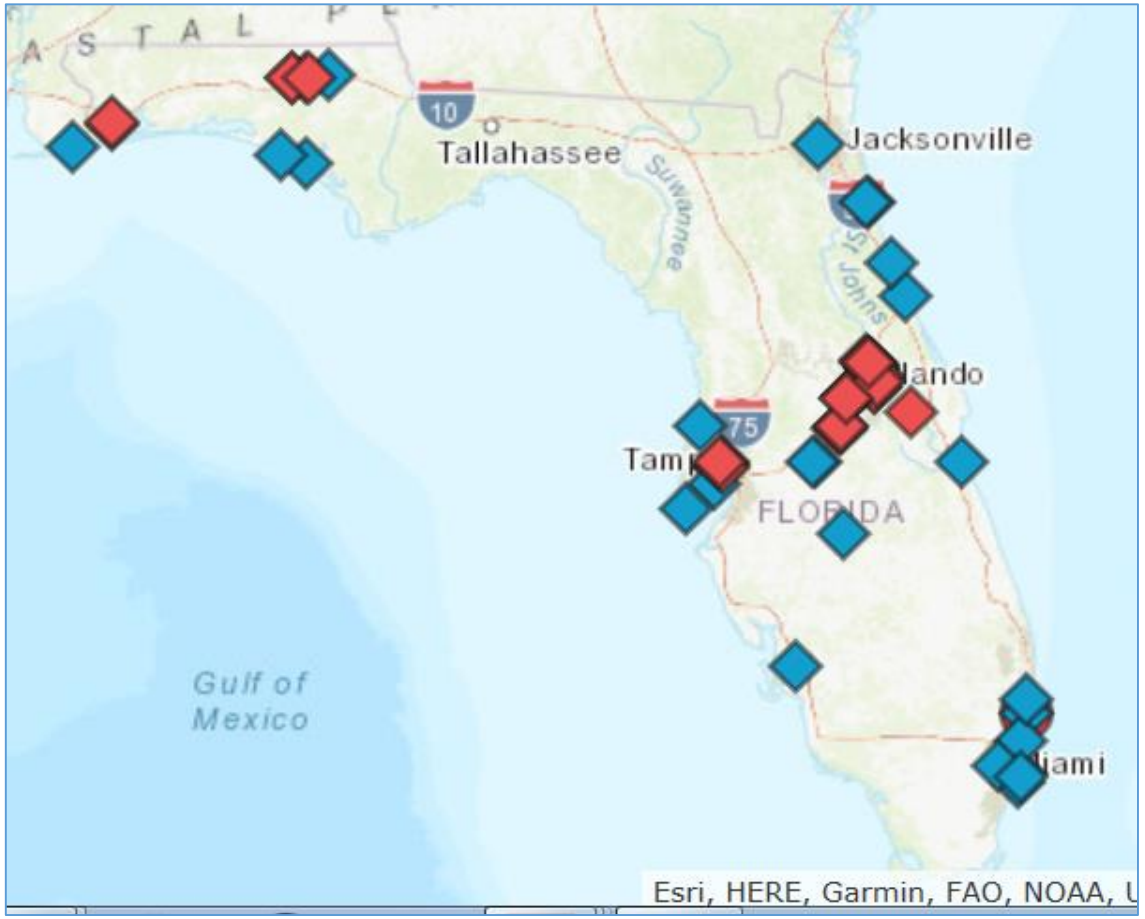
Anticipated Program Achievements:

- The HSID and HSLD requested funds are projected to yield an estimated:
  - 15,000 Total Crashes Reduced
  - 1,000+ Lives Saved/Serious Injuries Avoided
- Produce statewide implementation of systemic and site-specific safety projects.
- Develop crash thresholds to identify future project candidates through district coordination.

Lane Departure and Intersection Safety

Impacts will be Measured through Economic Evaluations of the project sites:

- Online GIS Mapping Database
- Tracking of Installation sites
- Before/After HSM-Level Analysis
- Provides Method to Measure Program Effectiveness



Statewide Intersection and Lane Departure Efforts

Intersection Safety Efforts - Alan ElUrfali

Traffic Service SAFE STRIDES 2 Zero Program

- Systems Analysis and Forecast Evaluation (SAFE) State Traffic Roadway and Intersection Data Evaluation System (STRIDES) 2 Zero Program
- Leverages department data, roadway characteristics, traffic volumes and crash data to evaluate safety performance of state highway system intersections and roadway segments.
- Using predictive Highway Safety Manual methodology to screen, identify, and program projects for safety and mobility improvements.

Tomorrow @ 8:30 am

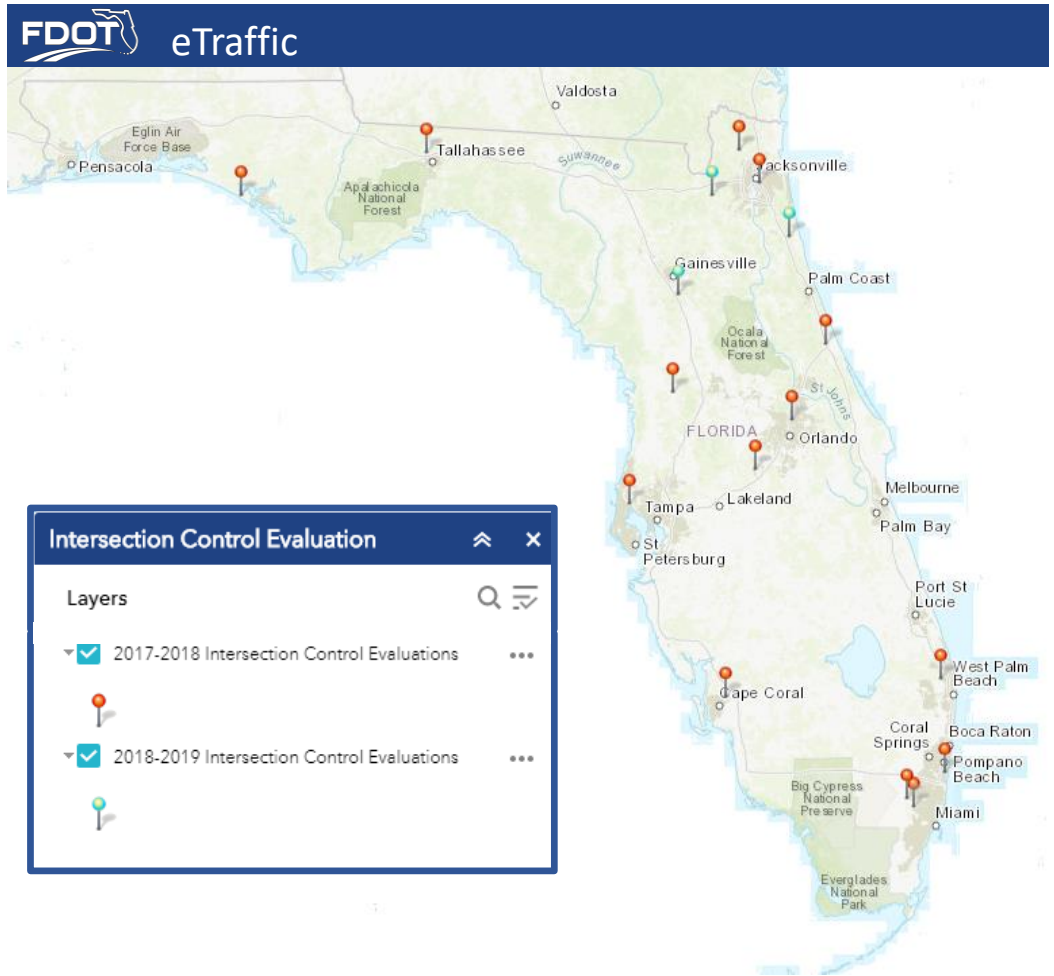
eTraffic and Engineering Safety

Alan El-Urfali and Javier Ponce

FDOT TRANSPORTATION SYMPOSIUM

Intersection Control Evaluation (ICE)

- ICE locations on eTraffic website
  - 2017-2018 ICE Locations
    - Two alternative intersection designs per district
    - Total 14 locations identified
  - 2018-2019 ICE Locations
    - Three alternative intersection designs per district
    - Total 21 locations to be identified



Wednesday @ 9:00 am

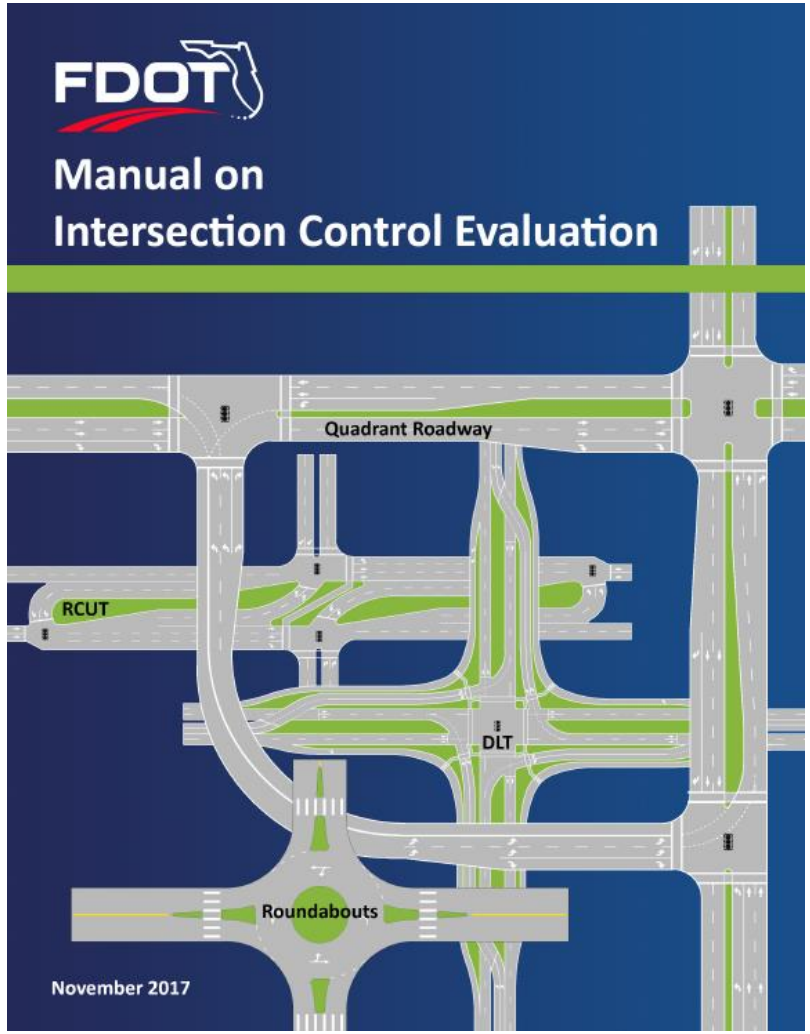
Pedestrian and Bicycle Treatments at Alternative Intersection and Interchanges

Alan El-Urfali

FDOT TRANSPORTATION SYMPOSIUM

FDOT 2019 ICE Training Schedule

District	Location	Date
1	Mike Rippe Auditorium	November 19-20, 2019
2	Lake Jeffery Crew Room	July 16-17, 2019
3/Central Office	Burns Auditorium	July 9-10, 2019
4	District Auditorium	October 1-2, 2019
5	Kepler – Sailfish Conference Room	August 6-7, 2019
6	District Auditorium	December 3-4, 2019
7	Center for Urban Transportation Research (CUTR) – Classroom 102	August 13-14, 2019



FDOT TRANSPORTATION SYMPOSIUM

Programed Intersection Improvements (District 1)

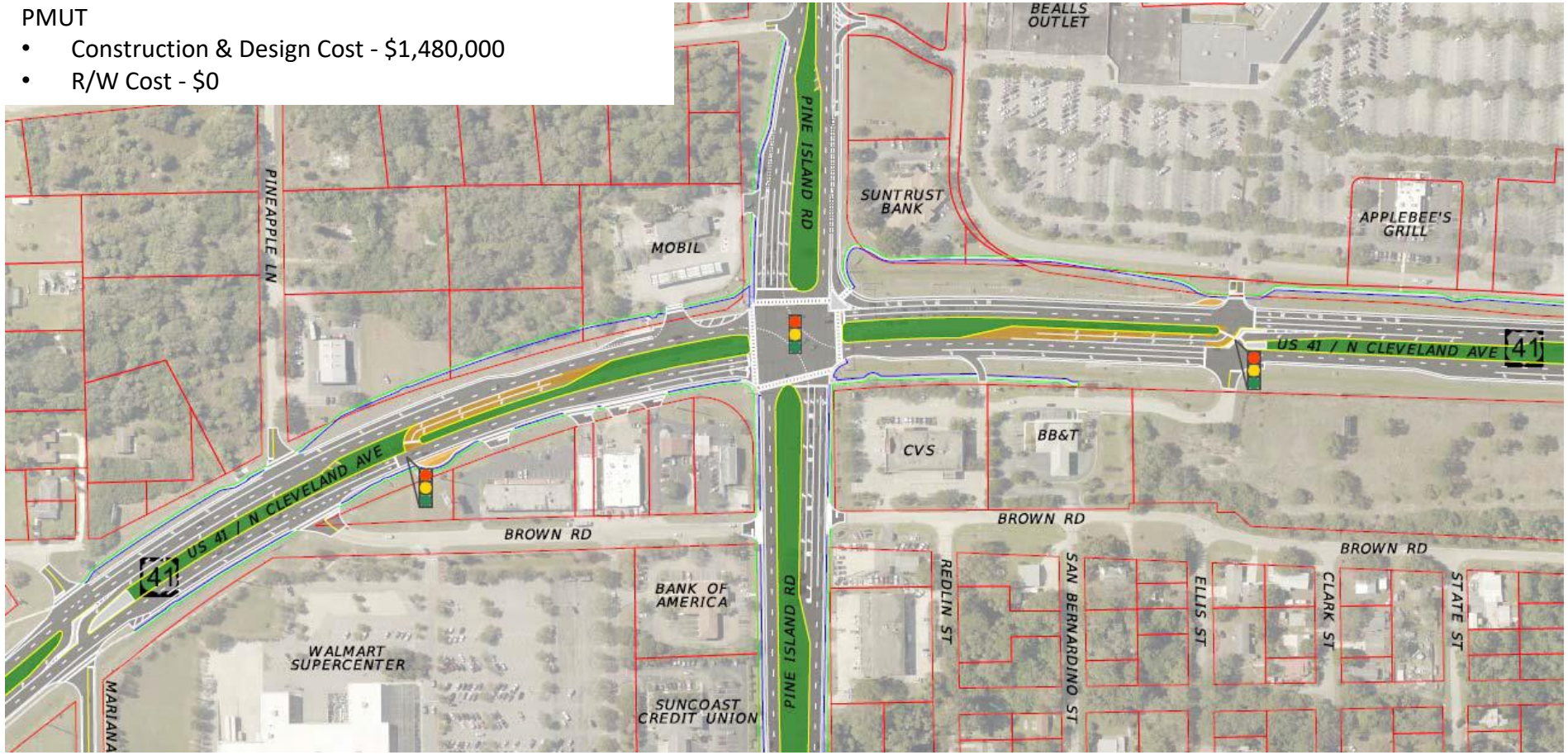
US 41 / PINE ISLAND RD

Programed Intersection Improvements (District 1)

US 41 / PINE ISLAND RD

PMUT

- Construction & Design Cost - $1,480,000
- R/W Cost - $0



Programed Intersection Improvements (District 2)

SR 353 / MEADOW CREEK DR

Programed Intersection Improvements (District 2)

SR 353 / MEADOW CREEK DR

Signalized Restricted Crossing U-Turn N-S

- Construction - $1,300,000
- Design Cost - $430,000
- ROW Cost - $500,000

Programed Intersection Improvements (District 3)

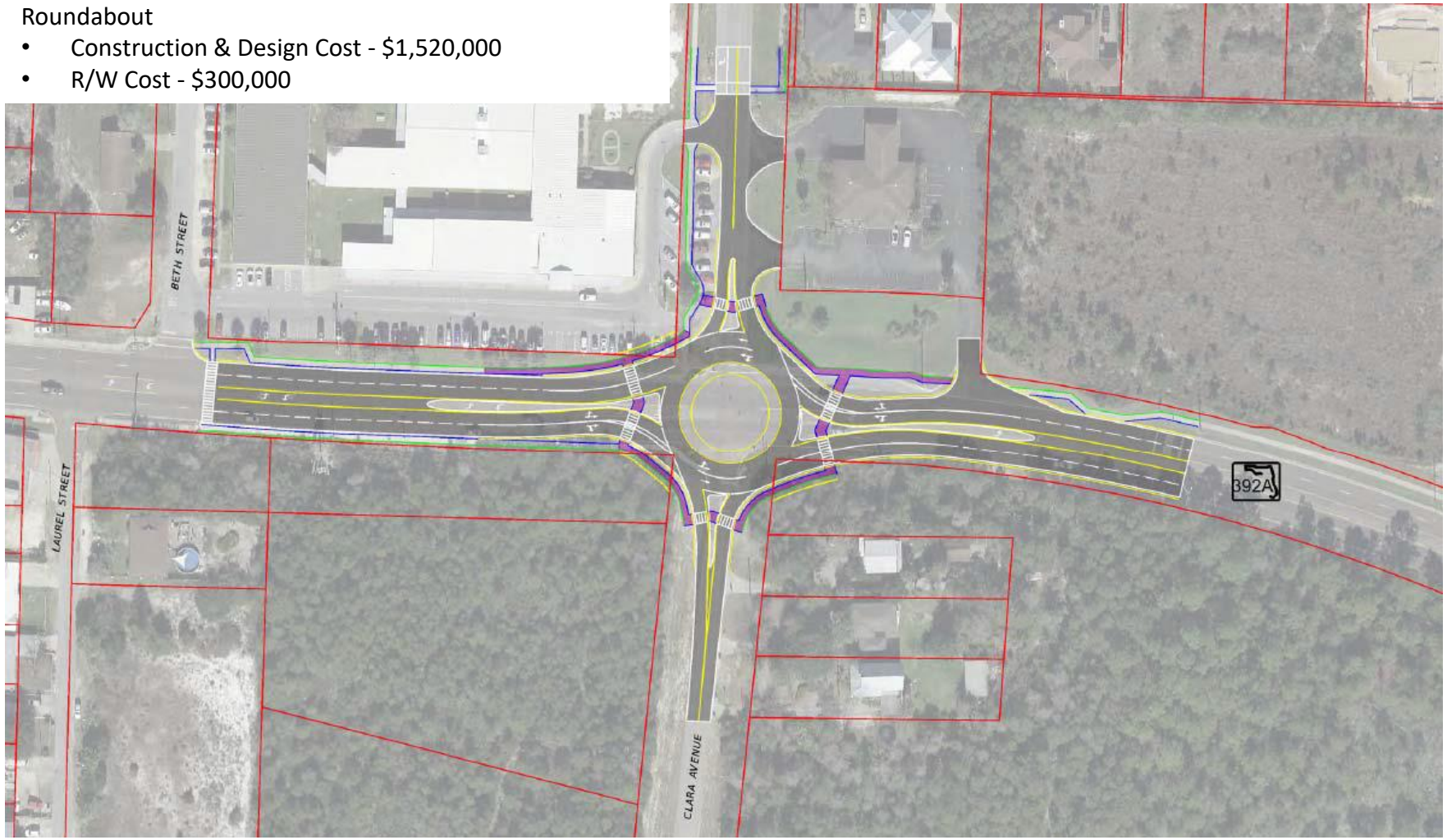
SR 392A / CLARA AVE

Programed Intersection Improvements (District 3)

SR 392A / CLARA AVE

Roundabout

- Construction & Design Cost - $1,520,000
- R/W Cost - $300,000



Programed Intersection Improvements (District 4)

SR 710 / NORTHLAKE BLVD.

Programed Intersection Improvements (District 4)

SR 710 / NORTHLAKE BLVD.

MUT

- Construction & Design Cost - $1,060,000
- R/W Cost - $0

Programed Intersection Improvements (District 5)

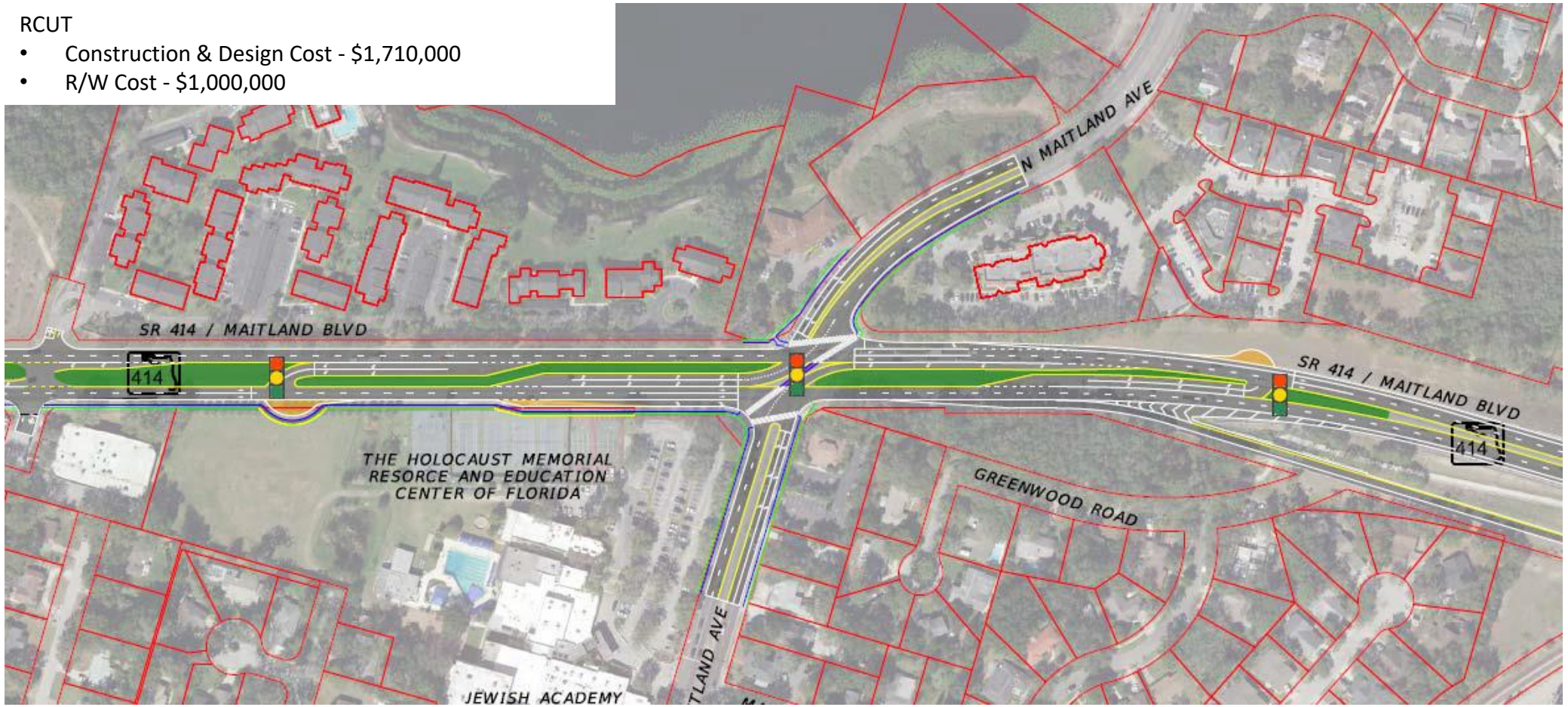
SR 414 / MAITLAND AVE

Programed Intersection Improvements (District 5)

SR 414 / MAITLAND AVE

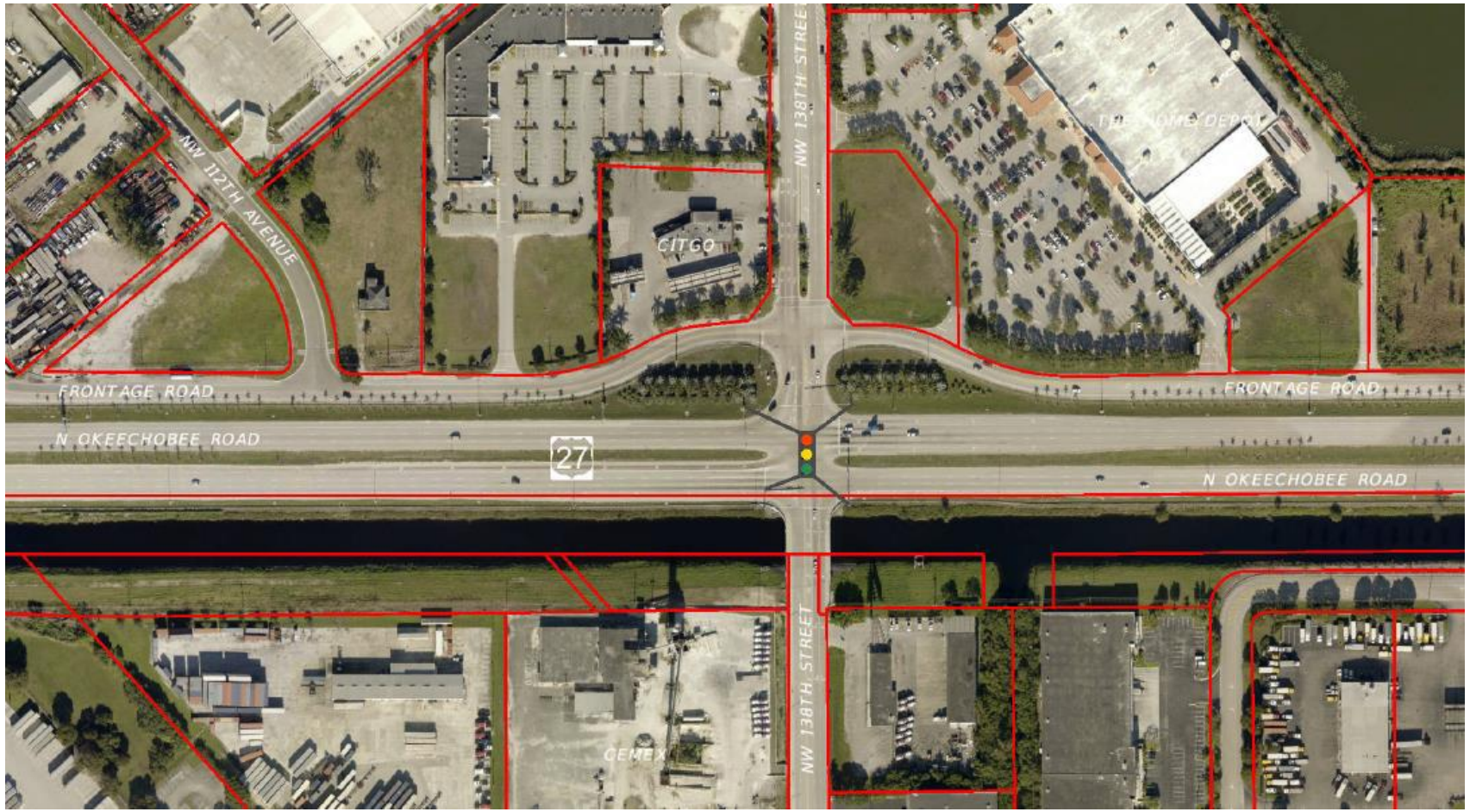
RCUT

- Construction & Design Cost - $1,710,000
- R/W Cost - $1,000,000



Programed Intersection Improvements (District 6)

US 27 / NW 138 ST



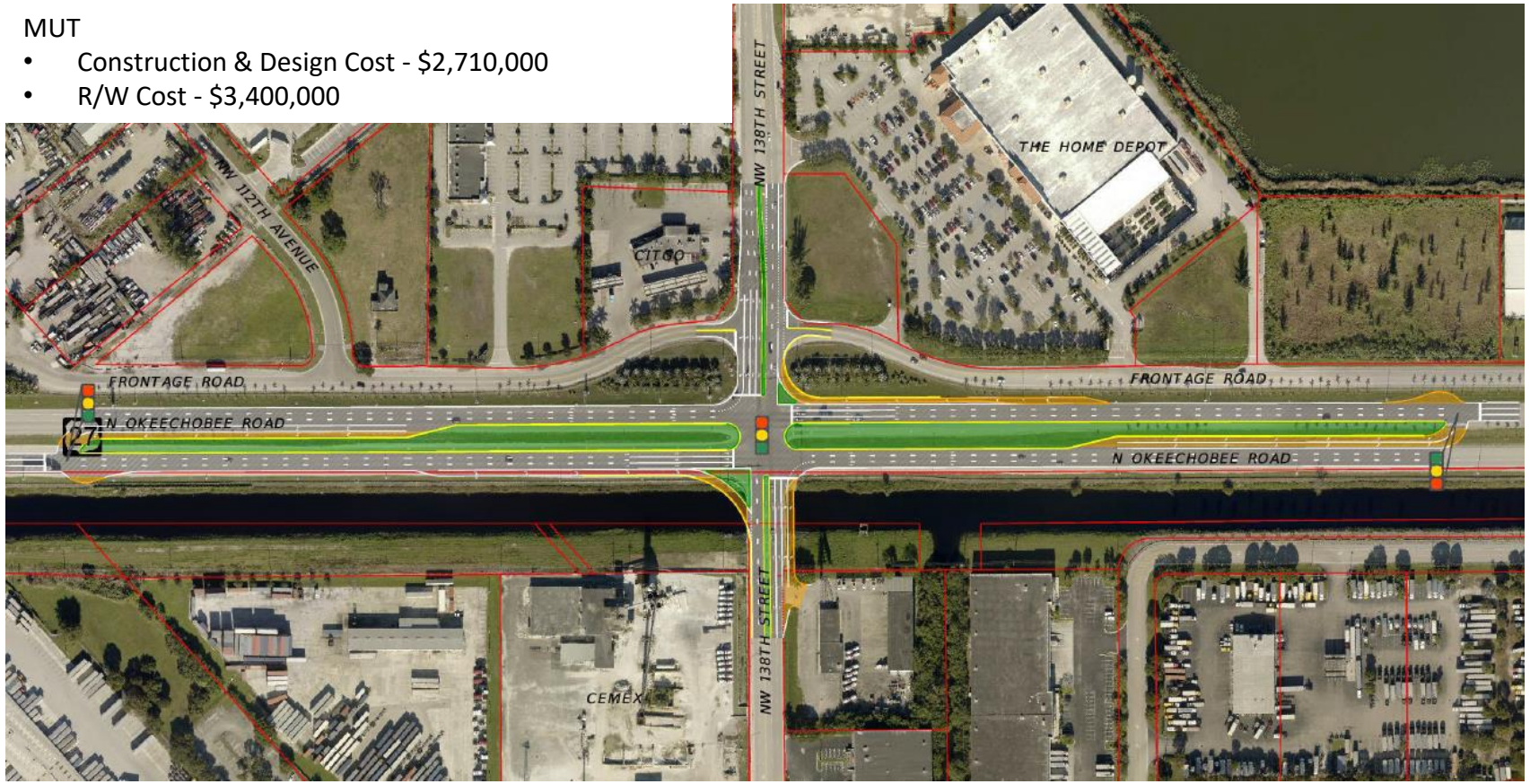
FDOT TRANSPORTATION SYMPOSIUM

Programed Intersection Improvements (District 6)

US 27 / NW 138 ST

MUT

- Construction & Design Cost - $2,710,000
- R/W Cost - $3,400,000



Programed Intersection Improvements (District 7)

SR 584 / BAY ARBOR BLVD.

FDOT TRANSPORTATION SYMPOSIUM

Programed Intersection Improvements (District 7)

SR 584 / BAY ARBOR BLVD.

RCUT

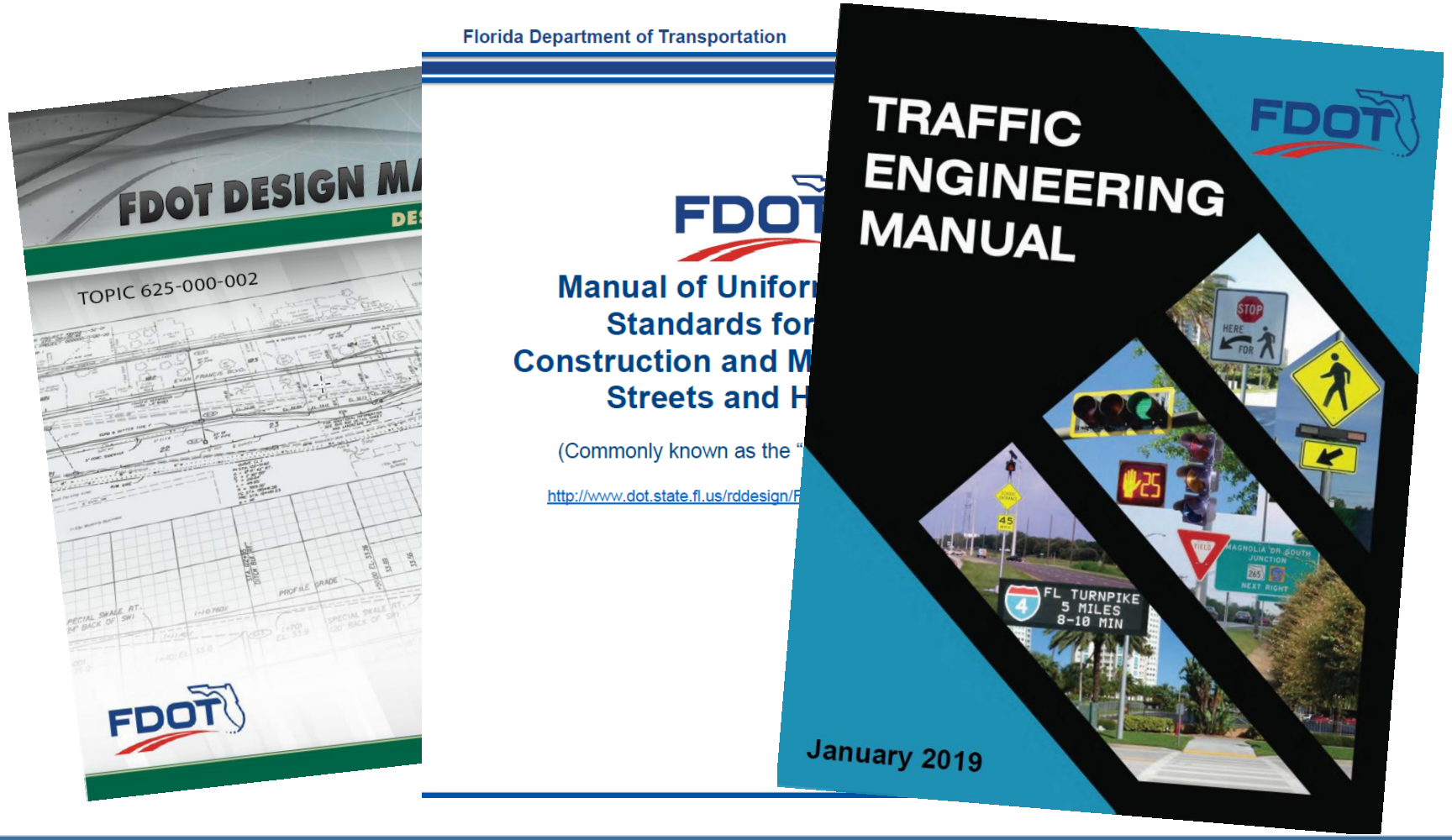
- Construction & Design Cost - $1,140,000
- R/W Cost - $0

Statewide Intersection and Lane Departure Efforts

Lane Departure Polices – Gevin McDaniel

FDOT Policy: Lane Departure Countermeasures

The Department has polices, procedures in place to implement lane departure countermeasures on all projects



FDOT TRANSPORTATION SYMPOSIUM

FDOT Policy: Lane Departure Countermeasures

Countermeasures to Keep Vehicles on the Road:

- Retroreflective Pavement Markings
- Raised Pavement Markers
    - Retroreflective & Internally Illuminated
- Pavement Friction Course
    - Open Graded
        - Reduced potential for hydroplaning
    - High Friction Surface Treatment
        - Ramps and tight radius curves with substandard geometry
- Curve Signing
- Lighting

FDOT Policy: Lane Departure Countermeasures

Countermeasures to Reduce Potential for Crashes:

- Audible and Vibratory Treatments
  - Ground-In Rumble Strips
  - Profiled Thermoplastic
- Wide Paved Shoulders

FDOT Policy: Lane Departure Countermeasures

Countermeasures to Minimize the Severity:

- Clear Zone
- Recoverable Slopes
- Break-away sign supports
- Barriers
  - Cable Barrier
  - Guardrail
    - Roadside Barriers: MASH Implementation Update & Lessons Learned, Tuesday 1:30pm in Orange D
  - Concrete Barrier

FDOT Policy: Lane Departure Countermeasures

Policy:

- Flush-Shoulder Roadways
- Posted Speed of 50mph and greater
- Three Types
  - Cylindrical Ground-in
  - Sinusoidal Ground-in
  - Profiled Thermoplastic
- Context-based Policy
- Be consistent throughout the project
- Consider the context of future adjacent projects to determine clear point to change type

210.4.6 Audible and Vibratory Treatment

Provide audible and vibratory treatment (AVT) on flush-shoulder roadways with a posted speed of 50 mph or greater. Do not exclude sections of the project where advisory speeds are used due to restricted horizontal or vertical geometry. Do not place AVTs within the limits of crosswalks.

Figure 210.4.4 provides guidance for placement of AVTs. See ***FDM 325*** for information regarding plan requirements.

AVTs on arterials and collectors are any of the following:

- Cylindrical Ground-In Rumble Strips,
- Sinusoidal Ground-In Rumble Strips, or
- Profiled Thermoplastic.

Consider potential noise impacts to residents and business adjacent to the roadway when selecting an appropriate AVT. A higher probability of strikes should be expected on the inside radius of horizontal curves. The expected increase in noise levels over typical road noise is as follows:

- Approximately 6 decibels for cylindrical ground-in rumble strips.
- Approximately 4 decibels for sinusoidal ground-in rumble strips.
- Approximately 2 decibels for profiled thermoplastic.

AVT type selected for each edge line or centerline should be consistent throughout the project length: however, there may be clear change in condition for which a change in the AVT type is appropriate. Use the same type of treatment for centerlines as is used for edge lines on undivided roadways.

Determine the appropriate AVT in accordance with ***FDM 210.4.6.1*** and ***FDM 210.4.6.2***.

FDOT Policy: Lane Departure Countermeasures

NOTES:

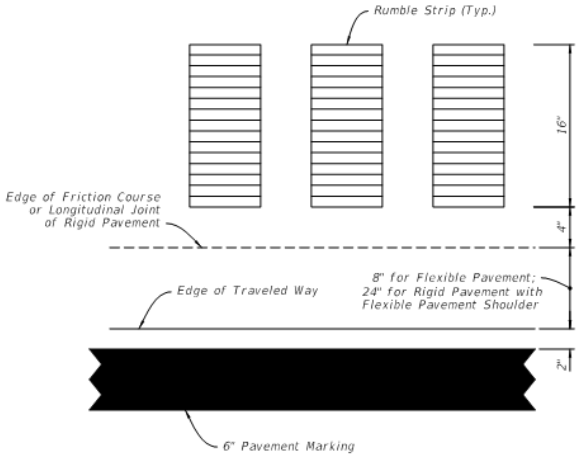
1. When friction course extends more than 8" beyond the edge of the traveled way, blade off the extended friction course to the 8" line prior to rumble strip grinding.

2. Use the continuous array on both inside and outside shoulders 1,000 feet in advance of bridge ends or back to the gore recovery area for mainline interchange bridges. Use the skip array for all other locations.

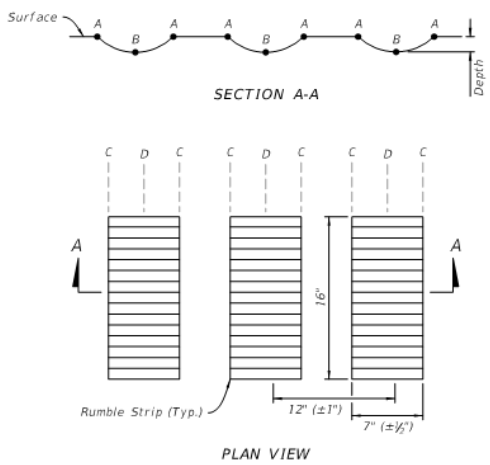
3. Exclude rumble strips at the following locations:

   A. At mainline tolling areas, terminate rumble strips at the end of the mainline normal section.
   B. At All Electronic Tolling (AET) facilities, terminate rumble strips within 50 feet of the centerline of the overhead gantry.
   C. On outside shoulders of entrance ramp terminals, terminate rumble strips at the point of the physical gore and resume at the end of the acceleration lane taper.
   D. On outside shoulders of exit ramp terminals, terminate rumble strips at the start of the deceleration lane taper and resume at the point of the physical gore.
   E. On approaches to bridges, terminate rumble strips at the approach slab joint.
   F. On either side of median crossover openings, terminate rumble strips within 400 feet.

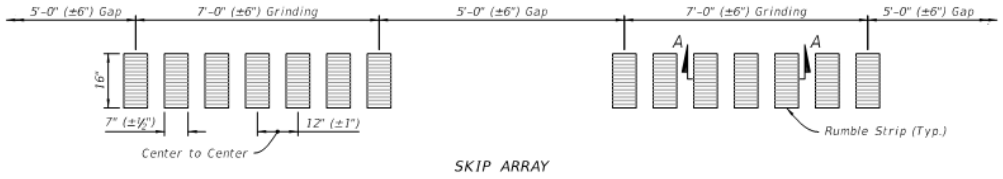
RUMBLE STRIP DEPTH TABLE	
LOCATION	DEPTH FROM SURFACE (IN.)
A	0
B	9/16 (±1/16)

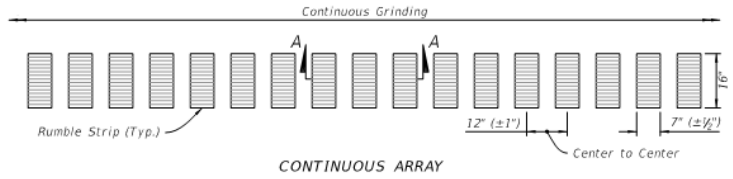


RUMBLE STRIP PLACEMENT
(Plan View)



RUMBLE STRIP DETAILS





RUMBLE STRIP ARRAY DETAILS

LIMITED ACCESS ROADWAYS

LAST REVISION	REVISION	DESCRIPTION:	FDOT		INDEX	SHEET
04/04/18		Revised sheet to incorporate Arterials and Collectors.		FY 2018-19 STANDARD PLANS	546-010	1 of 3

GROUND-IN RUMBLE STRIPS

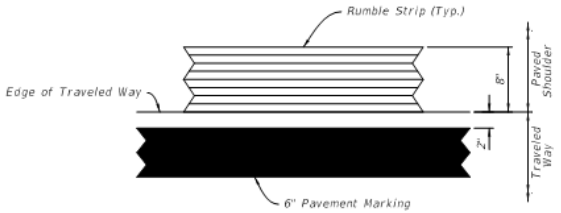
FDOT TRANSPORTATION SYMPOSIUM

FDOT Policy: Lane Departure Countermeasures

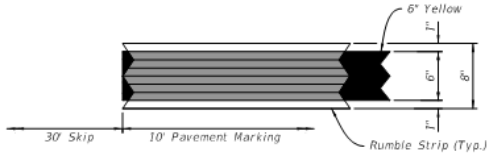
FDOT TRANSPORTATION SYMPOSIUM

FDOT Policy: Lane Departure Countermeasures

Why is there no Type "A2"?

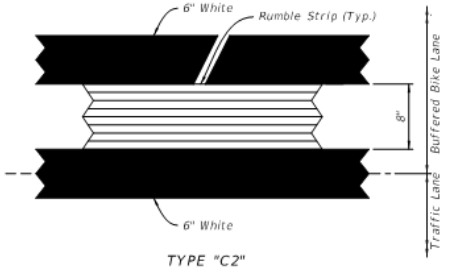


TYPE "B2"
(Plan View)

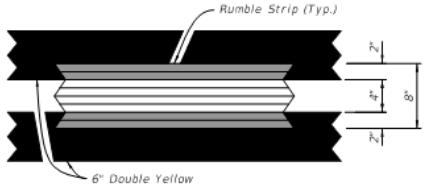


TYPE "D2" - PASSING
(Plan View)

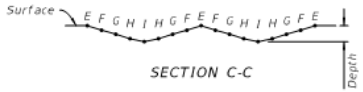
RUMBLE STRIP DEPTH TABLE	
LOCATION	DEPTH FROM SURFACE (IN.)
E	0
F	1/16
G	15/32
H	9/32
I	5/16



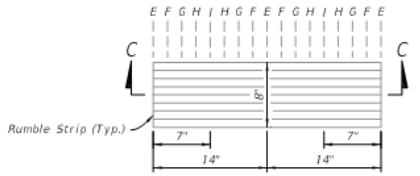
TYPE "C2"
(Plan View)



TYPE "D2" - NO PASSING
(Plan View)



SECTION C-C

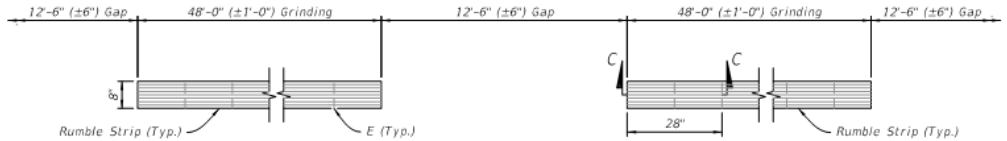


PLAN VIEW

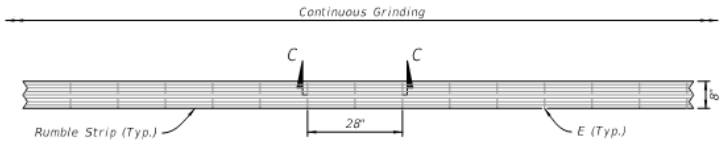
EDGE LINE RUMBLE STRIP PLACEMENT TYPES

CENTERLINE RUMBLE STRIP PLACEMENT TYPES

RUMBLE STRIP DETAILS



SKIP ARRAY
(Outside Shoulder Edge Lines)



CONTINUOUS ARRAY
(Centerlines and Inside Shoulder Edge Lines)

RUMBLE STRIP ARRAY DETAILS

NOTE:
See the Plans for the Placement Type to be used.

SINUSOIDAL FOR ARTERIALS AND COLLECTORS

LAST REVISION	REVISION	DESCRIPTION:	FDOT			INDEX	SHEET
02/19/18		Added new sheet for Arterials and Collectors.		FY 2018-19 STANDARD PLANS	GROUND-IN RUMBLE STRIPS	546-010	3 of 3

FDOT TRANSPORTATION SYMPOSIUM

FDOT Policy: Lane Departure Countermeasures

Standard Plans Instructions:

- Used by designers
- Determine limitations of use
- How to properly include it in the plans
- Includes some payment information

Index 546-010 Ground-In Rumble Strips

Design Criteria

FDOT Design Manual (FDM)

Usage Criteria

Limited Access – See ***FDM 211.4.4***.

Arterials and Collectors – See ***FDM 210.4.6***.

Plan Content Requirements

Limited Access Facilities – Tabulate quantities in the Roadway plans.

Arterials and Collectors – Identify and tabulate in the Signing and Pavement Marking plans. Include the "Type" (see Sheet 2-3 of ***Index 546-010*** for information) in the pavement marking callout labels (e.g., 6" White with Ground-In Rumble Strips, Type B1). It is not necessary to call out the array for Arterials and Collectors.

See ***FDM 325*** for plan content requirements.

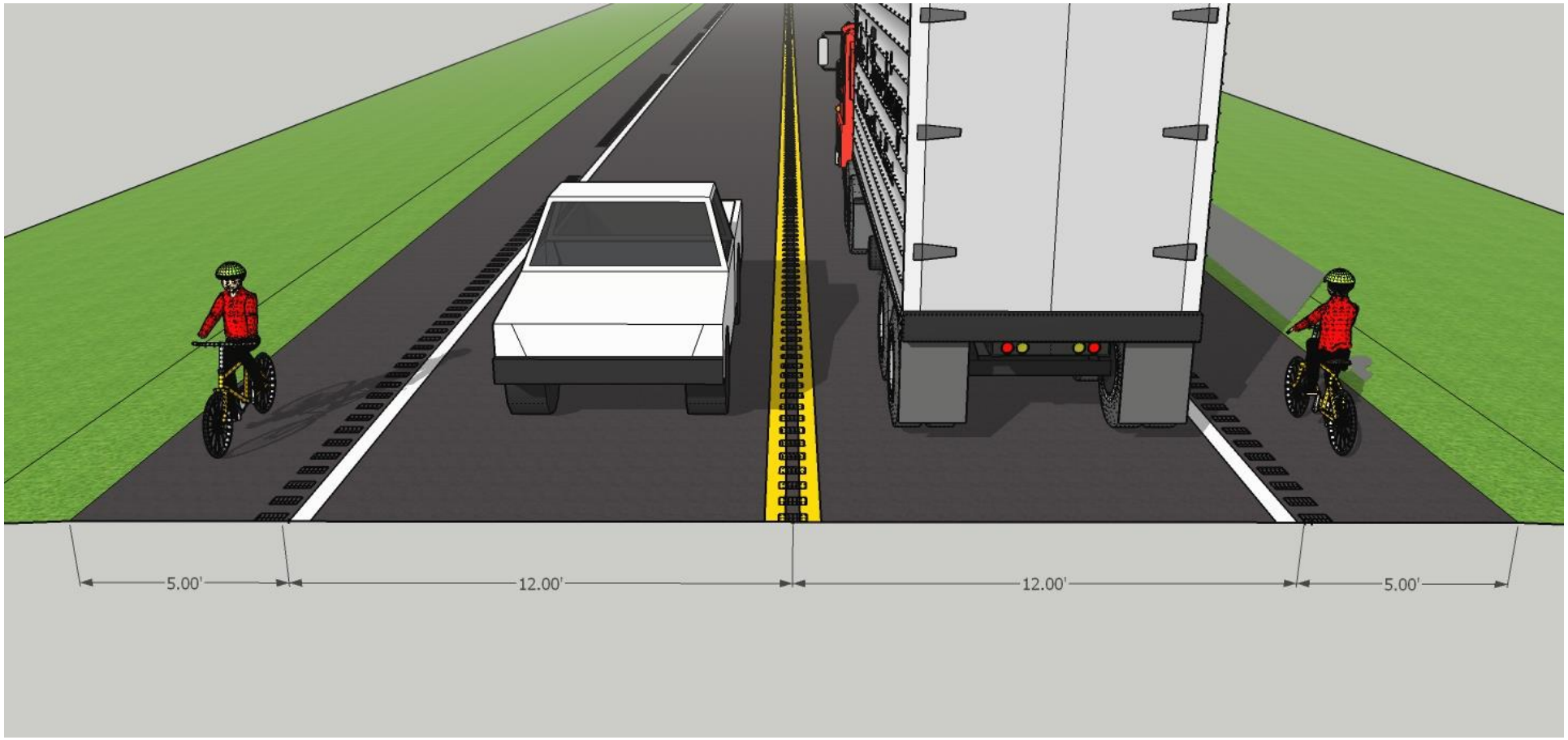
Payment

Item number	Item Description	Unit Measure
546- 72- A	Ground-In Rumble Strips	GM

See the ***BOE*** and ***Specifications 546*** for additional information on payment, pay item use and compensation. In all cases, payment for ground-in rumble strips is separate from any accompanying permanent pavement markings.

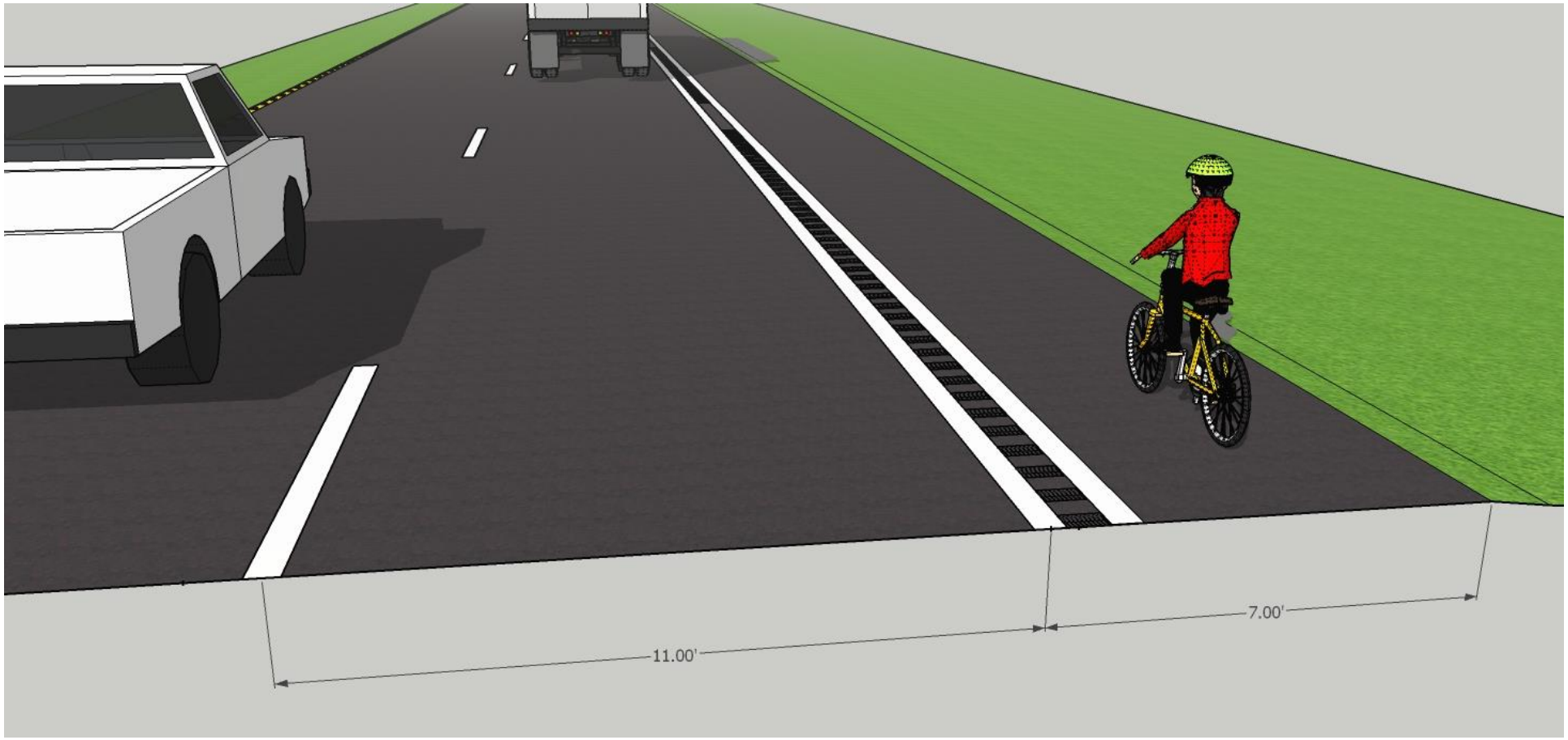
FDOT Policy: Lane Departure Countermeasures

- For paved shoulders greater than or equal to 5’, use ground-in rumble strips located in the shoulder.



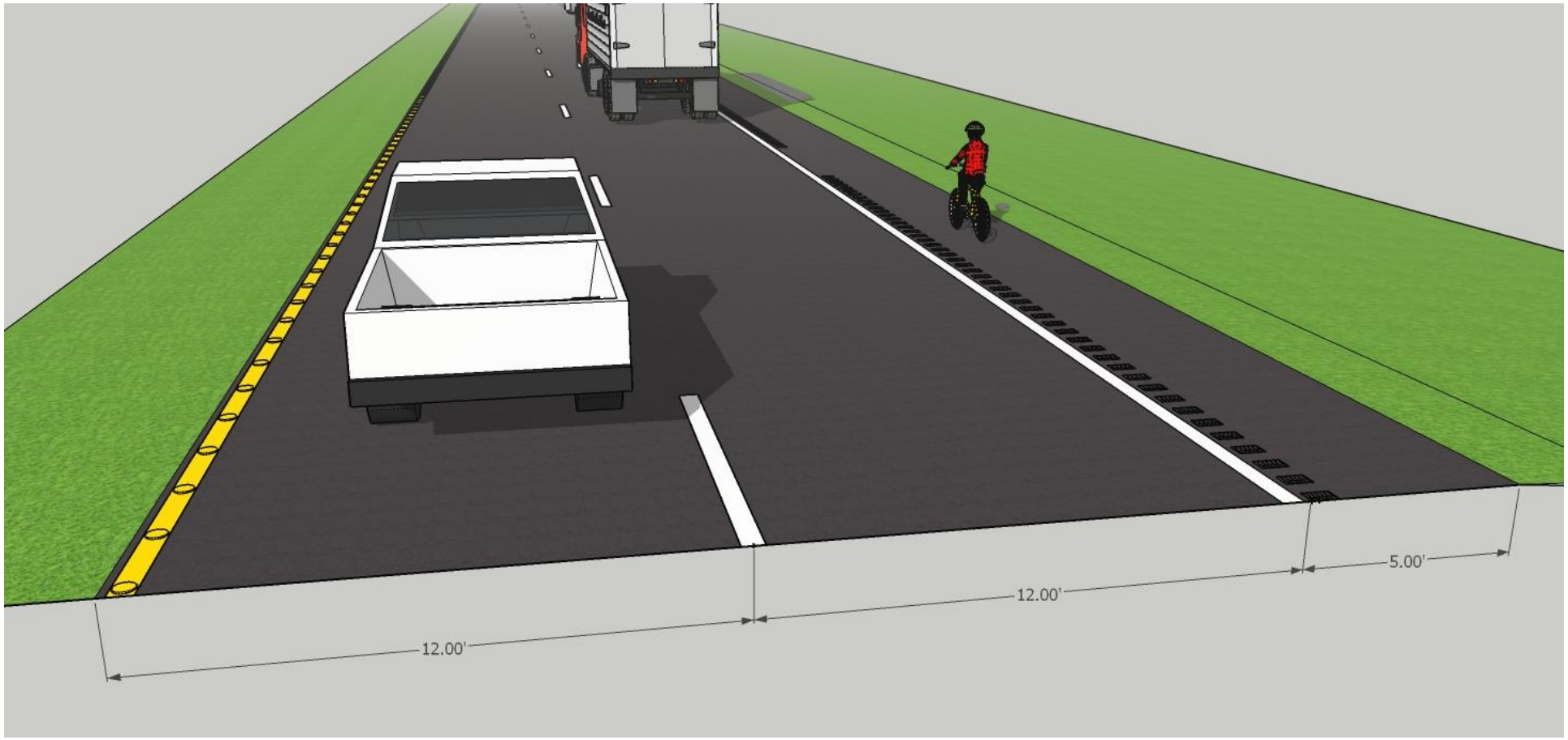
FDOT Policy: Lane Departure Countermeasures

- For buffered bike lanes, use ground-in rumble strips between the longitudinal buffer lines.



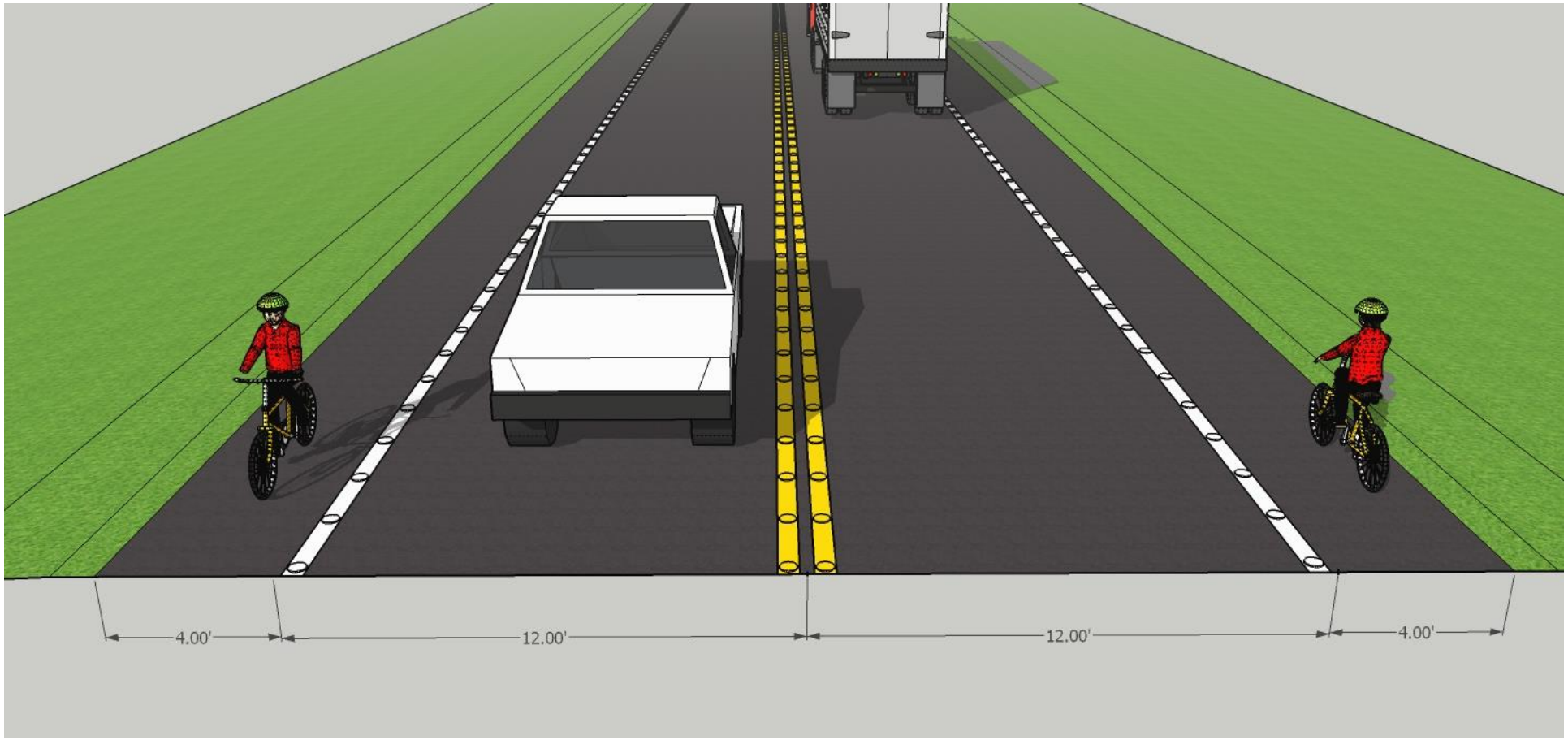
FDOT Policy: Lane Departure Countermeasures

- Regardless of context, use Profiled Thermoplastic for paved shoulders 1’ or less.
  - This is for durability of pavement and constructability.
  - May be used with ground-in rumble strips on outside shoulder.



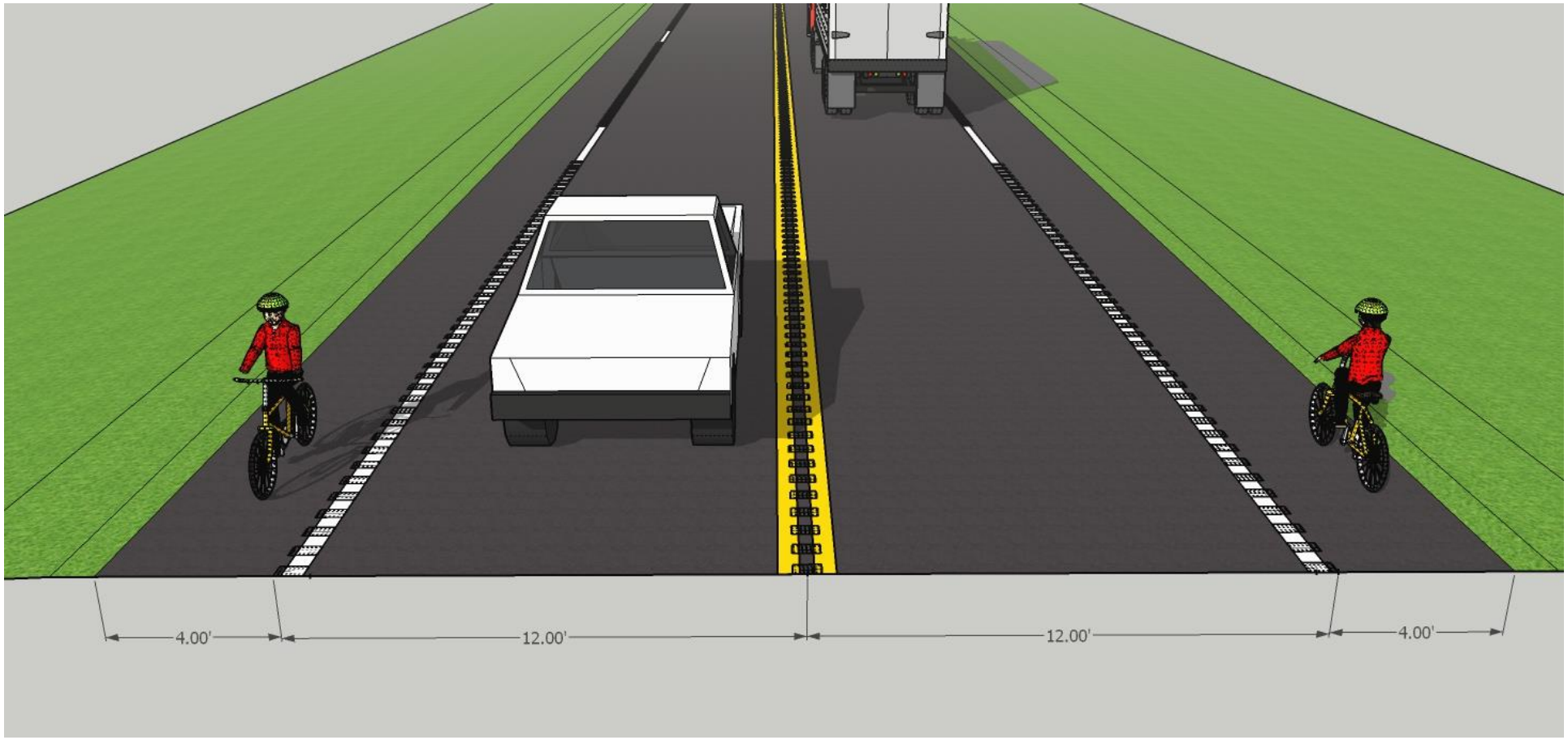
FDOT Policy: Lane Departure Countermeasures

- With residences nearby and for paved shoulders greater than 1’ and less than 5’, use Profiled Thermoplastic.
  - Residences are considered nearby when located within a minimum of a 650 ft radius. (650 ft radius is guidance only; the District may choose to increase this distance)



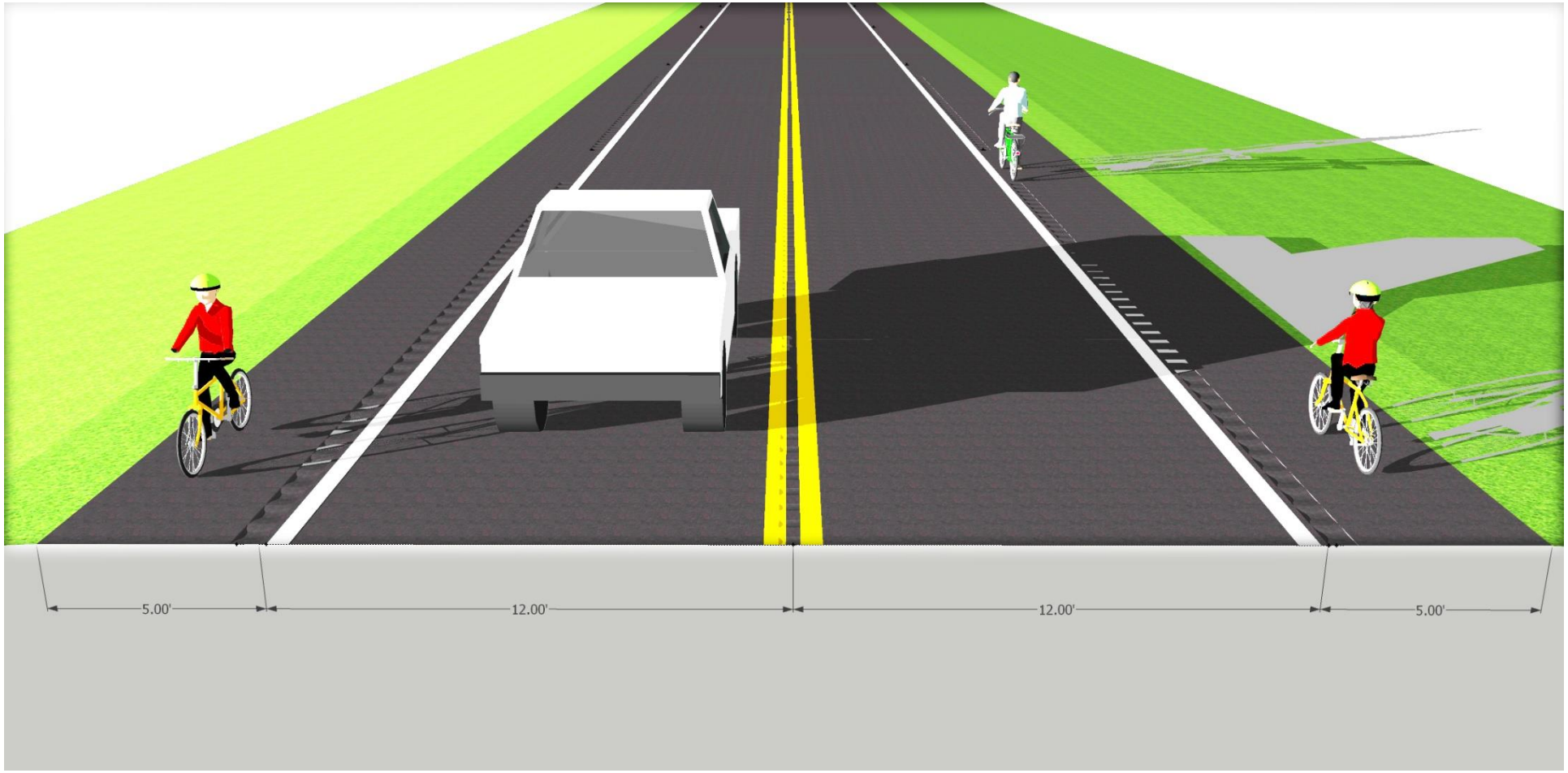
FDOT Policy: Lane Departure Countermeasures

- With no residences nearby and for paved shoulders greater than 1’ and less than 5’, use ground-in rumble strips on the edge line.
  - Residences are considered nearby when located within a minimum of a 650 ft radius. (650 ft radius is guidance only; the District may choose to increase this distance)



FDOT Policy: Lane Departure Countermeasures

- Sinusoidal ground-in rumble strips are optional treatment to the 3/16” Cylindrical pattern for reduced noise levels.



Florida's Intersection & Lane Departure Implementation Plan

A Guide to Support FDOT's Vision of "Driving Down Fatalities"

Florida’s Intersection and Lane Departure Implementation Plan

A Guide to support FDOT’s vision of “Driving Down Fatalities”

Google Search : fdot esri story map intersection and lane departure

https://www.arcgis.com/apps/Cascade/index.html?appid=0972ddd53bf5462eace18d4c97a0b969

FDOT TRANSPORTATION SYMPOSIUM

Questions?

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