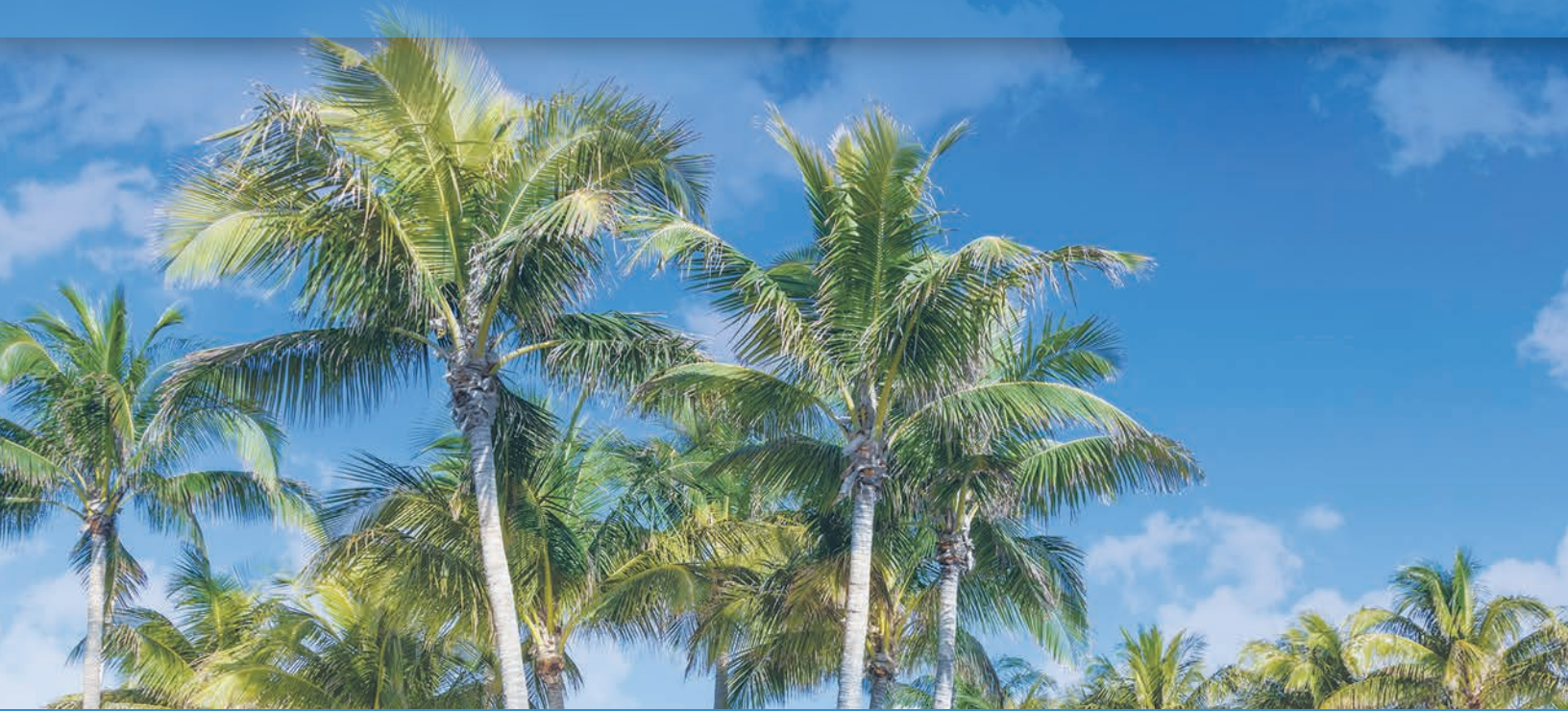




U.S. Department of Transportation  
**Federal Highway  
Administration**



# **PALM BEACH COUNTY LOCAL ROAD SAFETY PLAN**



**JANUARY 2019**

# Notice

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# Acronyms and Abbreviations

4E	engineering, education, law enforcement, emergency services
A	Serious Injury (category)
AADT	annual average daily traffic
ADT	average daily traffic
apm	access per mile
B	Moderate Injury (category)
DOT	Department of Transportation
EMS	emergency medical services
FAST	Fixing America's Surface and Transportation (Act)
FDHSMV	Florida Department of Highway Safety and Motor Vehicles
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
HSIP	Highway Safety Improvement Program
HVE	High Visibility Enforcement
K	Fatality (category)
LRSP	Local Road Safety Plan
NCHRP	National Cooperative Highway Research Program
SAFETEA LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SHSP	Strategic Highway Safety Plan
SMFL	Safe Mobility for Life
SSO	State Safety Office
TCP	Transportation Comprehensive Plan
vpd	vehicle(s) per day

# Executive Summary

The Palm Beach County Local Road Safety Plan (LRSP) is a comprehensive plan that provides a framework for reducing the number of fatalities and serious injuries associated with crashes that occur on Palm Beach County's (hereafter, "the County's") roadway system. The information in this LRSP draws on best practices in safety planning from documents prepared by the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials, the National Cooperative Highway Research Program, the National Highway Traffic Safety Administration, as well as state and local safety partners. The LRSP supports statewide goals and priorities established in the Florida Strategic Highway Safety Plan (SHSP), including Florida's vision of "A Fatality Free Roadway System".<sup>1</sup> The LRSP was developed using a data-driven, multi-disciplinary and collaborative process and summarizes an effort to determine the priority efforts for investing the County's safety project resources. With this LRSP as a guide, the County will be better positioned to compete for available safety funds.

The LRSP Mission, Vision, Goal, and Objectives are as follows:

## **VISION**

***A fatality free roadway system in Palm Beach County.***

## **MISSION**

***To reduce the number of traffic fatalities and serious injuries occurring on the Palm Beach County roadway system.***

## **STRATEGIC GOAL**

***Provide a comprehensive, data-driven approach to reduce fatalities and serious injuries by implementing safety strategies targeted towards addressing ongoing and emerging roadway safety issues in Palm Beach County.***

Nearly 30 County stakeholders met at a safety workshop in March 2017 to establish the framework for the County's LRSP. Analysis of 4 years of fatality and serious injury crashes led to the identification of six priority emphasis areas for the County. Mitigation strategies include a combination of infrastructure and behavioral strategies and countermeasures targeted at addressing fatality and serious injury crashes within each emphasis area. The emphasis areas, strategies for reducing fatalities and serious injuries, and recommended countermeasures for implementation include:

- **Intersection Crashes:** Strategy - Reducing intersection crashes by designing intersections for safe access for all users regardless of age, mode, and ability. Countermeasures include:
  - Increase the size and retro-reflectivity of signs.
  - Install signal backplates.
  - Upgrade traffic signal equipment.
  - Improve intersection geometry.
- **Aging Road Users:** Strategy - Reducing crashes involving older road users through a combination of infrastructure and education. Countermeasures include:
  - Increase the size and retro-reflectivity of signs.

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<sup>1</sup>Information about Florida's "A fatality free roadway system" vision can be found at <http://www.fdot.gov/safety/SHSP2016/SHSP-2012.shtm>

- Install signal backplates.
- Conduct outreach and promote older driver safety screening.
- Increase law enforcement education on detecting at-risk drivers.
- Increase education on transit/rideshare options and local driving skills courses for mature drivers.
- **Lane Departure Crashes:** Strategy - Reducing lane departure crashes through countermeasures that aim to keep vehicles in the travel lane, provide for a better recovery, and reduce crash severity. Countermeasures include:
  - Improve curve identification and awareness.
  - Install rumble strips (centerline and edge line).
  - Install paved shoulders.
  - Improve pavement friction.
  - Eliminate hazards in the clear zone.
  - Improve roadside design and hardware.
- **Occupant Protection (Unrestrained Occupants):** Strategy - Improve restraint use through partnerships with law enforcement and through education/outreach. Countermeasures include:
  - Conduct high-visibility restraint enforcement focusing on all vehicle occupants, child protection seats, and aging road users.
  - Promote parent-young driver contracts for seat belt use.
  - Collaborate with local employers to develop/strengthen employee safe driving policies.
- **Impaired Driving Crashes:** Strategy - Promote and leverage behavioral strategies being conducted through other County safety stakeholders and partners including enforcement and education. Countermeasures include:
  - Conduct high-visibility enforcement.
  - Promote blood alcohol concentration test “No Refusal” law and consequences.
  - Support community programs for alternative transportation.
  - Promote sobriety initiatives for driving under the influence offenders.
- **Pedestrians and Bicyclists:** Strategy - Reducing crashes involving pedestrians and bicyclists through countermeasures that improve visibility, establish separation and reduce conflict between modes, and increase awareness of good safety practices related to pedestrian and bicyclist safety. Countermeasures include:
  - Install sidewalks, walkways, curb ramps, crosswalks, crosswalk enhancements,<sup>2</sup> and bike lanes.
  - Provide countdown timers, leading pedestrian intervals, right-turn-on-red restrictions.
  - Construct refuge islands, raised medians, or curb extensions.
  - Provide bike boxes, bicycle preemption systems, and bicycle leading intervals.
  - Separate pedestrians and bicycles from motor vehicle traffic.

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<sup>2</sup> High-visibility markings, parking restrictions, advanced STOP and YIELD markings and signs, and in street STOP or YIELD signs [FHWA, 2018].



- Promote community-wide, pedestrian and bicycle outreach and awareness campaigns.
- Conduct high-visibility law enforcement targeting unsafe behaviors of motorists, pedestrians, and bicyclists.

The LRSP is a step forward toward improving safety and will serve as a guide for achieving the vision of a fatality-free roadway system in Palm Beach County. During the March 2017 workshop, stakeholders voted on the recommended strategies to address fatalities and serious injuries on the County roadway system. The County then refined those top six ranked emphasis areas, which were based on the analysis of the 4 years of crash data for the County. While this LRSP used feedback from stakeholders, the County chose the priority emphasis areas and countermeasures, selecting those that align with ones developed in the Florida SHSP for the statewide system.

The safety analysis process for the LRSP included a systemic assessment of Palm Beach County's roadway system. The systemic safety evaluation process uses the premise that a severe crash is more likely to occur if certain risk factors (for example, geometric or traffic characteristics) exist at a given location, even if the location has a limited history of severe crashes. In such locations, using targeted improvements regardless of the presence or frequency of severe crashes can reduce the potential for a crash. Because of data limitations, a modified approach to systemic analysis was used for LRSP development. While crash data were available, complete roadway inventory data—to which the systemic analysis could be applied—were not.

The modified systemic evaluation consisted of selecting random locations on the County system. Random locations allowed for a comparison of potential risk factors across representative sites with a range of crash history. The County selected 133<sup>3</sup> random signalized intersection sites and collected roadway attribute data at each location to provide a sample roadway inventory for evaluating roadway characteristics as risk factors. For multi-vehicle and pedestrian and bicycle crashes, the modified systemic evaluation process yielded 11 and 12 infrastructure risk factors, respectively. The typical systemic analysis process yields a list of prioritized projects ready for implementation selected from locations across the County system. However, for the LRSP and the modified systemic analysis process, project development decision trees were developed. The County can use the project development decision trees like a flow chart to address risk factors for individual sites in a consistent manner across the County system.

This document lays the groundwork for identifying the most critical traffic safety issues in Palm Beach County and develops a framework for developing consistent safety projects designed to address risk factors identified on the County's network. Specific project recommendations and development decisions will be made by County staff using the processes developed in this LRSP and based on consideration of economic, social, and political issues, and in coordination with other projects already in the County's Capital Improvement Program. Table ES-1 lists specific action items to aid the County in the application of the project development decision trees and to keep the LRSP active as an evolving document.

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<sup>3</sup> The original sample set included 150 intersections. However, because of missing data at some intersections, the number of intersections used to conduct the systemic analysis was 133.

Table ES-1. Palm Beach County LRSP Action Items

Action Step No.	Activity	Objective	Target	Timeframe	Status
<b>1</b>	<b>Conduct "Project Development Tree" analyses</b>				
1a	Conduct urban/suburban signalized intersection project development analysis.	Develop potential projects for 10 urban/suburban intersections.	10 Sites	near term	
1b	Conduct urban/suburban segments project development analysis.	Develop potential projects for 2 urban/suburban segments.	2 Sites	near term	
1c	Conduct rural segment project development analysis.	Develop projects for 2 rural segments.	2 Sites	near term	
1d	Conduct rural intersection project development analysis.	Develop projects for 2 rural intersection.	1 Sites	near term	
<b>2</b>	<b>Engage additional LRSP stakeholders</b>				
2a	Attend monthly District 4 Florida Law Enforcement Liaison program meeting.	Engage stakeholders capable of implementing and influencing behavioral aspects of the LRSP.	Minimum 1 staff member in attendance	ongoing	
2b	Engage Community Traffic Safety Team liaison in specific follow-up meeting on plans for the LRSP.	Develop initial contact with FDOT through CTST, who will be a continued partner in implementation of the LRSP.	1 Meeting	near term (ideally in the next 6 months)	
2c	Present LRSP to Community Traffic Safety Team.	Engage entire CTST and inform them of the vision, mission, goals, and objectives of the LRSP.	1 Meeting	near term	
2d	Meet with FDOT to discuss funding opportunities and the process to follow to obtain Highway Safety Program funds.	Learn process for obtaining funding for projected developed under Action Step 1.	1 Meeting	near term	
<b>3</b>	<b>Develop and enhance roadway data inventory - Once data are identified, collected, and available for use, the project development process can be conducted for all sites falling into one of the four facility types (urban/suburban signalized intersections, urban/suburban segments, rural segments, and rural intersections).</b>				
3a	Evaluate and analyze inventory data.	Determine the status of County roadway inventory data needed to conduct network wide assessments for Action Step 1.	Completed analysis	near term	
3b	Develop roadway inventory data collection plan.	Collect data as identified in Action Step 3a.	Completed data collection plan outlining steps to achieve complete roadway inventory	medium term	
3c	Complete development of roadway inventory database.	Compile data for use in network-wide analysis of focus facilities.	Completed database suitable for systemic analysis	long term	

Table ES-1. Palm Beach County LRSP Action Items

Action Step No.	Activity	Objective	Target	Timeframe	Status
<b>4</b>	<b><i>Conduct LRSP evaluation and update</i></b>				
4a	Conduct quarterly action item update.	Quarterly updates keep the document up-to date and keep action items moving forward.	Updated action item list	near term	
4b	Conduct review of crash data as a benchmark.	An annual review will allow the County to adjust and LRSP and its initiatives over time.	Completed analysis of fatal and serious injury crashes on County system	annually	
4c	Conduct additional systemic analysis as roadway inventory data becomes available.	Upon completion of Action Step 3, a full analysis of focus facilities can be completed at which time the LRSP should be updated.	Completed systemic analysis of entire county system	long term	
4d	Update Palm Beach County LRSP.	Updating the LRSP allows for an evaluation of efforts proceeding the initial LRSP and adjustments to the LRSP in its next version.	Updated LRSP	medium term	

## Notes:

Near term = estimated completion in the next 12 months

Medium term = estimated completion in 12 to 36 months

Long term = estimated completion beyond 3 years (36 months)

# Introduction

## 1.1 Strategic Goal, Plan Attributes, and Objectives

On March 2, 2017, Palm Beach County safety stakeholders met in a workshop setting to discuss the highway safety priorities for the County and establish the strategic goal, plan objectives, and desired outcome(s) of the Palm Beach County Local Road Safety Plan (LRSP). The group reached consensus on the following plan mission, vision, and strategic goal:

### **VISION**

***A fatality-free roadway system in Palm Beach County.***

### **MISSION**

***Reduce the number of traffic fatalities and serious injuries occurring on the Palm Beach County roadway system.***

### **STRATEGIC GOAL**

***Provide a comprehensive, data-driven approach to reduce fatalities and serious injuries by implementing safety strategies targeted toward addressing ongoing and emerging roadway safety issues in Palm Beach County.***

Additionally, the stakeholders group identified the following LRSP objectives, including:

- Be consistent with the vision and emphasis areas of the Florida Strategic Highway Safety Plan (SHSP).
- Transition from a traditionally reactive safety approach to a more proactive and systemic approach to assess existing and potential locations with crashes.
- Identify and prioritize safety strategies and projects for the County system identified through the systemic process.
- Identify potential sources of safety funding (such as Highway Safety Improvement Program and Safety Grants).
- Improve safety culture and awareness of safety issues on County roadways.
- Enhance partnership and communication among 4E (engineering, education, law enforcement, emergency services) safety stakeholders and elected officials.
- Address vulnerable and at-risk users, and other populations overrepresented in the crash data; encourage/focus on multimodal needs and opportunities.

The vision, mission, strategic goal, and plan objectives guided the development (including supporting data analysis) of this LRSP.

## 1.2 Background

To improve safety on the nation's roadways, the Federal Highway Administration (FHWA) partnered with Palm Beach County (hereafter, "the County") and the Florida Department of Transportation (FDOT) to develop the Palm Beach County LRSP. The County developed this LRSP to reduce the number of fatalities and serious injuries on County roads and to work toward a vision of a fatality-free roadway system in Palm Beach County. The LRSP uses a data-driven and multidisciplinary approach to:

- identify causes and locations of crashes
- establish priority emphasis areas
- document location types with potential for safety improvement
- identify effective safety improvement strategies and programs

With this LRSP, the County will be better positioned to compete for available safety funds and enhance transportation safety project and program implementation.

This LRSP supports Florida’s Strategic Highway Safety Plan (FDOT, 2016) by identifying countermeasures for implementation as projects on public roads in Palm Beach County in accordance with the state’s safety priorities. The process of identification and evaluation of proposed strategies involves applying safety performance measures adopted by the state of Florida. The LRSP supports FDOT’s vision of a fatality-free roadway system<sup>4</sup> and identifies countermeasures, projects, and programs that potentially could be eligible for state and federal funding. The Palm Beach County LRSP provides a roadmap for reducing the number of fatalities and serious injuries associated with crashes that occur on County roads.

### 1.3 County Roadway System Description

The County’s roadway system (see Figure 1-1) includes approximately 568 miles of County-maintained roads, the majority of which are multi-lane urban/suburban facilities. Figure 1-2 shows a typical urban multi-lane roadway in Palm Beach County. A small portion of the system is rural, with roads that extend inland toward Lake Okeechobee.

The County’s system also includes 427 major intersections, most of which are urban with signal control. Figure 1-3 shows a typical urban signalized intersection in Palm Beach County.

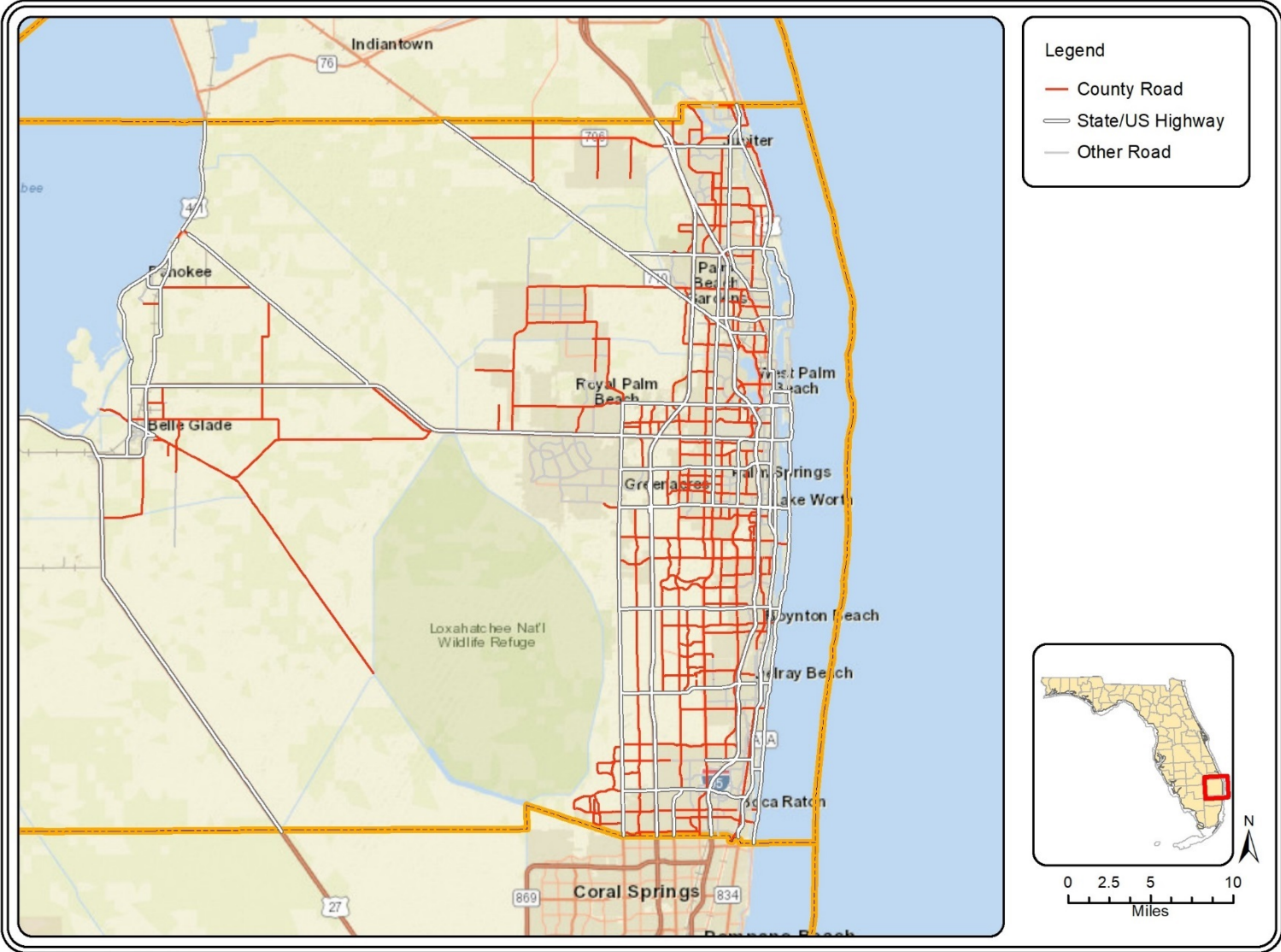
### 1.4 Relationship to National and State Safety Programs

FHWA supports safety at the individual state level through the Highway Safety Improvement Program (HSIP), which is managed by each state’s Department of Transportation. Florida’s 2017 HSIP Annual Report (FDOT, 2017) noted that the state invested approximately \$120 million of HSIP funding on projects in fiscal year 2016, with approximately 8 percent supporting projects on the local system.

The HSIP requires development of an SHSP for every state. An SHSP provides the statewide comprehensive framework for reducing highway fatalities and serious injuries on all public roads. It identifies a state’s safety needs and guides the state’s investments in safety toward the strategies and countermeasures with the greatest potential to reduce fatalities and severe injuries associated with crashes.

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<sup>4</sup> Information about Florida’s “fatality-free roadway system” vision can be found at the [2016 Florida Strategic Highway Safety Plan web site](#).



PBC\_12172018, 12/17/2018

Figure 1-1. Palm Beach County Road System Map  
Source: FDOT, 2017



Figure 1-2. North Jog road, a Typical Multi-lane Road in Palm Beach County  
Source: Google Earth© 2018

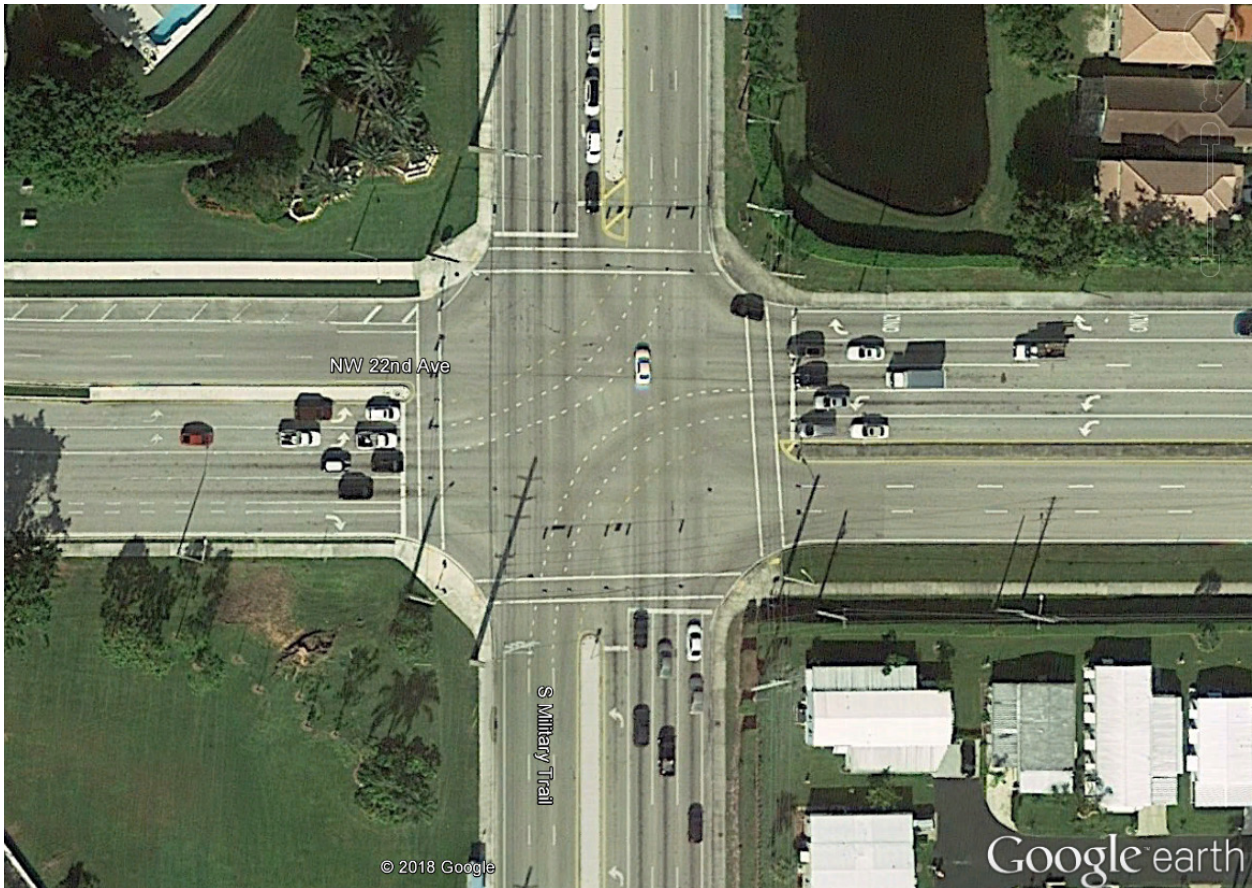


Figure 1-3. South Military Trail and N.W. 22<sup>nd</sup> Avenue, a Typical Urban Multi-lane Intersection in Palm Beach County  
Source: Google Earth© 2018

The most recent update of Florida’s SHSP is titled *Driving Down Fatalities* (FDOT, 2016) and focuses on how to accomplish the vision of eliminating traffic fatalities and reducing serious injuries on public streets and highways. The SHSP identifies Florida’s 13 priority highway safety emphasis areas and includes key safety metrics, target performance goals, and strategies for reducing fatalities and serious injuries. The Florida SHSP acts as a guiding document for stakeholders to use in developing regional and local transportation safety plans. It encourages the update of safety plans, including state, coalition, metropolitan planning organization, and local government plans to align with the Florida Transportation Plan and SHSP zero fatality vision, and the documentation and reporting of progress in each emphasis area toward achieving Florida’s vision of zero roadway fatalities. The Palm Beach County LRSP identifies emphasis areas, strategies, and goals for reducing fatalities and serious injuries on County roadways.

The SHSP also notes that Florida’s Community Traffic Safety Teams (CTSTs) are a valuable resource in the development of local plans. These teams are “locally based, data-driven groups of highway safety advocates that are committed to a common goal of improving traffic safety in their communities” (FDOT, 2018a). Working with multi-disciplinary teams including state and federal participants helps to ensure that programs implemented in the County agree with federal and state priorities. Palm Beach County included the FDOT District 4 CTST coordinator along with other federal, state, and local representatives as part of the stakeholder group that provided input on the development of the Palm Beach County LRSP.

## 1.5 Local Road Safety Plan Development Process

The development of an LRSP uses a data-driven, multi-disciplinary, and collaborative process. Stakeholders use data to establish priorities for the LRSP including implementation of countermeasures across the County roadway system. Additionally, the LRSP development complements the process and outcomes of the state SHSP. Figure 1-4 illustrates the standard recommended process used to guide the development of an LRSP.



Figure 1-4. LRSP Development Workflow



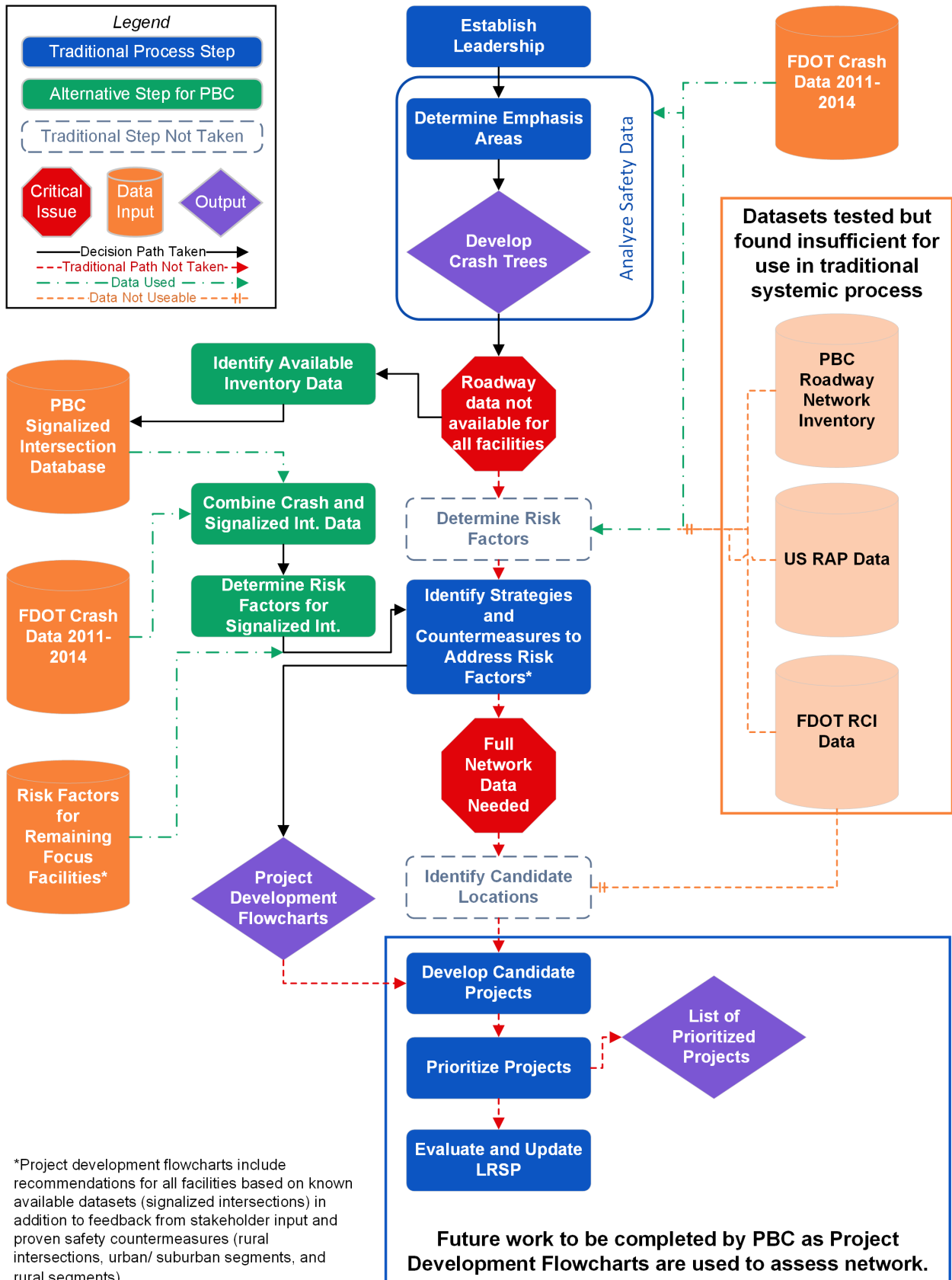
Once data analysis is complete and emphasis areas have been identified, Step 4 (Identify Strategies) and Step 5 (Prioritize and Incorporate Strategies) are commonly achieved through a systemic analysis process. Systemic analysis consists of identifying infrastructure-related risk factors associated with high crash frequencies. These risk factors are then identified across a road network. The locations with the highest number of risk factors are at the highest risk for a crash compared to locations with few or no risk factors. This systemic process yields a list of prioritized projects that the County can work to implement. By conducting a systemic analysis for an LRSP, a local agency develops a comprehensive plan for addressing crashes across the entire local roadway network. The resulting improvements can then be implemented over time as the LRSP is re-evaluated and updated.

## 1.6 Tailoring the LRSP Development for Palm Beach County

FHWA's recommended process for developing LRSPs allows flexibility. The LRSP is intended to be "a framework for organizing stakeholders to identify, analyze, and prioritize safety improvements on local and rural roads..." and "can be tailored to local protocols, needs and issues." It is also a living document that "can be continually reviewed and updated to reflect changing local needs and priorities" (FHWA, 2014). The Palm Beach County LRSP is a perfect example of how the process can be tailored to meet the needs and priorities of the local agency. Specifically, the process for Palm Beach County was tailored 1) to address County needs and 2) based on available data, as follows:

- **Palm Beach County Needs** - Palm Beach County's LRSP is broad in coverage. Most County roadways are within urban/suburban areas. While addressing all facilities classifications, the County's LRSP emphasizes the safety needs of urban and suburban facilities.
- **Available Data** - Crash data helped identify emphasis areas and focus facilities and helped identify and prioritize safety strategies. Roadway inventory data for focus facilities is generally necessary to determine risk factors, identify projects, and prioritize candidate locations. In Palm Beach County, while crash data were available, roadway inventory data were not available for the complete County system. Rather than collect all necessary data, which would have been labor- and resource-intensive, the County provided a subset of data for signalized intersections, which are the highest priority component of the system and a well-maintained data set by the County.

This tailoring of approach meant it was necessary to apply a modified systemic safety process to the county system. Specifically Step 4 (Identify Strategies) and Step 5 (Prioritize and Incorporate Strategies) were adapted to develop the process for the LRSP. Figure 1-5 and the accompanying narrative outlines the flow and process to develop the Palm Beach County LRSP. Chapters 2 through 7 provide in-depth details on the LRSP development process as applied to Palm Beach County. Final recommendations in the LRSP are based on the countermeasures identified for the intersections within the available data set, as well as from feedback from stakeholders obtained during the March 2014 workshop and proven safety countermeasures for County facility types (for example, rural intersections, urban/suburban segments, and rural segments) for which there were no roadway data.



\*Project development flowcharts include recommendations for all facilities based on known available datasets (signalized intersections) in addition to feedback from stakeholder input and proven safety countermeasures (rural intersections, urban/ suburban segments, and rural segments).

Figure 1-5. Palm Beach County Modified Systemic Safety Process

Palm Beach County LRSP development process began with establishing Palm Beach County Engineering and Publics Works as the leader for the LRSP development. The intent was to develop the LRSP in close coordination with the 2016 Florida SHSP, the guiding document for transportation safety planning in Florida. To establish emphasis areas for the LRSP in alignment with the SHSP, the project team sorted fatal and serious injury crash data from 2011 through 2014 occurring on County roads into groups reflecting the 13 emphasis areas of the 2016 Florida SHSP (see Chapter 3). From these broad emphasis areas, the County chose six emphasis areas to be the focus of the Palm Beach County LRSP: those that were not only ranked as the highest of the 13 emphasis areas, but also as the highest priorities for existing and emerging safety issues along the County roadway network.

Crash data helped determine the priority crash types and where they were occurring (see Chapter 4). If following the traditional systemic process, the next step would have been a risk factor analysis for the critical locations identified through this analysis for all roadway facility types within the County. However, comprehensive roadway network data are needed to conduct this systemwide risk factor analysis. Potential sources of these data included roadway inventory datasets from Palm Beach County, U.S. Road Assessment Program, and FDOT Roadway Characteristic Inventory. However, no complete data set was identified with sufficient detail to perform a system screening and risk factor identification. Therefore, the County applied a modified systemic evaluation to fit the available data (see Chapter 5). While the County could have conducted a detailed roadway network data collection, the data collection effort would have required considerable expense and time and was ruled out as a feasible option.

In a traditional systemic analysis, risk factors are identified across the study network and help guide the development of specific projects for the locations with the most risk factors. In lieu of conducting an evaluation for risk factors and screening the entire County system for locations where those risk factors existed, the process was applied to a subset of facilities within the County to identify methods and illustrate the approach to performing this analysis as additional data become available. The LRSP outlines this modified process and includes an example of the systemic process applied to a subset of the facility types most critical to the County where sufficient data were available. Specifically, the County had detailed data for 133 of its signalized intersections where the County identified angle/left-turning crashes, bicycle crashes, and pedestrian crashes as priority crash types. The project team conducted a risk factor analysis for signalized intersections for multi-vehicle and bicycle/pedestrian crashes resulting in specific risk factors for both crash types (see Chapter 5).

Because the example analysis used only a subset of the County's signalized intersections, the County LRSP does not include a defined list of projects for the County system, which would be a typical component of an LRSP. Instead this LRSP presents "Project Development Decision Trees" (see Chapter 6) for each focus facility type (that is, urban/suburban intersections, urban/suburban segments, rural intersections, and rural segments). The decision trees use a combination of the information gleaned from the evaluation of the subset of County urban/suburban intersections, feedback from LRSP stakeholders, and available research on proven countermeasures. The County will use these decision trees to develop consistent safety projects designed to address common risk factors and reduce fatalities and serious injuries across their network (see Chapter 6).

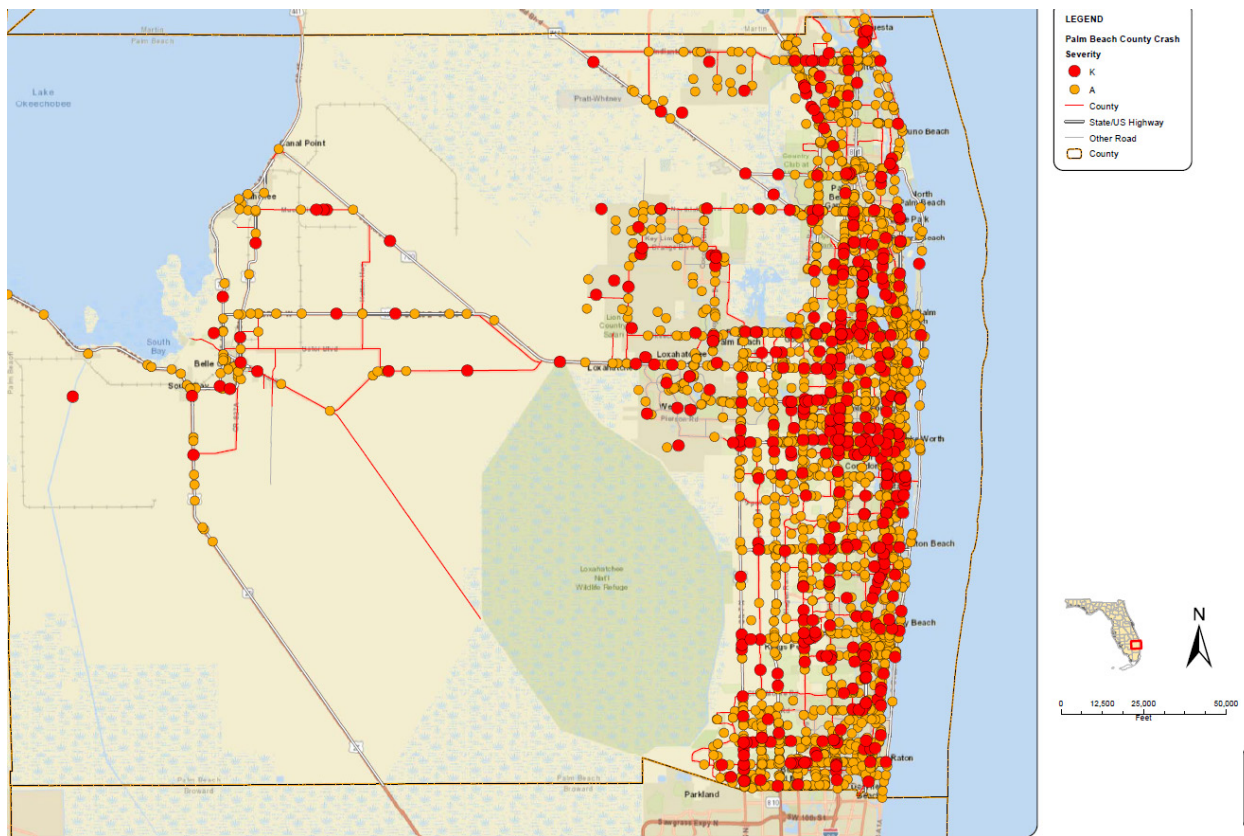
This LRSP is designed so that the specific projects can be developed with the information that the County has available using the project decision trees. While data are still limited, the County can proactively address risk factors and work toward reducing fatal and serious injury crashes on its network (see Chapter 7). This process can be applied Countywide and can be refined and expanded as the County gains more experience and receives more information on its effectiveness. As data are collected for the County system, the County can update the LRSP to include additional analysis and complete the traditional systemic project development process on additional components of the County system.

# Crash Analysis

## 2.1 Crash Data

The LRSP included evaluating 2011 through 2014 crash data provided by FDOT for County roads and roadway data provided by the County.

Crashes that result in fatalities and severe injuries (A-type severity) are consistent with the safety performance measures adopted by FHWA and the state of Florida. The County data set included 3,354 fatal and severe injury crashes. Figure 2-1 illustrates the reported locations of the severe crashes,<sup>5</sup> or crashes with a maximum reported injury of K or A on Palm Beach County Roadways.<sup>6</sup>



*“K” = fatalities; “A” = incapacitating injury*

**Figure 2-1. Severe Crash Location Map**

*Source: FDOT, 2017*

## 2.2 Crash Trends and Data Analysis

Crash trends and safety analysis provide the information necessary for transportation safety planning, prioritization, and implementation to achieve the goals of the LRSP. From 2011 through 2014, 3,354

<sup>5</sup> Severe crashes are defined as the combination of fatal and serious injury crashes.

<sup>6</sup> Based on National Safety Council’s [KABCO injury classification scale and definitions by state](#). “K” represents fatalities and “A” represents incapacitating injury.

severe crashes occurred in Palm Beach County, 631 of which happened on Palm Beach County’s roadway system. Figure 2-2 illustrates the yearly crash frequency by severity, KA, and all severities for crashes occurring on the County system. For comparison, Figure 2-2 also shows trend lines for crashes occurring on all roadway systems in the County, including local and state roadways. The points on the trend lines represent the crashes by year for the 4-year study period from 2011 through 2014. Figure 2-3 provides detail on the proportion of County road miles in the county as compared to state and local roadway facilities.

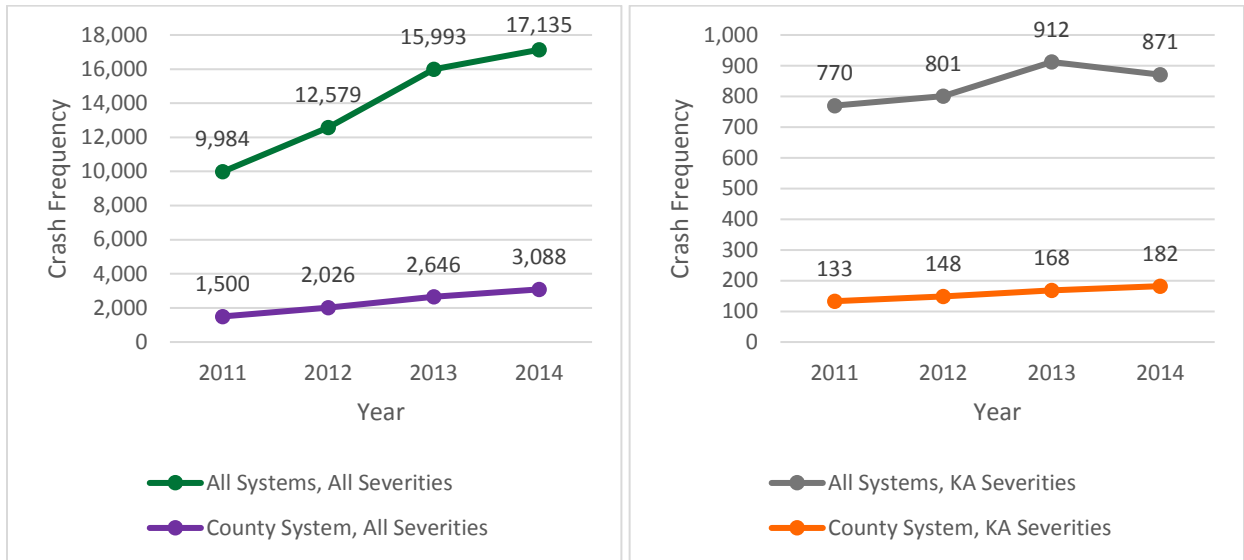


Figure 2-2. Palm Beach County and All Systems Crash Trend Lines  
Source: FDOT

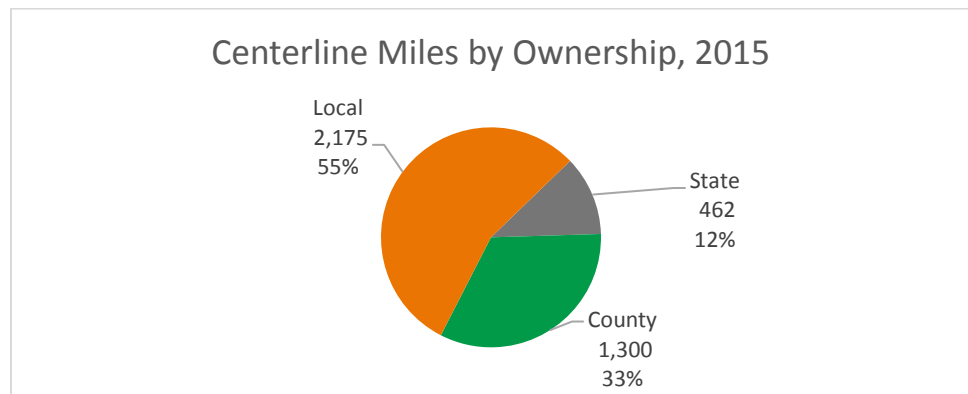


Figure 2-3. Palm Beach County Road Ownership Miles  
Source: FDOT

As illustrated on Figure 2-2, the number of crashes of all severities on all roads in Palm Beach County increased by approximately 72 percent from 2011 to 2014. For the same period, the number of crashes of all severities on County roads in Palm Beach increased approximately 105 percent. Similarly, County statistics being proportionally higher than all road statistics also applied to severe crashes. Severe crashes on all roads in Palm Beach County increased by approximately 13 percent from 2011 to 2014, while severe crashes on County roads increased by approximately 37 percent during the same period. County roads represent approximately one-third of all roadways within the County.

Additional analysis performed with the crash data supported the various steps of the LRSP development process, including identification of County emphasis areas; systemic analysis including network

screening, risk factor identification, and safety strategy identification and prioritization; and project development. These areas are discussed in Chapters 3 through 7.

# Safety Emphasis Areas

Developing an LRSP is a data-driven process that defines goals, objectives, and strategies to reduce fatalities and serious injuries on the local system that aligns the local agency plan with the state's SHSP (FHWA, 2014). The LRSP provides Palm Beach County with a means to address safety needs specific to the County while also supporting the goals and objective of the Florida SHSP. With FDOT crash and roadway data as its basis, the next step in the LRSP development process was to identify safety emphasis areas that form the basis of the LRSP.

## 3.1 Relationship to Florida SHSP Emphasis Areas

Emphasis areas establish the focus of a roadway safety plan and typically relate to crash types that represent the greatest opportunity for reducing fatal and severe injury crashes using safety strategies and countermeasures, which correspond to mitigation of a specific crash type. Therefore, prioritization of safety emphasis areas helps identify appropriate safety strategies and countermeasures for a roadway system. Priority emphasis areas identified from the crash data set are the crash types with the greatest proportion of crashes.

The Florida SHSP identifies 12 crash-related emphasis areas and an additional thirteenth emphasis area for traffic records and information systems. When developing the LRSP emphasis areas, crash data were classified and sorted by the safety emphasis areas identified in the Florida SHSP to align the LRSP with state priorities. Table 3-1 summarizes the disaggregation of severe crashes (the sum of fatal and serious injury crashes) by safety emphasis area for all roads versus County roads. Included next to each crash frequency is the proportion of severe crashes in the emphasis area. The table includes FDOT District 4 crashes for comparison to the County road system (Palm Beach County is one of five counties in FDOT District 4).

In consultation with stakeholders, the County used the results to identify the safety emphasis areas of focus for the LRSP based on existing and emerging crash trends. They selected six priority emphasis areas that represent the greatest opportunity for reducing fatal and serious injury crashes for the County and to establish strategies for addressing those crashes on the County system. As shown in Table 3-1, four emphasis areas stand out for the County: Intersections, Aging Road Users, Lane Departures, and Occupant Protection (Unrestrained Occupants). Each crash type contributes to 20 percent or more of the severe crashes occurring on the County's roadway system. Two more emphasis areas, impaired driving and pedestrian/bicyclist, both show an overrepresentation of severe crashes on the County system compared to the rest of District 4. These six comprise the priority emphasis areas for the Palm Beach County LRSP.

**Table 3-1. Palm Beach County Crash Data by Florida SHSP Emphasis Areas**  
*Crash Emphasis Area Disaggregation: Severities (Source FDOT, 2011–2014 crash data)*

Emphasis Area	Palm Beach County				District 4			
	County Roads		All Jurisdictions		County Roads		All Jurisdictions	
Total Severe Crashes <sup>a</sup>	631		3,354		1,937		10,793	
<b>Intersections</b>	<b>224</b>	<b>35%</b>	<b>1,034</b>	<b>31%</b>	832	43%	3,271	30%
<b>Aging Road Users</b>	<b>198</b>	<b>31%</b>	<b>879</b>	<b>26%</b>	509	26%	2,524	23%
<b>Lane Departures <sup>b</sup></b>	<b>182</b>	<b>29%</b>	<b>1,086</b>	<b>32%</b>	454	23%	3,232	30%
<b>Occupant Protection</b>	<b>126</b>	<b>20%</b>	<b>568</b>	<b>17%</b>	266	14%	1,421	13%
<b>Impaired Driving</b>	<b>108</b>	<b>17%</b>	<b>600</b>	<b>18%</b>	219	11%	1,389	13%
<b>Pedestrian/Bicyclist</b>	<b>110</b>	<b>17%</b>	<b>655</b>	<b>20%</b>	302	16%	2,009	19%
Teen Drivers	86	14%	377	11%	303	16%	1,235	11%
Motorcyclists	81	13%	409	12%	225	12%	1,363	13%
Speeding & Aggressive Driving	60	10%	369	11%	158	8%	1,047	10%
Distracted Driving	57	9%	349	10%	160	8%	961	9%
Commercial Motor Vehicles	40	6%	249	7%	569	29%	2,532	23%
Work Zones	5	1%	39	1%	21	1%	233	2%

<sup>a</sup> Severe crashes are defined as the combination of fatal and serious injury crashes and include type K (fatal) and A (incapacitating).

<sup>b</sup> Includes head-on, cross-median, and travel-way departure.

**bold values** indicate the six Palm Beach County emphasis areas.

## 3.2 County Priority Emphasis Areas

The County developed a preliminary list of safety emphasis areas based on the number of severe crash types and focused roadway facilities (urban or rural, intersection or segments). Upon review of the emphasis area evaluation and given consideration of specific concerns to the County related to existing and emerging safety priorities, the County identified the following top six ranked emphasis areas for County roadways as the priority emphasis areas in the LRSP:

- Intersections
- Aging Road Users
- Lane Departures
- Occupant Protection (Unrestrained Occupants)
- Impaired Driving
- Pedestrian/Bicyclist

Other trends may emerge when comparing the County roadway crash statistics to all County roads and District 4 roadway statistics. However, this LRSP addresses the County's highest priorities. In developing this LRSP, the County has considered the interrelationships between emphasis areas when identifying safety countermeasures. Emphasis areas overlap, and the strategies in this document will benefit other crash types (for example, lane departures will also address commercial vehicle crashes and impaired driving will address motorcycle, commercial vehicle, and work zones). Future updates to the LRSP may expand the focus to include additional emphasis areas as progress in the initial six areas is achieved.

### 3.2.1 Intersections

Intersection crashes account for the highest percent of the County's severe injury crashes, ranking this emphasis area as the highest in terms of opportunity for reducing fatal and severe crashes on County roads. While the statistics represent all intersections, most crashes occur at signalized intersections.



Therefore, the County adopted signalized intersections as the emphasis area, and proposed countermeasures target reducing crashes at these intersections.

### 3.2.2 Aging Road Users

Nationally, drivers over 50 years old remain the fastest-growing demographic group (FHWA, 2015). Research supports that fatal crash rates increase noticeably starting at age 70 to 74 and are highest among drivers age 85 and older. Drivers age 85 and older are four times more likely than drivers under age 65 to be fatally injured in a severe crash (Insurance Institute for Highway Safety, 2018). For aging road users, the severity of injuries often increases, though these drivers are more likely to consistently practice safe driving habits and self-regulate driving risk (for example, minimize night-time driving). Despite their safe driving practices, a wealth of driving experience, and driving fewer miles, the increased fatal crash potential among older drivers largely stems from their increased susceptibility to more serious injuries. In Palm Beach County, 31 percent of severe crashes on County roads involve a driver age 65 or older compared to 26 percent on county roads across the district. The proportion of severe crashes on County roads involving aging road users is the second-highest of all emphasis areas.

### 3.2.3 Lane Departures

Lane departure<sup>7</sup> crashes include several subcategories of crash types observed on County roads. Specifically, a crash defined as a lane departure crash may be referring to any of the following: head-on, cross-median, sideswipe meeting, roadway departure, and fixed object collisions. The proportion of severe lane departure crashes on all routes in Palm Beach County (32 percent) generally reflects lane departure crash trends on all routes across District 4 (30 percent). However, the proportion of severe lane departure crashes on Palm Beach County roads (29 percent) exceeds severe crashes on County routes within District 4 (23 percent).

### 3.2.4 Occupant Protection (Unrestrained Occupants)

The National Highway Traffic Safety Administration (NHTSA) reports that a motorist's seat belt is the most effective defense in a crash. When lap and shoulder seat belts are used, the potential for fatal injuries to front-seat passenger car occupants is reduced by 45 percent and the potential for moderate to critical injury is reduced by 50 percent. Restraint use keeps occupants within the vehicle compartment to maximize the designed safety features of the vehicle. Safety benefits are even greater for light-truck occupants, with seat belts reducing fatalities by 60 percent and moderate to critical injury by 65 percent (NHTSA, 2018).

In 2017 statewide driver and right-front seat passenger seat belt use was at an all-time high of 90 percent (FDOT, 2017), which is slightly higher than the national average of 89.7 percent (NHTSA, 2017). Although Palm Beach County has a seat belt rate of 90.5 percent (FDOT, 2017), 20 percent of severe crashes on County roads involve unbelted occupants, which is higher than the 14 percent for severe crashes with unbelted occupants on county roads across District 4.

### 3.2.5 Impaired Driving

The state of Florida defines impaired driving in Florida as driving under the influence of alcohol and/or legal drugs (prescription and over-the-counter) and/or illegal drugs (FDOT, 2018b). Impaired driving has implications for almost all other emphasis areas, including the other key emphasis areas selected by the County for the LRSP. Reducing impaired driving crashes should lead to reductions in lane departure crashes, intersection crashes, and aging-driver-related crashes. Impaired driving crashes in Palm Beach County account for a lower proportion of severe crashes (17 percent) on County roads compared to

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<sup>7</sup> FHWA refers to this emphasis area as Roadway Departure, which are crashes that occur after a vehicle crosses an edge or centerline or otherwise leaves the travel way (see FHWA's [Roadway Departure Safety website](#)).

several other emphasis areas. However, the proportion stands out because it is higher than the proportion of impaired-driving-related severe crashes on County-maintained roads across District 4 (11 percent). Impaired driving is also a priority emphasis area in Florida's SHSP, further aligning the LRSP with state and regional efforts.

### 3.2.6 Pedestrians and Bicyclists

According to the 2016 Florida SHSP (FDOT, 2016), Florida accounts for approximately 6 percent of the U.S. population but 17 percent of the nation's bicyclist fatalities and 11 percent of pedestrian fatalities. In Palm Beach County, pedestrian and bicycle safety issues were a frequent topic of stakeholder conversation during the March 2017 workshop. While the proportion of severe pedestrian and bicycle crashes on Palm Beach County roads (17 percent) is slightly lower than other emphasis areas, it still ranked fifth, which is higher than the proportion of similar severe crashes on county-maintained roads in District 4. This overrepresentation and the concern for these crash types across the region and state make this emphasis area a significant concern for the County.

# Identification and Prioritization of Safety Strategies

The next step in LRSP development involves identifying and prioritizing safety strategies targeted to address infrastructure and behavioral factors associated with crashes. This process considers the key characteristics (locations, systems, crash data, and contributing factors) and input from stakeholders to identify the most appropriate safety strategies and countermeasures for addressing the unique safety needs of the County's roadways.

## 4.1 Contributing Factors

Motor vehicle crashes are complex occurrences that most often have multiple crash contributors. Traffic crashes may result from any combination of overlapping crash factors including the roadway, the vehicle, and driver behavior. Figure 4-1 illustrates this complex interrelationship among these three crash contributors.

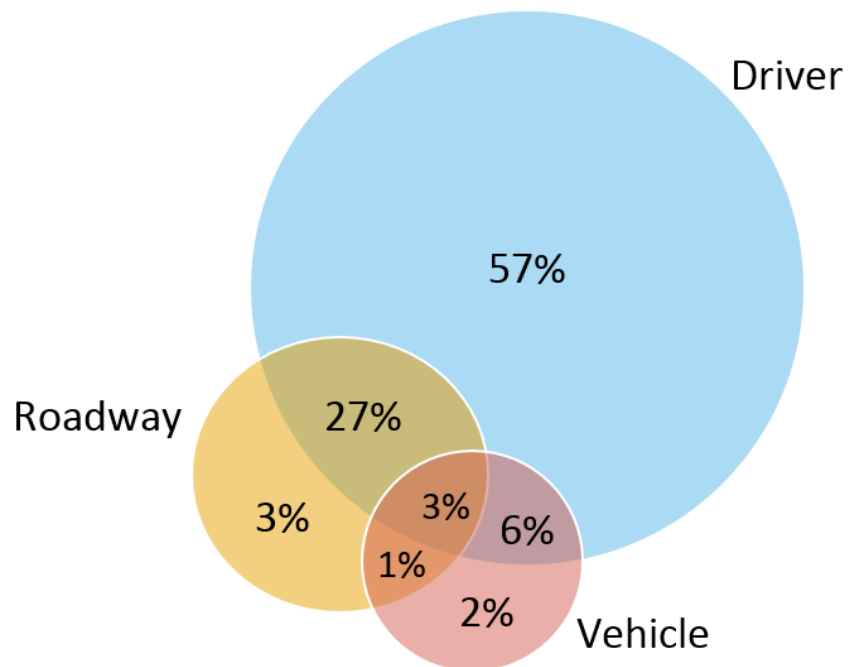


Figure 4-1. Traffic Crash Causation Factors  
Source: FHWA (1995)

Figure 4-1 shows that crashes often have multiple contributing factors. These contributing factors can often be addressed to prevent crashes. Communication and collaboration with multidisciplinary partners to better understand the safety data and context of where and why crashes occur can aid in identifying potential strategies and programs that can be employed to avoid, eliminate, or mitigate crashes and in turn, save lives.

An in-depth data analysis of FDOT safety data identified where crashes on the Palm Beach County system have occurred and provided factors related to crash causation so that optimal safety measures could be developed. Figure 4-2 shows the “crash tree” used for the in-depth data analysis. The crash

tree illustrates disaggregation of crash frequency and proportion by elements such as urban and rural, ownership (state, county, local, turnpike, and unknown), segment and intersection, segment type, and intersection control type. The crash tree permits the identification of the facility types where the focus crash types most frequently occur. Each level further disaggregates a specific crash type; therefore, the levels below the Road Ownership level (boxes labeled State/County/City/Township) in Figure 4-2 focus exclusively on the Palm Beach County crash dataset.

Examination of the Palm Beach County crash tree revealed that:

- County roads experience fewer severe crashes than the other roadway classifications (state, local, turnpike/toll, other) within the County.
- In general crashes on the County system were evenly distributed between intersections) and segments.
- While pedestrian crashes constitute only 4.8 percent of total intersection crashes and 5.7 percent of total segment crashes, these crashes correspond with 7.5 and 20.5 percent of severe crashes at intersections and segments, respectively.
- For segments:
  - The majority of severe crashes (60 percent) occurred on divided roadways. Of these crashes, 60 percent involved multiple vehicles and the most common severe crash type was multi-vehicle rear-end crashes (78 severe crashes, 66 percent of severe multi-vehicle crashes).
  - Single-vehicle crashes (26 percent) were the second most common crash type on divided roadways.
  - While a pedestrian or a bicycle was involved in only 4 percent of total crashes on divided roadways, crashes involving a pedestrian or bicyclist represented 14 percent of severe crashes on divided roads.
  - The most common manner of collision for multiple-vehicle crashes on undivided roadways was rear-end collisions.
  - While only 11 percent of all multiple-vehicle crashes on undivided roadways involve a head-on or sideswipe same-direction collision, these crashes accounted for 31 percent of severe multi-vehicle crashes.
  - On undivided roadways, pedestrians and bicyclists accounted for only 9 percent of total crashes but had nearly the same number of severe crashes (36 severe crashes) as single vehicle and multi-vehicle crashes (39 severe crashes each).

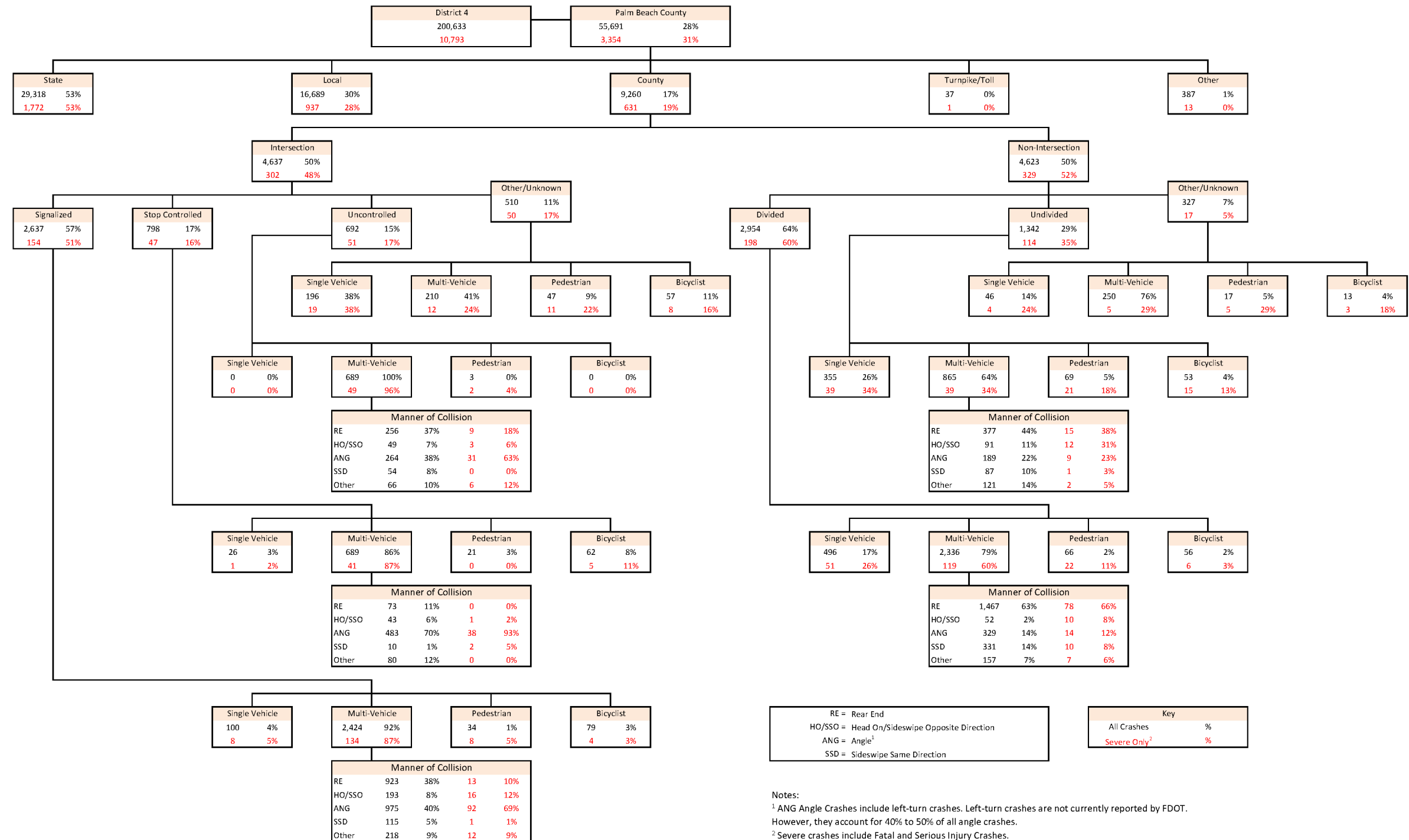


Figure 4-2. Palm Beach County Crash Trees 2011-2014 Crash Data Source: FDOT (2016)

- For intersections:
  - The majority of severe crashes at intersections on the County system occurred at signalized intersections (51 percent) followed by uncontrolled (17 percent) and stop-controlled (16 percent) intersections. An additional 17 percent of severe intersection crashes on the County system were reported as “Other/Unknown” traffic control.
  - At signalized intersections, 87 percent of severe crashes involved multiple vehicles with the majority involving angle collisions<sup>8</sup> (69 percent). Similarly, angle crashes involving multiple vehicles accounted for 93 percent of severe crashes at stop-controlled intersections and 63 percent of severe crashes at uncontrolled intersections.
  - Severe crashes involving pedestrians and bicyclists were less common at intersections, with 19 severe pedestrian/bicyclist crashes occurring at intersections as compared to 64 severe pedestrian/bicyclist crashes of this type occurring on segments.

This crash overview supports the use of a systemic safety assessment in the project development process to identify candidate locations for safety investment.

## 4.2 Safety Strategy Identification

The countermeasures identified by LRSP stakeholders focused on addressing crashes with characteristics that aligned with the six County emphasis areas and considered observations made on severe crashes within the system. For example, retro-reflective signal backplates can enhance the visibility of traffic signals effectively in any area, which can reduce the number of crashes at signalized intersections, and the addition of bike lanes can reduce the number of severe bicycle crashes along urban roads.

Based on the observations from the crash data analysis and crash tree evaluation, the following was considered when identifying potential safety countermeasures to be applied on Palm Beach County Roadways:

- For undivided roadway segments, addressing single-vehicle crashes has the greatest potential for reducing fatal and severe injury crashes.
- For divided roadways, addressing multi-vehicle rear-end and single-vehicle crashes has the greatest potential for reducing fatal and severe injury crashes.
- For all intersection types, addressing multi-vehicle angle crashes (especially left-turn crashes) has the highest potential for reducing fatal and severe injury crashes.
- Though pedestrian and bicyclist crashes are less frequent than vehicular crashes, they tend to demonstrate a disproportionate level of severity and, therefore, also offer potential for reducing fatal and severe injury crashes.

A comprehensive list of potential safety strategies from published research was assembled and included the National Cooperative Highway Research Program (NCHRP) Report 500 Series (published between 2003 and 2009), FHWA’s Crash Modification Factor Clearinghouse (FHWA, 2010), and the National Highway Traffic Safety Administration’s *Countermeasures that Work* (NHTSA, 2015). These resources provide an extensive overview of effective strategies for crash reduction. The initial list included 75 infrastructure-related and behavior-related safety strategies and countermeasures (Appendix A). The

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<sup>8</sup> Angle crash trends reported here include left-turn crashes. The Florida Crash Report Form (HSMV 90010S) does not have left-turn as an option for manner of collision/impact. A sample of angle crashes was evaluated for this project, and approximately 40 to 50 percent of reported angle crashes were left-turn crashes.

strategies were classified as either proven, tried, or experimental<sup>9</sup> as defined below, based on their current state of implementation in the transportation industry.

- **Proven effective strategies** are widely deployed across the country and are subject to academically rigorous statistical evaluation, and result in documented crash reductions that fall in a narrow range.
- **Tried strategies** have either not been widely deployed, lack rigorous statistical testing, or the results have not been consistent with results ranging from a decrease in crashes in some cases to an increase in others.
- **Experimental strategies** are typically newer and often involve technologies that are just beginning to be used and that lack sufficient deployment to support rigorous statistical evaluation.

Each safety strategy was also defined by general effectiveness (crash reduction factor) and basic implementation costs of the initial safety strategies and countermeasures. These details provide the information necessary to support the stakeholder's evaluation and selection of a shortlist of priority strategies.

### 4.3 Safety Strategy Prioritization

A portion of the 2017 workshop included discussions on goals, objectives, and potential safety strategies to be included in the LRSP. Participants reviewed the results of the crash analysis identifying the County's safety emphasis areas and participated in a facilitated discussion on an initial list of safety strategies and countermeasures for potential implementation in these emphasis areas. Appendix B provides a summary of the workshop, including a list of participants, an overview of the presentations, and the voting results.

Approximately 30 participants who represented local and state agencies working in the areas of engineering, enforcement, education, and emergency response attended the workshop. The session included a voting exercise during which participants selected the strategies from each emphasis area that they considered the highest priority for implementation to be included in the LRSP.

The strategies receiving the highest number of votes were:

- Intersections
  - Signal phasing and timing improvements
    - Employ multi-phase signal operations to reduce conflicts between traffic movements and pedestrians.
    - Optimize clearance intervals to reduce vehicle conflicts and keep vehicles from queuing through the intersection.
    - Improve operation of pedestrian and bicycle facilities to reduce pedestrian/vehicle conflicts and keep pedestrians and bicyclists separated from vehicular traffic.
    - Install advanced dilemma zone detection to warn approaching traffic of possible conflicts based on vehicle movement and traffic conditions.
    - Employ continuous flashing yellow arrow signal for permitted left-turn movements.

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<sup>9</sup> Terms originally defined in the NCHRP Report 500 Series documents that are commonly used for defining the stage of implementation of a safety strategy or countermeasure in the industry.

- Geometric improvements
  - Provide and/or improve left-turn and/or right-turn channelization to keep vehicle in the appropriate lane.
  - Improve geometry of pedestrian and bicycle facilities to keep them separated from vehicle traffic.
- Improve visibility of signals and signs.
- Control/improve access management
  - Restrict access to properties.
  - Restrict cross-median access near intersections.
- Aging Road Users
  - Improve visibility of signals, signs, and pavement markings.
  - Improve lighting at intersections, curves, and railroad crossings.
  - Conduct high-visibility enforcement.
  - Conduct outreach campaigns on aging road users' safety issues.
- Lane Departures
  - Improve/enhance shoulder, lighting, delineation and marking at curves.
  - Enhance pavement markings to improve visibility in all conditions.
  - Improve roadside design, hardware, and clear zone to allow vehicles the opportunity to return to the travel way and reduce severity of collision when vehicle leave the roadway.
  - Convert undivided sections to divided where crash types show significant cross-over or head-on collisions.
- Occupant Protection (Unrestrained Occupants)
  - Conduct outreach campaigns with parents, young drivers, and employers on seat belt use.
  - Conduct high-visibility enforcement.
  - Collaborate with local employers to develop/strengthen employee safe driving polices.
- Impaired Driving
  - Promote blood alcohol concentration (BAC) test “No Refusal” law and consequences.
  - Promote sobriety initiatives for driving under the influence (DUI) offenders.
  - Support community programs for alternative transportation.
  - Conduct high-visibility enforcement.
- Pedestrians and Bicyclists
  - Improve pedestrian and bicycle facilities at signalized intersections (signals and pavement markings, crosswalks, separated facilities for parallel travel).
  - Conduct outreach campaigns to promote awareness of pedestrian/bicycle safety topics.
  - Increase visibility of pedestrians and bicyclists at intersections.



### 4.3.1 Infrastructure Strategies

The County selected 44 specific infrastructure countermeasures for implementation in project development under the identified safety strategies. Tables 4-2 and 4-3 summarize these strategies for inter-sections and segments, respectively. Included in each table are the countermeasures, associated costs, crash reduction or modification factors, the area types (urban/rural, or urban and rural), and applicable Emphasis Areas to which the countermeasures apply.

Table 4-1. Palm Beach County Adopted Safety Engineering Countermeasures– Intersections

Strategy	Unit	Cost	CMF ID	Crash Reduction	Area Type (s)	Emphasis Area(s)
Retro-reflective Signal Backplates <sup>a</sup>	Intersection	\$2,110.00	1410	15%	R & U	INT, AG
Supplemental Post-Mounted Signal Heads	Intersection	\$2,700.00	1414	28% (Urban)	U	INT, AG, PB
Optimize Stop Bar Location	Approach	\$270.00	N/A	Unknown	R & U	INT, AG, PB
Upgrade Signs and Markings	Approach	\$3,000.00	8110, 8903	40%	R & U	INT, AG, PB
Increase Sign Size	Sign	\$300.00	62	15%	R & U	INT, AG, PB
Restrict or Eliminate Turning Maneuvers	Approach	\$5,000.00	390, 392	64% to 77%	U	INT
Signal Phasing and Timing Improvements	Intersection	\$5,000.00	4029, 4143, 4144	1% to 6% (Approach)	R & U	INT, PB
Install left-turn flashing arrow and supplemental traffic signs	Intersection	\$9,100.00	7730	14%	U	INT, AG
Change protected/permmissive left-turn phasing to protected	Intersection	\$5,000.00	4144	55%	U	INT
Advanced Dilemma Zone Dynamic Warning	Approach	\$60,000.00	1379	25% to 30%	R & U	INT, AG
Provide Turn Lanes/Channelization	Mile	\$380,000.00	280	25% to 30%	R & U	INT
Convert to Roundabout	Intersection	\$2,500,000.0	4705, 5228	60% to 90% (Angle)	R & U	INT
Reduced Conflict Intersection	Intersection	\$750,000.00	8666	60% to 90% (Angle)	R & U	INT
Streetlights/intersection lighting	Light	\$6,000.00	193, 433	40%	R & U	INT, AG, PB
Red-Light Running Confirmation Lights	Intersection	\$1,200.00	N/A	Unknown	U	INT
Close Driveway Near Intersection	Driveway	\$5,000.00	2196	Varies by Density	U	INT
Close Median	Opening	\$50,000.00	N/A	90%	R & U	INT, PB
Install Pedestrian Countdown Timers	Intersection	\$14,300.00	5272	70% (Pedestrian)	U	PB
Leading Pedestrian/ Bicyclist Interval	Approach	\$35,000.00	1993	59% (Pedestrian)	U	PB
Install High-Visibility Crosswalk	Approach	\$12,500.00	4123, 4124	19% to 40%	U	INT, PB
Provide Sidewalks/Walkways	Foot	\$64.00	9240	65% to 75%	U	PB
Provide Curb Ramps	Ramp	\$4,250.00	N/A	Unknown	U	PB
Provide Crosswalk	Square Foot	\$21.00	3019	65%	U	INT, PB
Pedestrian Refugee Island/Raised Median	Approach	\$20,125.00	9120	15%	U	PB
Overpass/Underpass	Square Foot	\$234.00	2944	40% to 50%	R & U	PB
Provide Bike Lanes	Mile	\$79,000.00	7838	30% to 60%	R & U	PB
Install Bike Boxes	Bike Box	\$2,000.00	N/A	Unknown	U	PB
Bike Preemption System	Intersection	\$40,000.00	N/A	Unknown	U	PB

Source: CMF (Crash Modification Factor) Clearinghouse (FHWA, 2010)

<sup>a</sup> Installation of retro-reflective signal back plates and signs on signal mast arms may require structural analysis. Costs shown here include structural analysis.

Notes:

R = rural; U = urban; INT = intersection, PB, = Pedestrian/Bicycle, AG = Aging Road Users, N/A = not applicable

Table 4-2. Palm Beach County Adopted Safety Engineering Countermeasures – Segment

Strategy	Unit	Cost	CMF ID	Crash Reduction	Area Type	Emphasis Area(s)
Shoulder Rumble Strips	Mile	\$6,000.00	3442	20%	R	LD
Safety Edge	Mile	\$1,340.00	9211	21%	R	LD
High Friction Surface Treatment	Square Foot	\$94.70	8744	24% (Curves)	R & U	LD
Streetlights	Light	\$6,000.00	193, 433	40%	R & U	LD, AG, PB
Delineation at Curves	Sign	\$100.00	1939, 91	25%	R & U	LD, AG
Remove/Relocate Objects in Hazardous Locations	Each (Object)	\$1,130.00	1024	38%	R & U	LD
Improve Roadside Barriers and Terminals	Replacement	\$2,829.00	5550	22% (Injury)	R	LD
Centerline Rumble Strips	Mile	\$4,000.00	3355	40% (Head On)	R	LD
Road Diet- Undivided 4 to 3 - Lane Cross Sections	Mile	\$46,000+	5553	25% (Urban)	U	LD, AG, PB
Traffic Calming	Speed Bump	\$4,000.00	128	32% (Urban)	U	LD, PB
Barrier Separation (Restrict Cross Centerline Movements)	Mile	\$370,000 (Concrete) \$15,000.00 (Steel)	N/A	Unknown	R & U	LD
Median Separation (Restrict Cross Centerline Movements)	Mile	\$1,600,00.00	22	25%	R & U	LD
Close Median	Each (Opening)	\$50,000-165,000.00	N/A	90%	R	LD, INT
Alternating or Two-Way Left Turn Lanes	Mile	\$400,000.00	1285	8%	R & U	LD
Advanced Warning at Curves	Sign	\$800.00	71	30% (Injury)	R & U	LD
Speed Advisory at Curves	Sign	\$800.00	73	13% (Injury)	R & U	LD
2-Foot Paved Shoulder	Mile	\$49,000.00	6707	43% (Fatal, Urban)	R & U	LD, PB

Source: CMF Clearinghouse (FHWA, 2010)

Notes:

R = rural; U = urban; LD = Lane Departure, PB, = Pedestrian/Bicycle, AG = Aging Road Users, N/A = not applicable

### 4.3.2 Behavioral Strategies

The County recognizes the importance of reaching beyond infrastructure strategies to include behavioral safety strategies for a more comprehensive program to address the County's road safety needs. Plan goals indicated the desire to remain consistent with the vision and emphasis areas of the Florida SHSP. The core of the SHSP is collaboration and leveraging of the various safety stakeholders. This was further adopted in Palm Beach County LRSP through the goal of enhancing partnerships and communication among the 4E stakeholders.

Additionally, several objectives of this LRSP focus on addressing or strengthening the relationship between infrastructure and behavior-based safety strategies. An added benefit of behavioral strategies can be improved effectiveness of infrastructure strategies. One example of infrastructure and behavioral coordination is deploying lane departure infrastructure safety strategies coupled with enhanced enforcement. Infrastructure-based countermeasures to reduce lane departures, like edge line rumble strips, help alert drivers when they are encroaching on the shoulder and thus reduce lane departure

crashes. However, not all lane departure crashes can be addressed solely by alerting the driver. For instance, impaired drivers may not be able to understand or correct their vehicle regardless of rumble strip warnings. This gap is where behavioral countermeasures play a critical role. Sustained law enforcement patrols are a proven method for removing impaired drivers from the road. When crash history indicates a location with high number of lane departure and impaired-driving-related crashes, a combination of infrastructure and behavioral treatments offers the greatest chance of reducing crashes at that location.

Therefore, in addition to targeted infrastructure strategies, the County has identified several behavioral strategies with low to moderate cost and short to medium implementation timeframes. Specifically, the following behavioral strategies were identified for continued and future implementation in the County:

- Bicycles and Pedestrians
  - Promote community-wide sustained outreach campaigns for pedestrians and bicyclists focused on increasing conspicuity; motor vehicle driver awareness and safety messages for at-risk populations of pedestrians and bicyclists (aging road users, children, diverse populations), such as road safety orientation at schools and universities; and focused advertisement major pedestrian generators, on transit vehicles, at bus hub areas, and via social media.
  - Conduct high-visibility enforcement (HVE) for pedestrians and bicyclists to emphasize the importance of practicing safe walking and biking habits and voluntary compliance with traffic laws. Effective HVE campaigns run concurrently with media and outreach campaigns promoting the presence and purpose of law enforcement.
  - Promote use of bicycle helmets by partnering with CTST and other community safety stakeholders.
  - Incorporate “Share the Road” and other bicycle safety information in local driver and bicyclist education training programs.
- Aging Road Users
  - Conduct outreach and promote aging road user safety screening for families, community members, physicians, law enforcement, and emergency medical services (EMS) professionals to report at-risk drivers.
  - Promote/provide accessible and safe mobility options for older drivers.
  - Promote local CTST programs to assess and plan for older driver education, information outreach, and transportation needs.
  - Promote CTST-provided refresher skills course for aging road users including assessment of driving skills.
- Impaired Driving
  - Strengthen local enforcement participation in statewide high-visibility DUI enforcement saturations including sobriety checkpoints.
  - Promote BAC test “No Refusal” laws and consequences to elected officials as a key component of reducing impaired-driving-related fatalities and serious injuries.
  - Promote sobriety initiatives for DUI offenders (ignition interlock devices, 24/7 monitoring).
  - Support community programs for alternative transportation.

- Occupant Protection
  - Promote high-visibility seat belt enforcement campaigns including nighttime enforcement and focused communication outreach to low belt use populations.
  - Promote parent-young driver contracts for belt use with clear consequences when teens fail to do so.
  - Collaborate with local employers to develop/strengthen employee safe driving polices (such as requiring employees to take defensive driving training).

These countermeasures are feasible and effective in supplementing infrastructure efforts if implemented. The County has a unique opportunity for implementing these strategies while enhancing relationships with fellow stakeholders. Through the State Safety Office (SSO), FDOT offers funding opportunities to help implement behavioral safety strategies using subgrants to a variety of traffic safety partners, including county agencies, to develop, continue, and expand programs aimed at improving traffic safety. These funding opportunities are an option for developing strategies moving forward from the LRSP. Additional information on behavioral grants through SSO is available on FDOT's [State Safety Office website](#). In the 2016 Florida SHSP, Palm Beach County is included in subgrants for areas including motorcycle safety, occupant protection enforcement, pedestrian safety outreach, and speeding and aggressive driving enforcement and education. While these projects are not limited to County roads, the LRSP further supports leveraging these existing programs to address, in part, the behavioral safety issues in the County.

# Network Evaluation and Prioritization Process

Traditional methods of identifying locations on the system for safety investment are reactive, focusing only on prioritizing and programming safety investments at locations that historically demonstrate high levels or rates of crashes. However, project stakeholders indicated a primary objective of this LRSP was to move from the traditionally reactive approach to addressing severe and fatal injuries on County roadways to a more comprehensive and proactive approach. To meet this objective, the County applied the systemic method of safety analysis in developing this LRSP to better evaluate the County's system and determine the best locations for safety investment based on a combination of observations made at locations where crashes occur on the system and proactive evaluation of potential risk at all locations across the system based on those observations.

The systemic safety evaluation process uses the premise that a severe crash may be more likely to occur if certain risk factors (for example, geometric or traffic characteristics) exist at a given location, even if the location has a limited history of severe crashes. In such locations, using targeted improvements regardless of the presence or frequency of severe crashes can reduce the potential for a crash. The systemwide crash analysis and systemic safety assessment process involves identifying the risk factors (that is, roadway characteristics) commonly associated with each focus crash type and then identifying and prioritizing the potential locations across the system based on the presence of those factors. The potential of a site is determined by the number of risk factors present at that location. The greater the number of factors indicates a greater the potential for a future crash and higher relative priority.

While crash data were available to identify emphasis areas and location types where the most severe crashes occur, and to identify appropriate safety strategies to address those crashes, complete roadway inventory data were not available from which to identify the risk factors at every location where crashes occurred. Rather than collect all necessary data to complete a systemwide evaluation of the focus facilities, which would have required significant time and resources, a modified approach applied the process to a subset of the system, signalized intersections. Data were collected for 133 random signalized intersections and the process of network evaluation and prioritization was completed for this subset and included within this LRSP.

Randomizing the selection allowed for a comparison of potential risk factors across representative sites with a range of crash histories. The County selected collected roadway attribute data at each location to provide a sample roadway inventory for evaluating data elements as risk factors. In certain cases, one focus facility addressed multiple focus crash types. This was the case with urban signalized intersections, which served as the focus facility for multi-vehicle intersection crashes and pedestrian and bicyclist crashes. This sample site evaluation allowed for an understanding of how roadway elements at intersections relate to severe crashes in the County without the need to develop a full roadway inventory. For multi-vehicle and pedestrian and bicycle crashes, the modified systemic evaluation process yielded 11 and 12 infrastructure risk factors, respectively, as listed in Table 5-1.

The rest of the evaluation followed the systemic method, which involves screening the focus facility network from which the risk factors were identified for locations that have the identified risk factors and then developing a risk score based on the number of risk factors present at each individual site. These scores are then used to develop a site ranking prioritization and the risk factors can be used to create project development selection trees to guide selection of the countermeasures for each location. Projects are then identified for these locations that implement the recommended countermeasures.

**Table 5-1. Risk Factors at Signalized Intersections with Severe Multi-Vehicle and Pedestrian & Bicyclist Crashes**

<b>Risk Factors</b>	<b>Multi-vehicle</b>	<b>Pedestrian &amp; Bicyclist</b>
Signal Indicators	Not Present for Every Lane	Not Present for Every Lane
Functional Class	Arterial	Arterial
Number of Approaches	4 or 5	4 or 5
Roadway Division	Divided	Divided
Double Left-turn Lane	Present	Present
Major App. Cross Section	6-Lane or greater	6-Lane or greater
Adjacent Land Use	Suburban Commercial	Suburban Commercial
Total Entering Vehicles	>30,000	>30,000
Adjacent Bus Stop	Present	Present
Speed Limit Cross Product	>1,400	>1,600
Max. Lanes to Cross	6 lanes or greater	6 lanes or greater
Right Turn on Red <sup>a</sup>	N/A	Permitted, All Legs

<sup>a</sup> Right Turn on Red was only found to be a significant factor for Pedestrian & Bicyclist crashes.

Note:

N/A = not applicable

The modified systemic evaluation method allowed for prioritization and ranking of 133 of the randomly selected intersection sample sites. Figures 5-1 and 5-2 illustrate the results of the intersection risk rating and prioritization exercise for the sample set of intersections by risk factors identified for multi-vehicle and pedestrian-bicycle crashes, respectively. Intersections exhibiting the most risk factors were the higher priority. For a detailed list of the sites and the results of the prioritization process, refer to Appendix C. Risk factors identified during this process formed the basis of the project development decision trees that the County can use to guide the application of the infrastructure countermeasures for signalized urban/suburban intersections developed in Chapter 4.3.1. Chapter 6 discusses the project development decision trees developed for Palm Beach County and the approach to applying the information in the trees to identify projects.

The traditional systemic process was modified for use in Palm Beach County and to complete development of the Palm Beach County LRSP. Because data were only available for a subset of the County roadway system (approximately 133 urban/suburban signalized intersections), the application of the network evaluation and prioritization step across the entire county roadway network was not feasible and was limited to the subset. However, the evaluation, ranking, and prioritization of projects within the subset can be used as an example to illustrate the process. The County can then apply this process in a similar fashion to other components of its system using this LRSP and example as guidance as more data become available.

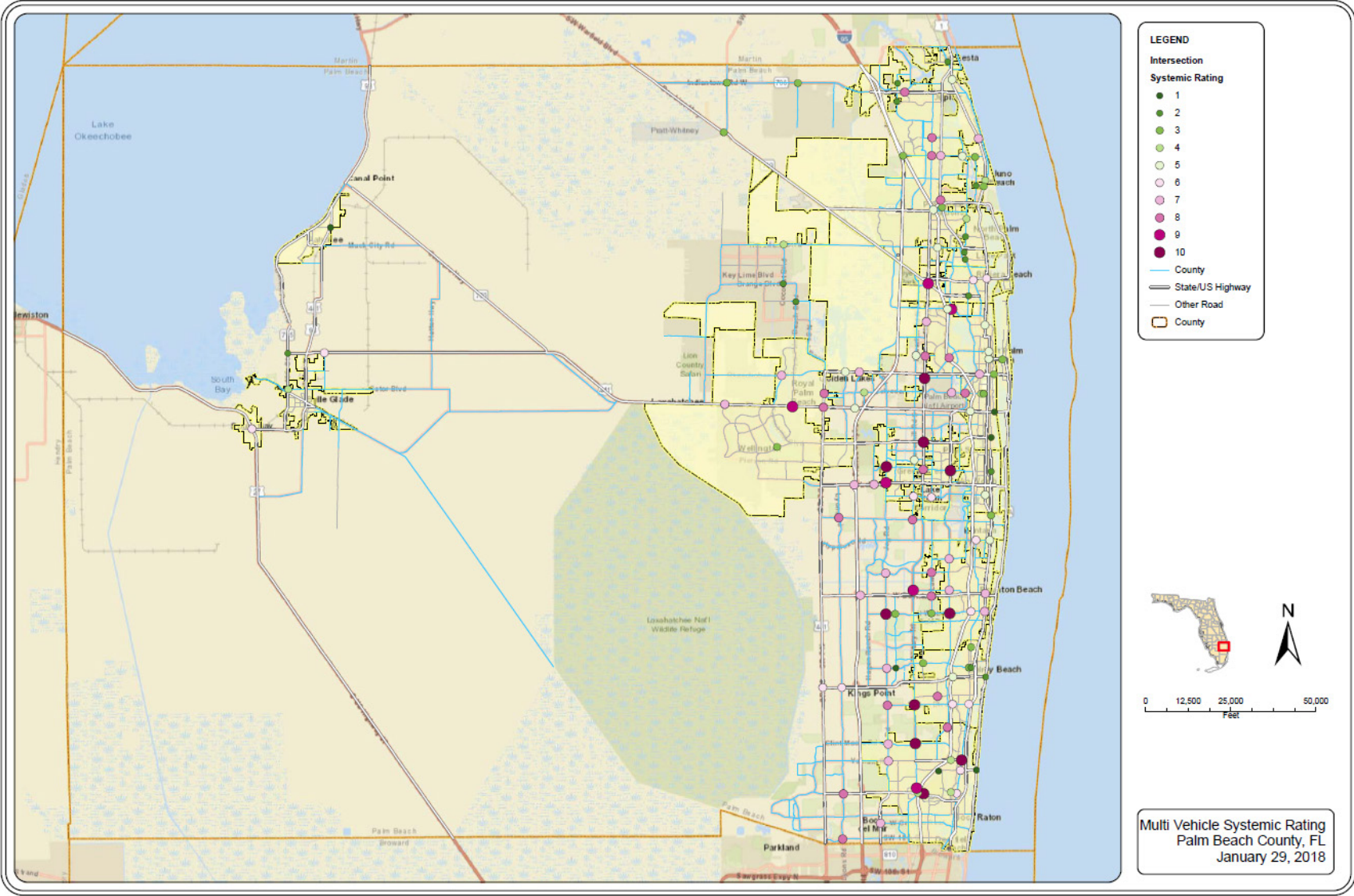


Figure 5-1. Multi-Vehicle Crash Risk Rating for Palm Beach County Intersection Sample Set  
Source: FDOT (2016)



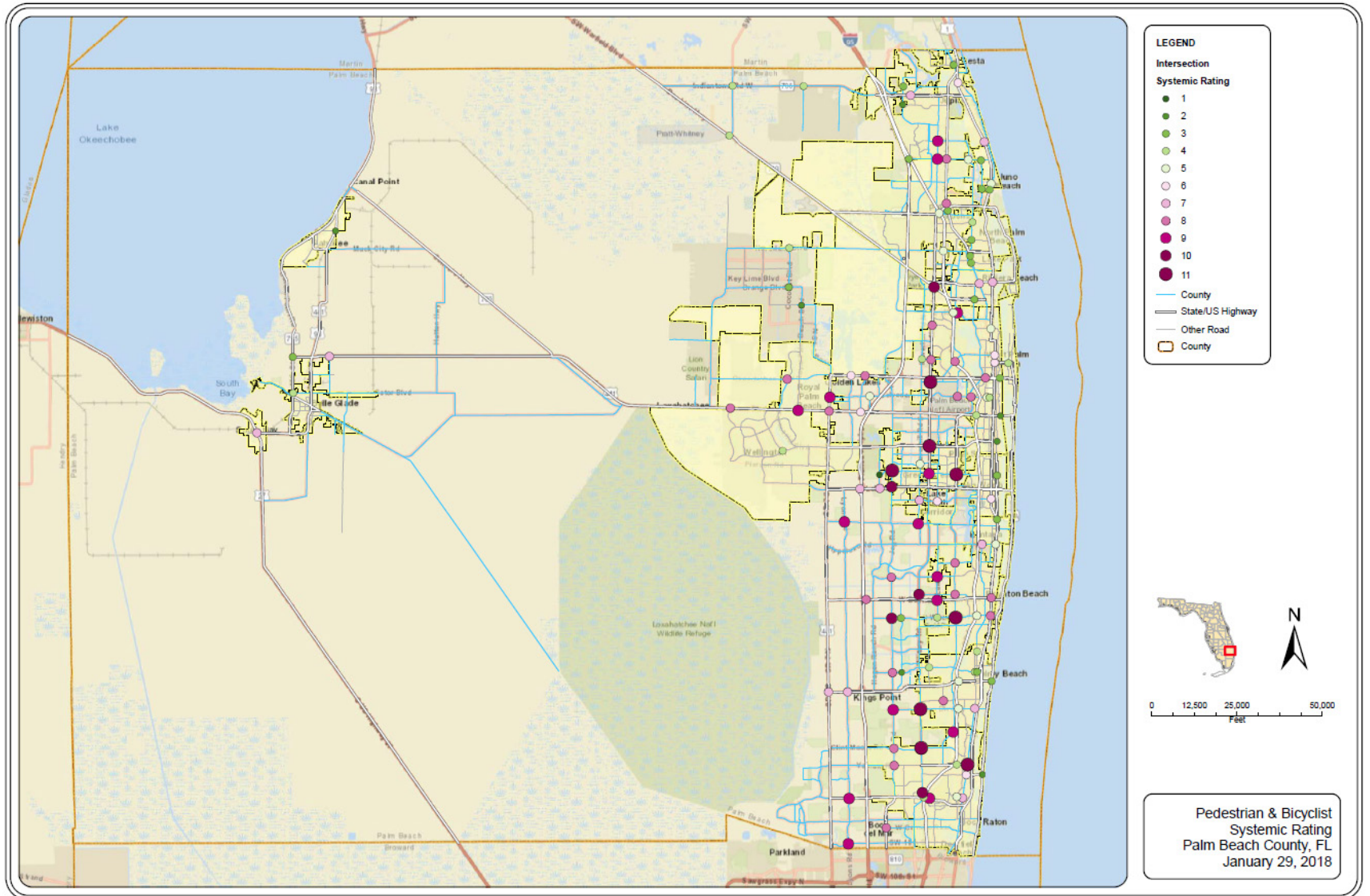


Figure 5-2. Pedestrian-Bicycle Crash Risk Rating for Palm Beach County Intersection Sample Set

Source: FDOT (2016)

# Project Identification and Development

The Strategic Goal of the LRSP is to reduce fatalities and serious injuries on County roadways through implementation of **safety strategies targeted toward addressing ongoing and emerging roadway safety issues in Palm Beach County**. The key to addressing severe crashes along Palm Beach County's system is to widely deploy highly effective strategies at prioritized (that is, higher ranked) locations (see Appendix C). Therefore, a primary product of this safety planning involves identifying and prioritizing safety projects and programs. These projects and programs consist of individual or combinations of the identified emphasis area safety strategies to be proactively deployed at the prioritized locations along the County's road system.

## 6.1 Infrastructure Projects

When developing a program based on a systemic safety review, a high emphasis is placed on the consistency of projects for locations with similar roadway and traffic characteristics. However, a single strategy may not apply to all locations because of variations in such features as traffic volume, cross section, and adjacent land use. Project development decision trees help guide safety analysts in identifying appropriate strategies for implementation based on site characteristics. The project development decision trees begin with identifying basic roadway features, accounting for the features present at specific locations, and pointing toward a specific strategy/countermeasure. Project development decision trees were developed for each of the focus facility types and are included in Appendix D.

The project development decision trees can be used like flow charts and applied at each prioritized location. The answer to a question provides the direction for the next question to be applied to/considered for the given location. The project development decision trees guide the identification and application of potential strategies once the flowchart has been fully executed and all questions answered based on engineering experience. The following sections describe the decisions trees and the process of applying each to the identified facility type during project development.

### 6.1.1 Urban/Suburban Intersections

The approach to safety project development for urban/suburban County intersections (see Figure 6-1 and Appendix C) focused on improving the visibility of intersections, improving driver awareness and compliance with traffic control, reducing the severity and frequency of intersection conflicts, and improving access management near signalized intersections. Additional considerations for bicycle and pedestrians included increasing the visibility of bicyclists and pedestrian, reducing their exposure to vehicular traffic, and developing and promoting multimodal accessibility. Recommendations included:

- Signal hardware, timing, and phasing improvements and optimization
- Improving the visibility of pavement markings, signals, and signs
- Geometric improvements to turn lanes and turn lane channelization
- Consideration of alternative intersection designs such as roundabouts, displaced left-turns, or Echelon Interchange
- Restricting access to properties using driveway closures
- Restricting cross-median access near intersection with medians or barriers
- Improving pedestrian facilities (signal timing, sidewalks, pedestrian islands, crosswalks)
- Improving bicycle facilities (signing and pavement markings, signal indications, bike lanes)

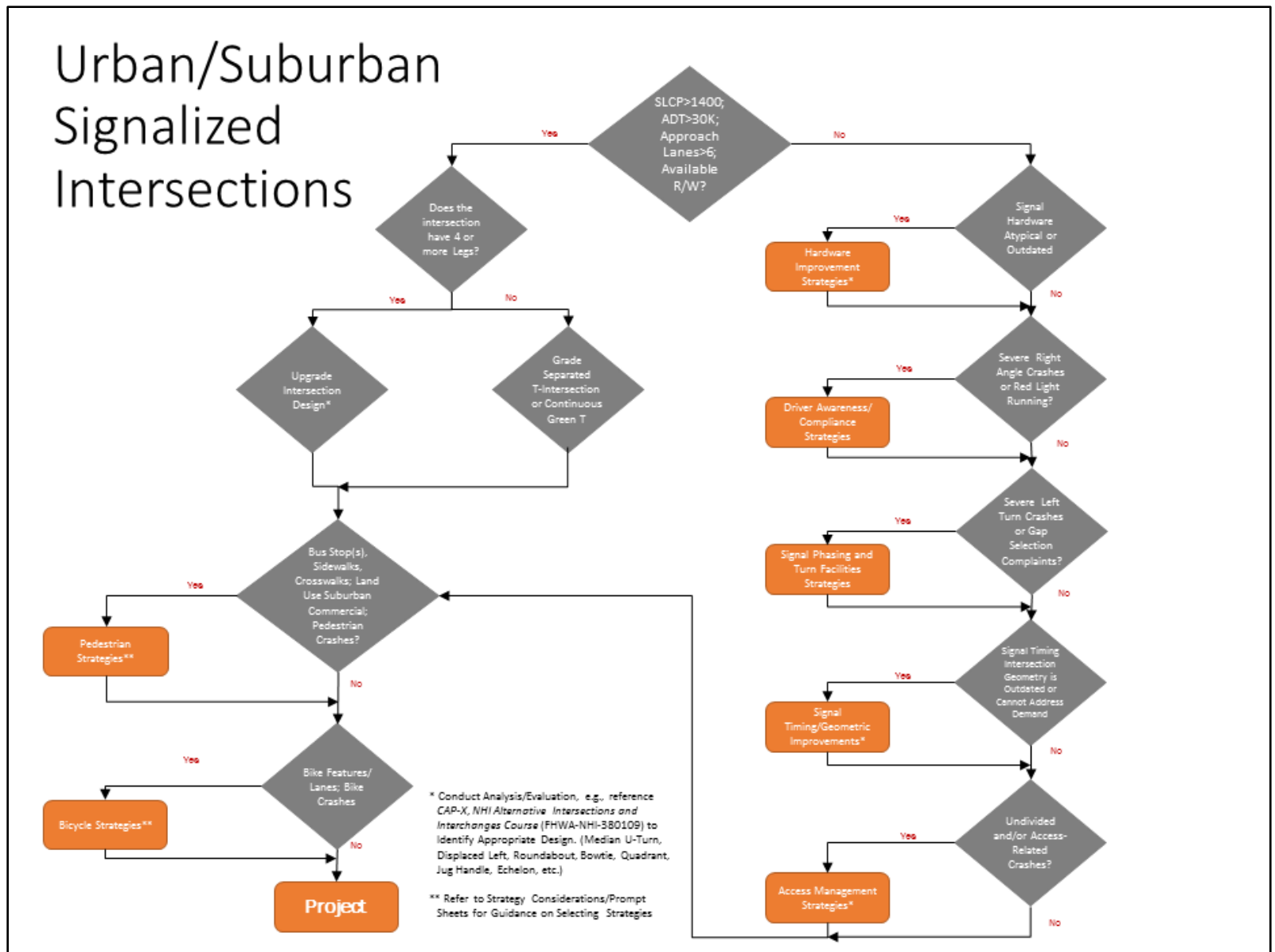


Figure 6-1. Urban/Suburban Signalized Intersections Project Development Decision Tree

To support identification of projects for urban/suburban intersections, additional prompt lists containing strategy considerations for the various strategy categories help guide assignment of an appropriate individual strategy or multiple strategies to potential project locations. Appendix D includes these additional resources.

### 6.1.2 Urban/Suburban Segments

The approach to countermeasure identification and safety project development for urban/suburban County segments (see Figure 6-2) focused on access management for divided and undivided roadways and road diets to achieve systemic improvement addressing safety for all road users. A list of potential countermeasures for implementation on urban/suburban segments was identified from the feedback received from stakeholders during the March 2017 workshop and from FHWA resources documenting known proven countermeasures for common crash issues on urban/suburban segments.

Recommendations included:

- Closing/consolidating driveways
- Restricting turning movements
- Location-specific traffic barriers to redirect traffic within sections of a segment (bollards, concrete median barrier)
- Conversion of undivided section to a divided section by adding a median or median barrier
- Improving the visibility of pavement markings, signals, and signs
- Road diets to reallocate the travel and/or effective width of the road; potential configurations included 4-lane to 3-lane, 6-lane to 5-lane, 2-lane to 3-lane through removal of parking lanes, and reallocation of through lanes to create bus lanes

Similar to urban/suburban intersections, project decision trees and additional prompt lists containing strategy considerations for urban/suburban segments for the various strategies categories can help guide assignment of an appropriate individual strategy or multiple strategies to potential project locations. The County can use these for identifying countermeasures to address crash patterns at urban/suburban segment locations with known safety issues within the County and then also as systemic analysis is completed for the urban/suburban segment components of the County system. Appendix D includes these additional resources.

### 6.1.3 Rural Intersections and Segments

Much of the County system is urban/suburban in design and classification, so the adopted strategies and recommendations of the LRSP focus heavily on urban/suburban countermeasures and project opportunities. However, to support project identification and development to address fatal and severe crashes on the rural component of the County system, project development decision trees can also guide the identification of appropriate strategies for implementation for the rural intersection and segments (see Figures 6-3 and 6-4). The rural project development decision trees include information to guide selection of appropriate countermeasures in lieu of prompt lists, which apply to only the higher complexity urban/suburban system. Similar to urban/suburban segments, potential countermeasures for implementation at rural intersections segments were identified from the feedback received from stakeholders during the March 2017 workshop and from FHWA resources documenting known proven countermeasures for common crash issues on rural intersections and segments. The County can use these for identifying countermeasures to address crash patterns at rural intersection and segment locations with known safety issues within the County and then also as systemic analysis is completed for the rural intersection and segment components of the County system.

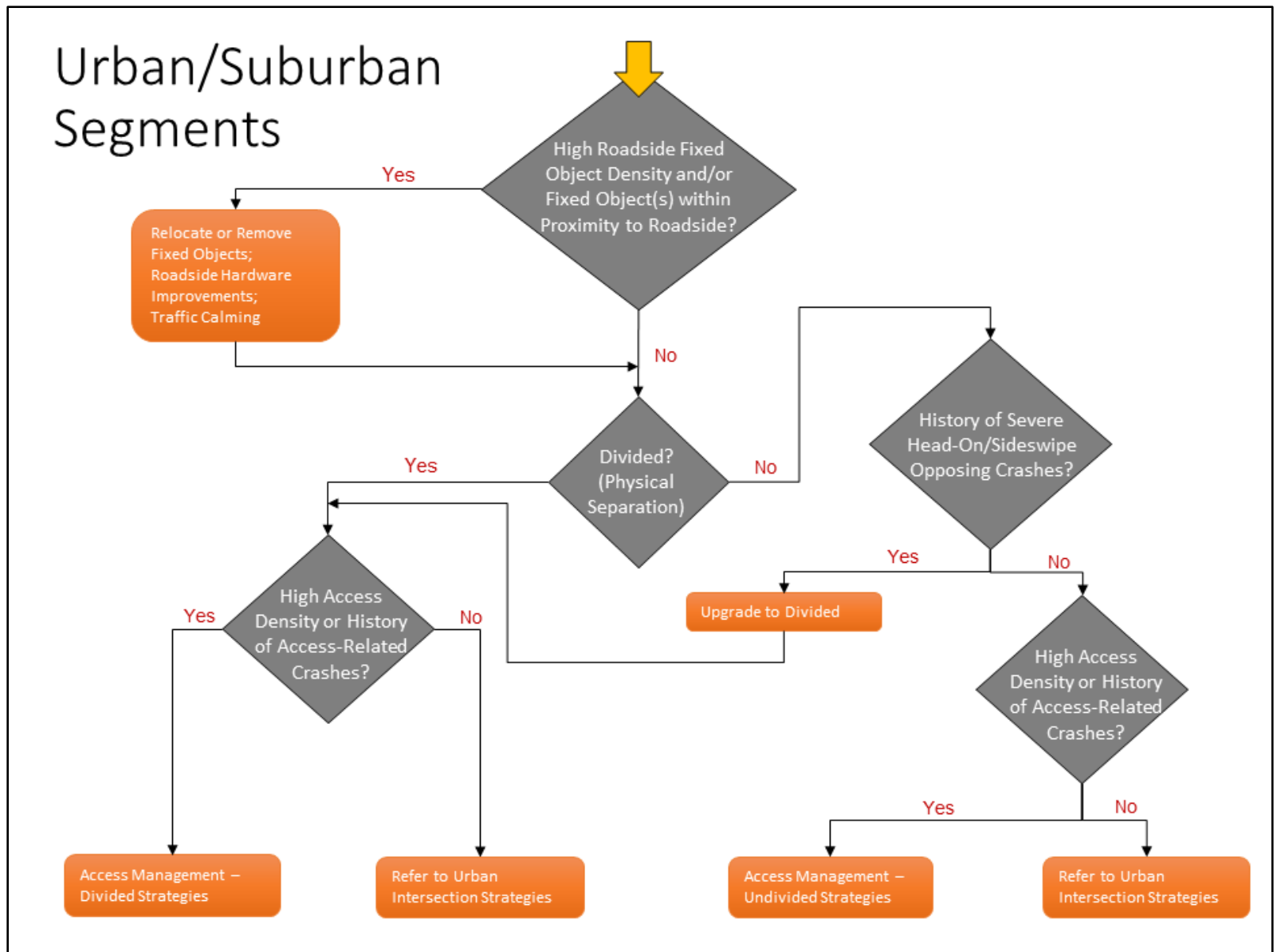


Figure 6-2. Urban/Suburban Segments Project Development Decision Tree

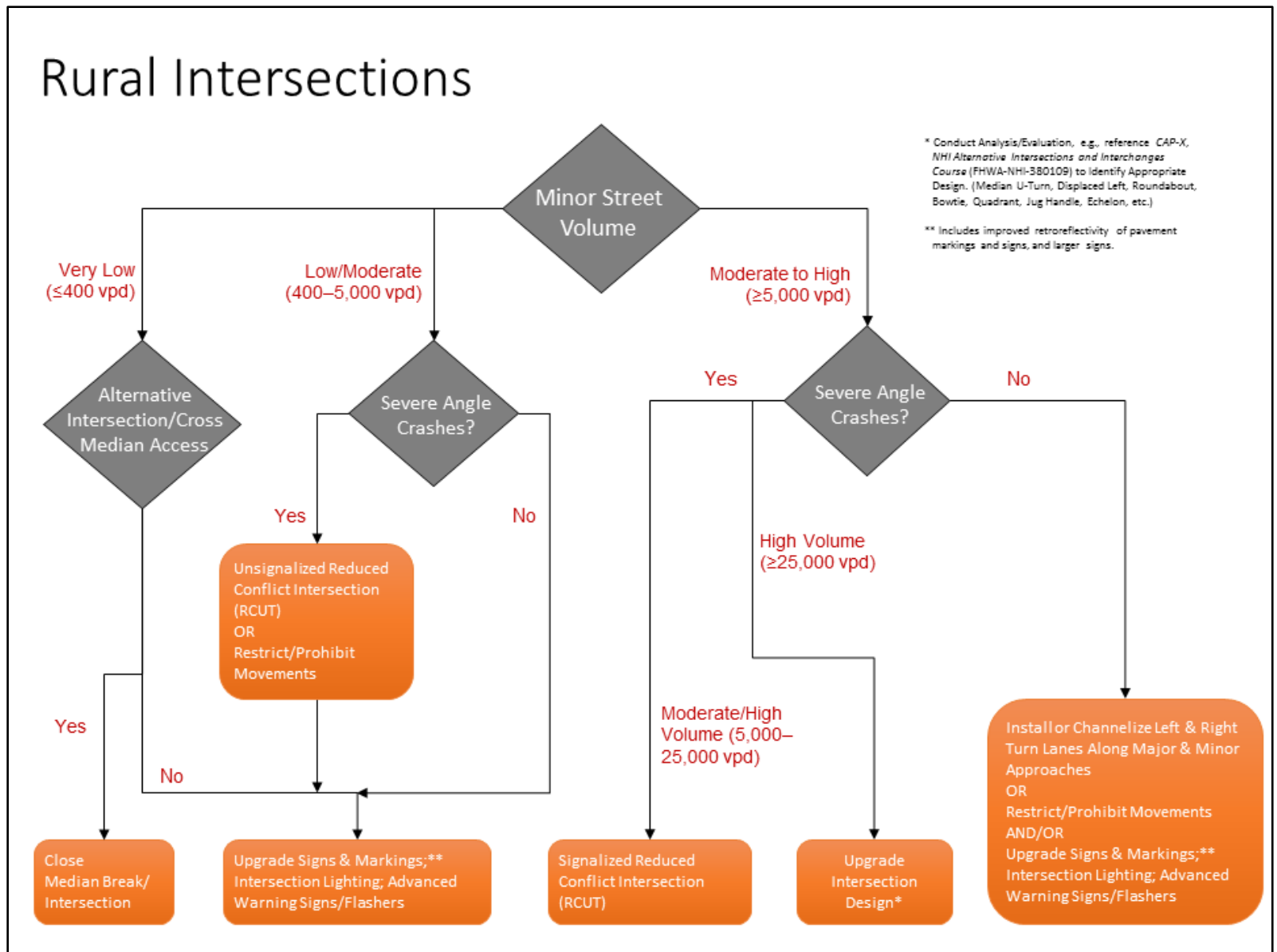


Figure 6-3. Rural Intersections Project Development Decision Tree

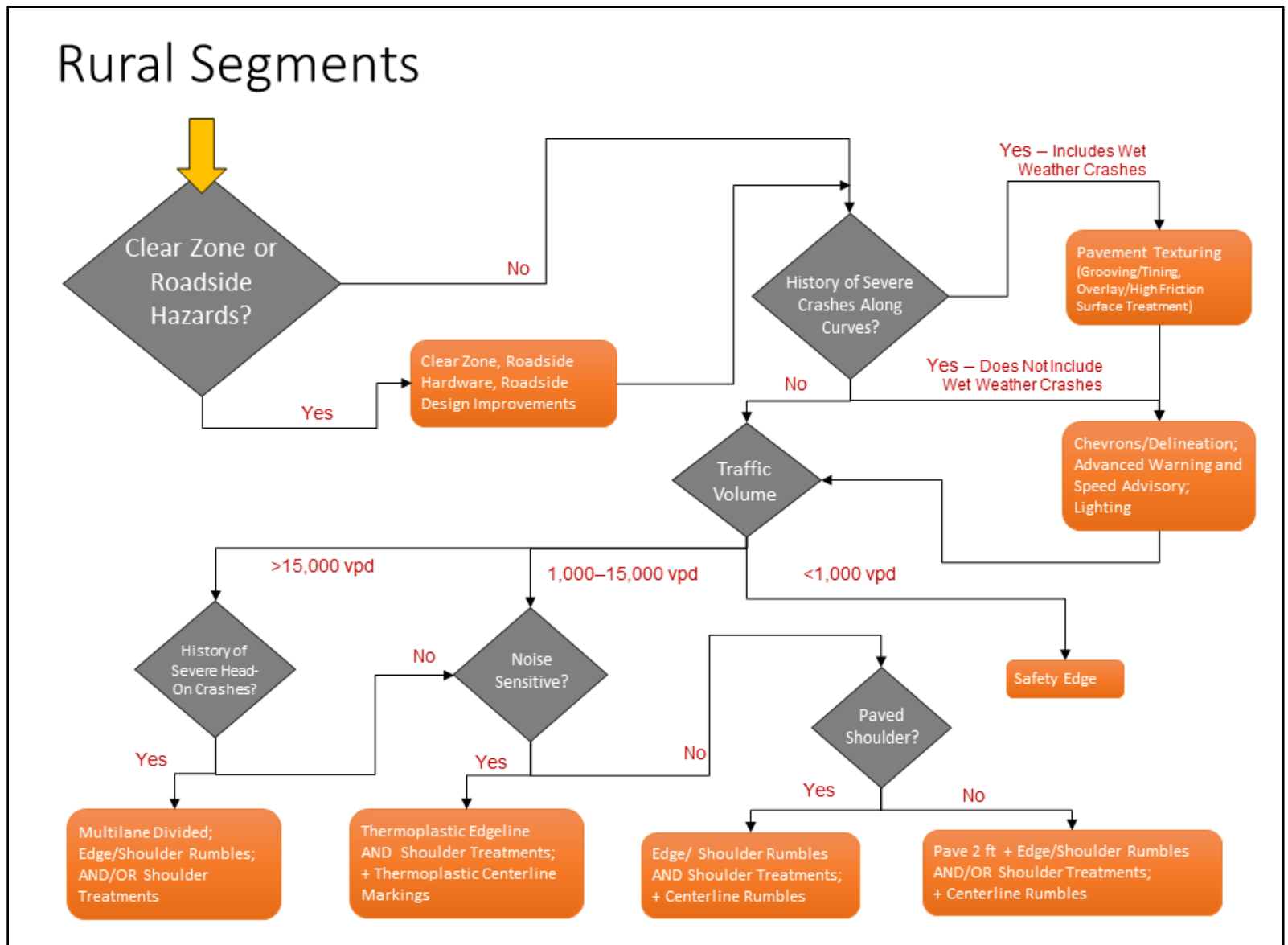


Figure 6-4. Rural Segments Project Development Decision Tree

## 6.2 Behavioral Programs

As illustrated on Figure 4-1, human factors contribute to approximately 93 percent of all crashes and are considered the primary contributing factor for approximately 57 percent of all crashes (FHWA, 1995). The greatest potential to improve safety is through a comprehensive approach that includes the four E's of safety: enforcement, education, emergency response, and engineering. Therefore, an LRSP would be incomplete if it did not include behavioral strategies to address road user behavior that results in crashes.

The County identified several behavioral strategies that can be developed into County programs in addition to existing ongoing programs from other stakeholders that can be leveraged to address the LRSP emphasis areas. Table 6-1 summarizes the proposed programs, estimated relative cost, and implementation timeframe. More detail on the proposed programs are noted below.

Table 6-1. Planning-Level Timeframes and Costs of Behavioral Countermeasures in Palm Beach County

Project	Emphasis Area(s)	Implementation Timeframe <sup>a</sup>	Cost <sup>b</sup>
Public Awareness Media Campaign	Distracted Unrestrained Impaired Aging	Short–Intermediate	Low–Moderate
High Visibility Enforcement (HVE)	Bicycle and Pedestrian Distracted Unrestrained Impaired	Intermediate	Moderate
Provide Bicycle Helmets	Pedestrians and Bicyclists	Short	Low
Child Restraint Inspections	Unrestrained	Short	Low
Older Driver Safety Screening Outreach	Older Drivers	Intermediate	Moderate
Promote Alternative Transportation for Older Drivers	Older Drivers	Short	Low
Saved by the Belt Testimonies	Unrestrained	Short	Low

<sup>a</sup> Timeframes: Short is <1 year; intermediate is ≥1 year to <5 years,

<sup>b</sup> Costs generally coincide with timeframe and assume the shorter the implementation timeframe the lower the costs. Cost categories are consistent with NHTSA's *Countermeasures that Work* (NHTSA, 2017) where low cost refers to projects that can be implemented with current staff, perhaps with training; limited costs for equipment, facilities, and publicity. Medium cost refers to projects that require some additional staff time, equipment, facilities, and/or publicity.

The first step in development of behavioral programs will involve coordination with the Florida Department of Transportation (through community traffic safety team), the SSO, the Florida Department of Highway Safety and Motor Vehicles (FDHSMV), law enforcement, and other stakeholders. Additional information regarding the implementation of these programs at the local level are included in the subsection below. The County will continue to work with FDOT, FDHSMV, and other stakeholders to identify opportunities for behavior outreach and education strategies and to develop additional behavioral-based programs for reducing fatal and severe injury crashes in the areas of roadway departure, intersection, older driver, seat belt usage, and distracted driving. Future LRSP updates may consider additional strategies in these areas.



### 6.2.1 Aging Driver Programs

Outreach efforts can assist drivers and family members in the following (NHTSA, 2017):

- understanding how aging affects driving
- understanding the effects of medications and health conditions
- how to assess an older driver's skills
- how to use specialized vehicle equipment to adapt to certain physical limitations
- how to guide older drivers into voluntarily restricting their driving
- how to report older drivers to the Department of Motor Vehicles, if necessary

The Florida Senior Mobility for Life Program and Coalition provides access to free information and available resources for aging residents of Florida, their families, healthcare providers, and law enforcement officers. [FDOT's Safe Mobility website](#) provides additional information and resources. The County can partner with these and other agencies to develop a plan for increasing outreach and education to older drivers, their families, law enforcement, physicians, and EMS professionals regarding older driver safety screening and identifying and reporting at-risk drivers.

- **Alternative Transportation for Older Drivers.** The Palm Beach County transit agency, Palm Tran, offers discounted rides to seniors through their "Seniors in Motion" program. This existing program serving Palm Beach County can be promoted as accessible and safe mobility options for seniors. The County's [Seniors in Motion website](#) provides more information on the program.
- **Safe Mobility for Life Program and Coalition Events.** In addition to the extensive resources and guidance for aging road users, the Safe Mobility for Life (SMFL) Program and Coalition hosts an extensive events page including events occurring in Palm Beach County. Some of the events included are safe driving courses/ refresher courses occurring in the County. These events take place at various venues throughout the year and are often supported by reputable aging road user advocates like AARP. [FDOT's Safe Mobility website](#) provides additional information on SMFL events.

### 6.2.2 Occupant Protection

- **Promoting Saved by the Belt Testimonies.** The Florida Saved by the Belt Program recognizes persons whose lives were saved, or who were spared serious injury, because of their use of seat belts. Enforcement officers involved in investigating traffic crashes or targeted enforcement activities can recommend candidates for the award. The [FDHSMV website](#) provides additional information on this focused public outreach and encouragement initiative.

This same program can be adopted by local law enforcement officials in Palm Beach County. Implementation of this program in the County would involve education for local law enforcement on the program and could be completed in conjunction with targeted HVE activities.

- **Child Restraint Inspections.** Safe Kids Palm Beach County offers a variety of educational and outreach materials aimed at decreasing preventable injuries in children from 0 to 19. In addition to educational materials for child pedestrian and bicycle safety, they also offer 21 child protection seat inspection stations through the county. The [Safe Kids website](#) provides additional information on the coalition and inspection locations, dates, and times.

### 6.2.3 Pedestrian and Bicycle Safety

- **Alert Today Alive Tomorrow.** Florida's Pedestrian and Bicycle Focused Initiative provides digital media and other resources that the County can use to promote awareness of pedestrian and bicycle

safety. Palm Beach County is one of Florida's Pedestrian and Bicycle Focused Initiative top 25 Priority Counties. The [Alert Today Florida website](#) provides additional information on the initiative.

- **Bicycle Helmet Program.** Florida's Pedestrian and Bicycling Safety Resource Center offers a multitude of resources and safety materials to their community partners. In addition to outreach and tangible items (for example, bicycle lights, reflective/lighted armbands, print materials.), the center offers free bicycle helmets available for community partners. The program requires helmet fitter training completion as well as a public awareness materials plan. [Florida's Pedestrian & Bicycling Safety Resource Center website](#) provides additional information on the bike helmet program and other resources.

#### 6.2.4 Public Awareness and High Visibility Enforcement Programs

FDOT and FDHSMV currently partner with local agencies on public awareness and law enforcement programs including:

- **Traffic Safety Subgrants.** SSO administers federally funded traffic safety subgrants to traffic safety partners that undertake priority area programs and activities to improve traffic safety and reduce crashes. Subgrants are awarded to a wide variety of local agencies that serve a city/county ranked in the top 25 percent of its population group for the priority area for which funds are requested. Subgrants can serve many purposes including educational programs, traffic safety material support, and high visibility enforcement. Subgrant requests are accepted on a yearly basis through concept papers submitted to SSO. [FDOT's State Safety Office website](#) provides additional information on concept paper and subgrant requirements.
- **Educational/Outreach Materials and Media Campaign Kits.** FDHSMV partnered with NHTSA to develop media plan templates to educate the public on the dangers of distracted driving, drunk and drugged driving, not wearing a seat belt, teen driving, and drowsy driving in addition to information on several national and state campaign efforts. The kits target specific priority crashes (for example, drunk driving, distracted driving, unbelted) and can be used by the agency to develop a plan for implementing high-visibility local campaigns that then coincide with larger scheduled initiatives that are implemented statewide across multiple agencies and jurisdictions. These kits contain social and traditional media templates, statistics, and guidance for implementing various campaign messages. Additional information on the available media plans and scheduled statewide traffic safety initiatives and campaigns can be found on the following sites:
  - [FDHSMV Driving Safety webpage](#)
  - [Alert Today Florida website](#)
  - [FDHSMV Campaign Calendar webpage](#)
- **High-Visibility Enforcement.** Through the partnerships developed by FDHSMV and FDOT, there are significant resources available for conducting targeted high visibility enforcement throughout the state. The Florida Law Enforcement Liaison (LEL) program is an FDOT and NHTSA funded effort targeted at local law enforcement agencies to increase awareness and participation in traffic safety law enforcement activities. The District 4 LEL works with the local agencies in five counties (including Palm Beach County) to facilitate and disseminate traffic safety information. The [Florida LEL Program Resource website](#) provides additional information and resources. The FDHSMV also conducts collaborative targeted traffic safety enforcement efforts throughout the state through the Arrive Alive program. Arrive Alive efforts focus enforcement, education, and engineering efforts in data defined "hot spots". [FDHSMV's Arrive Alive webpage](#) provides additional information on the Arrive Alive program. The [International Association of Chiefs of Police website](#) provides additional resources for conducting HVE. Florida's Pedestrian and Bicycle Safety Initiative, Alert Today Arrive

Tomorrow, has developed guidance and training materials for conducting bicycle and pedestrian high visibility enforcement. The materials are available on the [Alert Today Florida website](#).

The County will be able to access these programs and resources during implementation of public awareness and HVE programs.

### 6.3 Project/Program Development and Prioritization for Implementation

The County can use the project development decision trees and prompt lists developed for the County facilities to identify safety projects for intersection and segment locations on its system where reduction in fatalities and severe injuries has been identified as a need, either through traditional hot spot or systemic safety analysis. Cost information summarized for each countermeasure can then be used to estimate the costs of each project, or program of projects. However, because a complete systemwide review and systemic evaluation could not be performed for the County roadways, identifying and prioritizing locations with the greatest overall potential risk for crashes was not possible. The process and prioritization of locations for implementing safety strategies was limited to a sample set of the system—urban/suburban intersections—because of limited available roadway data. Similarly, the development of project recommendations for the prioritized locations per the systemic project selection process was not possible.

However, to facilitate future development of the plan and application of the processes described herein, Appendix E includes an example of how to identify countermeasures using the decision and prompt lists, applied to several locations within the sample intersection locations. The County can refer to these examples when developing projects for sites included in the sample set or for similar site types and as guidance for developing project for future projects additional data become available and analysis of the County System is expanded to include additional components.

# Plan Implementation, Monitoring, and Evaluation

The success of this LRSP requires coordinated implementation and continued collaboration. While this LRSP was developed based on input from stakeholders, the priority emphasis areas for the County and the resulting recommended strategies and programs to address fatalities and serious injuries on the County roadway system align with emphasis areas and strategies developed in the Florida SHSP for the statewide system. While the site-specific infrastructure strategies focus on engineering improvements, this LRSP also describes complementary education and enforcement programs for implementation within the County. These programs present tailored approaches to achieve the greatest reductions in fatalities and serious injuries when implemented in conjunction with the recommended infrastructure strategies.

## 7.1 Project Development and Implementation

This LRSP provides strategies defined through infrastructure countermeasure and behavioral program recommendations that can be implemented by the County. Project development decisions will be made by County staff based on consideration of economic, social, and political issues, and in coordination with other projects already in the County's Capital Improvement Program. The County will continue to coordinate with FDOT and appropriate safety stakeholders regarding the recommendations of this LRSP, including pursuing any strategy or program implementation associated with locations within multiple jurisdictions.

Completing this LRSP is a necessary first step in the process of saving lives, but does not actually achieve the crash reduction goal. The real work of moving toward zero traffic-related fatalities and serious and moderate injuries involves safety project implementation. Therefore, Palm Beach County should strive to continue the project identification and development process summarized within this LRSP. Initially, projects at the prioritized locations identified within the sample set can be investigated for potential funding through FDOT. Additionally, the County can apply the project development decision trees at locations with existing crash history and then also at additional locations identified through the systemic process as data are collected and additional systemic analysis is performed for additional components of the County system.

## 7.2 Monitoring and Evaluation

Monitoring and evaluation is a continuous process that is critical to LRSP success. Monitoring and evaluation enables the County to make informed strategy revisions and updates, allocate resources effectively, and achieve and adjust LRSP goals and objectives.

Any countermeasure and strategy installed or implemented should consider project and program effectiveness. In addition to understanding the impact of infrastructure treatments, the effectiveness of behavioral program implemented should be considered. While it may be challenging to draw distinct fatal and serious injury performance metrics conclusions, validation of program efforts will be necessary to continue to reduce fatalities and serious injuries.

The most important measures of tracking the progress and success of the LRSP will be the calculated reduction in fatal and serious injury crashes on County roads, measured for all crash types and by emphasis area. While typically a minimum of 3 to 5 years of crash data, collected after a project is completed, are necessary to evaluate the impacts of improvements, the low density of crashes on the

County system makes it likely that it will take longer for sufficient crash data to be available with which to evaluate the County system. Therefore, the County may need to set additional indicators by emphasis area or strategy to track implementation and relative effectiveness of the countermeasures and projects proposed in this LRSP. These indicators will provide information on the status and impact of specific strategies inform decision-making for LRSP updates and strategy revisions.

Until the outcome-based measures are available (that is, percent reduction in fatal and serious injury crashes overall and by emphasis area), the County can evaluate additional indicators by emphasis area and strategy to track implementation of the countermeasures and projects proposed in this LRSP. These measures focus on the output of the LRSP. Specifically, these output-based performance measures will measure 1) the implementation of the individual safety strategies identified under each emphasis area and 2) the quantity and cost of the implementation of the proposed projects to which these strategies have been associated. Strategies can be evaluated by units of implementation as defined for each strategy and shown in Tables 4-1 and 4-2. In addition to documenting the implementation of infrastructure improvements, the County should document progress toward incorporating more behavioral programs.

### 7.3 LRSP Updates

While it may be initially challenging to obtain distinct fatal and serious injury performance metrics for evaluating this LRSP, the additional performance measures focused on the status and progress of the implementation of strategies and projects will permit evaluation until crash-based metrics can be calculated. Annual progress can be monitored by emphasis area and information gleaned from the evaluation process incorporated into the LRSP updates. The LRSP will be revisited annually with progress updates by emphasis area to document the progress of strategy and program implementation.

# Summary

## 8.1 LRSP Development

The County developed this LRSP through outreach efforts to a broad range of safety stakeholders. Stakeholders reviewed crash data analysis that included 4 years of fatality and severe injury crashes. Based on the conclusions of the analysis, stakeholders selected the six safety emphasis areas with the greatest opportunity for improvement and identified preferred infrastructure countermeasures and behavioral programs targeted at reducing fatal and severe injury crashes on Palm Beach County Roadways.

Identifying and prioritizing project locations at which to apply the preferred strategies using the proactive systemic safety process typically requires a systemwide review of the roadway attributes of the focus facilities to identify the risk factors at locations where crashes occur. In lieu of collecting data for all identified focus facilities, the County implemented a modified approach to complete this LRSP, and performed a systemic evaluation of a priority focus facility including identification of risk factors associated with priority crash types for the focus facility using a subset of data. These risk factors helped the County identify and prioritize locations within the sample set for implementing the recommended strategies. Finally, the project development trees helped guide the identification of strategies that can be combined into specific location projects. An example of developing projects from these strategies using project development trees has also been included within this LRSP.

## 8.2 Project and Program Recommendations

The data-driven process produced a list of 44 infrastructure strategies that can be applied across the County's system on multiple focus facility types to address fatal and severe crashes. The County's LRSP also includes project development decision trees to guide identification of the strategies at the prioritized locations for further project development. While the primary focus of the future project recommendations from the LRSP will likely be infrastructure-related, Palm Beach County will continue to work with FDOT and other stakeholders to identify opportunities to expand upon the behavior outreach and education strategies in the areas of older drivers, seat belt usage, and distracted driving. LRSP updates may consider additional strategies in these areas incorporating complementary behavioral-based projects and programs.

## 8.3 LRSP Implementation

Completing this LRSP is a necessary first step in improving safety on the County network. However, this LRSP does not actually achieve the crash reduction goal. The real work of moving toward zero traffic-related fatalities and reducing traffic-related injuries involves development and implementation of specific safety projects. The first step in implementation of this LRSP will be for the County to use the recommendations from the evaluation of the intersection sample set to identify and define additional project opportunities within the sample set, and from locations with other similar attributes throughout other parts of the County system.

The implementation of the 44 infrastructure strategies for implementation across all focus facilities types can be guided by the project development trees. However, as more data become available for the County system, the same process demonstrated through the intersection example (Appendix C) can be applied to screen for and identify sites with the risk factors associated with additional focus facilities.

Palm Beach County staff will coordinate with FDOT staff to discuss procedures for submitting safety projects for approval and funding.

## 8.4 Next Steps and Action Items

Palm Beach County Engineering and Public Works has taken the initial steps in proactively working to reduce fatal and serious injury traffic crashes on their roadway network. Table 8-1 lists action items that will ensure that this living document generates meaningful safety projects and adapts to improvements in data and safety strategies.

Table 8-1. Palm Beach County LRSP Action Items

Action Step No.	Activity	Objective	Target	Timeframe	Status
<b>1</b>	<b>Conduct "Project Development Tree" analyses</b>				
1a	Conduct urban/suburban signalized intersection project development analysis.	Develop potential projects for 10 urban/suburban intersections.	10 Sites	near term	
1b	Conduct urban/suburban segments project development analysis.	Develop potential projects for 2 urban/suburban segments.	2 Sites	near term	
1c	Conduct rural segment project development analysis.	Develop projects for 2 rural segments.	2 Sites	near term	
1d	Conduct rural intersection project development analysis.	Develop projects for 2 rural intersection.	1 Sites	near term	
<b>2</b>	<b>Engage additional LRSP stakeholders</b>				
2a	Attend monthly District 4 Florida Law Enforcement Liaison program meeting.	Engage stakeholders capable of implementing and influencing behavioral aspects of the LRSP.	Minimum 1 staff member in attendance	ongoing	
2b	Engage Community Traffic Safety Team liaison in specific follow-up meeting on plans for the LRSP.	Develop initial contact with FDOT through CTST, who will be a continued partner in implementation of the LRSP.	1 Meeting	near term (ideally in the next 6 months)	
2c	Present LRSP to Community Traffic Safety Team.	Engage entire CTST and inform them of the vision, mission, goals, and objectives of the LRSP.	1 Meeting	near term	
2d	Meet with FDOT to discuss funding opportunities and the process to follow to obtain Highway Safety Program funds.	Learn process for obtaining funding for projected developed under Action Step 1.	1 Meeting	near term	
<b>3</b>	<b>Develop and enhance roadway data inventory - Once data are identified, collected, and available for use, the project development process can be conducted for all sites falling into one of the four facility types (urban/suburban signalized intersections, urban/suburban segments, rural segments, and rural intersections).</b>				
3a	Evaluate and analyze inventory data.	Determine the status of County roadway inventory data needed to conduct network wide assessments for Action Step 1.	Completed analysis	near term	
3b	Develop roadway inventory data collection plan.	Collect data as identified in Action Step 3a.	Completed data collection plan outlining steps to achieve complete roadway inventory	medium term	
3c	Complete development of roadway inventory database.	Compile data for use in network-wide analysis of focus facilities.	Completed database suitable for systemic analysis	long term	

Table 8-1. Palm Beach County LRSP Action Items

Action Step No.	Activity	Objective	Target	Timeframe	Status
<b>4</b>	<b><i>Conduct LRSP evaluation and update</i></b>				
4a	Conduct quarterly action item update.	Quarterly updates keep the document up-to date and keep action items moving forward.	Updated action item list	near term	
4b	Conduct review of crash data as a benchmark.	An annual review will allow the County to adjust and LRSP and its initiatives over time.	Completed analysis of fatal and serious injury crashes on County system	annually	
4c	Conduct additional systemic analysis as roadway inventory data becomes available.	Upon completion of Action Step 3, a full analysis of focus facilities can be completed at which time the LRSP should be updated.	Completed systemic analysis of entire county system	long term	
4d	Update Palm Beach County LRSP.	Updating the LRSP allows for an evaluation of efforts proceeding the initial LRSP and adjustments to the LRSP in its next version.	Updated LRSP	medium term	

## Notes:

Near term = estimated completion in the next 12 months

Medium term = estimated completion in 12 to 36 months

Long term = estimated completion beyond 3 years (36 months)



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Appendix A  
Infrastructure and Driver Behavior  
Related Safety Strategies/  
Countermeasures

## Signalized Intersection Safety Strategies

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness
A - Reduce frequency and severity of intersection conflicts through traffic control and operational improvements	A1 - Employ multiphase signal operation	Low	Tried / Proven
	A2 - Optimize clearance intervals	Low	Proven <i>(CRF: 15% to 20%)</i>
	A3 - Restrict or eliminate turning maneuvers (including right turns on red)	Low	Tried
	A4 - Employ signal coordination along a corridor or route	Moderate	Proven
	A5 - Employ emergency vehicle preemption	Moderate	Proven
	A6 - Improve operation of pedestrian and bicycle facilities at signalized intersections	Low	Tried / Proven
	A7 - Employ dilemma zone protection	Low	Tried
B - Reduce frequency and severity of intersection conflicts through geometric improvements	B1 - Provide/improve left-turn lanes	Moderate	Proven <i>(Add 1 LTL: 10%)</i> <i>(Add 2 LTL: 20%)</i>
	B2 - Provide/improve right-turn lanes	Moderate	Proven <i>(Add 1 RLTL: 5% to 10%)</i> <i>(Add 2 RTL: 10% to 15%)</i>
	B3 - Improve geometry of pedestrian and bicycle facilities	Low	Tried / Proven
	B4 - Install Roundabout	High	Proven
	B5 - Install echelon interchange network	High	Experimental
C - Improve driver awareness of intersections and signal control	C1 - Improve visibility of signals (overhead indications, 12" lenses, background shields, LED's) and signs (mast arm mounted street names) at intersections	Low	Tried <i>(CRF: 5% to 15%)</i>
D - Improve driver compliance with traffic control devices	D1 - Supplement conventional enforcement of red-light running with confirmation lights	Low	Tried
E - Improve access management near signalized intersections	E1 - Restrict access to properties using driveway closures or turn restrictions	Low	Tried
	E2 - Restrict cross-median access near intersections	Low	Tried

Source: NCHRP 500 Series

### Lane Departure & Fixed Object Safety Strategies

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness
A - Keep vehicles from encroaching on the roadside	A1 - Install shoulder rumble strips	Low	Tried
	A2 - Install edge lines "profile marking", edge line rumble strips or modified shoulder rumble strips on section with narrow or no paved shoulders	Low	Experimental
	A3 - Provide enhanced shoulder, lighting, or delineation (chevrons) and marking for sharp curves	Low	Tried / Proven
	A4 - Provide enhanced pavement markings (6", 8", etc.)	Low	Tried
	A5 - Provide skid-resistance pavement surfaces	Moderate	Proven
	A6 - Apply shoulder treatments *Eliminate shoulder drop-offs *Shoulder edge *Widen and/or pave shoulders *Safety edge	Low	Experimental/ Proven
B - Minimize the likelihood of crashing into an object or overturning if the vehicle travels off the shoulder	B1 - Design safer slopes and ditches to prevent rollovers	Moderate	Proven
	B2 - Remove/relocate objects in hazardous locations	Moderate to High	Proven
C - Reduce the severity of the crash	C1 - Improve design of roadside hardware	Moderate to High	Tried
	C2 - Improve design and application of barrier and attenuation systems	Moderate to High	Tried
D - Reduce the likelihood of a head on vehicles collision	D1 - Install centerline rumble strips for two-lane roads	Low	Proven
	D2 - Reallocate total two-lane roadway width (lane and shoulder) to include a narrow "buffer median"	Low	Tried
	D3 - Convert undivided sections to 3- & 5-Lane cross sections	Moderate	Proven

Source: NCHRP 500 Series

## Aging Driver Safety Strategies

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness
A - Improve the roadway and driving environment to better accommodate older drivers' special needs	A1 - Provide advanced signage and lane markings.	Low	Tried
	A2 - Enhance use of retroreflective materials to signs and safety devices such as cones and pavement markers to notify drivers of hard-to-see obstacles.	Low	Tried
	A3 - Increase size and letter height of roadway signs and maximize their placement for (i.e., overhead, centered) enhanced visibility.	Low	Tried
	A4 - Increase signal head size to 12 inch when replacing/upgrading signal.	Moderate	Tried
	A5 - Provide more protected left-turn signal phases at high-volume intersections	Low	Tried
	A6 - Improve lighting at intersections, horizontal curves, and railroad grade crossings.	Moderate to High	Tried
	A7 - Improve roadway delineation.	Low	Tried
B - Strengthened reporting/referral, assessment and licensing of at-risk older drivers	B1 - Conduct high visibility seat belt enforcement in older driver community locations.	Moderate	Proven
	B2 - Strengthen law enforcement training on detecting at-risk drivers, referring to licensing, and providing information to assist mature drivers.	Low	Tried
	B3 - Conduct outreach and promote older driver safety screening for family, community members, physicians, law enforcement, and EMS to report at-risk drivers.	Low to Moderate	Proven
	B4 - Promote the awareness and utilization of variable driver license restrictions (e.g., high speed, night, geographic limits).	Low	Proven
C - Improve mature driver mobility options, education and public outreach	C1 - Promote/provide accessible and safe mobility options for elderly drivers.	Moderate to High	Proven
	C2 - Establish local coalition to assess and plan for older driver education, information outreach, and transportation needs.	Low	Tried
	C3 - Promote locally-provided refresher skills course for mature drivers including assessment of driving skills.	Low	Proven

Source: NCHRP 500 Series & NHTSA's Countermeasures that Work

## Pedestrian Safety Strategies

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness
A - Reduce Pedestrian Exposure to Vehicular Traffic	A1 - Provide Sidewalks/Walkways and Curb Ramps	Moderate to High	Proven (CRF: 65% to 75%)
	A2 - Install or Upgrade Traffic and Pedestrian Signals	Moderate to High	Varies
	A3 - Construct Pedestrian Refuge Islands and Raised Medians	Moderate to High	Proven (CRF: 40% to 50%)
	A4 - Provide Full/Partial Diverters & Street Closure	Moderate to High	Proven (CRF: 40% to 50%)
	A5 - Install Countdown Timers	Low	Tried (CRF: 50%)
	A6 - Install Advance Walk Interval	Low	Tried (CRF: 35% to 45%)
	A7 - Promote adoption of Livable Communities and Complete Streets policies		
B - Improve Sight Distance and/or Visibility Between Motor Vehicles and Pedestrians	B1 - Provide Crosswalk Enhancements (Signs & Markings, Curb Extensions, Median Refuge Islands, Crossing Guards)	Low	Varies (Raised: 30% to 40%)
	B2 - Implement Lighting/Crosswalk Illumination Measures	Moderate to High	Proven
	B3 - Eliminate Screening by Physical Objects	Low	Tried
	B4 - Alert Motorists That Pedestrians are crossing -- HAWK Signal or Rectangular Rapid Flash Beacons	Moderate	Tried/Experimental (CRF:70%)
C - Improve Pedestrian and Motorist Safety Awareness and Behavior	C1 - Promote community-wide, sustained outreach campaigns (incorporating paying attention and increasing conspicuity) which seek to incorporate unfamiliar safety information to keep content fresh and the public engaged (new data trends, safety benefits of new infrastructure treatments, etc.).	Moderate	Tried/Experimental
	C2 - Conduct high visibility enforcement of unsafe behaviors of motorists and pedestrians at high-risk locations; focus outreach to high-risk audiences (older pedestrians, children, diverse populations).	Moderate	Tried
	C3 - Incorporate "share the road" and pedestrian safety in local driver education training programs.	Low	Tried

Source: NCHRP 500 Series

## Bicycle Safety Strategies

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness
A - Reduce bicycle crashes at intersections	A1 - Improve visibility at intersections	Moderate / High	Tried
	A2 - Improve signal timing and detection	Low / Moderate	Tried
	A3 - Improve signing	Low	Tried
	A4 - Improve pavement markings at intersections	Low	Tried
	A5 - Improve intersections geometry	High	Tried
	A6 - Addition of Bike Boxes	Low	Tried
B - Reduce bicycle crashes along roadways	B1 - Provide facilities for parallel travel -- On/Off Road Facilities, Shoulders, Dedicated Lanes, Bicycle Boulevards	High	Tried <i>(Bike Lane: 30%) (Bike Blvd: 60%)</i>
	B2 - Promote adoption of Livable Communities and Complete Streets policies		
	B3 - Implement traffic calming techniques	High	Proven
C -- Improve Bicyclist and Motorist Safety Awareness and Behavior	C1 - Promote community-wide, sustained outreach campaigns which seek to incorporate unfamiliar safety information to keep content fresh and the public engaged (new data trends, safety benefits of new infrastructure safety treatments, etc.).	Moderate	Tried/Experimental
	C2 - Conduct high visibility enforcement of unsafe behaviors of motorists and bicyclists at higher-risk locations, include speed enforcement.	Moderate	Tried
	C3 - Incorporate "share the road" and bicycle safety in local driver education training programs.	Low	Tried
D - Increase use of bicycle safety equipment	D1 - Increase use of bicycle helmets	Low / Moderate	Proven
	D2 - Increase rider and bicycle conspicuity	Low / Moderate	Tried

Source: NCHRP 500 Series



### Seat Belt Usage Safety Strategies

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness
A - Strengthen enforcement and penalties to improve compliance	A1 - Conduct high visibility seat belt enforcement campaigns including nighttime enforcement and focused communication outreach to low belt use populations.	Moderate	Proven
	A2 - Support local ordinance to strengthen belt use law penalties.	Low	Proven
	A3 - Promote parent-young driver contracts for belt use with clear consequences when teens fail to do so.	Low	Proven
	A4 - Collaborate with local employers to develop/strengthen employee safe driving policies including clear consequences.	Low	Tried
B - Increase driver awareness of the benefits of belt use	B1 - Promote “saved by the belt” testimonies during seat belt enforcement saturations	Low	Experimental
	B2 - Conduct brief interventions by health care providers following a crash regarding unbelted risks and consequences.	Low	Tried

Source: NCHRP 500 Series & NHTSA's Countermeasures that Work

### Impaired Driving Safety Strategies

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness
A - Strengthen enforcement and penalties	A1 - Strengthen local enforcement participation in statewide high visibility DUI enforcement saturations including sobriety checkpoints.	Moderate-High	Proven
	A2 - Promote BAC test "No Refusal" law and consequences.	Low	Proven
	A3 - Strengthen local liquor establishments' alcohol serving and selling compliance.		Proven
	A4 - Explore community/local agency support for local alcohol ordinances and penalties that may be more restrictive than state law (higher fines, longer license suspension, and earlier license revocation for repeated violations).	Low	Tried
B - Promote awareness to deter drinking and driving	B1 - Promote sobriety initiatives for DUI offenders (Ignition Interlock Devices, 24/7 monitoring)	Low	Proven
	B2 - Employ alcohol screening and brief interventions	Low	Proven
	B3 - Support community programs for alternative transportation	High	Proven

Source: NCHRP 500 Series & NHTSA's Countermeasures that Work

# Appendix B

## Workshop Summary

# Palm Beach County Local Roadway Safety Plan Workshop: Meeting Summary

Thursday, March 2, 2017

8:30 a.m. to 3:30 p.m.

Vista Center  
Room 1-E-58  
2300 N Jog Road  
West Palm Beach, Florida 33411

## Background

In conjunction with the development of Palm Beach County’s Roadway Safety Plan, a workshop involving various stakeholders was held in West Palm Beach, Florida. The morning portion of the workshop incorporated presentations from federal, state, and local level representatives while the afternoon portion involved a facilitated discussion and voting exercise regarding safety countermeasures potentially applicable to improving roadway safety in Palm Beach County.

## Participants

Name	Representing
Anaya de Yeats, Maria	Florida Department of Transportation
Coore, Brittani	Florida Department of Health Palm Beach County
Delgado, Anielle	Palm Beach Metropolitan Planning Organization
DeSantis, Brian	Riviera Police Department
Falconi, Xavier R.	City of Delray Beach
Gorby, Sue	Palm Beach County School District
Heinz, Jeff	Palm Beach County Fire Rescue
Karlecke, Jason C.	Palm Beach County Sheriff’s Office
Lan, CJ	Town of Jupiter
Livergood, Jeff	City of Boynton Beach
Mansour, Maher	Palm Beach County School District
Marsh, Christopher	Village of Royal Palm Beach
McGarry, Mari Hoover	Delray Medical Center
Morrow, Mike	City of Palm Beach Gardens
Mosley, Giselle	Palm Beach Metropolitan Planning Organization
Neilson, Valerie	Palm Beach Metropolitan Planning Organization
Pullins, Carmen B.	Florida Department of Transportation
Rispoli, Paul Lt.	Palm Beach County Sheriff’s Office
Snelgrove, Troy	Palm Beach County Sheriff’s Office
Stubbs, Fred	Palm Tran
Taylor, Franchesca	Palm Beach Metropolitan Planning Organization
Tejera, Maria	City of Boca Raton

Tribou, Heather	City of West Palm Beach
Usher, Angela Diaz	Palm Beach County School District
Vince, Bradley Sgt.	Jupiter Police Department
Wetherell, Leslie	Florida Department of Transportation
Xie, Yujing "Tracey"	Florida Department of Transportation
Yerostova, Margarita	City of Delray Beach

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*Project Team*

Al-Turk, Motasem	Palm Beach County
Anderson, Rosemarie	Federal Highway Administration
Kolody, Kim	CH2M, Inc.
Marti, Cheri	CH2M, Inc.
Polk, Chad	CH2M, Inc.
Santos, Joe	Florida Department of Transportation
Webb, George	Palm Beach County

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## Presentations and Discussion

### Welcome and Introductions (9:00)

#### **Palm Beach County – George Webb**

Mr. Webb presented an overview of the crashes that have occurred in Palm Beach County:

- 36,500 annual crashes 2015; 3600 are serious injury/fatality
- 900 crashes in 2015 with pedestrians and bicyclists
- 4600 fatalities/injuries
- 473 pedestrian fatalities/injuries
- 182 fatalities in PBC database in 2015
- 2/3 male, 1/3 female
- 25% under 25 years old; 65 and up – 22%
- Focus – what can we do and how do it?
- East of I-95:
  - 0 road improvements planned (widening) in next 20 years. Complete streets projects are planned. Cities making big push to make rights-of-way more friendly to all modes of transportation (SWs, bike lanes, buffered bike lanes, etc.)

### Background for Local Road Safety Plan (LRSP) (9:15)

#### **FHWA - Rosemarie Anderson**

- Imperative to have local agency voice in Strategic Highway Safety Plans (SHSPs)
- LRSPs – what are the issues, how do we move forward to address those issues?
- Stakeholder coordination is important – don't just focus on engineering/infrastructure (4 E's)
- Plans should be flexible so that they can be adjusted, if necessary

- Main objective – reducing fatalities and serious injuries on the roadways
- Some states are using Highway Safety Improvement Program funds to pay for LRSPs
  - Iowa – developed plans through HSIP funds for local agencies. In general, Iowa agency representatives feel they have a better idea where hazardous locations are
- LRSPs:
  - Locally initiated – more concise, more flexible, lower cost
  - State initiated – state sets aside funding, larger documents
- Issues found at local level need to complement state SHSP in order to qualify for HSIP funds
- HSIP guidance: data-driven and must be in SHSP; HSIP funds are eligible for the development of LRSPs
- Factors influencing LRSP
  - Need a champion (elected office as a champion can be helpful)
  - Important that LRSPs are implementable
  - Important to have strong partners/stakeholders
  - 55% of fatal crashes in 2015 were on local roads
- In 2014, FL spent 40% of HSIP funds on local roads
- LRSP can help identify HSIP funding eligible projects

### **Palm Beach County – George Webb**

- Federal government, through Congress puts together federal funding programs for safety every 5 or 6 years. Recent version significantly increased safety funding which creates an opportunity for states and locals to effectively improve local road safety.
- Looking to move from mostly reactive (hot spots) to proactive (systemic safety analysis)

### **FDOT (Central Office): HSIP – Joe Santos**

- FL SHSP was last updated September of 2016
- SHSP is similar to visit to a doctor – we recognize we have a lot of fatalities and severe injuries on the local road system. How do we diagnose to assess?
- FL has many unique situations – often cities or counties with populations that are as large as many states.
- Important high level facts from SHSP
  - 13 emphasis areas on page 12 – grouped into the 4E's
  - Page 7 – 10% of lane miles are state maintained; 88% are locally maintained
    - Substantial amount of VMT on local roads
    - A lot of fatalities occurring on local roads
    - Crashes on local roads are more scattered which lends itself well to systemic effort

- Data-driven, consistent with SHSP, and corrects or improves a hazardous road location or feature or addresses a highway safety problem
- How much HSIP is flexed (~\$118M total) to other program – FL is ~\$10-20M but goes to safety projects (Safe Routes to Schools, etc.).
- Big takeaway – know the right questions to ask and the right person to ask in order to obtain HSIP funding.
- The focus on a safety projects is to reduce fatalities and severe injuries (not offset a need such as maintenance). Safety funds are not used for resurfacing. If already touching a road for a safety project, they can be used for resurfacing.

#### **FDOT (District 4): HSIP – Yujing “Tracey” Xie**

- District 4 (D4) consists of 5 counties and serves as connection between locals and FDOT Central Office
- Safety projects must be consistent with:
  - SHSP emphasis areas
  - Safety countermeasures should be data-driven and must show positive Benefit-Cost to demonstrate potential for safety performance improvement.
  - FDOT Procedure 500-000-100 (HSIP Guidelines)
  - Work Program Instructions (Chapter 31 – Safety)
- Local requests for safety are on case-by-case basis (reactive)
- D4 looking to expand approach to include systemic (proactive)
- Q: (Mo) – Is the state looking at a grant program
  - A: (Joe) – state looking at set aside funding statewide, locals submit, state to prioritize and select (process similar to HSIP process).
- Q: What defines a “local road”
  - A: A non-state (county, city, other)
- Q: Is FDOT making decisions regarding HSIP funding without input from locals
  - A: State is trying to get everyone on the same plan for level communication. Currently, some districts solicit input from locals, others do not.
- If project not awarded SRTS funding, can reapply for other funding (TAP)
  - Tracey Xie is the coordinator for D4 SRTS
- Q: FL safety performance in bikes/peds is an issue, will more funding for bike/ped happen in future:
  - A: Joe has set aside funds for “Alert today, alive tomorrow”. Also, about \$5M statewide for bike/ped specific funding.
- Complete streets – different approach to roadways. Looks more at context, all modes of transportation. One key component in complete streets is incorporating a target speed (lowering speed). Depending on conditions, may accommodate all modes of transportation. We are in the infant stages of complete streets so unable to determine historical safety performance benefits for

complete streets at this time. Currently, FDOT does not have the data to fund complete streets programs.

- FDOT spending \$100M (\$60M safety funds) over 5 years that focus on addressing pedestrian fatalities at night (75% of ped fatalities occurring at night). FDOT looked at urban corridors with insufficient lighting. New standards have been developed for LED lights. Looked at primarily urban corridors with night time crashes.
- Q: (Cheri) – MN uses Section 164 (Penalty transfer funds). State is penalized because they don't have strong DUI repeat offenders laws. A portion of construction funds is transferred over toward safety. Sometimes we have to be creative due to resource limitations. MN takes the penalty funds and divides up with infrastructure and safety improvements as well as enforcement and education. MnDOT works to distribute those funds. This non-traditional source of funding is worth investigating.

## Local Traffic Safety Initiatives (9:45)

### **Palm Beach County – George Webb**

- State is putting a lot of emphasis on dealing with pedestrian and bicyclist.
- Law enforcement participation is important. They see things on a daily basis that agencies don't see. Looking to improve the communication.
- Safety practitioners live and die with the data from crash report forms. It is hugely important that the traffic forms are coded as accurately as possible.

### **Palm Beach County, Director of Palm Beach Metropolitan Planning Organization – Nick Uhren**

- MPO is the local voice to determine whether we're investing federal and local resources well.
- MPO vision is to "establish a safe, efficient, connected, multimodal transportation system."
- 3 recent initiatives:
  - Recently completed bicycle pedestrian study – looks for highest concentration of peds/bike crash locations.
  - SW inventory database – hoping to close gaps
  - Bicycle suitability map – where have we provided bicycle facilities (county-wide map) and future opportunities for bike facilities.
- 2 on-going activities at MPO:
  - Development of complete street guidelines (trying to infuse state, county, and local complete streets program)
  - MPO is allocated through the FAST Act a portion of the overall transportation funding to help with surface transportation funding.????
- MPO wants locals to drive projects. Agencies submit ideas and MPO allocates up to \$3.5M per project and up to \$1M for non-motorized transportation projects. Deadline is 3/3/17 by 5 pm.
- Locals are most familiar with their needs and opportunities. MPO hopes state will follow a similar process.
- If we can create a system that is safe for an 8-year-old or 80-year-old to navigate, we've created a successful system.



### **FDOT (Community Traffic Safety Team)– Carmen Pullins**

- Alert Today, Alive Tomorrow – safety campaign – focuses on pedestrians and cyclists. Broward and Palm Beach rank at the top. Set of high visibility enforcement funds available. FDOT going to do a ATAT awareness campaign at a hot spot.
- CTST has monthly meetings. If interested in participating, contact Carmen.

### **Mayor Paulette Burdick**

- Equity is important. May of the dots on safety heat maps occurring in locations with significant elderly populations.
- Education is hugely important.

## Overview of Statistics

### **Crash Data Overview – CH2M**

- Process – identify priority emphasis areas similar to state SHSP development. Then look at countermeasures, strategies, and treatments.
- Evaluating the County roadways. Next step is evaluating, prioritizing and getting to location specific groups of projects to guide future implementation efforts.
- Local safety plans are data-driven
- Goals:
  - Implementing strategies in appropriate locations is important to process
  - Fostering a culture
- Want to develop vision with group of how they want the plan to meet PBC’s needs
- PBC Severe crash history (2011 – 2014) – 3354 severe crashes, 631 of these occurred on PBC roadway system.
- Crash data tree – disaggregation of data. High level screening tool to identify where to locate candidates for improvement
  - 19% of fatal and severe injuries are on local road system.
  - 48% of fatalities and severe injuries on County Road system are on intersections.
  - Intersection crashes – 92% multi-vehicles
  - Divided, non-intersection – 17% of total crashes, 26% severe/fatal are single vehicle crashes
  - Lane departure not typical for urban environment. In case of these numbers, lane departure often represents crash with fixed object.
- PBC is in red on 7 of 8 of emphasis areas on FDOT county matrix (performing in bottom 25% of safety) on a frequency basis.
  - Traffic investigating officer has trouble identifying distracted driving. Q: How accurate does FDOT think distracted driving numbers are? A: We know distracted driving is underreported but added it as emphasis area in SHSP to start tracking it.

- FL is not unique in challenges with law enforcement. Example: even though we know hands-free is not safer than handheld-allowed, hands-free provides added ability to pull people over.
  - Good purpose of this effort is to develop a shared initiative to help state agencies recognize what is important to the local areas.
  - Law enforcement (crash reporting instructor) – they are instructed not to put speeds in unless you can prove it (liability). Same with distracted driving – if cannot prove it, they cannot report it.
  - FDOT is dedicating resources to get across point about distracted driving even if it doesn't show up as an emphasis area. FL is attacking all these areas and grant program is directing resources to these areas.
- Correlated emphasis areas are related to each other – lane departure, impaired, unrestrained, speeding & aggressive

## LSRP Goals/Objectives (11:00)

### LSRP Vision – Kim Kolody

- Vision/Goals/Objectives
  - Stakeholder collaboration and communication
  - Plan to continue proven strategies
  - HSIP dollar allocation and other funding sources
  - Safety for pedestrians and bicyclists
  - Data driven and priorities important
  - Plan that encourages/focuses on multimodal (find appropriate balance between encouraging behavior and increasing exposure concerns)
  - Vulnerable users – demographics that are overrepresented in the crash data (considering equity in implementation and planning approaches). Diverse populations.
  - Upward messages/communication to elected officials
  - Connecting east and west
  - Complete streets implementation (follow-through) and continuing implementation effort to enforce complete streets criteria and standards
  - Move toward a more proactive approach
  - Safety culture – improving awareness – George committed to including this in plan
  - Primary audience for LRSP – elected officials – George
  - Sense of complacency toward mortality rate needs to change
  - Take implementation plan to elected officials once developed – Rosemarie
  - Distracted bikers

## Infrastructure Safety Strategies – Kim Kolody

- Strategies are split between infrastructure-focused and behavioral-focused
- Infrastructure strategies:
  - Signalized Intersections
    - Employing multi-phase signals (protected lefts, etc.) – currently in use
    - Optimizing clearance intervals – County follows state guidance so potentially unable to optimize. Perceived that too much yellow and red time can incentivize running the lights.
    - Red light running cameras – no more programs active in Palm Beach County
    - Countdown timers – perceived that they sometimes confuse pedestrians. Education is important part of this.
      - Taking other cultures into account is important part of educational component
      - Consider audible pedestrian and bicyclist signals
    - FDOT using flashing red arrow instead of flashing yellow arrow.
      - Focus on protected phases as a Left Turn at Signalized Intersection safety countermeasure.
      - Law enforcement does not believe flashing turn arrows will be a good idea.
    - Improving left turn lanes:
      - Law enforcement: Offset right turn lane is beneficial because it provides refuge for pedestrians
      - Motasem (County) – offset right is not something the County wants to pursue, possibly offset lefts (although due to space limitations in County, unlikely)
      - Roundabouts – trans systems do not like roundabouts – unable to get their large vehicles through them. County is comfortable with single lane roundabouts. They have a few multi-lane roundabouts in special cases but not many.
        - Roundabouts should have access to bicycles.
    - One signal head per lane – currently a practice in Palm Beach County
    - Law enforcement is interested in red light running enforcement/confirmation lights. PBC has used them for a pilot but enforcement did not use them. PBC is open to using them again and coordinating with law enforcement to make sure they are utilized.
    - Access management – interested in continuing to look at access management improvements
    - Road diets – popular among workshop participants.
      - Concept of road diets is a good one and are in the process of being implemented in West Palm Beach; however, an engineering study is a requirement to justify it. Not a suitable countermeasures in all locations. Consider enhancing with green center two-way left turn lane when implementing road diets.
  - Lane departure
    - Guardrail in good shape – don't need to consider as low cost improvement

- Removing guard rail – County has not done that. Open to removing guard rail if there is belief it causes a problem.
  - Many people do not like rumble strips due to noise but believe they are beneficial. Rumble strips need to be implemented in the correct location (special design needed for bicyclists). Law enforcement thinks they are beneficial for limited access roadways.
  - Audible vibratory pavement markings – has similar effect but not quite as loud as rumbles, although they are more costly than traditional rumbles.
  - Armadillos (physical block to block drivers from bicyclists) – they can be bolted into the ground.
    - Palm Beach County is wary of implementing countermeasures that are experimental without preliminary documentation of crash reduction effectiveness.
  - 6" edge line is standard practice in Palm Beach County
    - Maintenance/enhancement of pavement markings is important
  - Pedestrian-activated embedded flashing lights
  - Skid resistant pavement – FDOT used on I-95 on curve
  - Safer slopes not of particular concern in Florida
  - Removing fixed objects – does FDOT allow trees in medians for roads > 45 mph (heard they just changed this to prohibit it).
- Pedestrian
- Rapid red flashing beacon is not approved but HAWK is; rectangular flashing beacons – permitted if using without the red (white).
  - Leading pedestrian intervals should be considered. Palm Beach County has some history of use leading pedestrian intervals.
- Bicycle
- Bike boxes at signalized intersections
  - Protected bicycle facilities are significantly more popular than non-buffered
  - We need protected intersections and protected roundabouts (physical barrier islands that prevent conflict points with right-turning vehicles, which increases sight distance of bicyclists and peds).

## Safety Project Development Approaches & Safety Strategies (11:20)

### **Strategy Overview and Behavior Safety Strategies - Cheri Marti**

- Crash Causation Factors – crashes are often a combination of variables. Roadway (34%), driver behavior (93%), vehicle (12%). These do not act independently – often a connected relationship. 95% of severe crashes are due in part to driver behavior. Infrastructure strategies help to mitigate poor driver behavior but they don't solve the problem. Driver behavior piece is hugely important.
- Strategies we're reviewing today are from NCHRP 500 Series. They are based on research on countermeasures. Strategies being presented today have science behind them.
  - Proven – widely deployed and demonstrated to help

- Tried – maybe not as widely deployed but may not be as good as proven
- Experimental – being tried but limited results
- Pedestrian/Bicyclist
  - 65% of severe crashes are happening out side of the crosswalk
  - Most at risk are children ages 10-14 and older > 65 years old
  - Pedestrians are at a greater vulnerability than any road user; twice that of a bicyclist
  - 2013 Pedestrian/Bicycle Strategic Plan included projects, 60% of which have been implemented.
    - Florida Pedestrian and Bicycle Safety Coalition – charged with implementing the Strategic Plan. 7 dimensions: enforcement, outreach, data, traffic engineering included.
    - Safe Mobility for Life Coalition – Safety Plan also exists specific to aging population transportation needs and issues. Statewide efforts include multiple agencies.
    - Alert Today, Alive Tomorrow campaign – in revitalization process, to include data analytics and develop statewide message.
    - Targeted education and enforcement efforts is a new trend with no history of grant availability.
      - Enforcement efforts should be coupled with public outreach and media. By publicizing it, you get more of an impact.
      - Population is large, consequently law enforcement does not have time to achieve all enforcement that they want to.
      - Many jurisdictions unable to cross without having a multi-agency agreement
- Aggressive driving: one solution – hire more officers.
  - Law enforcement - pedestrian bicycle grant has helped to educate them. Sustained need to focus on drivers.
- Aging population – fastest growing population in Palm Beach County – currently 31%:
  - Conduct outreach for older drivers safety screening – not doing assessment, just taking in information. This person it would be worth an evaluation. Do we need more law enforcement training to do that type of referral? Yes.
  - Training for law enforcement is key. 37% of these referrals is done by law enforcement. 35% is done by medical field.
  - Proven strategy that re-evaluation is good at getting at risk drivers off the road.
  - Takeaway point – drive elected officials to fund more traffic safety officers within law enforcement so that we have more enforcement of traffic aspects (per Mo) – general sense of strong support for law enforcement among the group.
  - FL is ahead of many others with regards to Safe Mobility for Life coalition. Anything you need to know is on that site – transition, planning, how to plan for less driving. Consider promoting that website more.
- Unbelted/Unrestrained
  - Seat belt rate in FL 88.4%. National average is 89%.

- Primary seat belt – front seat passengers and rear seat children. Comment – 47% of all killed passengers were unrestrained. 57% of those in rear seat were killed. Male pickup truck drivers are one of the highest at risk groups.
- PBC is participating in click it or ticket campaign. That is one of their biggest strategies for seat belt.
- Impaired Driving
  - ~75% of impaired drivers who are killed are unbelted. Enforcing this at night (impaired) is a big opportunity.
  - High visibility enforcement (it is allowed in Florida to do a checkpoint – many states are not able to do this).
  - Would be strong to promote at local level state’s no refusal law. If officer has probable cause, officer can pull you over and give you a request. If refuse, you can be hit with 1 year license suspension.
  - Ignition interlock device – breath testing unit for those convicted of DUI. If you are at 0.15 BAC, they you are required to be on ignition interlock for period of time before you get your license back.
  - 24/7 monitoring program – offender is tested twice per day. Any detection, they serve jail time. Swift, certain, and quite effective.
  - No specific requirement to not serve someone who is intoxicated. FL statutes do not prohibit sales of alcohol to intoxicated people. Is it possible to get a city ordinance to prohibit this. No – you can’t make a city ordinance that conflicts with a state statute.
  - City ordinance requiring alcohol vendors to take a training regarding not overserving.

## Individual Voting Exercise (2:55)

### **Voting Exercise and Results**

A total of 257 votes were cast among the various infrastructure and behavior safety strategies representing the top six emphasis areas for Palm Beach County: Lane Departure (28 votes), Impaired Driving (31 votes), Pedestrian/Bicyclist (104 votes), Intersection (55 votes), Unrestrained Occupants (7 votes), and Aging Drivers (32 votes). A tally of the votes for each strategy is presented below. The top 11 strategies (those receiving 7 or more votes) are bolded for reference.

## Signalized Intersection Safety Strategies

Objectives	Strategies	Votes
A - Reduce frequency and severity of intersection conflicts through traffic control and operational improvements	A1 - Employ multiphase signal operation	2
	A2 - Optimize clearance intervals	0
	<b>A3 - Restrict or eliminate turning maneuvers (including right turn on red)</b>	<b>7</b>
	A4 - Employ signal coordination along a corridor or route	0
	A5 - Employ emergency vehicle preemption	0
	<b>A6 - Improve operation of pedestrian and bicycle facilities at signalized intersections</b>	<b>8</b>
	A7 - Employ dilemma zone protection	3
B - Reduce frequency and severity of intersection conflicts through geometric improvements	B1 - Provide/improve left-turn lanes	1
	B2 - Provide/improve right-turn lanes	5
	B3 - Improve geometry of pedestrian and bicycle facilities	2
	<b>B4 - Install Roundabout</b>	<b>13</b>
	B5 - Install echelon interchange network	0
C - Improve driver awareness of intersections and signal control	C1 - Improve visibility of signals (overhead indications, 12" lenses, background shields, LED's) and signs (mast arm mounted street names) at intersections	3
D - Improve driver compliance with traffic control devices	D1 - Supplement conventional enforcement of red-light running with confirmation lights	0
E - Improve access management near signalized intersections	<b>E1 - Restrict access to properties using driveway closures or turn restrictions</b>	<b>8</b>
	E2 - Restrict cross-median access near intersections	3

Source: NCHRP 500 Series

## Lane Departure & Fixed Object Safety Strategies

Objectives	Strategies	Votes
A - Keep vehicles from encroaching on the roadside	A1 - Install shoulder rumble strips	0
	A2 - Install edge lines "profile marking", edge line rumble strips or modified shoulder rumble strips on section with narrow or no paved shoulders	0
	A3 - Provide enhanced shoulder, lighting, or delineation (chevrons) and marking for sharp curves	5
	A4 - Provide enhanced pavement markings (6", 8", etc.)	2
	A5 - Provide skid-resistance pavement surfaces	4
	A6 - Apply shoulder treatments *Eliminate shoulder drop-offs *Shoulder edge *Widen and/or pave shoulders *Safety edge	2
B - Minimize the likelihood of crashing into an object or overturning if the vehicle travels off the shoulder	B1 - Design safer slopes and ditches to prevent rollovers	3
	B2 - Remove/relocate objects in hazardous locations	3
C - Reduce the severity of the crash	C1 - Improve design of roadside hardware	0
	C2 - Improve design and application of barrier and attenuation systems	1
D - Reduce the likelihood of a head on vehicles collision	D1 - Install centerline rumble strips for two-lane roads	1
	D2 - Reallocate total two-lane roadway width (lane and shoulder) to include a narrow "buffer median"	0
	<b>D3 - Convert undivided sections to 3- &amp; 5-Lane cross sections</b>	<b>7</b>

Source: NCHRP 500 Series



## Aging Driver Safety Strategies

Objectives	Strategies	Votes
A - Improve the roadway and driving environment to better accommodate older drivers' special needs	A1 - Provide advanced signage and lane markings.	4
	A2 - Enhance use of retroreflective materials to signs and safety devices such as cones and pavement markers to notify drivers of hard-to-see obstacles.	1
	A3 - Increase size and letter height of roadway signs and maximize their placement for (i.e., overhead, centered) enhanced visibility.	3
	A4 - Increase signal head size to 12 inch when replacing/upgrading signal.	0
	A5 - Provide more protected left-turn signal phases at high-volume intersections	1
	<b>A6 - Improve lighting at intersections, horizontal curves, and railroad grade crossings.</b>	<b>7</b>
	A7 - Improve roadway delineation.	4
B - Strengthened reporting/referral, assessment and licensing of at-risk older drivers	B1 - Conduct high visibility seat belt enforcement in older driver community locations.	1
	B2 - Strengthen law enforcement training on detecting at-risk drivers, referring to licensing, and providing information to assist mature drivers.	1
	B3 - Conduct outreach and promote older driver safety screening for family, community members, physicians, law enforcement, and EMS to report at-risk drivers.	2
	B4 - Promote the awareness and utilization of variable driver license restrictions (e.g., high speed, night, geographic limits).	1
C - Improve mature driver mobility options, education and public outreach	C1 - Promote/provide accessible and safe mobility options for elderly drivers.	3
	C2 - Establish local coalition to assess and plan for older driver education, information outreach, and transportation needs.	2
	C3 - Promote locally-provided refresher skills course for mature drivers including assessment of driving skills.	2

Source: NCHRP 500 Series & NHTSA's Countermeasures that Work

## Pedestrian Safety Strategies

Objectives	Strategies	Votes
A - Reduce Pedestrian Exposure to Vehicular Traffic	A1 - Provide Sidewalks/Walkways and Curb Ramps	5
	<b>A2 - Install or Upgrade Traffic and Pedestrian Signals</b>	<b>7</b>
	A3 - Construct Pedestrian Refuge Islands and Raised Medians	4
	A4 - Provide Full/Partial Diverters & Street Closure	1
	A5 - Install Countdown Timers	5
	A6 - Install Advance Walk Interval	4
	A7 - Promote adoption of Livable Communities and Complete Streets policies	4
B - Improve Sight Distance and/or Visibility Between Motor Vehicles and Pedestrians	B1 - Provide Crosswalk Enhancements (Signs & Markings, Curb Extensions, Median Refuge Islands, Crossing Guards)	3
	B2 - Implement Lighting/Crosswalk Illumination Measures	3
	B3 - Eliminate Screening by Physical Objects	1
	<b>B4 - Alert Motorists That Pedestrians are crossing -- HAWK Signal or Rectangular Rapid Flash Beacons</b>	<b>12</b>
C - Improve Pedestrian and Motorist Safety Awareness and Behavior	<b>C1 - Promote community-wide, sustained outreach campaigns (incorporating paying attention and increasing conspicuity) which seek to incorporate unfamiliar safety information to keep content fresh and the public engaged (new data trends, safety benefits of new infrastructure treatments, etc.).</b>	<b>9</b>
	C2 - Conduct high visibility enforcement of unsafe behaviors of motorists and pedestrians at high-risk locations; focus outreach to high-risk audiences (older pedestrians, children, diverse populations).	4
	C3 - Incorporate "share the road" and pedestrian safety in local driver education training programs.	1

Source: NCHRP 500 Series

## Bicycle Safety Strategies

Objectives	Strategies	Votes
A - Reduce bicycle crashes at intersections	A1 - Improve visibility at intersections	4
	A2 - Improve signal timing and detection	2
	A3 - Improve signing	2
	A4 - Improve pavement markings at intersections	1
	A5 - Improve intersections geometry	2
	A6 - Addition of Bike Boxes	2
B - Reduce bicycle crashes along roadways	B1 - Provide facilities for parallel travel -- On/Off Road Facilities, Shoulders, Dedicated Lanes, Bicycle Boulevards	3
	B2 - Promote adoption of Livable Communities and Complete Streets policies	3
	B3 - Implement traffic calming techniques	2
C -- Improve Bicyclist and Motorist Safety Awareness and Behavior	<b>C1 - Promote community-wide, sustained outreach campaigns which seek to incorporate unfamiliar safety information to keep content fresh and the public engaged (new data trends, safety benefits of new infrastructure safety treatments, etc.).</b>	<b>10</b>
	C2 - Conduct high visibility enforcement of unsafe behaviors of motorists and bicyclists at higher-risk locations, include speed enforcement.	5
	C3 - Incorporate "share the road" and bicycle safety in local driver education training programs.	1
D - Increase use of bicycle safety equipment	D1 - Increase use of bicycle helmets	3
	D2 - Increase rider and bicycle conspicuity	1

Source: NCHRP 500 Series

## Seat Belt Usage Safety Strategies

Objectives	Strategies	Votes
A - Strengthen enforcement and penalties to improve compliance	A1 - Conduct high visibility seat belt enforcement campaigns including nighttime enforcement and focused communication outreach to low belt use populations.	3
	A2 - Support local ordinance to strengthen belt use law penalties.	0
	A3 - Promote parent-young driver contracts for belt use with clear consequences when teens fail to do so.	2
	A4 - Collaborate with local employers to develop/strengthen employee safe driving polices including clear consequences.	2
B - Increase driver awareness of the benefits of belt use	B1 - Promote “saved by the belt” testimonies during seat belt enforcement saturations	0
	B2 - Conduct brief interventions by health care providers following a crash regarding unbelted risks and consequences.	0

Source: NCHRP 500 Series & NHTSA's Countermeasures that Work

## Impaired Driving Safety Strategies

Objectives	Strategies	Votes
A - Strengthen enforcement and penalties	A1 - Strengthen local enforcement participation in statewide high visibility DUI enforcement saturations including sobriety checkpoints.	3
	<b>A2 - Promote BAC test "No Refusal" law and consequences.</b>	<b>17</b>
	A3 - Strengthen local liquor establishments' alcohol serving and selling compliance.	1
	A4 - Explore community/local agency support for local alcohol ordinances and penalties that may be more restrictive than state law (higher fines, longer license suspension, and earlier license revocation for repeated violations).	0
B - Promote awareness to deter drinking and driving	B1 - Promote sobriety initiatives for DUI offenders (Ignition Interlock Devices, 24/7 monitoring)	5
	B2 - Employ alcohol screening and brief interventions	0
	B3 - Support community programs for alternative transportation	5

Source: NCHRP 500 Series & NHTSA's Countermeasures that Work

Appendix C  
Systemic Evaluation -  
Urban/Suburban Intersection Example

Risk Factors	Multi-Vehicle		Pedestrian & Bicyclist	
	Minimum	Maximum	Minimum	Maximum
Signal Indicators	Not Present for Every Lane		Not Present for Every Lane	
Functional Class	Urban Minor Arterial, Urban Principal Arterial		Urban Minor Arterial, Urban Principal Arterial	
Number of Approaches	4	5	4	5
Roadway Division	Divided		Divided	
Double Left Turn Lane	Present		Present	
Major App. Cross Section	6-Lane		6-Lane	
Adjacent Land Use	Suburban Commercial		Suburban Commercial	
Total Entering Vehicles	30,000	Unlimited	30,000	Unlimited
Adjacent Bus Stop	Present		Present	
Speed Limit Cross Product	1,400	Unlimited	1,600	Unlimited
Max. Lanes to Cross	6	8	6	8
Right Turn On Red	N/A		Allowed On All Legs	

Signal Indicators - Risk factor present if each lane does not have a signal head above it.

Functional Class - Risk factor present if intersection is classified as Urban Minor Arterial or Urban Principal Arterial

Number of Approaches - Risk factor present if the intersection has 4 or 5 approaches. Any other number of approaches not counted as risk factor.

Roadway Division - Risk factor present if the intersection approaches are divided by physical median.

Double Left Turn Lane - Risk factor present if any approach has a double left turn lane.

Major App. Cross Section - Risk factor present if the major intersection approach has six (6) lanes.

Adjacent Land Use - Risk factor present if the area use surrounding the intersection is classified as 'suburban commercial'.

Total Entering Vehicles - Risk factor present if the total entering vehicles is greater than or equal to 30,000 vehicles per day.

Adjacent Bus Stop - Risk factor present if there is a bus stop within ~300 feet of the intersection.

Speed Limit Cross Product - Risk factor present if the product of the speed limits of the intersecting roads is greater than or equal to 1,400 (MV Crashes) or 1,600 (PB Crashes).

Max. Lanes to Cross - Risk factor present if there are 6, 7, or 8 lanes to cross.

Right Turn On Red - Risk factor applies on to PB crashes and is present if right turn on red is allowed at all intersection legs.

Multi-Vehicle Risk Prioritization

Palm Beach County Safety Plan

Rank	Intersection ID	Description	Signal Indicator	Functional Classification	Approaches	Roadway Division	Double Left Turn Lane	Major Approach	Adjacent Land Use	Total Entering Vehicles	Adjacent Bus Stop	Speed Limit Cross Product	Maximum Lanes to Cross	Total Risk Factors
1	2167	Elmhurst Rd/Westgate Ave & N Military Trl	★	★	★		★	★	★	★	★	★	★	10
2	1774	10th Ave N & S Congress Ave		★	★	★	★	★	★	★	★	★	★	10
3	1917	S Military Trail & Forest Hill Blvd	★	★	★	★	★	★		★	★	★	★	10
4	1790	10th Ave N & Jog Rd	★	★	★	★		★	★	★	★	★	★	10
5	1140	Woolbright Rd & Jog Rd	★	★	★	★	★	★	★	★		★	★	10
6	836	Clint Moore Rd & Military Trl	★	★	★	★	★	★	★	★	★	★		10
7	892	W Linton Blvd & S Military Trl	★	★	★	★	★	★	★	★	★	★		10
8	700	Glades Rd & Airport Rd	★	★	★	★	★	★	★	★		★	★	10
9	813	Yamato Rd & N Dixie Hwy	★	★	★	★	★	★	★	★		★	★	10
10	1149	Woolbright Rd & S Congress Ave	★	★	★	★	★	★	★	★	★	★		10
11	1226	Old Boynton Rd & S Military Trl		★	★		★	★	★	★	★	★	★	9
12	1712	Lake Worth Rd & S Jog Rd	★	★	★	★	★	★	★	★		★		9
13	1340	N Congress Ave & 45th St		★	★	★	★	★	★	★	★	★		9
14	1406	N Military Trail & Dr Martin Luther King Jr Blvd	★	★	★	★	★	★		★		★	★	9
15	731	Butts Rd & N Military Trl	★	★	★		★	★	★	★	★		★	9
16	222	SR 80 & Royal Palm Beach Blvd	★	★	★	★	★		★	★	★	★		9
17	695	Glades Rd & Lyons Rd		★	★	★	★		★	★	★	★		8
18	2085	Belvedere Rd & Australian Ave	★	★	★	★	★	★		★		★		8
19	2332	N Military Trail & Community Dr		★	★			★	★	★	★	★	★	8
20	537	SW 18th St & Lyons Rd		★	★	★	★			★	★	★	★	8
21	2722	W Indiantown Rd & Center St	★	★	★		★	★	★	★		★		8
22	305	Belvedere Rd & SR 7/US 441		★	★	★	★	★	★	★		★		8
23	1179	W Boynton Beach Blvd & Lawrence Rd	★	★	★			★		★	★	★	★	8
24	922	W Linton Blvd & Homewood Blvd	★	★	★			★		★	★	★	★	8
25	2328	I-95 & Palm Beach Lakes Blvd	★	★	★		★	★	★	★		★		8
26	2628	Donald Ross Rd & Military Trl		★	★	★	★	★	★	★		★		8
27	1574	Lantana Rd & Haverhill Rd		★	★	★	★	★		★	★	★		8
28	890	Linton Blvd & Jog Rd		★	★	★	★	★	★	★		★		8
29	2661	W Frederick Small Rd & Military Trl		★	★	★		★	★	★		★	★	8
30	2866	Hwy A1A & Kyoto Gardens Dr		★	★	★		★	★	★		★	★	8
31	1585	Lantana Rd & Lyons Rd		★	★	★	★		★	★		★	★	8
32	205	Southern Blvd & SR 7/US 441	★	★	★	★	★		★	★		★		8
33	1780	S Military Trail & 10th Ave N		★	★			★	★	★	★	★	★	8
34	1452	Gateway Blvd & Lawrence Rd	★	★	★			★		★	★	★	★	8
35	2852	Peninsula Corp Dr & Congress Ave	★	★	★	★	★	★	★	★				8
36	578	W Camino Real & Powerline Rd			★	★	★		★	★		★	★	7
37	2223	Okeechobee Blvd & Parker Ave/S Tamarind Ave	★	★	★	★	★		★	★				7
38	1015	Jog Rd & Lake Ida Rd		★	★	★		★		★		★	★	7
39	1194	Florida's Turnpike & W Boynton Beach Blvd/Orchid Grove Trail		★	★	★	★	★		★			★	7
40	1486	Congress Ave & Miner Rd		★	★			★		★	★	★	★	7

Multi-Vehicle Risk Prioritization

Palm Beach County Safety Plan

41	2255	Okeechobee Blvd & Benoist Farms Rd	★	★	★				★	★	★	★		7
42	1221	N Federal Hwy & E Boynton Beach Blvd		★	★		★		★	★	★		★	7
43	2626	Donald Ross Rd & Alt A1A		★	★	★	★	★		★		★		7
44	1232	Congress Ave & Old Boynton Rd		★	★			★		★	★	★	★	7
45	1694	Lake Worth Rd & Pinehurst Dr		★				★	★	★	★	★	★	7
46	1161	E Woolbright Rd & S Federal Hwy/US 1		★	★		★		★	★	★		★	7
47	1447	Gateway Blvd & S Jog Rd		★	★	★		★		★		★	★	7
48	340	Okeechobee Blvd & Crestwood Blvd		★	★	★	★			★		★	★	7
49	1321	N Military Trail & Cumberland Dr/Palmbrooke Cir	★	★	★	★		★			★		★	7
50	835	Jog Rd & Clint Moore Rd		★	★		★	★	★	★		★		7
51	1687	Lake Worth Rd & Turnpike SB			★	★	★	★	★	★			★	7
52	2091	Belvedere Rd & N Congress Ave/James L Turnage Blvd/Perimeter Rd		★	★	★		★		★		★	★	7
53	236	Southern Blvd & B Rd/Binks Forest Dr			★	★	★		★	★		★	★	7
54	2797	Marcinski Rd & US Highway 1		★	★	★	★		★			★	★	7
55	795	Yamato Rd & Jog Rd	★	★	★	★	★	★				★		7
56	2374	W Blue Heron Blvd & Broadway		★	★				★	★	★		★	6
57	900	I-95 & Linton Blvd	★	★			★		★	★		★		6
58	770	NE Spanish River Blvd & N Dixie Hwy		★	★				★	★		★	★	6
59	1624	Melaleuca Ln & Kirk Rd		★	★					★	★	★	★	6
60	63	Atlantic Ave & SR 7		★	★	★	★					★	★	6
61	368	State Road 80/Hooker Hwy & State Road 15/US 441		★	★	★			★			★	★	6
62	904	S Dixie Hwy & Linton Blvd		★	★			★		★		★	★	6
63	2360	Old Dixie Hwy & W Blue Heron Blvd		★	★			★		★	★		★	6
64	1628	Melaleuca Ln & Haverhill Rd		★	★					★	★	★	★	6
65	945	W Atlantic & Lyons Rd		★	★		★		★			★	★	6
66	1156	I-95 & Woolbright Rd		★	★		★	★		★		★		6
67	1528	Hypoluxo Rd & Seacrest Blvd/S 14th St		★	★				★	★	★	★		6
68	703	NW 20th St & N Dixie Hwy		★	★	★			★		★		★	6
69	135	State Rd 80 & W Palm Beach Rd		★	★	★			★		★		★	6
70	1636	6th Ave S & S Dixie Hwy		★	★				★	★	★			5
71	2025	Southern Blvd and I-95 SB Exit	★	★			★			★		★		5
72	1342	45th St & I-95 NB Exit	★	★			★		★	★				5
73	2348	Palm Beach Lakes Blvd & N Dixie Hwy		★	★					★	★		★	5
74	2624	Donald Ross Rd & Prosperity Farms Rd/Palmwood Rd		★	★					★		★	★	5
75	2337	Community Dr & Haverhill Rd		★			★		★			★	★	5
76	2321	N Quadrille Blvd & N Dixie Hwy		★	★		★				★		★	5
77	2257	Okeechobee Blvd & Grande Blvd/Sansburys Way		★	★	★			★			★		5
78	986	W Atlantic Ave & I-95 NB Exit Ramp	★	★			★	★		★				5
79	1315	Broadway & 36th St		★	★				★	★	★			5
80	1821	Haverhill Rd & Cresthaven Blvd		★	★					★	★	★		5
81	2750	US Hwy 1 & Ocean Blvd		★	★	★			★				★	5
82	2047	State Rd 80 & Benoist Farms Rd	★	★	★					★		★		5
83	2454	Northlake Blvd & I-95 SB Exit	★	★			★		★	★				5
84	2537	I-95 & PGA Blvd	★	★			★			★			★	5



## Multi-Vehicle Risk Prioritization

## Palm Beach County Safety Plan

85	1522	S Federal Hwy & Hypoluxo Rd		★	★				★		★	★		5
86	714	Glades Rd & I-95 SB Exit		★				★	★		★			4
87	722	NW 20th St & NW 2nd Ave			★				★	★	★			4
88	809	I-95 & Yamato Rd	★	★					★		★			4
89	456	Northlake Blvd & Coconut Blvd		★	★			★					★	4
90	2855	Belvedere Rd/Pike Rd		★	★				★				★	4
91	2515	Burns Rd & Prosperity Farms Rd			★				★		★	★		4
92	2587	US Hwy 1 & Juno Isles Blvd		★	★	★			★					4
93	2856	Belvedere Rd & Lake Ave		★	★				★		★			4
94	318	NW Ave L & NW 16th St			★				★		★	★		4
95	1148	Woolbright Rd & Lawrence Rd		★	★								★	3
96	2310	Royal Poinciana Way & Coconut Row			★			★					★	3
97	496	Beeline Hwy & Pratt Whitney Rd/Innovation Dr		★	★								★	3
98	1019	Lake Ida Rd/NE 4th St & N Swinton Ave			★				★		★			3
99	1074	NE 22nd St & Seacrest Blvd/NE 2nd Ave			★				★		★			3
100	505	Indiantown Rd & Pratt Whitney Rd		★	★								★	3
101	2764	Donald Ross Rd & I-95 SB Exit		★				★			★			3
102	2847	Lake Victoria Gardens Ave & Alt A1A				★	★		★					3
103	2841	Universe Blvd & US 1		★		★			★					3
104	2622	Donald Ross Rd & Ellison Wilson Rd		★	★								★	3
105	1042	Lake Ida Rd & Barwick Rd			★						★		★	3
106	1143	Woolbright Rd & E Clair Ranch Rd			★								★	3
107	101	S Shore Blvd & Big Blue Trace				★							★	3
108	1586	N Federal Hwy & N Dixie Hwy		★					★		★			3
109	2228	Lakeview Ave & S Flagler Dr		★	★								★	3
110	2857	Belvedere Rd & Georgia Ave		★	★				★					3
111	2850	Indiantown Rd & Alexander Run/Mack Dairy Rd		★	★								★	3
112	1374	Dr Martin Luther King Jr Dr/Australian Ave		★	★									2
113	411	Orange Blvd & Coconut Blvd			★								★	2
114	994	E Atlantic Ave & S Ocean Blvd		★					★					2
115	2318	Quadrille Blvd & Olive Ave		★	★									2
116	1759	10th Ave N & N Federal Hwy		★	★									2
117	2881	Jupiter Park Dr & Central Blvd				★						★		2
118	2482	Lighthouse Dr & Prosperity Farms Rd			★							★		2
119	360	Hooker Hwy & SR 715			★								★	2
120	1424	N Old Dixie Hwy & Tequesta Dr			★	★								2
121	395	60th St N & Royal Palm Beach Blvd			★								★	2
122	2424	Park Ave & Old Dixie Hwy			★				★					2
123	2794	Church St & Central Blvd	★		★									2
124	1021	NE 4th St & NE 2nd Ave		★	★									2
125	2804	Northern Dr & 10th St & Prosperity Farms Rd			★				★					2
126	2799	Universe Blvd & Ellison Wilson Rd			★				★					2
127	1018	Lake Ida Rd & El Clair Ranch Rd			★									1
128	762	Spanish River Blvd & Airport Rd											★	1

129	2863	State Road 80 & S Flagler Dr			★										1
130	1925	Forest Hill Blvd & S Olive Ave			★										1
131	782	NE Spanish River Blvd & N Ocean Blvd		★											1
132	479	Barack Obama Blvd & Barfield Hwy			★										1
133	1771	10th Ave N & Pinehurst Dr													0

Pedestrian Bicycle Risk Prioritization

Rank	Intersection ID	Description	Signal Indicator	Functional Classification	Approaches	Roadway Division	Double Left Turn Lane	Major Approach	Adjacent Land Use	Total Entering Vehicles	Adjacent Bus Stop	Speed Limit Cross Product	Maximum Lanes to Cross	Right Turn On Red	Total Risk Factors
1	2167	Elmhurst Rd/Westgate Ave & N Military Trl	★	★	★		★	★	★	★	★	★	★	★	11
2	1917	S Military Trail & Forest Hill Blvd	★	★	★	★	★	★		★	★	★	★	★	11
3	1790	10th Ave N & Jog Rd	★	★	★	★		★	★	★	★	★	★	★	11
4	1774	10th Ave N & S Congress Ave		★	★	★	★	★	★	★	★	★	★	★	11
5	836	Clint Moore Rd & Military Trl	★	★	★	★	★	★	★	★	★	★		★	11
6	813	Yamato Rd & N Dixie Hwy	★	★	★	★	★	★	★	★		★	★	★	11
7	892	W Linton Blvd & S Military Trl	★	★	★	★	★	★	★	★	★	★		★	11
8	1149	Woolbright Rd & S Congress Ave	★	★	★	★	★	★	★	★	★	★		★	11
9	1712	Lake Worth Rd & S Jog Rd	★	★	★	★	★	★	★	★		★		★	10
10	731	Butts Rd & N Military Trl	★	★	★		★	★	★	★	★		★	★	10
11	1406	N Military Trail & Dr Martin Luther King Jr Blvd	★	★	★	★	★	★		★		★	★	★	10
12	1226	Old Boynton Rd & S Military Trl		★	★		★	★	★	★	★	★	★	★	10
13	1140	Woolbright Rd & Jog Rd	★	★	★	★	★	★	★	★		★	★		10
14	1179	W Boynton Beach Blvd & Lawrence Rd	★	★	★			★		★	★	★	★	★	9
15	700	Glades Rd & Airport Rd	★	★	★	★	★	★	★	★			★		9
16	695	Glades Rd & Lyons Rd		★	★	★	★		★	★	★	★		★	9
17	222	SR 80 & Royal Palm Beach Blvd	★	★	★	★	★		★	★	★			★	9
18	1340	N Congress Ave & 45th St		★	★	★	★	★	★	★	★	★			9
19	1780	S Military Trail & 10th Ave N		★	★			★	★	★	★	★	★	★	9
20	305	Belvedere Rd & SR 7/US 441		★	★	★	★	★	★	★		★		★	9
21	2628	Donald Ross Rd & Military Trl		★	★	★	★	★	★	★		★		★	9
22	1574	Lantana Rd & Haverhill Rd		★	★	★	★	★		★	★	★		★	9
23	890	Linton Blvd & Jog Rd		★	★	★	★	★	★	★		★		★	9
24	537	SW 18th St & Lyons Rd		★	★	★	★			★	★	★	★	★	9
25	1452	Gateway Blvd & Lawrence Rd	★	★	★			★		★	★	★	★	★	9
26	2852	Peninsula Corp Dr & Congress Ave	★	★	★	★	★	★	★	★				★	9
27	2661	W Frederick Small Rd & Military Trl		★	★	★		★	★	★		★	★	★	9
28	1585	Lantana Rd & Lyons Rd		★	★	★	★		★	★		★	★	★	9
29	1161	E Woolbright Rd & S Federal Hwy/US 1		★	★		★		★	★	★		★	★	8
30	1321	N Military Trail & Cumberland Dr/Palmbrooke Cir	★	★	★	★		★			★		★	★	8
31	205	Southern Blvd & SR 7/US 441	★	★	★	★	★		★	★				★	8
32	2328	I-95 & Palm Beach Lakes Blvd	★	★	★		★	★	★	★		★			8
33	2223	Okeechobee Blvd & Parker Ave/S Tamarind Ave	★	★	★	★	★		★	★				★	8
34	835	Jog Rd & Clint Moore Rd		★	★		★	★	★	★		★		★	8
35	2255	Okeechobee Blvd & Benoist Farms Rd	★	★	★				★	★	★	★		★	8
36	2085	Belvedere Rd & Australian Ave	★	★	★	★	★	★		★				★	8
37	2626	Donald Ross Rd & Alt A1A		★	★	★	★	★		★		★		★	8
38	1232	Congress Ave & Old Boynton Rd		★	★			★		★	★	★	★	★	8
39	1194	Florida's Turnpike & W Boynton Beach Blvd/Orchid Grove Trail		★	★	★	★	★		★			★	★	8
40	2332	N Military Trail & Community Dr		★	★			★	★	★	★		★	★	8

Pedestrian Bicycle Risk Prioritization

41	1447	Gateway Blvd & S Jog Rd		★	★	★		★		★		★	★	★	8
42	922	W Linton Blvd & Homewood Blvd	★	★	★			★		★	★		★	★	8
43	578	W Camino Real & Powerline Rd			★	★	★		★	★		★	★	★	8
44	2091	Belvedere Rd & N Congress Ave/James L Turnage Blvd/Perimeter Rd		★	★	★		★		★		★	★	★	8
45	340	Okeechobee Blvd & Crestwood Blvd		★	★	★	★			★		★	★	★	8
46	236	Southern Blvd & B Rd/Binks Forest Dr			★	★	★		★	★		★	★	★	8
47	1486	Congress Ave & Miner Rd		★	★			★		★	★	★	★	★	8
48	1221	N Federal Hwy & E Boynton Beach Blvd		★	★		★		★	★	★		★	★	8
49	1015	Jog Rd & Lake Ida Rd		★	★	★		★		★		★	★	★	8
50	2866	Hwy A1A & Kyoto Gardens Dr		★	★	★		★	★	★			★	★	8
51	795	Yamato Rd & Jog Rd	★	★	★	★	★	★				★		★	8
52	2374	W Blue Heron Blvd & Broadway		★	★				★	★	★		★	★	7
53	2722	W Indiantown Rd & Center St	★	★	★		★	★	★	★					7
54	1687	Lake Worth Rd & Turnpike SB			★	★	★	★	★	★			★		7
55	1694	Lake Worth Rd & Pinehurst Dr		★				★	★	★	★		★	★	7
56	904	S Dixie Hwy & Linton Blvd		★	★			★		★		★	★	★	7
57	2360	Old Dixie Hwy & W Blue Heron Blvd		★	★			★		★	★		★	★	7
58	1528	Hypoluxo Rd & Seacrest Blvd/S 14th St		★	★				★	★	★	★		★	7
59	1628	Melaleuca Ln & Haverhill Rd		★	★					★	★	★	★	★	7
60	63	Atlantic Ave & SR 7		★	★	★	★					★	★	★	7
61	703	NW 20th St & N Dixie Hwy		★	★	★			★		★		★	★	7
62	135	State Rd 80 & W Palm Beach Rd		★	★	★			★		★		★	★	7
63	2797	Marcinski Rd & US Highway 1		★	★	★	★		★				★	★	7
64	945	W Atlantic & Lyons Rd		★	★		★		★			★	★	★	7
65	368	State Road 80/Hooker Hwy & State Road 15/US 441		★	★	★			★			★	★	★	7
66	770	NE Spanish River Blvd & N Dixie Hwy		★	★				★	★			★	★	6
67	2348	Palm Beach Lakes Blvd & N Dixie Hwy		★	★					★	★		★	★	6
68	2047	State Rd 80 & Benoist Farms Rd	★	★	★					★		★		★	6
69	1636	6th Ave S & S Dixie Hwy		★	★				★	★	★			★	6
70	1624	Melaleuca Ln & Kirk Rd		★	★					★	★		★	★	6
71	2321	N Quadrille Blvd & N Dixie Hwy		★	★		★				★		★	★	6
72	2750	US Hwy 1 & Ocean Blvd		★	★	★			★				★	★	6
73	2257	Okeechobee Blvd & Grande Blvd/Sansburys Way		★	★	★			★			★		★	6
74	1342	45th St & I-95 NB Exit	★	★			★		★	★					5
75	2454	Northlake Blvd & I-95 SB Exit	★	★			★		★	★					5
76	1156	I-95 & Woolbright Rd		★	★		★	★		★					5
77	900	I-95 & Linton Blvd	★	★			★		★	★					5
78	986	W Atlantic Ave & I-95 NB Exit Ramp	★	★			★	★		★					5
79	2537	I-95 & PGA Blvd	★	★			★			★			★		5
80	1315	Broadway & 36th St		★	★				★	★	★				5
81	722	NW 20th St & NW 2nd Ave			★				★	★	★			★	5
82	2624	Donald Ross Rd & Prosperity Farms Rd/Palmwood Rd		★	★					★			★	★	5
83	1821	Haverhill Rd & Cresthaven Blvd		★	★					★	★			★	5

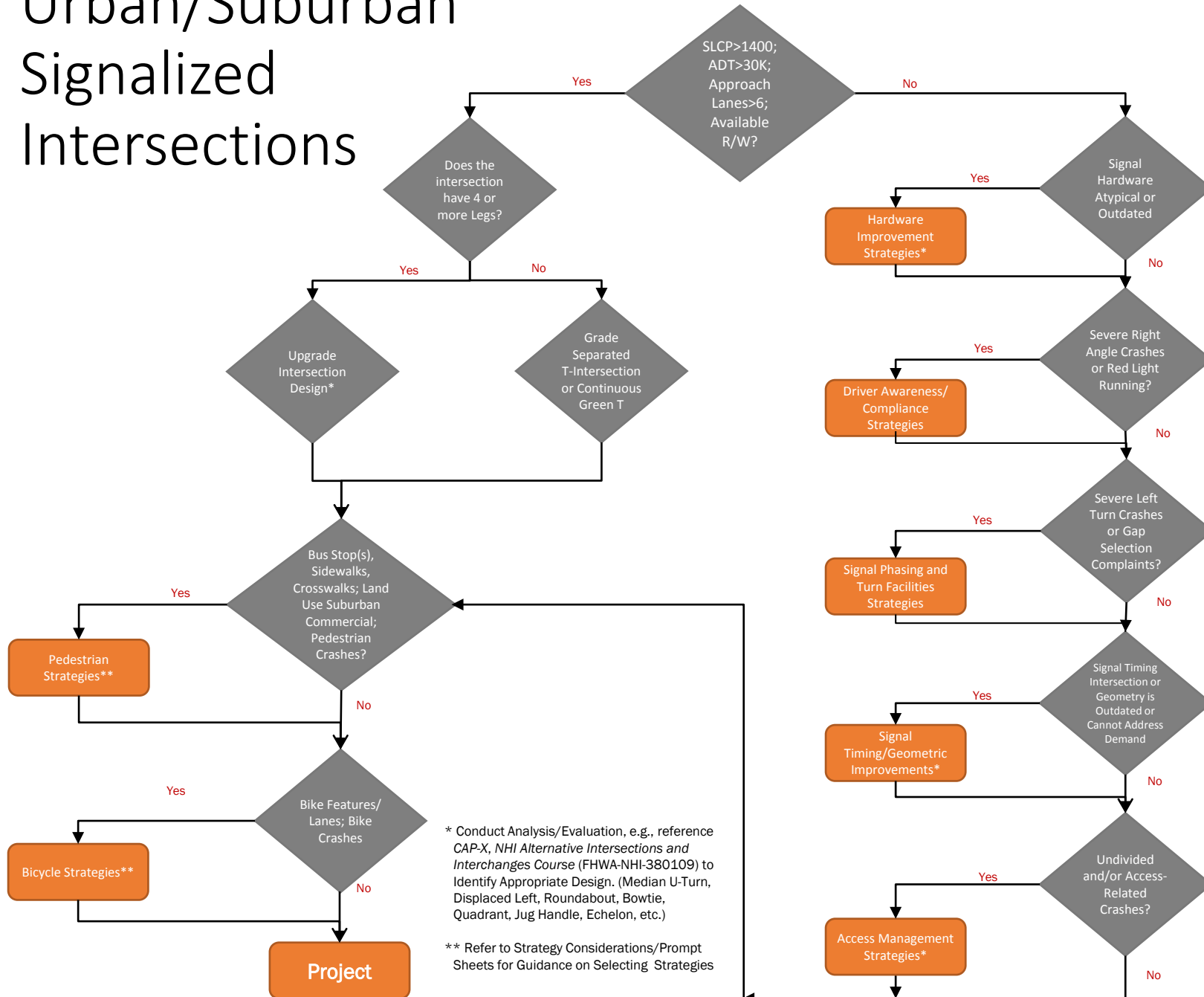
Pedestrian Bicycle Risk Prioritization

84	2855	Belvedere Rd/Pike Rd		★	★			★				★		★	5
85	1522	S Federal Hwy & Hypoluxo Rd		★	★				★		★			★	5
86	2587	US Hwy 1 & Juno Isles Blvd		★	★	★			★					★	5
87	2856	Belvedere Rd & Lake Ave		★	★				★		★			★	5
88	2025	Southern Blvd and I-95 SB Exit	★	★			★			★					4
89	714	Glades Rd & I-95 SB Exit		★			★	★		★					4
90	809	I-95 & Yamato Rd	★	★				★		★					4
91	2337	Community Dr & Haverhill Rd		★			★		★				★		4
92	1019	Lake Ida Rd/NE 4th St & N Swinton Ave			★				★		★			★	4
93	1148	Woolbright Rd & Lawrence Rd		★	★							★		★	4
94	1042	Lake Ida Rd & Barwick Rd			★					★			★	★	4
95	456	Northlake Blvd & Coconut Blvd		★	★		★					★			4
96	2515	Burns Rd & Prosperity Farms Rd			★				★		★			★	4
97	101	S Shore Blvd & Big Blue Trace				★						★	★	★	4
98	2857	Belvedere Rd & Georgia Ave		★	★				★					★	4
99	2850	Indiantown Rd & Alexander Run/Mack Dairy Rd		★	★							★		★	4
100	2310	Royal Poinciana Way & Coconut Row			★		★						★	★	4
101	496	Beeline Hwy & Pratt Whitney Rd/Innovation Dr		★	★							★		★	4
102	318	NW Ave L & NW 16th St			★				★		★			★	4
103	1074	NE 22nd St & Seacrest Blvd/NE 2nd Ave			★				★		★			★	4
104	505	Indiantown Rd & Pratt Whitney Rd		★	★							★		★	4
105	994	E Atlantic Ave & S Ocean Blvd		★					★					★	3
106	1374	Dr Martin Luther King Jr Dr/Australian Ave		★	★									★	3
107	2764	Donald Ross Rd & I-95 SB Exit		★			★			★					3
108	2847	Lake Victoria Gardens Ave & Alt A1A				★	★		★						3
109	2841	Universe Blvd & US 1		★		★			★						3
110	2622	Donald Ross Rd & Ellison Wilson Rd		★	★							★			3
111	1143	Woolbright Rd & E Clair Ranch Rd			★								★	★	3
112	2482	Lighthouse Dr & Prosperity Farms Rd			★					★				★	3
113	360	Hooker Hwy & SR 715			★							★		★	3
114	1586	N Federal Hwy & N Dixie Hwy		★					★		★				3
115	2228	Lakeview Ave & S Flagler Dr		★	★								★		3
116	411	Orange Blvd & Coconut Blvd			★							★		★	3
117	1424	N Old Dixie Hwy & Tequesta Dr			★	★								★	3
118	2424	Park Ave & Old Dixie Hwy			★				★					★	3
119	2794	Church St & Central Blvd	★		★									★	3
120	1021	NE 4th St & NE 2nd Ave		★	★									★	3
121	2804	Northern Dr & 10th St & Prosperity Farms Rd			★				★					★	3
122	2799	Universe Blvd & Ellison Wilson Rd			★				★					★	3
123	1759	10th Ave N & N Federal Hwy		★	★									★	3
124	2881	Jupiter Park Dr & Central Blvd				★					★				2
125	395	60th St N & Royal Palm Beach Blvd			★							★			2
126	2863	State Road 80 & S Flagler Dr			★									★	2

127	2318	Quadrille Blvd & Olive Ave		★	★										2
128	1018	Lake Ida Rd & El Clair Ranch Rd			★									★	2
129	1925	Forest Hill Blvd & S Olive Ave			★									★	2
130	782	NE Spanish River Blvd & N Ocean Blvd		★										★	2
131	479	Barack Obama Blvd & Barfield Hwy			★									★	2
132	1771	10th Ave N & Pinehurst Dr												★	1
133	762	Spanish River Blvd & Airport Rd													0

Appendix D  
Project Development Decision Trees  
and Prompt Lists

# Urban/Suburban Signalized Intersections





# Hardware Improvement Strategies (Optimizing Visibility)

## Objectives:

- Improve driver awareness (i.e., visibility) of intersections and signal control
- Reduce frequency and severity of conflicts through traffic control improvements

## Strategies:

- Improve visibility of pavement markings, signals, and signs

# Hardware Improvement Strategy Considerations (Optimizing Visibility)

## Optimizing Visibility:

- **Signal Visibility**
  - Check Location, Horizontal and Vertical Mounting
  - Add Background Shields to Improve Visibility (Especially Eastbound, Westbound Approaches)
  - Supplement Overhead Signal Heads with Post-Mounted Signal Heads
  - Install Flashing Yellow Arrow and Supplemental Signing for Left Turns
- **Optimize Location of Stop Bar**
  - Consider Design Vehicle Turning Radius
  - Appropriate Clearance for Crossing Pedestrians
- **Visibility and Condition of Pavement Markings and Signs**
  - Improve Retroreflectivity of Markings and/or Signs
  - Increase Sizing of Signs
  - In-Pavement or Raised Pavement Markers

# Driver Awareness, Compliance Strategies

## Objectives:

- Improve driver compliance with traffic control devices
- Reduce frequency and severity of conflicts through traffic control improvements

## Strategies:

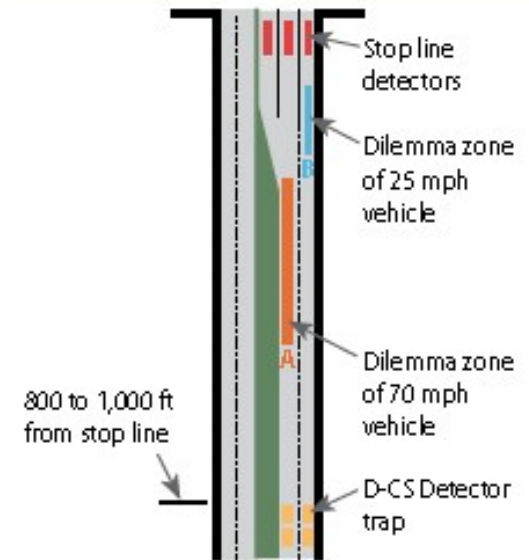
- Dilemma zone protection
- Red-light confirmation lights
- Signal phasing and timing improvements (multiphase signal timing, clearance interval optimization, signal coordination)
- Minimize, reduce, and manage visual clutter and information overload

Driver Awareness/  
Compliance  
Strategies

# Driver Awareness, Compliance Strategy Considerations

## What is the reason for the conflicts?

- IF Visibility – consider driver awareness:
  - Same as earlier slide - optimize visibility (may include sizing of signs)
- IF Driver Awareness/Compliance – consider:
  - Red-light running confirmation lights (requires targeted enforcement)
  - Advanced dilemma zone detection/extension of green
  - Reevaluate signal phasing and timing
  - Identify information priorities and address conflicts by emphasizing/deemphasizing based on priority



Advanced Dilemma Zone Detection  
Source: FHWA

Driver Awareness/  
Compliance  
Strategies

# Signal Phasing and Turn Facility Strategies (Left Turns)

## Objectives:

- Reduced frequency and severity of intersection conflicts through traffic control and operational control improvements

## Strategies:

- Protected phasing
- Restrict turning movements
- Add and/or channelize turn lanes

Signal Phasing  
and Turn Facilities  
Strategies

# Signal Phasing and Turn Facility Strategy Considerations (Left Turns)

What are the primary issues and/or constraints?

- Gap selection
- Sight distance
- Left turn offset
- Clearance intervals
- Speeds
- Capacity/level of service

# Signal Timing and Geometric Improvement Strategies

## Objectives:

- Reduced frequency and severity of intersection conflicts through traffic control and operational control improvements
- Reduce frequency and severity of intersection conflicts through geometric improvements

## Strategies:

- Signal phasing and timing improvements (multiphase signal timing, clearance interval optimization, signal coordination, emergency vehicle preemption)
- Geometric improvements (turn lanes, channelization, upgrade or conversion to alternative intersection type)

Signal  
Timing/Geometric  
Improvements

# Signal Timing Strategy Considerations

- How recently has signal timing/phasing been updated?
- Yellow Change and All Red Clearance Intervals? Does calculated AR differ from what has been applied at the intersection?
- Is signal part of a coordinated system? Is there an adjacent coordinated system? Any benefit to coordinate with other signals?
- Are there high turning movement volumes? Dedicated turn lanes? Protected turning movements?
- What is relationship of major to minor street traffic volumes? Does this create capacity issues?
- What is the relationship of major to minor street speed limit? If there is a significant difference between major and minor street speed limits, what issues does this create?
- Are there nearby hospital/fire station/emergency services?

Signal  
Timing/Geometric  
Improvements



# Intersection Geometry Strategy Considerations

- Are turn lanes (number and length) adequate to handle volume?
- Are turn lanes channelized?
- Is this a candidate location for an alternative intersection type?
  - Have all reasonable alternative improvements been tried?
  - Poor capacity/level of service or major-minor street volumes approach each other (i.e., difficult to time efficiently with a signal)
  - History of severe red-light-running, turning, or angle crashes that have not been addressed via traditional improvements (eliminates conflict points)
  - Is there sufficient space/right of way?
  - What is the target design vehicle?
  - Does the safety cost-benefit analysis support a major reconstructive alternative?

Signal  
Timing/Geometric  
Improvements

# Access Management Strategies

## Objectives:

- Improve access management near signalized intersections

## Strategies:

- Restrict access to properties using driveway closures or turn restrictions
- Restrict cross-median access near intersections

# Access Management Strategy Considerations

- Are there driveways within the limits of the intersection? Can the driveways be closed and/or consolidated and still maintain access to the properties being served?
- Are severe crashes or high frequency of crashes occurring within the limits of the intersection related to driveways? If so, what are the represented crash types?
  - Rear-end crashes may indicate need for driveway closure and/or consolidation
  - Angle crashes (ingress or egress) and cross-centerline turning crashes may indicate need for:
    - Restrict turning movements (RIRO)
    - Physical separation or prohibit turning movements (e.g., median barrier, delineated barrier)

# Pedestrian Strategies

## Objectives:

- Reduce pedestrian exposure to vehicular traffic
- Improve sight distance and/or visibility of pedestrians
- Develop and promote multimodal accessibility

## Strategies:

- Provide sidewalks, walkways, curb ramps, and crosswalks
- Improve signal features (countdown timers, leading pedestrian intervals)
- Construct pedestrian refuge islands, raised medians, or curb extensions
- Full/partial diverters, street closures
- Overpasses/underpasses
- Crosswalk enhancements

# Bicycle Strategies

## Objectives:

- Reduce bicycle exposure to vehicular traffic
- Improve sight distance and/or visibility of bicyclists
- Develop and promote multimodal accessibility

## Strategies:

- Provide bike lanes
- Restrict right turn on red
- Install bike boxes, bicycle preemption systems, and bicycle leading intervals
- Full/partial diverters, street closures
- Overpass/underpass

# Bicycle and Pedestrian Strategy Considerations

- What are existing pedestrian/bicycle features?
  - Are there ped signals, crosswalks?
  - Are there Refuge Islands?
- Is there any Pedestrian/Bicycle demand for the intersection?  
Consider land use, nearby generators.
- If no features are present or existing features are limited, will there be bicycle or pedestrian features in the future?
- Are there existing sidewalks, multi-use paths, or bike lanes?
- What is the condition of the exiting pavement markings, traffic signals?
- How many lanes must a pedestrian cross? (>6)
- If divided, does a pedestrian refuge island exist?

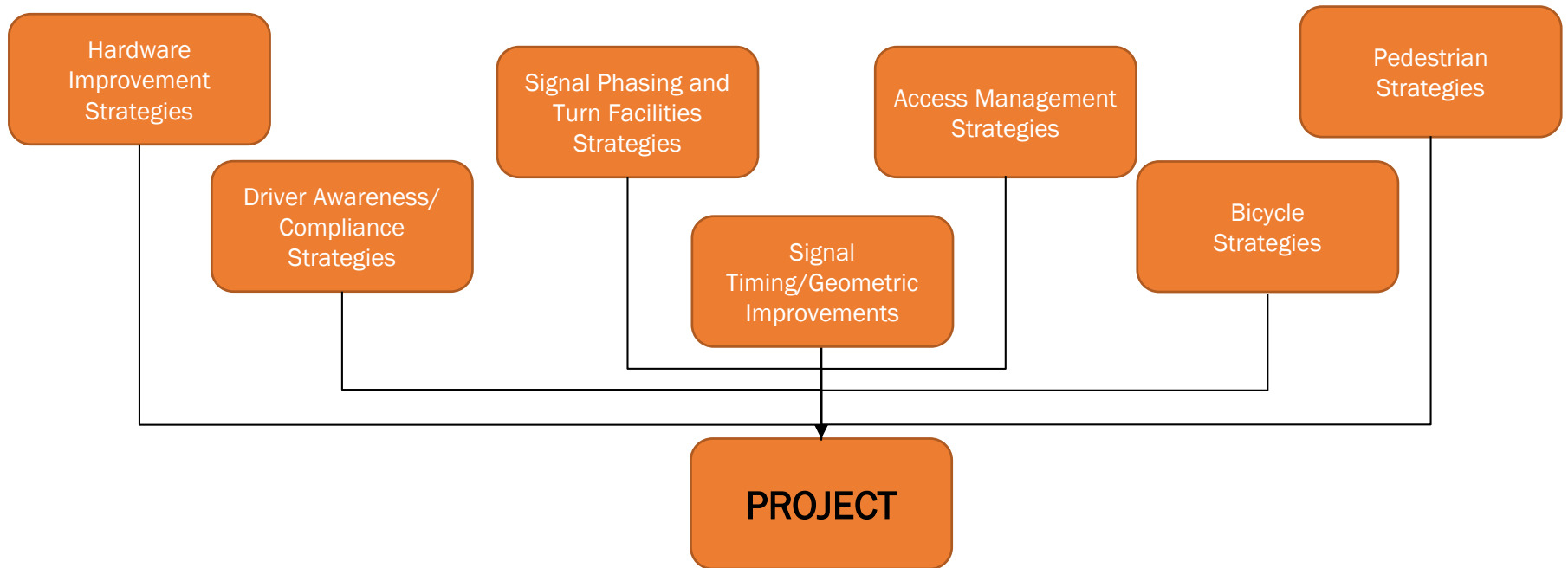
Bicycle  
Strategies

Pedestrian  
Strategies

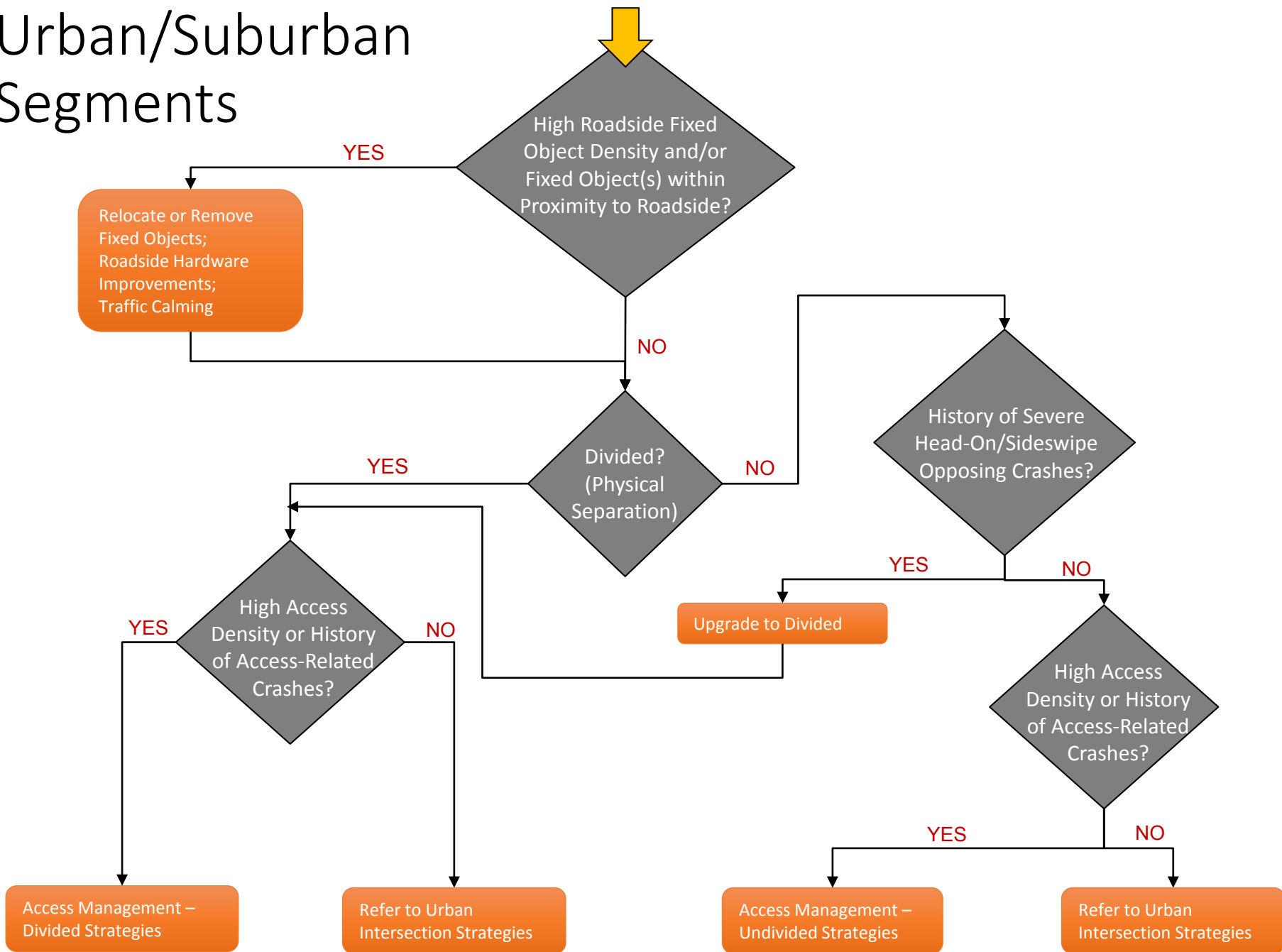
# Urban Signalized Intersections

## Final Project Description

- Complex intersections may result in multiple strategies recommended at one location to create a project



# Urban/Suburban Segments





# Urban Segments

## Strategies List: Access Management - Divided

### **Access Management Strategies for Divided Roadways:**

- Close Median Breaks
- Prohibit Traversable Medians
- Close/Consolidate Driveways
- Restrict Turning Movements (RIRO)
- Add or Channelize Turn Lanes

Certain conditions such as high access density create the potential for crashes. These strategies can be used proactively to address locations with these characteristics to reduce the potential risk for crashes, even at locations where no crashes have occurred. Where history of access-related crashes (e.g., at driveways, median breaks, mid-block pedestrian and bicycle crossings), these strategies can be used to effectively address known crash patterns.

# Urban Segments

## Strategies List: Access Management - Undivided

### **Access Management Strategies for Undivided Roadways:**

- Close/Consolidate Driveways
- Restrict Turning Movements (RIRO)
- Prohibit Cross-Centerline Turning Movements
  - Location-specific: Candlestick Delineators/Bollards, Low-Profile Concrete Median Barrier
  - Upgrade complete segment to divided: Jersey Barrier, Continuous Low-Profile Concrete Median Barrier
- Add or Channelize Turn Lanes
- Alternating or Two-Way Left Turn Lanes
- Road Diet (See Next Slide)

Certain conditions such as high access density create the potential for crashes. These strategies can be used proactively to address locations with these characteristics to reduce the potential risk for crashes, even at locations where no crashes have occurred. Where history of access-related crashes (e.g., at driveways, mid-block pedestrian and bicycle crossings), these strategies can be used to effectively address known crash patterns.

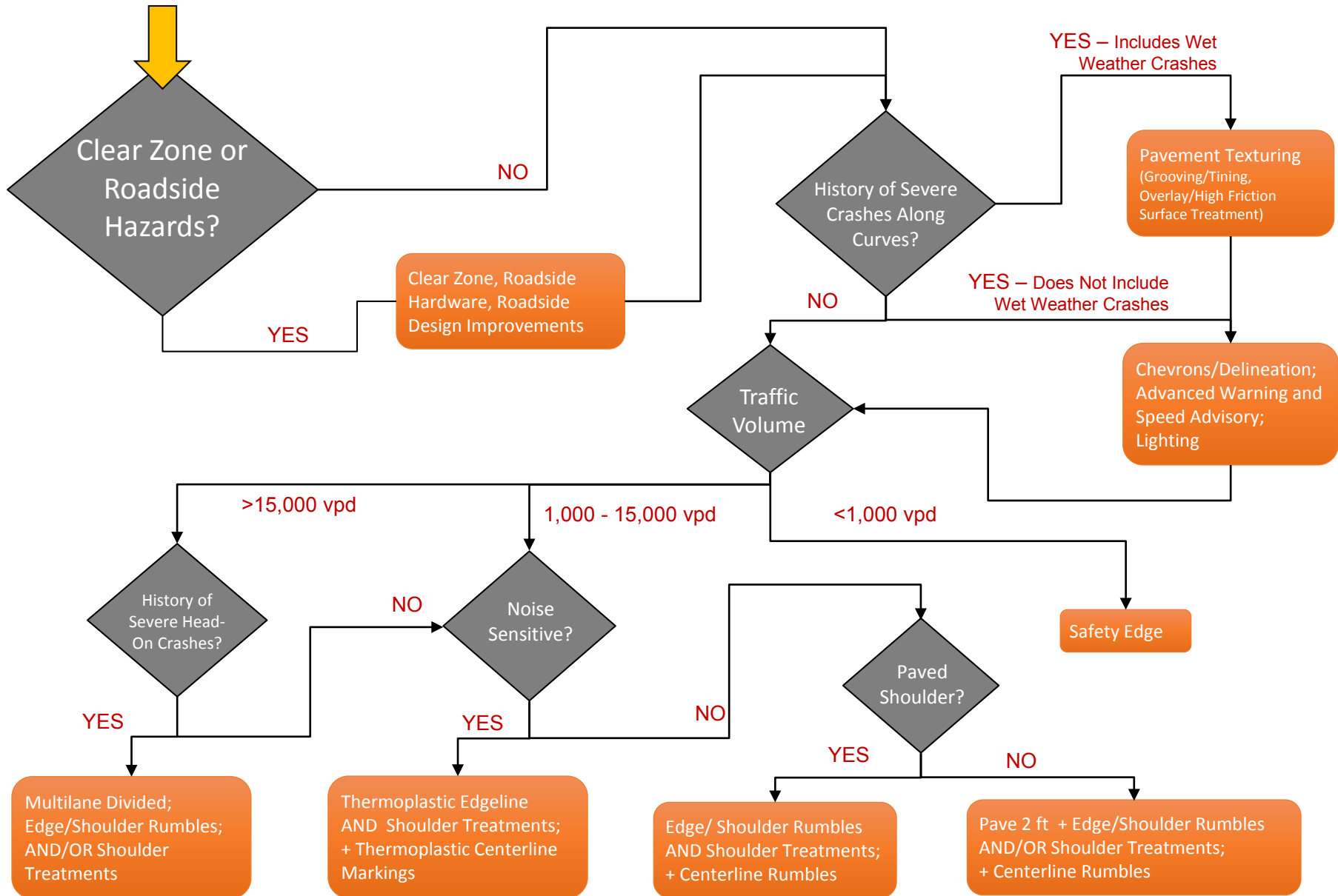
# Urban Segments

## Strategies List: Access Management – Road Diets

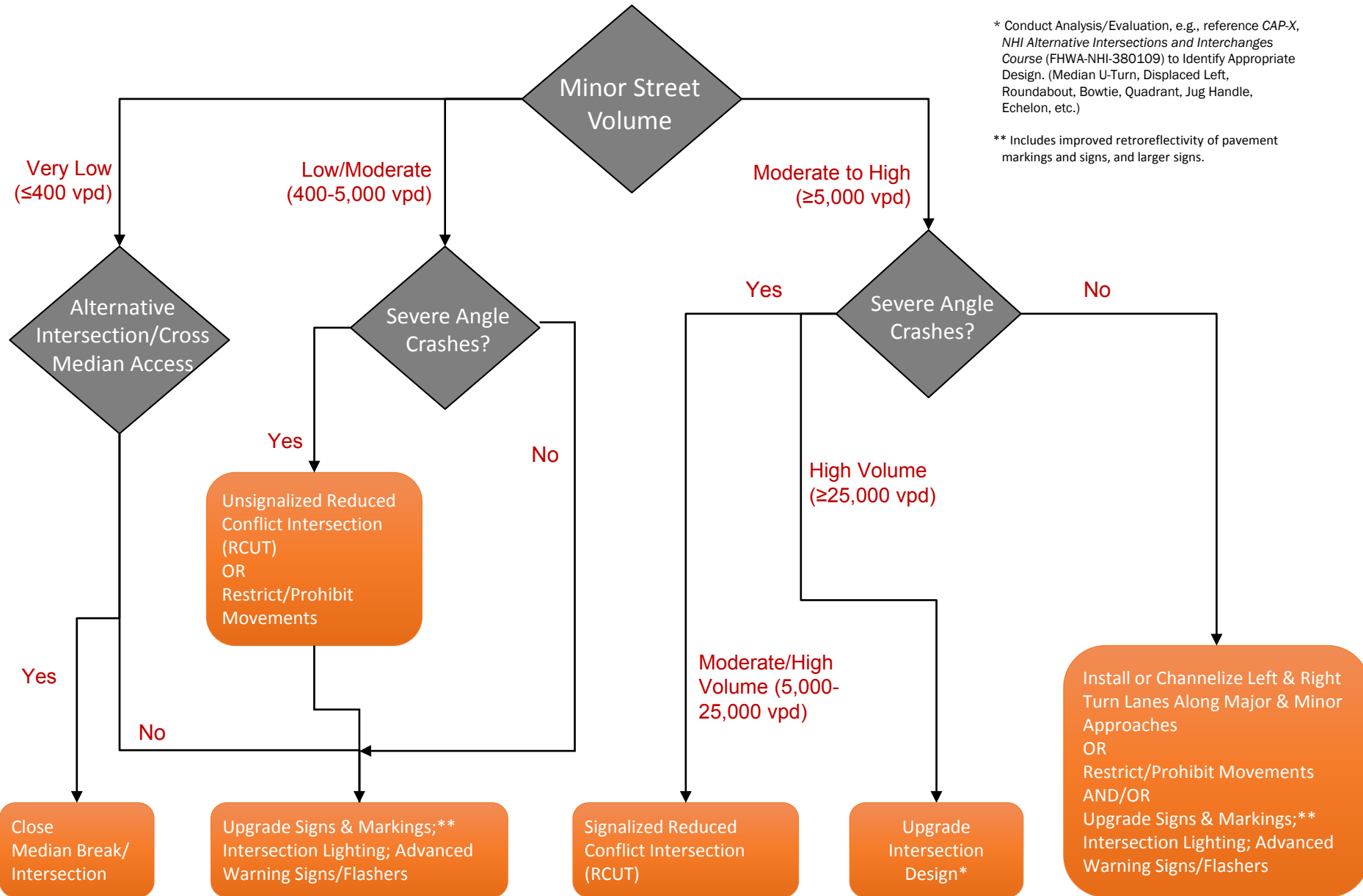
### **Road Diet - Strategy for Undivided Roadways:**

- Road Diet - reallocates the travel and/or effective width of the road to achieve systemic improvements addressing safety concerns for all road users.
  - 4-Lane to 3-Lane
  - 6-Lane to 5-Lane
  - 2-Lane to 3-Lane with Removal of Parking Lanes
  - Other Potential Combinations May Exist (e.g., 4-Lane to 2-Lane + Bus Lane)
- Considerations
  - Volume, Level of Service – Can the roadway accommodate fewer through lanes?
  - Alternate Modes (Pedestrian, Bicycle, Transit) – Does the demand warrant reallocation of pavement for alternate modes?
  - Driveway and Other Access Density – Is there a high demand for cross-centerline turns?
  - Parking – Are there nonmotorized or vehicular turning conflicts and/or visibility issues with existing parking? Is it necessary to retain on-street parking?
  - Road diets need to consider impacts to other infrastructure elements (e.g., alignment of signal heads)

# Rural Segments



# Rural Intersections



\* Conduct Analysis/Evaluation, e.g., reference CAP-X, NHI Alternative Intersections and Interchanges Course (FHWA-NHI-380109) to Identify Appropriate Design. (Median U-Turn, Displaced Left, Roundabout, Bowtie, Quadrant, Jug Handle, Echelon, etc.)

\*\* Includes improved retroreflectivity of pavement markings and signs, and larger signs.

Appendix E  
Example Project Identification Using  
Project Development Decision Trees  
and Prompt Lists

# Project Decision Tree Example

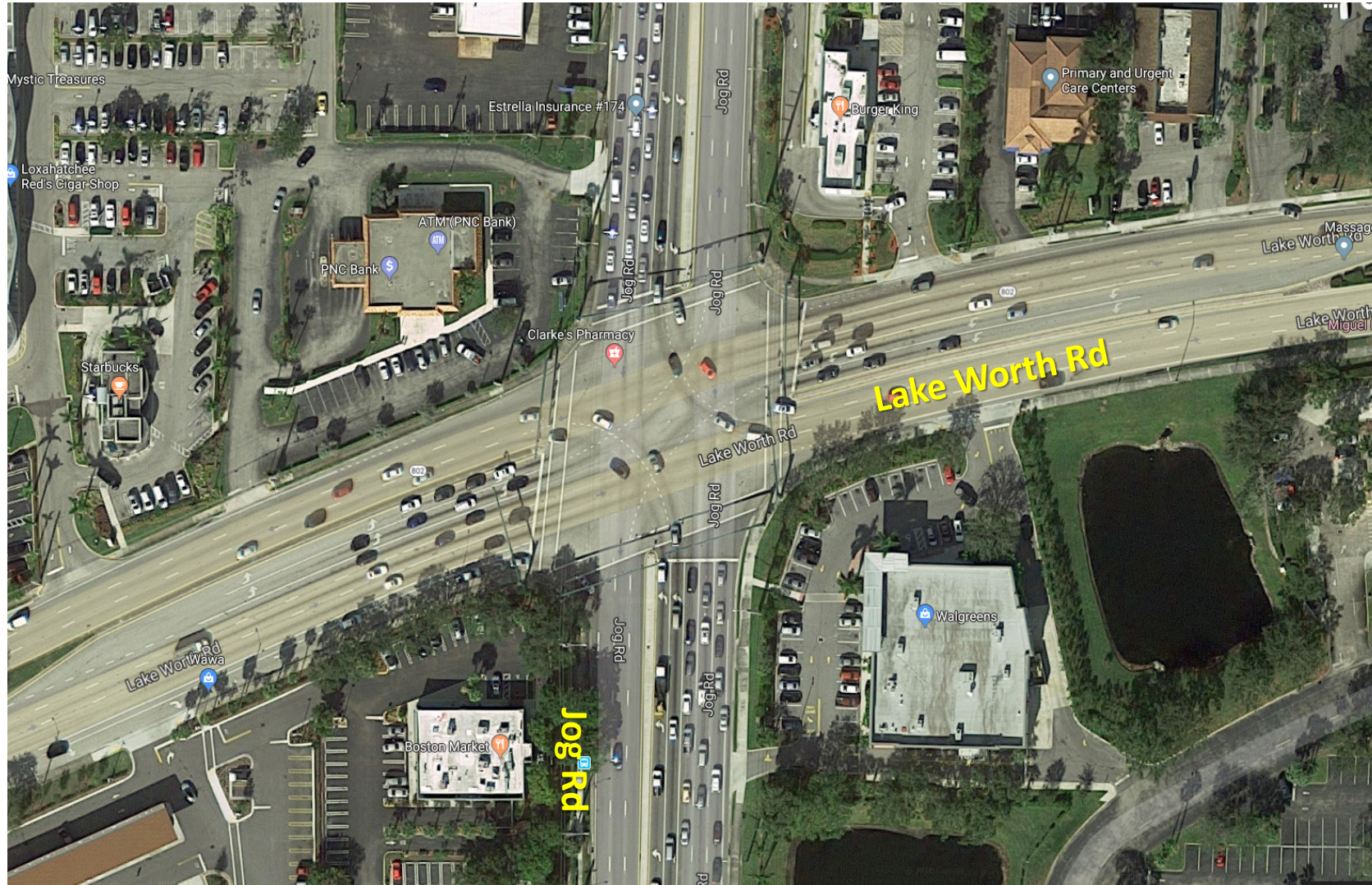
## PALM BEACH COUNTY LOCAL ROAD SAFETY PLAN DEVELOPMENT

Urban/Suburban Intersection

Intersection of Lake Worth Rd (FL 802) & S. Jog Road

Rank 12, Intersection ID 1712

# Site Overview



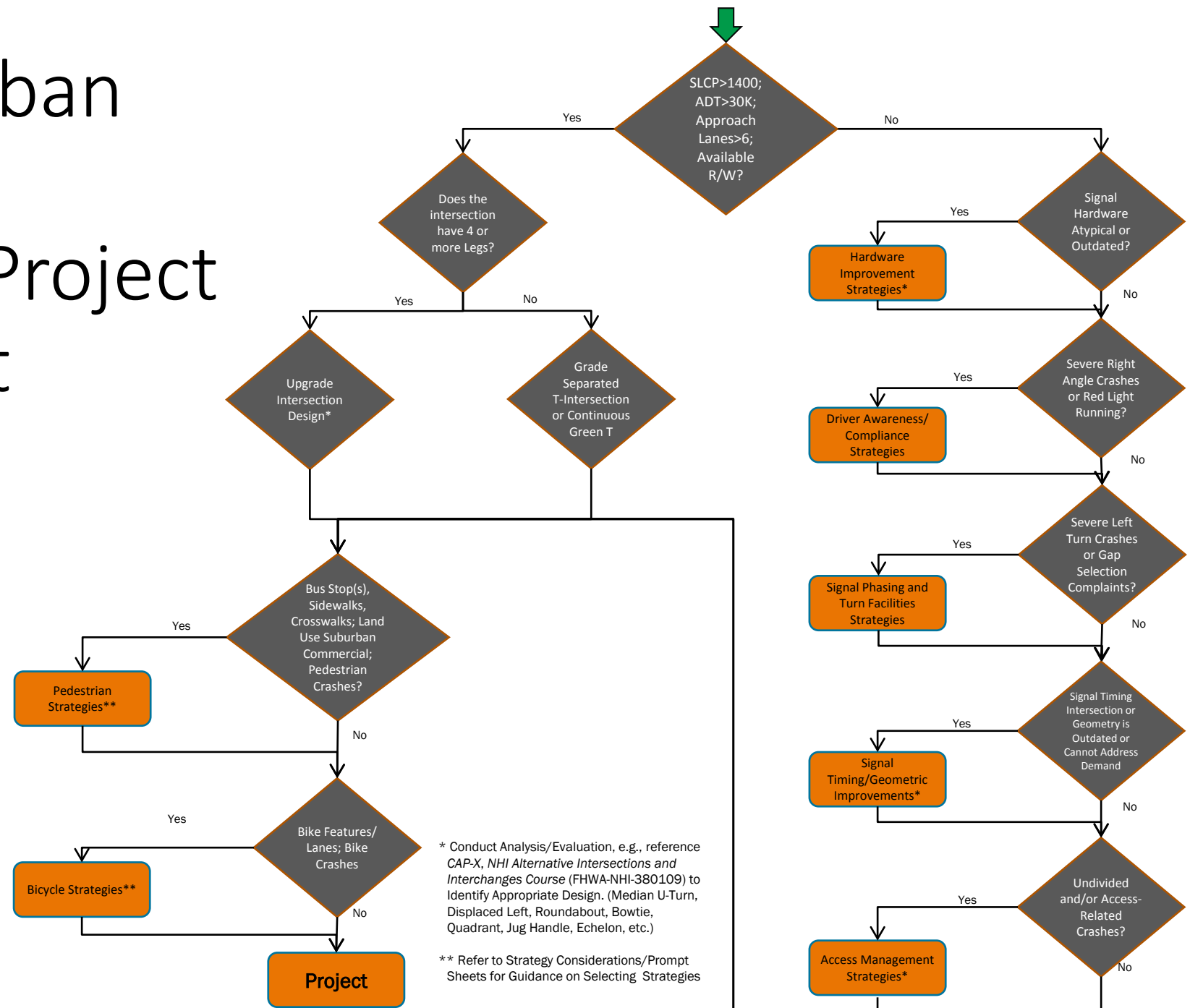
Source: Google map, 2018 imagery



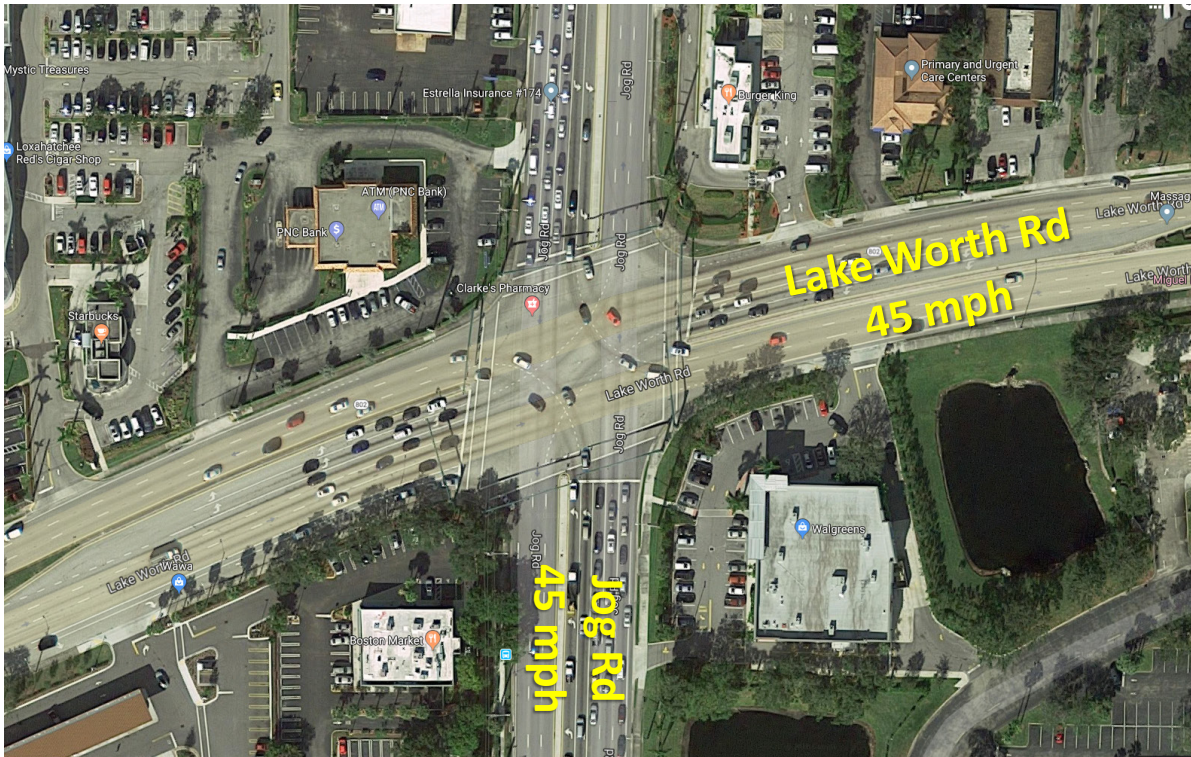
# Site Overview

- Four leg signalized urban intersection
- Total entering vehicles = 86,000 vehicles per day (VPD) (2016)
- Speed limit on all approaches is 45 mph
- All approaches are media divided beyond intersection extents
- Exclusive double left turns on all approaches
- Exclusive right turn on eastbound (EB) approach (heading south)
- Pedestrian crosswalks at all approaches
- Both roads have existing bicycle lanes in both directions
- Northbound (NB), southbound (SB), and westbound (WB) are 5-lane approaches; EB is a 6-lane approach

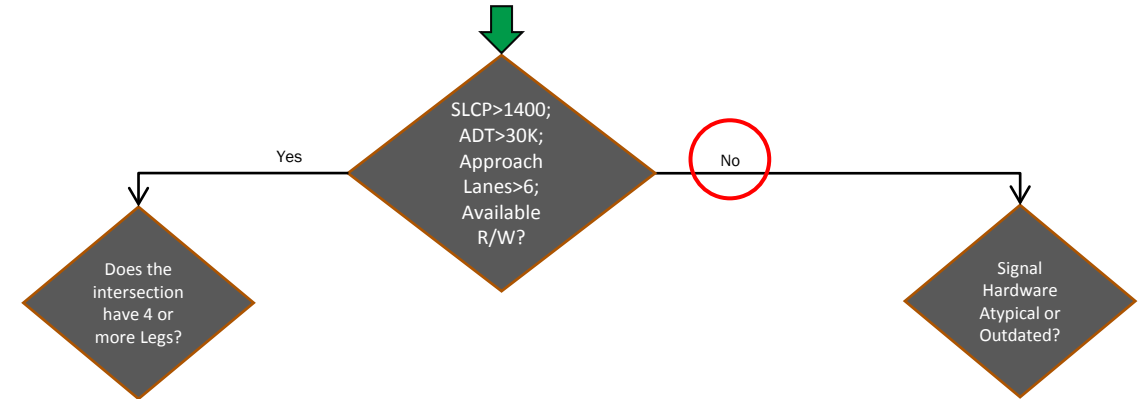
# Urban/Suburban Signalized Intersection Project Development Process



# Step 1 – Site Demographics



Source: Google map, 2018 imagery



Speed Limit Cross Product > 1400? Yes  
 $SLCP = 45 \text{ MPH} \times 45 \text{ MPH} = 2,025$

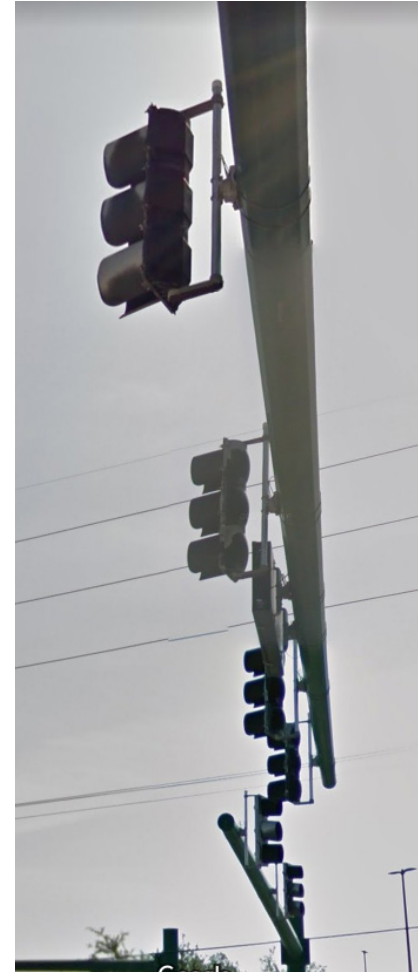
ADT > 30,000 VPD? Yes  
 Entering Vehicles=86,000 VPD

Approach Lanes > 6? Yes  
 Eastbound is a 6-lane approach

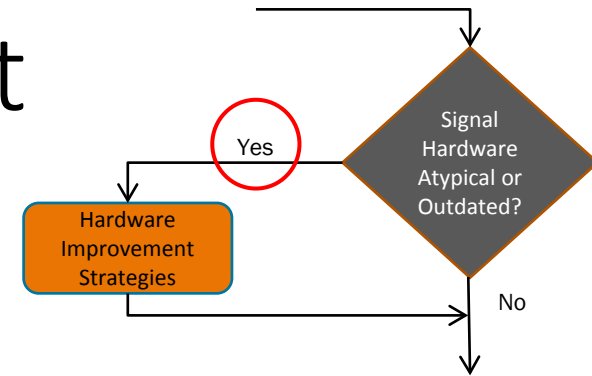
Available R/W? No  
 Intersection is surrounded by several businesses and property acquisition is a costly alternative

# Step 2 – Signal Hardware Assessment

- ❑ Signal heads appear to be outdated (chipped paint) and are inconsistent (based on visual inspection)
  - Some signal heads have LED lenses while some do not
  - EB and WB signal heads have background shields, while NB and SB approaches do not
- ❑ Current signal heads are 12”



Signal heads mounted on the SW corner mast arm  
Source: Google Street View  
Image capture: May 2017



# Step 2 – Signal Hardware Improvements

- ❑ Improve Signal Visibility:
  - Install signal background shields on northbound and southbound heads to improve visibility.
  - Install supplemental mast arm-mounted signal heads so that each lane has a dedicated signal head. This included mast arms on the approach side and far side of the intersection.
    - Note: this upgrade requires a structural analysis of each mast arm/span wire where a signal will potentially be added.
- ❑ Place lane dedication regulatory sign at the beginning and the end of channelizing line per USDOT MUTCD Requirements:
  - Place R3-H8ec on northbound, southbound, and westbound (one each)
  - Place R3-H8eb on eastbound
- ❑ Retroreflectivity of the existing signs and markings appears to be in good shape. Upgrading existing signs for retroreflectivity is not recommended.
- ❑ There are existing raised markings for all longitudinal markings and a project to implement is not required.



Source: Google Street View, Image capture: June 2017



R3-H8ec



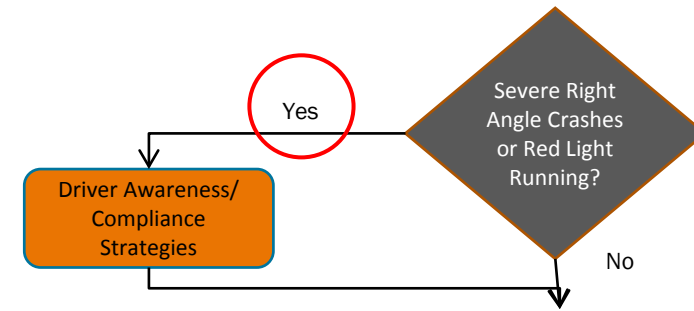
R3-H8eb



Source: Google Street View, Image capture: June 2017

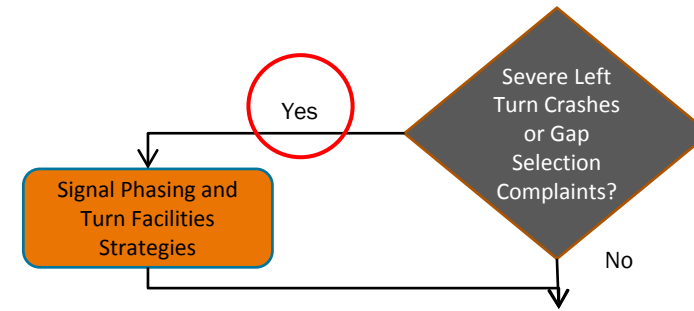
# Step 3 – Driver Awareness, Compliance Strategies

- ❑ The intersection experienced 1 fatal crash and 2 serious injury crashes from 2011 through 2015. Of these crashes, the single fatal crash and one of the serious injury crashes were right-angle crashes.
  - Neither of the angle crashes were noted as visibility-related; however, **visibility will be addressed with upgraded signals as previously noted.**
  - The fatal crash involved a pedestrian and will be best addressed with pedestrian-specific countermeasures.
  - The volume of angle crashes is low – advanced dilemma warning systems may address the crashes but the cost is significant. **An advanced dilemma system is not recommended at this time.**
- ❑ There were 6 red-light running crashes from 2011 through 2015, of which 3 were minor injury, 1 was possible injury, and 2 were property damage only.
  - Red-light running compliance lights combined with enforcement may reduce these crashes; however, these are not the target crashes. Confirmation lights are not recommended.



# Step 4 – Signal Phasing and Turn Facilities Strategies

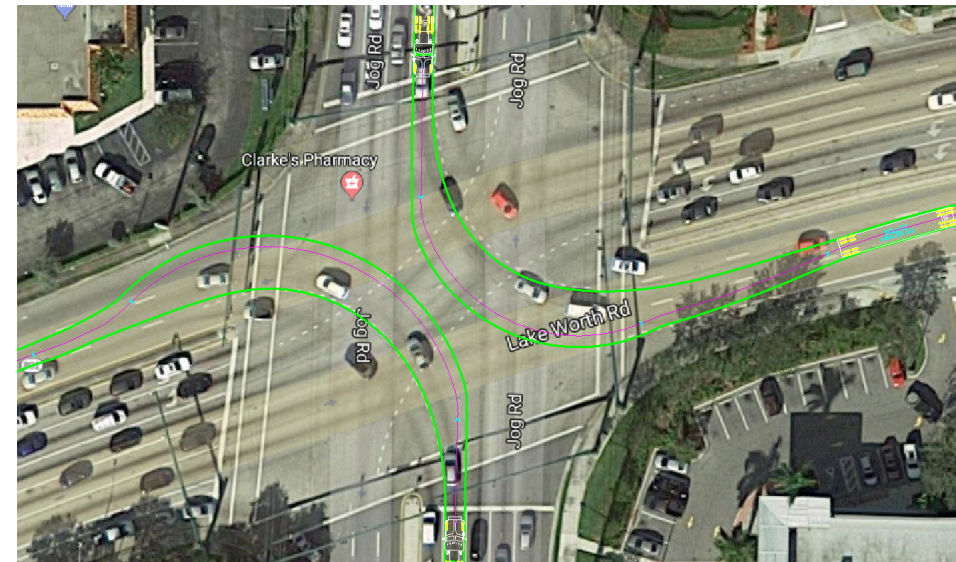
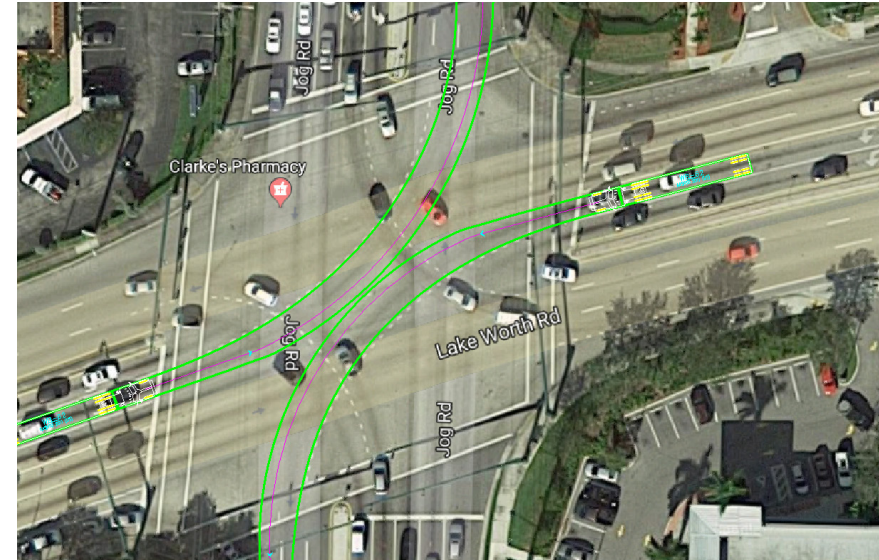
- ❑ 11 crashes involved left turns of which 3 were severe. Specific details on gap acceptance were not available, though they are presumed unrelated given the protected left turn signal timing (assumed based on number of lanes).
  - Storage length of turn facilities is enough to accommodate peak turning movements without through blocking.
- ❑ Turn radius analysis was completed using AutoTurn (design vehicle: WB-62). (Details next figure)
  - It appears concurrent eastbound to northbound and westbound to southbound left turn movements have almost no clearance, which may be slowing down turning traffic. This may be leading to the high level of “Following Too Closely” Crashes (29 crashes).



Source: Google Street View, Image capture: July 2017

# Step 4 – Signal Phasing and Turn Facilities Strategies

- ❑ Left turn movements on opposite approaches are related to design vehicle WB-62 drafted with AutoTurn. Green path represents total turning width of design vehicle.
- ❑ Signal Phasing improvements
  - Update signal phasing to avoid concurrent protected left turns of opposite approaches, especially on eastbound and westbound approaches.
  - Since there is an urgent care facility 200' east of intersection, and a fire station 0.6 miles west of intersection, and a fire station almost a mile north of intersection, preemption should be utilized.

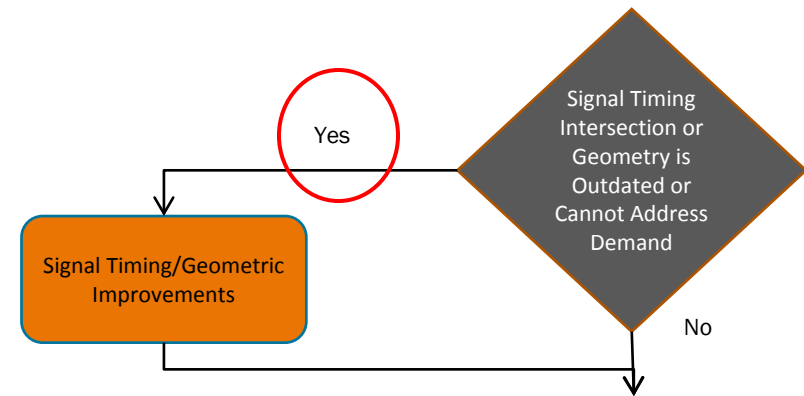


Source: Google map, 2018 imagery

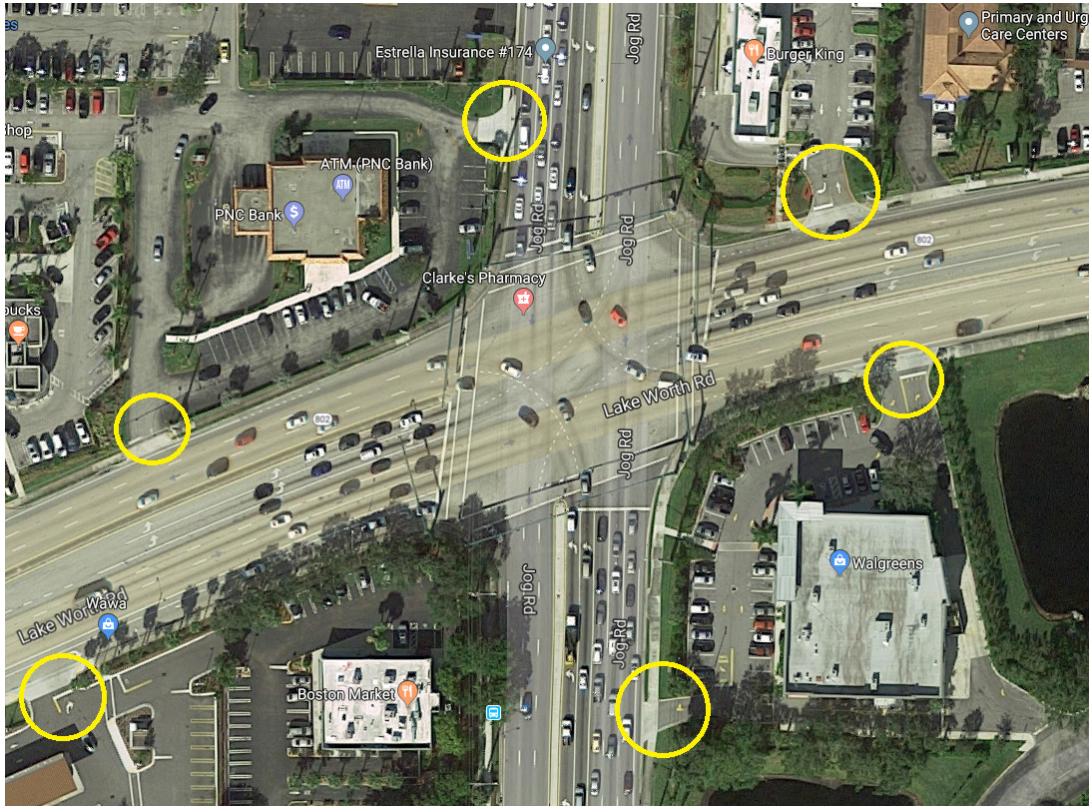


# Step 4 – Signal Timing/ Geometric Improvements

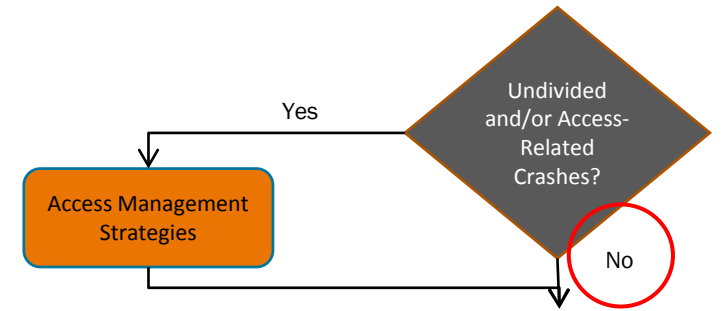
- ❑ It is unknown when the last signal timing/capacity analysis was completed. Therefore, **it is recommended to study the signal to improve Capacity/LOS by updating timing/phasing of intersection to improve operation.**
- ❑ Intersection geometry improvements
  - **Shift back stop-bars and crossing lines to make more space for design vehicle movements (see AutoTurn Analysis).**
  - Restripe pavement markings.
  - Due to cost and existing heavy left turn volumes on all approaches, **alternative intersection types are not recommended.**



# Step 5 – Access Management



Source: Google Map, Image capture: July 2017

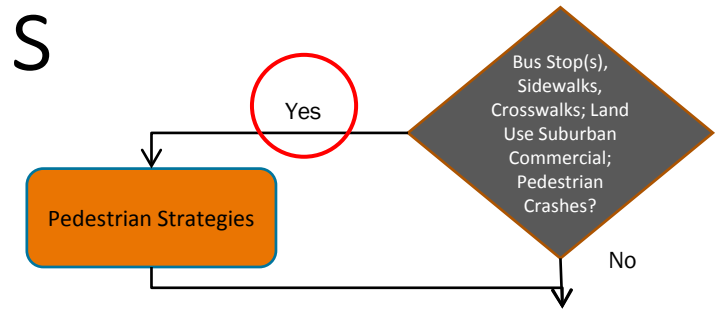


All of the approaches are divided and all of the access points are right-in/right-out. Therefore, **access management improvements are not recommended.**

# Step 6 – Pedestrian Considerations



Source: Google Street View, Image capture: July 2017

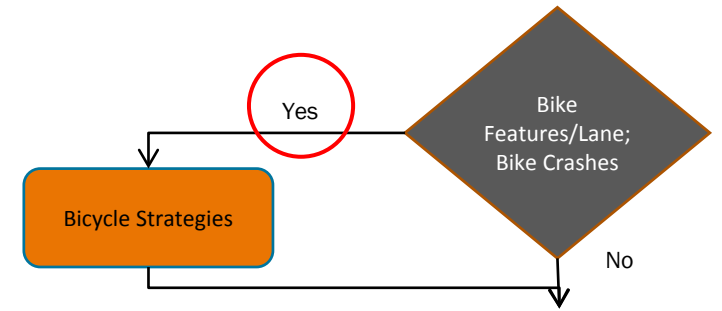


- ❑ The one fatal crash at the site involved a pedestrian. Additionally there is:
  - Evidence of high volume pedestrian traffic
  - Presence of handicapped sidewalk/crosswalk users
  - Two bus stops within 500' on all four legs (totally eight bus stops)
  - Existence of surrounding businesses that generate high volume of pedestrian traffic
  - Crosswalks with long crossing distances (150'-170')
- ❑ Recommended pedestrian upgrades include
  - Pedestrian countdown timers with pedestrian leading interval signal timing
  - Future consideration for raised pedestrian refuge islands (likely width would have to be taken from lanes and added to median)

# Step 7 – Bicyclist Considerations



Source: Google Street View, Image capture: July 2017



- Bike lanes already exist along all approaches in all directions.
- 5 injury crashes involving bicycles occurred from 2011-2015.
- Proposed bicycle features include **leading bicycle interval signal timing**, and marking the **full bike lane with green markings and white bicycle markings**.
- Advanced bicyclist facilities, like bike bokes and bicycle detectors, should be considered only after lower cost countermeasures do not improve bicyclist safety.

# Planning Level Cost Estimate

Below is the break-down of cost estimates of the recommendation:

Strategy	Unit	Cost	Quantity	Sub-total
Retroreflective Signal Backplates	Signal Head	\$ 110.00	23	\$ 2,530
Supplemental Signal Heads	Intersection	\$ 2,700.00	1	\$ 2,700
Structural Analysis for Additional Signal Heads	Mast Arm/ Span Wire	\$ 2,400.00	8	\$ 19,200
Upgrade Signs and Markings	Approach	\$ 3,000.00	4	\$ 12,000
Signal Phasing and Timing Improvements	Intersection	\$ 5,000.00	1	\$ 5,000
Install Pedestrian Countdown Timers with leading pedestrian interval	Intersection	\$ 14,300.00	1	\$ 14,300
Total approximate project cost				\$ 55,730

# Project Decision Tree Example

## PALM BEACH COUNTY LOCAL ROAD SAFETY PLAN DEVELOPMENT

Rural Segment

Palm Beach County Route 717 (Muck City Road)

Observed Severe Injury Hotspot

# Site Overview

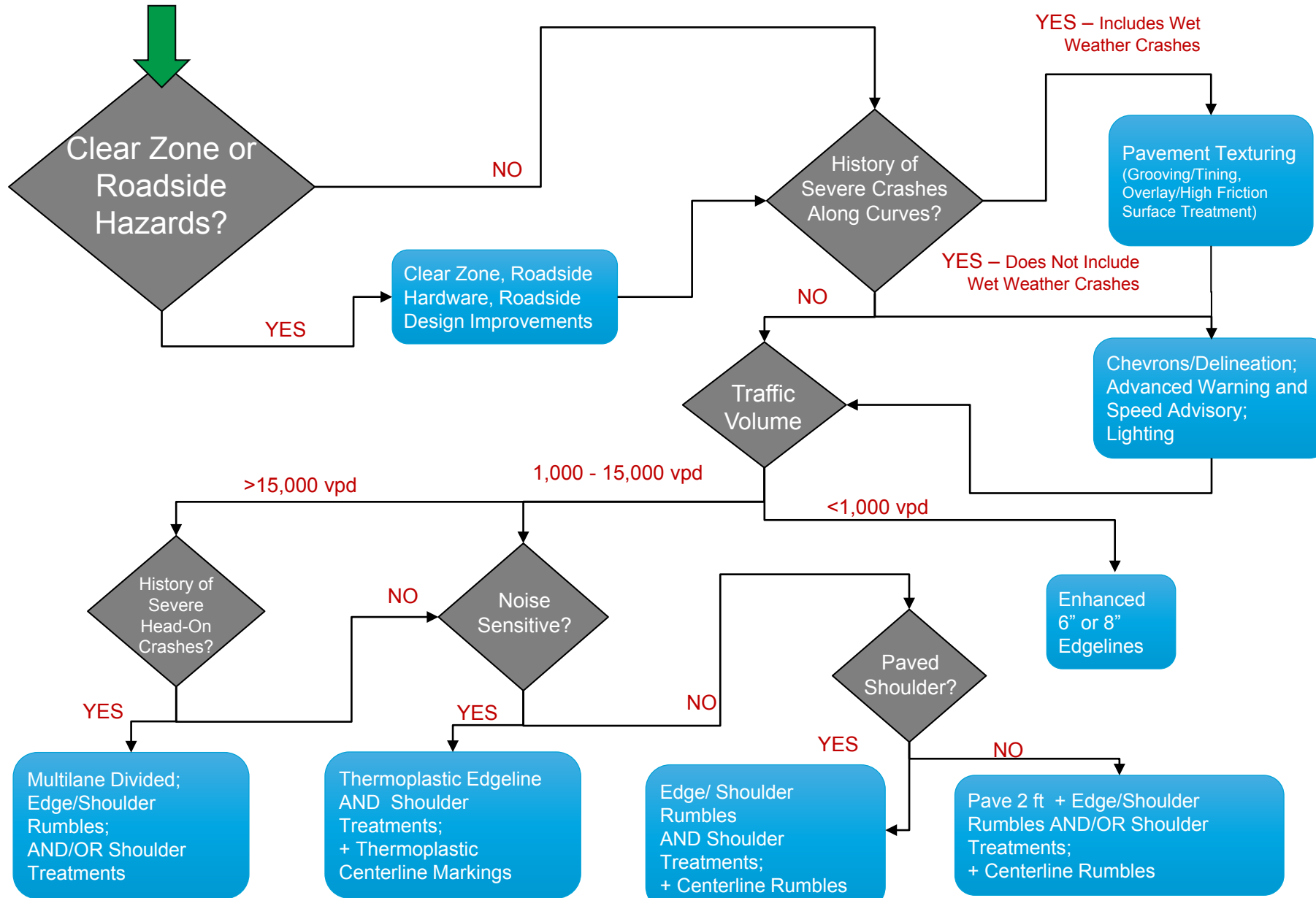


# Site Overview

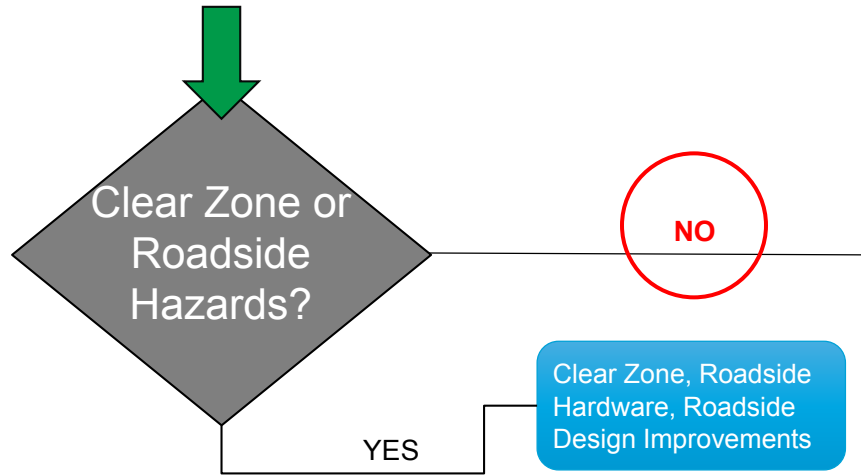
- 3 Fatal Crashes (2011-2014)
  - All single vehicle, roadway departure
  - No other severe crashes along corridor
- No grade or curvature present
- AADT 3,172 ([Palm Beach County, 2016](#))
- Site is 2 lanes with no shoulders
- Approximately 5.6 miles long



# Rural Segment Decision Tree



# Step 1 – Clear Zone/ Roadside Hazards

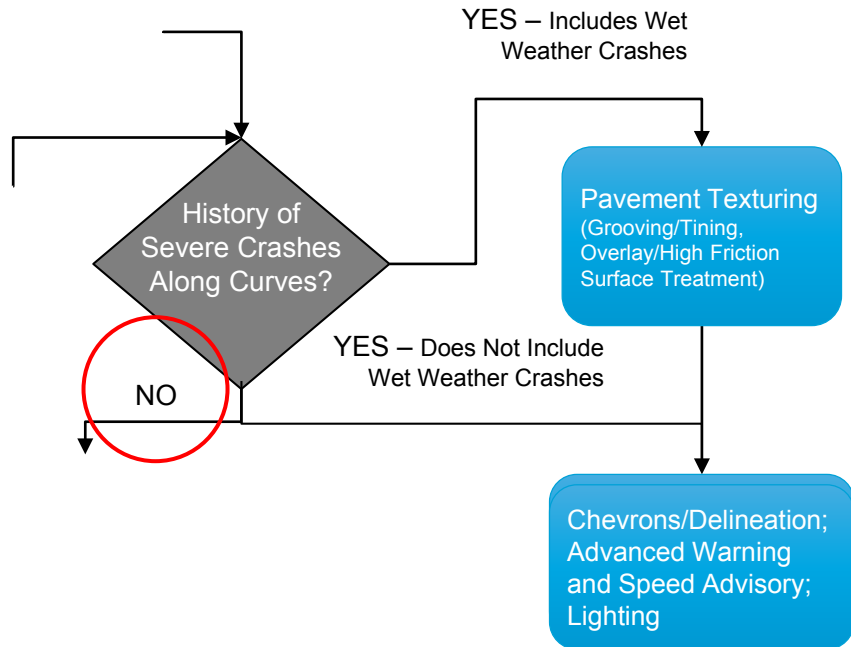


- Shoulders have gentle slope
- Fixed objects, like telephone poles, are set back from the roadway ~25'
- No barriers or equipment in clear zone
- Clear zone, roadside hardware, and roadside design improvements are **NOT** recommended at this site



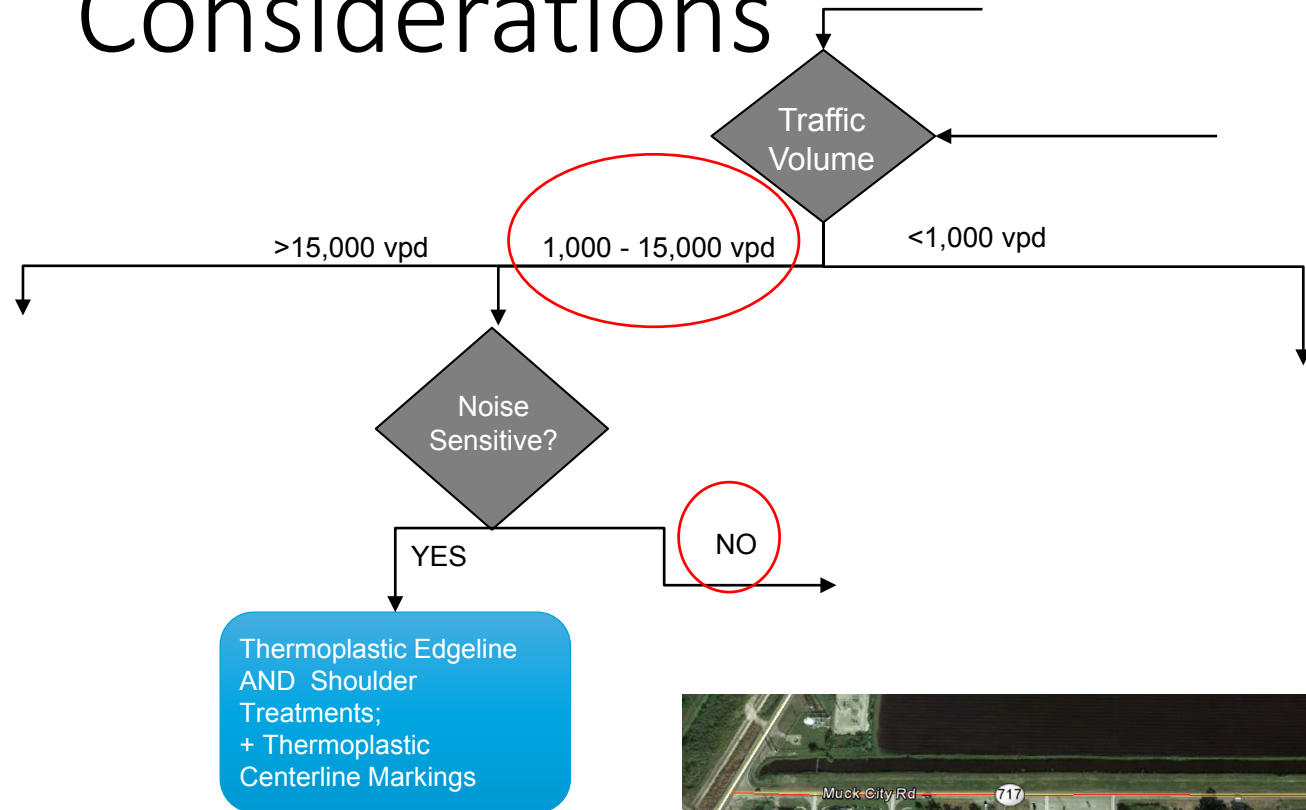
Typical view of CR-717. Image Courtesy of Google Street View, accessed 10/29/2018

# Step 2 – Severe Crashes Along Curves



- ❑ There are no curves along the route. Therefore, there are no severe crashes along curves.
- ❑ Pavement texturing, chevrons/delineations, advanced warning and speed advisory signs, and lighting are NOT recommended for this site.

# Steps 3 and 4 – Traffic and Noise Considerations

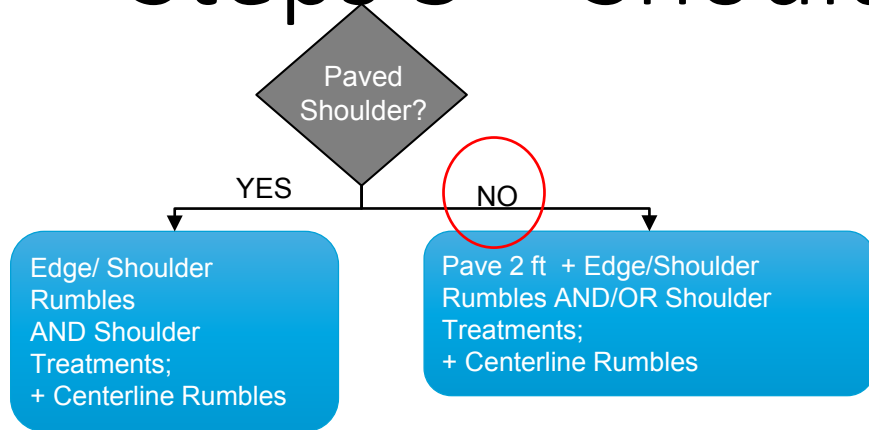


Aerial View of residences along CR-717 at State Market Road. Image Courtesy of Google Earth, accessed 10/29/2018



- ❑ Most recent traffic volume for the section was approx. 3,100 vpd- the middle path will be followed.
- ❑ The western end of the corridor is close to residential properties which may be sensitive to noise. Otherwise, noise is not an issue.
- ❑ Recommend NOT pursuing noise-sensitive applications. The majority of the corridor is not a noise-sensitive location and installing pavement markings that vary along the corridor could cause confusion.
- ❑ Also, there is currently no shoulder to improve, which is addressed further down the “NO” branch.

# Steps 5 – Shoulder Presence



Typical view of CR-717. Image Courtesy of Google Street View, accessed 10/29/2018

- There is no shoulder along the corridor.
- Recommend to install paved 2-foot shoulder with edge/shoulder rumble strips.
- Recommend to install centerline rumble strips
  - Requires repainting of centerline to acceptable standards

# Final Recommendations

- ❑ The final recommendation is the installation of a 2-foot paved shoulder on both sides of the roadway with shoulder and centerline rumble strips.
- ❑ Approximate project cost = \$330,400
  - Shoulder rumble strips \$6,000 per mile x 5.6 miles = \$33,600
  - Centerline rumble strips (with restriping) \$4,000 per mile x 5.6 miles = \$22,400
  - 2 foot paved shoulder (both sides) \$49,000 per mile x 5.6 miles = \$274,400