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

<table>
<thead>
<tr>
<th>Serious Injuries</th>
<th>2011-2015</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane Departure Crashes</td>
<td>34,276</td>
<td>5,940</td>
</tr>
<tr>
<td>Impaired Driving Crashes</td>
<td>7,252</td>
<td>4,030</td>
</tr>
<tr>
<td>Pedestrians and Bicyclists</td>
<td>12,499</td>
<td>3,365</td>
</tr>
<tr>
<td>Intersection Crashes</td>
<td>34,183</td>
<td>3,053</td>
</tr>
<tr>
<td>Unrestrained Occupants</td>
<td>9,456</td>
<td>2,932</td>
</tr>
<tr>
<td>Motorcyclists</td>
<td>12,093</td>
<td>2,402</td>
</tr>
<tr>
<td>Aging Drivers</td>
<td>12,228</td>
<td>2,326</td>
</tr>
<tr>
<td>Speeding and Aggressive Driving Crashes</td>
<td>7,190</td>
<td>1,870</td>
</tr>
<tr>
<td>Commercial Motor Vehicle Crashes</td>
<td>7,247</td>
<td>1,401</td>
</tr>
<tr>
<td>Teen Driver Crashes</td>
<td>12,741</td>
<td>1,148</td>
</tr>
<tr>
<td>Distracted Driving Crashes</td>
<td>15,236</td>
<td>994</td>
</tr>
<tr>
<td>Work Zone Crashes</td>
<td>2,099</td>
<td>340</td>
</tr>
</tbody>
</table>

Note: Multiple factors are involved in almost every crash.  

This graphic is from the Florida Strategic Highway Safety Plan October 2016, page 8.
Florida Annual Serious Injuries and Fatalities
Statewide for 2011 through 2018

Counts from FDOT State Safety Office Crash Analysis and Reporting (CAR) system
Florida Annual Fatalities and Serious Injuries Involving Lane Departure Statewide for 2011 through 2018

<table>
<thead>
<tr>
<th>Year</th>
<th>Fatalities</th>
<th>Serious Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>7,098</td>
<td>1,144</td>
</tr>
<tr>
<td>2012</td>
<td>6,808</td>
<td>1,192</td>
</tr>
<tr>
<td>2013</td>
<td>6,629</td>
<td>1,151</td>
</tr>
<tr>
<td>2014</td>
<td>6,736</td>
<td>1,142</td>
</tr>
<tr>
<td>2015</td>
<td>7,019</td>
<td>1,314</td>
</tr>
<tr>
<td>2016</td>
<td>7,379</td>
<td>1,459</td>
</tr>
<tr>
<td>2017</td>
<td>6,738</td>
<td>1,369</td>
</tr>
<tr>
<td>2018</td>
<td>6,059</td>
<td>1,381</td>
</tr>
</tbody>
</table>

Counts from FDOT State Safety Office Crash Analysis and Reporting (CAR) system
Florida Annual Fatalities and Serious Injuries At or Influenced by Intersections
Statewide for 2011 through 2018

<table>
<thead>
<tr>
<th>Year</th>
<th>Fatalities</th>
<th>Serious Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>6,722</td>
<td>599</td>
</tr>
<tr>
<td>2012</td>
<td>6,606</td>
<td>581</td>
</tr>
<tr>
<td>2013</td>
<td>6,785</td>
<td>578</td>
</tr>
<tr>
<td>2014</td>
<td>6,991</td>
<td>593</td>
</tr>
<tr>
<td>2015</td>
<td>7,034</td>
<td>702</td>
</tr>
<tr>
<td>2016</td>
<td>7,264</td>
<td>767</td>
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<tr>
<td>2017</td>
<td>7,096</td>
<td>887</td>
</tr>
<tr>
<td>2018</td>
<td>7,046</td>
<td>830</td>
</tr>
</tbody>
</table>

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)

“What” is Happening
(Ph. 1 and 2 Complete)

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

Verify Program Effectiveness
(Start FY22–)

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

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

Network Screening

Diagnosis

Countermeasure Selection

Project Prioritization

Safety Effectiveness Evaluation

Economic Appraisal

Florida Department of Transportation
Intersection Safety Overview
**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.
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

<table>
<thead>
<tr>
<th>District</th>
<th>Count of Intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
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<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intersection Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int/Urb; 3-leg signalized</td>
<td>11</td>
</tr>
<tr>
<td>Int/Urb; 4-leg signalized</td>
<td>37</td>
</tr>
<tr>
<td>Rural Four-leg Unsignalized Intersection</td>
<td>1</td>
</tr>
<tr>
<td>Urban Four-leg Unsignalized Intersection</td>
<td>1</td>
</tr>
<tr>
<td>Urban Three-leg Unsignalized Intersection</td>
<td>12</td>
</tr>
<tr>
<td>Grand Total</td>
<td>62</td>
</tr>
</tbody>
</table>
Intersection Network Screening

• Screening based on three methods combined:


  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

[Map of Florida showing intersection crash frequencies by county, with color codes indicating crash counts: 400 or more, 170-399, 75-169, 50-74, 25-49, Less than 25]
Lane Departure and Intersection Safety

Intersection Diagnostics Crash Tree

Figure 1. Florida Intersection Crashes (2011 – 2015)
## Intersection Diagnostics Summary Table

<table>
<thead>
<tr>
<th>Diagnostics Summary</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signalized</td>
<td>Stop-Control</td>
</tr>
<tr>
<td>State (On-System)</td>
<td>12,529 KA; D4, D5, D7 ≥ 18% 509 Bike KA; 1,166 Ped KA</td>
<td>8,803 KA; D1, D5, D7 ≥ 14% 448 Bike KA; 801 Ped KA</td>
</tr>
<tr>
<td></td>
<td>4,649 Angle KA; 3,400 Rear End KA</td>
<td>3,478 Angle KA; 1,796 Rear End KA</td>
</tr>
<tr>
<td>% Distribution</td>
<td>Bike; Ped; Rear End</td>
<td>Bike; Ped; Angle</td>
</tr>
<tr>
<td>Focus Areas</td>
<td>Bike; Ped; Angle; Rear End</td>
<td>Bike; Ped; Angle; Rear End</td>
</tr>
<tr>
<td>Local (Off-System)</td>
<td>5,601 KA; D4, D5, D7 ≥ 21% 229 Bike KA; 327 Ped KA</td>
<td>8,405 KA; D5, D7 ≥ 24% 536 Bike KA; 534 Ped KA</td>
</tr>
<tr>
<td></td>
<td>2,910 Angle KA; 980 Rear End KA</td>
<td>4,225 Angle KA; 880 Rear End KA</td>
</tr>
<tr>
<td>KABCO %</td>
<td>Bike; Ped; Angle; Rear End</td>
<td>Bike; Ped; Angle</td>
</tr>
<tr>
<td></td>
<td>Bike; Ped; Angle; Rear End</td>
<td>Bike; Ped; Angle; Rear End</td>
</tr>
</tbody>
</table>

NOTE: 'KA' refers to Fatal (K) and Serious/Incapacitating Injury (A) Crashes Only
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

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

**Lane Departure Overview**

- Network Screening
- Safety Effectiveness Evaluation
- Project Prioritization
- Diagnosis
- Countermeasure Selection
- Economic Appraisal
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


<table>
<thead>
<tr>
<th>District</th>
<th>Count of Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>530</td>
</tr>
<tr>
<td>2</td>
<td>637</td>
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<tr>
<td>3</td>
<td>499</td>
</tr>
<tr>
<td>4</td>
<td>855</td>
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<tr>
<td>5</td>
<td>1009</td>
</tr>
<tr>
<td>6</td>
<td>665</td>
</tr>
<tr>
<td>7</td>
<td>994</td>
</tr>
<tr>
<td>Grand Total</td>
<td>5189</td>
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<table>
<thead>
<tr>
<th>Segment Countermeasures</th>
<th>Count of Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highway Lighting</td>
<td>340</td>
</tr>
<tr>
<td>Centerline Rumble Strips</td>
<td>340</td>
</tr>
<tr>
<td>Shoulder Rumble Strips</td>
<td>286</td>
</tr>
<tr>
<td>Curve Warning and Advisory Speed Signs</td>
<td>340</td>
</tr>
</tbody>
</table>
Lane Departure Diagnostics Crash Tree

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
HSID Implementation:

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

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

**TOTAL** $153,900,000
### HSLD Implementation:

<table>
<thead>
<tr>
<th>Countermeasure Name</th>
<th>Crash Thresholds</th>
<th>Estimated Program Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systemic Improvements - Urban Off-System</td>
<td>HSM Sliding Window</td>
<td>$20,000,000</td>
</tr>
<tr>
<td>Systemic Improvements - Rural Off-System</td>
<td>HSM Sliding Window</td>
<td>$13,000,000</td>
</tr>
<tr>
<td>Highway Lighting Off-System</td>
<td>HSM Sliding Window</td>
<td>$44,500,000</td>
</tr>
<tr>
<td>HFST Off-System</td>
<td>HSM Sliding Window</td>
<td>$1,500,000</td>
</tr>
</tbody>
</table>

This table shows the implementation of various countermeasures with their respective crash thresholds and estimated program costs. The costs are expected using Safety Analyst.
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 EIUrfali
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
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 2019 ICE Training Schedule

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

US 41 / PINE ISLAND RD

PMUT
- Construction & Design Cost: $1,480,000
- R/W Cost: $0
Programmed 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
Programmed 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
Programmed Intersection Improvements (District 5)

SR 414 / MAITLAND AVE
Programmed 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
Programmed 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.
Programeed 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
The Department has policies, procedures in place to implement lane departure countermeasures on all projects.
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
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 6’ beyond the edge of the traveled way, make all the extended friction course to the 6’ lane area to rumble strip grinding.

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

3. Exclude rumble strips at the following locations:
   A. At maintenance areas, terminate rumble strips at the end of the maintenance normal section.
   B. At all electronic tolling (ET) 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 span.
   D. On outside shoulders of exit ramp terminals, terminate rumble strips at the start of the deceleration lane span and resume at the point of the physical gore.
   E. At approaches to bridges, terminate rumble strips at the approach side joint.
   F. On either side of median crossover openings, terminate rumble strips within 400 feet.

RUMBLE STRIP DEPTH TABLE

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>DEPTH FROM SURFACE (IN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>D</td>
</tr>
<tr>
<td>R</td>
<td>3.5 (192)</td>
</tr>
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</table>

SECTION A-A

PLAN VIEW

RUMBLE STRIP ARRAYS DETAILS

LIMITED ACCESS ROADWAYS
FDOT Policy: Lane Departure Countermeasures

EDGE LINE RUMBLE STRIP PLACEMENT TYPES

CENTERLINE RUMBLE STRIP PLACEMENT TYPES

RUMBLE STRIP ARRAY DETAILS

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

CYLINDRICAL FOR ARTERIALS AND COLLECTORS
Why is there no Type “A2”?

EDGE LINE RUMBLE STRIP PLACEMENT TYPES

CENTERLINE RUMBLE STRIP PLACEMENT TYPES

RUMBLE STRIP DETAILS

RUMBLE STRIP ARRAY DETAILS

NOTE:
See the Plans for the Placement Type to be used.
Standard Plans Instructions:
- Used by designers
- Determine limitations of use
- How to properly include it in the plans
- Includes some payment information

FDOT Policy: Lane Departure Countermeasures

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
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

<table>
<thead>
<tr>
<th>Item number</th>
<th>Item Description</th>
<th>Unit Measure</th>
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<tbody>
<tr>
<td>546- 72- A</td>
<td>Ground-In Rumble Strips</td>
<td>GM</td>
</tr>
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</table>

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.
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.
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.
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)
• 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)
• 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
Questions?

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Alan ElUrfali, alan.elurfali@dot.state.fl.us
Gevin McDaniel, gevin.mcdaniel@dot.state.fl.us