Orlando, FL

November 7-8, 2024

2024 TRANSPORTATION SYMPOSIUM


# STRIDES 2 Zero Program Implementation and Challenges

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FDOT

# Outline

- STRIDES 2 Zero (S2Z) program objectives and strategies
- Network Screening process
  - What, why, and how we do
  - Focus on Signalized Intersection
- District 4's approach to S2Z implementation and challenges
- Systemic Safety approach

# What is STRIDES 2 Zero?

- An initiative managed by FDOT Traffic Engineering and Operations Office in collaboration with Safety Office  toward the goal of zero fatalities and serious injuries on our roadways
- Enhance highway safety management practices in Florida through data-driven process
- Provide engineering-based safety solutions for different transportation facilities and modes


State Traffic Roadway and Intersection Data Evaluation System Toward Zero Fatalities and Serious Injuries

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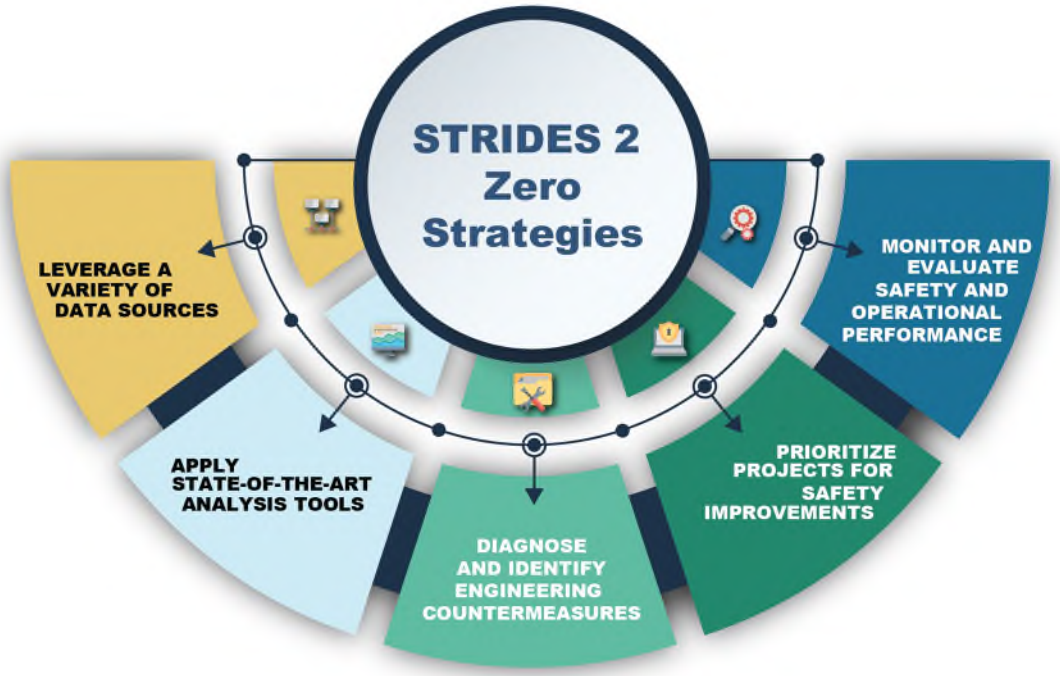
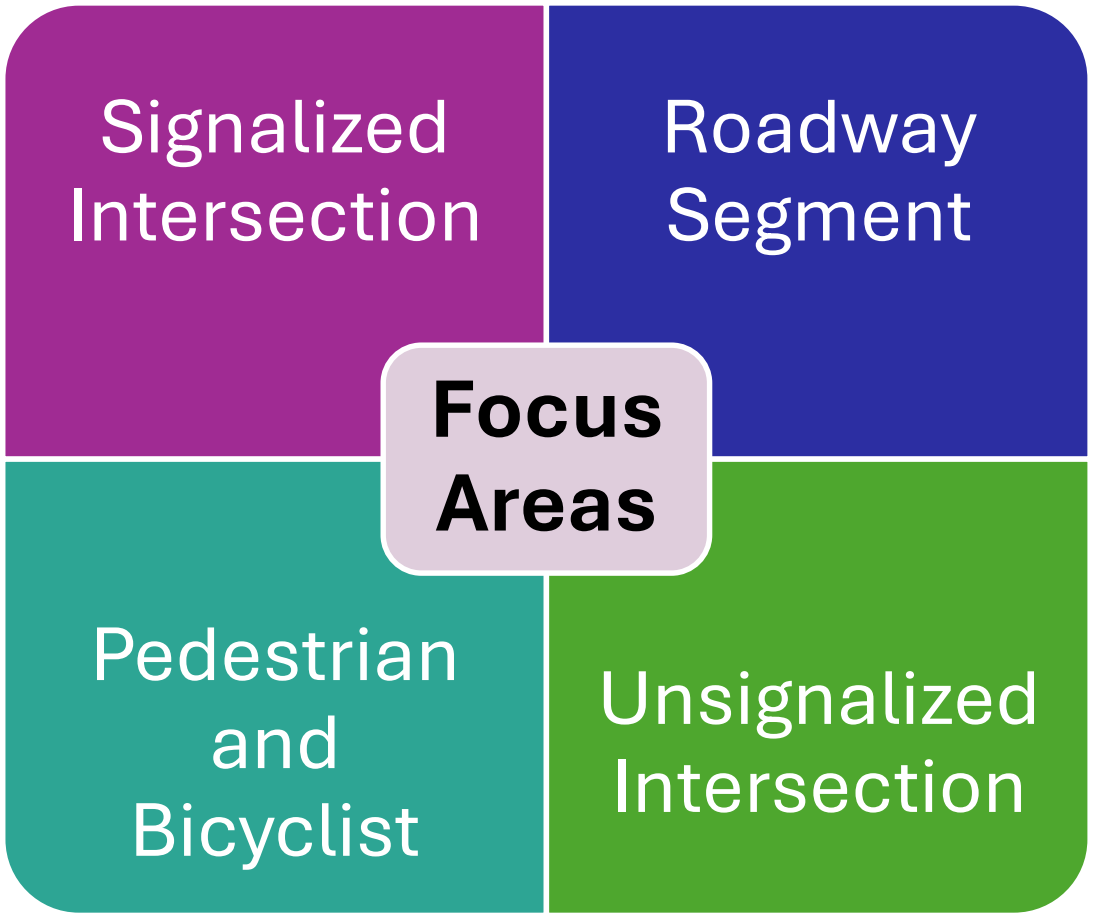
# STRIDES 2 Zero Program Strategies

- Leverage a variety of data sources
- Apply state-of-the-art analysis tools
- Diagnose and identify engineering countermeasures
- Prioritize projects for safety implementation
- Monitor and evaluate safety and operational performance of countermeasures



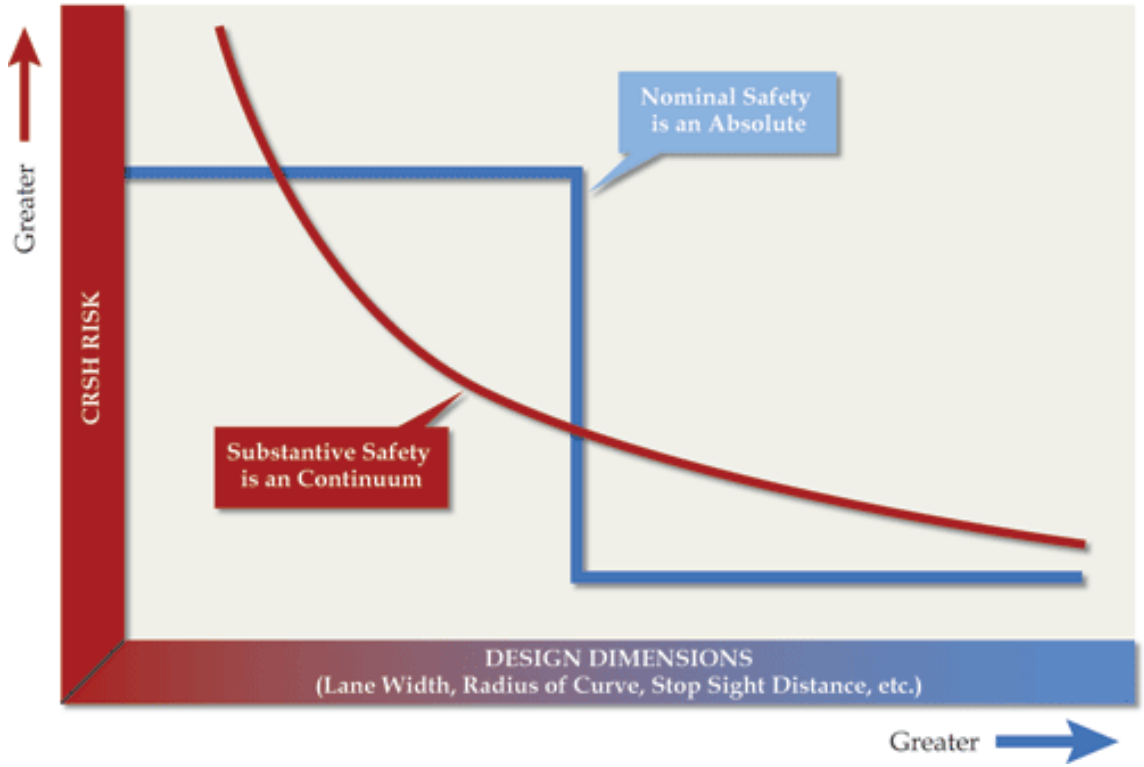
# Focus Areas




- All focus area efforts concentrated on arterial roads along State Highway System
- Started with Signalized Intersection focus area

# Evaluate Safety Performance

- Nominal vs. Substantive Safety



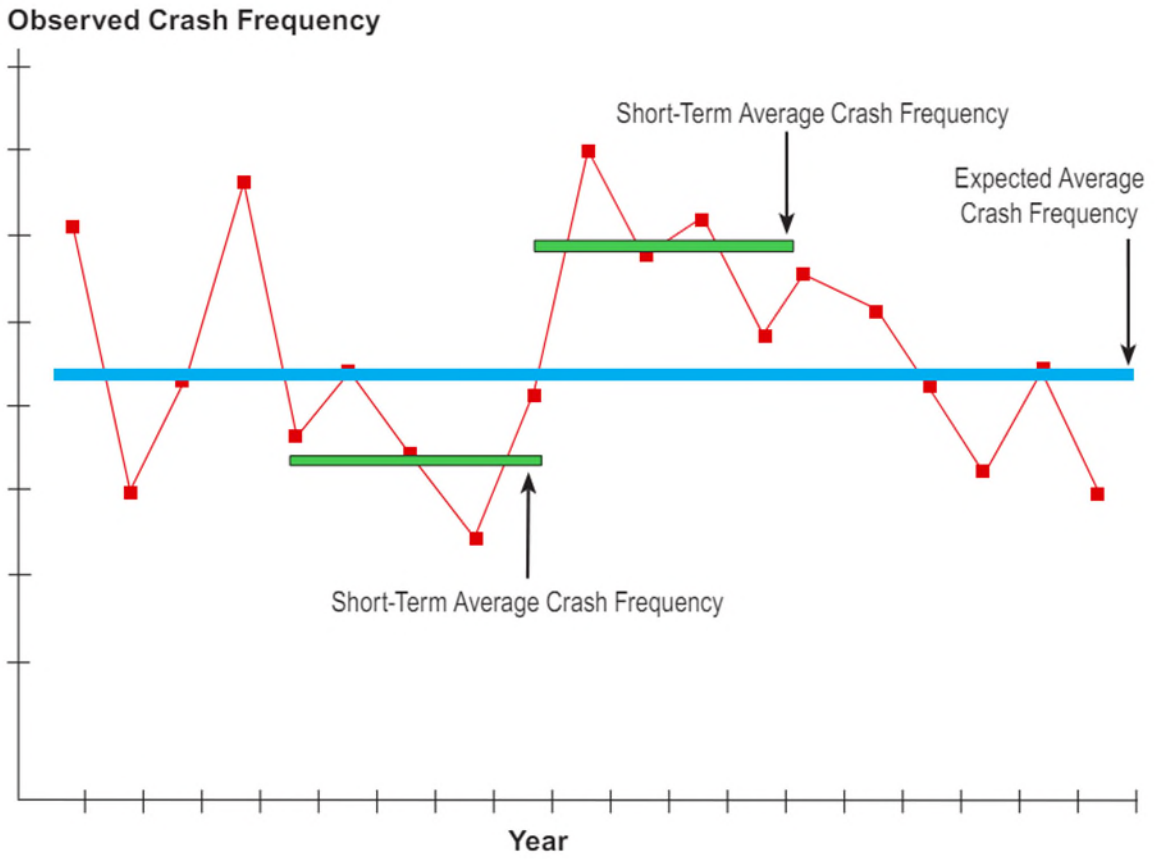

**Nominal Safety:** a design feature or roadway either meets minimum criteria or it does not.

**Substantive Safety:** actual or expected long-term safety performance of a roadway.

# How to Determine Expected Safety Performance?

## Concern #1: Natural Variability in Crash Frequency

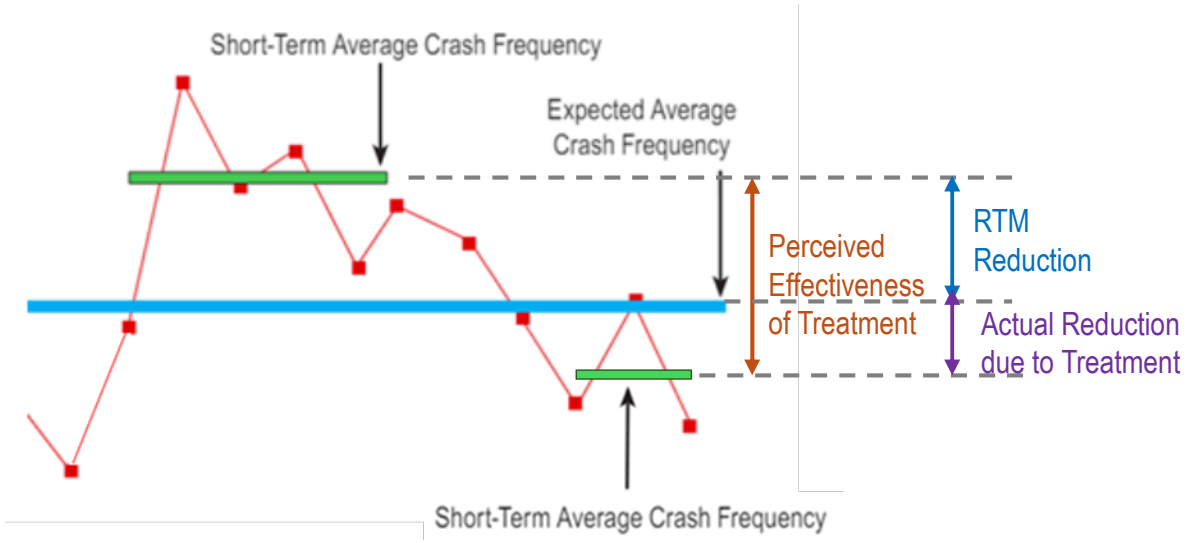
- Crashes are random events
  - *What is the probability of a crash occurring at a site on a particular day and time?*
- Observed average crash frequency over short periods
  - *Is it high, average, or low?*



# How to Determine Expected Safety Performance?

## Concern #2: Regression-to-the-mean (RTM) Bias

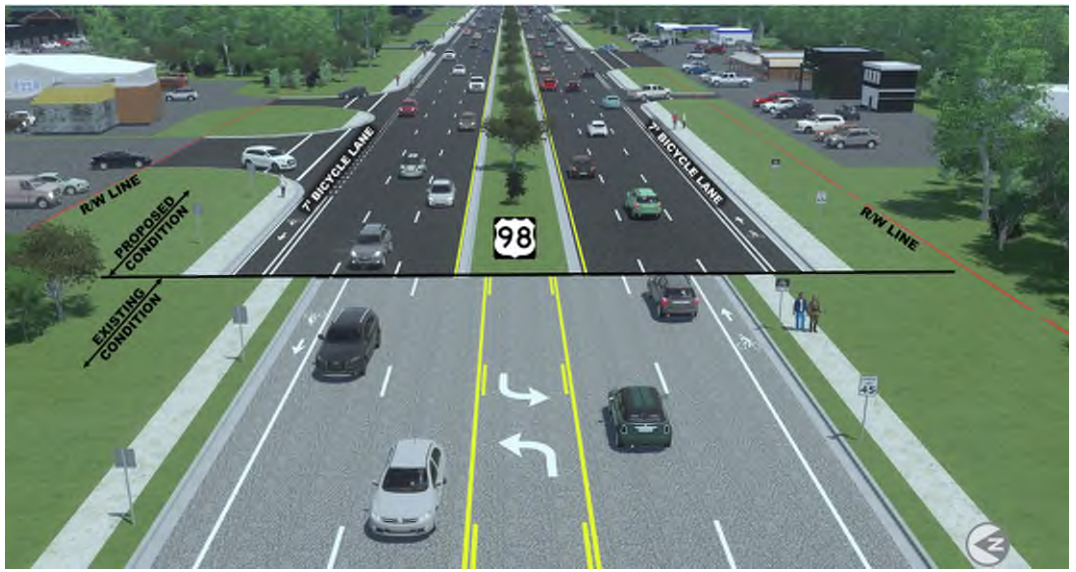
- A period of high crash frequency is likely to be followed by a period of low crash frequency or vice versa.
- Had the treatment not been applied for, what would have been the safety performance of the site for which treatment is selected based on short-term observed average crash frequency?



# How to Determine Expected Safety Performance?

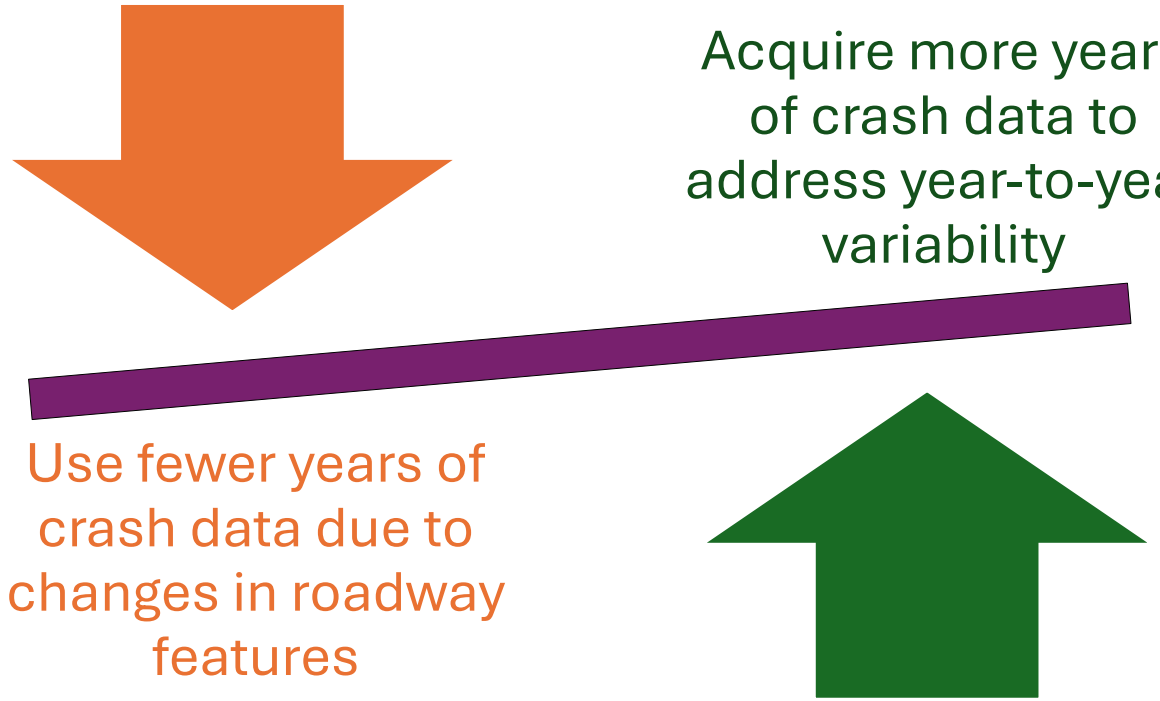
## Concern #3: Variation in Roadway Characteristics

- Some roadway characteristics are subject to change over time.
- Some characteristics change on a continual basis.
- Use of a longer period of data may not capture the changes in site conditions that occurred within the period to understand their association with crashes



# How to Determine Expected Safety Performance?

## Concern #4: Conflict between Crash Frequency Variability and Changing Site Conditions



# Highway Safety Manual (HSM) Predictive Method

- Basis of predictive method is Safety Performance Function (SPF)
- SPF: A regression equation to estimate predicted average crash frequency as a function of exposure and roadway features.

**SPFs for two-way, three-leg signalized intersections:**

$$N_{spf,3ST} = exp[-7.6005 + 0.6500 \times \log(AADT_{minor}) + 0.3881 \times I_{CSCOR} - 0.4237 \times I_{CR} - 0.8506 \times I_{CSO}]$$

with $k = 0.535$

**SPFs for three-leg signalized intersections where at least one of the legs is a one-way road:**

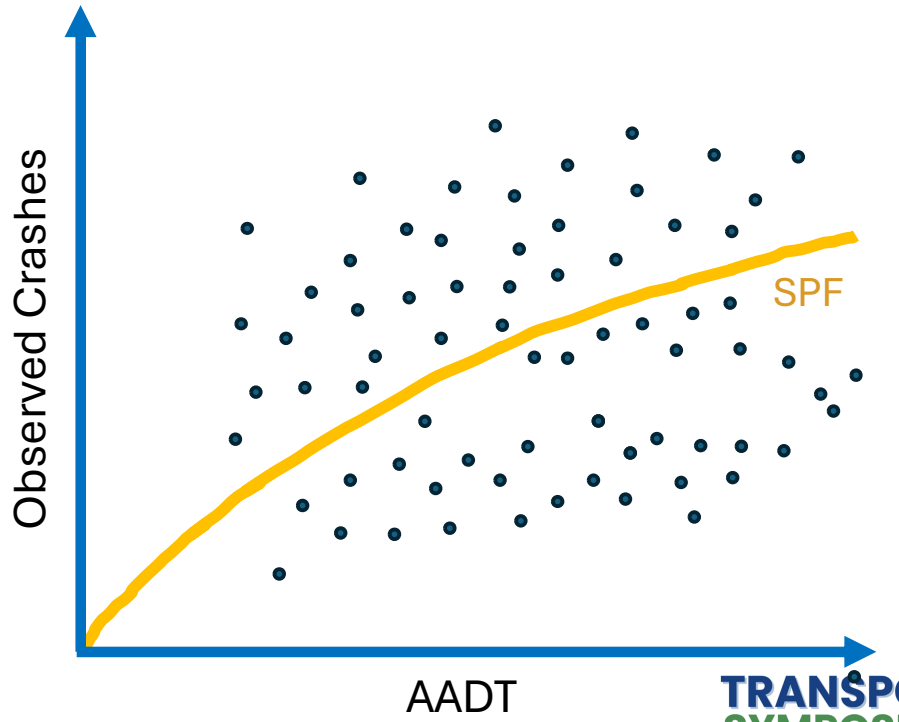
$$N_{spf,3ST} = exp[-6.2950 + 0.5248 \times \log(AADT_{major}) - 0.7455 \times I_{CSO}]$$

with $k = 0.186$

**SPFs for two-way, four-leg signalized intersections:**

$$N_{spf,4ST} = exp[-7.5677 + 0.5101 \times \log(AADT_{major}) + 0.1941 \times \log(AADT_{minor}) - 0.6025 \times I_{CPT} - 0.1995 \times I_{CSC} - 0.3857 \times I_{CSB} - 0.2604 \times I_{CR} - 0.4570 \times I_{CSO}]$$

with $k = 0.390$

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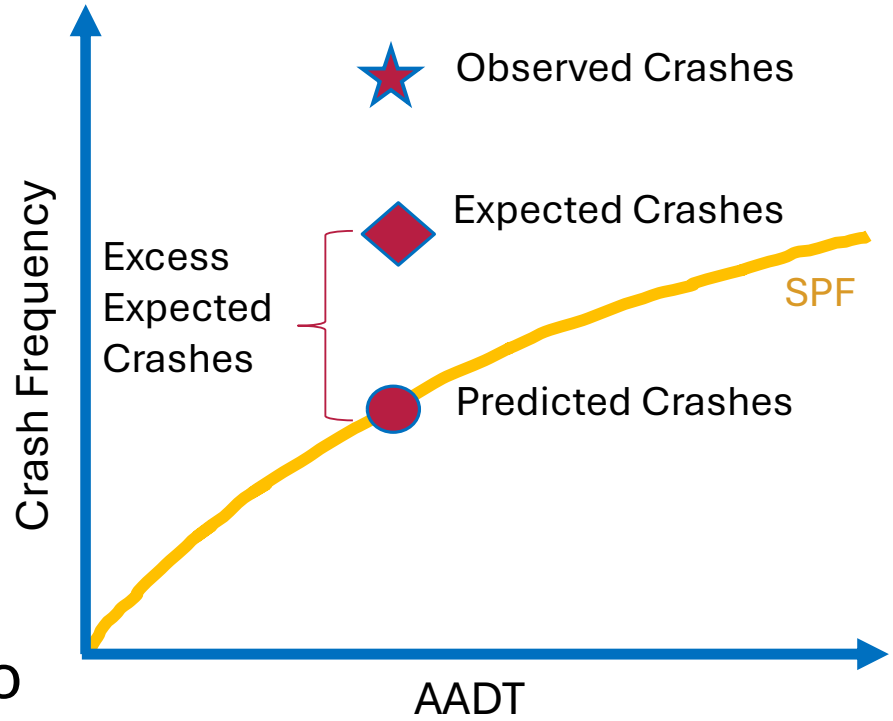
# Expected Crash Frequency

- Predicted: an average of crash predictions over similar sites
  - A good prediction depends on model reliability
  - Prediction alone does not account for RTM bias
- Expected: a weighted average of observed and predicted crashes

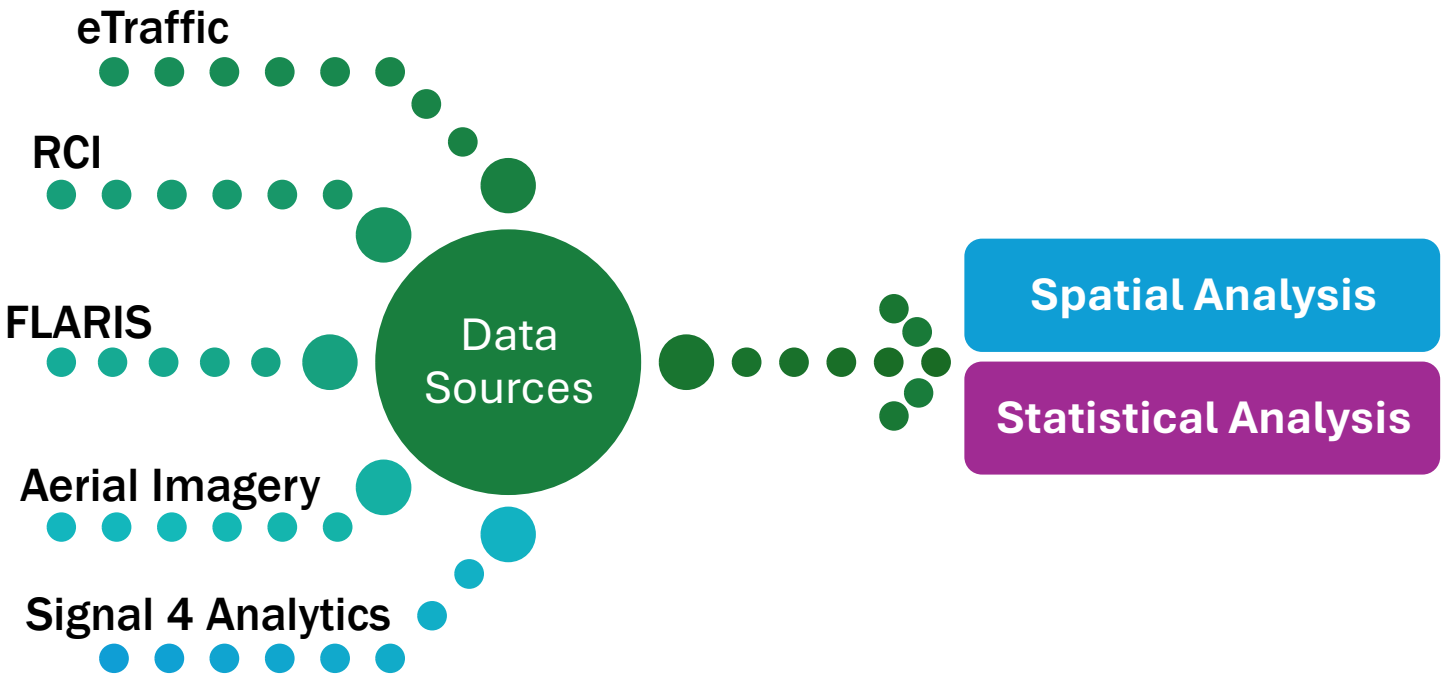
$$N_e = w \times N_p + (1 - w) \times N_o]$$

- Excess Expected: difference between expected and predicted crashes and can be used as a threshold to determine potential for safety improvement



# Our Process

- Since 2020, annual network screening of signalized intersections
- Annual SPFs using the latest three years of K+A crash data as a function of
  - AADT of major and minor approaches
  - Number of approaches
  - Context class
  - Approach road type (1-way, 2-way)
  - Ramp type



# Candidate Signalized Intersections

- Candidate intersections selected based on the highest excess expected crash frequency

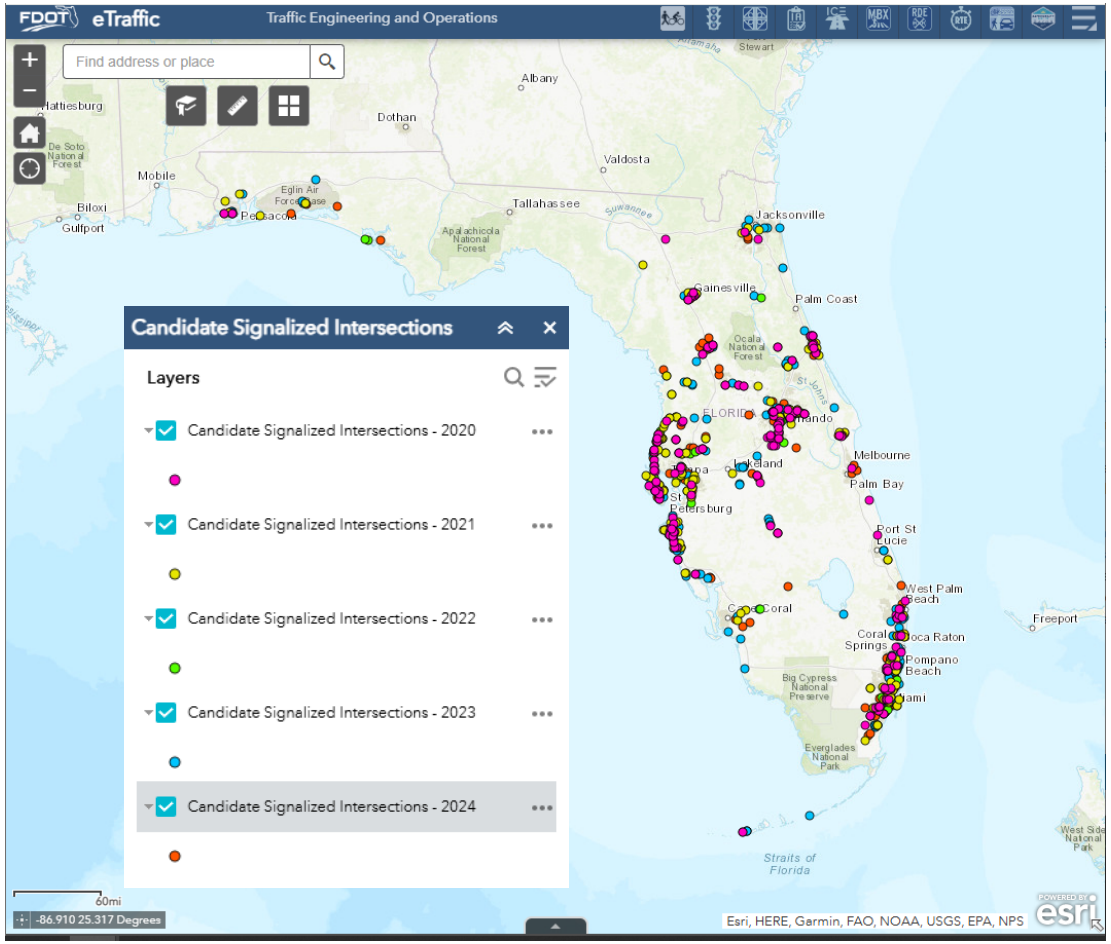




Table 1. Number of Candidate Signalized Intersections in 2024

| FDOT District | Total Identified Candidates | Identical to Previous Candidates | New Candidates |
|---|---|---|---|
| 1 | 25 | 13 | 12 |
| 2 | 6 | 1 | 5 |
| 3 | 8 | 4 | 4 |
| 4 | 28 | 11 | 17 |
| 5 | 55 | 26 | 29 |
| 6 | 33 | 13 | 20 |
| 7 | 50 | 24 | 26 |
| **Total** | **205** | **92** | **113** |

# Sister Intersection – Unique Concept by FDOT

- What is a sister intersection?

  An intersection with similar characteristics and traffic volumes compared to a candidate intersection but experienced only a few KA crashes (0 or 1) during the study period

- How is recognizing sister intersections useful?

  Identify existing safety features at better performing sister intersections, which may not be present at the candidate intersection

- A set of five (5) sister intersections for each candidate intersection

# Overrepresented/Disproportionate Crash Type

- Type of crashes where their proportion at an intersection exceeds the threshold proportion from the similar group
- Overrepresentation (OVR) - determined by the probability of the excess crash proportion of a type occurring at random
- Assess the contributing factors associated with the OVR crash type and select specific countermeasures that may help reduce the occurrence of such crashes

**Angle:** A crash where the impact type is coded in the crash report as "Angle."

**Head-on:** A crash where the impact type is coded in the crash report as "Front to Front."

**Rear-end:** A crash where the impact type is coded in the crash report as "Front to Rear."

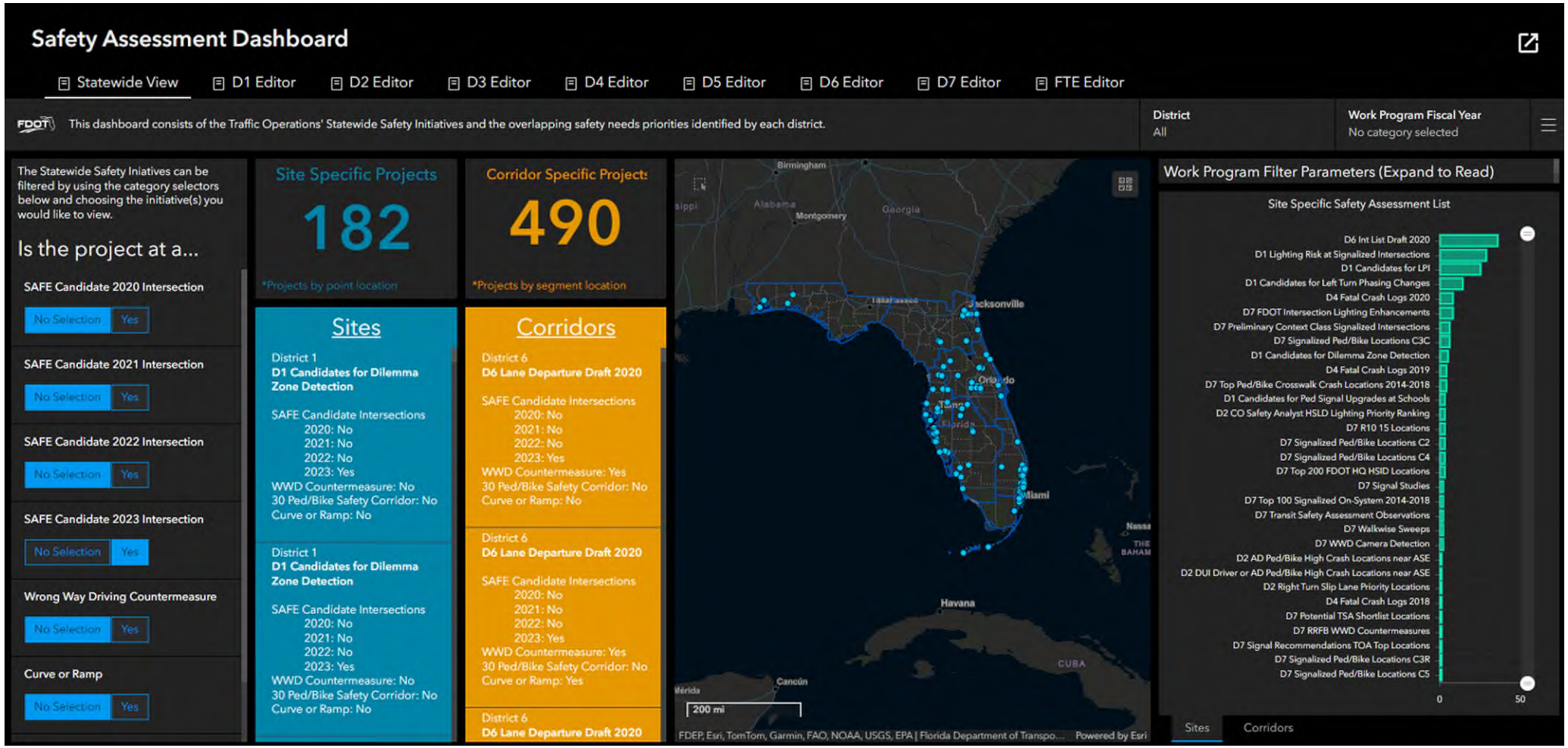
**Sideswipe:** A crash where the impact type is coded in the crash report as either "Sideswipe, Same Direction" or "Sideswipe, Opposite Direction."

**Other Multi-vehicle:** A multi-vehicle involved crash where the crash type does not fall into any of the aforementioned categories, including Angle, Head-on, Rear-end, and Sideswipe.

**Pedestrian/Bicyclist (Ped/Bike):** A crash where at least one pedestrian or bicyclist is involved in the collision with a vehicle.

**Single-Vehicle:** A crash where only one vehicle is involved in the collision, but a pedestrian or a bicyclist is not involved.

# Mapping Locations with Existing Safety Priority Lists

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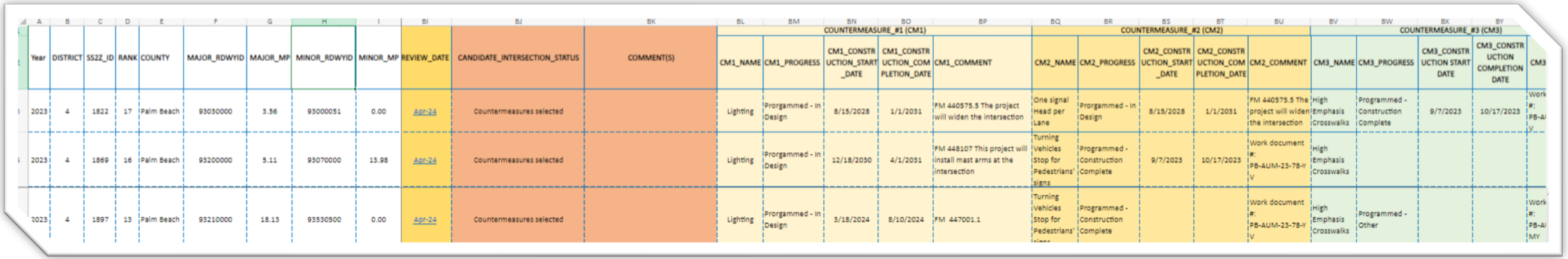
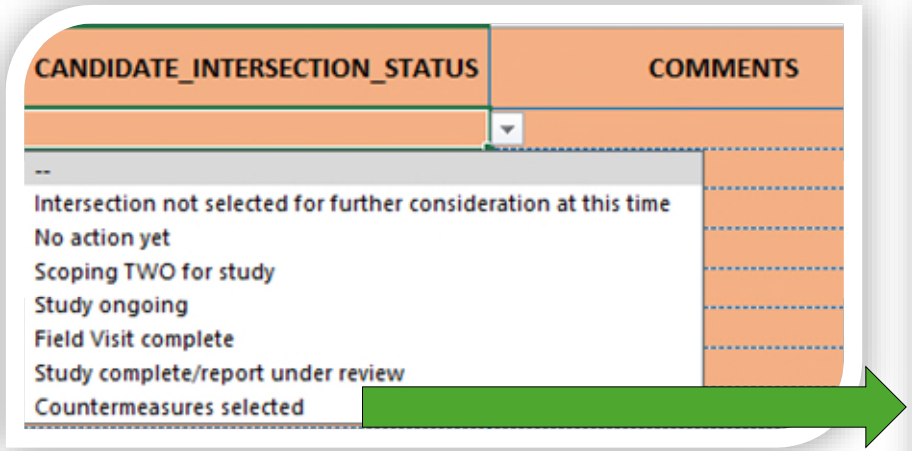
# Monitor and Tracking of Implementations



| Year | DISTRICT | SS2Z_ID | RANK | COUNTY | MAJOR_RDWYID | MAJOR_MP | MINOR_RDWYID | MINOR_MP | REVIEW_DATE | CANDIDATE_INTERSECTION_STATUS | COMMENT(S) | COUNTERMEASURE_#1 (CM1) | | | | | COUNTERMEASURE_#2 (CM2) | | | | | COUNTERMEASURE_#3 (CM3) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | CM1_NAME | CM1_PROGRESS | CM1_CONSTRUCTION_START_DATE | CM1_CONSTRUCTION_COMPLETION_DATE | CM1_COMMENT | CM2_NAME | CM2_PROGRESS | CM2_CONSTRUCTION_START_DATE | CM2_CONSTRUCTION_COMPLETION_DATE | CM2_COMMENT | CM3_NAME | CM3_PROGRESS | CM3_CONSTRUCTION START DATE | CM3_CONSTRUCTION COMPLETION DATE | CM3 |
| 2023 | 4 | 1822 | 17 | Palm Beach | 93030000 | 3.56 | 93000051 | 0.00 | Apr-24 | Countermeasures selected | | Lighting | Prorgammed - In Design | 8/15/2028 | 1/1/2031 | FM 440575.5 The project will widen the intersection | One signal Head per Lane | Prorgammed - In Design | 8/15/2028 | 1/1/2031 | FM 440575.5 The project will widen the intersection | High Emphasis Crosswalks | Programmed - Construction Complete | 9/7/2023 | 10/17/2023 | Work #: PB-A V |
| 2023 | 4 | 1869 | 16 | Palm Beach | 93200000 | 5.11 | 93070000 | 13.98 | Apr-24 | Countermeasures selected | | Lighting | Prorgammed - In Design | 12/18/2030 | 4/1/2031 | FM 448107 This project will install mast arms at the intersection | Turning Vehicles Stop for Pedestrians' signs | Programmed - Construction Complete | 9/7/2023 | 10/17/2023 | Work document #: PB-AUM-23-78-YV | High Emphasis Crosswalks | | | | |
| 2023 | 4 | 1897 | 13 | Palm Beach | 93210000 | 18.13 | 93530500 | 0.00 | Apr-24 | Countermeasures selected | | Lighting | Prorgammed - In Design | 3/18/2024 | 8/10/2024 | FM 447001.1 | Turning Vehicles Stop for Pedestrians' signs | Programmed - Construction Complete | | | Work document #: PB-AUM-23-78-YV | High Emphasis Crosswalks | Programmed - Other | | | Work #: PB-A MY |

**Excel-based Form in Central SharePoint Site**




**Overall Status of Candidate Intersection**

| COUNTERMEASURE_#1 (CM1) | | | | | COUNTERMEASURE_#2 (CM2) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CM1_NAME | CM1_PROGRESS | CM1_CONSTRUCTION_START_DATE | CM1_CONSTRUCTION_COMPLETION_DATE | CM1_COMMENT | CM2_NAME | CM2_PROGRESS | CM2_CONSTRUCTION_START_DATE | CM2_CONSTRUCTION_COMPLETION_DATE | CM2_COMMENT |
| Lighting | Prorgammed - In Design | 8/15/2028 | 1/1/2031 | FM 440575.5 The project will widen the intersection | One signal Head per Lane | Prorgammed - In Design | 8/15/2028 | 1/1/2031 | FM 440575.5 The project will widen the intersection |
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| Lighting | Prorgammed - In Design | 3/18/2024 | 8/10/2024 | FM 447001.1 | Turning Vehicles Stop for Pedestrians' signs | Programmed - Construction Complete | | | Work document #: PB-AUM-23-78-YV |

**Countermeasure Implementation Status**

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# District 4 STRIDES 2 Zero Program Implementation

- District 4's Approach to S2Z implementation
- Traffic Operations Office and Safety Tag Team
- Traffic Operations Office (comprised of Traffic Services/TSM&O)
- Traffic Services assists with improving safety through implementation of short-term improvements

# District 4 Team

**Traffic Services Role:**

- Implement the short-term improvements → Not requiring additional analysis/feasibility studies
- Coordinate improvements through upcoming programmed projects
- Coordinate improvements through local maintaining agencies

**Traffic Services Resources:**

- Push Button Contracts
  - Pavement Markings and Signing Contracts (PMS)
  - Roadway & Signalization Contracts
- Maintenance
  - Operation Centers Maintenance Units
  - Asset Maintenance Contracts

**Supplementary Data/ Resources:**

- FDOT Work Program (Recently completed projects/Upcoming projects)
- Traffic Operations/Safety Studies Database

# District 4 Approach

- Obtain List of Candidate Intersections from CO
  - 34 Intersections for year 2023
- Prepare checklist of Intersection Features at Sister Intersections
- Compare Study Intersection features against Sister Intersections
- Review Work Program and Studies Database
- Identify short-term improvements that can be implemented using Traffic Services Resources
- Determine potential improvements for coordination through upcoming projects and/or Local Maintenance Agencies

| Intersection Features | Yes/No | Comment |
|---|---|---|
| High Emphasis Crosswalks | | |
| Backplates | | |
| Signage | | |
| Yellow Retroreflective Tape | | |
| High Visibility Pavement Markings | | |
| Skip guidelines markings | | |
| Pedestrian Signals | | |
| Lighting | | |
| One Signal Head per Lane | | |
| Exclusive Left Turn Lanes | | |
| Exclusive Right Turn Lanes | | |
| Bike Lanes | | |
| Other | | |

# Example 1: N Jog Rd & SR 704/Okeechobee Blvd, West Palm Beach, FL

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | SR 704 / Okeechobee Blvd<br>93280000 (3.02)<br>N Jog Rd<br>93000220 (1.16) | Palm Beach | C4 | 4 | 6 | 2.52 | 4.49 | 1.97 | HEAD-ON<br>ANGLE<br>PED / BIKE | D4 – 93851000 (1.98)<br>D4 – 86080550 (1.53)<br>D4 – 86100000 (23.88)<br>D2 – 71130000 (2.78)<br>D6 – 87072000 (6.67) |


| Intersection Features | Yes/No | Comment |
|---|---|---|
| High Emphasis Crosswalks | · | |
| Backplates | · | |
| Signage | · | |
| Yellow Retroreflective Tape | · | |
| High Visibility Pavement Markings | | |
| Skip guidelines markings | ✓ | |
| Pedestrian Signals | ✓ | |
| Lighting | ✓ | Determine the need |
| One Signal Head per Lane | ✓ | |
| Exclusive Left Turn Lanes | ✓ | |
| Exclusive Right Turn Lanes | ✓ | Channelized SB RT Lane |
| Bike Lanes | · | |
| Other | · | |

# Sister Intersections






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# Sister Intersections Features

| Intersection Features | Study Intersection Jog Road at Okeechobee Blvd | Sister Intersections | | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | 1: SR 706/ Indiantown Rd & Central Blvd | 2: SR 84 & University Dr | 3: Hillsboro Blvd at SR 7 | 4: Hwy 17 & Kingsley Ave | 5: SR 968/Flagler St at SW 107th Ave | |
| High Emphasis Crosswalks | | ✓ | · | ✓ | ✓ | ✓ | |
| Backplates | | ✓ | ✓ | ✓ | ✓ | ✓ | **1, 2, 3, 4:** EB/WB |
| Signage | | ✓ | ✓ | · | ✓ | · | **1, 2:** Turning Vehicles Stop for Pedestrian<br>**1:** U-Turn Yield to Right Turn on mast arms<br>**4**: No U-Turn, Do Not Block Intersection |
| Yellow Retroreflective Tape | | ✓ | · | ✓ | · | ✓ | **1:** EB/WB<br>**3:** WB |
| High Visibility Pavement Markings | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Skip guidelines markings | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Pedestrian Signals | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Lighting | ✓[1] | ✓ | · | ✓ | ✓ | ✓ | |
| One Signal Head per Lane | ✓ | ✓ | ✓ | ✓ | ✓ | · | |
| Exclusive Left Turn Lanes | ✓ | ✓ | N/A | ✓ | ✓ | ✓ | **4:** NB, SB, EB |
| Exclusive Right Turn Lanes | ✓[2] | ✓ | N/A | ✓ | ✓ | · | **1, 4:** EB<br>**4:** SB |
| Bike Lanes | | ✓ | ✓ | ✓ | · | · | |
| Other | | | One Way (WB) | | Channelized Turn Lanes | · | |

[1] Determine the need

[2] Channelize SB RT Lane

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# **N Jog Rd & Okeechobee Blvd** - Planned Work Program Improvements & Potential Improvements Via Push Button

**Planned Work Program Projects:**

FM 449279.1 - SHSP Emphasis Area (S) – Intersection & Vulnerable Road Crashes - **Add Lighting**
Production Date: 3/3/2025

**Quick Potential Improvements Implemented Via Push Button:**

- Addition of High Emphasis Crosswalks – Work Document prepared
- Installation of Backplates with Yellow Retroreflective Tape: Programmed for June 2024 in the Push Button Program
- Installation of "One Way" signs and "Do Not Enter" signs at median openings – Work Document Prepared
- Incorporation of Pedestrian Signage – Work Document Prepared

| Intersection Features | Yes/No | Comment |
|---|---|---|
| High Emphasis Crosswalks | · | |
| Backplates | · | |
| Signage | · | |
| Yellow Retroreflective Tape | · | |
| High Visibility Pavement Markings | | |
| Skip guidelines markings | ✓ | |
| Pedestrian Signals | ✓ | |
| Lighting | ✓ | Determine the need |
| One Signal Head per Lane | ✓ | |
| Exclusive Left Turn Lanes | ✓ | |
| Exclusive Right Turn Lanes | ✓ | Channelized SB RT Lane |
| Bike Lanes | · | |
| Other | · | |

**Coordination with FDOT Maintenance Office and Palm Beach County:**

- Refurbishment of Pavement Markings
- Verification of Pedestrian Clearance Times

# Improvements Implemented at N Jog Rd & Okeechobee Blvd

Pedestrian Signage

Head-On Crashes Prevention Treatment


High Emphasis Crosswalks

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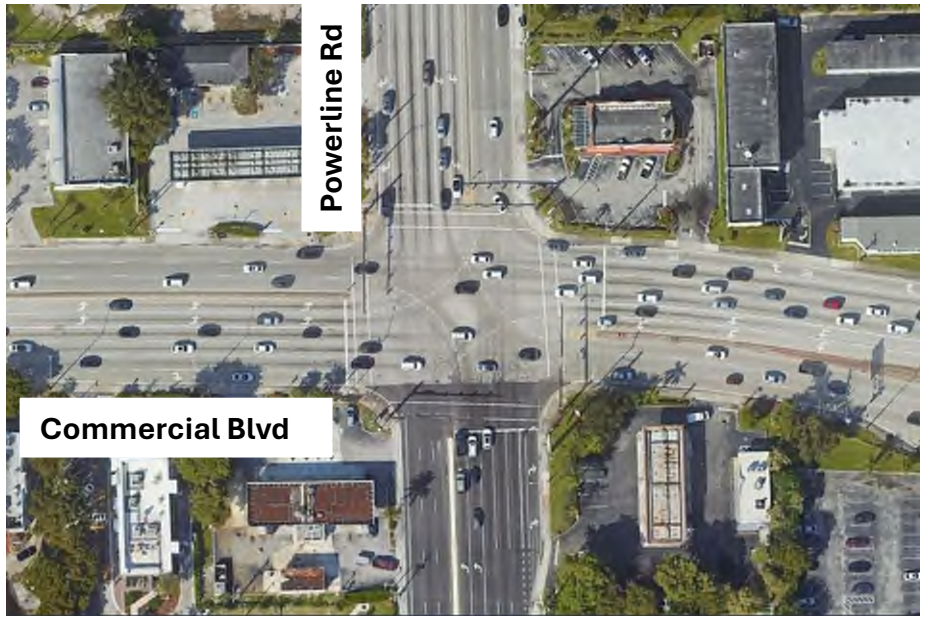
# Example 2: SR 845/Powerline Rd & SR 870/Commercial Blvd

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | SR 870 / Commercial Blvd<br>86014000 (6.24)<br>SR 845 / Powerline Rd / NW 9th Ave<br>86065000 (3.57) | Broward | C4 | 4 | 6 | 2.59 | 4.54 | 1.95 | REAR-END<br>HEAD-ON | D4 - 93851000 (1.98)<br>D4 - 86028000 (3.98)<br>D6 - 87072000 (1.05)<br>D6 - 87072000 (6.67)<br>D4 - 86080550 (1.53) |




| Intersection Features | Yes/No | Comment |
|---|---|---|
| High Emphasis Crosswalks | · | Only on south leg |
| Backplates | ✓ | EB/WB |
| Signage | ✓ | Next Signal Intersection signs |
| Yellow Retroreflective Tape | · | |
| High Visibility Pavement Markings | ✓ | |
| Skip guidelines markings | ✓ | |
| Pedestrian Signals | ✓ | |
| Lighting | ✓ | Determine the need |
| One Signal Head per Lane | ✓ | |
| Exclusive Left Turn Lanes | ✓ | |
| Exclusive Right Turn Lanes | ✓ | |
| Bike Lanes | · | |
| Other | · | |

# Sister Intersections



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# Sister Intersections Features

| Intersection Features | Study Intersection Powerline Rd & Comercial Blvd | Sister Intersections | | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | 1: SR 706/ Indiantown Rd & Central Blvd | 2: Lyons Rd & SR 834/ Sample Rd | 3: SW 107th Ave & SW 88th Street/Kendall Dr | 4: SR 968/Flagler St at SW 107th Ave | 5: SR 84 & University Dr | |
| High Emphasis Crosswalks | [1] | ✓ | ✓ | ✓ | ✓ | · | |
| Backplates | ✓[2] | ✓ | ✓ | ✓ | ✓ | ✓ | **1:** EB/WB |
| Signage | ✓[3] | ✓ | ✓ | ✓ | · | ✓ | **1, 3:** Turning Vehicles Stop for Pedestrian<br>**1:** U-Turn Yield to Right Turn on mast arms<br>**2**: Next Signal Intersection signs,<br>**2:** No U-Turn Sign (EB)<br>**3:** Next Signal Intersection signs<br>**3:** School Crossing Signs |
| Yellow Retroreflective Tape | · | ✓ | ✓ | ✓ | ✓ | · | **1, 3:** EB/WB |
| High Visibility Pavement Markings | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Skip guidelines markings | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Pedestrian Signals | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Lighting | ✓[4] | ✓ | ✓ | ✓ | ✓ | · | |
| One Signal Head per Lane | · | ✓ | ✓ | ✓ | · | ✓ | |
| Exclusive Left Turn Lanes | ✓ | ✓ | ✓ | ✓ | ✓ | N/A | |
| Exclusive Right Turn Lanes | ✓ | ✓ | ✓ | · | · | N/A | **1:** EB |
| Bike Lanes | · | ✓ | ✓ | · | · | ✓ | |
| Other | | | Green Colored Bike lanes NB/SB | | | One Way (WB) | |

[1] Only on south leg

[2] EB/WB

[3] Next Signal Signs

[4] Determine the need

# **Powerline Rd & Commercial Blvd** - Planned Work Program Improvements & Potential Improvements Via Push Button

**Safety Study Proposed Improvements:**
Extend all left-turn and right-turn storage lanes, Provide high emphasis crosswalks, Signal improvements (backplates, yellow reflective borders); Pedestrian Signage, Head-On crashes prevention signage (driveways).

**Planned Work Program Projects:**

- **FM 446196.1**: Lighting Retrofit, Pedestrian Signalization Upgrades, Replacement of detection Loops. This project will incorporate some elements from the safety study: Pedestrian Signage, high emphasis crosswalks, Head-on crashes prevention signage (driveways)

  Estimated Work Begin Date: 12/04/24

- **FM 441944.1 & 441944.2:** Install & Deploy Adaptive Traffic Controllers & Vehicle Detection

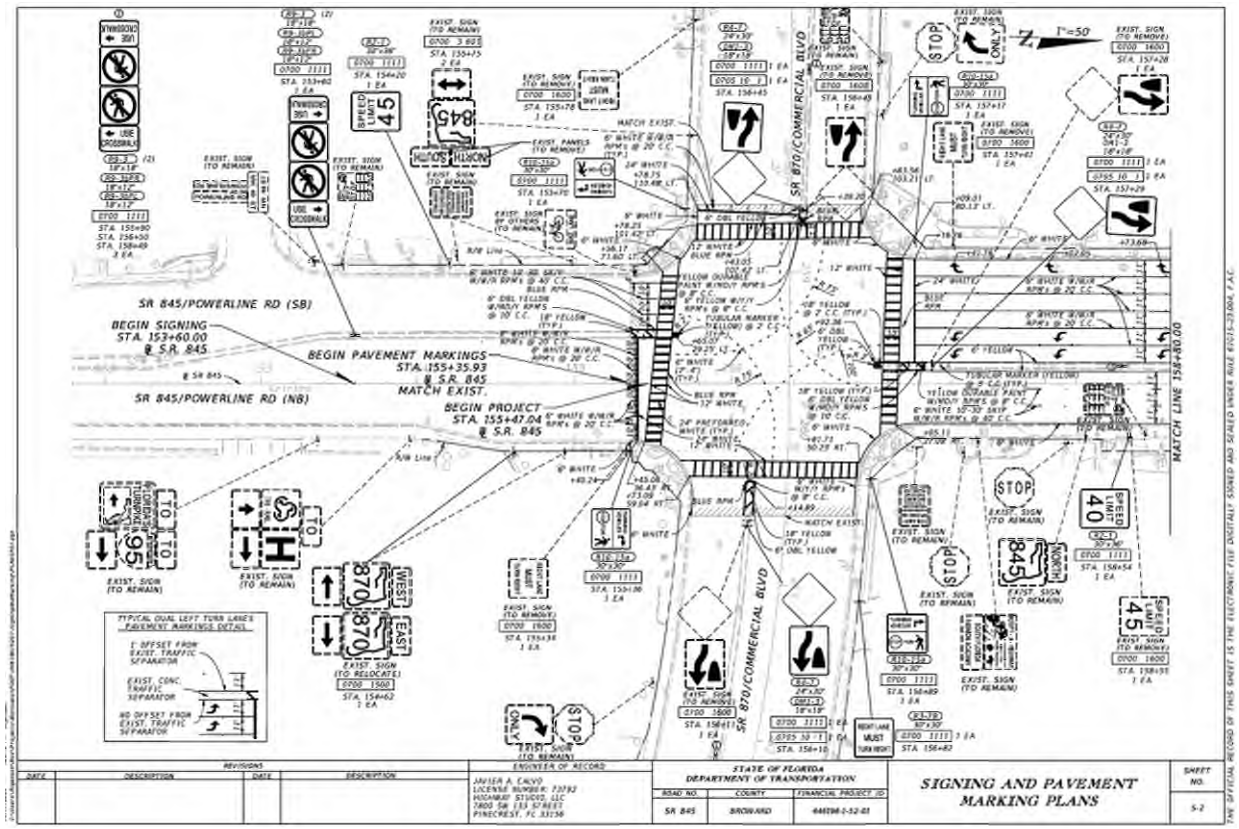
  Estimated Work Begin Date: 12/04/24

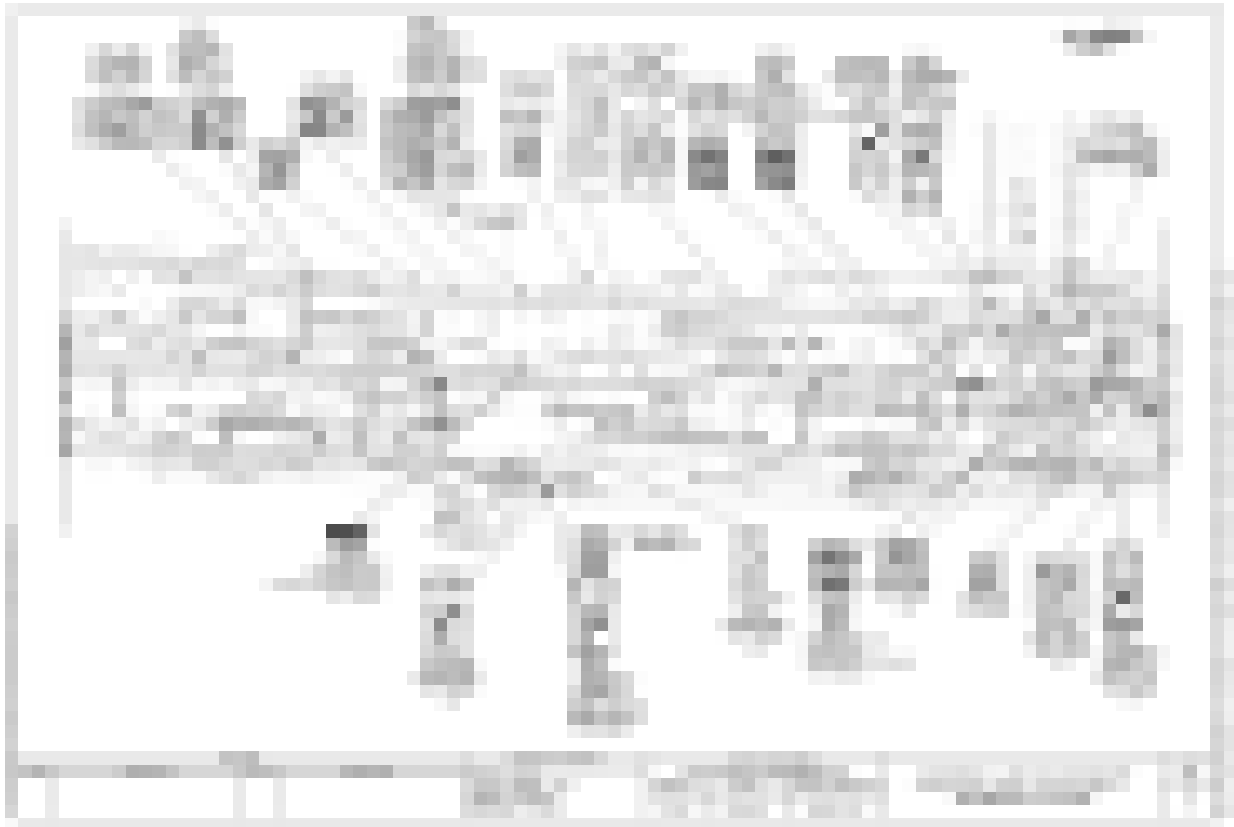
- **FM 448408.1**: The resurfacing project along Commercial Blvd excludes this intersection for now. However, its boundaries may expand pending safety funding to extend all left-turn and right-turn storage lanes as recommended in the safety report.

  Estimated Work Begin Date: 10/14/25

# **Powerline Rd & Commercial Blvd** - Planned Work Program Improvements

**FM 446196.1**



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# Implementation Advantages/ Challenges

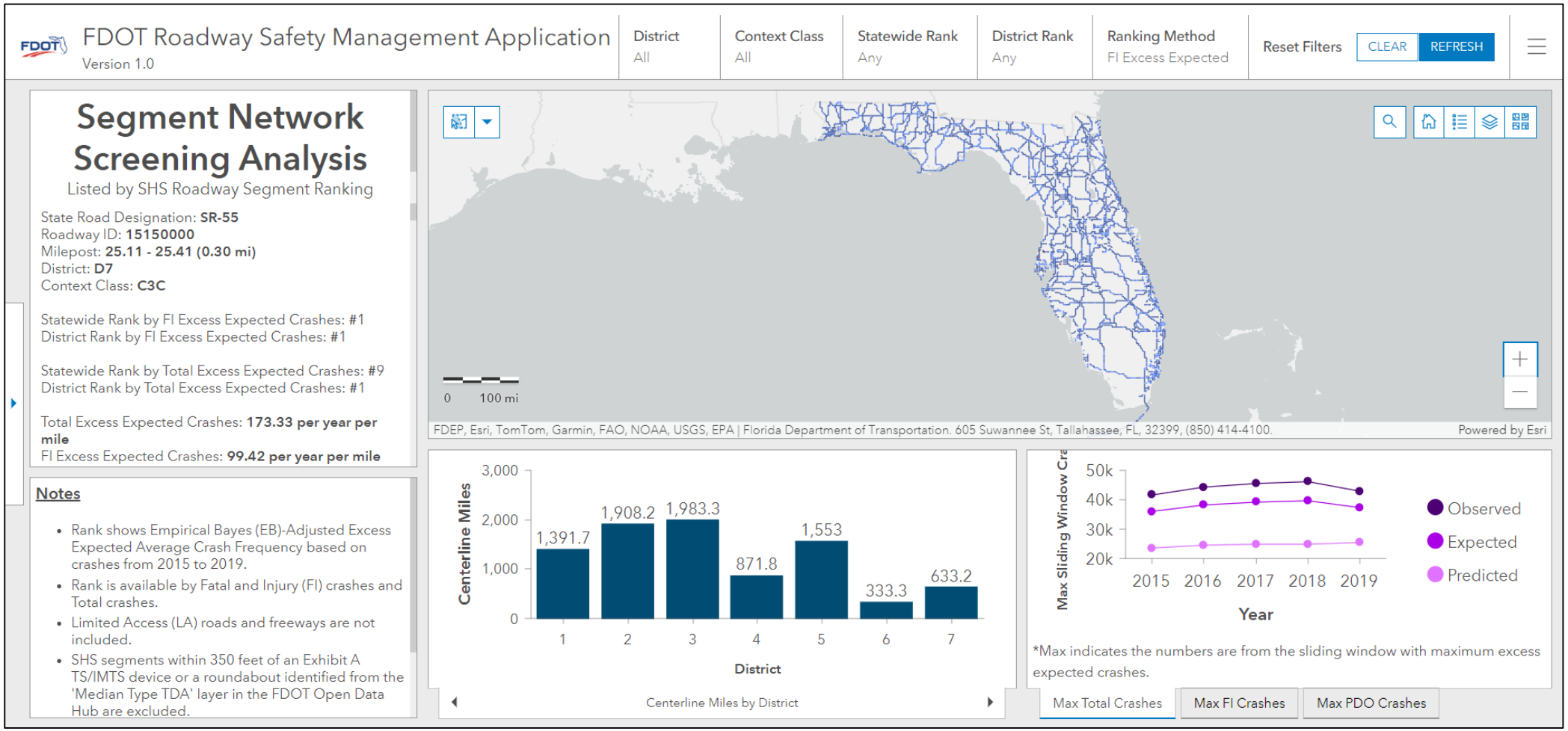
## Advantages

- Safety benefit achieved through quick implementation of short-term improvements
- Consistent application of potential countermeasures (less deviation from driver expectancy)
- Collaboration - shared responsibility for Safety

## Challenges

- ROW and Budget limitations
- Improvements through programmed projects may take longer
- Need for additional analysis/feasibility studies

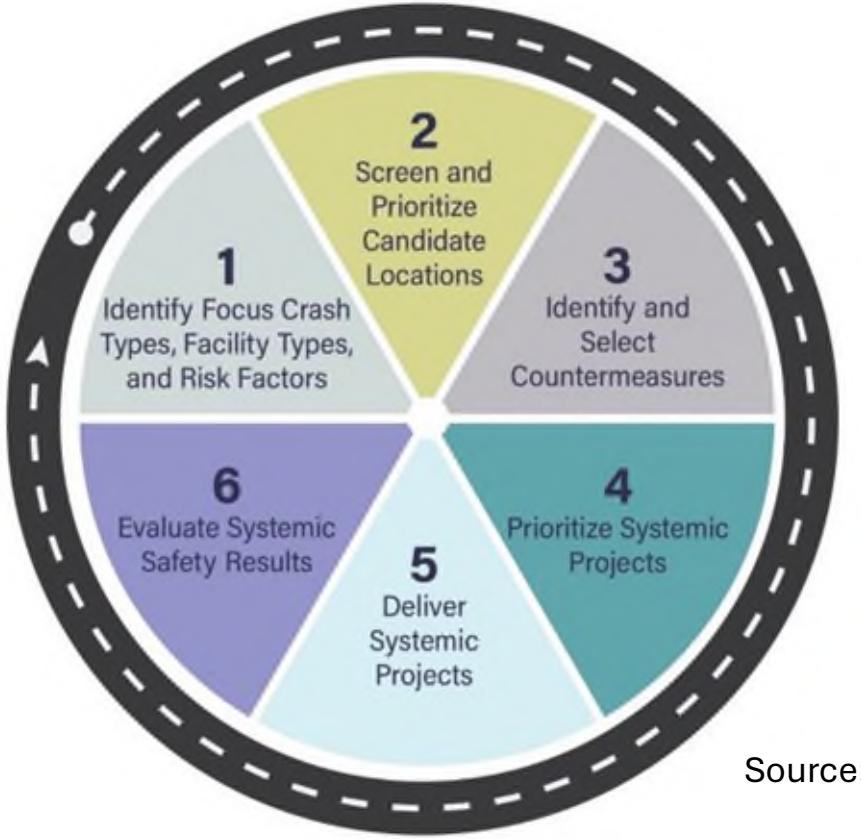
# Other Activities: Extension to Roadway Segments




**Requires FDOT ArcGIS for Portal Account**

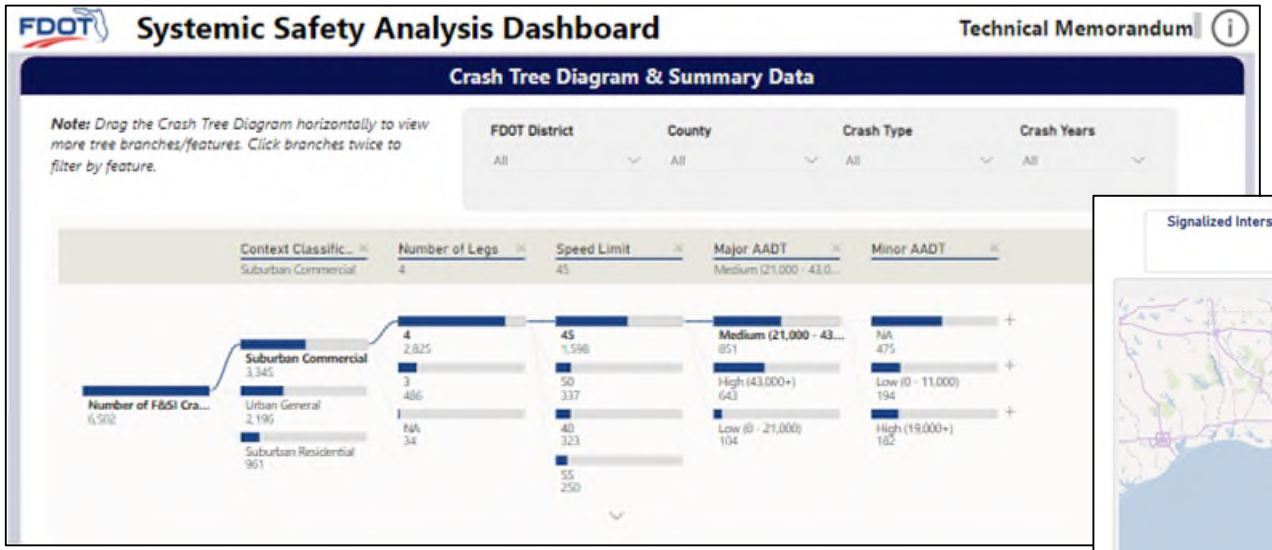
# Systemic Safety Analysis

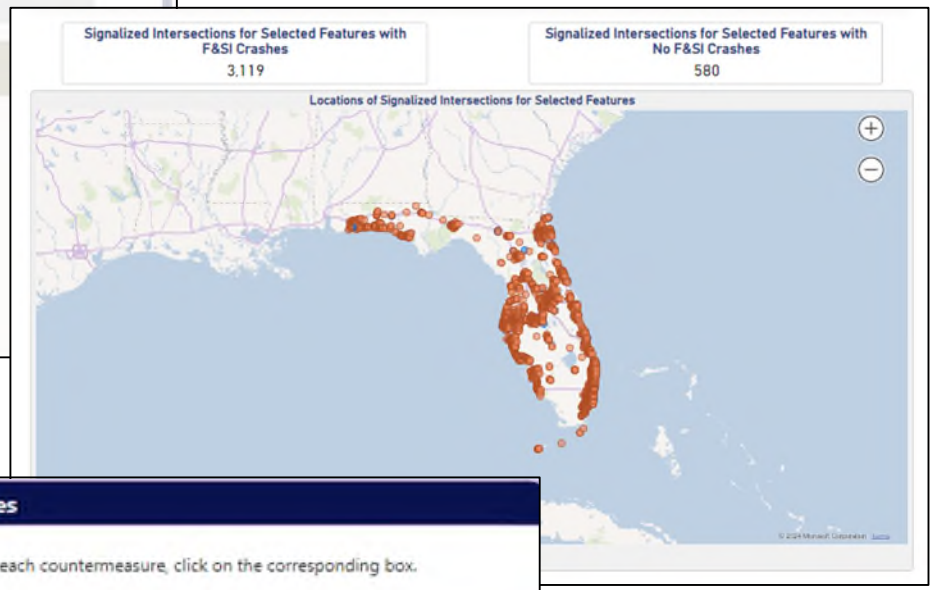
- Identify sites with similar characteristics based on their crash potential, rather than only focusing on observed crashes
- Proactive approach, supporting the Safe System principles



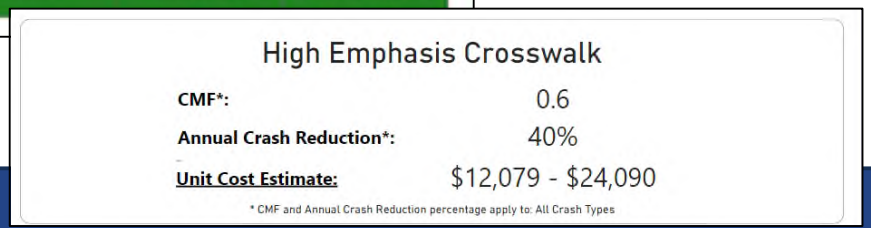

Source: FHWA

# FDOT Systemic Safety Analysis of Signalized Intersections








**Power BI App - Publicly Accessible**

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# What Lies Ahad?

- Unsignalized Intersections
- Pedestrian and bicyclist corridor safety
- Midblock pedestrian crossing screening
- Evaluate pedestrian and bicyclist SPFs for Florida per NCHRP Report 1064
- Continue improving process for safety analysis of signalized intersection and roadway segment
- Develop Florida-specific CMFs based on countermeasure implemented

# Safety Message

# Contact Us

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