Complete Streets

Design Guidelines 2.0

PALM BEACH
Transportation
Planning Agency


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Introduction


BIKE LANE

CHAPTER 1: INTRODUCTION

PURPOSE

The Palm Beach Transportation Planning Agency (TPA) serves as the federally designated Metropolitan Planning Organization (MPO) for Palm Beach County, FL. The TPA plays a major role in connecting county commissioners, city officials, seaport commissioners, and transportation professionals to implement a safe, efficient, connected, and multimodal transportation system.

Palm Beach TPA has established these Complete Streets Design Guidelines to provide guidance to local practitioners on how to plan and design Complete Streets elements into all types of transportation and land development projects. The Complete Streets principles included herein promote the concept of "proactive design" recognizing that the way we design our streets has a significant impact on the way people use the street. Design principles of a street are vital for:

- Guiding users through physical and environmental cues
- Managing vehicle speeds
- Encouraging safe walking, bicycling, and public transit use
- Embracing the unique place characteristics that surround the street (often referred to as context-sensitive design)

Prioritizing these initiatives is imperative to minimizing gaps in the multimodal network for all user types. By closing these gaps in the Complete Streets network, the TPA is able to enhance safety and comfort for all users, contributing to lower crash rates and better quality of life for residents.

Sidewalk Level Bicycle Lane

Example of Urban Center Context

The development of a safe and accessible multimodal network connecting people to jobs, educational institutions, transit, and healthcare can be achieved approaching this effort from a comprehensive countywide level. This collaborative approach to a Complete Streets network creates a well-connected multimodal system where users of all modal types can efficiently travel in unison throughout Palm Beach County.

This guide connects with the Florida Department of Transportation's (FDOT) Complete Streets Initiative, which includes the Context Classification Guide published in February 2022. FDOT's context classification system describes the general characteristics of roadways and land use throughout the state of Florida. The context classification will inform FDOT's planning, design, construction, and maintenance approaches to ensure that state roadways are supportive of safe and comfortable travel. The various combinations of context classification type and roadway functionality predominantly influence the design elements applicable for implementation into the roadway. The Palm Beach TPA Complete Streets Design Guidelines provides local guidance to complement FDOT's approach to Complete Streets.

In addition, this document provides local practitioners with street design criteria and tools that provide context-sensitive designs and next steps for implementation.

GUIDING OBJECTIVES

Develop a context sensitive design framework that integrates streets and multimodal facilities with adjacent land uses.

Provide local governments criteria for modifying, retrofitting, and constructing streets in accordance with surrounding development projects.

Create consistent guidelines for agencies and municipalities to follow for multimodal improvements to ensure a well-connected and efficient transportation system.

Emphasize multimodal safety and mobility across every element of the guidelines.

Implement a street network that is safe and convenient for all to encourage more people to walk, bike, and take transit.

HOW TO USE THE GUIDELINES

This document is intended for Palm Beach County and local municipalities to use as a resource to shape Complete Streets designs, policies and ordinances. Users can reference this document to establish ideal multimodal features and facility dimensions and understand typical roadway conditions based on land use and roadway settings. Specific elements for different street realms are outlined throughout the document and should be used as The Palm Beach TPA Complete Streets Design Guidelines were developed using a typology approach, which allows for context-sensitive design. Streets and land uses were classified into distinct typologies, as shown in Chapter 2, based upon land use and roadway characteristics. Historical street design processes focused largely on the movement of motor vehicles, designing to its "functional classification" rather than examining the street's role within a community. By contrast, context-sensitive design recognizes that streets vary in function in separate land use contexts and design should respond to that changing purpose.

Design guidance in Chapter 3 focuses on this blended approach to create streets that complement surrounding land uses and are inclusive of all modal types. Guidelines in Chapter 3 are organized into three sections: Non-Motorized Travel Realm; Roadway Realm; and Intersections. This approach reinforces the need to consider every aspect when designing Complete Streets - safety and comfort are equally important and necessary in each of these street components.

Users of these guidelines will find that some recommendations are prescriptive, with minimum and target dimensions recommended, while others are tools for inclusion where they support a street's needs. The typology approach allows dimensions to apply across the region because context-sensitivity is already included; flexibility is maintained through the provision of minimums and absence of maximums.

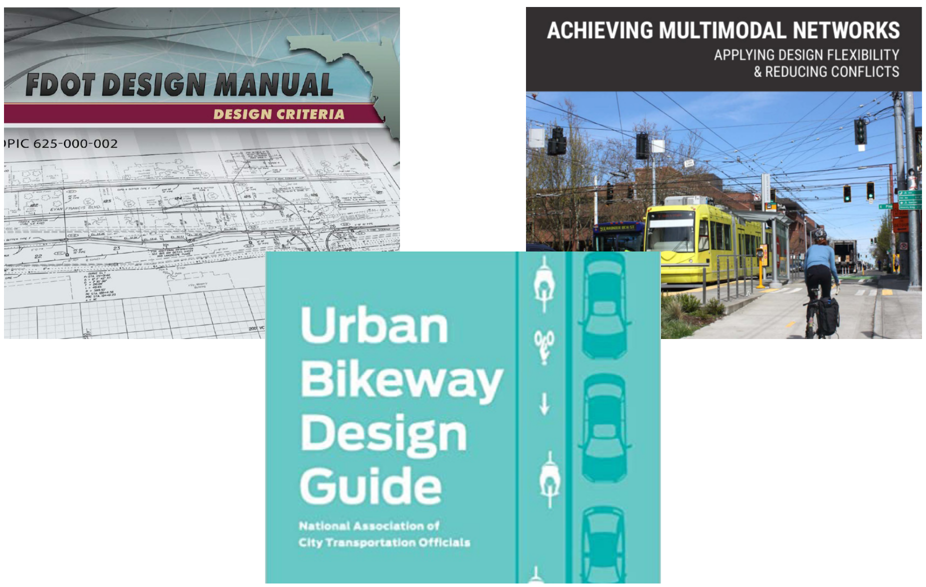
EXISTING DESIGN GUIDANCE

STREET DESIGN CRITERIA AND GUIDELINES

An inventory of existing roadway design standards, guidelines, and other Complete Streets elements was undertaken. The purpose of the inventory was to identify documentation for design elements to be included within the Complete Streets Design Guidelines. An increased emphasis on providing context-based transportation planning and design has been conveyed in guides such as the 2021 FDOT Design Manual (FDM) and the 2018 Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (commonly known as the Florida Greenbook) and is being used as a guiding principle for the Complete Streets Design Guidelines. The following standards and guides were reviewed and help to inform the TPA's Complete Streets Guidelines:

- The American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets (AASHTO Green Book)
- 2009 United States Department of Transportation (USDOT) Manual on Uniform Traffic Control Devices (MUTCD)
- 2016 USDOT Achieving Multimodal Networks: Applying Design Flexibility & Reducing Conflicts
- 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design
- 2010 Institute of Transportation Engineers (ITE) Designing Walkable Urban Thoroughfares: A Context Sensitive Approach
- 2013 National Association of City Transportation Officials (NACTO) Urban Street Design Guide

- 2014 NACTO Urban Bikeway Design Guide (2nd Edition)
- 2016 NACTO Transit Street Design Guide
- 2018 FDOT The Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (the “Florida Greenbook”)
- 2015 FDOT Complete Streets Implementation Plan
- 2018 Palm Beach County Engineering Standards: Land Development Design Standards Manual (Revised 2018) and Typical Sections for Thoroughfare Roads (Effective 2018)
- 2022 FDOT Design Manual (FDM)



AASHTO Green Book

The AASHTO Green Book provides guidance for geometric design elements of highways and streets. The document is also intended as a comprehensive reference manual to assist in administrative, planning, and educational efforts pertaining to design formulation. Design guidelines are included for freeways, arterials, collectors, and local roads, in both urban and rural locations, based on the functional classification system used in highway planning. The guide is also used by some local governments as design standards for all streets. Design flexibility is encouraged by the AASHTO Green Book, including the use of 10-foot travel lanes depending on desired speed, capacity, and context of a roadway.

USDOT Manual on Traffic Control Devices (MUTCD)

The MUTCD provides standards and guidance for the design and application of all allowed traffic control devices including roadway markings, traffic signs, and signals. The State of Florida chooses to adopt the Federal MUTCD as its manual for signs, pavement markings, and traffic control devices. Whereas many other documents are considered guidelines, the MUTCD allows for limited variations from approved traffic control methods due to the relationship between the MUTCD, the Code of Federal Regulations, and state law. Agencies can apply for experimental status for inclusion of innovative treatments in projects. Several recent Interim Approvals (IAs) have lessened restrictions on the use of specific bicycle facility design treatments.

USDOT Achieving Multimodal Networks

Published in 2016, *Achieving Multimodal Networks: Applying Design Flexibility & Reducing Conflicts* is a resource for practitioners seeking to build multimodal networks. In particular, this document focuses on design treatments for which engineers and planners can apply the design flexibility found in current national design guidance to address common roadway design challenges and barriers. The document highlights sources for design guidelines and criteria when mentioned. *Achieving Multimodal Networks* is divided into two parts – Applying Design Flexibility and Reducing Conflicts. Key topic areas and themes in this document include lane width, design speed, traffic calming, intersection geometry, road diets, and pedestrian crossings.

Americans with Disabilities Act Standards for Accessible Design

The ADA Accessible Design Standards are issued by the federal government and apply to all new construction and alteration projects. These standards ensure access to the built environment for all users. ADA standards govern accessibility for all infrastructure, including public transportation facilities, sidewalks, and curb ramps. The U.S. Access Board published Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) in 2011. PROWAG will become the U.S. standard for accessibility in the public right-of-way when the Board issues a final PROWAG rule. Until that time the U.S. Department of Justice (USDOJ) 2010 ADA Standards and the USDOT 2006 ADA/Section 504 Standards provide enforceable standards applicable to the public right-of-way. Where the current standards do not address a particular issue, FHWA encourages agencies to draw upon the draft PROWAG for best practices.

ITE Designing Walkable Urban Thoroughfares

The ITE *Designing Walkable Urban Thoroughfares* Manual takes a context-sensitive approach to Complete Streets design. The methodology guides practitioners to identify land use and building form to match a street's design elements to the appropriate context zone. The land use context and the services provided on a street inform classification of a "thoroughfare type" as a supplemental guide to the traditional functional classification methodology. By combining context zone and thoroughfare type, the guide offers context-sensitive elements and design guidelines for inclusion on Complete Streets.

National Association of City Transportation Officials (NACTO) Urban Design Guide

NACTO guides have quickly gained acceptance as approved design guidance in many states and cities. Both FHWA and FDOT support the use of NACTO guidance to help plan and design safe and convenient pedestrian and bicycle facilities. Most treatments included in NACTO guides are either supported by or not precluded by the MUTCD standards and guidance. This guide covers street design, including intersection design, and facilities specific to bicycles and transit to develop a clear vision for complete streets and identifies procedures for incorporating best practices.

NACTO Urban Bikeway Design Guide

The NACTO *Urban Bikeway Design Guide, Second Edition* identifies some bicycle facility treatments that would require request for experimentation from FHWA to implement. The NACTO guides cover street design, including intersection design, and facilities specific to bicycles and transit. The guide contains three sections detailing the required, recommended, and optional elements of bicycle treatments for multiple street environments.

NACTO Transit Street Design Guidance

This guide focuses on designing transit corridors as public spaces to create streets capable of supporting vibrant urban environments. Additionally, the guide details methods that improve transit service while minimizing the impact on typical traffic patterns. The growing importance of providing walkable neighborhoods with accessibility to multiple modes of transportation is addressed as the key to maintaining efficiency and sustainability as urban populations continue to grow. The guide is an effective resource for methods that can incorporate transit into an active urban environment.

FDOT Manual of Uniform Minimum Standards for Design, Construction and Maintenance (Florida Greenbook)

Minimum standards for street design in Florida are governed by FDOT's *Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways* (also known as the *Florida Greenbook*). The guide specifically focuses on providing criteria for public streets, roads, highway, bridges, sidewalks, curbs/curb ramps, crosswalks and bicycle facilities used by the public for vehicular and pedestrian travel. This manual provides design standards and guidance based upon design speed, traffic volumes, and context-classification. The context-sensitivity includes urban, suburban, and rural settings.

The 2018 Florida Greenbook became effective July 20, 2021. Updates from the previous 2016 version of this guide include:

- A new definition of road users
- Revised criteria for geometric design and updated requirements for the offset of roadside features
- A new section for barriers, end treatments and crash cushions
- New definitions for lighting types and elaboration of lighting methods
- Changes to the standard design requirements of pedestrian facilities such as minimum sidewalk width and buffer strips
- Added section for traditional neighborhood development
- A revised section for curb ramps and blended transitions
- An extensive review of bicycle facilities, which included new sections on buffered bike lanes and green bike lanes
- Detailed specifications for Shared-Use Paths

FDOT Design Manual

The FDM establishes geometric configurations, design criteria, and procedures for all new construction, reconstruction, and resurfacing projects on State Highway System (SHS) and National Highway System. FDOT applies the criteria and standards in the 2022 FDOT Design Manual (FDM) to all state highways. Deviations from the minimum design criteria found in the FDM require approval through FDOT's design variance process. Part 2 of the FDM elaborates on Context-Based Design and how it applies to the many transportation facility types.

FDOT Complete Streets Implementation Plan

FDOT published the *Complete Streets Implementation Plan* in December 2015 in conjunction with Smart Growth America. The plan was published to guide FDOT's efforts to implement the Complete Streets Policy adopted in September 2014. The plan outlines a five-part implementation framework and process for integrating a Complete Streets approach into FDOT's practices to ensure that future transportation decision-making and investments address the needs of all users of the transportation network and respond to community goals and context. The plan provides detailed recommendations for updating ten FDOT documents including the *Plans Preparation Manual* (PPM), which is in the process of being transitioned into the *FDOT Design Manual* (FDM), and will include a new section establishing a framework for making decisions based on a context-sensitive approach during project development.

Palm Beach County Engineering Standards: Land Development Design Standards Manual (2018) and Typical Sections for Thoroughfare Roads (2018)

The County's engineering standards are the prescriptive guidelines that agency staff and engineers use in design of county streets. Design-based solutions are defined in the standards, with a focus on uniformity. These Complete Streets Design Guidelines use Palm Beach County's Engineering Standards as a foundation and identify new features for implementation and allow the practitioner to identify street design elements which are applicable to the particular situation.

OTHER RESOURCES

Access to Transit

America's public transportation infrastructure plays a vital role in our economy, connecting millions of people with jobs, medical facilities, schools, shopping, and recreation. Unlike many U.S. infrastructure systems, the transit system is not comprehensive, as 45 percent of American households lack any access to transit, and millions more have inadequate service levels. According to the American Society of Civil Engineers (ASCE), Americans with access to transit have increased their ridership 9.1 percent in the past decade, and that trend is expected to continue. Although investment in transit has also increased, deficient and deteriorating transit systems costed the U.S. economy $90 billion in 2010. Many transit agencies are struggling to maintain aging and obsolete fleets and facilities amid an economic downturn that has reduced their funding, forcing service cuts and fare increases.

Complete Streets improvements have the potential to enhance access to transit by creating safer and more comfortable walking and bicycling routes for people to travel to bus stops and transit stations. Polling data indicate that over 70 percent of Americans support investments in more robust public transit systems. In addition to this, approximately two-thirds of public transit ballot initiatives since 2000 have passed.

Voters in Palm Beach County approved a one-cent Infrastructure Surtax Initiative on the November 2016 election ballot, which can fund Complete Streets improvements such as sidewalks, pathways, lighting improvements, and bicycle paths, among other transportation-related improvements that can help improve access to transit.

Transportation Planning and Health

The USDOT is committed to promoting better consideration of health outcomes in transportation focused on the following objectives:

- Promote safety
- Improve air quality
- Respect the natural environment through Context Sensitive Solutions
- Improve social equity through access to jobs, health care, and other community services

- Create additional opportunities for the positive effects of walking, bicycling, and public transportation

The USDOT and the Centers for Disease Control and Prevention (CDC) have jointly released the Transportation and Health Tool (THT), which provides data on transportation and public health indicators for each State, Urbanized Area, and Metropolitan Statistical Area (MSA) that describe how the transportation environment affects safety, active transportation, air quality, and connectivity.

Health tool URL: https://www.transportation.gov/transportation-health-tool

Creating a comprehensive Complete Streets network begins with providing accessible transportation for all regardless of one's age, race, gender, ability, income, or other personal characteristics. Ensuring that efficient and safe transportation infrastructure is provided in areas of low income, education levels and high concentration of minorities is critical in achieving transportation equity. These communities are often under-invested or discriminated against during the planning process despite greater number of deaths, crashes and injuries compared to communities with higher income and economic activity. Transportation improvements must be tailored to the specific needs of these communities, rather than settling for macro-level improvements. With this focus, transportation equity can have significant impacts on communities, enabling safe access to school and work, healthy food, parks and more.

Aging in Place

Safe Routes to Age in Place is a grant program that aims to at foster accessible, safe, comfortable, and active transportation options for adults of all ages and abilities. Focusing on better walking environments on our streets and roadways allows seniors to remain active, healthy, and independent within their own communities. Unfortunately for the country's aging population, many communities lack proper services to allow for prolong independent living.

One of the most important components of independent living is having the ability to easily access needed destinations, such as grocery stores, medical services, parks, libraries, and bus stops. Community engagement, physical activity and social connectivity that come with the ability to age in place can provide a better quality of life and help to keep older adults healthy, both physically and mentally (Brummett et. al., 2001).

When older adults are no longer able to use a car as a primary means of travel, they report a lower quality of life. Access to alternatives to driving allows for enhanced social interaction and creating a sense of control and independence among older adults, which leads to a greater quality of life (Musselwhite & Haddad, 2010).

Additional Resources for Interested Users

The following list of resources also contain information on Complete Streets and mobility planning best practices:

- FDOT Complete Streets Handbook
- FHWA Separated Bike Lane Planning and Design Guide
- MassDOT Separated Bike Lane Planning & Design Guide
- Dutch Design Manual for Bicycle Traffic (CROW Manual)
- Smart Growth America

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Context Classifications and Roadway Types

CHAPTER 2: CONTEXT CLASSIFICATIONS AND ROADWAY TYPES

FRAMEWORK

Typology is a common approach to categorizing elements by similar characteristics. This approach allows for planning and treatment identification based on a reflection of a typology's defining elements. In the context of Complete Streets, identifying both streets and land use context by typologies allows for a context-sensitive approach to design. Detailed criteria derived from traffic patterns, bicycle/pedestrian interaction, land uses, block layout, and mobility potential separate the different FDOT Context Classifications and FHWA functional classification types. Once defined, the Context Classification and Functional Classification type determine design criteria and elements of multimodal infrastructure to be incorporated into street design with the goal of creating street environments that fulfill the functionality and operations of the surrounding area.

The FHWA Roadway Functional Classifications and FDOT Context Classifications used as a basis for establishing various aspects of Complete Streets design criteria are identified throughout this chapter. Distinguishing characteristics and typical conditions for each classification type within Palm Beach County are also provided. All roads inside the county have been given an FHWA Roadway Functional Classification type. FDOT Context Classifications have been assigned for roadways included in the State Highway System (SHS) and key local roads. Systemwide Preliminary Context Classifications (SPCC) are used to determine preliminary context classification for FDOT projects. This classification is not final for SHS projects and instead is used as a framework to provide guidance for SHS projects that will be designated with a Project Level Context Classification (PLCC) that supersedes the SPCC.

The FDOT Context Classification maps in Appendix A display assigned PLCC's and SPCC's where a PLCC has yet to be assigned. As part of continued project-specific collaborative reviews, the context classification may differ from what is shown in the Appendix maps. Maps displaying the FHWA Roadway Functional Classifications designations on roads in the county are also included in Appendix A. These maps should be used when categorizing local conditions to determine the appropriate Complete Streets design criteria for a given roadway.

C1-Natural | C2-Rural | C2T-Rural Town | C3R-Suburban Residential | C3C-Suburban Commercial | C4-Urban General | C5-Urban Center | C6-Urban Core

TYPOLOGIES

FDOT CONTEXT CLASSIFICATIONS

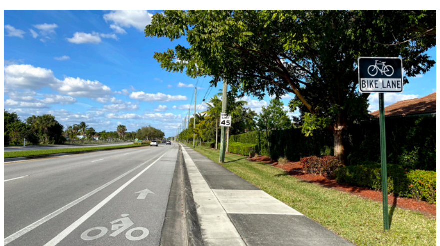
FDOT created a roadway classification system using a context-based method to plan and design roadways that support safety and mobility. Generally, the various classification types are distinguished by changes in land use, development patterns, multimodal interaction, roadway connectivity and traffic operations. Establishing a context classification type based on the elements above identifies anticipated roadway users and expectations for travel demand. Understanding the needs of all users ensures that adequate facilities are provided to support an efficient and inclusive roadway. Establishing a Context Classification type during the early project phases will advise planners, designers and engineers of key design elements and multimodal improvements that support the Complete Streets initiative. Considering various land use and roadway characteristics, FDOT determined the following to be typical environments found throughout the State of Florida. Maps displaying the FDOT Context Classifications on state roads within Palm Beach County can be found in Appendix A.


C6 - Urban Core

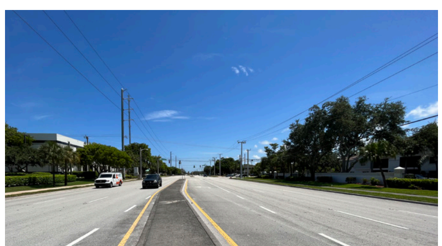

C5 - Urban Center


C4 - Urban General

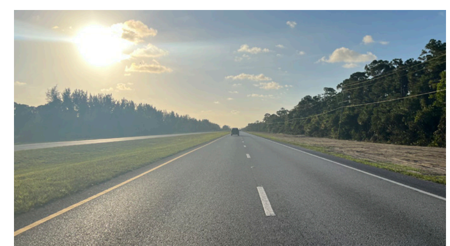

C3C - Suburban Commercial



C3R - Suburban Residential


C2T - Rural Town


C2 - Rural

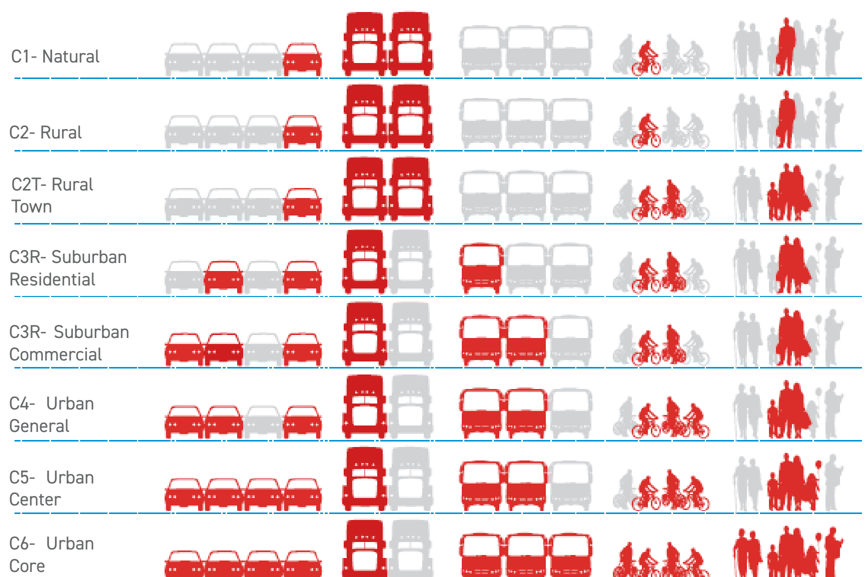

C1 - Natural

FDOT Context Classification Table

FDOT Context Classifications	Description	Typical Features	Land Uses	Examples
C6- Urban Core	Areas of the highest densities and building heights that include a mix of uses built up to the roadway. Typically designated as regional centers and destinations. Parking typically located in the rear or a parking garage.	**Building Height:** >4 floors **Setback Distance:** <10 ft. **Block Length:** <660 ft. **Block Perimeter:** <2,500 ft.	Retail, Office, Institutional, or Multi-Family Residential	• Rosemary Avenue in Downtown West Palm Beach
C5- Urban Center	Mix of uses set within small blocks with a well-connected roadway network. Typically concentrated around a few blocks and identified as part of a civic or economic center of a community or city.	**Building Height:** 1-5 floors **Setback Distance:** <20 ft. **Block Length:** <500 ft. **Block Perimeter:** <2,500 ft.	Retail, Office, Institutional, Single/Multi-Family Residential, or Light Industrial	• Federal Highway in Downtown Boca Raton
C4- Urban General	Mix of uses set within small blocks with a well-connected roadway network. Activities and uses less concentrated and likely to extend long distances throughout a corridor. Residential neighborhoods typically located behind fronting uses.	**Building Height:** 1-3 floors **Setback Distance:** <75 ft. **Block Length:** <500 ft. **Block Perimeter:** <3,000 ft.	Neighborhood-Scale Retail, Office, Institutional, or Single/Multi-Family Residential	• US-1 in Lantana
C3C- Suburban Commercial	Mostly non-residential uses with large building footprints and large parking lots within large blocks and a disconnected or sparse roadway network.	**Building Height:** 1 floor (retail uses), 1-4 floors (office uses) **Setback Distance:** >75 ft. **Block Length:** >660 ft. **Block Perimeter:** >3,000 ft.	Retail, Office, Institutional, Multi-Family Residential, or Industrial	• Linton Boulevard between Interstate 95 and Dixie Highway
C3R- Suburban Residential	Mostly residential uses within large blocks and a disconnected or sparse roadway network. Minimal or no interaction between uses and the roadway.	**Building Height:** 1-2 floors **Setback Distance:** 20-75 ft. **Block Length:** N/A **Block Perimeter:** N/A	Primarily Single/ Multi-Family Residential	• Jog Road north of Atlantic Avenue

FDOT Context Classification Table (Cont.)

FDOT Context Classifications	Description	Typical Features	Land Uses	Examples
C2T- Rural Town	Small concentrations of developed areas immediately surrounded by rural and natural areas, includes many historic towns.	**Building Height:** 1-2 floors **Setback Distance:** <20 ft. **Block Length:** <500 ft. **Block Perimeter:** <3,000 ft.	Retail, Office, Single/Multi-Family Residential, Institutional, Industrial	• Bacom Point Road south of Pahokee
C2- Rural	Sparsely settled lands - may include agricultural land, grassland, woodland, and wetlands.	**Building Height:** 1-2 floors **Setback Distance:** Inconsistent **Block Length:** N/A **Block Perimeter:** N/A	Agricultural or Single-Family Residential	• Connors Highway beyond Southern Boulevard
C1- Natural	Lands preserved in a natural or wilderness condition, including lands unsuitable for settlement due to natural conditions.	**Building Height:** N/A **Setback Distance:** N/A **Block Length:** N/A **Block Perimeter:** N/A	Conservation Land, Open Space, or Park	• Beeline Highway west of Jog Road



Expected User Types by Context (Source: FDOT)

FHWA ROADWAY FUNCTIONAL CLASSIFICATIONS

A functional classification defines the role a roadway segment plays in serving the flow of traffic through the transportation network. FHWA roadway functional classifications are primarily distinguished by the characteristics of two key transportation functions, mobility, and access. Other elements such as trip length, speed limit, volume, trip purpose and vehicle mix influence the classification type. Categorization constructed around these fundamental transportation attributes precisely defines a roadways role within the greater transportation network, while also identifying the effect it has at a more local level.

After a street segment is categorized by its roadway functional classification and context classification there is a defined clear understanding of the purpose it serves in the transportation network and influence it has on the surrounding environment. Design objectives and mobility standards are defined through the context-based assignments, ensuring that the roadway promotes all components of Complete Streets Design. Maps displaying the FHWA Roadway Functional Classifications within Palm Beach County can be found in Appendix A.

Limited Access Facility

Principal Arterial

Minor Arterial

Major Collector

Minor Collector

Local Roads

FHWA Road Functional Classification Table

FHWA Functional Classifications	Description	Typical Features	Typical AADT	Examples
Limited Access Facilities	Highest classification of roadways in the United States. Provide regional and interstate trips and support freight movement between markets and shipping locations. Experience highest mobility and highest speeds.	**Lanes:** Vary **Lane Width:** 12 ft. **Outside Shoulder Width:** 8-12 ft. **Typical Speed Limit:** 55-75 mph	**AADT (Urban):** 60,000-260,000	• I-95 • Florida's Turnpike
Principal Arterial	Serves major activity centers of a metropolitan area, has the highest traffic volumes and longest trip desires. Abutting land uses can be served directly.	**Lanes:** 4-8 **Lane Width:** 11-12 ft. **Outside Shoulder Width:** 8-12 ft. **Typical Speed Limit:** 35-55 mph	**AADT (Urban):** 30,000-75,000	• Lantana Road (Lantana) • Jog Road (Boynton Beach)
Minor Arterial	Provides service for trips of moderate length. Lower traffic volumes and provide more direct property access than principal arterials without penetrating neighborhoods.	**Lanes:** 4-6 **Lane Width:** 10-12 ft. **Outside Shoulder Width:** 4-8 ft. **Typical Speed Limit:** 30-45 mph	**AADT (Urban):** 15,000-45,000	• Linton Boulevard (Delray Beach) • Donald Ross Road (Jupiter)
Major Collector	Provide direct property access and traffic circulation into higher density residential neighborhoods and commercial/industrial areas. Often channels traffic from local streets to arterial system.	**Lanes:** 2-4 **Lane Width:** 10-11 ft. **Outside Shoulder Width:** 1-6 ft. **Typical Speed Limit:** 30-45 mph	**AADT (Urban):** 7,000-30,000	• Kirk Road (Palm Springs) • SW 18th Street (Boca Raton)
Minor Collector	Serves less traffic volumes than major collectors. Direct property access to lower density residential and commercial/industrial areas. Channels trips between local streets and arterials for short distances (<.75 miles).	**Lanes:** 2 **Lane Width:** 10-11ft. **Outside Shoulder Width:** 0-6 ft. **Typical Speed Limit:** 25-40 mph	**AADT (Urban):** 2,000-20,000	• S Pennock Lane (Jupiter) • Paddock Drive (Wellington)
Local Roads	Provides direct access to adjacent property. Does not carry through traffic movement, roads with the lowest traffic volumes.	**Lanes:** 2 **Lane Width:** 8-10 ft. **Outside Shoulder Width:** 0-2 ft. **Typical Speed Limit:** 10-30 mph	**AADT (Urban):** 100-10,000	• 7 Avenue N (Lake Worth) • W 22nd Court (Riviera Beach)

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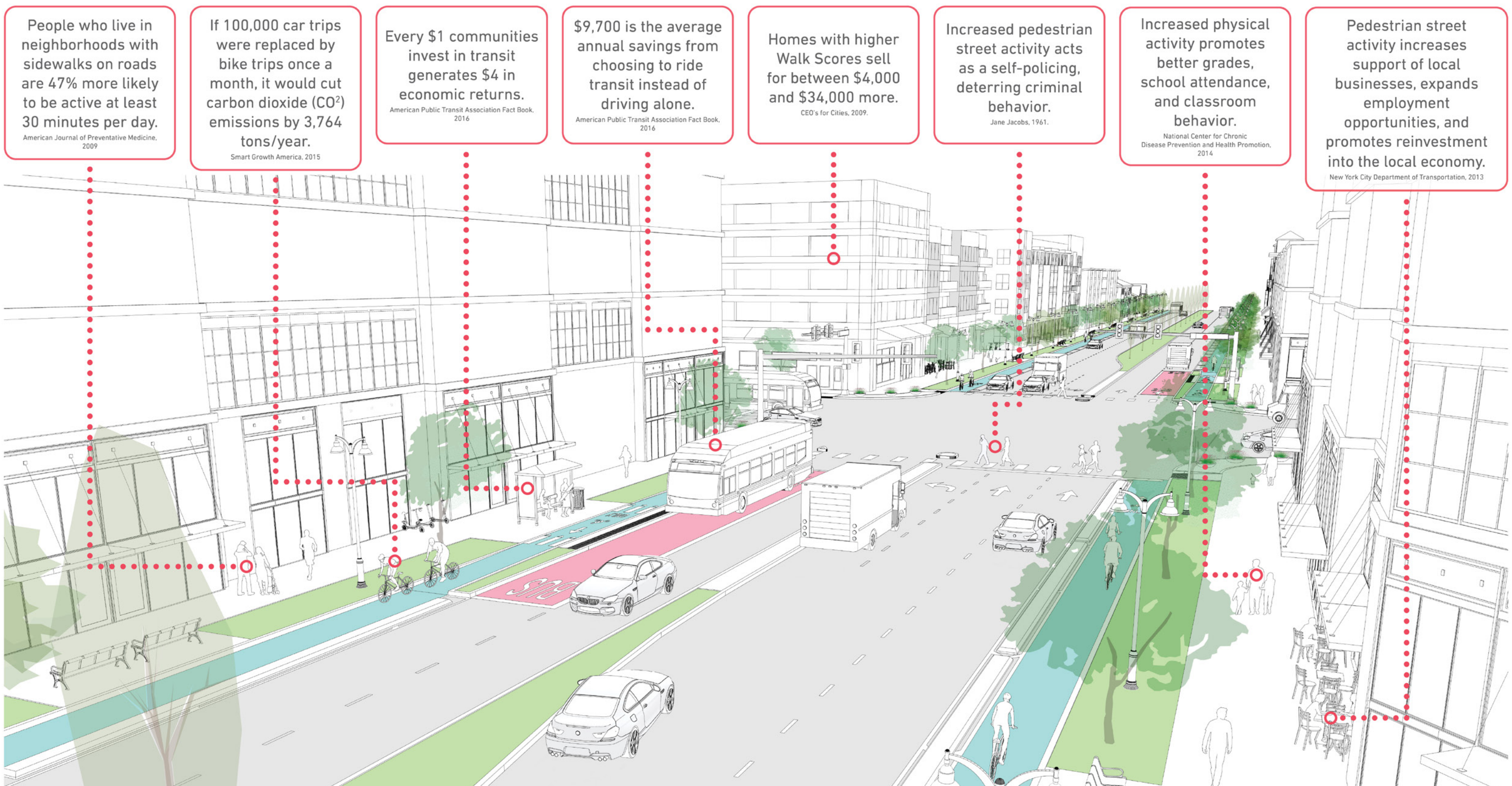
Roadway Design Guidelines

CHAPTER 3: ROADWAY DESIGN GUIDELINES

INTRODUCTION

The FHWA Roadway Functional Classifications and FDOT Context Classifications from Chapter 2 are the foundation for the Complete Streets design guidance presented in this chapter. Subsequent sections focus on the distinct realms of street design, with recommended elements and dimensions to support the street design goals. The typical section of a roadway includes elements that can be organized as belonging to either the Non-Motorized Travel Realm or the Roadway Realm.

The design guidance in this chapter is organized by the three major realms of street design: Non-Motorized Travel Realm, Roadway Realm, and Intersections.



Benefits of Complete Streets Infographic

NON-MOTORIZED TRAVEL REALM

The Non-Motorized Travel Realm has evolved to accommodate more than just pedestrian movement. The pedestrian-oriented setting of the Non-Motorized Travel Realm is comprised of the sidewalk, street furnishings, landscaping, multimodal facilities and frontage to the surrounding land use. The inclusion of multiple travel modes into a space separated from the roadway promotes a safer and more lively space for those interacting with the surrounding land uses outside of the private automobile. Shifting away from vehicle trips to Non-Motorized Travel Realm begins with crafting attractive facilities that conform to their environments. As motorists shift to sustainable modes of transportation, the community experiences positive changes attributed to a reduction in traffic congestion and vehicle emissions and the improvement of local economies and increased physical activity.

Non-Motorized Travel Realm Diagram

Example of Non-Motorized Travel Realm

Example of Non-Motorized Travel Realm

ROADWAY REALM

The Roadway Realm is defined as the space between the curbs on a street generally allocated to the movement of people, either in motor vehicles, on bicycles, or riding transit. Travel lanes can move people more efficiently through the provisions of dedicated transit lanes, which can often be implemented through repurposing general traffic lanes. Freight movement is another significant roadway activity that must be acknowledged during Complete Streets planning. To establish where and how freight fits into the roadway, it is critical to consider the operations and activity of nearby land uses and where the importance of freight ranks in comparison to other modes of transportation. Integrating freight into a Complete Street is possible by matching the type of delivery vehicle to a roadways functional and context classifications- doing so can significantly reduce freight-related issues such as noise pollution, disruption of normal traffic flow and roadway surface damage.

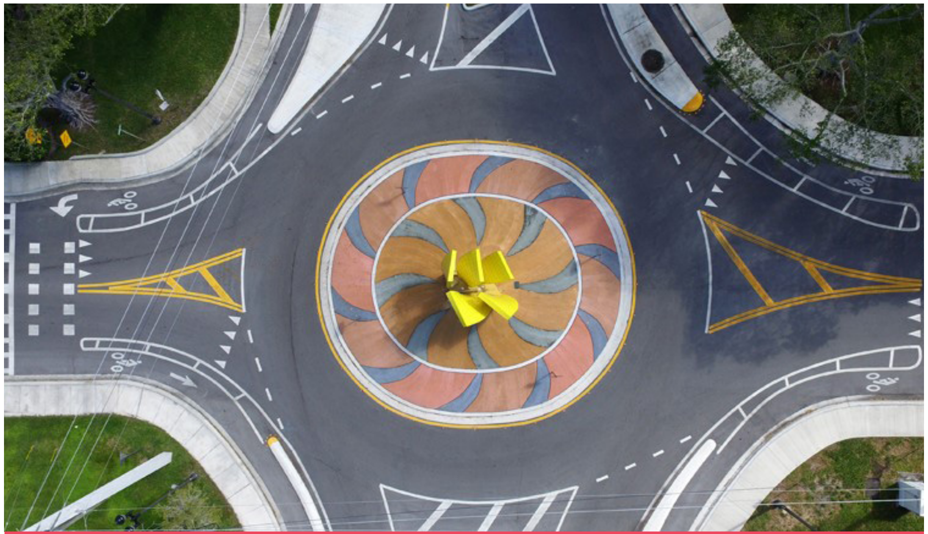
Lastly, well-planned lane geometry and configuration of other on-street elements such as bicycle lanes, on-street parking and medians ensure that a roadway is being used to its maximum potential. Target speeds and multimodal infrastructure are appropriately implemented when a roadway is designed as a product of its environment, thus improving the commuting experience for users of all street design realms.

Example of Dedicated Transit Lane in the Roadway Realm

Example of Bicycle Facilities in the Roadway Realm

INTERSECTIONS

Integrating the demands of multiple user types into intersection design is crucial to maintaining continuity in the Complete Streets network. Intersections are crucial areas where users need to be aware of each other safely; this includes pedestrians and also vehicles. Intersection design should continue the safety of the pedestrian and vehicular zones. For example, a comfortable sidewalk can only achieve limited benefits if crosswalks and intersections remain dangerous and intimidating. The principles outlined in these Guidelines enable the design of intersections to function well for all modal users and support the concept of an intersection as a shared-use space. Some elements that improve the conditions for one mode may reduce the comfort or convenience of another, but these should never supersede the need for safety of all users.



Example of Multimodal Interaction at an Intersection

Example of Bicycle Facility at an Intersection

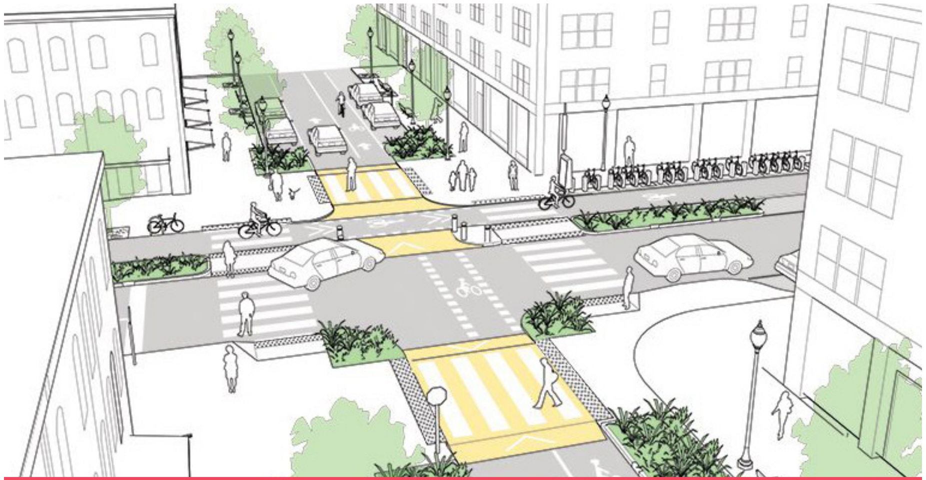
Example of Multimodal Interaction at an Intersection

DESIGN DIMENSIONS FOR STREET TYPE AND LAND USE CONTEXT COMBINATIONS

The graphics and dimensions on the following tables describe the most common scenarios in Palm Beach County. Note that when a street is the boundary between two Context Classification types, or briefly passes through a land use context, the higher Context Classification on the tables is presumed to be most applicable. The typical section dimensions shown in the graphic tables on the following pages are constrained by typical right-of-way widths and laneage found in Palm Beach County based on an analysis of the most common right-of-way widths for each combination. Right-of-way widths and number of lanes are based on Palm Beach County Engineering's typical roadway sections. Street Type/Land Use Type combinations that do not exist within Palm Beach County are marked with N/A for each dimension, such as a Principal Arterial within an Urban Core area.

The dimensions have been tailored to provide appropriate Complete Streets elements without exceeding the assumed right-of-way width and number of travel lanes. Wider dimensions for the Frontage Zone, Furnishing Zones, and Bicycle Facility should be provided if conditions warrant. For Principal Arterials and Major Collector roads, Furnishing Zone widths of 5 to 15 feet create ideal separation of pedestrians from vehicular traffic and offer the opportunity to plant street trees to improve shade and separation from traffic. To reduce the interaction between bicyclists and motorists and attract a wider range of people to bicycle for transportation purposes, separated bicycle lanes or wide sidewalks (<8 feet)/shared-use paths are considered the preferred bicycle facility type.

Arterial Roadway Example Diagram



Collector Roadway Example Diagram

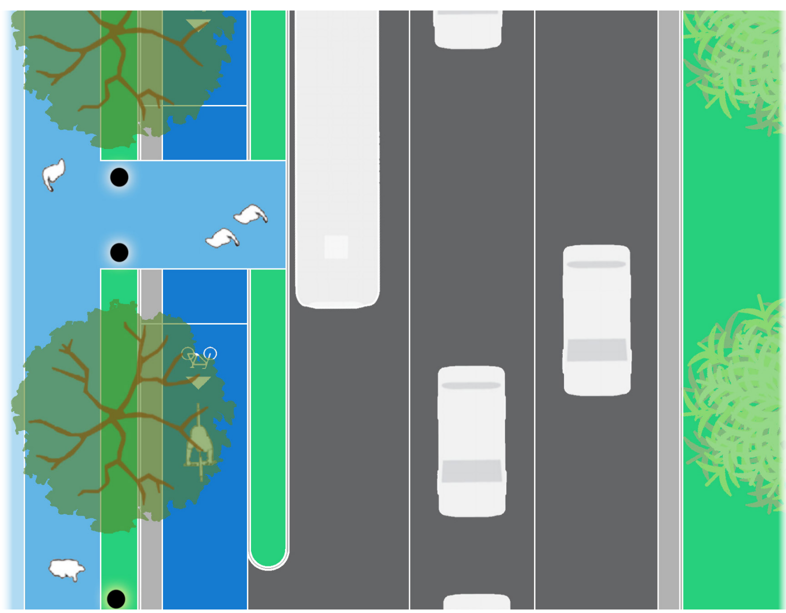
PRINCIPAL ARTERIAL

The primary function of Principal Arterial roadways is to serve major activity centers of metropolitan areas. These roads carry the largest volumes of traffic and serve users with long-distance trips. It is recommended that these roads be designed with speeds of 50 mph and are anticipated to carry between 30,000 to 75,000 in urban areas.

The proposed typical cross section for Principal Arterials is six-lane divided with protected bike lanes. The total right-of-way widths for each land use context range from 110 feet in suburban contexts to 220 feet for rural context. To enhance comfort for pedestrians in the Urban Center context, four travel lanes are recommended instead of six.

Context		Sidewalk			Bicycle		Through Lane	Through Lane	Through Lane		Half of Median
Urban Core (None)	-	-	-	-	-	-	-	-	-	-	-
Urban Center (120' ROW)	4	10	6	2	6	2	11	10	-	1	8
Urban General (120' ROW)	-	7	-	2	6	2	11	11	10	1	10
Suburban Commercial (110' ROW)	-	6	-	2	4	2	11	11	10	1	8
Suburban Residential (110' ROW)	-	10	4	2	*	-	11	11	10	1	8
Rural Town (120' ROW)	-	6	5	-	5	2	11	11	11	1	8
Rural (220' ROW)	10	10	12	-	*	-	12	12	12	4	30
Natural (None)	-	-	-	-	-	-	-	-	-	-	-

Section Repeats on Other Side



Frontage Zone
Pedestrian Zone
Furnishing Zone
Curb Zone
Bicycle Path
Vehicle Travel Lanes

* Denotes an instance where the bicycle facility is combined into the sidepath

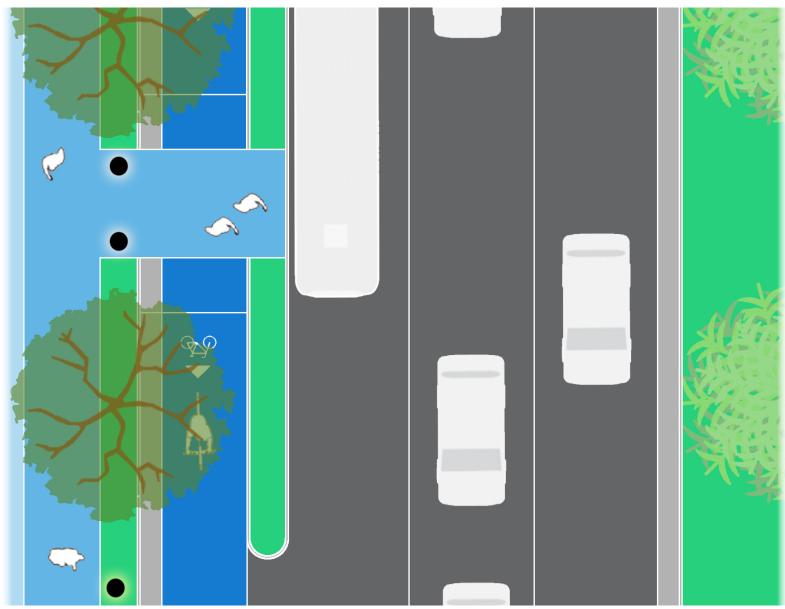
MINOR ARTERIAL

Roads classified as Minor Arterials are built to serve moderate length trips, sometimes with lower speeds to provide direct access to destinations. The recommended speed limit can vary from 30 to 45 mph, though higher speeds may be implemented in rural areas. The anticipated volume for Minor Arterials is 15,000 to 45,000 in urban areas.

The typical cross section recommended for Minor Arterials is four lanes with a center median. Bicycle facilities can either be protected on-street bike lanes or side paths depending on the land use context. The Urban General land use context is recommended to have six lanes instead of four due to the individual function of these roadways.

Context		Sidewalk			Bicycle		Through Lane	Through Lane	Through Lane		Half of Median
Urban Core *(80' ROW)*	-	8	4	2	6	2	11	10	-	1	6
Urban Center *(110' ROW)*	3	8	6	2	6	2	11	10	-	1	6
Urban General *(130' ROW)*	-	10	4	2	6	2	11	11	10	1	8
Suburban Commercial *(100' ROW)*	-	10	5	2	*	-	11	11	-	1	10
Suburban Residential *(100' ROW)*	-	10	5	2	*	-	11	11	-	1	10
Rural Town *(100' ROW)*	3	10	4	2	*	-	11	11	-	1	8
Rural *(120' ROW)*	-	10	10	2	*	-	12	12	-	4	10
Natural *(None)*	-	-	-	-	-	-	-	-	-	-	-

Section Repeats on Other Side



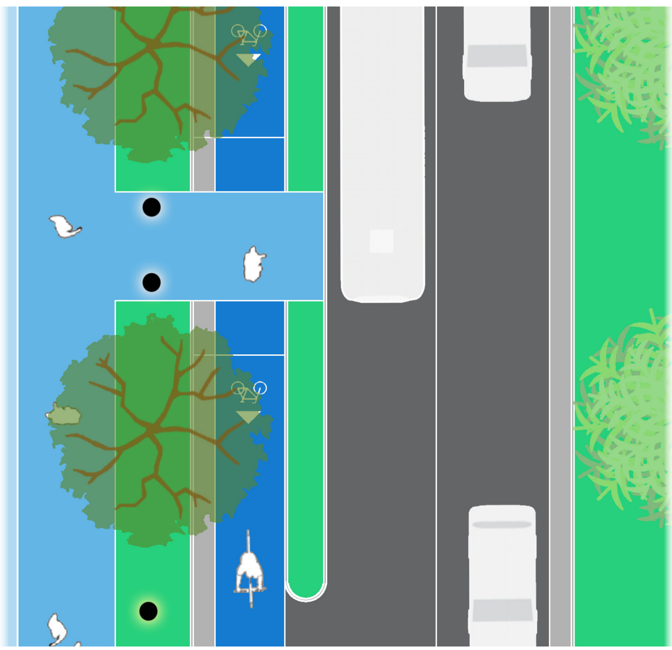
Frontage Zone
Pedestrian Zone
Furnishing Zone
Curb Zone
Bicycle Path
Vehicle Travel Lanes

* Denotes an instance where the bicycle facility is combined into the sidepath

MAJOR COLLECTOR

For Major Collectors roadways, their primary function is to provide direct property access and traffic circulation into higher density residential neighborhoods and commercial areas. The typical speed limit for Major Collectors is 30 to 45 mph, depending on context. Expected volumes range from 7,000 to 30,000 vehicles per day.

Cross sections vary for Major Collectors, though all of them are recommended to have four travel lanes. Bicycle facilities range from protected on-street lanes to side paths, depending on the available right-of-way space. The Urban General, Suburban Residential, and Rural contexts are recommended to have two-way left turn lanes in their design, while the Suburban Commercial context has a center median for access management purposes.



Context		Sidewalk			Bicycle		Through Lane	Through Lane		Half of Median
Urban Core *(70' ROW)*	-	8	-	2	4	-	11	10	-	-
Urban Center *(80' ROW)*	-	9	-	2	6	2	11	10	-	-
Urban General *(80' ROW)*	-	10	2	2	*	-	11	10	-	5 (TWLTL)
Suburban Commercial *(80' ROW)*	-	6	4	2	-	-	11	11	1	7
Suburban Residential *(80' ROW)*	-	8	4	2	*	-	11	11	-	6 (TWLTL)
Rural Town *(80' ROW)*	-	6	6	-	6	-	11	11	-	-
Rural *(100' ROW)*	3	10	6	-	*	-	12	12	-	7 (TWLTL)
Natural *(None)*	-	-	-	-	-	-	-	-	-	-

Section Repeats on Other Side

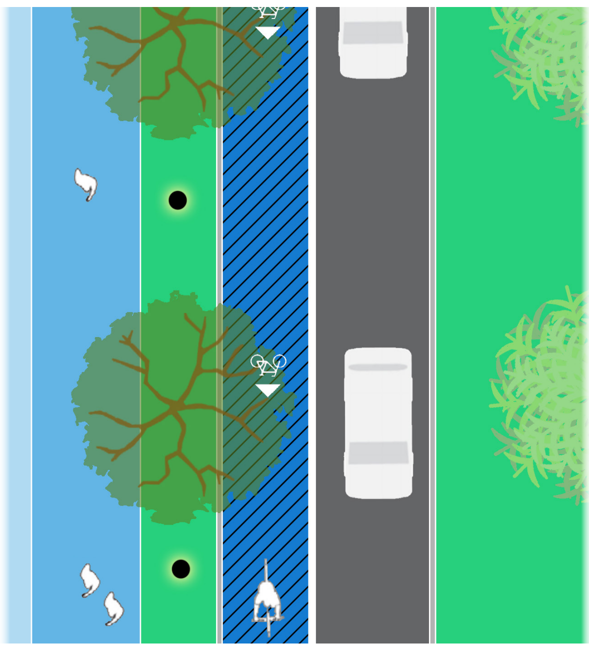
Frontage Zone
Pedestrian Zone
Furnishing Zone
Curb Zone
Bicycle Path
Vehicle Travel Lanes

* Denotes an instance where the bicycle facility is combined into the sidepath

MINOR COLLECTOR

Minor Collectors are the lowest volume roads on the classification system before Local roads and provide direct property access to lower density residential and commercial properties. They also channel trips between local streets and arterials for short distances. The recommended speed limit range is 25 to 40 mph, with volumes anticipated to be between 2,000 and 20,000 vehicles per day.

The typical cross section for most Minor Collectors is two travel lanes with a two-way center turn lane. Due to the limited amount of right-of-way (some as low as 50 feet) bicycle facilities are recommended to be side paths, with just the Rural context having enough room for an on-street bike lane.



Context		Sidewalk			Bicycle	Through Lane		Half of Median
Urban Core (50' ROW)		7	2	2	-	11	-	5 (TWLTL)
Urban Center (60' ROW)		10	4	2	*	11	-	5 (TWLTL)
Urban General (60' ROW)		10	4	2	*	11	-	5 (TWLTL)
Suburban Commercial (60' ROW)		10	4	2	*	11	-	5 (TWLTL)
Suburban Residential (60' ROW)		10	4	2	*	11	-	5 (TWLTL)
Rural Town (60' ROW)		10	4	2	*	11	-	5 (TWLTL)
Rural (80' ROW)	4	6	6	-	6	12	-	6 (TWLTL)
Natural (None)								

Section Repeats on Other Side

Frontage Zone
Pedestrian Zone
Furnishing Zone
Curb Zone
Bicycle Path
Vehicle Travel Lanes

* Denotes an instance where the bicycle facility is combined into the sidepath

CURB RADII

The curb or corner radius controls the speed of turning vehicles and affects crossing distances. Actual curb radius refers to the curvature along the curb line, while the effective curb radius refers to the curve vehicles follow when turning. The table to the right details the curve vehicles will follow (effective curb radius) for each recommended actual curb radii. A small radius increases safety by reducing crossing distances and slowing turning vehicles; this is particularly important given the number of crashes in which turning vehicles strike pedestrians in crosswalks. The effective curb radius can be increased, where necessary for larger vehicles, without increasing the actual radius. Textures and colored paint can be used to mark out a smaller curb radius without physically blocking large vehicles from turning through that space. Parking and bicycle lanes can also increase the effective radius. If the turn cannot fit within the existing geometry, the stop bar on the receiving street can be recessed to allow space for wide turns. Where the potential for conflicts with pedestrians is high and intersection geometry necessitates an effective radius greater than 50 feet, evaluate installation of a channelized right-turn lane with a pedestrian refuge island.

Notes:

1. Bicycle lanes and parking lanes may increase the effective curb radius.
2. Effective curb radius may be increased to 30 feet in urban center and urban general areas to accommodate a bus or a truck along certain corridors.
3. Consider alternate strategies such as recessed stop bars and mountable curbs in unusual situations where 30 feet effective curb radius cannot be met.

Road Class	Land Use Context	Actual Curb Radius	Effective Curb Radius
Principal & Minor Arterials	Urban Center/Core	15'	20'
	Suburban/Rural Town	25'	30'
	Rural/Natural	40'	45'
	All intersection corners without vehicle turns	5'	-
Major Collector	Urban Center/Core	15'	20'
	Suburban/Rural Town	25'	30'
	Rural/Natural	25'	40'
	All intersection corners without vehicle turns	5'	-
Minor Collector	Urban Center/Core	15'	25'
	Suburban/Rural Town	25'	30'
	Rural/Natural	25'	30'
	All intersection corners without vehicle turns	5'	-
Local Roads	Urban Center/Core	15'	20'
	Suburban/Rural Town	15'	20'
	Rural/Natural	15'	20'
	All intersection corners without vehicle turns	5'	-

NON-MOTORIZED TRAVEL REALM DESIGN GUIDANCE

The Non-Motorized Travel Realm is critical to the function of a street. Basic purposes of the Non-Motorized Travel Realm include:

- Transit access
- Public space
- Landscaping
- Utilities
- Support of adjacent land use, especially retail uses in business districts

The Non-Motorized Travel Realm can be made more inviting through the use of public space amenities such as benches and lighting. Additionally, implementing bicycle facilities in this area provides additional travel options that are separated from the roadway, increasing the safety of these commuters and fostering an environment oriented around social and physical activity. Active and vibrant spaces formed from the elements above promote community cohesion and increase the value of adjacent properties.

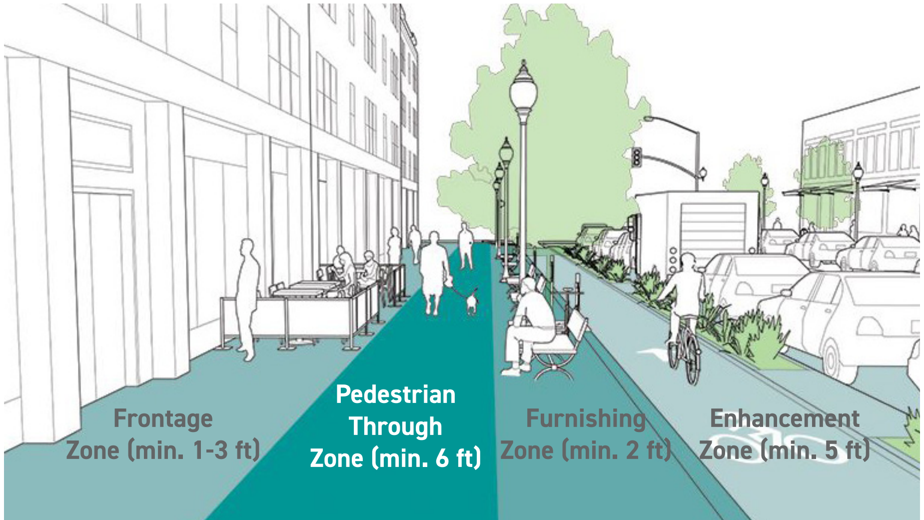
Cohesion between nearby land uses and pedestrian spaces is an emphasis in the Complete Streets Design Guidelines. An inviting sidewalk can help support adjacent businesses and make communities economically stronger by increasing pedestrian foot traffic. Space for people to slow down and examine window displays or advertising boards increases interaction with storefronts and businesses. Additionally, opportunities for café seating can expand the capacity of smaller restaurants and adds activity to the sidewalk.

Ensuring that facilities are designed to meet the needs of users with accessibility challenges is another critical detail in creating an inclusive environment. Completing gaps in sidewalks and providing accessible links to other facilities and uses between the three street realms eliminates many barriers for limited-mobility users. Spaces in the Non-Motorized Travel Realm should be designed for unobstructed, continuous travel with minimal vertical deflection in the Pedestrian Zone to provide reliable travel among the elderly, people living with a disability and parents with children/strollers.

The Non-Motorized Travel Realm also plays a key role in leveraging street infrastructure for environmental benefit. Public spaces that provide for stormwater detention and filtration improve public waterways and reduce street flooding. Street tree coverage enhances comfort for users by creating shaded environments and providing physical protection between the sidewalk and the roadway. Materials that provide innovative drainage solutions should be considered in the Non-Motorized Travel Realm when necessary, such as permeable asphalt pavement or permeable concrete for sidewalks. Permeable pavements may give urban trees the rooting space they need to grow full size.

THE THREE ZONES OF THE NON-MOTORIZED TRAVEL REALM

The Non-Motorized Travel Realm is divided into three zones. Each zone has unique functions and characteristics that contribute to the overall mobility and appearance of the area. The boundaries between the three zones are not exact, but the surrounding land context is a main determinant in identifying where there are transitions in the Non-Motorized Travel Realm and Transportation Realm zones. Detailed design that focuses on integrating all zones ensures that the entire realm functions as a well-integrated system.



Non-Motorized Travel Three Zones

Frontage Zone

The Frontage Zone occupies the space between the front of a building or yard and the through movement space of the Pedestrian Zone. Space is provided as a buffer between engagements with a building (opening a door, stopping to view a display) and people walking past. In residential areas, the Frontage Zone may provide a buffer between the sidewalk and improvements on the adjacent property, such as a fence or hedge. In Suburban Commercial areas, the frontage zone may help buffer the sidewalk from an adjacent parking lot. Café seating, business displays and planters are examples of items that can be placed within the Frontage Zone. When implementing café spaces or outdoor seating, ensure that 5 feet of pedestrian passageway is unobstructed from the edge of the outdoor seating to permanent objects on the sidewalk in the Frontage Zone. Elements included in the frontage zone are expected to change based on the context of the location. For example, places experiencing frequent pedestrian traffic and economic activity should look for opportunities to increase the width of the frontage zone to implement features that enhance the user experience. Frontage zones that function as an extension of a business activate the Non-Motorized Travel Realm to encourage pedestrian interaction. The minimum width of the Frontage Zone typically ranges from 1 to 3 feet depending on typology, as shown in the Summary Design Guidelines tables.

Example Pedestrian Zone in Boca Raton, FL

Pedestrian Zone

Most Non-Motorized Travel Realm trips occur on the sidewalk through the Pedestrian Zone. Multiple modes of transportation can effectively traverse this space when wide sidewalks and suitable bicycle/ pedestrian facilities are implemented. A straight path that lines up with crosswalks should be provided wherever feasible to facilitate convenient through movement and clear lines of sight. The Pedestrian Zone should remain free of obstructions to avoid tripping hazards and obstacles to flow. Shared-use paths capable of simultaneously supporting pedestrians and micro-mobility can also be incorporated into the pedestrian zone where adequate width is provided in the ROW. Surfaces and slopes must be Americans with Disabilities Act (ADA) compliant and should remain slip resistant when wet. Lighting should illuminate this zone to create a safe walking environment and widths should be sufficient for the anticipated volumes of people. The minimum width of the Pedestrian Zone typically ranges from 5 to 10 feet depending on typology, as shown in the Summary Design Guidelines tables. Wider Pedestrian Zones can be provided as necessary depending on context and available space.

Furnishing Zone

The Furnishing Zone exists between the Pedestrian Zone and the curb and provides space for many of the public space elements of the Non-Motorized Travel Realm, as well as serving as the primary separation of people on the sidewalk from vehicular traffic. Landscaping, street trees, furniture, litter and recycling bins, transit shelters, utility equipment, lighting and parking meters should all be placed within the Furnishing Zone where space permits. In urban core areas, café seating can be provided within the Furnishing Zone in cases where the Frontage Zone is not wide enough to accommodate it. Care should be taken to ensure that the adjacent Pedestrian Zone is clear from obstacles. Placement of these items within the Furnishing Zone leaves the Pedestrian Zone free of obstacles and provides a buffer between moving vehicular traffic and people on the sidewalk.

Enhancement Zone

The space immediately next to the sidewalk, closest to the roadway, is known as the Enhancement Zone and can support a variety of elements including curb extensions, parklets, micro-mobility parking and flexible loading zones. If space permits, micro-mobility infrastructure should be implemented to the maximum extent possible as this space provides separation from both motorists and pedestrians.

Design Elements by Non-Motorized Travel Realm Zones

Design Elements	Frontage Zone	Pedestrian Zone	Furnishing Zone	Enhancement Zone
Cafe Seating	✓			✓
Lighting/ Utilities			✓	
Street Vending			✓	✓
Parklets			✓	✓
Footpath		✓		
Micro-Mobility Parking			✓	✓
Transit Stops/ Shelters			✓	
Street Furniture			✓	
Bicycle/Micro-Mobility Path		✓		✓
Planters/ Landscaping	✓		✓	✓
Business Displays	✓		✓	
Overhang Elements	✓	✓		
Signage/ Wayfinding			✓	

DESIGN ELEMENTS OF THE NON-MOTORIZED TRAVEL REALM

Numerous design elements provide an enhanced user experience within the Non-Motorized Travel Realm. Overviews of elements for consideration are included below.

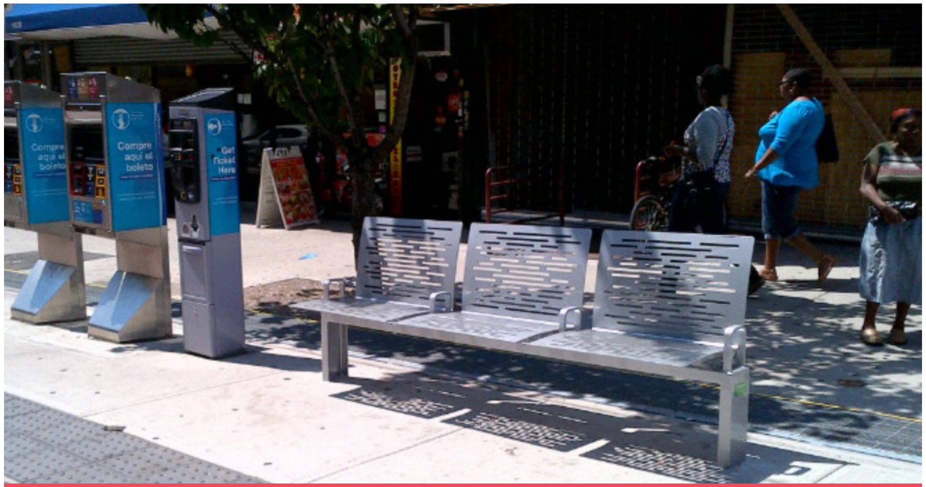
Seating

Seating can be provided via benches or through landscape planters with extended edges. Seating should be oriented toward the Pedestrian Zone, allowing for easy access and focusing views towards passersby. Seats should be placed in either the Frontage or Furnishing Zones to leave the Pedestrian Zone clear. The best locations for seating in these zones are near transit stops, popular destinations, shading and dedicated rideshare zones. Clear zones must also be provided to allow for ADA access and for maintenance of both the seating and surrounding items, such as utilities.

Bollards

Bollards provide physical separation between realms and enhance safety by restricting vehicular access. They are particularly effective in plazas or flush streets where separation of pedestrian and vehicular spaces needs reinforcing. If protected bicycle lanes are proposed on a roadway with high speeds and traffic volumes, bollards are an ideal element to use as a barrier between bicycles and vehicles. They can also be placed along curb extensions to prevent vehicles from turning on to the sidewalk and can be used as curb extensions for temporary installations. Bollards are also effective as protection for elements which extend into the street, such as parklets, stormwater features and mid-block crosswalk extensions.

Lane delineators can be used for conducting pilot projects or in areas where flexible curb zones are created. In flexible curb zone spaces, delineators can be used to protect on-street bicycle or multimodal facilities, and then removed or reconfigured during scheduled freight pick-up/drop-off times to accommodate both bicycle and freight services.



Furnishing Zone Pedestrian Seating in New York, NY

Bollards Separating Bicycle Lane in Philadelphia, PA

Lighting

Lighting provides a sense of safety to people walking at night and can increase activation of a block in the evenings. Well-lit spaces also enhance the visibility of pedestrians among motorists and is a key element needed to improve multimodal safety. In urban core, urban general, and rural town areas, it is important that pedestrian-scaled light fixtures be provided (shorter than 20 feet) and focused down on the sidewalk to minimize stray light. Pedestrian-scaled lighting for sidewalks and crosswalks ensures that pedestrians are more visible to motorists and illuminates potential tripping hazards. Lighting structures should be placed in areas to ensure that a clear path is provided.

Street Trees/Landscaping

Trees and landscaping can transform a less desirable space into an inviting outdoor environment. Trees provide shade to pedestrians walking and sitting alike while also helping to block wind that is funneled down streets. Trees and landscaping provide a buffer between the Roadway Realm and the Non-Motorized Travel Realm; trees that provide a canopy over the Roadway Realm also help to calm traffic by visually narrowing the roadway.

Street trees should be placed at regular intervals within the sidewalk as long as adequate pedestrian clear width is maintained (5 feet preferred, 4 feet minimum) adjacent to the tree well. In this case the line between the furnishing zone and the pedestrian zone is somewhat blurred; however, minimum widths may still be maintained.

Green elements are also an important component of stormwater filtration and management. Runoff from both the sidewalk and street can be directed into tree trenches and planters where it can be filtered before trickling into the groundwater or making its way into

Street Tree Example

drainage pipes. Plantings should be selected for resilience to dirt, oil, and debris from the roadway as well as occasional trampling by pedestrians. Lastly, landscaping maintenance is necessary to preserve a clean environment with clear, unobstructed paths. Unmanaged landscape poses a safety risk to drivers and pedestrians- as branches may scratch vehicles or block the view of pedestrians entering the roadway.

Paseos

Paseos improve the walkability of a district or neighborhood by creating pedestrian-only "cut-through" locations where people can walk from one street to an adjacent parallel street within a block. Paseos incentivize pedestrian travel by shortening travel time, especially in locations where block lengths are relatively long by pedestrian scale (>500 feet). Paseos should be designed with a clear line of sight from one street to the adjacent street and be at least 10 feet in width. Paseos may provide access to adjacent land use and often are integrated into the surrounding land use. Low-volume roadways where the Non-Motorized Travel Realm and Roadway Realm is frequently active are ideal facilities for pedestrian paseos. Other typical uses of paseos include access to small-scale businesses off the adjacent street and to serve as beach access between two adjacent properties.

Parklets

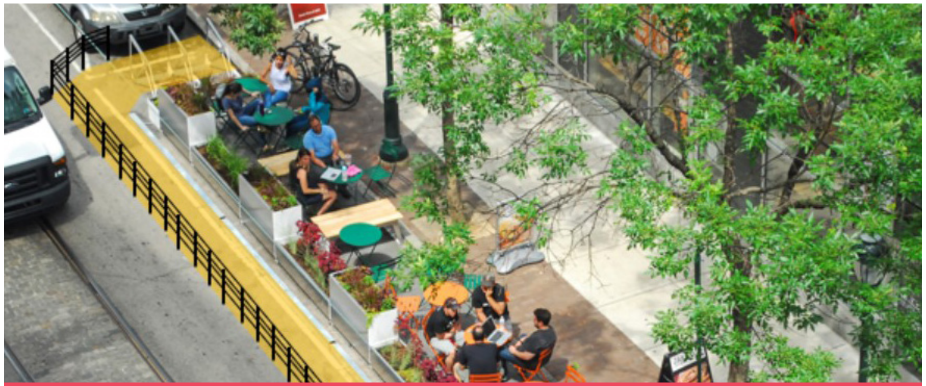
Parklets are a special type of amenity that extend the Non-Motorized Travel Realm into the Roadway Realm. Parklets are most frequently constructed in place of existing on-street parking. A parklet is often constructed using lighter materials and is not rigidly fixed to the street. Parklets match the sidewalk level and drainage along the gutter is usually preserved, lowering the cost of implementation. A parklet can provide increased public seating along sidewalks that are otherwise constrained and can be paired with cafés to provide seating to both customers and the public.

Pedestrian Wayfinding Signage

Wayfinding is an important component of facilitating walking as a mode of transportation, just as cars are provided with directional signage. Pedestrian wayfinding helps people orient themselves in physical space and navigate from place to place. Wayfinding should include key destinations and attractions with distance and approximate time needed to walk there. Best practice wayfinding systems include 5, 10, and/or 15-minute walksheds and “heads-up” orientation from the perspective of the person viewing the sign (“heads-up” orientation in which the compass directions are rotated to correspond with the direction the person is facing). Signage should be placed at each intersection or at each decision point to continue to point pedestrians in the right direction.

Driveways

From the perspective of the sidewalk user, driveways are locations where curb cuts connect to access drives to buildings and loading areas and can negatively impact the pedestrian experience. Ideally the Pedestrian Zone area of the sidewalk should remain straight across the driveway with no change in cross-slope. Driveways should not be excessively wide. Curb radii should remain small to slow entering and exiting vehicles. To prevent sidewalk interruptions and to reinforce the priority of pedestrians over vehicles on the sidewalk, a driveway should ramp up to sidewalk level and sidewalk surface materials should continue across the driveway.



Parklet Example

Pedestrian Wayfinding Map Example

Bicycle/Micro-Mobility Parking

Accessible, ample, and secure bicycle and micro-mobility parking is an important component of supporting multimodal transportation in Palm Beach County. Bicycle racks should be provided in the Furnishing Zone to avoid conflicts between bicycles and people walking. Dockless micro-mobility parking zones can be placed in either the furnishing zone or in the curb zone, if feasible. Where there is sufficient room, placing bicycle parking in the Frontage Zone could take advantage of overhangs to provide shelter during inclement weather. Bicycle parking racks should be placed in a line and should allow for two points of contact between a bicycle frame and the rack to keep the bicycle stable. The design should allow for securing both a wheel and the frame to the rack. The Association of Pedestrian and Bicycle Professionals (APBP) publishes a *Bicycle Parking Guide*, which provides detailed design guidance. Micro-mobility parking stations are typically designated with symbols, paint, or thermoplastic. If placed in the furnishing zone, cohesion with a shared-use path or roadway multimodal infrastructure should be encouraged to discourage riding in the Pedestrian Zone.

Bicycle Parking in West Palm Beach, FL

Shared-Use Path Facilities

Although most bicycle facilities are included in the Roadway Realm, bicycle facilities may sometimes be provided in the Non-Motorized Travel Realm. Bicycle facilities may be marked on the sidewalk using pavement markings where it is desired to provide a continuous separated bicycle facility outside of the roadway. If provided, sidewalk bicycle facilities should always be clearly distinguished from the pedestrian zone to minimize the potential for conflict between pedestrian and bicyclists. More detail on the design of bicycle facilities can be found in the Roadway Realm section on page 47.

Dismount Zones

Local jurisdictions may restrict wheeled vehicles, such as bicycles and skateboards, on narrow sidewalks in downtown districts where high volumes of pedestrian traffic are common. A best practice for jurisdictions that may want a less aggressive approach to restricting bicycling on sidewalks in certain areas, while still encouraging people to use bicycles where appropriate, is to provide separated bicycle lanes on street to encourage people to ride in the street rather than on the sidewalk. On streets where this is not possible due to right-of-way or other constraints, a secondary solution is to mark dismount zones on the sidewalk so that bicyclists are informed where sidewalk riding is not allowed in a less discouraging manner than prohibition signs.

Transit Stops and Shelters

Transit stops are typically found in the Non-Motorized Travel Realm. Transit stops should include amenities to provide a safe and comfortable environment for waiting riders, including benches, shelters, trash receptacles, system/route maps, real-time information displays, lighting, and off-board ticketing systems.

Bus stop placement is typically guided by Palm Tran policies in partnership with the roadway jurisdiction agency. Stops can be placed near-side of an intersection, far-side, or mid-block to line up with key destinations and transfers to other routes. Far-side bus stops are typically preferred to mitigate interaction with intersection operations. The NACTO Transit Street Design Guide provides guidance on stop lengths, position, and recommended clear distances around stop amenities to remain ADA-compliant. Shelters are particularly important for their protection from sun, wind, and rain.

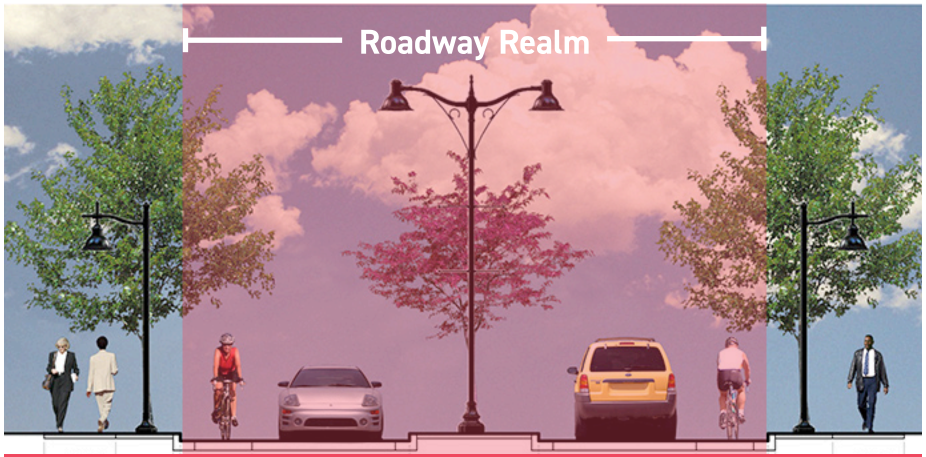
Where there is insufficient space for a shelter, a "bus bulb" can be used to increase the sidewalk space available for a bus stop, or to provide ample space for walking in locations where the shelter is placed in the Pedestrian Zone. Bus bulbs benefit transit riders through increased space and safety; operations are also improved by eliminating delays associated with merging in and out of lanes.

Bus Shelter Example

ROADWAY REALM DESIGN GUIDANCE

The Roadway Realm is the space between the curbs or edge of travel of a street right-of-way. Palm Beach County's vehicular ways provide a platform for countywide mobility via bicycle, bus, and car. The vehicular realm supports nearly all transportation options and, consequently, must be designed thoughtfully to maximize safety for all users. Urban and suburban street design has become more complex over time given rapid growth in Palm Beach County.

The roadway is not just about moving motorized vehicles – its design affects multimodal mobility, the safety and comfort of the Non-Motorized Travel Realm, the ability to cross the street, economic vitality, and quality of life. There are many tools available for increasing street safety, including speed reductions, traffic calming, and dedicated facilities for bicycles.



Roadway Realm Diagram

CURB ZONE

The Curb Zone occupies the space between the edge of the Roadway Realm and the Furnishing Zone and typically consists of the street curb, although in some cases it may consist of other items. An effectively managed and designed Curb Zone increases the flexibility of the Roadway Realm, making it a space capable of supporting a variety of activities for many users. Curb management should first consider the uses critical to the roadway environment such as transit stops, transit lanes, and micro-mobility infrastructure. Next, transit and business supportive elements like bikeshare stations, loading zones, and rideshare loading are assigned. The remaining portion of the curb can be used for the extension of the Non-Motorized Travel Realm, stormwater infrastructure, on-street parking, trash collection, or beautification installments.

The Curb Zone may also be expanded to include sidewalk-level separated bicycle lanes (raised bicycle lanes) capable of supporting different modes of micro-mobility or elements that expand the sidewalk into the Roadway Realm (e.g. parklets). In more rural settings, the curb zone may also include swale areas for roadway drainage.

Curb Zone with Bicycle and Micro-Mobility Parking

Freight and Passenger Loading Zone

Flexible Loading Zones

Delivery and freight services are better incorporated into the roadway when sections along the curb are dedicated for scheduled pick-ups/drop-offs. Loading zones prevent the interruption of normal traffic flow and can function as flexible spaces outside of the scheduled delivery times that support a variety of multimodal elements including micro-mobility facilities, transit stops, rideshare pick-up/drop-off zones, carshare services, temporary landscape installments, and paid parking. Urban settings are ideal for implementing flexible loading zones because of the high demand for space in the Non-Motorized Travel and Roadway Realms.

DESIGN SPEED

The selected design speed establishes the range of design values for many of the other geometric elements of the roadway. The selected design speed should be high enough so that an appropriate regulatory speed limit will be less than or equal to it. Desirably, the speed at which drivers are operating comfortably will be close to the posted speed limit. For most cases, the ranges provide adequate flexibility for designers to choose an appropriate design speed without the need for a design exception. *A Guide for Achieving Flexibility in Highway Design* (AASHTO) provides additional information on how to apply this flexibility for selecting appropriate design speeds for various roadway types and contexts.

According to *Mitigation Strategies for Design Exceptions (FHWA), "Research confirms that lower speeds are safer and lowering speed limits can decrease both crash frequency and severity. However, speeds cannot be reduced simply by changing the posted speed limit. Geometric and cross-sectional elements, in combination with the context, establish a driving environment where drivers choose speeds that feel reasonable and comfortable."* These geometric and cross-sectional elements are known as traffic calming. Adding features such as curb extensions and median islands helps to slow and calm traffic without major flow disruptions.

TARGET SPEED

Target speed is the intended speed of travel for drivers based on a street's context. The concept of target speed represents an evolution over the traditional design and posted speed approach. Sometimes, streets are designed for one speed and then posted at speeds 5 or 10 mph lower. This approach leads to speeding as drivers recognize that a road supports speeds higher than the speed limit. The target speed approach aligns the design and posted speeds and results in a street designed for the desired travel speed. In the table below, Allowable Range refers to a set of speeds modified for each land use context classification type and is applicable for any roadway not designated as part of the Strategic Intermodal System (SIS). SIS is a roadway of significant statewide and regional transportation service and are typically essential to the economy, hurricane preparedness, and transportation of the State of Florida. Minimum speeds are established on SIS roadways to ensure the efficient movement of vehicles on key transportation corridors.

FDOT Design Manual Design Speed Ranges

	Allowable Range (mph)	SIS Minimum (mph)
C1- Natural	55-70	65
C2T Rural Town	25-45	40
C2 Rural	55-70	65
C3 Suburban	35-55	50
C4 Urban General	25-45	45
C5 Urban Center	25-35	35
C6 Urban Core	25-30	30

LANE WIDTH

The AASHTO Green Book recommends a range of lane widths be considered based on desired speed, capacity, and context of a roadway. The Draft 2016 Florida Greenbook provides for minimum lane widths based on functional classification, area type, design speed, and average daily traffic (ADT).

Minimum lane widths generally range from 9 to 12 feet. For urban arterial roadways, lane widths range from 11 feet (design speed less than or equal to 45) to 12 feet (design speed greater than 45). In constrained areas where truck and bus volumes are low and speeds are less than 35 mph, lane widths of 10 feet may be used. The FDOT PPM also provides for the use of 10-foot through lanes on streets with design speeds of 35 mph or less and truck volumes less than 10 percent.

As visualized in the Summary Design Guidelines, lane widths are recommended as either 10 or 11 feet. 10-foot lanes are preferable in the urban core and urban center land uses, particularly for the Major Corridor and Main Connector typologies. This guidance reflects the urban environment, where space is at a premium and speed of travel is a lower priority. For all other land use and street typologies, lane width should be established based on set design speeds. Section 210 in the FDOT FDM has specific lane width criteria based on design speed ranges and context classification.

FDOT Green Book Lane Width Ranges

Road Type	FDOT Recommended Width Rural (feet)	FDOT Recommended Width Urban (feet)
Arterial Through Lane	12	11-12
Collector Through Lane	11-12	11
Local Through Lane	9-12	10
Turn Lane	11-12	10 -12
Parking Lane	7	7
Conventional Bicycle Lane	5	4-5
Buffered Bicycle Lane	6-7	6-7

AASHTO Green Book Lane Width Ranges

Road Type	AASHTO Recommended Width Rural (feet)	AASHTO Recommended Width Urban (feet)
Arterial	11-12	10-12
Collector	10-12	10-12
Local	9-12	9-12

RESILIENT GREEN STREETS

Roadways must be designed to respond to the emerging environmental and health concerns of the South Florida region. The ongoing battle with flooding, air and water pollution, and traffic congestion caused by recent roadway development trends can be combated through sustainable design, or resilient green streets.

Green streets can be incorporated into new road construction or during corridor retrofitting projects and should be designed to address the specific environmental and traffic concerns of the roadway. Sustainable roadway design in Palm Beach County should aim to improve stormwater management, implement permeable street surfaces, and reduce traffic congestion. Concentrating improvement efforts on these areas leads to more inclusive, climate resilient roadways that can withstand many of the environmental and traffic issues posing the biggest threats to mobility and livability.

Stormwater Management

Roadway flooding has been a continuous problem in Palm Beach County. Previous efforts of stormwater management have focused on the implementation of expensive “gray” water infrastructure such as concrete and metal pipes, gutters and tanks to treat stormwater. Typical rainfall often causes these systems to be overwhelmed, resulting in flooded streets/homes/businesses and the pollution of nearby water sources. Roadways can be designed at certain angles and deflection to direct water to collection areas or trench drains that carry runoff to gardens or planters where it can be absorbed and filtered. Shifting from conventional "gray" water infrastructure to natural methods of water collection and treatment such as bioretention areas/planters, swales and organic filters (sand, vegetation, soil) is highly recommended to address flooding and water pollution issues.

Sustainable stormwater management can also offer many additional benefits like traffic calming, minimal maintenance/low implementation costs and beautification of the street landscape.

Permeable Surfaces

Differing from the typical roadway materials of asphalt and concrete, permeable surfaces allow stormwater and runoff to infiltrate through porous surfaces into the soil or groundwater reducing the frequency of flooding and accumulation of pollutants on the roadway surface. Typical permeable pavement surfaces include pervious concrete, porous asphalt, and permeable interlocking concrete pavers. Grass pavers are another option that provide additional benefits such as street beautification and inexpensive construction costs. Additionally, systems can also be placed underneath permeable surfaces to direct stormwater to bioretention areas and prevent the spread of untreated runoff.

Addressing Traffic Congestion

Providing adequate infrastructure for multiple modes of transportation is a key factor in shifting away from the automobile as the primary form of transportation. Reducing the number of lanes available to private vehicles, in favor of public transportation or micro-mobility is another solution for corridors identified as significant multimodal environments. Reducing the number of private automobiles results in several environmental and economic benefits including improved air quality, less surface pollution, increased business activity and organized freight pick-up/drop-off.

Bioswale Built into Median

Grass Pavers Road Surface Example

LANE REPURPOSING & REDUCTION

One approach to reduce speeds is to repurpose excess travel lanes. Lane repurposing uses the space from excess vehicle lanes and reallocates it to other modes, including bicycle lanes, bus-only lanes and wider sidewalks. These lanes should also be sized appropriately per the guidance provided above – lanes will be either 10 or 11 feet wide. The most common lane repurposing transforms 4-lane, undivided streets into 3-lane streets with one lane in each direction and one center, two-way turn lane. Traffic operations are improved with provision of a turning lane while crashes and speeding are reduced by eliminating unsafe lane changes and passing maneuvers. Reallocated street space is often used to provide conventional or buffered bicycle lanes. Lane repurposing can be implemented relatively inexpensively through restriping during road resurfacing projects.

Just as lane repurposing reallocates excess lanes, a lane reduction reallocates excess lane widths without fully repurposing lanes. The 12-foot-wide lane, a carryover from prior highway engineering standards, provides additional space that can be reallocated to other purposes when narrowed to 10 to 11 feet in width.

ROADWAY REALM BICYCLE ELEMENTS

A variety of bicycle facility options are available to practitioners to suit a variety of street types, widths, and roles within the bicycle network. The recommended bicycle elements are presented below in descending level of comfort for bicyclists. Increased separation from vehicular traffic is important on higher speed, higher volume streets; by contrast, low volume, low speed local streets may benefit from a shared-space approach. It is equally important to focus on a bicycle network rather than isolated stretches of high-quality facilities. Additionally, as micro-mobility grows in popularity, providing wider bicycle facilities should be a priority to accommodate multiple modes of transportation. For additional design guidance, consult the *NACTO Urban Bikeway Design Guide, Second Edition and AASHTO's Guide for the Development of Bicycle Facilities, Fourth Edition*. The table below presents target and constrained bicycle facility dimensions.

Bicycle Facility Target and Constrained Widths

Element	Target		Constrained	
	Lane	Buffer	Lane	Buffer
Separated Bicycle Lane	6'	2'	5'	2'
Two-way Separated Bicycle Lanes	12'	3'	8'	3'
Raised Separated Bicycle Lane	6.5'	1' for vertical element 3' (next to parked cars)	4'	1' for vertical element 3' (next to parked cars)
Two-way Median Bicycle Lanes	12'	6' (3' for each side)	8'	6'(3' for each side)
Buffered Bicycle Lane	5'	3'	-	-
Conventional Bicycle Lane	6'	-	4'	-
Contra-Flow Bicycle Lane	6'	-	4'	-

Raised Separated Bicycle Lanes

Raised separated bicycle lanes provide an elevated surface for bicycle riders. These lanes are also ideal for supporting micro-mobility devices, as it would create separation between pedestrian traffic and fast-traveling devices. Dockless parking can be placed adjacent to the lane, which provides accessibility and ease when beginning or completing micro-mobility trips. This lane is most often at an interim elevation between the street level and sidewalk/curb level. Providing a raised surface makes bicycles and their riders more visible to drivers and helps to keep vehicles from driving in the bicycle lane. Perceived safety is increased through this vertical separation.

Separated Bicycle Lanes

A separated bicycle lane is located between vehicles and the curb, offering a protected environment which is separated from vehicle conflicts other than at intersections and driveways. Separated bicycle lanes may also be referred to as protected bicycle lanes and are usually separated from traffic through various buffers, including parked vehicles, a curb or median, and bollards or planters. This facility provides the most comfortable on-street environment for bicycles and micro-mobility devices and reduces the conflicts with parking or loading vehicles that other bicycle lanes face.

Two-Way Separated Bicycle Lane

Separated bicycle lanes can also be designed as two-way separated bicycle lanes, allowing for bi-directional travel on one facility. Two-way separated bicycle lanes require mitigation for conflicts at intersections, including dedicated bicycle signals. Two-way separated bicycle lanes may be preferred in highly urban environments where it is easier to provide bicycle facilities only on specific streets, particularly if those streets are one-way to vehicles.

Median Bicycle Lanes

Conflicts between bicycles and right turning vehicles can be eliminated using median bicycle lanes. These lanes create separated bicycle lanes in the middle of a roadway, either within space already used as a median or through striping bicycle lanes. Intersection conflicts require mitigation like 2-way separated bicycle lanes and contra-flow bicycle lanes, with bicycle signals provided to eliminate conflicts with turning vehicles. Median bicycle lanes require intersections to be signalized; non-signalized median openings should be closed as part of implementation. Median bicycle lanes are common in many South American cities. These bicycle lanes provide a high degree of separation from surrounding vehicles; their comfort and safety help to facilitate longer trips by allowing for more consistent speeds.

Raised Separated Bicycle Lane

Separated Bicycle Lane with Bollards

Two-Way Separated Bicycle Lane

Median Bicycle Lane with Concrete Buffer

Conventional Bicycle Lanes

A conventional bicycle lane consists of a striped lane at the edge of the vehicle lanes and is the most basic form of a dedicated bicycle facility. Conventional bicycle lanes can be placed between vehicle lanes and the curb or, if parking is present, between travel lanes and the parking lane. In instances where on-street parking is provided, a wider parking lane can provide space for drivers to open doors without conflicting with bicyclists.

Buffered Bicycle Lanes

Buffered bicycle lanes are similar to conventional bicycle lanes with the addition of a striped or painted buffer that increases the separation between bicyclists and vehicles. The buffer can also be provided between the bicycle lane and a parking lane to reduce conflicts between bicycles and opening vehicle doors. The additional space provided by the buffer can also present an opportunity for loading and waiting vehicles to use the space. Enforcement and signage are important components of keeping buffered bicycle lanes clear of vehicles.

Contra-Flow Bicycle Lanes

A contra-flow lane allows bicyclists to travel in the opposite direction of traffic; contra-flow lanes are used on one-way streets to increase the connectivity of the bike network and reduce out of way travel. As with two-way separated bicycle lane, special signage, markings, and bike signals may be required to alert motorists to the presence of contra-flow travel, particularly at intersections.

Shared Lane Markings

A shared lane for bicycles and vehicles breaks from the dedicated facility approach and is only appropriate for low volume, low speed streets. Shared lane markings, often called “sharrows”, advise bicycles of where to position themselves within a lane, helping them to ride in the middle of the lane rather than along the gutter or next to parked cars in the door zone. The markings also serve as reminders to drivers that bicycles are allowed to ride in the lane, and to expect their presence. Shared lanes are more effective when paired with traffic calming features and diverters to reduce vehicle speeds and volumes.

Conventional Bicycle Lane

Buffered Bicycle Lane

Contra-Flow Bicycle Lane

Sharrow & Buffered Bicycle Lane

Green Color Bicycle Lanes

Green color pavement markings can be provided to enhance bicycle lanes. This treatment helps bicyclists to know where to ride and helps increase driver awareness of the potential presence of bicycles. FHWA has given an Interim Approval for the use of green colored pavement in bicycle lanes, this treatment can be used after requesting written permission by FHWA. FDOT PPM Chapter 8 expands upon the Interim Approval provided by FHWA. FHWA recommends that green colored pavement can be used in bicycle lanes and at conflict points between vehicles and bicycle lanes. FDOT states that green colored pavement will only be permitted on the State Highway System when used in conflict points, often called "keyholes." Practitioners must satisfy two conditions for use of green coloration on the SHS. The location must: 1) be at a traffic conflict area, and 2) have a demonstrated need for safety treatments, either through crash history or through document failure of motor vehicles to yield to bicycles. Green colored pavement has been used on both 15th Street in West Palm Beach and NE 2nd Avenue in Delray Beach (pictured on the previous page).

Importantly, in situations where parking is provided adjacent to the travel lane, the shared lane marking should be placed in the center of the travel lane, not the combined parking and travel lane. This helps to keep bicyclists out of the "door zone" of parked cars. There is currently experimental clearance for using green colored pavement beneath the shared lane marking to highlight its presence. The MUTCD also allows black coloration beneath the marking, which can be useful in highlighting the marking on concrete streets.

Green Color Striped Buffer

ROADWAY REALM TRANSIT ELEMENTS

Transit vehicles are significantly more space efficient for the movement of people; a dedicated lane can greatly increase the efficiency of transit operations. Improved operations encourage ridership through faster travel times and increased on-time arrival reliability. Reductions in delays also help to lower operating costs.

Bus lane width should be determined based on the available street space and the needs of competing modes of transportation. A set of recommended widths for the different types of bus lanes are presented in the table below. When using the minimum recommended widths, adjacent lanes should have the flexibility to adjust to the occasional occurrence where part of the bus intrudes into another lane.

The Context Classification Framework for Bus Transit published by FDOT in December 2020 can be used as an additional resource for how transit amenities and infrastructure fit into each of the FDOT Context Classification categories.

Bus Lane Widths

Bus-Only Lane Type	Recommended Width
Curb lane	11'
Offest Lane (bulb-out stations)	11' (10' minimum)
Dedicated Median Lane	11'
Combined Bicycle/Bus Lane	13' (12' minimum)

Curbside Bus Lanes

A bus-only lane that runs alongside the curb provides an effective exclusive operating facility where parking is either not provided or underutilized and removed. For streets with heavy peak traffic flows a time-restricted parking lane can be converted to a curbside bus lane during peak periods while allowing for parking during the off-peak period. Curbside bus lanes are subject to conflict between vehicles turning into and out of driveways and between vehicles loading or unloading at the curb. Implementation requires signage, pavement markings, and enforcement.

Offset Bus Lanes

An offset bus lane provides an exclusive lane separated from the curb by on-street parking or bicycle lane. This configuration allows for curb activities to remain in place, limiting impacts on the street and conflicts between illegal stopping and transit vehicles. Enforcement is a crucial component of effective offset bus lane operations. To allow buses to remain in the offset bus lane stops can be placed on bus-bulbs, allowing for greater amenities.

Median Bus Lanes

Median bus lanes remove the conflicts that occur with parking lanes, loading zones, and driveways by placing the bus lanes in the center of the street. This treatment is effective for high frequency routes which have high ridership and experience significant delay due to congestion. Median bus lanes can be denoted by pavement markings or via curbs, creating a median guideway. Stops are also located in the median on the right side of the lane and are often placed on the far-side of intersections in offset pairs.

Light Rail Lanes

Light-rail lanes can be accommodated via a center median guideway similar to bus lanes. It is important that left turns be carefully managed; turns can be prohibited at minor intersections and provided at major intersections with an independent signal phase to remove conflicts with through transit vehicles. Due to their similar needs, center bus lanes are excellent candidates for conversion to light rail lanes if light rail is planned in the future.

Curbside Bus Lane

Offset Bus Lane

Median Bus Lane

Light Rail Line

Combined Bicycle/Bus Lanes

A combined bicycle/bus lane is useful in situations where roadway space is limited and a dedicated bicycle-only facility is not possible given the needs of other modes using the roadway. The combined lane is effective because buses and bicyclists typically use the same space near the curb to travel. When buses are not actively using the dedicated lane bicyclists are able to operate in a wide, dedicated lane separated from regular vehicular traffic. These facilities are ideal in locations where buses operate at low speeds and moderate headways.

SLOW STREETS

Slow streets represent a focus on slow speeds and safety for local streets. Designs should limit speeds to 20-25 mph to minimize the speed differentials between vehicles and bicyclists and to increase the safety and comfort of pedestrians. Traffic calming measures, discussed below in greater detail, allow designers to slow traffic through these streets. Per the NACTO Urban Bikeway Design Guide, “Streets developed as bicycle boulevards should have 85th percentile speeds at 25 mph or less (20 mph preferred).” FHWA’s Achieving Multimodal Networks provides further guidance on slow street design.

Shared Space

Shared space designs do not have delineation (or may have only partial delineation) between various modes of transportation and instead focus on streets that are safely shared by all users. This design removes the vertical separation between the sidewalk and street, creating a flush surface street that is available to all users. Special pavements, colors, and textures help to increase awareness of the shared nature of the street. Bollards, planters, benches, bicycle parking, and vehicle parking spaces can all be used to create some

Shared Space with Flush Surface

Neighborhood Greenway Signage

form of separation for pedestrians. Alternating the placement of these amenities can create a calming effect on the street, helping to slow motor vehicles. Providing drainage in the center of the street reduces the likelihood that pedestrian space will experience drainage problems. The term “woonerf” is a Dutch term that is used to refer to shared space streets, creating safe, inviting places while still allowing for local vehicular access to properties. Special considerations should be made for those with vision impairments, as cues such as curbs and dedicated crossings are less defined in shared spaces.

Neighborhood Greenway Streets

Neighborhood greenways embrace the philosophy of a given set of streets, with low vehicle volumes and speeds, which are oriented to provide priority to bicycles and pedestrians. These streets can include traffic calming features, such as diverters and traffic circles, to create a safer environment for all users. Streets within this network are often provided with branded signage and wayfinding to help users find and stay on them while also informing drivers of their designation. Where neighborhood greenways cross larger, busier roads, signals and two-stage crossing refuges can be used to continue the safety and comfort of the greenway through intersections.

TRAFFIC CALMING/ROADWAY ELEMENTS

Street design can be leveraged to achieve desired target speeds (the speed intended for drivers), rather than the operating speed of the roadway. Necessary trade-offs between safety and speed must occur. Speed management strategies reclaim and repurpose roadway space for a variety of intended uses and users, creating safe and accessible roadways. Importance to the surrounding roadway network and access needs of the target roadway should be considered during the development process. Vehicular and pedestrian counts along with speed data and crash history of the streets should all be reviewed.

Center Median Island

Pedestrians often struggle to find acceptable gaps in traffic to cross streets when long blocks make crossing at intersections undesirable or infeasible. A center median island creates space for pedestrians to cross traffic one direction at a time and helps to slow vehicles by narrowing the street. Landscaping can also be included to capture and clean stormwater runoff. Center islands should be at least 6 feet wide to allow enough space to wait safely. Islands can also be placed at intersections where left turns need to be prohibited.

Median Island Pedestrian Refuge

Landscaped Bulb-Out

Bulb-Out

A bulb-out helps to narrow the street from the curbs rather than from the middle. Bulb-outs are sometimes known as "pinch-points" and are very effective on longer blocks where vehicles may continue to accelerate between intersections. If a bicycle lane is present, shared lane markings should be provided to bicycles to merge into traffic and travel safely through the neckdown. Landscaped stormwater filtration systems can be placed within bulb-outs to mitigate flooding issues and improve the attractiveness of the street.

Speed Table

Speed tables are vertical elements with a flat top and are longer than the traditional speed hump or bump. Their design allows for slightly higher operating speeds and does not obstruct emergency or transit vehicle access. Speed tables can be combined with midblock crosswalks to provide pedestrians with a level crossing and to clearly prioritize pedestrians over vehicles at the crossing. As with crosswalks, clearly signage and markings are necessary to alert drivers to upcoming speed tables.

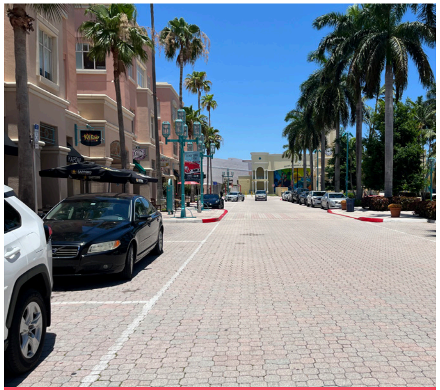
Parklets

As mentioned previously, parklets add public seating space in the place of on-street parking, often converting one or more spaces into a platform which supports an extension of the sidewalk realm. Like other amenities, parklets should be placed far enough away from intersections to avoid inhibiting sight lines. Parklets are typically funded and maintained by local neighborhood groups or business associations. Because parklets are not permanent and do not affect the drainage of the roadway, implementation can be quick and can be done as part of a pilot program.

On-Street Parking

On-street parking can provide traffic calming or placemaking as it helps to narrow the street both physically and visually. Drivers who pass by parked cars must slow down to monitor potential conflicts with opening doors and cars pulling into and out of spaces. Parking can also be used as a barrier to create physically protected bicycle lanes. Bicycle lanes placed adjacent to parked vehicles should include a buffered space for the "door zone" to avoid the conflict between opening doors and bicyclists. On-street parking lanes should provide 8 feet where curb and gutter are present – 6.5 feet of roadway and 1.5 feet of gutter. For streets without a gutter, a 7-foot parking lane should be provided. In "main street" settings, angled parking can help to create a sense of place by increasing the distance between cars passing by and the sidewalk realm. Angled parking can be provided in the traditional "head-in" configuration, wherein drivers pull forward into the spot, or through reverse-angled parking where drivers pass the space and then back into it.

Reverse-angled parking creates a safer environment for all users. Drivers can monitor for conflicts as they pull out of the space, avoiding situations where they cannot see oncoming traffic and bicyclists. Loading the vehicle is also safer since the trunk is adjacent to the sidewalk and open doors direct occupants towards the sidewalk.



On-Street Parking in Mizner Park

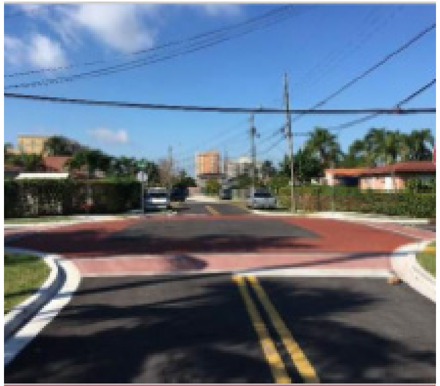
Chicanes

Chicanes intend to reduce vehicle speeds by narrowing the roadway and installing alternating mid-block curb extensions that require vehicles to follow a curving, S-shaped path. Chicanes also provide opportunities for landscaping and other pedestrian amenities to be implemented. This is an effective traffic calming measure in areas where the roadway continues in a straight path for long distances.

Chicane

Raised Intersections

A raised intersection consists of a raised surface extending the length of an intersection and is intended to increase awareness of bicyclists and pedestrians at intersections and reduce vehicle speeds. The elevated surface can be made from a variety of materials including asphalt, concrete, and pavers. Inclines are provided on approaches and ramp up to the flat, raised portion of the intersection. The entire intersection is elevated by approximately three (3) to five (5) inches or the elevation of the sidewalk. Crosswalks are also included in the raised portion of the intersection.



Raised Intersection

Speed Cushions

Speed cushions raise the roadway to reduce vehicle speeds. A speed cushion differs from a speed table in that it includes wheel cutouts to allow vehicles with wide-width wheel tracks, specifically emergency vehicles, to pass without being affected by the device. These are also effective for providing bicyclists with an unobstructed passage in scenarios where there is no alternate path for riding. The raised portion of the traffic calming device extends across both directions of travel, the gap is located between the humps. Speed cushions are typically three (3) inches high and four (4) feet long. The width of these devices will vary and depends on the size of emergency vehicles and other large vehicles that are anticipated to pass.

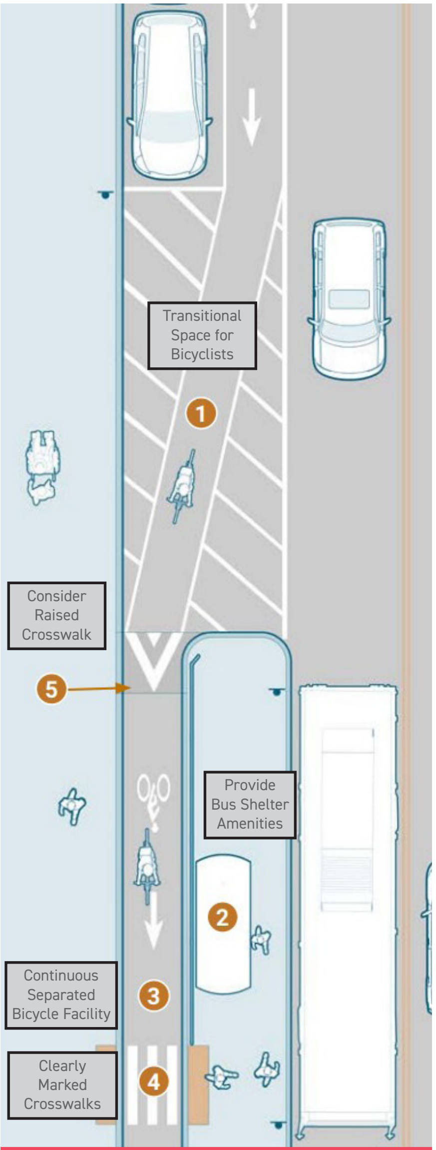
Speed Cushions

Speed Bumps

Speed bumps are used on roadways intended for slow vehicle travel, such as Collector and Local roads. Speed bumps allow traffic to continue flowing while limiting the ability for motorists to operate at high speeds. Speed humps can often be implemented at low cost and can be temporary or permanent installments.

Loading Zone

Freight and goods movement is critical to the economy of the region. In urban environments, shops and restaurants rely on frequent deliveries to cater to their customers. Delivery vehicles can vary from smaller trucks to large tractor-trailers and pose unique challenges to operating in urban rights-of-way. Providing adequate loading zones can help to reduce conflicts between trucks and other street users. Bicyclists are particularly at risk; in the absence of proper loading zones, trucks will park as close to the curb as possible, even if that means blocking a bicycle lane. Bicyclists can then be forced to swing into the travel lanes, putting themselves at risk and catching drivers by surprise. The graphic from FHWA's Achieving Multimodal Networks guide shows potential arrangements for mitigating loading zone conflicts with bicycle lanes.



Loading Zone Bicycle Lane Interaction

INTERSECTION DESIGN GUIDANCE

Intersections represent significant opportunities to make streets safer and more comfortable for all users. They present the potential for numerous conflicts on Palm Beach County's streets. Redesigning them to focus on ease of use and prioritization for vulnerable users – bicycles and pedestrians – can greatly improve the street experience and serves to support Complete Streets features on the streets leading to and from intersections. Intersection design must also be accessible to all users; curb ramps, crosswalks, and signal timing must be ADA-compliant so that intersections do not create barriers to mobility for anyone.

TRAFFIC CONTROL ELEMENTS

Fundamental to an intersection is the need to control how and when users pass through. Traffic control elements either actively or passively communicate right-of-way information to users to provide for safe movements. It is important to note that traffic control elements should be selected based upon policy goals such as queue management and safety provisions; traffic control devices are not used for speed management or traffic calming by themselves.

SIGNALIZED INTERSECTIONS

Traffic signals or "traffic lights" are used to allocate time between the various intersection approaches. Signalization is effective for managing larger volumes of traffic at intersections with multiple lanes per approach and can be an effective tool when vehicles from side streets cannot find acceptable gaps in traffic flow to safely complete turns. Signals can also be beneficial to pedestrians and bicycles who may otherwise have trouble asserting their right to use the intersection. Large intersections tend to have long signal cycle times which can significantly affect transit travel time reliability and create a barrier to walking. Shorter cycle times are recommended to reduce delay to all users.

Pedestrian Signals

Pedestrian signal heads communicate crossing permission to pedestrians. Pedestrian signals provide a Walk indication signified by the symbol of a walking person, a change interval signified by the flashing hand or Don't Walk symbol and a countdown timer, and a don't walk indication of a solid red hand. The change interval should always include the countdown timer so that pedestrians are aware of how much crossing time is remaining. Timing is based on a walking speed of 3.5 ft/sec, although 2.8 ft/sec is gaining greater acceptance, particularly in areas with large senior populations who may need more time to cross.

Bicycle Signals

Bicycle signal heads can also be provided at signalized intersections. These signals resemble vehicle signals except that they replace the circular light with the symbol of a bicycle. These signals are effective for contra-flow and two way separated bicycle lanes where bicycles would otherwise not have a traffic signal facing them. Bicycle signals can also be programmed to provide an early green indication; this allows bicycles to enter the intersection and be visible ahead of turning drivers. FHWA has granted Interim Approval for the use of bicycle signal heads. They are optional for use with bicycle lanes and must meet conditions as outlined in the approval. Bicycle signal heads are not allowed for use when bicycle movements on green or yellow indications would conflict with any simultaneous motor vehicle movements, including turns on red.

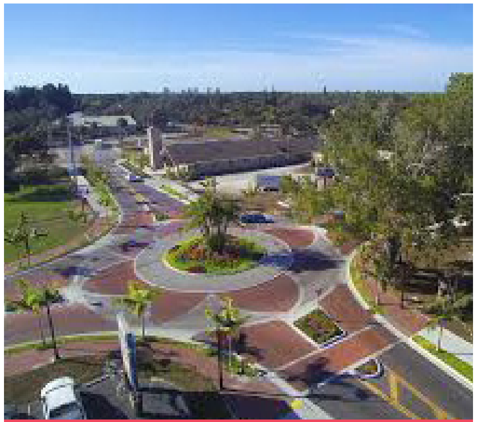
UNSIGNALIZED, STOP CONTROLLED

Unsignalized intersections may have stop signs at all approaches or only at the minor street approaches. Stop control is significantly cheaper to install and maintain compared with signals. They can also reduce delays compared to signal cycles for roads with lower volumes. Stop signs require driver awareness of crossing pedestrians; this can be difficult for users in wheelchairs who may be below a driver's line of sight. Intersections with stop signs on the minor cross-street may make it difficult for pedestrians and bicycles to cross the major street if clear gaps are not present. A center median island can facilitate this crossing, particularly if paired with high visibility crosswalk markings and lighting.

ROUNDABOUTS

FHWA defines three essential characteristics of roundabouts: counterclockwise flow, entry yield control, and low speed (15-25mph). Roundabouts are proven as safer and cheaper ways to provide traffic control at intersections while also reducing delays. Delays are reduced through a constant traffic flow achieved by the entry yield control, rather than stop-control. Incorporate landscaping and elevated curbs to prevent vehicles from driving through the center of the roundabout and ensure that the radius of the roundabout is the adequate size needed to support the design speed of the roadway. The strategy also provides opportunities to implement pedestrian refuge spaces in the medians and dedicated micro-mobility facilities on the perimeter of the intersection. FHWA designates roundabouts as a "Proven Safety Countermeasure" due to their reductions in intersection crashes that often lead to injuries and fatalities. In the event of a collision, damages and injuries are usually less significant due to the rear-end and side-swipe nature of collisions at roundabouts. By contrast, traditional intersections can result in right-angle collisions which are significantly more dangerous. Implementation of roundabouts are most effective in locations with low-to-moderate speeds and balanced traffic volumes between the main and side street. Substantial right-of-way is not as critical due to recent treatments that decrease the footprint of the roundabout while maintaining effectiveness in slowing vehicles and reducing crashes.

Multimodal Facilities at Roundabout



Roundabout in an Urban Context

NEIGHBORHOOD TRAFFIC CIRCLES

Neighborhood traffic circles work to replace stop signs at low volume, low speed intersections. In contrast to roundabouts, neighborhood traffic circles do not divert cars as they enter the intersection. These "mini roundabouts" require slight deflections as cars travel through the intersection. Flow is interrupted less than a traditional roundabout and bicycles can continue straight through the intersection without changing direction. The center of neighborhood traffic circles can be landscaped to beautify the intersection as well as filter and drain stormwater.

INTERSECTION GEOMETRY SAFETY

Intersection geometry should balance the needs of pedestrians and bicyclists with those of drivers and transit vehicles. The safety of vulnerable users can be greatly improved by decreasing crossing distances and reducing the speeds of turning vehicles. Turning speeds should be kept to between 0 and 10 mph to provide drivers with more time and stopping space to look for pedestrians crossing before turning. Among the most crucial decisions in designing an intersection is the selection of the controlling vehicle, which determines how a given vehicle will be able to use and turn through the intersection. Oftentimes, the largest possible vehicle is selected so that any and all vehicles can turn through at any time. However, the frequency of such vehicles should be considered; the controlling design vehicle should be one that frequently uses the intersection. Other accommodations can be put in place to allow for the occasional larger vehicle that must use the intersection. FHWA's Achieving Multimodal Networks guide provides this quote from the AASHTO 2011 Green Book, *"If turning traffic is nearly all passenger vehicles, it may not be cost-effective or pedestrian friendly to design for large trucks. However, the design should allow for an occasional large truck to turn by swinging wide and encroaching on other traffic lanes without disrupting traffic significantly."*

CURB RAMPS

Curb ramps are an important component of pedestrian safety and are required as part of ADA accessible design. Ramps assist people of all ages and abilities in walking between the Roadway and the Non-Motorized Travel Realms; people who have trouble stepping up on a 6-inch curb, people who are pushing carts or strollers, and people walking bicycles all benefit from curb ramps. Curb ramps should line up directly with crosswalks and must include a detectible warning strip at the street edge. To ensure that ADA standards are met and access for multiple modes is possible, refer to the recommended curb ramp dimensions table below.

Reccommended Curb Ramp Dimensions

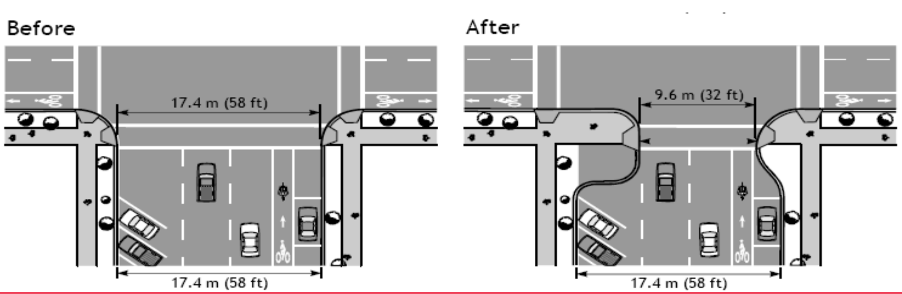
	Land Use	Constrained	Target	Maximum
Curb Ramp Width	All	4'	Width of Pedestrian Walking Zone	Width of Pedestrian Zone
Curb Ramp Width for Shared-Use Path	All	10'	Width of Shared-Use Path	Width of Pedestrian Zone
Curb Extension Width	All	4'	8'	Do not block an existing or potential Bicycle lane
Curb Extension Length	All	Width of Curb Ramp	20'	As needed to improve pedestrian visibility and prohibit parking near intersection
Crossing Refuge Island Width	All	6'	10'	Width of Median

INTERSECTION SAFETY

Several intersection features can be used to increase the safety of the intersection for vulnerable users. These features can be used to reduce crossing distances and allow provisions for larger vehicles to turn without the need to increase corner radii.

Curb Extensions

Curb extensions extend the Non-Motorized Travel Realm into the vehicular realm at intersections, similar to bulb outs. Curb extensions reduce crossing distance and place waiting pedestrians in the driver's line of sight, past the obstructions of street furniture, parked cars, and trees. Extensions can also add space for wider curb ramps that might not fit within the existing sidewalk. Extensions are most appropriate in situations where there is an existing parking lane approaching an intersection; curb extensions help to enforce no parking zones, increasing visibility around the intersection and improving safety for all users.



Before & After Example of Curb Extensions

Stop Bars

Clearly marked white stop lines for vehicles across approach lanes should be maintained at intersections to communicate exact stopping locations and prevent vehicles from impeding into dedicated pedestrian crossing zones. Stop lines should be placed a minimum of 4 feet in advance of the nearest crosswalk line at controlled intersections.

Raised Intersections

A raised intersection brings the vehicular way's surface up to the level of the Non-Motorized Travel Realm. Vehicles slow down to navigate the change in surface level as they yield to pedestrians at the intersection level. Bollards can be used at raised intersections to keep vehicles from driving through the Non-Motorized Travel Realm, especially when turning. Traffic control can be accomplished through yield signs unless pedestrians have trouble crossing with the right-of-way. If that is the case, stop signs may be more appropriate.

Textured Intersections

Textured intersections use pavement or pavers of different colors and materials to increase visibility of the intersection for all users. Textured treatments are often used in intersection crosswalks to highlight their presence and raise driver awareness of the potential for pedestrians in the intersection. Texturization is often successfully combined with raised crosswalks or intersections to further slow drivers and increase awareness of the vertical change in the roadway.

Mountable Curb Aprons

A mountable apron is a distinct material between the traveled way and the sidewalk. It is designed to be occasionally driven over, or mounted, by large vehicles which would otherwise drive over the sidewalk in the process of making a turn. Apron material should be colored and easily distinguishable to prevent use by vehicles that can complete a turn in the traveled way.

INTERSECTION PEDESTRIAN ELEMENTS

Mid-Block Crossing Signals

Practitioners have many signals and signs at their disposal to emphasize the priority of pedestrians crossing the street and gain compliance from drivers. At a minimum, yield to pedestrian signage can remind drivers that pedestrians have the right-of-way at the crosswalk. For those with accessibility challenges or physical impairments, the opportunity to reduce travel distance is a significant benefit of implementing mid-block crossing signals. Mid-block crossings are typically justifiable near significant generators of pedestrian activity, areas of identified pedestrian-vehicle crash history and in locations where there is excessive distance between crossing locations. For further guidance on the conditions where mid-block crossings are justified, refer to the *2019 FDOT Transportation Symposium on Midblock Crossings* report.

Rectangular Rapid Flashing Beacons (RRFBs)

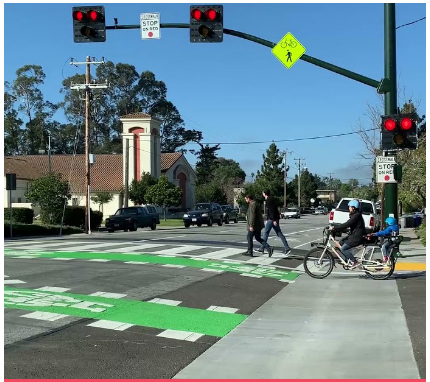
RRFBs are an enhanced crosswalk safety treatment and provide flashing warning signs to vehicles directing them to the presence of a pedestrian in the crosswalk. RRFBs are usually button-activated and can increase the safety of a crossing; however, they still rely on drivers to yield the right-of-way to pedestrians attempting to cross the street.

Rectangular Rapid Flashing Beacon (RRFB) systems can be installed to upgrade the pedestrian priority treatments. These systems include flashing signs activated by a push button and have been found to significantly increase the number of drivers who yield to pedestrians. They are relatively cheap to install and can be powered with a solar panel. Pedestrian Hybrid Beacon (PHB) systems can be installed to further upgrade a crossing and are particularly effective for higher speed, multi-lane streets. PHB installations consist of two red lights above one yellow light and are mounted on mast arms over the roadway. Pedestrian activation starts a cycle that displays a red light to drivers, allowing pedestrians to cross. Per FHWA, PHBs have been shown to decrease pedestrian crashes up to 69% and total roadway crashes up to 29%.

Pedestrian Hybrid Beacons (PHBs)

Pedestrian Hybrid Beacons, also known as HAWK signals, are pedestrian-activated traffic signals, which provide a red-light to oncoming traffic when a crossing is requested. PHBs provide greater safety over RRFBs because drivers are more likely to comply with the familiar red light indication. A PHB gives an extended period of time for a protected-crossing and is of considerable value to users that may need more time to cross a roadway, such as the elderly, parents with children/strollers, and people with accessibility challenges.

Rectangular Rapid Flashing Beacon



Pedestrian Hybrid Beacon

Pedestrian Push Buttons

Pedestrian push buttons are most appropriate at signalized intersections and should be placed in locations that allow for easy activation near each end of the crosswalks.

The following criteria should be met when deciding where to place pedestrian push buttons:

- Unobstructed and adjacent to a level all-weather surface to provide access from a wheelchair
- Ensure that a clear route is provided to the push button location
- Placed between 1.5-6 feet from the edge of curb, should, or pavement
- Ensure mounting height of approximately 3.5 feet above the sidewalk
- Orient the face of the pushbutton parallel to the crosswalk to be used

Pedestrian Crossing Island

Crossing Island

Crossing islands, or pedestrian refuges, resemble the median crossing islands for mid-block usage described in the traffic calming section. At larger intersections crossing islands can help to break crossing into two shorter segments, which is particularly helpful at unsignalized intersections. For large, signalized intersections, slower pedestrians can make use of a crossing push button in the crossing island, allowing them two separate signal cycles to cross the intersection. Refuge should be a minimum 6 feet wide and should include a "nose" that extends into the intersection to protect pedestrians from left-turning vehicles.

Mid-Block Crosswalk

Mid-Block Crosswalk

Mid-block crosswalks refer to any street crossing which occurs between intersections. These crosswalks can be useful in circumstances where long blocks would force pedestrians to walk relatively far out of their ways to reach their destination. Crosswalks can be paired with paseos or alleys that have been activated and draw activity to cross mid-block. Similarly, shared-use paths often create crossing demands between intersections and require safe crossing accommodations on-par with the safety and comfort of the path. It is imperative that mid-block crosswalks be prominently marked since both drivers and pedestrians may not be expecting them. Traffic calming features such as neckdowns and median refuges can help to slow vehicles while increasing visibility of crossing pedestrians to drivers. Lighting is also an essential element of safe mid-block crossings. Street lighting is often focused on intersections and it may be necessary to add lighting to mid-block crosswalk locations. Mid-block crosswalks also benefit from the use of bulb-outs or curb extensions. These devices help bring pedestrians out into drivers' line of sight prior to crossing. Extensions can often be landscaped so as to provide filtration opportunities for stormwater. To preserve safe sight lines for all users, any landscaping consists mainly of grasses or low-profile shrubs rather than trees or hedges. Crosswalks should be clearly marked with paint and signage to alert drivers to the need to yield to people crossing. Mid-block crosswalks with stop signs or signals require stop bars for vehicles placed 40 feet prior to the crosswalk as seen in FDOT Standard Index 17346.

INTERSECTION BICYCLE ELEMENTS

Protected Bicycle Lanes at Intersections

Intersections can be designed to continue the comfort of separated bicycle lanes through the intersection. These intersections provide a clear travel path for bicyclists while shortening the exposed crossing distance. Concrete islands help to reduce the turning speed of drivers while also providing a space for drivers to wait for passing bicyclists without blocking the intersection.

Pavement Markings Through Intersections

Pavement markings extend bicycle lane treatments through an intersection and reduce the comfort gap between protected facilities and intersections. Markings raise drivers' awareness of bicycles continuing through the intersection and show them where to expect bicycles. Treatments typically consist of dotted or striped lines of a width consistent with the bicycle facility to which they connect. Striping can be filled with green colored pavement to further highlight the markings. These treatments can also be applied at merges, driveways, keyholes, and conflict points where drivers may not be aware of oncoming bicycles.


Multimodal Crossing Example Aerial


Multimodal Crossing Example Profile


Bicycle Green Pavement Markings Through an Intersection

Bicycle Boxes

Bicycle boxes prevent bicycles from mixing with queued vehicles and turning vehicles at intersections. Boxes place bicycles at the front of the intersection and increase their visibility to vehicles behind them. This allows for positioning for left turns and allows them an opportunity to enter the intersection ahead of cars and to be seen by turning vehicles. Bicycle boxes are recommended as 10-16 feet deep with pavement markings and signage to indicate that vehicles should stop behind the box.

Two-Stage Turn Boxes

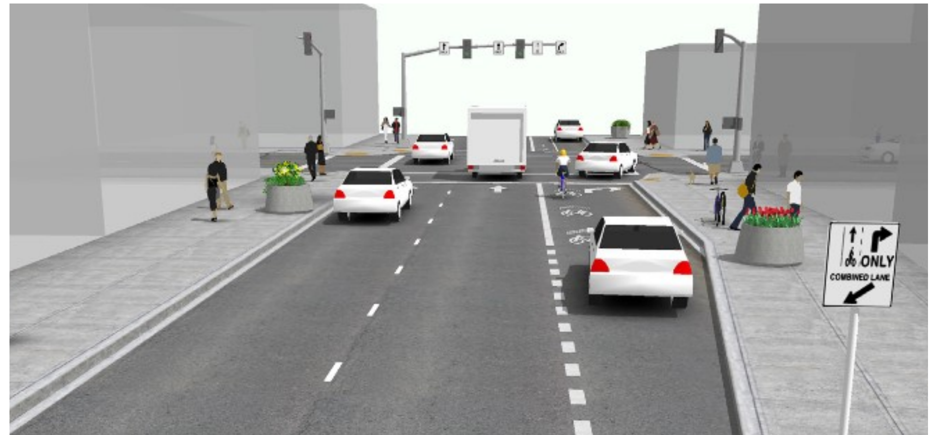
Left turns can be dangerous for bicycles as they merge across traffic before turning. Two-stage turn boxes eliminate this danger by allowing bicycles to continue through the intersection before using a two-stage turn box to pull out of through traffic and continue left in a second movement. To complete the treatment, a dedicated bicycle facility or sharrow pavement markings should be present on the receiving roadway. Two through movements replace a left turn and bicycles can use provided on-street bicycle facilities in the process. This treatment is generally best for high-speed roads and separated bicycle lane applications where bicycles cannot merge to turn left.

Bicycle Box Example Rendering

Two-Stage Turn Box Example Rendering

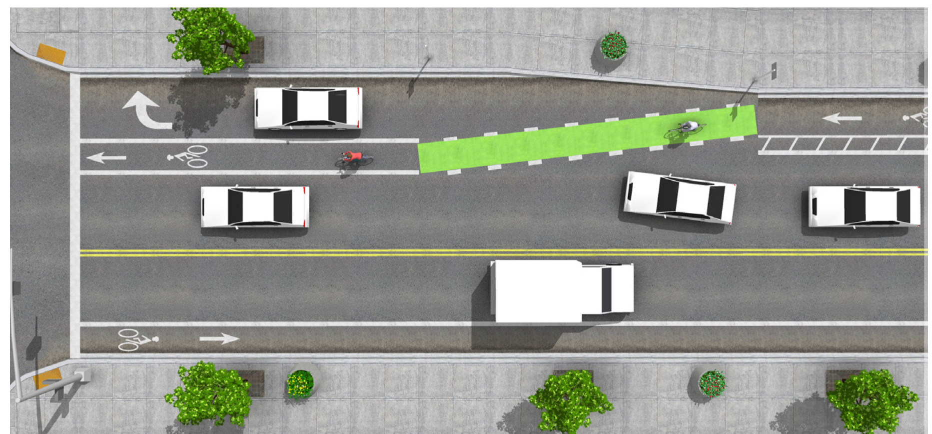
Right -Turn Lane Conflicts

Several configurations exist to mitigate conflicts between bicycles and right-turning vehicles, particularly where separated bicycle lanes approach intersections. These solutions range from bicycles and vehicles mixing and sharing the right-most lane to bicycle boxes to a merge point where bicycles and right-turning vehicles cross paths to allow bicycles to continue through the intersection. Flashing-yellow-arrow traffic signals are used to indicate that drivers may turn after yielding to bicyclists and pedestrians. These signals are also effective at balancing safety and efficiency through an increase in the attentiveness of motorists to pedestrians while offering drivers more opportunities to make turns. Yield signage, yield pavement markings, and colored pavement can help to distinguish right-of-way and proper placement for all users in the conflict space.



Combined Right-Turn Lane


Continuous Bicycle Lane with Right-Turn Pocket


Buffered Bicycle Lane with Travel Side Buffer and Merging Area

INTERSECTION TRANSIT ELEMENTS

Queue Jump Lanes

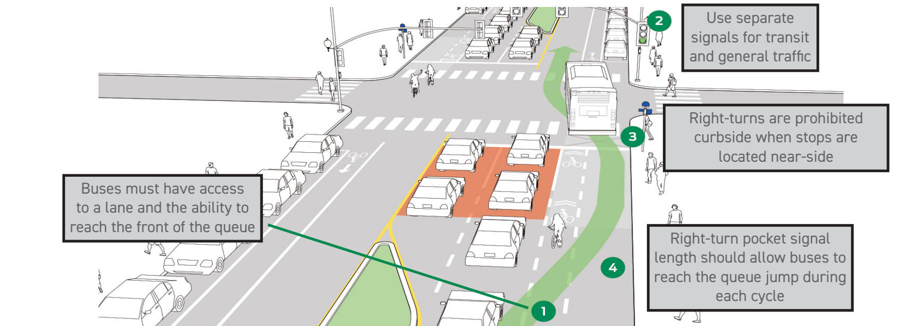
Queue jump lanes create a dedicated lane immediately prior to an intersection to allow a vehicle to “jump” ahead of a queue at a traffic signal. A transit priority signal is used to give the vehicle an early green phase, allowing the bus to move ahead of queued traffic. A queue jump can also be combined with a near-side transit stop and will allow a bus to merge back into traffic more easily.

Transit Signal Priority (TSP)

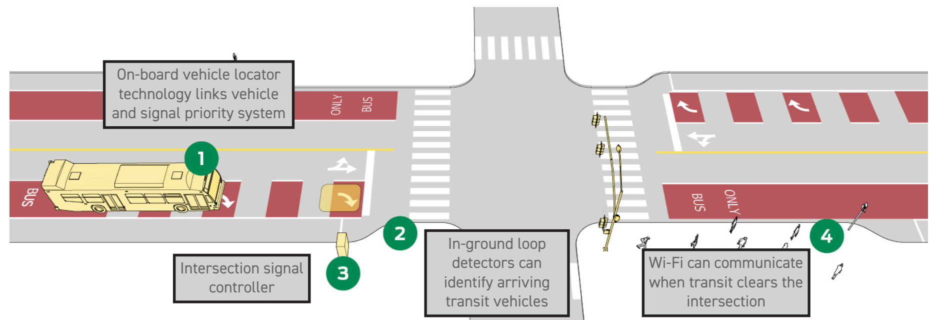
TSP can accommodate frequent, high-quality transit service by reducing the running delay associated with signalized intersections. TSP is not the same as preemption – the system by which emergency vehicles and trains receive an exclusive phase immediately. Signal priority is triggered when a bus is determined to be behind schedule; a signal from the onboard GPS system is sent to the traffic signal which determines whether to provide priority. A green phase may be provided early to shorten the wait time, or a green phase may be extended briefly to allow a vehicle to pass through the intersection. Further TSP requests are not granted until a signal recovers from the provision of the initial TSP.

Right-Turn Lane Conflict

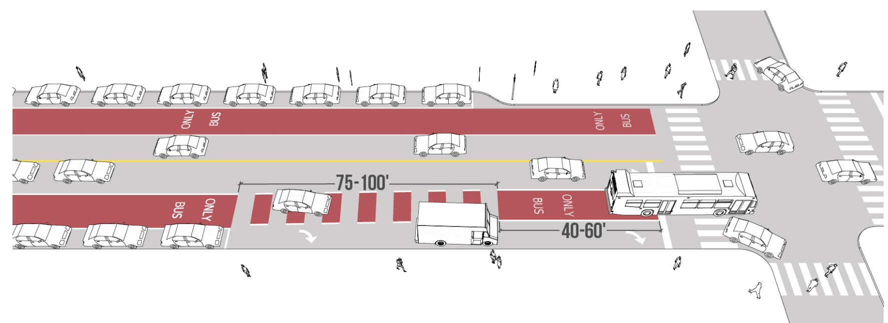
Bus-only lanes can conflict with right turning vehicles at intersections. When right turn volumes are moderate, vehicles may be permitted to use the bus-only lane to turn. At intersections with greater right turn volumes the bus may experience delays. A right-turn pocket can be provided to allow cars to merge across the bus-only lane and into the turn pocket. In the case of a near-side bus stop, a floating bus bulb can provide a bus stop while still allowing for the right-turn pocket.



Bus Queue Jump Lane Rendering



Transit Signal Priority Diagram



Bus Only Lane & Adjacent Right-Turn Pocket

Transfer of Transit Riders

Transit riders are often challenged with time-sensitive transfers to complete their trip. Most transfers require pedestrians to cross a street at an intersection, which can take many minutes to receive a signal for a safe and facilitated crossing. Pedestrian-priority signals show a continuous green signal until a vehicle approaches the crossing, which would prompt a change to red for the pedestrians to stop. These signals significantly reduce wait time and result in more-compliant crossings among pedestrians at intersections, reducing the risk of collision with a vehicle. Implementing these signals near key transfer points and high ridership stops provide significant improvements in accessibility and efficiency for transit users.

PLACEMAKING AT INTERSECTIONS

Placemaking is a planning concept that aims to create locations that are easily identifiable by the public as a center of economic, artistic, and social activity that can support the diverse functions of a community. Parks, downtowns, waterfronts, plazas, and campuses are common examples of public spaces where members of the community frequently gather to convene in economic and social activity. These spaces are typically compact in size and contain uses that promote physical interaction, while placing an emphasis on providing experiences tailored toward pedestrians.

Placemaking often involves the addition of art in public spaces through the addition of textures or paint through intersections and crosswalks and through the installation of public art, seating, and lighting. Placemaking can help to draw people to an intersection or district and increase the pedestrian activity of an area. Increasing the liveliness of Palm Beach County's streets and intersections is one strategy to increase the profile of walking as a transportation mode.

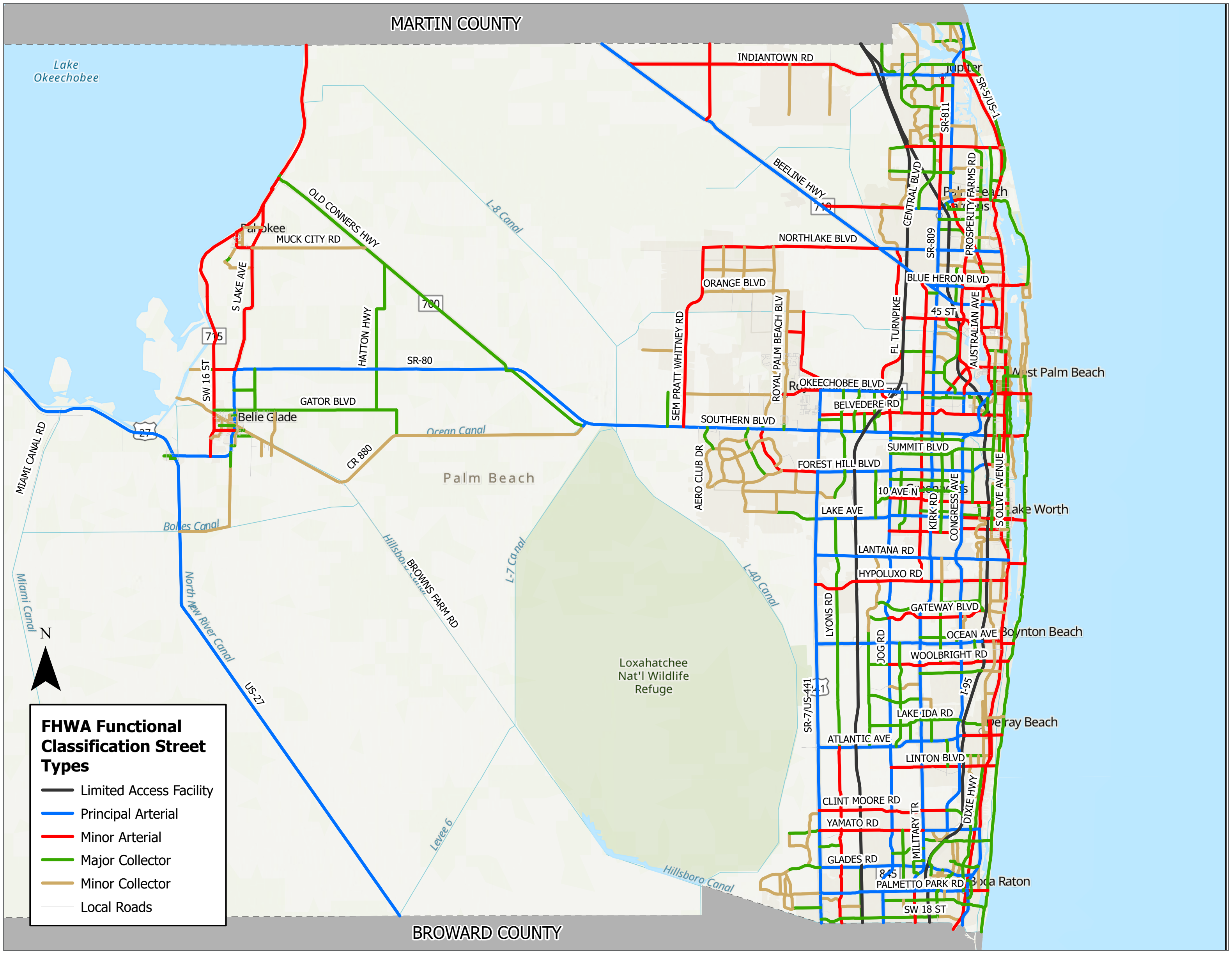
Placemaking Pop-up Project
Source: Congress for the new Urbanism

Placemaking Through Intersection Art in Portland, OR
Source: Project for Public Spaces

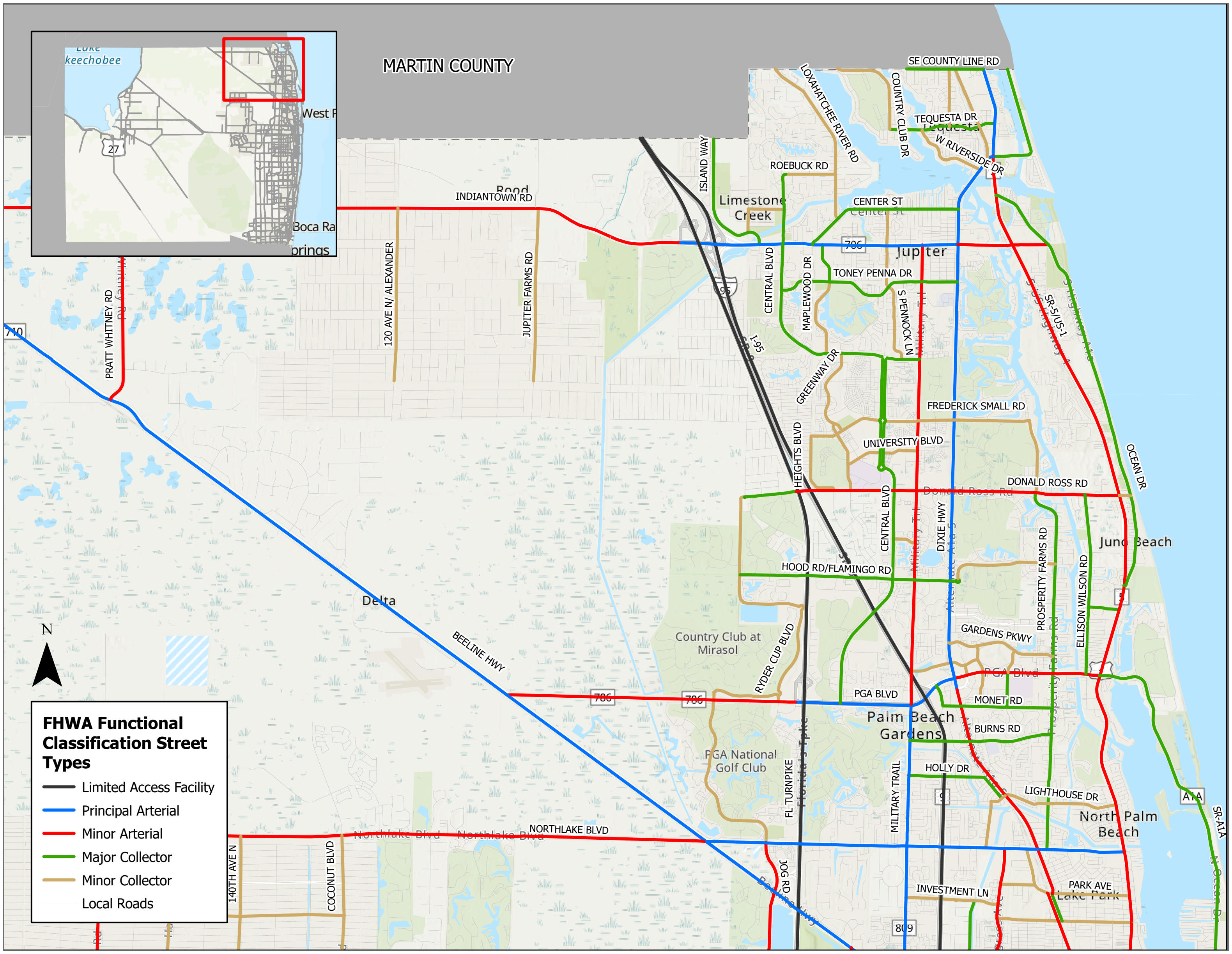
A

Appendix

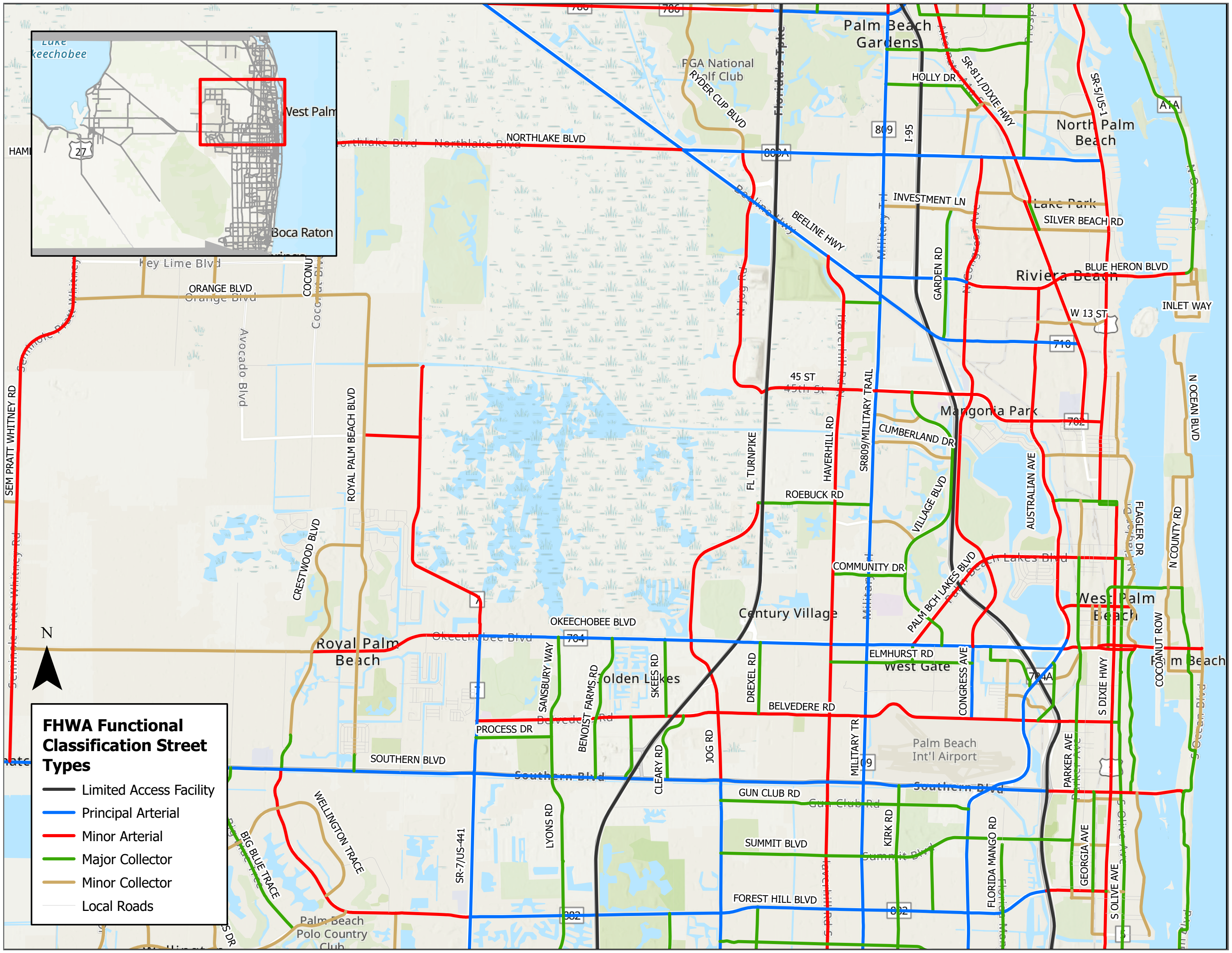
FHWA Road Functional Classifications: Palm Beach County



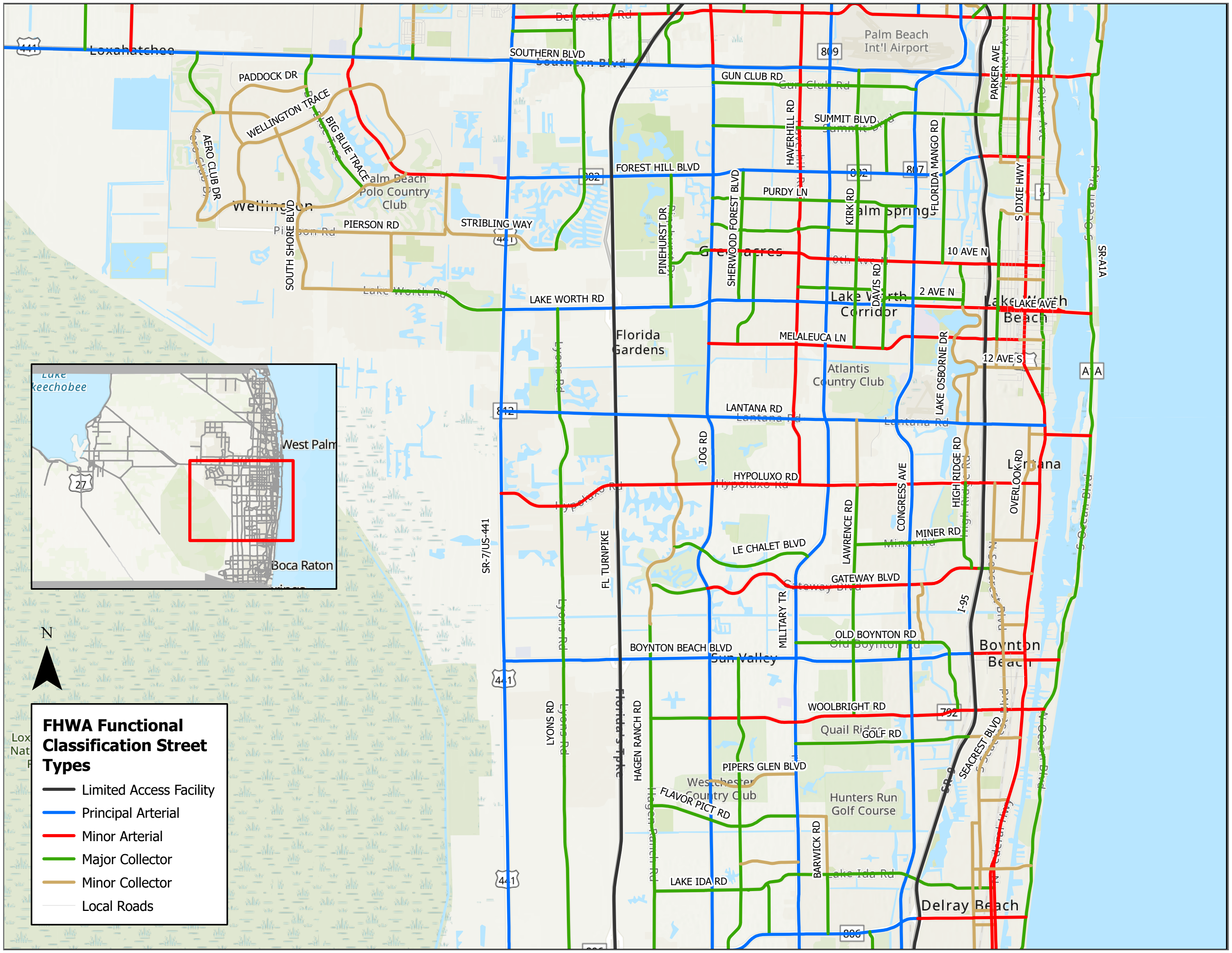
FHWA Road Functional Classifications: Northern County



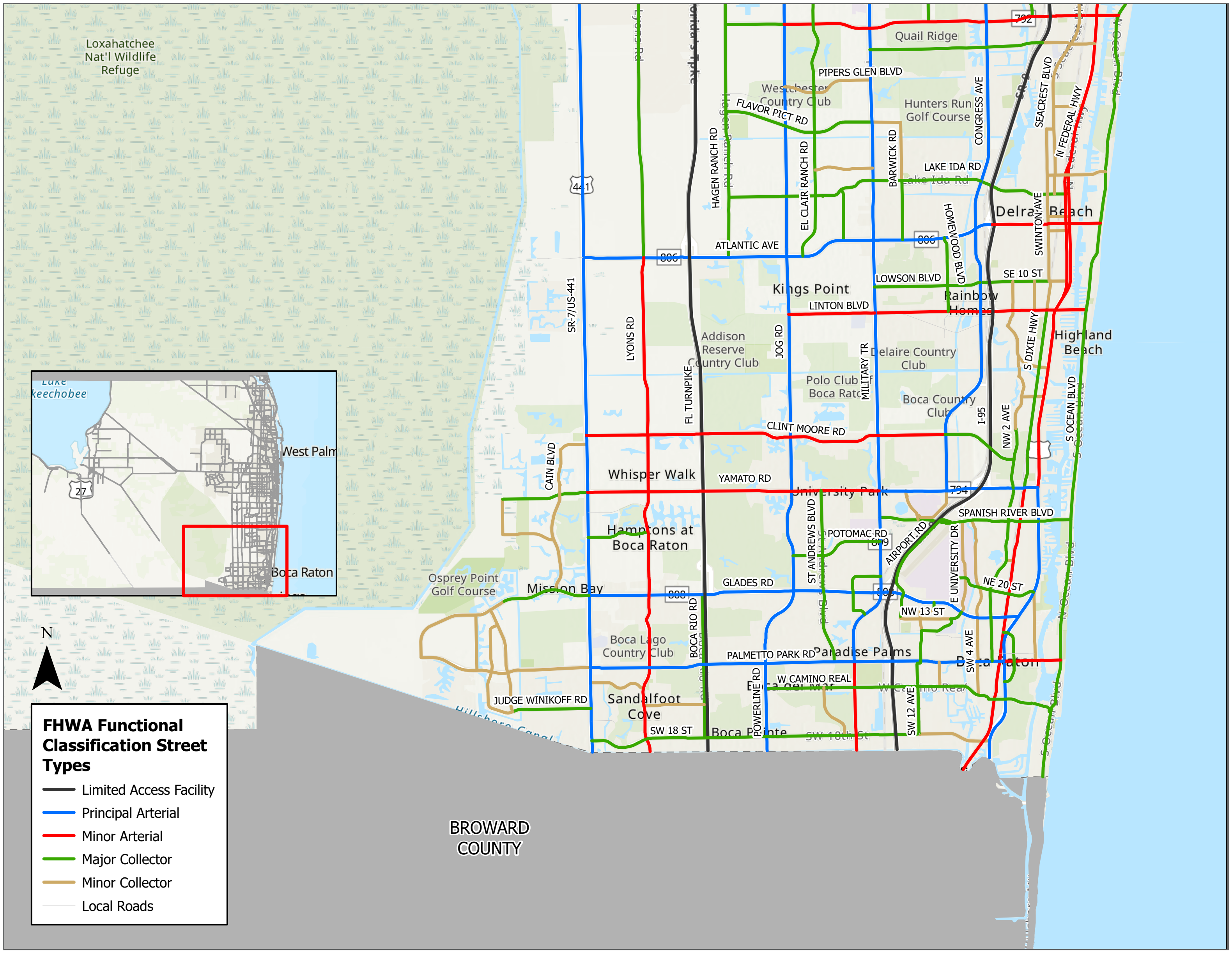
FHWA Road Functional Classifications: Central County



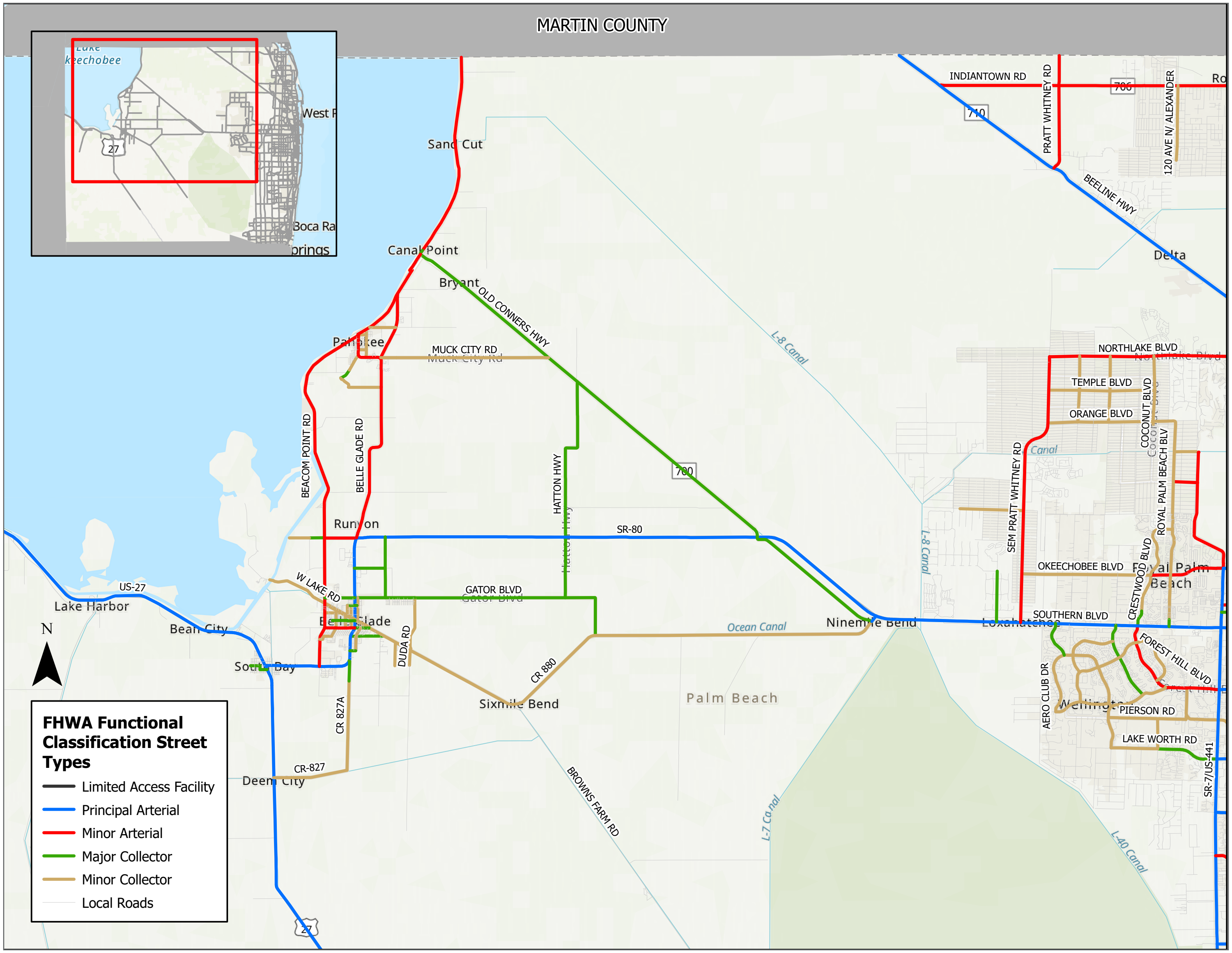
FHWA Road Functional Classifications: Central-Southern County



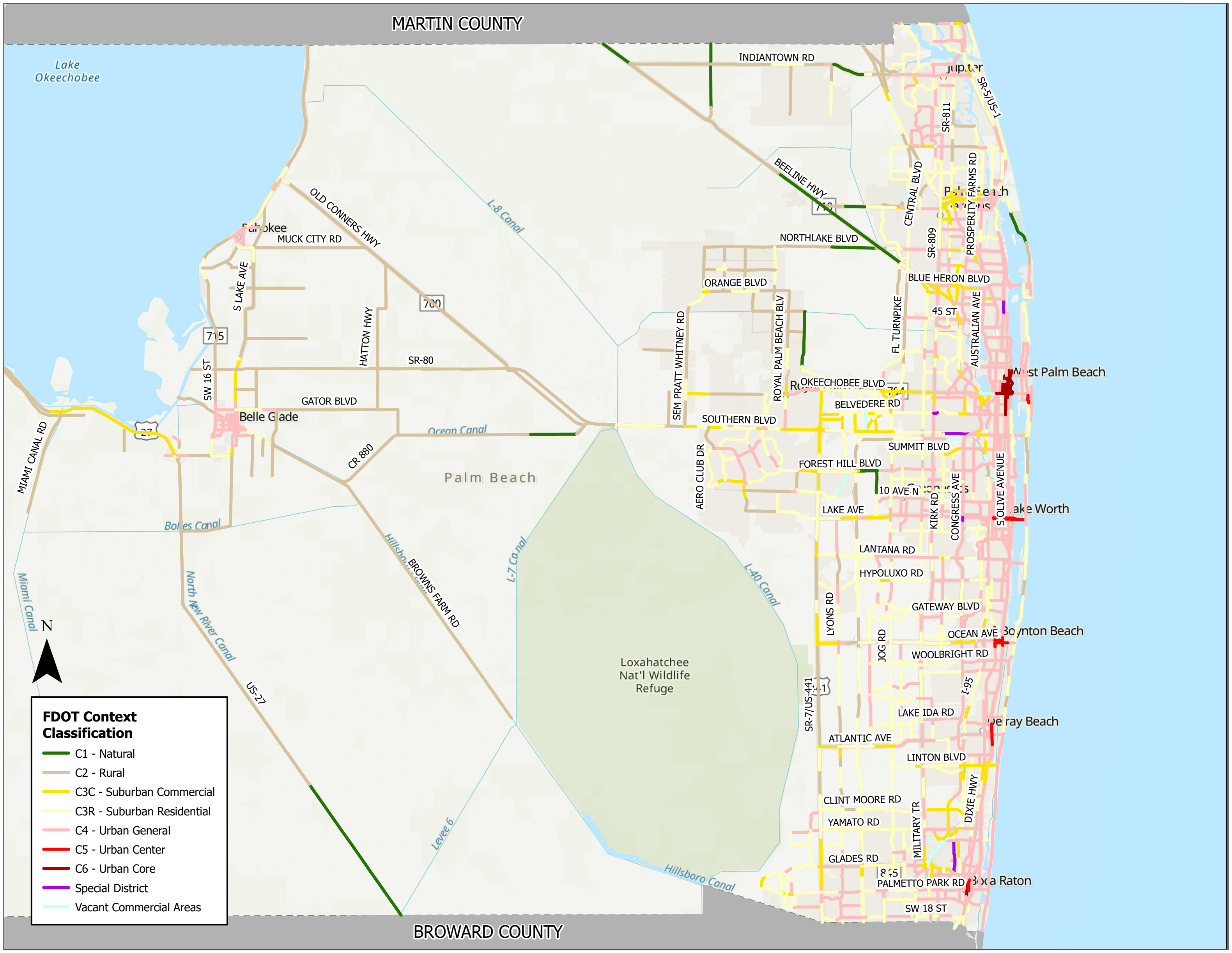
FHWA Road Function Classifications: Southern County



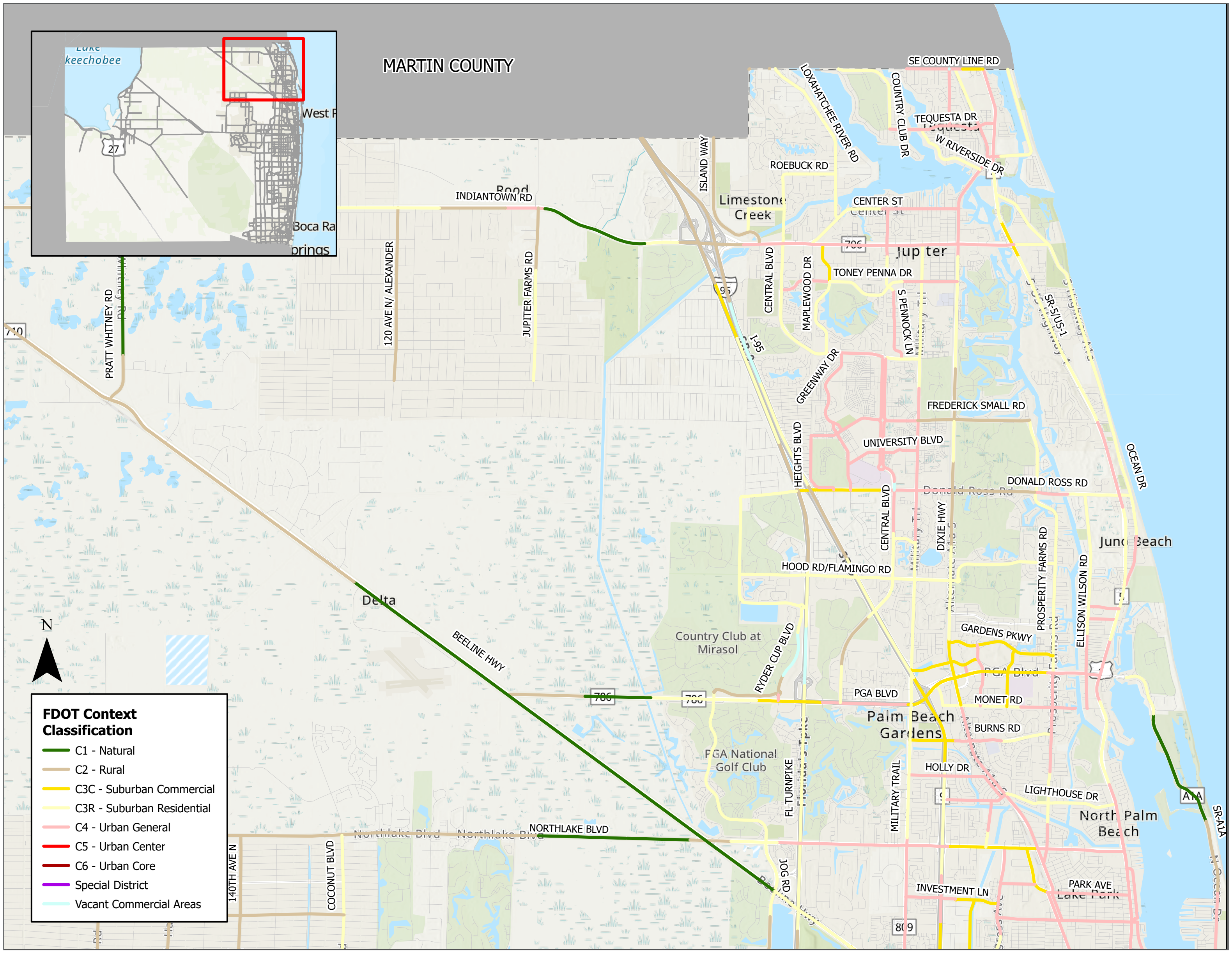
FHWA Road Function Classifications: Western County



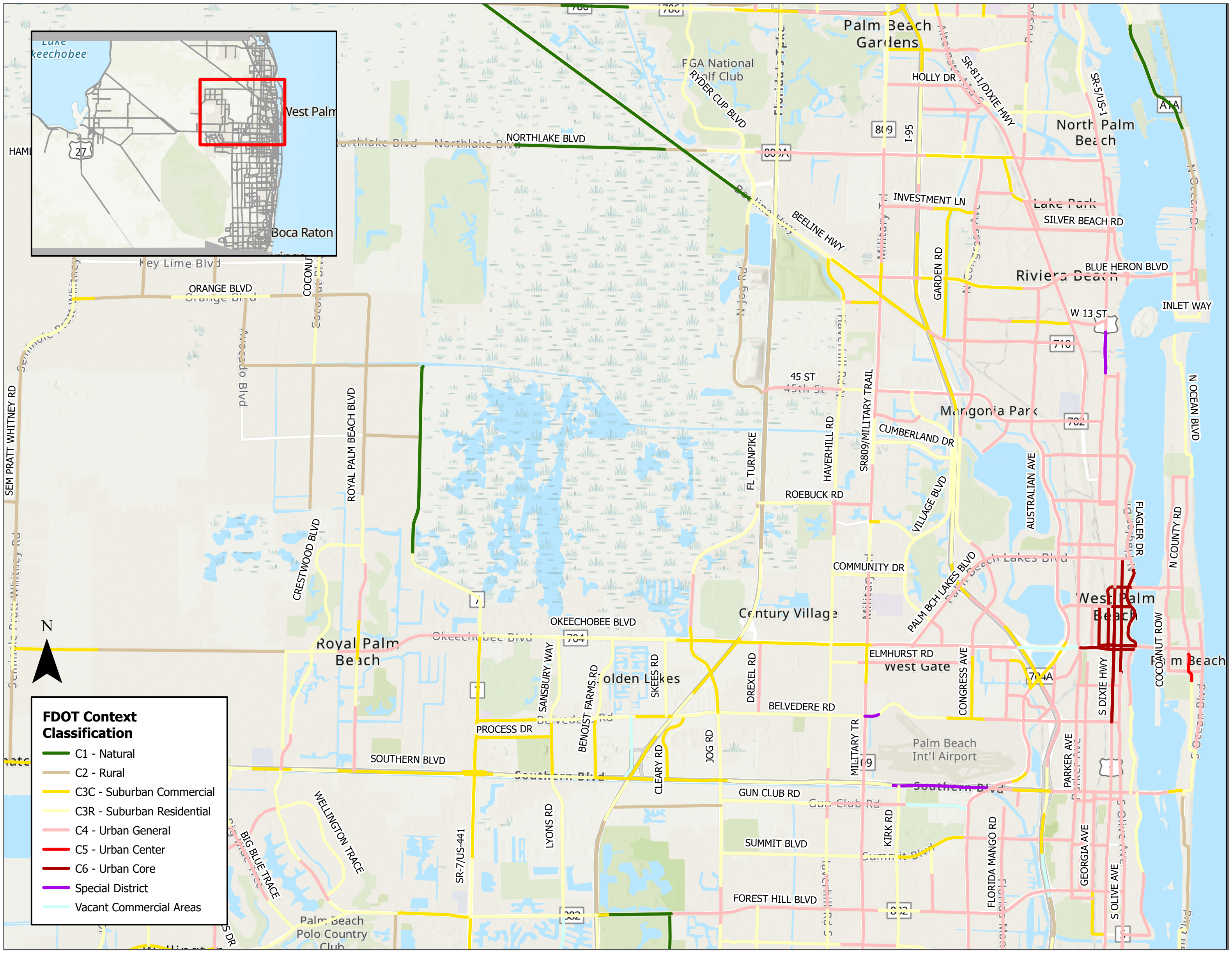
FDOT Context Classifications: Palm Beach County



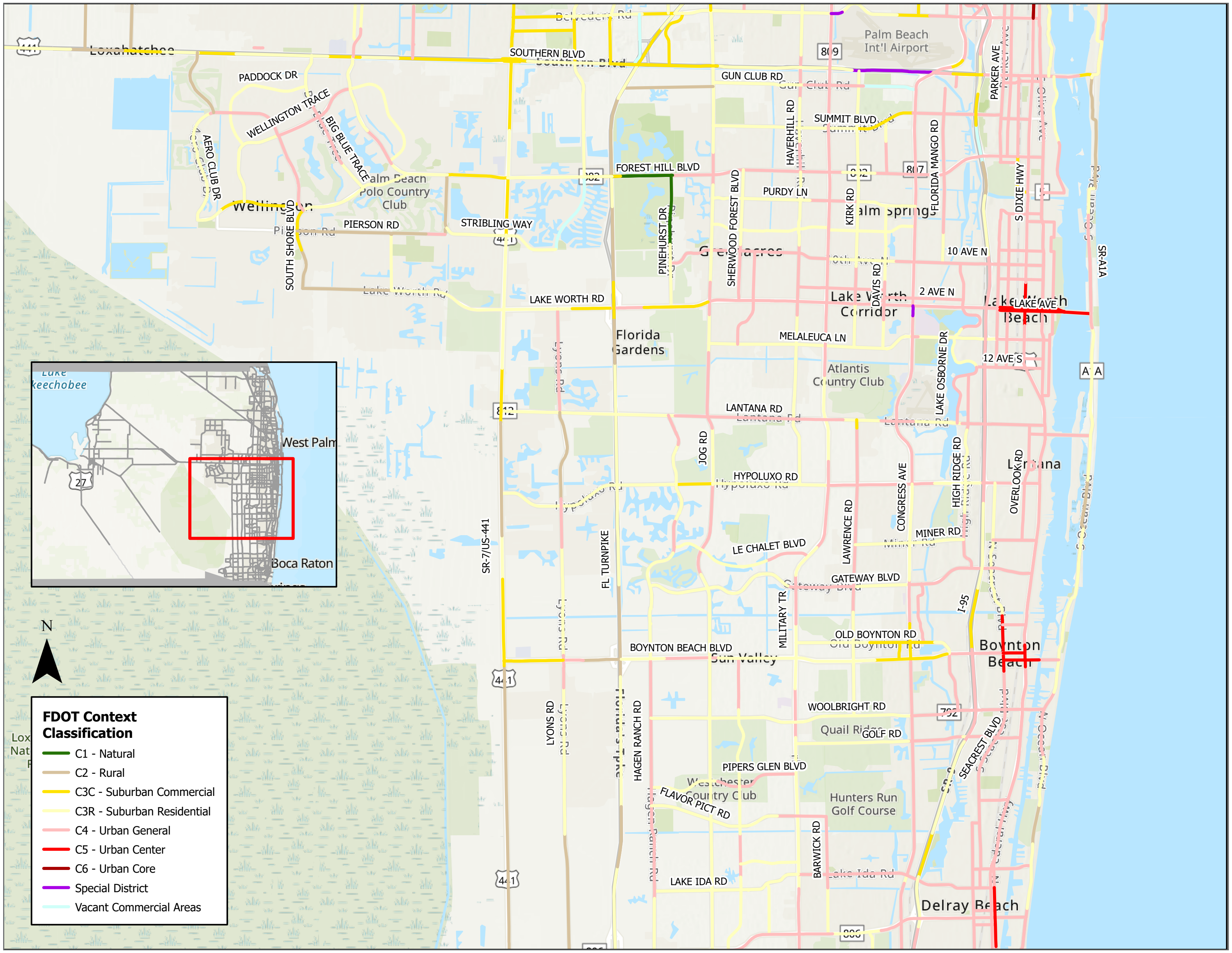
FDOT Context Classifications: Northern County



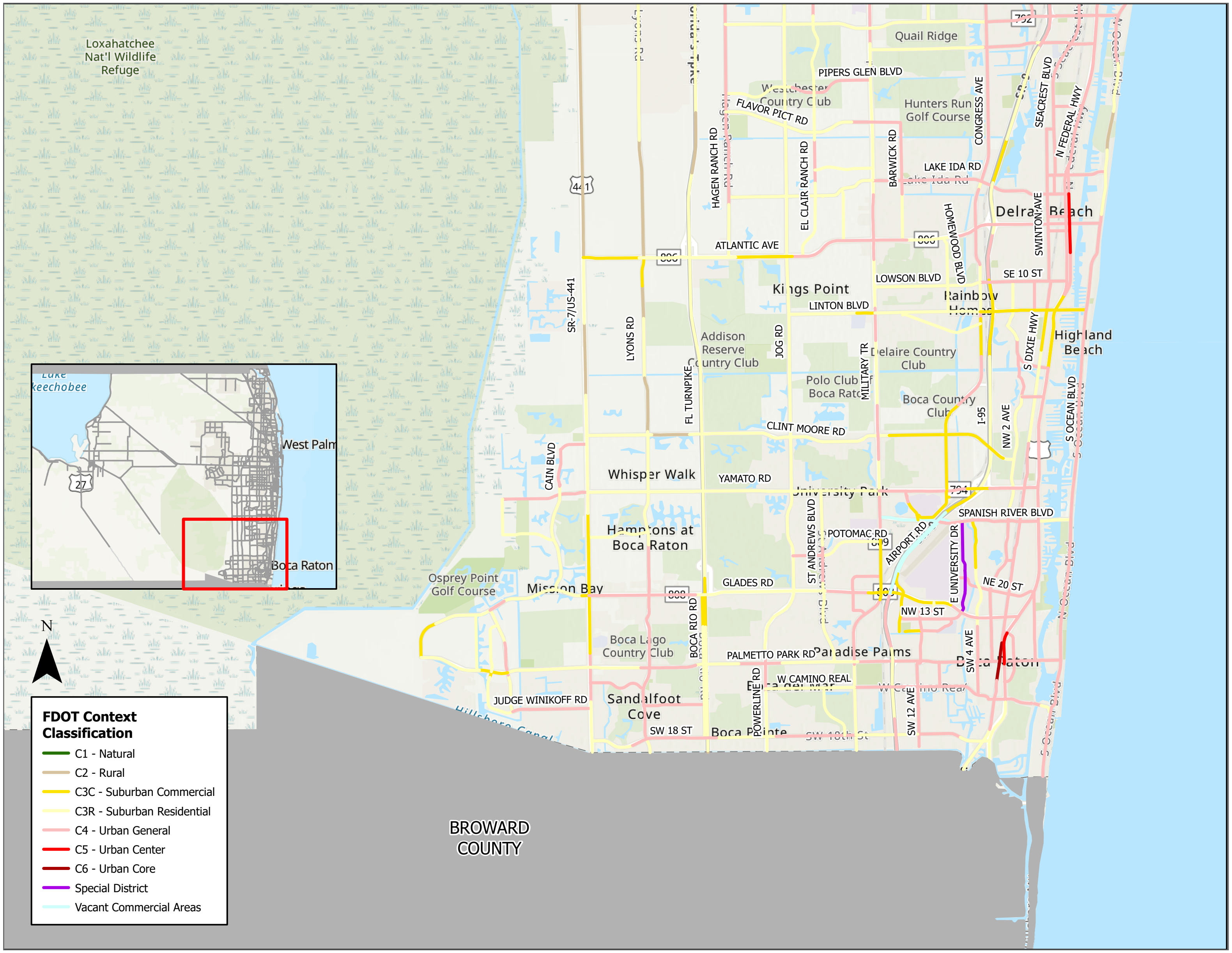
FDOT Context Classifications: Central County



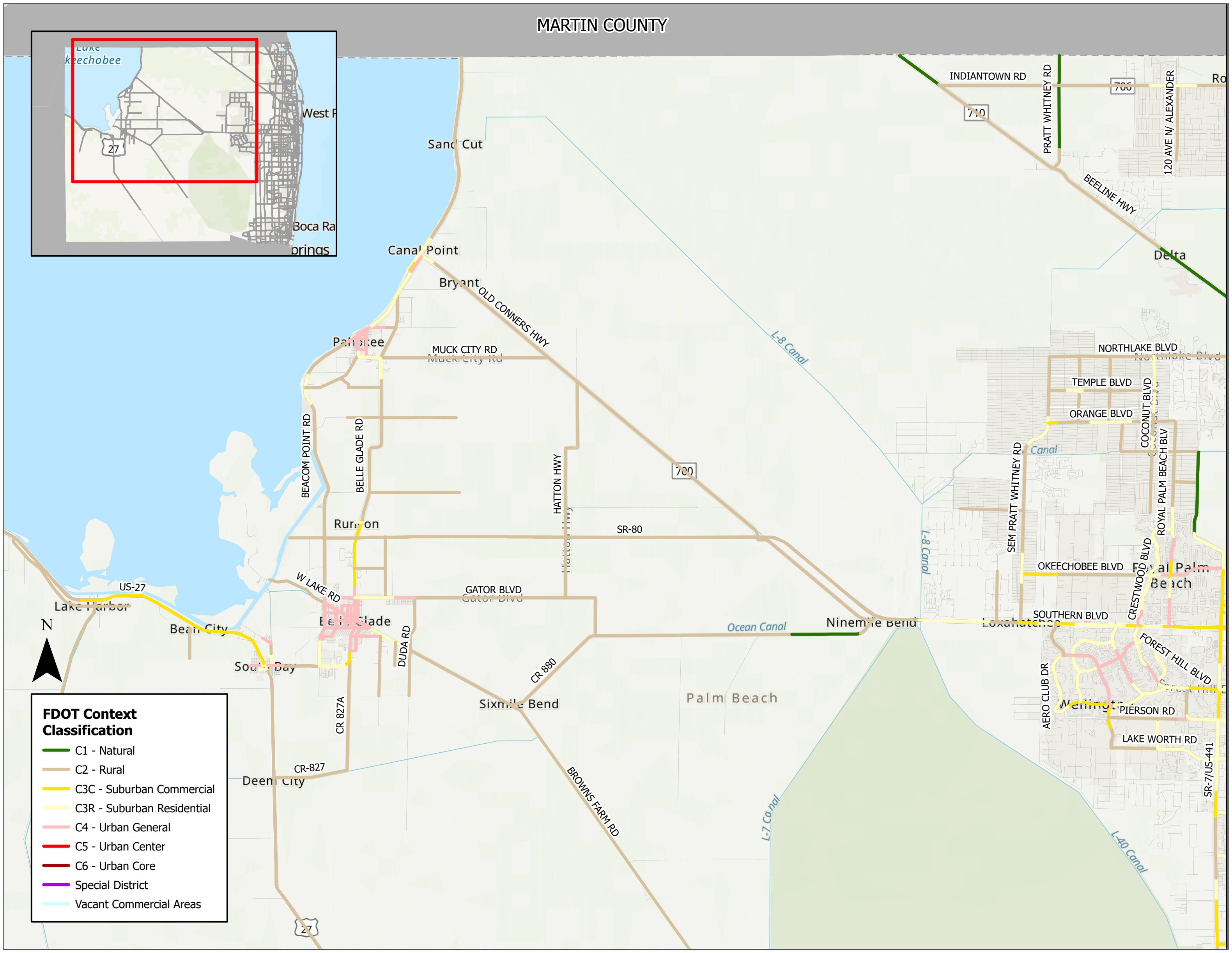
FDOT Context Classifications: Central-Southern County



FDOT Context Classifications: Southern County



FDOT Context Classifications: Western County



PALM BEACH
Transportation
Planning Agency