Master Comprehensive Bicycle Transportation Plan

Palm Beach MPO
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Chapter 1: Introduction and Vision

The purpose of this Master Comprehensive Bicycle Transportation Plan is to provide a foundation on which future decisions regarding bicycle transportation will be based, including both long and short range strategies and actions that will most efficiently integrate bicycling into the overall multi-modal transportation system. The chapters of this report provide those long and short range strategies, based on an approach that seeks to leverage cost-effective approaches to provide improved bicycling conditions across Palm Beach County, with a concerted effort to focus investments where facilities are most likely to be used. Over time, as facility improvements are implemented in a manner that meets community expectations, the utility of bicycling as a true transportation option will increase. As more and more roadways accommodate to bicycle travel, reality will begin to resemble the Vision described by this plan.

In 2035 Palm Beach County will be a place where bicycling is experienced as

- **a safe and convenient transportation option and**
- **an attractive form of recreation for residents and visitors alike.**

1.1 BENEFITS OF BICYCLING

The desired results of this effort - increasing the viability of biking and as transportation and recreation options for residents of and visitors to Palm Beach County - will benefit the County in numerous ways (see Figure 1.1). In addition to being a highly enjoyable activity in and of itself, bicycling fulfills important functions in the overall transportation network and in people's everyday lives. Bicycling provides basic mobility - and therefore access to work, school, and necessary personal appointments - for people who cannot afford a car or who are unable to drive or are prohibited from driving, and also provides transportation options for those people who would prefer not to travel by automobile on all trips. Bicycling can also serve as the final leg of transit trips, allowing riders to get between home and their boarding stop and between their disembarking stop and their final destination.

In addition to these direct benefits to the mobility of bicyclists, increased bicycling benefits the overall transportation network by providing cost-effective options for short trips and increasing the viability of transit for longer trips, both of which can provide alternatives to car trips and reduce the problem of roadway congestion. Bicycling produces no emissions, and so provides travel options that do not contribute to air pollution. More significantly, bike trips can replace many short automobile trips, which contribute disproportionately to emissions levels. Biking has personal and social benefits as well, as it provides opportunities to incorporate physical activity into the daily routines of Palm Beach County residents, leading to better public health and a greater quality of life.

Bicycling opportunities can also serve as an attractive family activity for visitors. Communities across the country have embraced non-motorized transportation as a popular and beneficial option that residents

Why Improve Bicycling Conditions?

Personal, Local and Regional Benefits

Healthy Living and Quality of Life

- 30 minutes of moderate exercise, five days a week, can significantly reduce risks for many illnesses including heart disease, high blood pressure, arthritis, depression and obesity.
- Bicycling for short errands can provide the sort of moderate exercise needed to reduce these risks.
- Improved bicycling conditions provide transportation benefits while also providing opportunities for physical activity.
- Improved bicycling conditions add to the vitality and quality of life of community centers and recreational destinations across Palm Beach County.

Transportation Options

- Improved bicycling conditions provide basic mobility for people who do not have personal automobiles.
- Improved bicycling conditions provide access to public transit for longer trips.
- Improved bicycling conditions allow people to use their cars less, thereby saving money on gas and car maintenance.

Congestion Mitigation

- Improved bicycling conditions provide commuting options for people who live relatively close to work.
- Improved bicycling conditions provide access to public transit for longer trips.
- Improved bicycling conditions are cost-effective ways to accommodate more trips on our existing transportation rights-of-way.

Air Quality

- Bicycle trips create no vehicle emissions.
- Enhanced opportunities for local bicycling, combined with access to transit, allows people to reduce their contribution to the problem of air pollution.
- Vehicles burn fuel less efficiently before their engines have warmed up, increasing harmful emissions. Bike trips can replace short car trips which pollute at disproportionately high levels.

metropolitan PALM BEACH MPO planning organization

Master Comprehensive Bicycle Transportation Plan for Palm Beach County

American Consulting Engineers of Florida

Sprinkle Consulting

Figure 1.1: Poster describing the benefits of non-motorized modes, prepared for plan workshops

increasingly expect and visitors actively seek when making choices about where to locate their families and spend their vacation dollars. With this plan, Palm Beach County is taking important steps towards a future in which biking and walking are experienced as viable options for trips of all purposes.

1.2 STRUCTURE OF THE PLAN

This document takes a methodical approach to identifying ways to improve bicycling conditions in Palm Beach County. First, it paints a picture of the existing conditions for bicycling around the county, by evaluating existing infrastructure conditions, reviewing safety data and by surveying planning and code-based initiatives related to bicycling. The infrastructure analysis reveals that the countywide study network of arterial and collector roadways has a distance-weighted average Bicycle Level of Service (a nationally established measure of bicycling conditions) grade of "D" (on an A-F scale). This is a common result in major metropolitan areas across the United States; it presents a challenging environment for bicyclists which could be improved, but it is not unusually difficult compared to other communities. The plan then establishes performance thresholds derived from public input, that infrastructure performance should achieve Bicycle Level of Service "C" on priority roadways in the county, and Bicycle Level of Service "D" elsewhere.

The existing conditions were measured against these thresholds, and it was found that 523 miles of roadway are already meeting these expectations, while another 596 miles were in need of improvement. Based on geometric (including lane count and width) and traffic data (including speed and volume) collected on each roadway, the plan then recommends strategies, such as re-striping to create bike lanes, widening shoulders, and performing detailed studies of corridors on which neither of the first two strategies are feasible (a special section of the plan develops pilot studies of six such corridors, as examples of this more intensive approach). The plan then prioritizes the recommended improvements based on a variety of benefit measures, including demand indicators and measurable performance improvements, and estimated costs of implementation. These prioritized recommendations are stratified into tiers to guide decisions by the Metropolitan Planning Organization (MPO) with respect to their ultimate implementation.

The MPO presently provides funding assistance to bicycle projects through their inclusion in larger roadway projects and through the Florida Department of Transportation's (FDOT) Transportation Enhancement Program. These will continue to be important avenues for implementing bicycle facilities. Inclusion of bicycle facilities in roadway projects, sometimes referred to as "routine accommodation" and consistent with the "Complete Streets" ethos, is a very effective way to provide bicycle accommodation. It incorporates a relatively small incremental cost within a significantly larger overall budget and the more comprehensive construction processes provide flexibility of design by removing many of the constraints faced by standalone bicycle projects. Routine accommodation will continue to be an important approach to providing bicycle facilities in Palm Beach

County, but this Plan also provides prioritized facility recommendations (described above and detailed in Chapters 5 and 6) that will assist the MPO in deciding which standalone bicycle projects to support with funding assistance as other funding strategies become established.

The Plan also contains policy and program recommendations that, if implemented, will support the vision of a future in which bicycling is experienced as a safe and convenient mode of transportation in Palm Beach County. Finally, the Plan proposes an evaluation process that will assist the MPO in tracking the progress made on the plan's objectives, the meeting of its goals, and ultimately, the achievement of the vision.

1.3 PUBLIC INVOLVEMENT

The development of this plan had two distinct phases of public involvement. A series of four public open house workshops were held in April 2010, in Belle Glade, Jupiter, West Palm Beach, and Boca Raton. At these meetings, participants were able to review the existing conditions (Bicycle Level of Service) results and provide their input on what should be acceptable performance thresholds for the plan's study network. Participants were also asked to identify a limited number of roadways on which bicycle improvements should be prioritized. The responses to these questions figured directly into the determination of performance thresholds and identification of priority corridors.

A final public meeting was held in December 2010, and a draft report was posted on the MPO website to allow comment upon the draft document.

The Plan's progress and general recommendations was presented to the MPO Board on October 21, 2010. Comments and suggestions from MPO board members were taken into consideration as the draft final Plan was developed.

1.4 VISION, GOALS, AND OBJECTIVES

This Plan's recommendations were developed to assist the MPO, the County, and local municipalities work together to achieve the overall vision. This vision can be realized by meeting a number of discrete goals, which in turn are supported by specific objectives.

VISION:

In 2035 Palm Beach County will be a place where bicycling is experienced as

- **a safe and convenient transportation option, and**
- **an attractive form of recreation for residents and visitors alike.**

Achieving this vision will help Palm Beach County remain a preferred place to live and visit, with a truly multimodal transportation system, an unparalleled quality of life, and a healthy, active, and vibrant population. The following goals (*and supporting objectives in italics)*, if met, will help Palm Beach County become the place described in the Vision.

TRANSPORTATION GOALS FOR SAFETY

Palm Beach County and its municipalities shall increase bicycle safety by achieving the following goals:

S1 Provide bicycle facilities that are designed to maximize user safety and provide a comfortable experience that encourages their use.

- *Increase the mileage of roadways achieving their designated performance threshold for bicycling by 2030.*
- *Plan and fund regular maintenance for on-street bicycle facilities.*

S2 Educate the public about the safe operation of bicycles.

- *Plan and fund regular educational campaigns on bicycle safety, especially in response to crash factors found to be common in Palm Beach County.*

S3 Encourage the public to choose bicycling as a preferred mode when appropriate.

- *Plan, fund and promote the system of on-street and off-street bicycling facilities with emphasis on providing access to preferred destinations within short distances.*
- *Enforce laws, codes, and ordinances that have bearing on the safe integration of bicycles into the transportation system.*
- *Train and encourage law enforcement officers to enforce laws related to bicycle safety, especially those found to be related to common crash factors in Palm Beach County.*
- *Continuously evaluate bicycle related initiatives for effectiveness and making adjustments to these initiatives when appropriate; and*
- *Plan and fund regular review of the objectives described above, in order to track their effectiveness so that results may be reported to the public and adjustments may be made as needed.*

TRANSPORTATION GOALS FOR CONVENIENCE

Palm Beach County and its municipalities shall increase the convenience of bicycling as a mode of transportation by achieving the following goals:

C1 Provide a network of bicycle facilities that serves the broadest possible range of users and accesses important destinations.

- *Prioritize investments in improved on-street bicycle facilities to focus on areas with high potential for bicycle rips and/or which serve populations with less access to personal motor vehicles.*

C2 Encourage bicycling as a practical mode for certain trip types.

- *Plan and fund encouragement programs with public and private partners (including employers and local businesses) to provide incentives for customers and employees who travel by bicycle, and to recognize regular participation.*
- *Review and revise (as necessary development codes, incentive programs, and private partnerships to increase the availability of short term and long term bicycle parking and show facilities at important destinations, intermodal points, and employment centers.*

C3 Educate the public about the facilities available to serve their transportation needs.

- *Plan and fund promotional efforts, such as maps and wayfinding systems which will increase public awareness of available bicycle infrastructure and its utility for work and shopping trips.*

C4 Enforce traffic laws to promote bicycling safety.

- *Identify specific motorist behaviors that should be targeted in enforcement campaigns.*

C5 Monitor the use of bicycling activity and periodically adjust priorities so as to meet the needs of area bicyclists as they change over time.

- *Plan and fund regular reviews of bicycling activity in targeted areas, use of designated routes, and participation in encouragement programs, so that results may be reported to the public and adjustments made as needed.*

RECREATION GOALS

Palm Beach County and its municipalities shall increase recreational bicycling in the County by achieving the following goals:

R1 Provide on-street facilities that provide access to the County's network of greenways and trails.

- *Prioritize investments in improved on street bicycle facilities to focus on segments which connect to local greenways and trails.*

R2 Encourage use of the greenways, trails, and the on-street facilities that provide access to them.

- *Plan and fund promotional materials, such as maps, brochures, and/or wayfinding systems that emphasize connections to Greenways and trails via on-street facilities.*

- *Coordinate promotion of greenways, trails, and on-street facilities that serve recreational trips with the Palm Beach County Convention and Visitors Bureau, Visit FLORIDA, local hotels and resorts, and other representatives of the local tourism industry.*

R3 Educate the public about the opportunities available for recreational bicycling and the practices that maximize bicyclist safety.

- *Plan and fund programs to educate recreational riders about bicycle safety, with particular emphasis on crash factors found to be common in Palm Beach County.*

R4 Enforce laws and regulations that impact recreational bicycling.

R5 Monitor recreational bicycling in the County and making recommendations responding to evolving needs.

- *Plan and fund regular reviews of recreational bicycling activity so that results may be reported to the public and adjustments made as needed.*

Chapter 2: Current Conditions

2.1 INTRODUCTION

This report summarizes background information and current bicycling conditions in Palm Beach County. The objective of this section is to present a picture of the overall "climate" for bicycling as it presently exists, which will inform discussions, decisions, and, ultimately, recommendations in subsequent tasks. The first task was to assess current conditions and establish a "baseline" from which strategies and actions will be developed that will help the Palm Beach MPO and its member jurisdictions achieve the vision and goals identified for bicycle transportation in Palm Beach County's future.

Current conditions were examined from numerous perspectives. Planning documents from agencies within Palm Beach County were reviewed to understand past efforts that have been undertaken to plan and improve bicycle transportation. Assessments were made of the current level of bicycling and trends in crashes involving bicyclists. The County's thoroughfare roadways were evaluated for how well they accommodate bicycling. Needs for bicycle parking were evaluated at points of connection with other modes, especially transit. Codes and standards relating to bicycle operations, facility design, transportation planning, and land use planning were reviewed across the County's many jurisdictions for their potential impacts - both positive and negative - on bicycling. The general state of access to schools was evaluated, and finally, the availability of bike-on-bus and bike-on-rail access was determined. Taken in sum these qualities will present a general picture of the state of bicycling for transportation in Palm Beach County.

One of the assessments initially scoped for this task, the identification of desired corridors for bicycling, was postponed so that it could incorporate the findings of the other assessments described above, input from the public at plan-related workshop meetings and other correspondence, and the discernment of the project steering committee based on these and other contributing factors. The process by which preferred corridors were selected is described in Chapter 3.

2.2 REVIEW OF CURRENT DOCUMENTS

The Scope of Work section of the Professional Services Contract for this project calls for the consultant team to review numerous existing regional, County, and local plans, studies and ordinances to provide context for work associated with the development of the Master Comprehensive Bicycle Transportation Plan. The following section includes summaries of those scope-identified studies, details regarding their relevance to bicycle and pedestrian issues, and identifies ways in which this Plan may clarify issues raised, or complement recommendations made, by the existing studies. The documents reviewed include regional-scale, county-wide, and municipal planning and policy documents. Where applicable, recommendations for potential amendments to these documents are included in Chapter 6.

2.2.1 REGIONAL PLANS

Palm Beach County Comprehensive Plan

This administrative document provides the framework for land use development in Palm Beach County. The support for planning for non-motorized transportation is evident in a number of elements of the Plan, including the Transportation Element, the Future Land Use Element and the Recreation and Open Space Element. The County also has developed particular emphasis on connecting lands and open space corridors in order to encourage environmentally viable ecosystems, and identifies and develops trails, with the goal of enhancing the interconnectivity of these greenways and open space and recreational areas, also known as the Greenways and Linked Open Space System or GLOSS. The GLOSS is mentioned across multiple elements of the Comprehensive Plan, and while it encompasses more than bike facilities, GLOSS is a critical part of the Palm Beach County bicycle facilities program. The Northeast Everglades Natural Area (NENA) Regional Plan is the planning and implementation document for this program.

Transportation Element

The following are policies from the Transportation Element that support the MPO's efforts to increase bicycling as an activity in the County:

> Objective 1.9 Bicycle, Pedestrian, and Linked Open Space Facilities[1]
>
> The County shall promote the increased use of the bicycle, pedestrian, and linked open space facilities as viable alternate means of transportation.

- Policy 1.9-a: Bikeways shall be given full consideration in the planning and development of state, regional, and local transportation facilities and programs.

- Policy 1.9-b: The County shall provide for bicycle, pedestrian, and bus transit facilities in the plans for all major roadway construction and reconstruction projects consistent with adopted standards developed by the County and State, especially when connecting to GLOSS components.

- Policy 1.9-d: The County shall support and encourage the MPO to continue completing and adopting, by January 1999, the Long Range Bicycle Facilities Concept Plan[2] , which will provide for and promote the use of the bicycle as an alternate means of transportation.

- Policy 1.9-e: By July, 1999, the County shall amend the Unified Land Development Code to require all new development or redevelopment to provide bicycle facilities to promote bicycling unless the establishment of bicycle facilities is contrary to public safety, the cost of doing so is excessively disproportionate to the need or probable use, or other factors indicate an absence of any need for such facilities.

1 Palm Beach County 1989 Comprehensive Plan, Transportation Element, Objective 1.9; p71-72-TE

2 It is believed this refers to what eventually became the 2000 Palm Beach County Bike Master Plan, described in subsequent pages of this document.

- Policy 1.9-g: The County shall encourage the use of expanded road rights-of-way corridor cross-sections which allow for multi-use bicycle and pedestrian and equestrian trails cross sections where appropriate, especially when connecting to GLOSS components.

- Policy 1.9-l: For new residential developments, the County shall encourage cut through linkages for pedestrian and bicycle access to transit. The County shall also encourage developers of new master plans to include specific circulation planning for pedestrian and bicycle access.

- Policy 1.9-m: The County shall encourage pedestrian and bicycle linkages between existing residential and non-residential land uses, especially for commercial and open space.

- Policy 1.9-n: The County shall incorporate the principle of linking open space into ongoing planning efforts such as the Bicycle/Pedestrian plan efforts of the Metropolitan Planning Organization (MPO). The use of publicly owned road rights-of-way and abandoned publicly owned road rights-of-way shall be annually examined during the Bicycle/Pedestrian planning process to determine which rights-of-way can be safely used to achieve the following: increasing alternative access to beach parks; facilitating bicycle/pedestrian connections between County and municipal parks as well as parks and conservation areas; facilitating connections between residential areas, parks and conservation areas; supporting connections to the bikeway/hiking/equestrian path around Lake Okeechobee; and facilitating bicycle, hiking and equestrian access to County parks.

- Policy 1.9-q: The County shall require, where feasible, pedestrian and bicycle linkages between non-residential land uses.

Future Land Use Element

The Future Land Use Element of the Comprehensive Plan explicitly supports bicycle facility inclusion in the designated development tiers. In the Urban Redevelopment Area there is an emphasis on multi-modal facilities, while in the Agricultural Enclave areas, Rural Parkways are to be designed with opportunities for alternative transportation. Objective 4.4: (Mixed-Use Development, Planned Development Districts) states that areas must be connected with respect to, among other things, bike paths. In another area, the Traditional Town Development (TTD) requires inclusion of the following:

> TTD shall be primarily pedestrian-oriented design and secondarily for vehicles, through the development of pedestrian and bikeway circulation systems which serve to functionally and physically integrate the various land use activities...[3]

And,

> …shall be designed to include mass transit (including land for bus stops) and accessibility to existing mass transit, where available, and provide alternative modes

3 Palm Beach County 1989 Comprehensive Plan, Future land use element, Policy 4.4.1-i:4; p78-FLU

of transportation, such as bikeways and pedestrian paths.[4]

In a TTD area, the transportation system within this land use shall functionally and physically integrate the various land uses.[5]

In a Multiple Land Use area of a TTD, the master plan must include a pedestrian/non-vehicular circulation system that integrates the project's land uses and open spaces.[6]

Recreation and Open Space Element

The following are policies from the Recreation and Open Space Element that support the effort of the MPO to increase bicycling as an activity in the County:

Objective 1.4 Open Space[7]

The County shall ensure that lands are set aside in new developments for open space, and that environmentally sensitive lands are protected for inclusion in the Countywide GLOSS.

- Policy 1.4-a: The County shall develop
- planning strategies for a GLOSS network that include but are not limited to consideration of the following components:
  - ° Conservation Areas and Preserves;
  - ° Natural Areas;
  - ° Parks and recreational facilities;
  - ° Commercial recreation areas;
  - ° Civic, cultural and educational facilities;
  - ° Lakes, blueway trails and canal systems;
  - ° Bikeways and trails;
  - ° Greenways;
  - ° Wildlife corridors;
  - ° National Scenic Trails – the Lake Okeechobee Scenic Trail and the Ocean to Lake Greenway; and
  - ° Waterways.

Objective 1.5 Recreational & Cultural Opportunities[8]

The County shall develop and/or expand park facilities that allow for public access and appropriate use of recreational, cultural, natural, historic and archeological resources.

- Policy 1.5-a: The County shall promote public access to County parks, recreational facilities, beaches, shores, and waterways through the provision and/or expansion of vehicle and bicycle parking areas, boat ramps, bikeways and pedestrian ways. All parks and recreational facilities shall

4 Palm Beach County 1989 Comprehensive Plan, Future Land Use Element, Policy 4.4.1-i:17; p79-FLU

5 Palm Beach County 1989 Comprehensive Plan, Future Land Use Element, Policy 4.4.1-i:17; p79-FLU

6 Palm Beach County 1989 Comprehensive Plan, Future Land Use Element, Policy 4.4.1-i:17; p80-FLU

7 Palm Beach County 1989 Comprehensive Plan, Recreation and Open Space Element; p7-RO

8 Palm Beach County 1989 Comprehensive Plan, Recreation and Open Space element; p8-RO

utilize barrier-free design and be consistent with federal Americans with Disabilities Act requirements and other state and local building codes.

NENA Plan

The *Northeast Everglades Natural Area Regional Plan* (NENA) connects a wide variety of NENA places throughout Palm Beach County. There are 29 NENA places throughout the county, ranging from activity and education centers to parks, wildlife management areas and trails. NENA includes over 165,000 acres of natural Florida lands.

This county vision to enhance and protect conservation lands in the Northeast Everglades area envisions and facilitates recreational opportunities between and among the individual areas. The North County area will be crisscrossed by a number of trails suited for bicycling that are either under construction or slated for funding. It is worth noting that the NENA Plan is a multi-county effort, connecting to trails in Martin County and also connects the county to the East Coast Greenway Corridor, the Lake Okeechobee Scenic Trail, and the Ocean to Lake Hiking Trail allowing users to ride from Lake Okeechobee to the Atlantic Ocean on a variety of hardened surface trails.

The NENA Plan includes the following connector trails:

- Historic Jupiter-Indiantown Trail;
- Pântano Trail;
- Bluegill Trail; and
- Everglades Rim Trail.

The *Master Comprehensive Bicycle Transportation Plan* will evaluate the conditions of principal roadway system linkages and recommend improvements where needed to facilitate access to both existing and proposed greenways of the NENA Plan.

South County Greenways and Trails Plan

The *South County Greenways and Trails Plan* (SCGAT) lays the foundation for a long range planning strategy to identify and prioritize a system of passive recreational greenways and open space corridors that will connect regional resources within the County. The Plan identifies, maps, and prioritizes a regional system of blueways, greenways and urban pathways that link to numerous state, local, municipal, and community level greenways and trails.

The SCGAT Plan follows up on the vision outlined in the NENA Plan and works to establish a more specific program for southern Palm Beach County and the western Glades Agricultural Area. The basis for the SCGAT Plan is the County's Greenways and Linked Open Space System Map. Various Comprehensive Plan element objectives and policies address the County's Greenways and Linked Open Space Program (GLOSP), acknowledging the priority of the program.

The SCGAT Plan identifies:

- 12 greenway corridors totaling 180 miles;
- 11 blueways totaling 230 miles;
- 12 urban pathways totaling 160 miles;

- 32 destinations and trailheads; and
- Seven regional connectors that will link to regional connection points with similar facilities in Broward County as well as to facilities identified in the NENA Plan.

An important outcome of the *Master Comprehensive Bicycle Transportation Plan* will be to evaluate the conditions of principal roadway system linkages and recommend improvements where needed to facilitate access to both existing and proposed greenways of the South County Greenways and Trails Plan.

2000 Palm Beach County Bike Master Plan

This regional plan provides an overview of the bicycle facility planning process in Palm Beach County prior to 2000 and sets goals to support bicycling as an important activity in the County.

The 2000 Bike Master Plan identified three goals:

- To create a safe an enjoyable bicycling environment along the ocean, recognizing that the primary venue for riding is along State and County Road A-1-A and County Road 707.
- To provide access from the interior of the county to the beachfront roadway.
- To link the oceanfront corridors, creating a network of bicycle facilities covering developed portions of the county, intending that no resident should be more than three to five miles from a major, long-distance bikeway facility.

The Bike Master Plan detailed the history of bicycle facility planning in the County, from the funding to the Transportation Enhancement application process. It provides summaries of prior planning efforts in 1990 and 1994, and the 1998 Coastal Resources Access Enhancement Study. This project generated the “Bicycle Interaction Map” and explains the methodology that was used to generate the map. The Bike Master Plan includes detailed descriptions of what is shown on the map and the mileage within each corridor and discusses the guidance that was used to develop the standards and the costs to construct the facility in the corridor.

The current *Master Comprehensive Bicycle Transportation Plan* will update the 2000 Bike Plan by providing a summary of current conditions, assessing countywide needs, identifying candidate projects for improvement, developing a cost-affordable plan of prioritized projects, and an evaluation procedure to monitor the progress of recommendations.

Eastern Palm Beach County Bicycle Suitability Map

The *Eastern Palm Beach County Bicycle Suitability Map* was developed to serve as a reference for bicycling in Eastern Palm Beach County. The ranking of its existing conditions was determined by a study completed by the Transportation Research Board that was adapted for Palm Beach County. The roads were ranked according to factors such as traffic speed, volume, outside lane width, roadway grade, pavement condition, number of driveways and the adjacent land use.

Each facility was then color coded according to level of bicycle-automobile interaction.

Bicycle facility types were also noted, as were parks, natural areas, nature centers and bike shops.

The data collected for this *Master Comprehensive Bicycle Transportation Plan* will allow the Bicycle Suitability Map to be updated with current facility information.

Palm Beach County Greenways, Bikeways and Trails Master Plan (2005)

This document includes a list of trails and cross-sections, costs, a summary of the implementation process and also prioritizes the following list of projects.

- Loxahatchee Slough Greenway;
- East Coast Greenway;
- Ocean to Lake Trail;
- Earman River Greenway;
- Barge Trail Greenway;
- Chain of Lakes Trail; and
- Grassy Waters Greenway.

For the project listed as the number one priority an implementation strategy is described. The subsequent NENA Plan and SCGAT Plan include several of the trails, bikeways and greenways listed in this Plan.

2035 Long Range Transportation Plan

The Long Range Transportation Plan (LRTP) was adopted in December 2009. The *Master Comprehensive Bicycle Transportation Plan* will be incorporated into the LRTP and will serve as the reference for bicycle facility planning for the future.

2030 Long Range Transportation Plan

The 2030 LRTP included a Proposed Cost Feasible Plan and a Bicycle Facilities Map. This map shows existing and proposed bicycle facilities and can be used as a reference for updates to the bicycle network.

This *Master Comprehensive Bicycle Transportation Plan* evaluates bicycle accommodation in greater detail and includes specific strategies to improve bicycle accommodation on roadways across the county.

Transportation Improvement Program (TIP) 2006-2010; TIP 2009-2013

Both documents list a number of projects identified for funding that span the entire county. These projects include bicycle improvements, demonstrating an existing priority to improve safety and mobility for this mode.

2.2.2 MUNICIPAL PLANS

Town of Jupiter Bike Master Plan

The Town of Jupiter completed its *Bicycle Transportation Master Plan* in the spring of 2000. The Plan used the Bicycle Level of Service model and Latent Demand method (a land-use and demographic analysis of bicycling potential), other analysis and public input to identify a proposed bicycle network, priority corridors for improvement and a variety of programs that support and encourage the mode shift. As of March 2010, the Town of Jupiter had implemented approximately 80% of the Plan's recommendations.

The 2007-2011 Community Investment Program (CIP) identifies a Strategic Priority of "Jupiter as a Livable Community." Bicycle facility projects identified in the CIP are described with "Needs, Justification and Benefits" and the "Consequences of Delaying the Project" must also be described. Review of the CIP shows a goal of the provision of 39 miles of additional bike lanes and another of increased mobility and safety. In most cases the consequence of not meeting a goal is a reduction in the level of service.

The Palm Beach County MPO *Master Comprehensive Bicycle Transportation Plan* will contain an additional evaluation of Jupiter's needs in the context of the entire county and identify needs for improvement in adjacent communities, expanding the range of trips from and through Jupiter.

Palm Beach County Agricultural Reserve Concept Trails and Greenways Master Plan

This Master Plan is focused on an area to the east of the Agricultural Reserve and Loxahatachee National Wildlife Refuge, extending as far south as Clint Moore Road and north to 60th Street South. Conceptual in nature, this Plan describes Trail and Greenway types and identifies where they might be most appropriate. The intent of the Plan is to connect each residential development and neighborhood with conservation lands, parks and recreational facilities, regional greenway and trail systems, cultural and historic sites, schools, and business areas.

This Master Plan covers a very small area and is able to detail, on a neighborhood level, the conservation area to ocean connectivity. Of note is the suggested treatment for corridors that offer little or no opportunity for development of more generous pedestrian areas. Shade trees and landscape enhancements are used to create an enjoyable biking and walking experience. The right-of-way along SR441 is highlighted as providing a potential opportunity for a multi-modal greenway corridor.

Boca Raton Bicycle, Pedestrian, Greenways and Trails Master Plan

This plan, adopted in 1996, incorporates current and proposed facilities to establish an interconnecting system of sidewalks, bicycle lanes and shared use pathways throughout the City.

Boca Raton Bicycle Suitability Map

This map, published in 2006, was developed to serve as a reference for bicycling on roads within the Boca Raton area. The map also includes the locations of shared-use paths within Boca Raton. The ranking of the existing condition of these facilities was scored utilizing the Florida Department of Transportation's 2002 Quality/Level of Service Handbook methodology. The methodology measures five main variables that impact on-road bicycling to determine a road's desirability or "suitability" for bicycling. Variables include the number of vehicles, speed of vehicles, percentage of trucks, pavement condition and the width of outside travel lane.

City of Boynton Beach Greenway & Bikeway Master Plan Summary Report/ and City of Boynton Beach Greenways and Bikeways Plan

The City of Boynton Beach developed, but did not adopt, a draft Greenway and Bikeway Master Plan in 2004, leaving it as a summary report; the City has since performed some additional work towards a draft *Greenways and Bikeways Plan* and intends to re-visit its planning efforts upon completion of the MPO's *Master Comprehensive Bicycle Transportation Plan*.

Some analysis has been done regarding existing facilities and opportunities. The draft plan states there are currently no bike lanes within the City boundaries, but acknowledges that opportunities may exist on some of the County and State owned corridors.

The draft plan also identifies general policies assuring safe and convenient bicycle access to all areas of the City, the promotion of the use of bicycles as both a viable and attractive alternative to motorized vehicles, and to create an interconnected system of greenways, bikeways and blueways to facilitate access to major destination points.

The draft plan includes standards and guidelines for several classes of bikeways, for use in appropriate areas, as well as standards for greenways and blueways. The implementation plan will include financing options and a method for prioritizing projects for future funding and project approvals.

The Palm Beach County MPO *Bicycle Master Comprehensive Bicycle Transportation Plan* will work in concert with the Boynton Beach Greenway and Bikeway Master Plan to ensure that the appropriate facilities are identified for City roadways, as well as providing for connectivity to the City's identified network from neighboring municipalities

City of Lake Worth Bicycle Network Plan

The City of Lake Worth adopted its Bicycle Network Plan on June 1, 2010. Objectives of the Plan include: providing continuous north-south and east-west travel routes for commuters; maximizing opportunities for recreational bicycling through selective treatment of lower traffic corridors and scenic routes and; connecting residential neighborhoods to major community destinations including schools, downtown, recreational facilities and employment centers.

The Plan identifies and prioritizes routes, as well as other engineering, enforcement and education solutions. The MPO plan will complement the Lake Worth Plan, ensuring that County facilities support Lake Worth's efforts to increase safe bicycling opportunities.

2.3 STATE AND LOCAL LAWS, PLANNING, ZONING, LAND USE AND DESIGN STANDARDS

The state of Florida, Palm Beach County and local municipalities can influence bicycling in numerous ways through the enactment of codes and ordinances that govern both the operation of bicycles and land development patterns that affect the utility of bicycling as a mode of transportation. This section reviews the Codes of the State, the County and the example municipalities of West Palm Beach and Boynton Beach for a general baseline of the sorts of legal mechanisms that influence bicycling and through enactment or revision could assist this Plan's vision and goals.

2.3.1 STATE OF FLORIDA

In 2009, Section 316.2065 of the Florida Statutes (F.S.) included 20 regulations (plus sub-regulations thereof that applied to the operation of bicycles on roadways, sidewalks, and bicycle paths. In general, the statutes assign the same rights and duties to operators of bicycles as are assigned to drivers of other vehicles (316.2065(1), F.S.); when riding on a sidewalk or using a cross walk, bicyclists must yield the right of way to pedestrians (316.2065(11), F.S.), but otherwise are assigned the rights and duties of pedestrians (316.2065(10), F.S.). In the roadway, bicycles are generally required to keep as close as practicable to the right hand side of the roadway, with specific exceptions for when passing another bicycle, preparing for a left turn, or when necessary to avoid a condition that makes the right hand side of the roadway unsafe. Included in conditions that may make the right hand side of the road unsafe is a substandard width lane, which is defined as being too narrow for a bicycle and another vehicle to travel safely side by side within.

Other regulations within SECTION 316.2065, F.S. specify proper equipment of bicycles including that they have a permanent and regular seat (316.2065(2), F.S.), that they be equipped with lights at night (316.2065(8), F.S.), and that they be equipped with brakes (316.2065(14),F.S.). Regulations regarding safe operation stipulate the conditions under which bicycles may carry passengers (316.2065(3), F.S.), require keeping one hand on the handlebars (316.2065(7), F.S.) and that bicyclists under age sixteen must wear helmets (316.2065 (3)(d), F.S.). Further regulations deal with the sale and lease of bicycles and with the fines and penalties associated with violations of these regulations.

With respect to development of facilities, Section 335.065, F.S., requires that bicycle and pedestrian ways be given "full consideration" in the planning and development of pedestrian facilities, with limited specific exceptions where such facilities would be contrary to public safety, where their cost would be excessively disproportionate to their use, or where available factors indicate and absence of need. Further, the statute says the State shall establish a statewide system of facilities, comprised of facilities maintained by the state DOT and other government agencies and both on-road and off-road facilities.

The State of Florida also publishes design guidance regarding bicycle facilities. The *Manual of Uniform Minimum Standards for Design and Construction and Maintenance for Streets and Highways*, also known as the "Florida Green Book," is intended to provide standards for new construction projects off the State and Federal Highway systems, making it the guidance document for roads built and maintained by local governments. Chapter 9 of the *Florida Green Book* provides guidance on the design of on-street bike facilities such as paved shoulder, wide curb lanes and bike lanes, as well as for shared use pathways.

The Florida Department of Transportation (FDOT) Plans Preparation Manual (PPM) regulates the geometric design of roads maintained by FDOT; Chapter 8 of the PPM includes specifications for bike lanes, paved shoulders and wide curb lanes and the designation of bicycle route systems.

Local governments are permitted to adopt their own design standards for bicycle facilities, provided they do not violate the minimums established by the Florida Green Book, or the PPM in the case of FDOT roadways.

2.3.2 PALM BEACH COUNTY

Palm Beach County has relatively few regulations specific to bicycling. Several ordinances specifically seek to protect facilities such as bike lanes and bike paths from obstruction. For example Section 19.21 (C)1.i prohibits the stopping standing, or parking of a vehicle on a bicycle path (among other places), except to avoid conflict with other traffic, or at the direction of an officer or a traffic control device. Similarly, Section 19.21 (C) 3.f prohibits standing or parking a vehicle, "except momentarily to pick up a passenger or passengers" in a variety of locations, including on a bicycle lane. Section 23-100(b) prohibits businesses from vending on County rights-of-way, including bike paths. With respect to bicycle operations, there is little to supplement the general regulations enshrined in state laws. One notable provision (Section 19-113) specifically excludes bicycles from the definition of "motor vehicles" within an ordinance that authorizes the use of cameras to enforce traffic signal compliance ("red light cameras"). The County does include bicycles among the vehicles whose use is regulated within County parks, allowing their use on "regular vehicle roads" as well as designated bicycle trails, but prohibiting them from designated nature trails.

The County's Unified Land Development Code (ULDC) deals with bicycle parking in a few sections. Article 5 (Supplementary Standards), Chapter B, Section 1.A.17 describes requirements for bike racks (which should accommodate five bikes each) at multi-family projects over 100 units (one rack per 50 units) and commercial projects subject to site plan approval (one rack per 200 parking spaces). Article 5, Chapter H, Section 2.B.2 states that bus stops built to serve commercial developments in excess of 100,000 square feet should include a bike rack and the site should provide bicycle access from the bus stop to the uses it is intended to serve. Article 6 (Parking), Chapter A, Section1.B.3 requires installation of bicycle racks at certain specific recreational uses, including clubhouses, swimming pools, tennis courts and basketball courts. Article 6, Chapter A, Section 1.D.14 states that there should be a "safe, adequate and convenient" arrangement of "bikeways" within parking areas.

2.3.3 CITY OF WEST PALM BEACH

The City of West Palm Beach also has a few specific ordinances that affect the operation of bicycles and the planning and construction of bicycle facilities. Section 78-1 includes bicycle paths among the facilities in which it is unlawful to obstruct or hinder the free flow of traffic; Section 78-243.(e), which regulates the placement of newsracks in the City, specifies that authorized newsracks shall be placed in such a manner that they not "impede pedestrian bicycle or vehicle traffic." Section 86-67(b) authorizes the City's traffic engineer to designate certain "heavily traveled" streets, upon which bicycles and other non-motorized or slow-moving vehicles may be prohibited through the posting of signage giving notice of the ban.

The City also makes provisions to encourage bicycling through zoning and land development regulations contained within the Code of Ordinances. Specifically, Section 94-35.(c)(9) requires that site plans submitted with zoning applications be reviewed for how well the "common ways for vehicular and pedestrian circulation" proposed within the development coordinate with existing or planned streets and pedestrian bicycle pathways in the surrounding area. The City also has requirements for bicycle parking within land development regulations. SECTION 94-485(q)(1) mandates bicycle parking spaces at a general rate of one per each 20 required automobile spaces. A supplementary table specifies that bicycle parking is not required for a conventional detached home or model home, and that the rate for "arcades, games, skating, tennis, handball, racquetball and swimming pool uses is one space per ten automobile spaces.

The City also has specific requirements for bicycle parking within the area governed by the Downtown Master Plan. These regulations stipulate one bicycle parking space per each fifteen required motor vehicle parking spaces at commercial and residential developments. Commercial sites larger than 50,000 square feet must also provide showers and changing facilities at a location available to all tenants. Residential bike parking areas are required to be secure and covered from the elements.

2.3.4 CITY OF BOYNTON BEACH

The City of Boynton Beach has recently updated its Land Development Requirements to require bicycle parking in almost all types of new construction. These requirements are defined Chapter 4, Article III, Section 3.D, and specify the number of bicycle racks for each site, according to the size of the project as measured in appropriate units. For example, one rack per 25,000 square feet of gross floor area of office space, up to 50,000 square feet, and then one additional rack per each additional 50,000 square feet. The regulation requires that bike racks be enclosed or covered and in close proximity to the project entrance.

2.4 CURRENT LEVELS OF BICYCLING AND CRASH PATTERNS

2.4.1 ESTIMATES OF BICYCLE USE IN PALM BEACH COUNTY

Bicycling plays a significant role in transportation and recreation in Palm Beach County. With beaches, parks, and shopping districts, and a year round climate that is conducive to bicycling, the result is many people riding bikes many miles. According to the National Household Transportation Survey, 2.23% of all trips in Palm Beach County, more than 18 million per year, are made by bicycle. This means that on an average day, more than 49,000 trips are made by bicycle.

In Florida, about 25% of all bicycle trips are utilitarian, whether to commute, or home-to-shopping trips or errands, in that they replaced what might otherwise have been a motor vehicle trip.[9] Given that the average utilitarian bicycle trip in Florida is three miles in length, this equals approximately 36,570 miles per day (13.5 million miles per year) of travel

9 CUTR. *Bicycle and Pedestrian Travel: Exploration of Collision Exposure in Florida.* University of South Florida, Tampa, FL, 2002.

that does not occur by car. This equates to saving approximately 675,000 gallons of gas and $1.89 million in fuel costs to the people of Palm Beach County.[10] Social and recreational bicycling (average trip lengths of five miles) represent more than 183,000 miles (65 million miles per year) of bicycling that occurred in Palm Beach County for a total of 220,500 miles per day (78.5 million miles per year) bicycled.

While the numbers above represent a significant amount of bicycling, there is room for improvement. Consider that the average daily vehicle miles travelled in Palm Beach County, excluding limited access highways, is 24.3 million miles. Consequently, in terms of miles travelled, bicycling represents only 0.9% of the distance travelled by vehicle in Palm Beach County. Additionally the individual bicycling usage rate in Palm Beach County is 0.04 trips per person[11] per day, compared to a statewide rate of 0.17 trips per person per day.[12]

2.4.2 CRASH PATTERNS

Bicycle and pedestrians crash trends for Palm Beach County were analyzed based on data from both county and state agencies. The following sections discuss trends that can be discerned from this data, with respect to the frequency, location, and time of day of these reported crashes. Recommendations associated with these analyses are described in Chapter 6.

Data for the crash analyses were obtained from the PBC MPO staff. This data, when compared to the data in the Florida

10 Assumes 20 mph average mileage rate for cars and light trucks, and $2.80 for regular gas.

11 Assumes Palm Beach County 2008 population of 1,265,293, http://quickfacts.census.gov/qfd/states/12/12099.html

12 CUTR. *Bicycle and Pedestrian Travel: Exploration of Collision Exposure in Florida.* University of South Florida, Tampa, FL, 2002.

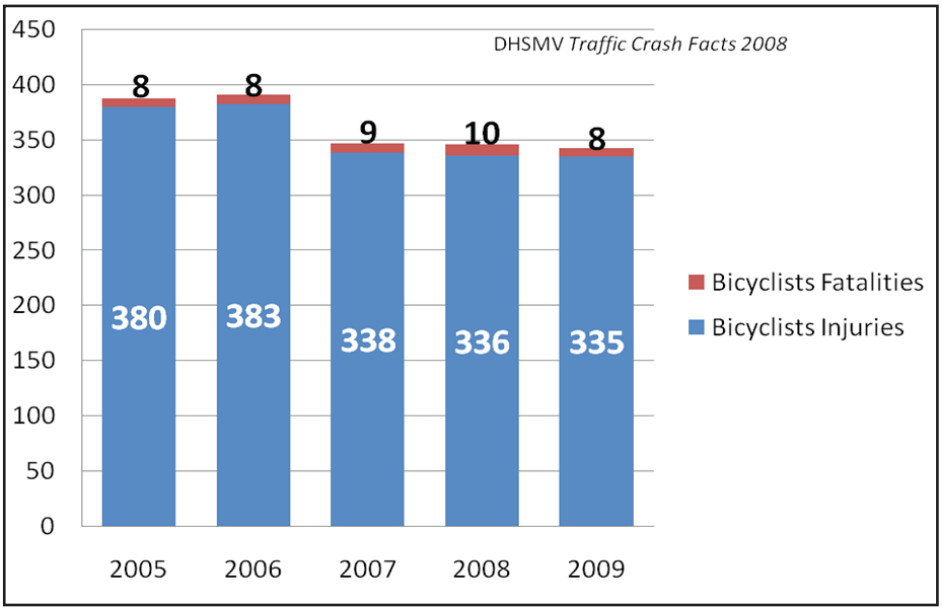


Figure 2.1: Bike injuries and fatalities by year in Palm Beach County

Department of Highway Safety and Motor Vehicles (DHSMV) 2008 Florida Traffic Crash Statistics, was found to be significantly under-reporting the actual number of bicycle crashes that have occurred in Palm Beach County. For example, in 2005 the county data reports a total of 282 crash incidents, while the state data logs 388 combined injuries and fatalities. The discrepancy is even greater in subsequent years. Consequently, the DHSMV data was used to determine annual trends.

Bicycle Crashes

After a slight drop in 2007, bicyclist injuries and fatalities in Palm Beach County have remained fairly consistent, around 345 per year (Figure 2.1). It is worth noting that this is the sum of injuries and fatalities and not crashes; multiple injuries or fatalities could result from a single crash. It should also be recognized that these statistics (and the subsequent crash statistics) relate only to crashes with motor vehicles. Bicycle-bicycle, bicycle-pedestrian, and single bicycle crashes are not included in this data.

Given that gas prices crested in July 2008, it is likely that a correlated increase in bicycling for utilitarian purposes also occurred in the period prior to summer 2008 (this was reported anecdotally by news agencies during this period). Therefore, an actual reduction in injuries or fatalities per bicycle trip may have occurred during this same period.

Additional Crash Trends

The DHSMV crash facts document does not provide the level of detail about individual incidents necessary to evaluate trends beyond the frequency of crashes. Consequently, as 2005 data from the MPO appeared to be the most complete, this was used for the following analyses that dig into the particulars of individual crashes.

Location

Approximately 85% of the bicycle crashes in 2005 occurred within 100 feet of an intersection. This implies failure to yield on the part of either motorists or bicyclists. Alternatively, a bicyclist may be moving left to turn at an intersection and fail to properly scan for motorists (sometimes the actual act of scanning can cause inexperienced cyclists to swerve). The right-hook crash, where a motorist passes a bicyclist and then turns right, is another, although less common, crash that occurs at intersections.

Bicycle crashes by lighting condition

One of the data fields in the crash reports indicates lighting conditions at the time of the crash. If we look at the total number of crashes reported in the MPO's 2005 data, we find that of the 282 crashes reported during that time, 65% occurred in "Daylight," leaving 35% in categories which might be considered suboptimal lighting conditions: dawn, dusk, dark (without streetlights), dark (street lights on), or dark (streetlights present, but off). Figure 2.2 shows this relationship.[13]

While still a minority of crashes, non-daylight crashes seem disproportionately high for the share of total bicycle trips that would be made in these conditions; it is unlikely that close to

13 It is important to note that the degree of streetlighting is not quantified for crash reports. Therefore, "Dark, with streetlights, on" can represent lighting conditions ranging from well lit downtown urban arterial roadways to sporadically lit rural collectors.

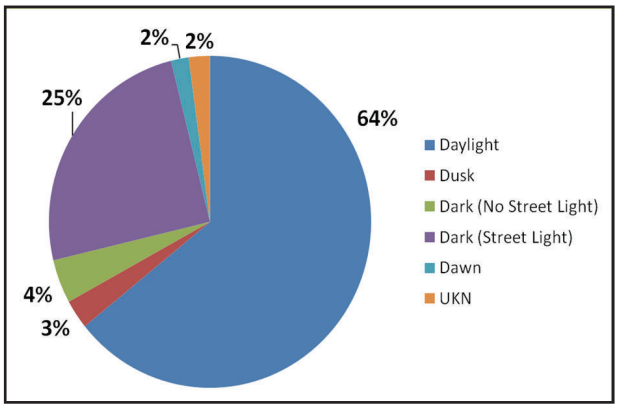


Figure 2.2: Bike crashes by time of day, 2005 *Palm Beach County Crash Reports*

35% of Palm Beach County's bicycling activity occurs outside of daylight hours.

There may be several factors which may account for the increased crash risk at these times:

- Night time crashes are often the result of at least one crash participant being under the influence of alcohol;
- Bicycles are often unlit and may have poorly aligned reflectors;
- Bicyclists riding at night (and motorists driving at night) may be fatigued or sleepy; and
- Glare on windshields can reduce motorists' visibility of the roadway environment.

As might be expected most crashes occur in the afternoon and early evening with a slight peak during morning commute hours. (Figure 2.4)

When one separates weekend and weekday trips a contrast can be seen. On weekends the number of morning crashes is much lower than weekday crashes. Anecdotally, when serious recreational riders ride on weekends they usually ride in the morning. Clubs, for instance, tend to schedule their rides for early morning. A typical Saturday morning ride schedule from the Boca Raton Bike Club web page is shown in Figure 2.3. These rides often finish up at about 10:00 A.M. Interestingly, the crash numbers on weekend mornings do not reflect an increase during this period. More casual cyclists tend to ride more on weekend afternoons, which may be represented by increased afternoon crash numbers on weekends (Figure 2.5).

Weekday crash trends appear to show

Event	Location	Date/Time
Nostalgia Ride	Nostalgia Ride	7:15 AM
Loggers Run	The Shoppes of Loggers Run	7:30 AM
John Doyle's Sat Ride	Start locations may vary	8:00 AM
Wellington	Town Square at Wellington	8:00 AM

Figure 2.3: Schedule of group rides, www.bocabikeclub.org

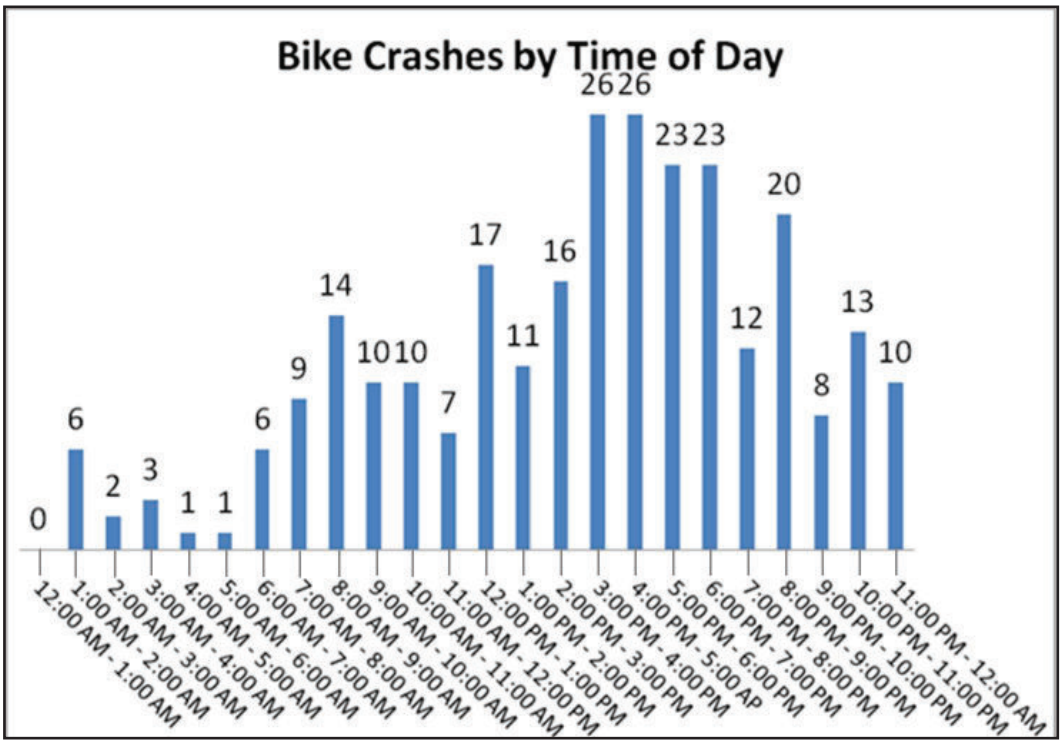


Figure 2.4: Bike crashes by time of day, 2005 Palm Beach County Crash Reports

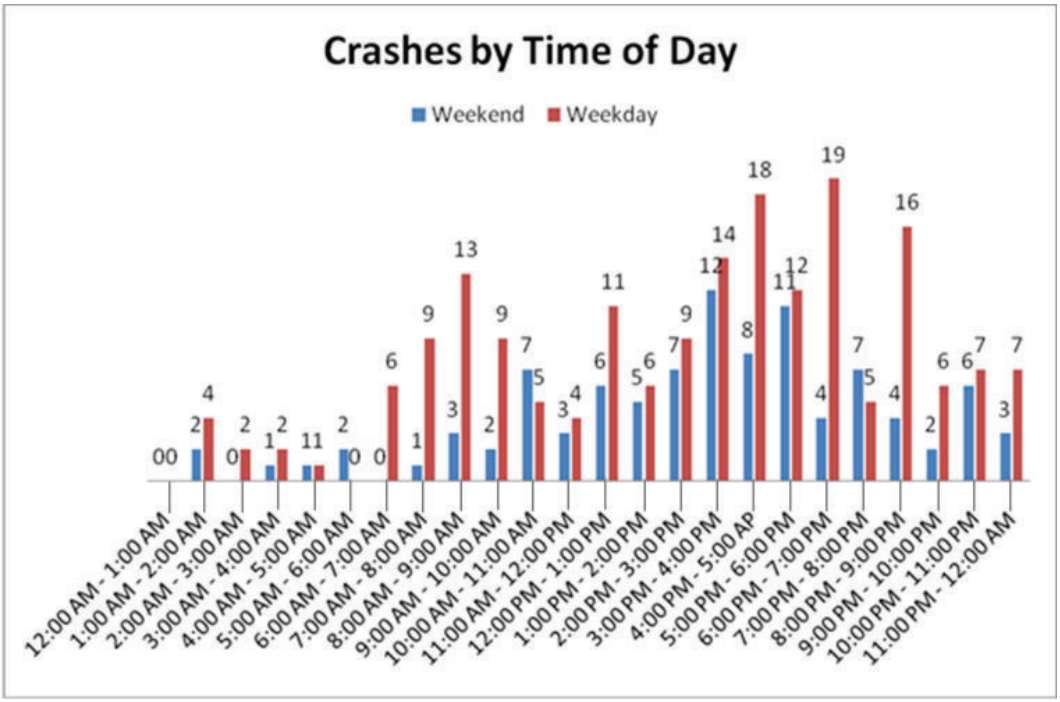


Figure 2.5: Crashes by time of day, *2005 Palm Beach County crash reports*

significant crash numbers during commuting hours and lunch break periods. This may be when non-choice riders would likely be riding.

2.5 BICYCLE PARKING NEEDS AT INTERMODAL CONNECTIONS AND BIKES ON TRANSIT

The utility of bicycles as a transportation mode for long trips can be greatly increased if bicycle trips serve to connect people from their homes to transit stops, and from transit stops to their final destinations. In order for this utility to be maximized, people must be able to secure their bikes at transit stations or bring the bikes onto the bus or train. This section describes existing conditions in Palm Beach County for these important accommodations to bicycle mobility, and any stated intentions by local agencies to improve or increase bicycle parking at their facilities or bicycle accessibility to their services.

The lack of secure parking space keeps many people from using their bikes for basic transportation. Leaving a bicycle unattended, even for short periods, can easily result in damage or theft. The Association of Pedestrian and Bicycle Professionals (APBP)(www.apbp.org) has published bicycle parking guidelines, which describe the characteristics of effective bicycle parking infrastructure. Because transit users will often leave their bikes for extended periods of time, bicycle parking at transit stations should be considered long term parking, and consideration should be given to providing the shelter and added security recommended by APBP for long term parking, such as the installation of lockers or use of indoor locations where feasible. Sheltered parking may not be feasible at all bus stop locations, but secure bike racks could be considered at most stops. It is important that all bicycle parking be situated in such a way that it does not interfere with basic pedestrian mobility around the transit stop or compromise compliance with the Americans with Disabilities Act (ADA).

2.5.1 SFRTA AND TRI-RAIL

The South Florida Regional Transportation Authority (SFRTA) is a tri-county federal public transit authority that operates in cooperation with Miami-Dade Transit (MDT), Broward County Transit (BCT), and Palm-Tran. SRFTA operates Tri-Rail, Florida's only commuter passenger rail line, which extends 72 miles from Miami to Mangonia Park (just north of West Palm Beach) with a total of 18 stations. Palm-Tran and other public transportation agencies such as BCT, MDT, and shuttle buses connect most Tri-Rail stations with nearby downtowns and other important locations including the Miami, Fort Lauderdale/ Hollywood and Palm Beach airports. Bicyclists are allowed on Tri-Rail trains on a first-come, first-served basis, allowing of up to a maximum of two bicycles per designated car. Bicycles are to be securely placed in designated areas while onboard the train, secured with velcro straps which are located near the doors of the car.

Bicycle racks are also available at Tri-Rail facilities. In December 2008, Tri-Rail published an update to its Parking and Circulation Study which considered bicycle parking among the multimodal access issues within its scope. The study found inconsistency in the number and placement of bike racks at all Palm-Tran

stations and noted that only the Boca Raton station had bike lockers. The study's long and short term recommendations include specific needs for bike rack and bike lockers at most Tri-Rail stations. Bike lockers are now being implemented systemwide; as of February 2011 there were over 400 locker spaces available at 11 of Tri-Rail's 18 stations.

2.5.2 PALM TRAN

A department of Palm Beach County Government, Palm Tran is responsible for providing transit services in Palm Beach County. Operations include an integrated system of bus routes connecting with other mass transit bus routes, local circulator services, Tri-Rail and Palm Tran's CONNECTION – a paratransit service for the elderly and mobility impaired. Annual ridership is more than ten million with nearly 40,000 riders each weekday. Currently all Palm Tran buses have bike racks. The "Bikes On Buses" program allows customers to secure bikes onto a bicycle rack attached to the front of every Palm-Tran bus. Permits or passes are not required to bring a bike on a bus. The bus racks only hold two bikes, however, and space is provided on a first-come, first-served basis.

A GIS inventory of Palm Tran stops compiled in June 2008 lists bike racks at 99 Palm Tran stops throughout the county. Palm Tran representatives report that these existing bike racks are the result of special circumstances such as an initiative undertaken by the City of Boca Raton, the development of the West Palm Beach Intermodal Center, or as the result of private developer decisions. Palm Tran does not have a program to install bike racks at stops and does not have any specific plan to increase the availability of bike parking at stops. Palm Tran officials cite budgetary concerns due to both the cost of the racks themselves and any necessary upgrades needed to meet the accessibility requirements of the Americans with Disabilities Act (ADA) that may be triggered by modifications to existing bus stops. Right of way constraints are also an obstacle to installation of bike racks at Palm Tran stops.

2.6 BICYCLING ACCESS TO SCHOOLS

Bicycling to school is assumed to be an option for the students of public schools around Palm Beach County. School districts receive state funding assistance to provide transportation to students who live farther than two miles from school. Students who live within two miles must find another way to get to school. They may be driven to school, or they may walk or ride bikes. The decision to walk or ride bikes to school is influenced by numerous factors, and some parents may feel uncomfortable letting their children walk or bike to school. Some parents perceive the routes to be unsafe with respect to traffic conditions, available facilities, or have concerns about their children's personal security (i.e. fear of crime). If parents and/or schools make a judgment that a student's walking or biking route is unsafe due to infrastructure or traffic conditions, an exception may be granted to transport a child by bus.

Florida Statute 1006.23 defines a hazardous walking condition which, if uncorrected, would justify the funding for transport of students (up to Grade 6) who live within two miles of their school. These conditions include:

- sidewalks less than four feet wide on roads that carry greater than 180 vehicles an hour (per direction at school arrival and dismissal times) or have posted speeds greater than 30 miles per hour;

- sidewalks adjacent to uncurbed roadways with posted speed limits of 55 miles per hour which are not separated from the roads by at least three feet;

- uncontrolled crossings of roadways which carry more than 360 vehicles per hour at school arrival and dismissal times; and

- controlled crossings of roadways which carry in excess of 4,000 vehicles per hour, but which are not supplemented by crossing guards.

Florida Statute 1013.36 regulates the planning and selection of school sites. The requirements of this statute can impact the feasibility of biking to school in several ways. Section 1031.36 (1), F.S., encourages the placement of school facilities close to residential areas and adjacent to other facilities (to the extent possible) and encourages the use of elementary schools as the focal point of neighborhoods. If these guidelines are followed, then the length of trips to school for many students should fall within a distance that is reasonable for biking or walking.

Section 1031.36 (3) F.S., requires that, to the extent practicable, schools be placed on sites which provide safe access between schools and their surrounding neighborhoods. Section 1013.35 (5) F.S., allows school boards to requests the construction and maintenance of sidewalks and bicycle trails within a two mile radius of each school site, and establishes procedures for coordination between agencies when a hazardous condition (as defined in Statue 1006.23 F.S.) is identified within the two mile radius around a school.

The School District of Palm Beach County manages transportation for 164 schools in the County, and as of March 2010, the school district reports that slightly more than half of the schools have documented “hazardous” conditions within their two-mile buffers requiring the use of supplemental state funding for student transportation. While there are specific criteria that define a hazardous condition with respect to the state statutes, the perceptions of parents are also a consideration. The School District investigates and reports verifiable hazards, but also works with schools, parents, and students to address concerns that fall short of the statutory definition of “hazardous”. The School District recently received a non-infrastructure Safe Routes to School grant and is developing education, enforcement and encouragement programs to help students and parents make the choice to walk in areas they may find personally intimidating, but which have not been deemed hazardous.

The existing conditions for bicycling in Section 2.4 describe an overall environment for bicycling in Palm Beach County that is challenging. It can be expected that the public will desire better bicycling conditions on routes serving schools, and proxmity to schools is a factor in the project prioritization described in Chapter 6.

2.7 EVALUATION OF EXISTING INFRASTRUCTURE

For the residents and officials of Palm Beach County and its municipalities to understand the progress of this Plan as it is implemented, it is important to have a clear understanding of the conditions for bicycling as they existed at the time the Plan was developed. Any attempt to describe such conditions must be done in a manner that allows for continual monitoring, so that improvements recommended by the Plan can be observed as they take effect. Subsequently, measurable progress towards the Plan's objectives can be reported to elected officials and the public alike. This section of the Plan reports on conditions for bicycling observed on the study network segments in February and March 2010.

The bicycle study network consists of 1,142 centerline miles of roadways, comprised of arterial and collector roadways- the roadways identified in the County's Thoroughfare Plan. The study network roadways include a significant number with shoulders or bike lanes, that represent separate space in the roadway cross section that bicyclists can claim as their own operating space. One hundred miles of the study network feature designated bike lanes compliant with the minimum recommendations of the AASHTO *Guide for the Development of Bicycle Facilities* [14] on both sides of the road, while a total of 347 miles of roadway feature paved shoulders four feet wide or greater (including designated bike lanes). Additionally, there are approximately 91 miles of roadway with outside lanes wider than 13 feet. On the remaining miles of network with no shoulder, bike lane, or wide outside lane, the average width between the edge of pavement and the stripe marking the outside lane is 11.2 feet, which is a tight space to be shared by bicycles and motor vehicles.

Palm Beach County does have a substantial roadway mileage with existing bike lanes, shoulders and wide curb lanes. Together these comprise less than 40% of a very large roadway network, leaving significant mileage on which bicycles are sharing the lanes with cars. Roadway geometry alone does not indicate how well a roadway meets the need of bicyclists. The section below describes how traffic conditions can be combined with roadway geometry to model how a given roadway is perceived by bicyclists with regard to their overall safety and comfort. If too many roadways are experienced as stressful for bicyclists, it may have the effect of limiting the viability of bicycling as an effective transportation option in Palm Beach County.

2.7.1 LEVEL OF SERVICE

The method of evaluation used for this study is a statistical tool that assigns "grades" to roadway segments, using a pseudo-academic scale (A-F), based on how well each of those roadway segments accommodate the needs of bicyclists. This method, the *Bicycle Level of Service* model, has been used by counties and cities across the nation as well as regional, state and federal agencies, to evaluate more than 200,000 miles of roadway. This method has recently been adopted by the national Highway Capacity and Quality of Service Committee as its official measure

14 Designated bike lanes adjacent to curbs should have a minimum of 5 feet clear to the face of curb from the bike lane stripe, maintaining a minimum three feet of rideable surface (i.e. not the gutter pan), bike lanes in an open-shouldered cross section should be at least four feet wide.

of bicycle accommodation in the upcoming edition of the *Highway Capacity Manual*.

The Bicycle Level of Service model is described in detail in Appendix B. This section will discuss its results for the study network, as well as the general conditions that contributed to those results. The findings are descriptive; they make no attempt to determine an appropriate level of accommodation or facility treatments on a given roadway. These issues will be addressed in later sections of the Plan. The stratification of Bicycle Level of Service Scores into letter grades is shown in Table 2.1.

Level of Service	LOS Score
A	<1.50
B	1.51-2.50
C	2.51-3.50
D	3.51-4.50
E	4.51-5.50
F	>5.50

Table 2.1: Bicycle Level of Service score stratification

It is important to note that while Bicycle Level of Service and Motor Vehicle Level of Service are both expressed on A-F scales, they do measure different performance characteristics important to their respective modes. Bicycle Level of Service rates bicycle accommodation by modeling a bicyclist's perception of safety and comfort on the subject roadway. Each community that uses this method establishes its own threshold representing which Bicycle

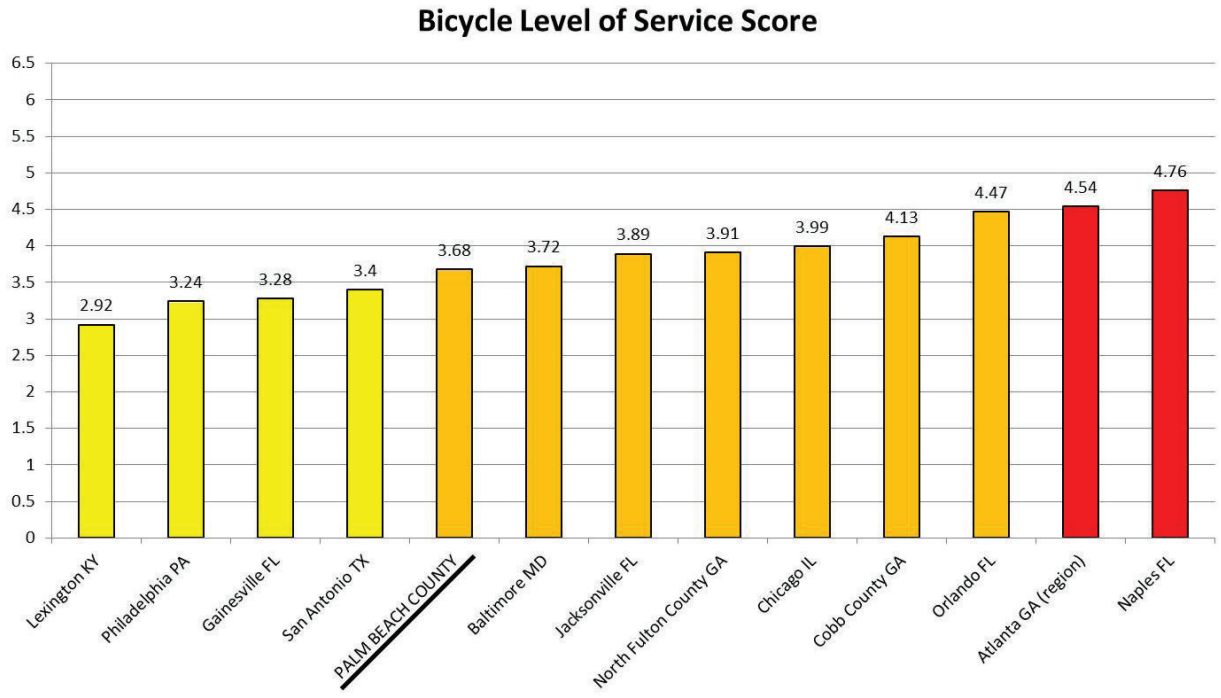


Figure 2.6: Distance weighted average for areawide bicycle level of service evaluations

Level of Service grade is acceptable. Motor vehicle level of service is strictly a measure of roadway performance with respect to capacity (i.e., is the roadway carrying more traffic than it was designed to handle), and is not directly drawn from the experience of users.

In order to apply this model, various types of data were gathered for input to the model. These data were field-gathered by the consultant team, culled from existing records, or, in limited cases, estimated based on analogous observations. Field-gathered data included geometric data, such as widths of lanes and shoulders, and observed roadway characteristics including number of lanes, lane configuration (undivided, divided, or use of a two-way left turn lane) posted speed limit, roadside profile, pavement condition, and cross-section type (curbed or open shoulder). Traffic volume and heavy vehicle (i.e. trucks) percentage data were also included.

The study network totaled approximately 1,142 centerline miles. Approximately 23 miles of roadway were under construction at the time of the data collection, leaving 1,119 miles of roadway with a calculated Bicycle Level of Service. The average mile of Palm Beach County roadway has a Bicycle Level of Service score of 3.69, equal to a grade of "D." The full data and results for all segments of the study network are shown in Appendix A, and are depicted on the accompanying map at the end of this chapter.

While every community has different expectations regarding accommodations for bicycling, these results can be understood to

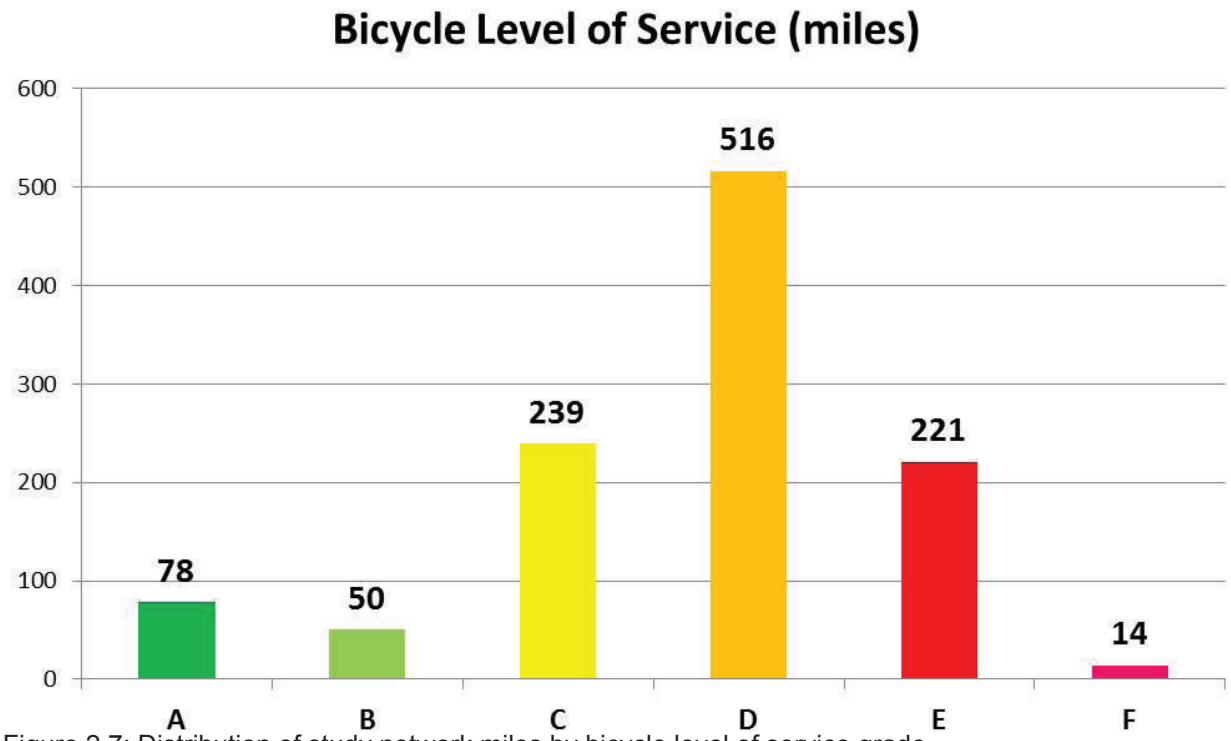
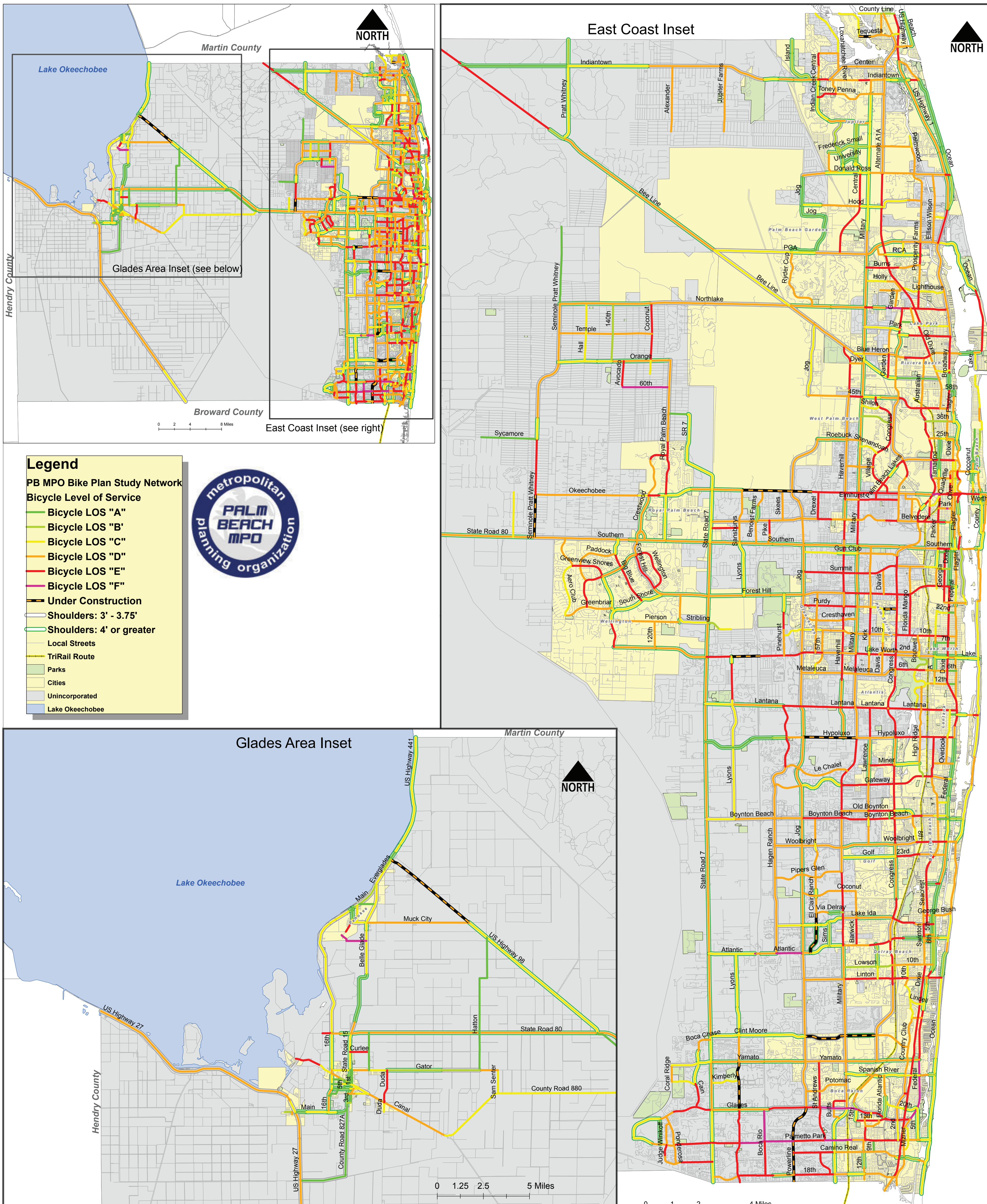


Figure 2.7: Distribution of study network miles by bicycle level of service grade

describe a challenging situation for bicycling along a typical Palm Beach County road. This is not an unusual result for urbanized areas in the United States, however, as similar evaluations of roadway networks have been performed in metropolitan areas around the country. A sample of these results for bicycling conditions, including the result for Palm Beach County, is shown in Figure 2.6. Communities whose networks earned a Bicycle Level of Service grade of "C" include Lexington, KY (1999), Philadelphia, PA (1996), Gainesville, FL (2000), and San Antonio, TX (2000). Communities whose networks scored a grade of "D," include Baltimore, MD (1998), Jacksonville, FL (2004), Chicago, IL (2001), and Orlando, FL, (2001). The study network for the entire Atlanta region (comprised of roadways from the Atlanta Regional Commission's Regionally Strategic Transportation System) scored a grade of "E" in 2006, as did the roadways of Collier County, FL (Naples metropolitan area) in 2004.

As might be inferred form from the distance weighted averages reported above, the distribution of mileage for easch Bicycle Level of Service grade also reflects challenging conditions for bicycling. In Palm Beach County, Bicycle Level of Service "D" is the grade for the greatest number of roadway miles. The distribution of mileage for Bicycle LOS in Palm Beach County is shown in Figure 2.7.

Some general observations may be made about factors that contribute to the challenging character of bicycling conditions along Palm Beach County's roadways. It is important to note, however, that the *Bicycle Level of Service* model considers a complicated interplay of contributing factors as it models a bicyclist's perception of comfort and safety on a given roadway. No one factor is likely responsible for a segment's result, and later sections of this Plan will make recommendations about how to counteract the existing conditions to improve accommodation where needed. Certain factors can be identified as contributing to the overall environment to provide some context beyond the numbers. First, traffic volumes on arterial and collector roadways can be very high. Of the 1,119 centerline miles surveyed, 752 miles reported volumes in excess of 10,000 vehicles per day, a volume that can be translated into a bicyclist being passed by a car approximately every seven seconds during the peak hour. Second, while Palm Beach County roadways do currently feature a significant number of bike lanes and shoulders, the majority of roadways require bicyclists to share the outside lane with motor vehicles. Finally, largely due to the fact that this study network is comprised of arterial and collector roadways, the speed of motor vehicle traffic on these roadways is significantly higher than a bicyclist's operating speed. The study network includes over 800 miles of roadways with posted speed limits of 35 miles per hour or greater. Bicyclists usually travel in a range between 10 and 20 miles per hour. This speed differential can greatly heighten the stress experienced by a bicyclist on the roadway.



Master Comprehensive Bicycle Transportation Plan for Palm Beach County

Bicycling Condtions
Bicycle Level of Service Results

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Figure 2.8: Bicycle Level of Service Results

Chapter 3: The Bicycle Transportation Network

This chapter describes the activities undertaken to help the Palm Beach MPO and its member agencies make informed choices about how to invest in bicycling infrastructure so those investments are beneficial to the broadest spectrum of bicyclists among the County's residents and visitors. This will, in turn help to achieve the Plan's vision of Palm Beach County becoming a place where bicycling is experienced as a safe and convenient transportation option, and an attractive form of recreation.

This study uses several different types of information to identify which roadways need improvement with respect to bicycle improvement and then proposes the priority with which these needs should be addressed. A basic premise of this study, in response to Federal and State directives as well as local policies, however, is that all roadways are bicycle facilities and should therefore accommodate bicycle travel, except those few limited access roadways upon which bicycles are specifically prohibited. Within this large and comprehensive network, choices must be made about how expected bicycle accommodation is provided on specific roadways and which needs for improved accommodation should be met first.

This Plan proposes a two-tiered approach to understanding bicycle accommodation within the overall roadway network. First, a basic performance threshold is established countywide, setting an expected level of bicycle accommodation, equal to a grade of "D" as measured with the *Bicycle Level of Service* model. Secondly, there are roadways on which better bicycle accommodation is expected, equal to a Grade of "C" as measured with Bicycle Level of Service. The definition of needs relative to these expectations is discussed in Chapter 4, and strategies for meeting these needs are discussed in Chapter 5. Achieving significant compliance with these performance expectations is among the objectives described in Chapter 1.

This section deals primarily with the criteria by which roadways were categorized as either part of the overall bicycle network, or as roadways upon which a better level of accommodation is expected, or what might be called the "Priority Accommodation Network." These roadways were selected according to specific criteria, described below.

3.1 PUBLIC INPUT

Four public workshop meetings were held across the County in April 2010. At those meetings, participants were asked to identify roadways they felt had the greatest need for improved bicycling conditions. Each participant was limited to identifying the three miles of roadway that represented their individual highest priorities. These participant responses were then matched to roadway segments defined within the review of existing conditions.

Over 200 segments were identified as "having need" on at least one response form, while 68 were identified on at least two forms. (The highest number of responses identifying any single segment was six). It was recommended that roadway segments receiving two or more votes be included on the "Priority Accommodation Network." These segments represent locations where more than one member of the public identified a desire for improved bicycle accommodation. The roadways identified for inclusion by this criterion total just over 50 miles in length, and are displayed on a map in Figure 3.1 on page 3-5.

3.2 PREVIOUS STUDIES

In 2000, a draft bicycle plan for Palm Beach County was developed that identified 34 corridors that criss-crossed the county and could be improved for bicycling by various strategies. The current Plan's steering committee reviewed the draft list and refined it down to 25 priority corridors that should serve overall bicycle mobility across the County, and accepted a recommendation that the roadway segments comprising these corridors be included on the Priority Accommodation Network. These corridors are shown in Table 3.1. The roadways identified for inclusion by this criterion total just over 140 miles in length, and are displayed on a map in Figure 3.2 on page 3-5.

3.3 DENSITY ANALYSIS

Bicycles are chosen as a useful mode of travel for relatively short trips. Because the potential for bicycle travel can be estimated to be higher in areas where the origins and destinations of common trips are found relatively close to one another. Origins can be represented by people's homes, and destinations (for both shopping and work-commutes) can be represented by places of employment. An analysis of population and employment data was used to calculate a "Density Score" for Traffic Analysis Zones (TAZs) within the county. This score was calculated by multiplying the population of the TAZ by the number of jobs within the TAZ, and then dividing the product by the area of the TAZ. This intensity of potential home-to-workplace interaction was then used as an indicator of potential bicycle travel in an area. The density scores of TAZs adjacent to particular roadways were used to calculate a total number of potential work-to-home trip exchanges within a buffer drawn around each segment. These calculated trip potentials were then used as the basis for comparing the relative trip potential of the study network roadways.

It was recommended that segment density scores be used as a criterion for inclusion on the Priority Accommodation Network. The steering committee viewed maps showing the top 30%, 40%, and 50% of overall network mileage with respect the density score. Based on input from the committee, the MPO selected the top 40% of mileage as the density score threshold. This criterion resulted in the identification of just over 450 miles of roadway, which are shown on a map in Figure 3.3. This measure helps address one of the objectives supporting the goal to make bicycling a convenient transportation option, by prioritizing investment in on-street bicycle facilities in those areas with high potential for bicycle trips.

3.4 STAFF/STEERING COMMITTEE REVIEW

The segments selected for inclusion on the Priority Accommodation Network by the criteria described above were mapped and presented to the project's steering committee for their review. Following committee discussion and further review by MPO staff, additional segments were identified to fill in gaps in coverage and to maximize county-wide continuity of roadways with enhanced bicycle accommodation. Special notice was taken of roadways which cross Florida's Turnpike, Interstate 95 and the Intracoastal Waterway. The roadways selected by this criterion add up to just over 160 miles in total, and are shown in Figure 3.4.

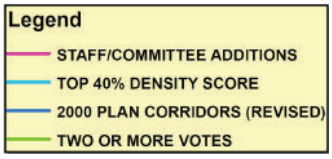
3.5 OVERLAY: THE PRIORITY ACCOMMODATION NETWORK

The roadways selected by the four criteria described above (which overlap in some cases) were overlain on a map and combined to create the Priority Accommodation Network. The total length of the segments selected for the Priority Accommodation Network is 718 miles, or approximately 63% of the total 1,142 miles of arterial and collector roadways that were included in the Plan's study network. These two tiers of roadways are shown in Figure 3.5.

Subsequent chapters will detail how future needs for improvement can be identified and recommend strategies to address those needs on the roadways of the entire study network. The ultimate effect of this Plan will be to provide basic bicycle accommodation across the county and enhanced accommodation on a majority of the county's roadways, fullfilling the Plan's vision of a Palm Beach County where bicycling is experienced as a safe and convenient transportation option and an attractive form of recreation for residents and visitors alike.

Table 3.1: Priority Corridors (selected from the 2000 Master Plan for inclusion in Priority Network)

Corridor #	Road	From	To
1	US 1	Blue Heron Blvd.	Lantana Rd.
2	Ellison Wilson Rd.	PGA Blvd.	Donald Ross Rd.
3	Prosperity Farms Rd	Northlake Blvd.	Donald Ross Rd.
4	Australian Ave.	I-95	45th St.
5	Village Blvd.	45th St.	Palm Beach Lakes Blvd.
6	Haverhill Rd./ Military Trl.	Bee Line Hwy.	45th St.
7	Jog Rd.	Okeechobee Blvd.	Southern Blvd.
8	Lyons Rd.	Forest Hill Blvd.	Okeechobee Blvd.
9	Royal Palm Beach Blvd./ Coconut Blvd.	Okeechobee Blvd.	Northlake Blvd.
10	Seminole Pratt Whitney Rd.	Southern Blvd.	Northlake Blvd.
11	SR 715	Belle Glade	Pahokee
12	Indiantown Rd.	FL Turnpike	I-95
13	Northlake Blvd.	Military Trl.	Broadway
14	Blue Heron Blvd.	I-95	Broadway
15	Okeechobee Blvd.	FL Turnpike	I-95
16	Belvedere Rd.	FL Turnpike	I-95
17	Forest Hill Blvd.	Jog Rd.	US 1
18	Lake Worth Rd.	Military Trl.	Ocean Blvd .
19	Lantana Rd.	Jog Rd.	Dixie Hwy.
20	Boynton Beach Blvd.	Congress Ave.	Ocean Blvd.
21	Atlantic Ave.	FL Turnpike	I-95
22	Linton Blvd.	Military Trl.	A1A
23	Spanish River Blvd.	Dixie Hwy.	A1A
24	Glades Rd.	Boca Rio Rd.	US 1
25	Camino Real /SW18th	SR 7	US 1



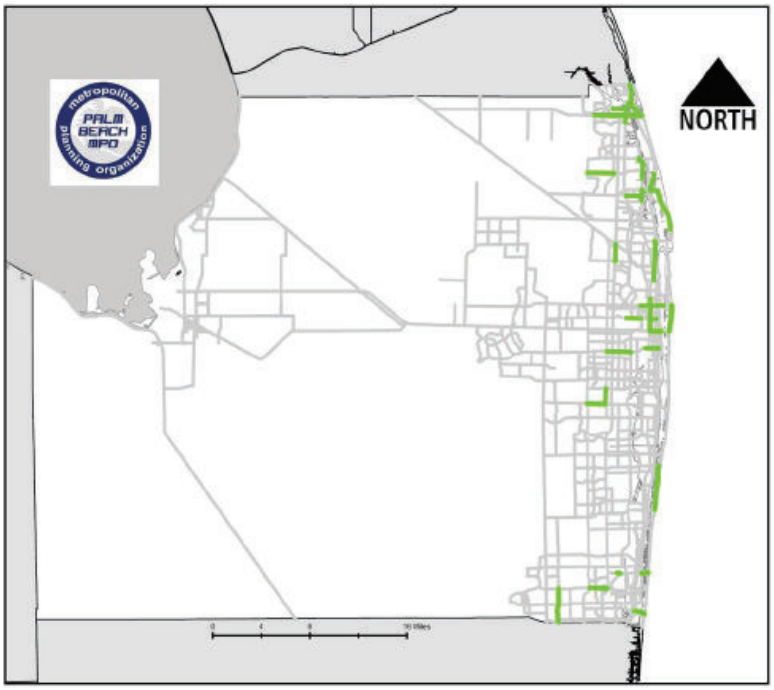


Figure 3.1: Roadways receiving two or more votes from the public

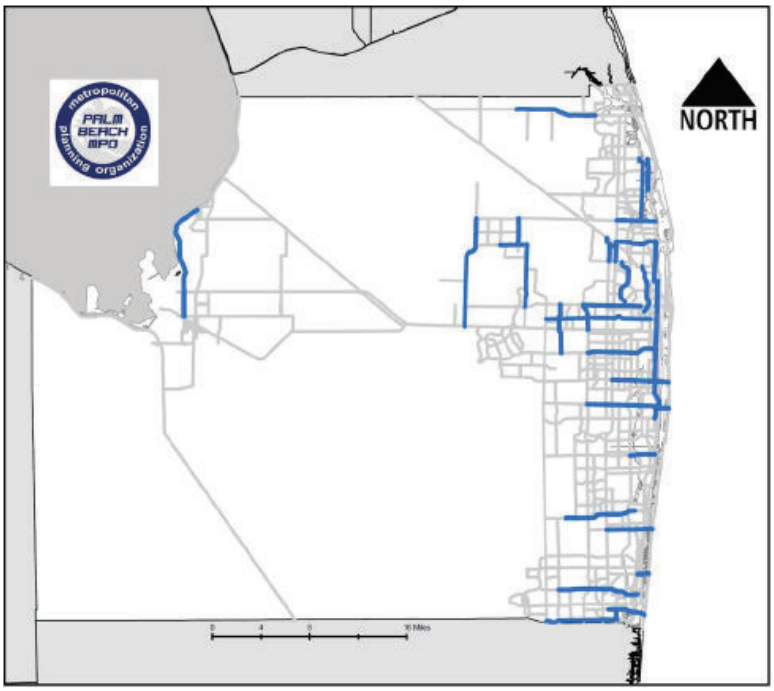


Figure 3.2: Roadways on the revised list of corridors identified in the draft 2000 plan

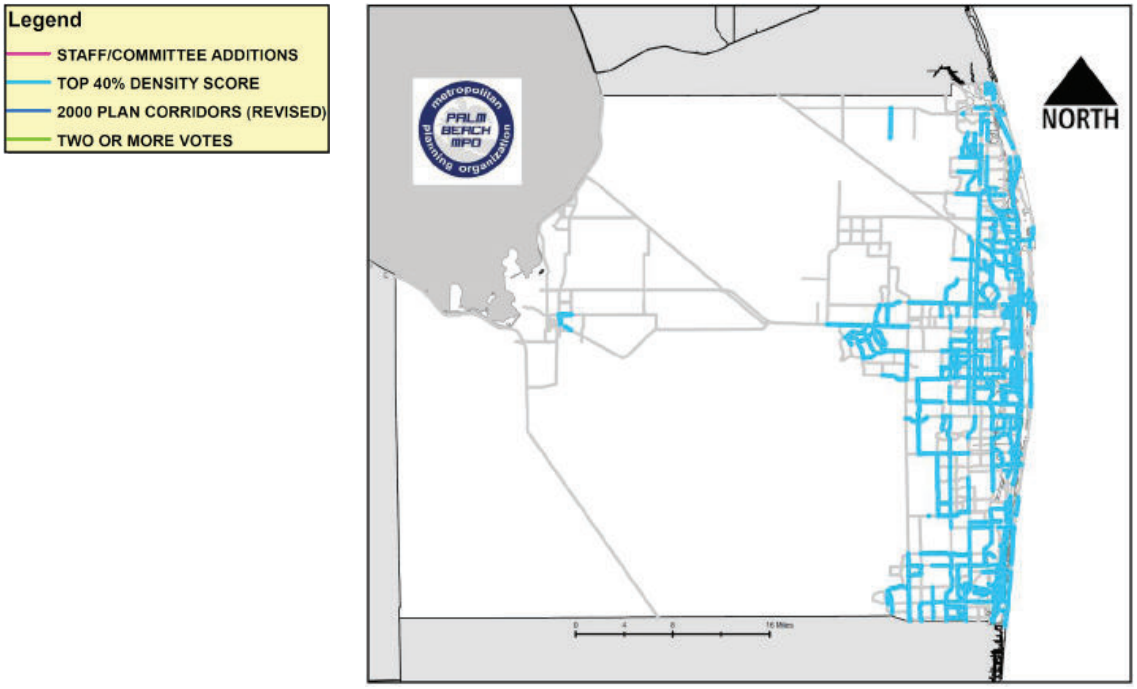


Figure 3.3: Roadways on the revised list of corridors identified in the draft 2000 plan

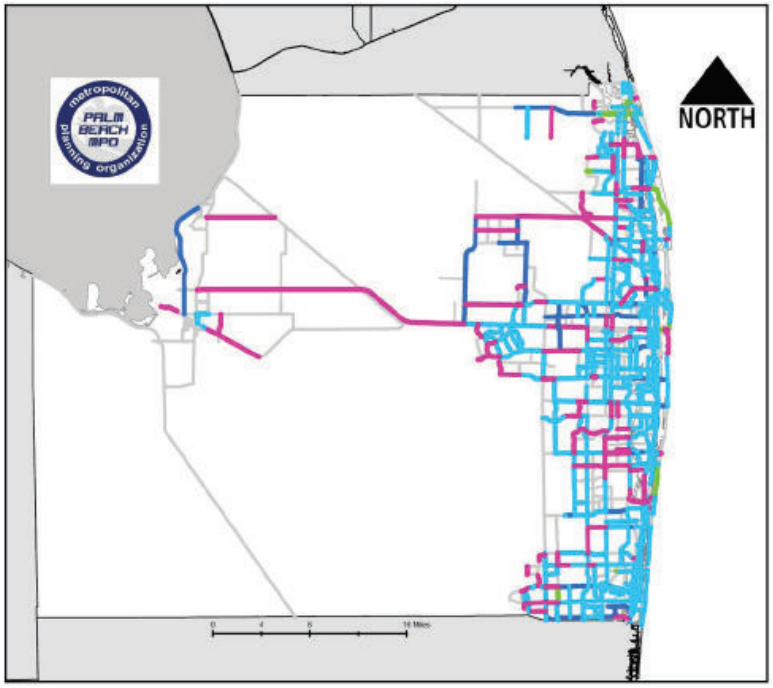


Figure 3.4: Roadways selected to bridge gaps left by previous criteria

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Martin County

Lake Okeechobee

Hendry County

Broward County

Glades Area Inset (see below)

East Coast Inset (see right)

0 2 4 8 Miles

NORTH

East Coast Inset

Legend

PB MPO Bike Plan Study Network

Bicycle Level of Service Threshold

Priority Network = Bike LOS "C"

Overall Network = Bike LOS "D"

metropolitan planning organization PALM BEACH MPO

Glades Area Inset

Martin County

Lake Okeechobee

Hendry County

US Highway 441

US Highway 27

US Highway 98

State Road 80

State Road 15

County Road 827A

County Road 880

Muck City

Belle Glade

Everglades

Main

Curlee

Gator

Duda

Canal

Halton

Sam Senter

16th

5th

3rd

1st

0 1.25 2.5 5 Miles

0 1 2 4 Miles

Master Comprehensive Bicycle Transportation Plan for Palm Beach County

Bicycle Facility Network and Enhanced Priority Corridors

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Figure 3.5: Priority Accommodation Network

Chapter 4: Needs Assessment

Bicycle accommodation along the arterial and collector roadways of Palm Beach County was evaluated with the Bicycle Level of Service Model, a statistical method that can predict a bicyclist's perception of safety and comfort based on roadway geometry and traffic conditions. As discussed in Chapter 2 of this Plan, the distance-weighted average Bicycle Level of Service across Palm Beach County's arterial and collector roadways is 3.69, which is equal to a Bicycle Level of Service grade of "D." The distribution of Bicycle Level of Service results for the County's roads is discussed in greater detail in Chapter 2, with full results and a technical description of the model included as Appendices A and B.

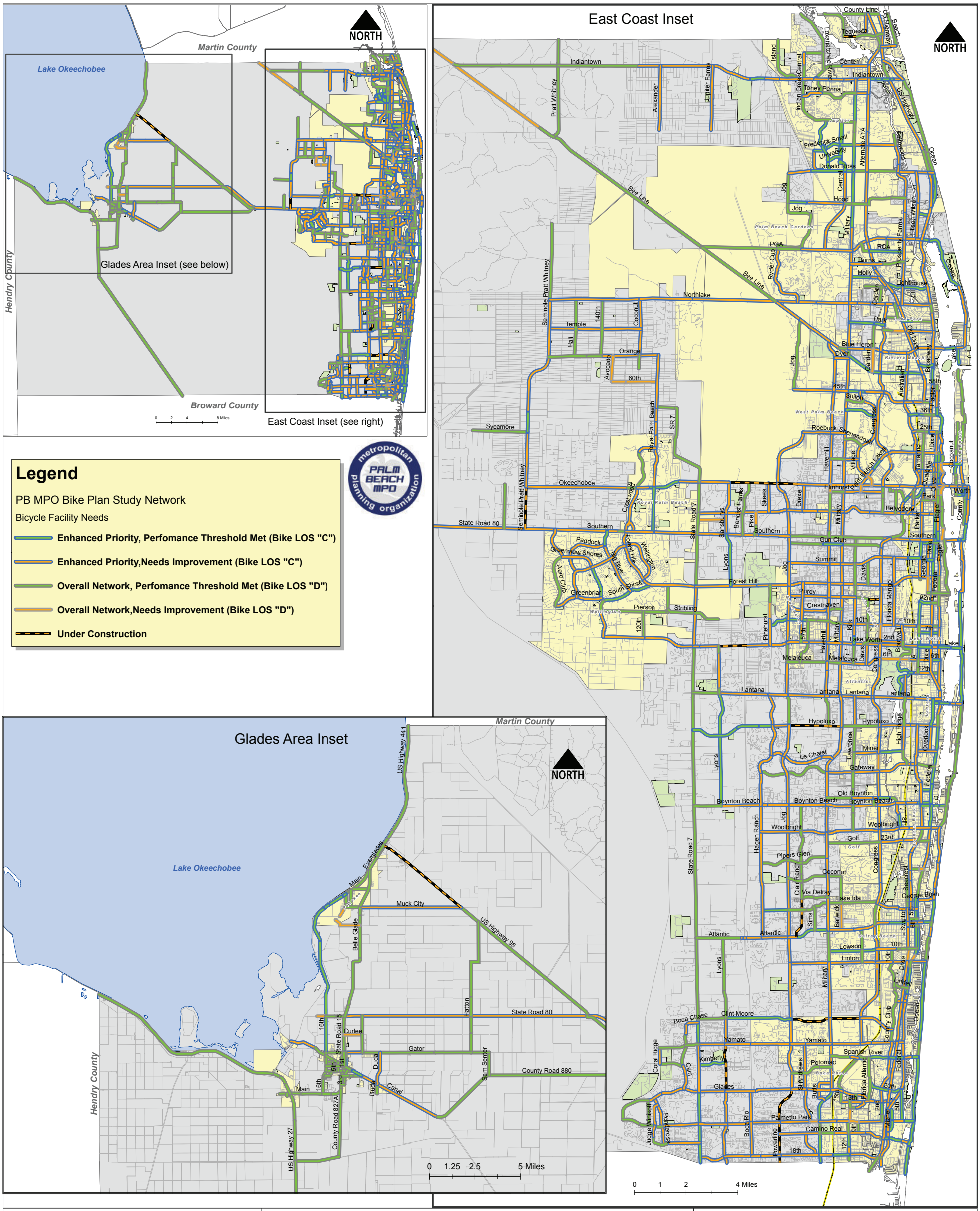
In Chapter 3, two separate performance thresholds for determining acceptable bicycle accommodations were established across Palm Beach County, with a general performance threshold of Bicycle Level of Service "D" and an enhanced accommodation threshold of Bicycle Level of Service "C" along roadways of particular emphasis. These roadways of particular emphasis are the "Enhanced Accommodation Network" described in Chapter 3, and were selected by assorted criteria including public input, identification in previous planning projects, an estimated potential for certain trip types based on population and employment data, and input from MPO staff and the project steering committee. These performance thresholds are consistent with feedback received from participants in the Plan's public workshop meetings, where Bicycle Level of Service "C" was provided as the most frequent response when asked to state a preferred level of accommodation for bicycling. The criteria described in Chapter 3 designate over 60% of the County's roadways to meet this enhanced performance threshold.

Roadways that meet or exceed their designated performance threshold are understood to be currently operating in a satisfactory manner, while those performing below the designated threshold are determined to have needs for improvement. Across Palm Beach County, 523 miles of roadway (45%) are currently meeting their designated performance threshold, while the remaining 596 miles are in need of improvement. The general distribution of roadways meeting their performance expectations or needing improvement is shown in Figure 4.1 on page 4-2. Table 4.1 on the following page shows the specific distribution of roadways meeting their respective performance thresholds. Roadways meeting their performance thresholds are identified as "LOS MET" in the recommendation/prioritization table in Appendix C.

Table 4.1: Distribution of roadways meeting performance expectations and needing improvement

Network	LOS Met	Needs Improvement
Enhanced Accommodation Network (Bike LOS “C”)	137 Miles	570 Miles
General Bicycle Network (Bike LOS “D”)	386 Miles	26 Miles

Strategies to meet the needs for improvement identified by this analysis are discussed in Chapter 5.



Master Comprehensive Bicycle Transportation Plan for Palm Beach County

Bicycle Facility Needs

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Figure 4.1: Map of roadways meeting performance threshold (green) and needing improvement (orange)

Chapter 5: Bicycle Facilities Improvement Recommendations

5.1 INTRODUCTION

This section provides a summary of potential changes to existing roadways to improve bicycle accommodations in Palm Beach County. These proposed "retro-fit" strategies propose ways individual roadway segments could be modified to the benefit of bicyclists. Combined with the on-going incorporation of bicycle facilities within roadway design and reconstruction projects, the results indicate that there is a significant opportunity to improve bicycling conditions across Palm Beach County – in some cases at very low cost to the implementing jurisdictions.

As described in the existing conditions report, the *Bicycle Level of Service* model was the method used for evaluating bicycle accommodation on Palm Beach County's study network. When the data was collected for the Bicycle Level of Service calculation, additional data was collected to facilitate the evaluation of potential roadway improvements for bicyclists. This data included total width of asphalt, presence of a raised median, presence of curb and gutter, and roadside profile (flat, sloping, or ditch). This data was used to evaluate the potential improvements described below.

5.2 FACILITY RECOMMENDATION METHODOLOGY

The analysis results, detailed in the tables published as Appendix C, include four basic categories of recommendation for each evaluated segment:

- Bicycle Level of Service met;
- Roadway Restripe Candidate;
- Add Paved Shoulders; and
- Detailed Corridor Study Needed (DCSN).

The recommendations data in Appendix C includes additional information within these larger categories as well, such as the options for specific geometric variations of the general facility type, roadside profile condition (which has impacts on construction costs), etc. The processes for identifying recommendations and additional information within them are described in the following paragraphs.

BICYCLE LEVEL OF SERVICE MET

This category (abbreviated in the database as "LOS MET") indicates that a segment already accommodates bicycling at a satisfactory level.

Every study network segment was analyzed during Phase I to determine the existing level of accommodation provided to bicyclists. A Bicycle Level of Service score, ranging from "A" (best) to "F" (worst) was calculated. The Bicycle Level of Service methodology is the same technique that is included in the 2010 *Highway Capacity Manual*. There are

many cases where a relatively high level of accommodation can be achieved even in the absence of a striped shoulder or bike lane. This situation frequently occurs on low-volume (including low-truck volume) local and minor collector streets with typical, or greater than typical, lane widths. For Palm Beach County, two Bicycle Level of Service performance thresholds were identified: Bicycle Level of Service "D" for the overall network, and Bicycle LOS "C" for segments designated for priority accommodation. Network segments were assigned to the priority accommodation tier if they met one of the following criteria:

- they were included on a list of principal bicycle corridors, drawn from the draft *2000 Palm Beach County Bike Master Plan*, and revised by the current Plan's steering committee;
- they were among those segments receiving two or more votes by participants in the Plan's public open house workshops;
- they were above a designated threshold in the ranking of all network segments according to a measure of the relative population density of their surrounding areas; or
- they were added at the discretion of MPO staff upon reviewing the results of the three criteria described above, for reasons of geographic continuity, equitable distribution, etc.

This Bicycle Level of Service Met category includes 537 miles, or approximately 46% of the study network. While bicycle improvements should be included in any future roadway projects on these segments, they already meet the minimum identified Bicycle Level of Service thresholds and therefore are not identified as "needs" for the purposes of this Plan. The database published in Appendix C does include some additional information regarding these segments, including:

- whether they have an existing shoulder, how wide that shoulder is, and if it is presently designated as a bike lane; and
- if the existing pavement could be re-striped to provide four foot shoulders adjacent to 11 foot travel lanes.[15]

ROADWAY RESTRIPE CANDIDATES

This category (abbreviated in the database as Restripe) indicates that this roadway could be easily modified to included bike lanes.

Among strategies commonly used to improve bicycling conditions, roadway re striping is frequently considered the most desirable solution. This is because of the very low (or effectively non-existent, if performed in concert with scheduled resurfacing) cost and the existence of "excess" lane width on many

15 Four foot wide shoulders will be generally consistent with the minimum widths recommended for designated bike lanes in the AASHTO *Guide for the Development of Bicycle Facilities* (Bike Guide) as well as the FDOT's *Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways* (Florida Greenbook) and *Plans Preparation Manual* (PPM). On roadway sections with on-street parking, and/or curb and gutter cross sections, certain other dimensional requirements apply. Eleven foot wide travel lanes are current practice in Palm Beach County and are also consistent with the Florida *Greenbook*. The responsible design engineers of implementing agencies are ultimately responsible for deciding the lane dimensions appropriate to each individual roadway.

streets. For this reason, roadway restriping was the first recommended option analyzed for the study network, after those already meeting the threshold Bicycle Level of Service were filtered out of the process.

Roadway restripe projects are recommended on those roadways where the existing pavement markings could be modified to include shoulders at least four feet wide, adjacent to travel lanes no less than 11 feet wide, and where such a change would bring the roadway's Bicycle Level of Service into accord with its designated performance threshold. These dimensions are consistent with current County practice with respect to lane widths and are consistent with guidance from FDOT and AASHTO regarding widths of designated bike lanes.

The database published in Appendix C also indicates those segments where six feet or more of shoulder may be possible, which could potentially allow a four-foot wide bike lane to be separated from motor vehicles by a buffered area of at least two feet.

The analysis identified 142 miles of roadway, 13% of the network, that fall into the potential *Restripe for Bike Lanes* category.

ADD PAVED SHOULDER

This category (abbreviated in the database as ADD SHOULDER) indicates that the roadway's shoulders could be widened to accommodate bicycling.

The next level of analysis was to identify the potential for the addition of paved shoulders to roadways with rural (without curb and gutter) cross-sections. While more expensive than restriping projects, constructing paved shoulders on the outside of the existing edge of pavement is still much less expensive than projects that involve roadway reconstruction. For a network segment to be considered a candidate for adding paved shoulders, it must meet two criteria: 1) have an open shoulder cross-section, and 2) have a relatively flat roadside profile to eliminate the need for significant regrading. Of the remaining unclassified segments, 143 miles, 13% of the network, meet these criteria.

The database in Appendix C also indicates the shoulder widths that would need to be added to bring the roadway's Bicycle Level of Service result into accord with its designated performance threshold.

DETAILED CORRIDOR STUDY NEEDED

This category (Abbreviated in the database as DCSN) indicates that the roadway will need a more detailed study to identify the appropriate improvements.

Many study segments present few opportunities for improving bicycling conditions through any of the identified roadway retrofit strategies discussed above. Specific bicycling-related improvements to these segments (311 miles, or approximately 27% of the study network) will require extensive and detailed operational-level investigations of the constraints and opportunities along the corridors. These detailed studies may reveal a variety of specific approaches for each segment, or sub-segments thereof, which could include identification of alternate routes, use of alternative lane widths (subject to applicable State and local polices at the

discretion of the implementing agency's responsible engineer), development of pathways outside the roadway, localized facility design, warning signage, and other customized approaches. Chapter 5A of this Plan, "Pilot Corridor" Recommendations includes example investigations of this type for seven major corridors from across the county. These pilot studies can serve as templates for the process of identifying strategies to improve bicycling accommodation across these remaining "DCSN" designated segments. Closing these challenging gaps can greatly increase connectivity of the bicycling network and improve neighborhood linkages, thereby promoting increased bicycling activity and leading to associated public health, environmental, and energy savings benefits.

The database published in Appendix C includes additional information about many of these "DCSN" designated segments. The additional data includes:

- roadways on which markings could be altered, or shoulders could be widened, to create shoulders useable as bicycle facilities, but where the presence of the shoulder would still not bring the roadway's Bicycle Level of Service result into accord with its designated performance threshold; and
- the degree of regrading that would be required to facilitate construction of a pathway adjacent to the roadway, if such a facility is ultimately deemed the appropriate strategy for the segment.

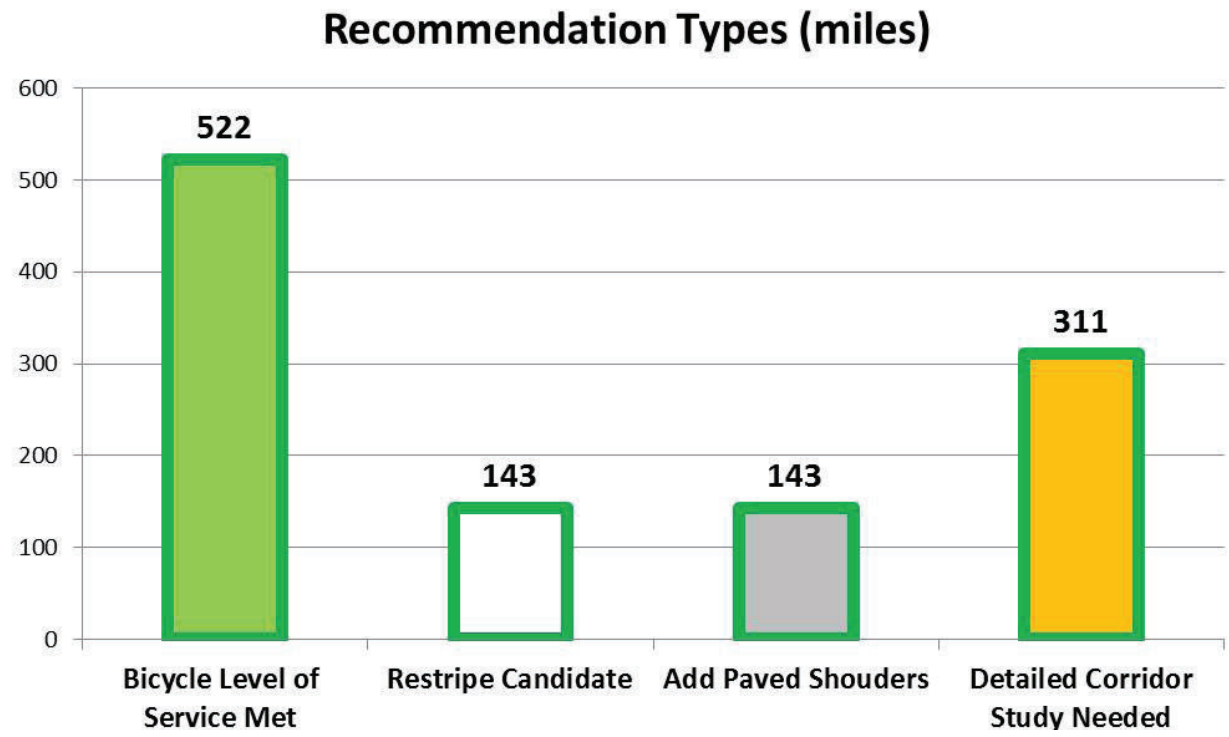

Figure 5.1: Summary of Results

5.3 SUMMARY

Figure 5.1 below shows a summary of the facility recommendations by mileage, and Figure 5.2 displays them on a map. These recommendations show an opportunity to improve bicycling conditions on hundreds of miles of Palm Beach County roadways. Chapter 6 will discuss how these recommendations can be prioritized and selected for implementation in the future.

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Glades Area Inset (see below)

East Coast Inset (see right)

Martin County

Lake Okeechobee

Hendry County

Broward County

0 2 4 8 Miles

NORTH

Legend

PB MPO Bike Plan Study Network

Recommendation

- Bike LOS Threshold Met
- Re-Stripe Candidate
- Shoulder Candidate
- Detailed Corridor Study Needed
- Under Construction

metropolitan planning organization — PALM BEACH MPO

East Coast Inset

Glades Area Inset

0 1.25 2.5 5 Miles

0 1 2 4 Miles

Master Comprehensive Bicycle Transportation Plan for Palm Beach County

Bicycle Facility Recommendations

Sprinkle Consulting — Active Transportation Planners+Engineers

American Consulting Engineers of Florida

Figure 5.2: Countywide facility recommendations

Chapter 5A: Pilot Corridor Recommendations

5A.1 INTRODUCTION

This chapter provides examples of detailed recommendations to improve bicycling conditions on select corridors in Palm Beach County. The corridors chosen for these pilot studies are drawn from a list of priority corridors developed for a draft countywide plan in 2000, and selected for inclusion in this report by the steering committee assembled for this Plan. The intent of these studies is not only to identify specific strategies for the selected corridors, but also to provide examples of the detailed corridor review process that could be applied to other corridors throughout the County.

The countywide recommendations made in Chapter 5 are drawn from data gathered in a countywide assessment of bicycling conditions. These recommendations were able to identify a variety of different strategies based on this higher-level information. A certain portion of those recommendations, however, show that the existing roadway geometry or configuration will not lend itself to restriping for bike lanes to the County's preferred dimensions (no less than four-foot bike lanes adjacent to no less than 11-foot travel lanes) or to shoulder widening. The remainder of the roadways, are classified as needing further study to determine the most feasible and appropriate strategies for improving bicycle accommodations.

These pilot studies examine six of the County's more challenging corridors and provide examples of the variety of approaches which could be considered to better accommodate bicycle travel within them and to address specific barriers to bicycling on each. The recommendations range from considering alternative lane and shoulder widths in constrained areas, to shoulder widening to specific widths, to identifying potential alternate on-street routings or possible pathway links to provide mobility around constrained sections, to identifying specific features that impede bicycle travel - such as curbs, utilities, debris, and other obstructions - and could possibly be altered to the benefit of bicycle travel.

The six corridors examined in these studies are:

- Prosperity Farms Road, between Northlake Boulevard and Donald Ross Road;
- Australian Avenue, between Okeechobee Boulevard and 45th Street;
- Indiantown Road, at the I-95 Interchange;
- Belvedere Road, between Florida's Turnpike and Parker Avenue;
- Lake Worth Road/ Lake Avenue/ Lucerne Avenue, between Military Trail and Ocean Boulevard; and
- Boynton Beach Boulevard/ Ocean Avenue, between Congress Avenue and Ocean Boulevard.

The recommendations contained within these corridor pilot studies, if pursued by the MPO and/or local agencies, should bring

improved bicycling conditions for residents and visitors along these particular roadways. Additionally, the approaches applied to these six study areas can be replicated on other corridors throughout Palm Beach County. The challenges found in these areas are fairly common for around the County, and there are certainly areas where similar opportunities will present themselves after thoughtful application of the approaches demonstrated in these pilot studies. Similar localized corridor or neighborhood scale plans, carried out across the County, would help provide better bicycling conditions in numerous locations, and thus contribute to the vision of a future Palm Beach County where bicycling is experienced as a safe and convenient transportation option and an attractive form of recreation.

5A.2 PROSPERITY FARMS ROAD, FROM NORTHLAKE BOULEVARD TO DONALD ROSS ROAD: 5.25 MILES

The pilot study for Prosperity Farms Road extends from Northlake Boulevard to Donald Ross Road (Figure 5A.1), and includes four distinct segments as identified in the existing conditions report data in Appendix A (566.1, 566.2, 566.3, 567.1, and 567.2). Each of these segments is operating below the bicycle accommodation performance threshold of Bicycle Level of Service “C” for priority corridors.

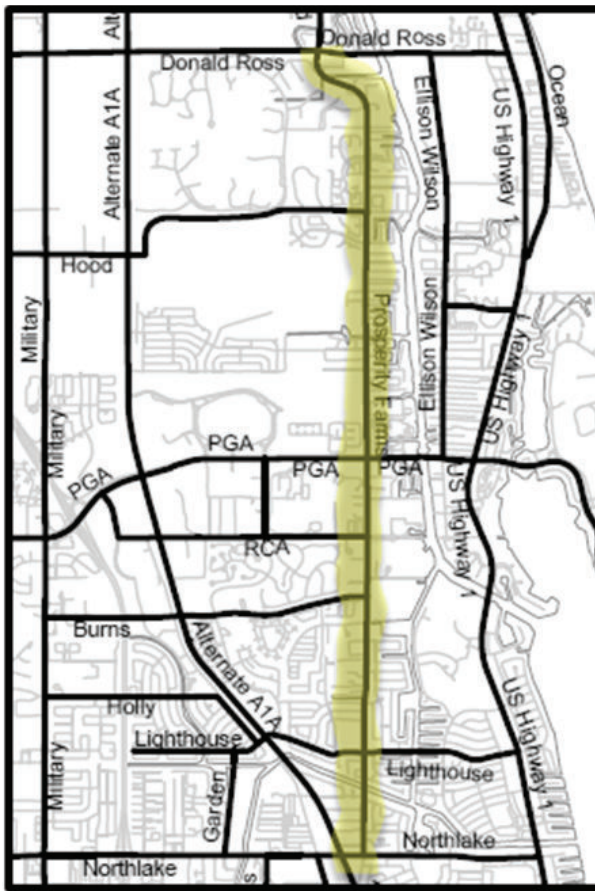

Figure 5A.1: Overview of Prosperity Farms corridor

EXISTING CONDITIONS, OPPORTUNITIES AND CHALLENGES

In a sequence running from south to north, the first particular segment is a 60 -foot wide section in the first 500 feet north of the intersection with Northlake Boulevard. This cross section includes two through lanes as well as a center alternating left turn lane, and right turn lanes on each side. This configuration facilitates access to several commercial properties as well as to two local streets: Park Road and Fairhaven Drive. This section has six-foot sidewalks at the back of curb, with the apparent limit of the right-of-way

at the back of the sidewalk. This segment has no bike lanes or shoulders.

500 feet north of Northlake Boulevard the space occupied by a center left turn lane is interrupted by a landscaped median and the right turn lanes go away. Continuing north through the intersection with Lighthouse Road to the intersection with Burns Road, the cross section is mostly two lanes with a center two-way left turn lane, but with occasional landscaped medians. The current striping appears to be for twelve -foot lanes, with narrow and variable width shoulders ranging from one to four feet. Both the lane and shoulder widths are variable and asymmetrically distributed; the northbound shoulders are typically two to three feet wide, while the southbound shoulders are typically three to four feet wide. Neither shoulder is designated as a bike lane. The total distance across the roadway is approximately 42.5 feet. Traffic volumes in these sections are reported to be between 17,000 and 19,000 vehicles per day, moving at a posted speed limit of 35 miles per hour. The conditions for this section are recorded in segments 566.1 and 566.2 and were calculated to be performing at Bicycle Levels of Service “E” and “D,” respectively. This section does feature sidewalks, which are set behind a twelve-foot wide buffer.

North of Burns Road, the cross section changes to four lanes plus a center right turn lane, for about a mile to the intersection with PGA Boulevard. Traffic volumes in excess of 25,000 vehicles per day are reported in this section, subject to a posted speed limit of 40 miles per hour. The outside lanes in both directions are 14 feet wide, while the total distance across the roadway is 62.5 feet. The calculated Bicycle Level of Service for this section (segment # 566.3) is 4.63, equal to a grade of “E.” This section includes six-foot sidewalks at the back of curb on the northbound side; a guardrail is installed adjacent to the southbound side, due to a steep canal bank immediately west of the roadway.

Continuing north from PGA Boulevard, Prosperity Farms returns to a cross section of two through lanes, with a center space that alternates between two-way left turn lanes, directional left turn lanes and periodic landscaped medians. The through lanes are 11 feet wide with shoulders that are somewhat variable in width, but generally around three feet. Traffic data reports a return to volumes around 18,000 vehicles per day, while still subject to a 40 mile per hour speed limit. This section (segment # 567.1) was calculated to perform at Bicycle Level of Service “D,” with a numeric score of 4.22. Six-foot wide curvilinear sidewalks line both sides of the road, behind a significant buffer in most, but

Figure 5A.2: Shoulder widths are variable and have been encroached by vegetation

not all, places.

About nine-tenths of a mile north of PGA Boulevard, at about the intersection with Driftwood Circle, Prosperity Farms is reduced to a two-lane, undivided, open-shouldered cross section, which remains until the road's northern terminus at Donald Ross Road (recorded as segment # 567.2). The lanes are striped to be 11 feet wide, but the shoulder widths are highly variable, ranging from two feet down to effectively non-existent. In many places, wider shoulders may have been constructed, but accumulation of debris and encroaching vegetation have obscured them and their utility as accommodations for bicycle travel has been reduced (Figures 5A.2 and 5A.3). This segment reports a lesser traffic volume of just over 8,000 vehicles per day, subject to a speed limit of 40 miles per hour. The geometric and traffic conditions of this section contribute to a calculated Bicycle Level of Service score of 4.42, equivalent to a grade of "D". There is a six-foot wide sidewalk alongside the northbound lanes and an eight -foot sidewalk along much of the southbound side, which is set behind a wide buffer much of the way.

Figure 5A. 3: Shoulder widths are variable and have been encroached by vegetation

At the extreme north end of the segment, the road bends sharply to the west and then back north, where it crosses a bridge over a canal. On the approaches, and the bridge itself, the northbound sidewalk disappears, while the wider, southbound sidewalk is drawn up to the edge of the roadway, and guardrails are positioned close to both sides.

RECOMMENDATIONS

The recommendations to improve bicycling along Prosperity Farms Road are shown in Table 5A.1, and are described in detail in the paragraphs that follow. Large sections of Prosperity Farms could be improved for bicycling with relatively simple steps such as roadway restriping and shoulder widening. In the area between Northlake Boulevard and Eagle Way, which includes right turn lanes, re-striping could find room for bike lanes if the through lanes were reduced to 11 feet, and the right turn and two-way left turn lanes are reduced to 10 feet. If these widths are ultimately determined to be infeasible, shared lane markings could be used until after Eagle Way, at which point bike lanes could begin, as described below. In the section between Eagle Way and Burns Road, the roadway could be re-striped to a more symmetrical cross section, such as a four-foot shoulders, adjacent to eleven-foot lanes, leaving over 12 feet for the two-way left turn lane. The occasional median islands were observed to be placed slightly off center in the roadway, but the curblines flare outward throughout the median areas, which should leave ample space for continuous shoulders on both

Table 5A.1: Summary table of recommendations for Prosperity Farms Road

Prosperity Farms Road			
From	**To**	**Recommendations**	**Note**
Northlake Blvd	Burns Road	Restripe	May require narrow lanes or turn lane reduction
Burns Rd	PGA Blvd	Restripe	May require narrow lanes or turn lane reduction
PGA	South end of Bridge	Widen shoulders	Some isolated curbs to be altered
South end of Bridge	Daniel Ross Road	Actived warning signs	

sides of the roadway. A continuous four-foot shoulder through this section, combined with the improved pavement condition realized by resurfacing would provide a Bicycle Level of Service of "C" for these sections. Narrower lane widths - perhaps as low as 10 feet, with either a four or five-foot shoulder - may be considered through this section, given that this is not a State road and the speed limits do not exceed 45 miles per hour[16]. Adjustments to the width of the two way left turn lane could also be considered, given that most of the properties through the corridor are residential in nature.

From Burns Road north to PGA Boulevard, the roadway could be restriped to include at the very least three - foot shoulders adjacent to 11-foot lanes, which would yield a Bicycle Level of Service of "D," which is an improvement over the existing condition, but still does not meet the performance threshold of Bicycle Level of Service "C" established for priority corridors. Given the relatively low speeds and residential character of the corridor, narrower lanes or an adjustment to the two-way-left turn lane could also be considered.

North of PGA Boulevard, the roadway has an open-shouldered profile, and bicycling conditions would benefit from a shoulder widening project. Shoulders actually exist through much of these segments, but they have been allowed to become overgrown and are not equally apportioned to both sides of the roadway. Occasional adjustments would need to be made to the deal with some

16 Any decision to narrow lanes shall be made with the authorization of the responsible engineer of the implementing agency. AASHTO's *A Policy on Geometric Design of Highways and Streets* gives 10-12 feet as range of recommended widths for Urban Arterials (p.472) and identifies the higher values as being most desirable on "higher speed, free flowing principal arterials". The Policy later describes narrow lanes as being adequate on "interrupted flow operating conditions at low speeds (45 mph or less)."(p.473). Florida DOT's *Plans Preparations Manual* allows for lanes less than 11 feet to accommodate inclusion of a bicycle facilities on State roadways for roadways with speed limits less than or equal to 35 miles per hour (Section 25.4.19.2). Both AASHTO and FDOT qualify that narrow lane widths should not be used in areas of high truck traffic (unspecified in AASHTO, 10% or higher for FDOT). For the purposes of this report, narrow lanes will be provided as an option to be considered on State roadways with speed limits of 35 miles per hour or less, and on other roadways with speed limits of 45 miles per hour or less. As all the roadways in this report in are in highly urbanized areas, it is assumed that truck volumes are not unusually concentrated.

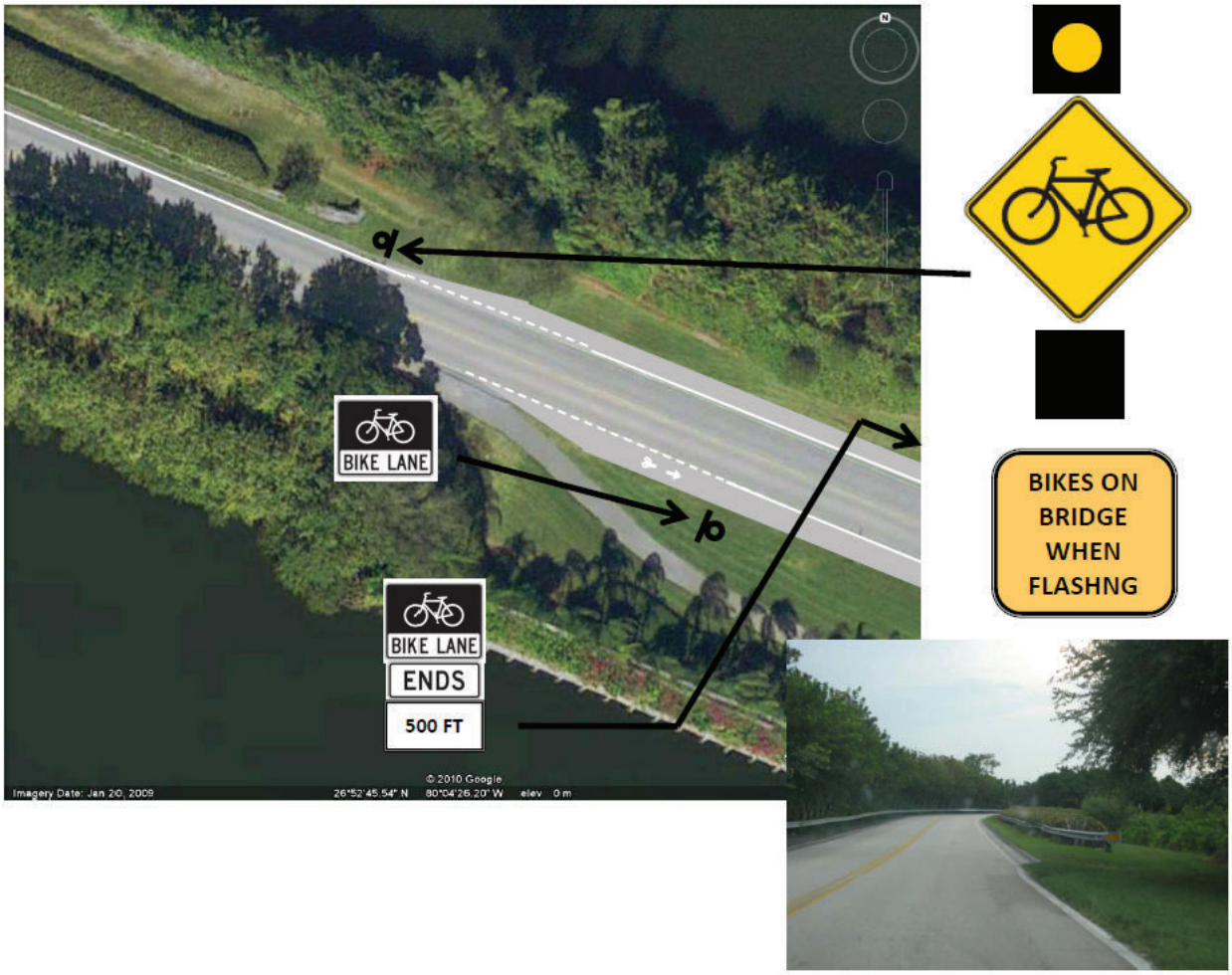

Figure 5A.4: Activated warning signs may be used across the bridge just south of Donald Ross Road

intermittent curbs, and to design through areas - such as the frontage of St. Patrick's Church, north of Hope Lane - where the existing sidewalk is close enough to the edge of the roadway that it may be impacted by a widened shoulder.

The roadway narrows on the approaches to the canal bridge at the far north end of the corridor. Widening the shoulder on the approach embankments would involve significant earthwork and likely be infeasible. It is recommended that an activated warning sign, such as a Bicycle Warning Sign (W11-1), with a supplementary plaque reading "Bicycles on Bridge When Flashing" be considered on the approaches and across this bridge (Figure 5A.4). Bicycles could be detected by a variety of passive technologies, such as loop detectors in the shoulders, or bicyclists could call for the flashing light by means of push buttons near the points where they need to move from the shoulder to a shared lane.

Shared use pathways adjacent to the roadway ("sidepaths") could be considered through

this corridor as well. There appear to be wide areas of reasonably level right-of way through much of the corridor, generally on the west side of the road. There is currently a wide (8-9 - foot) asphalt sidewalk on the west side of the roadway for the last 1.25 miles, between Venice Drive and the bridge at the north end of the corridor, which conceivably could be modified to function as a shared use path. There is also a 0.9 mile long stretch between Burns Road and PGA Boulevard which includes guardrail immediately at the edge of pavement on the west side of the road, due to a steep embankment to a ditch at the roadside, which would likely necessitate the switching of any trail alignment to the east side of the road through this section. It should also be noted that both the AASHTO *Guide for the Development of Bicycle Facilities* and the Florida *Green Book* warn of known difficulties associated with pathways located immediately adjacent to roadways. These difficulties are largely operational concerns associated with two way vehicular traffic (bicyclists and other path users) to the right of a directional flow of traffic on one side of the roadway. This situation introduces many turning conflicts at points where neither motorists nor bicyclists may be looking for them. However, sidepaths are popular with the public and are sometimes useful facilities in constrained corridors. Any consideration of a sidepath option in this or any other corridor should include careful design of all intersections with streets and driveways to mitigate conflicts between path users and motor vehicles.

The options for re-striping and shoulder widening through this corridor should be considered first; the sidepath option should only be pursued after it has been firmly established that the on-street options will not meet the needs of the local population.

5A.3 AUSTRALIAN AVENUE, FROM OKEECHOBEE BOULEVARD TO 45TH STREET: 3.5 MILES

The pilot study for Australian Avenue extends from the Okeechobee Boulevard overpass to 45th Street (Figure 5A.5), and includes five distinct segments as identified in the existing

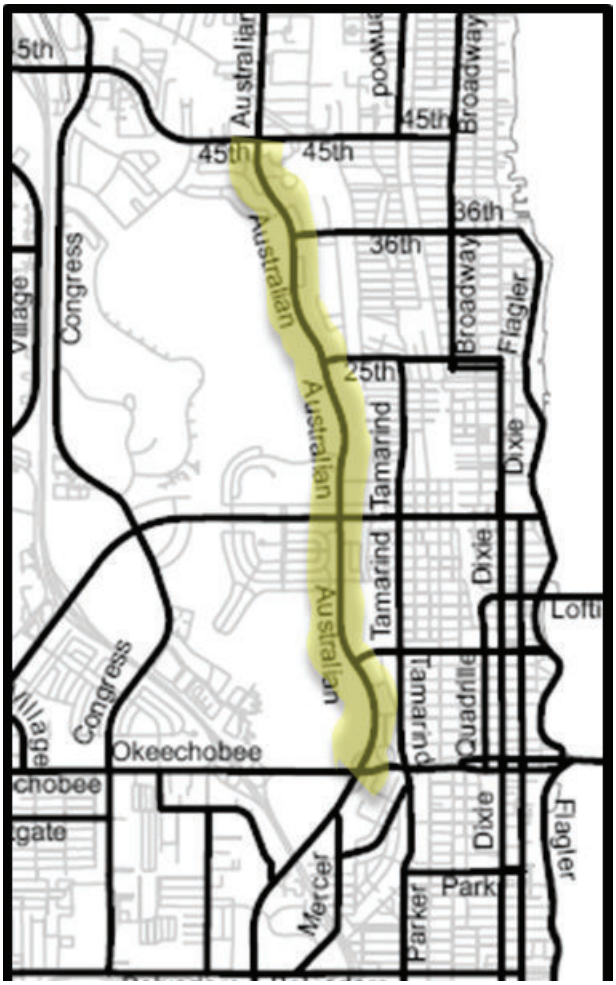

Figure 5A.5: Overview of Australian corridor

conditions reprt and database in Appendix A (100.4, 97.1, 97.2, 98.1, 99.1). Of these, none currently achieve the performance threshold of Bicycle Level of Service “C” for priority corridors.

EXISTING CONDITIONS, OPPORTUNITIES AND CHALLENGES

The cross section on the overpass across Okeechobee Boulevard is four lanes and divided with additional acceleration lanes fed from cloverleaf ramps in both directions, so that the cross section across the overpass is effectively six lanes wide. There are very wide gore areas where the on-ramps merge onto the overpass. The acceleration lane ends at both the north and south ends of the overpass, so that both directional flows are two-lanes wide upon leaving the bridge. The outer lanes through this section are over 12 feet wide, but with no usable shoulder area to accommodate bicyclists. With over 30,000 vehicles a day, moving around 45 miles per hour, these conditions result in a Bicycle Level of Service score of 5.22, equal to a grade of “E” (segment # 100.3).

From the end of the Okeechobee Boulevard overpass to the intersection with Banyan Boulevard, the cross section for Australian Avenue is six lanes wide and divided, with six-foot wide sidewalks at the back of curb (segment # 97.1). The outside lanes were noted to be in excess of 12 feet wide, but with no marked shoulder space. Traffic volumes in excess of 36,000 vehicles per day (at 45 miles per hour) contribute to a calculated Bicycle Level of Service of “E” (4.88). The outside lanes disappear at either end of the segment - as a right turn lane northbound and as an on-ramp to westbound Okeechobee Boulevard southbound. The total distance across the lanes is approximately 36 feet.

North of Banyan Boulevard, the cross section is reduced to four lanes, divided, through the intersection with Palm Beach Lakes Boulevard. The first ¼ mile north of Banyan is constructed on a causeway across an arm of Clear Lake, and then crosses a short bridge; this causeway and bridge section is lined with curb and gutter, while the remaining half-mile of this stretch (segment # 97.2) has open shoulders. The distance across each side of the causeway section is only about 24 feet, currently divided between two eleven -foot lanes and a two-foot wide shoulder. This section carries over 25,000 vehicles per day at a posted speed of 45 miles per hour, which combined with some very rough pavement, results in a Bicycle Level of Service Score of “F.” In the open shouldered section north of the bridge, the speed limit drops to 35 miles per hour and there is a grassy buffer between the edge of pavement and the sidewalk, which features a slight swale to handle roadside runoff; this buffer area is interrupted by frequent sidewalks, and occasional curb radius returns at intersections. The northbound approach to the intersection of Australian Avenue and Palm Beach Lakes Boulevard includes a narrow (approximately three feet) undesignated bike shoulder slot between the right turn lane and the rightmost through lane. There is no such slot on the southbound approach.

After the intersection with Palm Beach Lakes Boulevard, the roadway continues as a four-lane divided cross section with open

shoulders. The outer lanes are approximately 12 feet wide, with no marked shoulder space. Traffic data reports volumes in excess of 29,000 vehicles per day, subject to a speed limit of 35 miles per hour. This section, up to 25th Street, corresponds with segment # 97.2, which received a Bicycle Level of Service grade of "E." There is a grassy strip between the roadside and the sidewalks throughout most of this section, typically 14 feet wide on the northbound side, but only six feet wide southbound. This grassy area is interrupted by curb radii at several intersections and a brief stretch of curb-and-gutter along the frontage of the Magnolia Residence, a senior housing community in the 2200 block of Australian Avenue.

The roadway stays very similar north of 25th Street to 45th Street, where lower reported traffic volumes result in a slightly better Bicycle Level of Service Score for segment #99.1, but which is still classified with a grade of "D." The open shouldered cross section is interrupted by curbing at several intersections, including those with 36th Street and Australian Court. There is also a bridge over a canal between 39th and 42nd Streets. The bridge decks are each over 26 feet wide, and are currently striped to provide a shoulder area of approximately two feet on the outside, as well as about one-foot on the inside, between the left lane and the inner guardrail. A large tree occupies the median just south of the bridge, and several of its lower branches hang over

Figure 5A.6: Branches from a tree in the median encroach on the inside lanes of the bridge south of 45th Street.

the left lanes of both sides of the roadway (Figure 5A.6).

The northbound approach to the intersection with 45th Street includes a bike lane slot between the right turn lane and the rightmost through lane. The southbound departure from the intersection with 45th Street includes a right turn only lane for traffic turning into the neighborhood off of 43rd Street; there is no slot adjacent to this turn lane and the roadside is curbed for the 500 feet between 43rd and 45th Streets.

RECOMMENDATIONS

The recommendations to improve bicycling along Australian Avenue are shown in Table 5A.2, and are described in detail in the paragraphs that follow.

Australian Avenue south of the Okeechobee Boulevard overpass was recently reconstructed to include four-foot shoulders on both sides of a six lane divided roadway. However, the outside lane of the northbound side is a “drop lane” (it leads directly into the ramp to northbound Eastbound Okeechobee boulevard), and the new shoulder stays to the right of that lane, requiring bicyclists to change lanes across the drop lane to a through lane, or to cross the off-ramp to the continuation of the shoulder. Given the relatively high speeds and free-flow traffic onto the ramp, a pavement widening should be considered in the shoulder to allow bicyclists to cross the ramp at a 90° angle, as shown in figure 5A.12 in the section for Indiantown Road, below. (Note: the reconstruction of Australian Avenue south of Okeechobee Boulevard has occurred since the field review for this study, and updated aerials were not yet available at the time of publication.)

Table 5A.2: Summary table of recommendations for Australian Avenue

Australian Avenue			
From	**To**	**Recommendation**	**Note**
S. end Okeechobee overpass	N. end Okeechobee overpass	Mark/sign shoulder to better accommodate ramp crossing; Convert accel lane to bike lane	Requires gap-acceptance slip lane from ramps
N. end Okeechobee overpass	Banyan Blvd	Restripe for shoulder/ bike lanes	4-foot bike lanes will require narrow lanes
Banyan Blvd	Clear Lake bridge	Restripe for shoulder/ bike lanes	4-foot bike lanes will require narrow lanes
Clear Lake bridge	45th Street	Widen shoulders	Isolated curbs may need to be altered; intersections and some parcels may require specific solutions

Access to northbound Australian Boulevard from eastbound Okeechobee Boulevard is made by means of a cloverleaf ramp that flows freely into an acceleration lane; a similar configuration provides access to southbound Australian from westbound Okeechobee. Each of these acceleration lanes disappears at the far end of its respective overpass: they serve as third lanes for each side, but the northbound lane gives way to another acceleration lane - this one from westbound Okeechobee Boulevard - and the southbound lane disappears as Australian Avenue transitions back into a four lane road to the south of here. It may be possible to replace these acceleration lanes - each over 700 feet long - with a gap-acceptance yield control slip lane at the end of each ramp Figure 5A.7). This would allow the space currently occupied by the acceleration lanes to be used as shoulders or bike lanes. Enough space exists - 12 feet, the width of the lane - so that even a buffered bike lane could be installed, providing an extra boost of accommodation to bicycles in this very challenging corridor. Brief, anecdotal observation of motorists behaviors on the day of the field review showed cars moving out of the acceleration lane very quickly, suggesting that except in periods of very high traffic, the long acceleration lanes are not necessary to effectively integrate traffic coming off of Okeechobee Boulevard into the flow of Australian Avenue (Figure 5A.8).

A gap acceptance slip lane functions in a very similar manner to a compact roundabout, given that cars entering the main flow must wait for a gap before turning out of the intersecting roadway. The FHWA document *Roundabouts: An Informational Guide* includes a table[17] for determining the capacity of single lane roundabouts and includes a diagram (reproduced in Figure 5A.9) which shows that an Urban Compact Roundabout (with relatively lower speeds) with a circulating

17 Roundabouts: An Informational Guide, FHWA, 2000, p. 87.

Figure 5A.7: A gap acceptance slip lane could allow for a bike lane across the overpass

Figure 5A.8: Vehicles using the acceleration lane on the Okeechobee Boulevard overpass merge quickly as the lane is taken away on the far side of the bridge

flow of 1,000 vehicles per hour can accept an incoming flow up to 500 cars an hour. The faster-moving urban and rural single lane roundabout presents even more gaps than the urban compact roundabout. The four lane segment of Australian boulevard, where a gap acceptance slip lane was recommended, has a model volume of 33,384 vehicles per day. This would translate into a peak hourly lane flow of 834 vehicles, which would allow entry of up to almost 600 vehicles an hour in an urban compact roundabout, and over 700 vehicles per hour for a single lane urban roundabout. If the entering volumes from Okeechobee Boulevard onto this segment of Australian are found to be within these ranges, a gap acceptance slip lane may be a workable feature of this interchange, freeing up space for the inclusion of a bike lane.

Between the north end of the Okeechobee Boulevard overpass and Banyan Boulevard, the roadway is only 36 feet across for three (directional) through lanes, making it possible only to re-stripe for a three - foot shoulder adjacent to 11 - foot wide lanes. This configuration would raise the Bicycle Level of Service score for this segment by almost an entire point (4.85 to 3.93) and would move it up one grade (“E” to”D”) but would not achieve a performance consistent with the designated

performance standard. Nonetheless, it would be a substantial improvement and should be considered for this constrained corridor. A four-foot bike lane, consistent with AASHTO guidance, is possible next to 10.5-foot lanes, or a five-foot bike lane next to 10-foot lanes would each meet the performance threshold of Bicycle Level of Service "C." According to AASHTO guidance, such narrow lanes might be possible on this 45 mile per hour roadway, at the discretion of the responsible engineer of the implementing agency.

Another option for this segment would be a pathway on the west side of the roadway, where there is a long stretch of frontage on the banks of Clear Lake, however, given that it is a high-speed, divided roadway, moving northbound bicyclists to the west side of the roadway may prove impractical.

Between Banyan Boulevard and the bridge over the arm of Clear Lake, the two northbound lanes could be striped with a three -foot shoulder adjacent to 10.5-foot lanes, or a four-foot bike lane next to 10-foot lanes. Care should be taken upon resurfacing to provided smooth transition between the edge of pavement and the gutter pan (the existing transition was observed to be very uneven).

North of 7th Street, however, the potential for bicycle facilities improves, as the roadway has an open-shouldered cross section much of the way to 45th Street. Such a project will require some minor regrading of roadside swales that currently exist between the edge of pavement and the sidewalk. A consistently widened shoulder of four feet, together with the improved pavement condition provided by resurfacing, would help these segments all operate at Bicycle Level of Service "C." In addition to grading and drainage work, a shoulder project will involve the reconstruction of several short curb radius sections at intersections, including those at Palm Beach

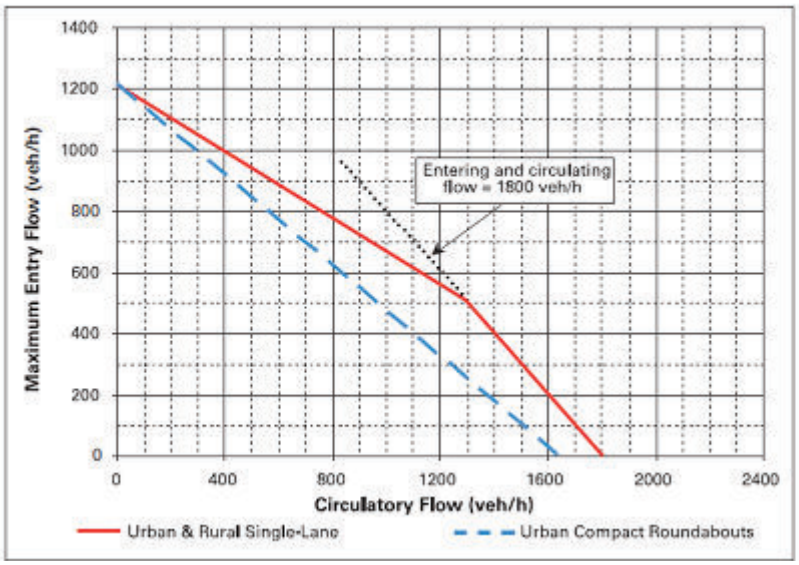

Exhibit 4-3. Approach capacity of a single-lane roundabout.

The slope of the upper line changes because circulating flow downstream from a roundabout entry should not exceed 1,800 veh/h.

Figure 5A.9, Exhibit showing entry and circulating volumes for roundabouts, from Roundabouts: An Informational Guide, FHWA, 2000, p. 87

Lakes Boulevard and Kirksey Street. A signal pole at the southwest corner of the Australian Avenue/Kirksey Street intersection will likely need to be relocated if a shoulder widening project is ultimately developed.

Additionally, some site-specific operational design issues will need to be worked out at the entrance of Roosevelt Middle School, where the roadside shoulder appears to be an important drop-off and pickup zone for parents. The northbound roadside is curbed and a right turn only lane takes up the shoulder areas across the frontage of the Magnolia Residence. The lane configuration should be restriped to allow a bike lane slot to continue through this area, properly positioned to the left of this right turn lane, and proper signage (R4-4, "Begin Right Turn Lane Yield to Bikes") should be installed.

The twin-span canal bridge approximately 1,600 feet south of the intersection with 45th Street could be restriped with to provide more outside shoulder space and less inside shoulder space; provided that the tree in the median on the south side of the bridge is trimmed so that its lower branches do not interfere with vehicles in the repositioned inside lanes.

5A.4 INDIANTOWN ROAD (SR 706) AT I-95 INTERCHANGE: 1.1 MILES

The pilot study for Indiantown Road extends between the plaza for entry to and exit from Florida's Turnpike and Island Way (Figure 5A.10). The interchange between Indiantown Road and Interstate 95 is at the junction of two segments as identified in the existing conditions study (354.35 and 354.4). Each of these segments is operating below the performance threshold of Bicycle Level of Service "C" established for priority corridors. Each of these segments includes a four-foot shoulder on the approach to the interchange, but these shoulders are interrupted by the various ramps and turn lanes at intersections associated with the interchange.

EXISTING CONDITIONS, OPPORTUNITIES AND CHALLENGES

The eastbound shoulder is initially kept to the right of the on-ramp to southbound I-95, forcing riders to cross a lane of accelerating traffic to continue straight. While there is a very wide shoulder on the overpass over Florida's Turnpike, it is marked with a diagonal stripe pattern, which may confuse riders as to whether they are permitted to go there. Then, on the east side of the freeway, bicyclists would again have to cross a free-flowing traffic stream coming off of a cloverleaf from I-95 southbound in order to enjoy the benefit of the shoulder which reappears as the road passes under the twin spans of I-95. Bicyclists need to cross one more fast-moving movement of motor vehicles as they reach the ramp from northbound I-95 approximately one-quarter mile east of the underpass. Traffic from this ramp flows into its own lane on I-95, allowing for relatively high speeds to continue through this interchange and onto Indiantown Road. The shoulder resumes to the right of this new lane and continues through to the intersection with Island way.

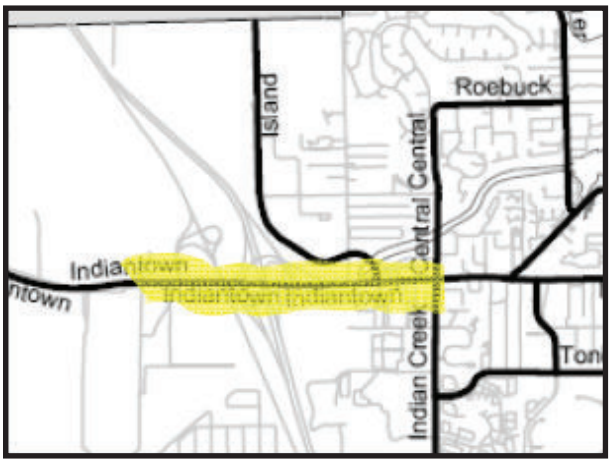

Figure 5A.10: Overview of the Indiantown Road corridor

Westbound, coming from the Island Way intersection, the shoulder is to the right of a right turn only lane that feeds onto a two-lane on ramp that serves southbound I-95. Once clear of that double-lane ramp, bicyclists can use a shoulder for about 900 feet, before having to cross right again as a cloverleaf off-ramp from Northbound I-95 feeds onto a new rightmost lane on Indiantown Road, allowing exiting traffic to maintain high speeds. A shoulder is again found on the right side of the road under the twin I-95 overpasses. This shoulder can be used by bicyclists for another quarter-mile, at which point it is interrupted by another off-ramp (from southbound I-95) into a dedicated lane. Those who can cross yet again to the roadside shoulder then very quickly find themselves to the right of a right turn only lane for the Turnpike entry plaza. So, between both sides of the roadways through this 1.1 mile stretch of Indiantown Road, bicyclists find themselves having to negotiate crossing to a new position across heavy and fast traffic eight separate times (Figure 5A.11).

Given that close to 50,000 vehicles a day pass through this section of Indiantown road at speeds of 45 miles per hour or higher, these interruptions to the bicycle facilities have the effect of making a challenging situation even worse. The recommendations that follow will focus on improving the accommodation of bicycles through this very difficult sequence of ramps and intersections.

RECOMMENDATIONS

The recommendations to improve bicycling along Indiantown Road are shown in Table 5A.3, and are described in detail in the paragraphs that follow.

It is recommended that bike lanes be designated through this study area. This designation is recommended as the bike lane markings, particularly the arrows, will provide positive guidance to cyclists riding through this section of Indiantown Road.

Because the roadway configurations and conflict areas are markedly different in the eastbound and westbound directions, this narration of recommendations will be made directionally.

Eastbound

Beginning at Marsala Court the bike lanes should be designated with the bike lane symbol and arrows.

East of the Turnpike off-ramp intersection, the bike lane should continue along the outside of the right turn only drop lane/on-ramp onto southbound I-95. To provide for through bicyclists, consider constructing a pavement

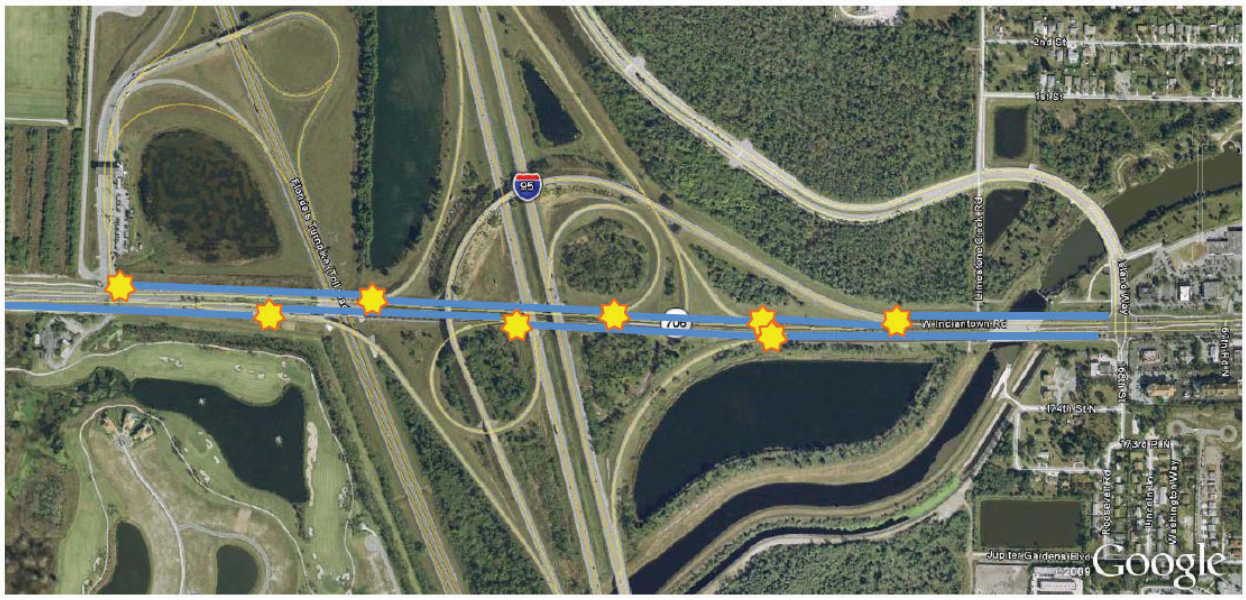

Figure 5A.11: There are eight conflict points between turning or exiting motor vehicles and bicyclists using the shoulders.

widening for bicyclists to re-align themselves to cross the ramp at a 90° angle (Figure 5A.12). There is a valley gutter along the outside of the on-ramp shoulder; this should not pose a problem for bicyclists. Install a STOP sign (R1-1) and stop line for bicyclists crossing the on-ramp. Provide a receiving bike lane on the north side of the on-ramp. An example of how this on-ramp treatment might look is provided below. If a large number of bicyclists are expected along this corridor, BICYCLE CROSSING advance (W11-1) and BICYCLE CROSSING assembly (W11-1 and W16-7P) can be installed.

The bike lane should be continued across the bridge to the southbound to eastbound off-ramp of I-95. Within the off-ramp gore area, the bike lane should be channelized to the right to cross the loop of the ramp at a 90° angle. Again, a STOP sign should be installed for the bicyclists (Figure 5A.13). The pavement on the southbound side of the ramp should be widened to provide a receiving bike lane. BICYCLE WARNING signs are also an option for this location. An example of how this off-ramp treatment might look is provided on the next page.

The off-ramp treatment should be repeated at northbound to eastbound I-95 off-ramp. Then the bike lane should be continued across the bridge to 168th Street; this would require restriping the shoulders across the bridge.

Westbound

Westbound from 168th Street, bike lanes should be provided across the bridge (Figure 5A.14).

The bike lane on-ramp approach treatment should be installed across the westbound to southbound I-95 on-ramp and again across the westbound to northbound I-95 on-ramp.

Table 5A.3: Summary table of recommendations for Indiantown Road

Indiantown Road			
Location		**Recommendations**	**Note**
Ramp EB to SB I-95		Mark/sign shoulder to better facilitate ramp crossing	
Ramp SB I-95 to EB		Mark/sign shoulder to better facilitate ramp crossing	
Ramp NB I-95 to EB		Mark/sign shoulder to better facilitate ramp crossing	
Bridge over canal EB and WB		Provide shoulder as bike lane	
Ramp WB to SB I-95		Mark/sign shoulder to better facilitate ramp crossing	
Ramp WB to NB I-95		Mark/sign shoulder to better facilitate ramp crossing	
Ramp SB I-95 to WB		Mark/sign shoulder to better facilitate ramp crossing	Will require guardrail relocation
Intersection with Turn-pike plaza		Provide bike lane slot to left of right turn only lane	

The eastbound to northbound I-95 on-ramp requires no special treatments.

The northbound to westbound I-95 and the southbound to westbound I-95 off-ramps should have the bike-lane off-ramp treatment installed. It should be noted that the southbound to westbound off-ramp is on the approach to an overpass and consequently has a sloped shoulder behind a guardrail (Figure 5A.15).Installing the off-ramp treatment at this location would require regrading the berm and relocating the guardrail. Once again, bicyclists would have to negotiate a valley gutter.

The westbound approach to the Turnpike ramp intersection should be striped as a typical right turn drop lane bike lane per the FDOT Standard Design Drawings (Index 117346, 12 of 13). This is illustrated below (Figure 5A.16).

5A.5 BELVEDERE ROAD FROM FLORIDA'S TURNPIKE TO PARKER AVENUE: 6.0 MILES

The pilot study for Belvedere Road extends from Florida's Turnpike to Interstate 95 (Figure

5A.17), and includes eleven distinct segments as identified in the existing conditions report. (127.1, 128.1, 128.2, 128.3, 129.1, 130.1, 130.2, 131.1, 132.1, 132.2, 132.3). Each of these segments is currently operating below the bicycle accommodation performance threshold of Bicycle Level of Service "C" for priority corridors. Anecdotally, there seems to be significant demand for bicycling in this area, as twelve bicyclists were observed passing under I-95 in just a few minutes on the day of the field review.

EXISTING CONDITIONS, OPPORTUNITIES AND CHALLENGES

The first segment is from the Turnpike overpass to the intersection with Jog Road. This section is six lanes and divided, and currently includes shoulders just under four feet wide. These shoulders are adjacent to a traffic flow of over 30,000 vehicles per day moving at a posted speed of 50 miles per hour, resulting in a Bicycle Level of Service of "D" for segment 127.1. Each side of the roadway is approximately 38.5 feet wide. The utility of the shoulders for bicycle use

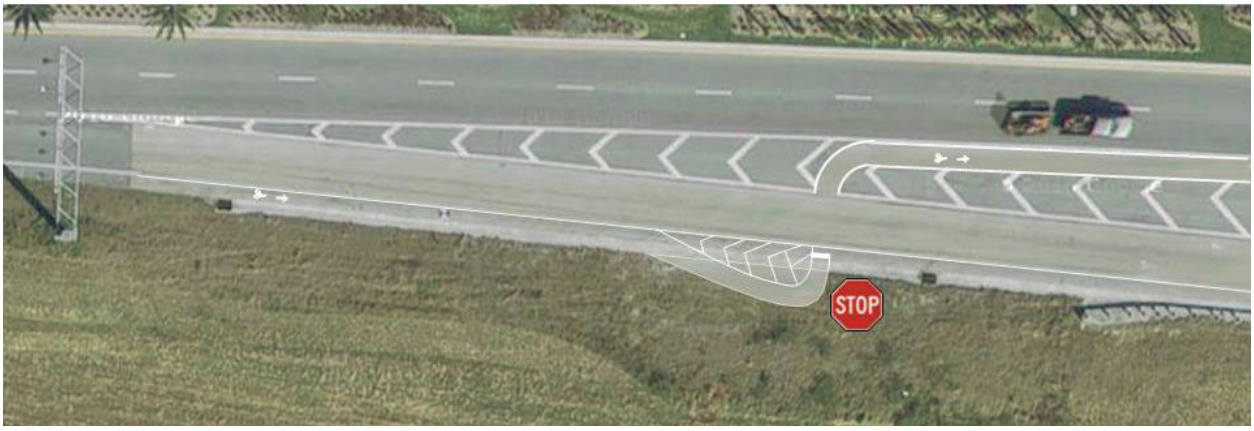

Figure 5A.12: Proposed treatment to facilitate bicyclists crossing of on-ramp

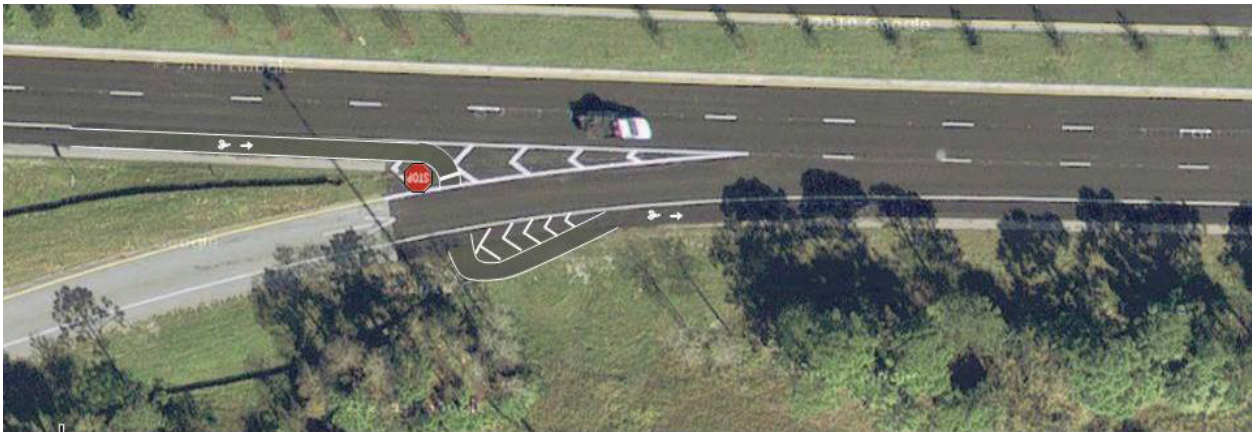

Figure 5A.13: Proposed treatment to facilitate bicyclists crossing of off-ramp

Figure 5A.14: Proposed treatment to facilitate bicyclists crossing of bridge

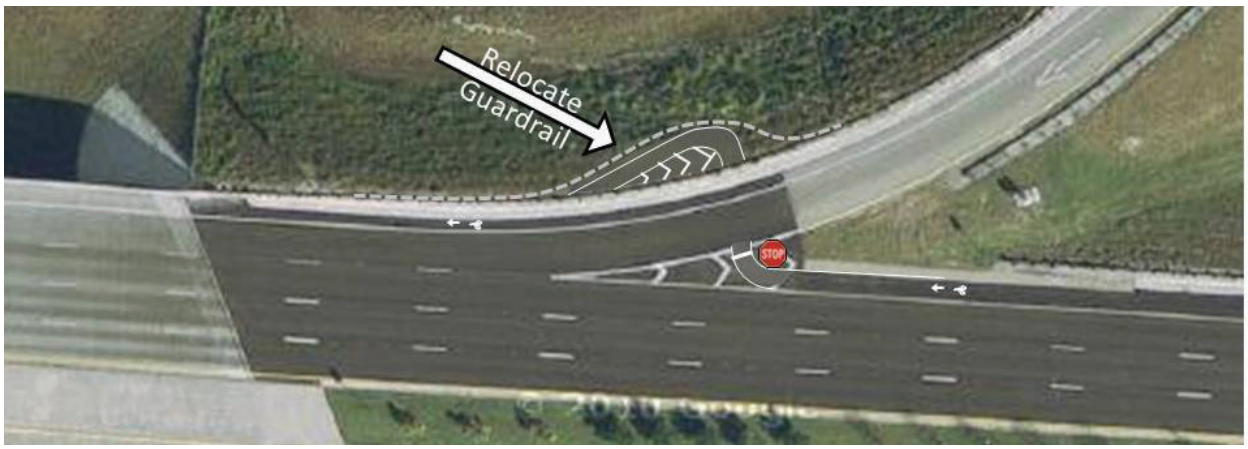

Figure 5A.15: Proposed treatment to facilitate bicyclists crossing of off-ramp

across the Turnpike was further hindered by the presence of a noticeable amount of debris on the day of the field review. Also, despite the presence of a very wide gore area between the right turn lane and the rightmost through lane, there is no bike lane "slot" on the eastbound approach to the Jog Road intersection.

The next segment (# 128.1) is found between Jog Road and Drexel Road, also has four-foot shoulders, adjacent to a four lane, divided roadway. Even with the shoulders, traffic volumes in excess of 26,000 vehicles per day and a posted speed of 45 miles per hour contribute to a challenging bicycle experience, as indicated by a Bicycle Level of Service grade of "D." The width of the shoulder is somewhat variable throughout this section, which adds to the challenges for bicycling.

East of Drexel Road, the width of shoulders becomes narrower and more variable, typically around two feet. The speed limit is reduced to 35 miles per hour in this segment (#128.2), but the reduced shoulder and slightly higher traffic volumes result in a worse condition for bicycling, indicated by a Bicycle Level of Service of "E." The roadway is generally open-shouldered through this section, with the

Figure 5A.16: Proposed treatment to facilitate through moving bicyclists at intersection with Turnpike Plaza

exception of curbed radii at the intersection of the eastbound side with Fieldstone Way.

There is a short bridge over a canal about a half-mile east of Drexel Road; the bridge spans are approximately 26 feet wide in each direction. This canal represents the beginning of a new segment (#128.3) which is no longer divided, but includes a center two-way left turn lane. The speed limit is reduced to 30 miles per hour in this segment, and the shoulder area is further reduced to just over one-foot; these conditions contribute to a continuing Bicycle Level of Service of "D." The segment ends at the intersection with Haverhill Road, which includes a very narrow (just under three feet) bike lane slot on the eastbound approach.

Between Haverhill Road and Military Trail (segment #129.1), the roadway is again four lanes and divided, with three-foot shoulders adjacent to 11-foot lanes. The posted speed limit is 30 miles per hour, and traffic volumes are reported at over 28,000 vehicles per day, yielding a Bicycle Level of Service grade of "D."

Between Military Trail and Congress Avenue, Belvedere Road fronts the Palm Beach International Airport on the south side of the road. The roadway itself is six lanes and divided, with a narrow (approximately two-feet) shoulder area striped off within a curbed cross section. Traffic volumes are in excess of 27,000 vehicles per day through this section. An observed change in the posted speed limit from 40 miles per hour west of 8th Street (segment # 130.1) to 45 miles per hour east of 8th street (segment #130.2) yields bicycle Level of Service results of "D" and "E," respectively. Each side of this divided roadway is approximately 35.5 feet across (three lanes plus shoulder).

Between Congress and Australian Avenues, the roadway remains six lanes and divided, shoulder space is non-existent on the westbound lanes, and is approximately three feet wide eastbound. The 45 mile per hour speed limit and the increased traffic volumes of over 36,000 vehicles per day combine with the tight geometry to yield a Bicycle Level of service of "E."

East of Australian Avenue, to Mercer Avenue, segment # 132.1 is six lanes and divided, with no shoulder space. The existing three lanes in each direction are contained within 34 feet of roadway. The speed limit of 45 miles per

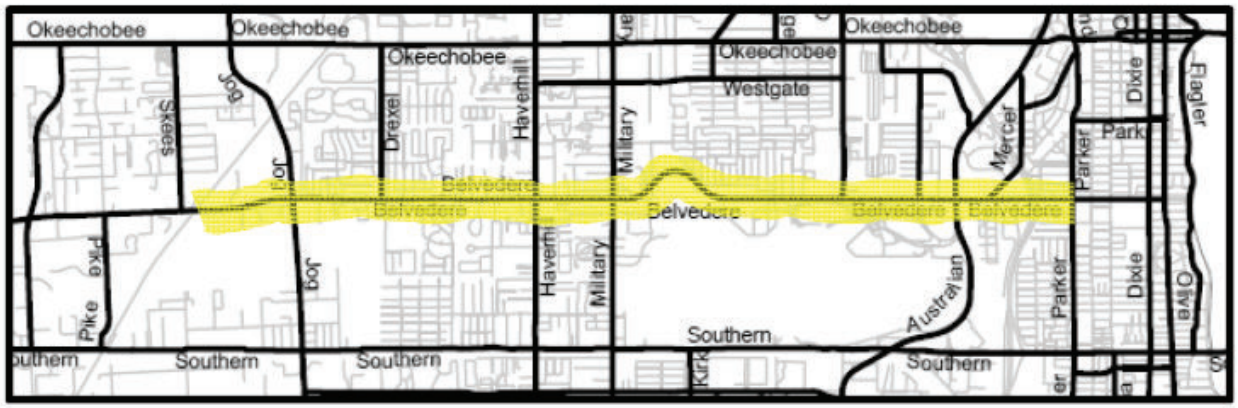

Figure 5A.17: Overview of Belvedere corridor.

hour and the high traffic volumes through this stretch yield a Bicycle Level of Service of “E.” East of Mercer Avenue, through the I-95 interchange, the roadway is reduced to four lanes, but lack shoulder space, relatively high speeds and traffic volumes continue to challenge the bicycling conditions of segment # 132.2, giving it a Bicycle Level of Service grade of “E” also. The roadway characteristics stay very similar through to Parker Avenue, but with even narrower lanes, continuing this highly stressful environment through the end of this study corridor (segment #132.3).

RECOMMENDATIONS

The recommendations to improve bicycling along Belvedere Road are shown in Table 5A.4, and are described in detail in the paragraphs that follow.

The shoulder on the Turnpike Overpass could be widened to five feet or more if used in conjunction with eleven - foot travel lanes. This lane configuration and the improved surface condition brought about by resurfacing would bring the Bicycle Level of Service grade for this segment to “C,” which equals the performance threshold for priority corridors. A regular maintenance regimen to remove debris would also enhance the experience for bicyclists through this section.

Belvedere Road is six lanes wide coming across the turnpike, but the outside lane becomes a right turn-only lane at the intersection with Jog Road, and the shoulder disappears on this approach, dying out to the right of the right turn lane in advance of the intersection. This approach should be re-striped to as a typical right turn drop lane bike lane per the FDOT Standard Design Drawings (Index 117346, 12 of 13), as shown in the recommendations for Indiantown Road above.

Between Jog and Drexel Roads, the existing four-foot shoulders do not provide accommodation that meets the performance expectation, but do provide a basic facility. As this is not a State Road, narrow lanes could be considered with the 45 mile per hour speed limit (at the discretion of responsible engineer of the implementing agency). However, even a 5.5-foot wide bike lane adjacent to 10 -foot lanes would not bring the roadway to the performance threshold of Bicycle Level of Service “C.” A pathway adjacent to the

roadway would be difficult due to the presence of an embankment down to a canal on the south side of the road.

From Drexel Road to the canal bridge, shoulders could be widened and made more consistent. A consistent four-foot wide shoulder and the improved pavement condition brought about through resurfacing would bring this section to the desired performance threshold of Bicycle Level of Service "C." Any shoulder widening project will need to involve alterations to the curb radius at the intersection with Fieldstone Way.

As the shoulders disappear over the canal bridge, a Bicycle Warning Sign (W11-1) with a supplementary plaque (Bicycles on Bridge When Flashing) and real-time activated flashing lights should be considered in advance of the spans. Between the bridge and Haverhill Road, the shoulders could be widened as they were west of the bridge.

The eastbound bike lane slot at the intersection with Haverhill Road could be widened to four feet upon resurfacing with a careful apportionment of the 60 feet of total roadway width shared by the bike lane, two through lanes, and three turn lanes.

East of Haverhill Road the posted speed limits drop to 30 miles per hour, perhaps making this roadway a stronger candidate for considering lanes narrower than 11 feet. The segment between Haverhill Road and Military Trail is very constrained and would benefit from such a strategy. Reducing lane widths to 10.5 feet could provide enough space for four-foot wide bike lanes and result in a Bicycle Level of Service grade of "C," which would meet the performance threshold for priority corridors.

The segment east Military Trail, extending to 8th street, could also benefit from reduced lane widths to provide wider shoulders. A consistent four-foot wide shoulder adjacent to 10.5 - foot lanes would, along with the improved pavement condition that results from resurfacing, bring this segment to the expected performance threshold of Bicycle Level of Service "C." However, such a strategy should consider that the posted speed limit is higher here, at 40 miles per hour. If this strategy is not chosen, or if a higher level of accommodation is desired, options for a pathway adjacent to the south side of the roadway could be explored. Right of way acquisition may be made easier by the fact that the adjacent property is owned by the County, through the Department of Airports. A sidepath adjacent to the airport would be less susceptible to several of the problems associated with such facilities, as the number of driveway and roadway intersections would be limited along this large, secure single parcel. It appears that a trail project would be relatively simple in the area between Military Trail and 8th Street, but would get more complicated between 8th Street and Congress Avenue and then Congress Avenue and Australian Avenue, as the airport frontage includes a number of designed landscape areas with established and sizeable plant material.

Between Congress Avenue and Australian Avenue, the existing pavement could again allow narrower lanes, but it should be noted that the speed limit is again higher, at 45 miles per hour. Ten and one-half-foot wide lanes, together with the improved pavement

Figure 5A.4: Summary table of recommendations for Belvedere Road

Belevedere Road			
From	**To**	**Recommendations**	**Note**
Turnpike Overpass	Jog Road	Restripe to widen existing shoulder	Re-stripe Jog Road intersection to match FDOT drop lane treatment
Jog Road	Drexel Road	Restripe to provide bike lane	Maximizing shoulder by using narrow lanes will still not bring performance to threshold
Drexel Road	Haverhill Road	Widen shoulder	Activated warnings on bridge, widen slot at Haverhill intersection
Haverhill Road	Military Trail	Restripe	Narrow lanes likely needed
Military Trail	Congress Avenue	Restripe	Narrow lanes likely needed, or trail adjacent to EB lanes possible
Congress Avenue	Australian Avenue	Restripe	Narrow lanes likely needed, or trail adjacent to EB lanes possible (Airport property)
Australian Avenue	Parker Avenue	Activated warnings and Shared Lane Markings	Trail possible adjacent to EB lanes (DOT Property)

condition brought about by resurfacing, would provide a more standard-width bicycle facility and nudge the Bicycle Level of Service to 3.67, which is close to “C,” but not quite, and so would not meet the performance threshold. This section could perhaps accommodate a pathway adjacent to the Airport property, but would impact the established landscape areas as discussed above.

Between Australian Avenue and Mercer Avenue, the existing lanes are already very narrow and the speed limit is 45 miles per hour, but a lane width of 10 feet would allow a four-foot shoulder. Such a configuration would still yield a Bicycle level of Service Score of “D”. The right-of-way limits appear very tight to the edge of pavement through this segment, but the south side of the roadway is bounded by an undeveloped private parcel and right-of-way for the flyover ramps leading from I-95 to the Airport, so a pathway is a possibility. Shared Lane Markings could be considered through this constrained section to provide continuity and positive guidance to motorists and bicyclist to share the roadway space. It is not known to what degree shared lane markings can improve the perception of safety and comfort modeled by Bicycle Level of Service, but they have been shown to induce motorists to give wider clearance when passing bicyclists. Bicycle Warning Signs (W11-1) with real-time activated flashers would also communicate the presence of

bicyclists to motorists in this very busy and constrained corridor (Figure 5A.18).

The final section, from Mercer Avenue though I-95 to Parker Avenue, is similarly constrained, and would also be a candidate for Shared Lane Symbols supplemented with activated flashing warning signs. Lane widths are already very narrow. Underneath I-95, much of the land adjacent to the south side of the roadway, between Mercer Avenue on the west side and the off-ramp from Northbound I-95 on the east, is owned by Florida DOT, and so the possibility of a pathway could be investigated through this portion of the segment.

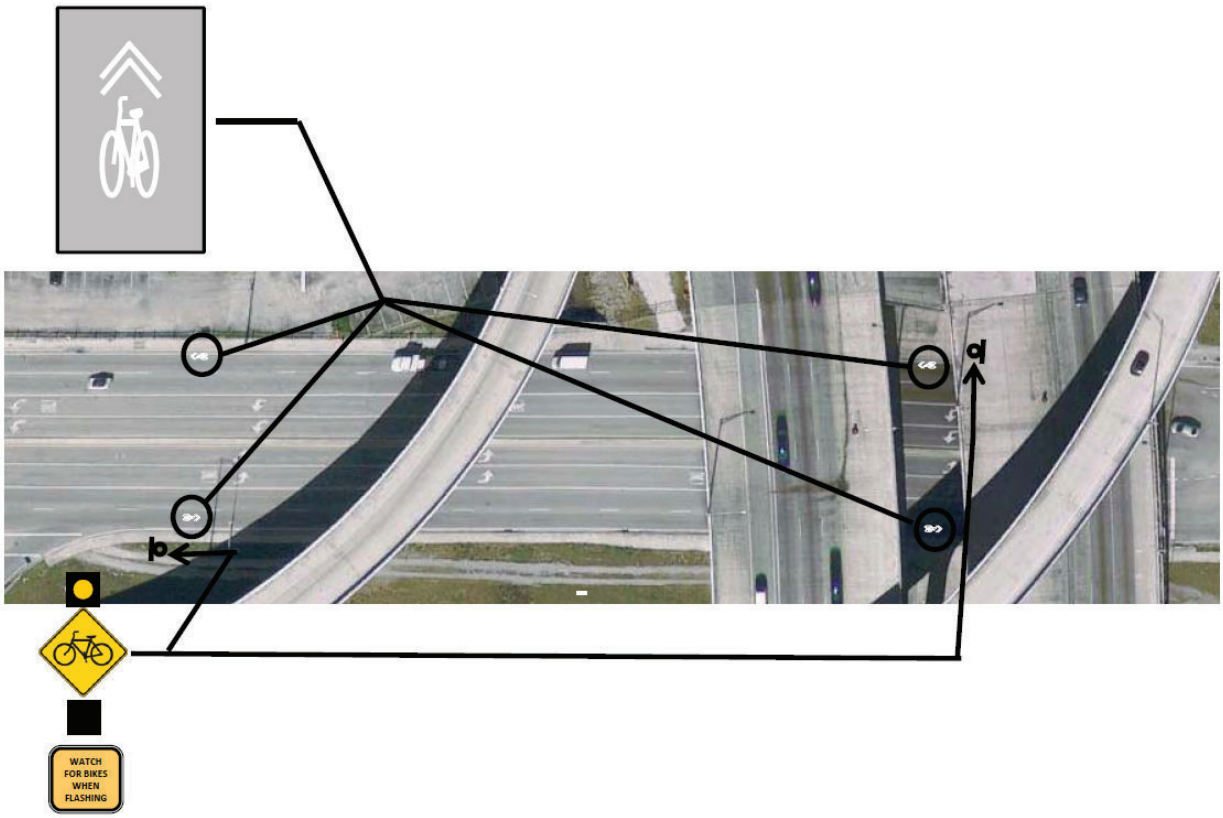

Figure 5A.18: Proposed Shared Lane Markings and activated warning signs under I-95 overpass

5A.6 LAKE WORTH ROAD (SR 802), FROM MILITARY TRAIL TO OCEAN BOULEVARD: 4.6 MILES

This corridor covers the easternmost end of Lake Worth Road as well as a pair of one-way streets, Lake Avenue and Lucerne Avenue, that connect the City of Lake Worth to the Lake Worth Bridge and ultimately out Ocean Boulevard (Figure 5A.19). The portions of Lake Worth Boulevard covered in this corridor are found between Military Trail and A Street (segments 399.1 and 400.1). These are each operating below the performance threshold of Bicycle Level of Service "C" established for priority corridors. The portions of Lake Avenue contained in this corridor are found between A Street and Ocean Boulevard (segments 385.1, 385.2, 386.1, and 386.2). The section between Dixie Highway and Federal Highway (385.2) is currently operating at Bicycle Level of Service "D"; the other sections are currently operating at Bicycle Level of Service "C." The sections of Lucerne Avenue covered in this study are between A Street and the foot of the Lake Avenue Bridge; these segments currently function very well for bicyclists, and have achieved Bicycle Level of Service "A."

EXISTING CONDITIONS, OPPORTUNITIES AND CHALLENGES

The westernmost distinct section of Lake Worth Road within this corridor is found between Military Trail to Congress Avenue (segment # 299.1) This section is six lanes and divided, and already has a narrow shoulder area striped off (field measured at 2.8 feet). The total pavement width for each direction is approximately 36 feet, indicating that the roadway is already using 11-foot wide travel lanes. Traffic data indicate that there are close to 45,000 vehicles per day along this section, subject to a speed limit of 45 miles per hour. The relatively high traffic volume and speeds work with the narrow shoulders to create a bicycling environment that is very challenging, as evidenced by its Bicycle Level of Service grade of "E." The field measurements and other observations along this segment indicate that the shoulder width is less than three feet, adjacent to a curbed roadside, and is somewhat variable in it's width.

The section between Congress Avenue and A Street is reduced to four lanes, but still divided. It, too, already has 3-foot shoulders, set within directional cross-sections of approximately 27 feet (12-foot travel lanes). The shoulders are not designated as bike lanes, except for the portion immediately in advance of and through the Tri-Rail tracks and the I-95 underpass. (The west bound bike lane under I-95 even features its own pavement marking warning of the railroad crossing ahead.) The slightly wider shoulders and reduced traffic volumes in this segment help it yield a slightly better Bicycle Level of Service "C."

The results of the Bicycle Level of Service analysis for these two segments west of I-95 indicate that despite the presence of the existing shoulders, traffic conditions are contributing to a highly stressful environment for bicycling. There are potential alternate routes nearby, making use of publicly owned parcels and park property on the south

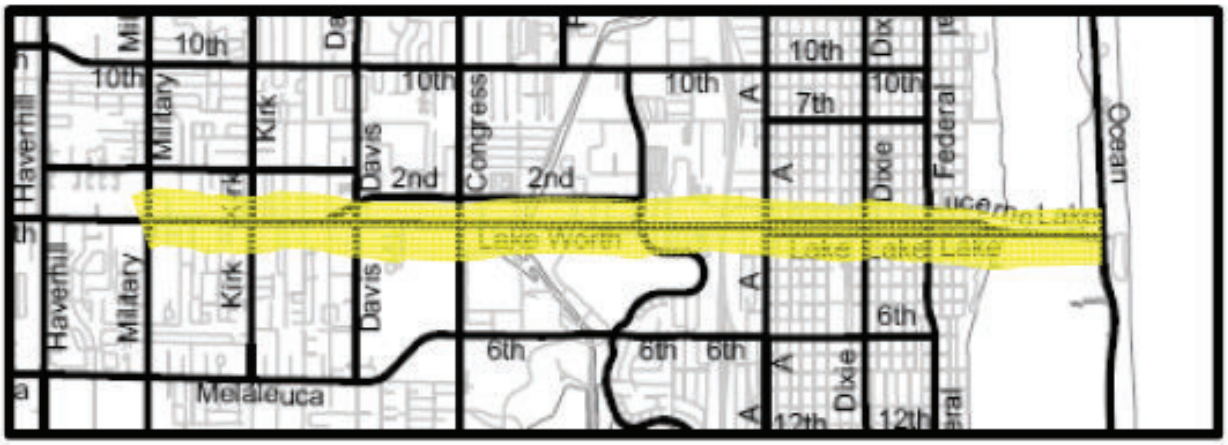

Figure 5A.19: Overview of Lake Worth corridor

side of Lake Worth Road, and of Lakewood Road and 2nd Avenue on the north. These will be discussed in more detail in the recommendations section below.

On the east side of Interstate 95, Lake Worth Road terminates in a roundabout, which allows eastbound traffic to continue on (one-way) Lake Avenue and receives westbound traffic from (one way) Lucerne Avenue. Lake Worth Road and Lucerne Avenue each have marked bike lanes on the approaches to this roundabout. The roundabout itself, however, has no bike lane or shoulder of any kind, forcing bicyclists to share the lane with motor vehicles through the roundabout. Given the low speeds of roundabouts, this is an appropriate design choice and consistent with best practices of roundabout design; bicyclists who are uncomfortable with sharing the road have several opportunities to exit the roadway to the sidewalk via driveway cuts, and then proceed thorough this intersection as pedestrians via the crosswalks.

The segments of Lake Avenue that extend from the A Street roundabout, through downtown Lake Worth, and to the Lake Worth Bridge (385.1, 385.2, and 386.1) are all two lane, one-way streets, with striped-off parallel parking on each side. Traffic volumes are relatively low through this stretch, under 9,000 on the two segments east of Federal Highway (385.1 and 385.2), and speeds are also low, subject to a posted limit of 25 miles per hour through this business district. The on-street parking area is more heavily utilized in the section between Dixie Highway and Federal Highway (385.2), limiting its utility as a space for bicyclists, giving this section a Bicycle Level of Service of “D,” while the other segments of Lake Avenue all achieved the expected Bicycle Level of Service “C.” The striping of the parking areas is already done in such a way that the travel lanes on the roadway are only 10.5 feet wide. Curb extensions at the end of each block though the business district also inhibit the utility of the parking area as a travel zone for bicyclists.

While a considerable number of bicyclists were observed in the Lake Worth business district during the field review, few bike racks were apparent.

Across the bridge and through to Ocean Boulevard (Segment 386.2), Lake Avenue is again a two way street, of a four lane, divided configuration. A four and one-half-foot bike lane is striped on the roadway throughout this section, including the bridge deck (paved approaches and bascule drawbridge deck). While traffic is heavier through here - reported at over 12,000 vehicles per day - the presence of the shoulder and the continuing low speed allow this last segment to achieve a very strong Bicycle Level of Service "C," which meets the performance expectation for priority corridors.

Returning westbound from the bridge into downtown on one-way Lucerne Avenue, three distinct segments (429.1, 429.2, 429.3) each have very wide bike lanes (over six feet) that work with the relatively low traffic volumes (under 8,000 vehicles per day) and low speeds (25 mph) on this two lane road, to provide excellent accommodation for bicyclists, as indicated by their having achieved Bicycle Level of Service "A." The only critical point observed in this section is that the pavement markings (especially lane lines and crosswalk markings) were somewhat worn, making the excellent facilities provided here hard to discern in places.

RECOMMENDATIONS

The recommendations to improve bicycling through the Lake Worth Corridor are shown in Table 5A.5, and are described in detail in the paragraphs that follow.

The sections between Military Trail and Congress Avenue, and then Congress Avenue to A Street, are each already providing basic facilities, maximizing what is feasible within the cross section. A four-foot shoulder could be squeezed in the section between Military Trail and Congress Avenue by using 10.5-foot travel lanes, however the posted 40 mile per hour speed limit would preclude this option on this FDOT road (and doing so would still only provide a Bicycle Level of Service of "D"). In any event, at the next resurfacing project, efforts should be made to stripe the roadway from the outside in, so that the bike lane/shoulder area ends up delineated with a consistent width, and any discrepancy in the overall width of the roadway is absorbed across the three remaining travel lanes.

The section between Congress and A Street could be re-striped and widened to provide up to a four or five foot wide shoulder; a consistent four-foot shoulder with the improved pavement condition provided by re-striping could improve the segment's performance to the expected threshold of Bicycle Level of Service "C." Any shoulder widening work may have to include alteration of intermittent curbs at some intersections, such as at the bus stop pull-out areas on both sides of the road between Cleveland and Erie Streets (Figure 5A.20).

There is also potential for alternate route designations on both the north and south sides of the Lake Worth Corridor (Figure 5A.21). Given the generally high traffic volumes along Lake Worth Road, some bicyclists may prefer alternate routes to even the best bicycle facilities. Since shoulders already exist on Lake Worth Road and they could be improved for bicycling with relatively inexpensive interventions, these alternate routes could be identified in addition to the

shoulder improvements described above, providing the broadest possible range of options for a variety of users.

The first and easiest alternate route is to the north side of Lake Worth Road, making use of Lakewood Road between Military Trail and Davis Road, then connecting to 2nd Avenue North via Davis Road, and then again paralleling Lake Worth Road along 2nd Avenue North from Davis Road, across Congress Avenue and through to Detroit Street (just west of I-95). Lakewood Road is a two-lane undivided roadway with a posted speed limit of 30 miles per hour. Observance of its low speed limit is ensured by the presence of speed tables throughout the length of the road from Military Trail to Davis Road. The roadway is approximately 30 feet wide providing ample space for four-foot bike lanes adjacent to 11-foot lanes, if desired. The existing cross section is open shouldered, which would allow for widening, provided ample consideration of drainage is made when impacting the grassy strips and shallow swales adjacent to the roadside. There are intermittent locations where a curb has been constructed to shore up the asphalt sidewalks adjacent to some of the lower swale areas. Any shoulder re-design would have to address the impacts to these features. The most significant intersection is a crossing of Kirk Road, which is already signalized, and so would present no special crossing difficulty for bicyclists along Lakewood Road, however the signal poles may need to be relocated if widened shoulders are to be carried through the intersection.

Davis Road is a two-lane undivided roadway with a posted speed limit of 35 miles per hour.

Figure 5A.20: Curbs at bus pull-outs encroach on the bike lane just between Akron and Erie Streets

The 900-foot long stretch between Lakewood Road and 2nd Avenue North has an open-shouldered cross section and thus could be a candidate for shoulder widening; however a very close and deep ditch on the west side of the road and a close sidewalk on the east side of the road will require careful consideration in the course of such a project. The existing roadway is only slightly more than 20 feet across, and so is a very tight space to share; shared lanes symbols are recommended if shoulder widening is determined to be infeasible so that bicyclists may be encouraged to take the lane for this short stretch between the two east-west roadways.

Second Avenue North is also a two-lane, undivided roadway with a 35 mile per hour speed limit. It was included as a study network corridor in the Existing Conditions report, broken into two segments: one between Lake Worth Road and Congress Avenue (segment #44.1) and one between Congress Avenue and Boutwell Road (Segment #44.2) These

Figure 5A.5: Summary table of recommendations for the Lake Worth Corridor

Lake Worth Corridor			
Lake Worth Road			
From	**To**	**Recommendations**	**Note**
Military Trail	Congress Avenue	Maximize existing shoulder	Narrow lanes may be needed, performance threshold will not be met
Congress Avenue	A Street	Widen shoulders	Isolated curbs will need to be altered
Alternate Route North			
Lakewood Road			
Military Trail	Davis Road	Widen shoulders	Isolated curbs may need to be altered, drainage issues
Davis Road			
Lakewood Road	2nd Avenue N	Widen shoulders	Shared Lane Marking if ditches make shoulders infeasible
2nd Avenue N			
Davis Road	Boutwell Road	Widen shoulders	Isolated curbs and some constrained parcel frontage
Boutwell Road	End	Widen shoulders	Likely low volumes, existing condition may be sufficient
End	Lake Worth Road	Trail connection	Negotiation w/ Tri-Rail necessary, or connect via Detroit St.
Alternate Route South			
Trail Connections			
Congress Avenue	A Street S	Trail connection	Negotiation w/ Parks, City, School Board, PBCC
Lake Avenue			
A Street	Bridge	Shared Lane Markings	
W. side of bridge	E. side of bridge	Concrete insert for shoulder	
Lucerne Avenue			
A Street	Bridge	Existing facility sufficient	Current markings could be “freshened”

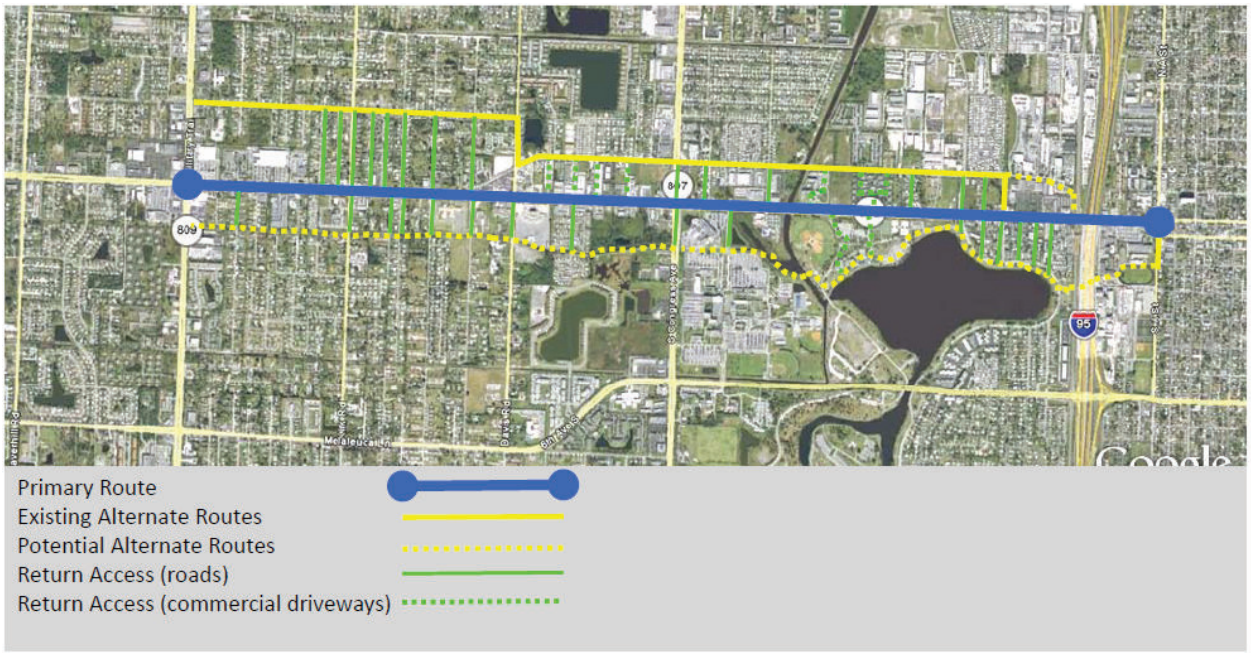

Figure 5A.21: Potential alternate routes near Lake Worth corridor

segments each currently have lane widths of 10.5 feet and no separated shoulder space. The traffic volume reported for segment # 44.1 is approximately 5,600 vehicles per day, yielding a Bicycle Level of Service grade of "D." while slightly higher volumes (8,600 vehicles per day) are reported on segment # 44.2, yielding a Bicycle Level of Service grade of "E." While these results indicate a still challenging environment for bicyclists, the greatly reduced traffic volumes and lower speeds (relative to Lake Worth Road) may make 2nd Avenue North an attractive alternate route for some bicyclists. Development of four-foot wide shoulders could drastically improve bicycling conditions, bringing the two segments to Bicycle Level of Service Grades of "B" and "C," respectively. There are drainage swales adjacent to the eastbound lanes, which will require some regrading and drainage engineering if widened shoulders are developed here. Between Congress and Boutwell, there is a brief section adjacent to the frontage of the Palm Club apartment complex where the north side sidewalk is brought fairly close to the edge of pavement and where several mature banyan trees are very close to the existing south side edge of pavement; any shoulder widening project will need to address these constraints, perhaps with a brief shared lane section highlighted by real-time activated warning signs and flashers.

The proposed alternate route along 2nd Avenue North includes some sizeable intersections with Congress Avenue and Boutwell Road. The Congress Avenue intersection is already signalized; any shoulder widening project would need to include bringing the shoulders to the intersection (which would be relatively straightforward, as the configuration does not include any right-turn only lanes).The intersection with Boutwell Road is a 4-way Stop controlled intersection,

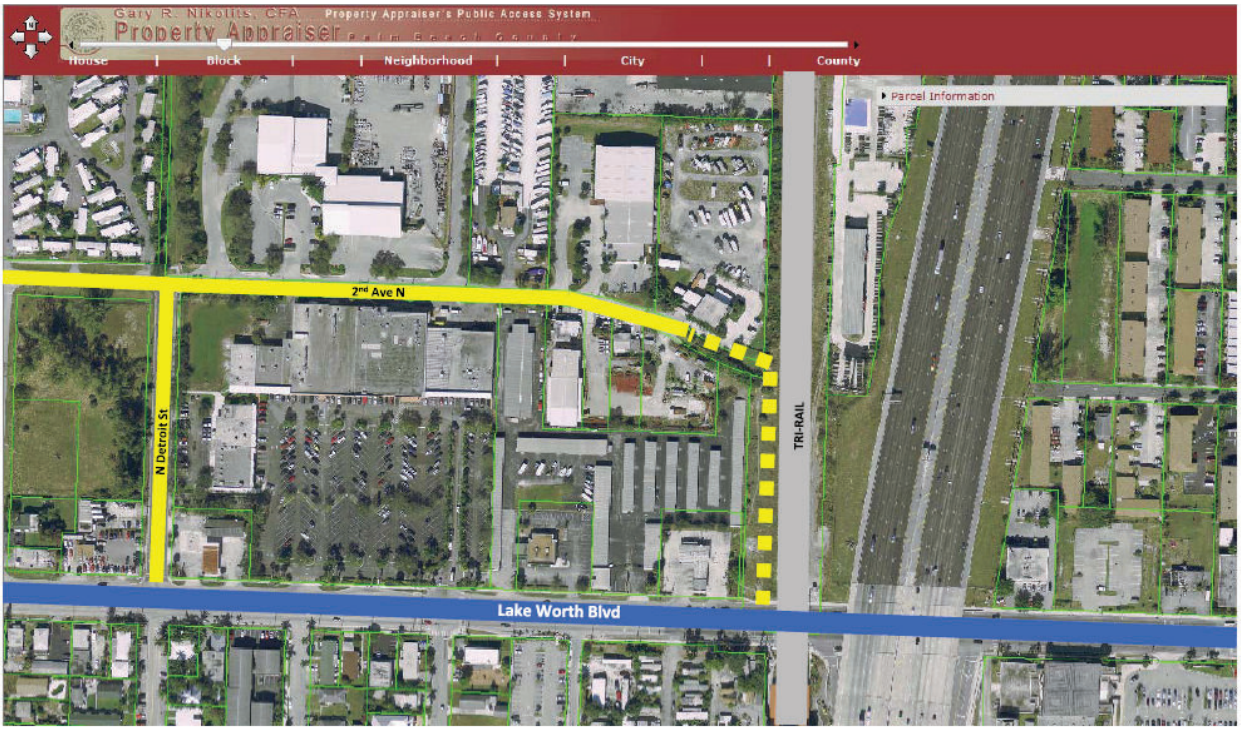

Figure 5A.22:Parcel map showing access from 2nd Avenue North to Tri Rail right of way

and already includes a somewhat narrow bike lane slot adjacent to the right turn lane on the eastbound approach.

The proposed alternate route continues east past Boutwell Road to Detroit Street. This section was not included in the study network for the Existing Conditions report; it has narrow shoulders between Boutwell Road and Buffalo Street, and no shoulders between Buffalo and Detroit Streets. Shoulders could be added, however it is likely that this section has very low volumes, as it serves accesses only a trailer park and a few commercial parcels. After a brief jog across one block of Detroit Street, users of this alternate route could rejoin Lake Worth Road at the intersection of Detroit Street and Lake Worth Road, in order to continue along Lake Worth Road eastbound under I-95.

Another option could be explored at the eastern terminus of 2nd Avenue North, which dead ends into the Tri-Rail right of way just 450 feet north of Lake Worth Road. If an agreement could be made with SFRTA for a secure easement, a trail connection could be made directly to 2nd Avenue North to Lake Worth Road on the west side of the tracks (Figure 5A.22).

An alternate route could also be explored on the south side of Lake Worth Corridor, utilizing several contiguous publicly owned parcels including the John Prince Park, which fronts over a half-mile of Lake Worth Road. Coming from the east, a trail could possibly be routed from east of I-95, connecting from Lake Avenue and A Street via the campus of Lake Worth Community High School (Figure 5A.23). 1st Avenue South provides access

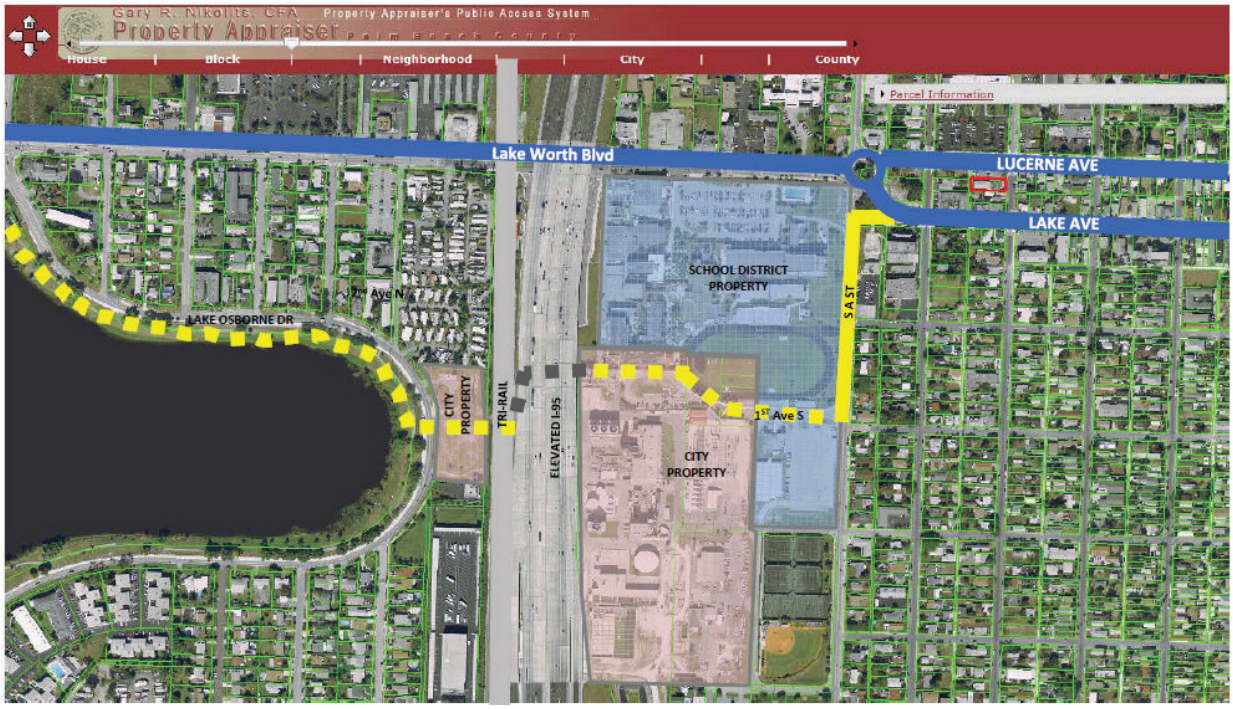

Figure 5A.23: Parcel map showing potential connections under I-95

under the elevated I-95 and a trail connection and a crossing of the Tri-Rail tracks (which would have to be negotiated with SFRTA) could connect to Lake Osborne Drive and John Prince Park via a City owned parcel (with electrical transmission infrastructure - Figure 5A.24) on the east side of Lake Osborne Road, just south of the intersection with Erie Street. This connection could then lead to an existing trail in the park, which could be improved and extended to connect to either the campus of Palm Beach Community College or a County-owned parcel at 2728 Lake Worth Road (either of these connections would require a bridge over the canal that runs between John Prince Park and the PBCC campus). Once an appropriate route through the PBCC campus was determined, the trail would ultimately connect to Congress Avenue.

Figure 5A.24: View from Lake Osborne Drive under I-95

On the east side of I-95, the roadways are largely performing well and have maximized their potential for on-street bicycle facilities. The roundabout at A Street is designed in a manner that is compliant with the current best

practices of roundabout design with respect to bicycles. There are no shoulders or bike lanes on Lake Avenue, but the lanes are already very narrow and it is unlikely that any on-street parking space could be taken away. Given these circumstances, shared lane symbols would be appropriate to emphasize the proper positioning of bicycles in the shared lanes. Additional bike parking throughout downtown Lake Worth would be responsive to the observed level of bicycling in the area.

On the Lake Worth Bridge, the draw span has a bascule deck, including over the area of the striped shoulders. A lightweight, air-entrained concrete insert in the shoulder areas would improve the experience of bicycling over the bridge.

The bike lanes on Lucerne Avenue provide excellent bicycle accommodation; the pavement markings for the bike lanes and the crosswalks in this area should be reapplied so that they are more visible to all users.

5A.7 BOYNTON BEACH BOULEVARD (SR 804) AND OCEAN AVENUE, FROM CONGRESS AVENUE TO OCEAN BOULEVARD: 2.75 MILES

The pilot study for Boynton Beach Boulevard extends from Congress Avenue to Federal Highway (Figure 5A.25), and includes four distinct segments as analyzed in the existing conditions report (152.1, 152.2., 152.3, 152.4). Each of these currently operates below the expected performance threshold of Bicycle

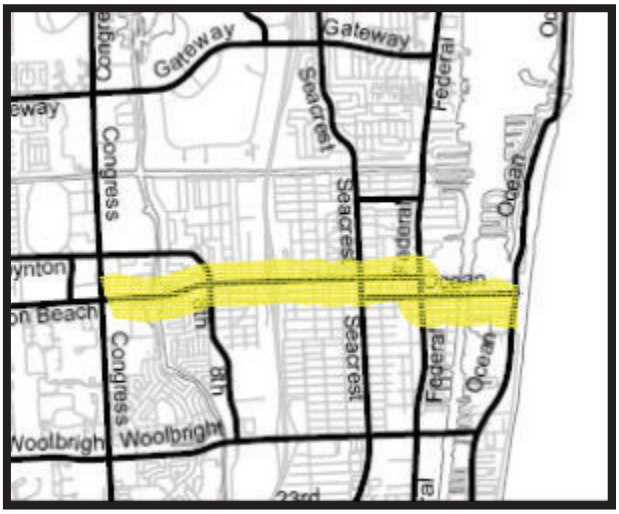

Figure 5A. 25:Overview of Boynton Beach Boulevard corridor

Level of Service “C” established for priority corridors. Access across the intracoastal waterway (via the Ocean Avenue bridge) to the town of Ocean Ridge is also considered in this study (segments 492.1, 492.2, and 492.3), all of which currently operate above the performance threshold established for priority corridors.

EXISTING CONDITIONS, OPPORTUNITIES AND CHALLENGES

Beginning at Congress Avenue, and extending through to Federal Highway, each of the segments of Boynton Beach Boulevard includes a three-foot shoulder area, which is not designated as a bike lane (Figure 5A.26). The roadway is six lanes wide and divided, between Congress Avenue and I-95 (segments 152.1 and 152.1). There are very heavy traffic volumes—in excess of 40,000—through these segments, resulting in Bicycle Level of Service grades of “D” for

Figure 5A.26: Shoulders along Boynton Beach Boulevard are narrow in places

both segments. The narrow shoulder space continues across the I-95 overpass, and the roadway configuration drops to four lanes, divided, on the east side of the Interstate (segment #152.3) through the intersection with NW 2nd Street. The traffic volumes drop to around 31,000, but the narrow shoulders aren't enough to raise the level of bicycle accommodation above Bike Level of Service "D". In the last segment, between NW 2nd Street and Federal Highway, the cross section changes to include a two-way center left turn lane. The narrow shoulders remain, but the reported traffic volumes decrease to around 16,000, allowing the Bicycle Level of Service grade to reach "C" for this half-mile stretch.

The portion of Ocean Boulevard that connects across the Intracoastal Waterway is a two lane roadway; it is divided between Dixie Highway and the eastbound approach to the bridge (segments 492.1 and 492.2), and across the span itself, and then changes to include a two way left turn lane between the bridge and Ocean Boulevard (segment 492.3). Each of these segments includes five-foot wide designated bike lanes which provide acceptable accommodation for a priority corridor that sees just over 7,000 vehicles per day and is subject to a posted speed limit of 30 miles per hour. The segment between Federal Highway and the bridge actually achieves a Bicycle Level of Service of "A" due to the additional space provided by the adjacent on-street parking lane, while the other segments still provide an exceptional level of accommodation, equal to Bicycle Level of Service "B." The corridor ends at a T-intersection with Ocean Boulevard; at this terminal point the bike lane is interestingly (and properly) marked as a left turn only lane, to the left of a right turn lane for both bikes and motor vehicles (Figure 5A.27).

Figure 5A.27: Left turn only bike lane at Ocean Boulevard

There are potential alternate routes close to Boynton Beach Boulevard on both sides of I-95. These will be discussed in the recommendations section below.

RECOMMENDATIONS

The recommendations to improve bicycling through the Boynton Beach Road corridor are shown in Table 5A.6, and are described in detail in the paragraphs that follow.

Each of the segments west of I-95 is currently using 11- foot lanes to provide a three-foot shoulder in a very constrained cross section. The segment between Congress and Old Boynton Road has a posted speed of 40 miles per hour, and so could not be striped with narrower lanes per FDOT practice. The section between Old Boynton Road and I-95, however, has a posted speed limit of 35 miles per hour, and so could be considered for narrower lanes. The existing roadway is 36 feet across each half (three lanes), and so could be striped with 10.5 -foot lanes and a 4.5 -foot bike lane. Such changes, would bring the Bicycle Level of Service for this segment to a score of 3.60, which is close to the designated performance threshold of 3.50 (Bicycle Level of Service "C"), but does not achieve it. Such changes do reflect a substantially improved level of bicycle accommodation, and should still be considered, but more will need to be done to provide safety and comfort to a broader cohort of bicyclists.

On the I-95 overpass, the bike lanes are positioned to the left of a diagonally striped shoulder/gore area which is approximately four feet wide and adjacent to the curb. Some of this space could be given to the bike lane, or the two areas could be flipped, so that the "gore" (re-striped with a "V" pattern) serves as a buffer between the bike lane and the shared travel lanes.

Narrowed lanes could make a marginal improvement to the sections east of I-95, as well; the posted speed limit is 35 miles per hour and lanes down to ten feet could be considered in accordance with FDOT practice. There is ample space for four-foot bike lanes in conjunction with 10.5-foot lanes between I-95 and NW 2nd Street, which, together with the improved pavement condition brought about by resurfacing, will yield a Bicycle Level of Service score of 3.53, which just barely misses achieving a grade of "C." The section between NW 2nd Street and Federal Highway is already performing at Bicycle Level of Service "C," but a ten-foot lane could allow for the striping and designating of a four-foot wide bike lane, which would meet the minimum dimensions recommended by AASHTO and FDOT.

Alternative routes could also be identified through this corridor, both north and south of Boynton Beach Boulevard and east and west of I-95 (Figure 5A.28). Beginning on the west side of I-95, Ocean Drive (¼ mile to the south) provides a parallel route between Congress Avenue and NW 8th to the south, and Old Boynton Road provides an alternate option to the north between the same extents. Ocean Drive is a two lane, undivided roadway, fronted almost exclusively by residential parcels. No posted speed limit was observed on Ocean Drive, so it is assumed to be 25 miles per hour. The roadway is approximately 24 feet wide and has an open-shouldered cross section. Ocean Drive is already posted with D11-1 (Bike Route) signs, although with no directional indicators or destination signage (Figure 5A.29). If this is developed further as an alternate to the Boynton Beach corridor, bicycling conditions could be enhanced

Figure 5A.6:Summary table of recommendations for the Boynton Beach Corridor

Boynton Beach Boulevard Corridor			
Boynton Beach Boulevard			
From	**To**	**Recommendations**	**Note**
Congress Ave	Old Boynton Road	Constrained	Existing 3 foot shoulders
Old Boynton Road	W. side I-95	Restripe	Narrow lanes may be needed, performance threshold will not be met
W. side I-95	E. side I-95	Restripe	Buffered bike lanes possible
E. side I-95	NW 2nd St	Restripe	Narrow lanes may be needed, performance threshold will not be met
NW 2nd St	Federal Highway	Existing 3ft shoulder sufficient	Narrow lanes could allow 4 foot bike lane
Alternate Route South (west of I-95)			
Ocean Drive			
Congress Avenue	NW 8th Street	Shared Lane Marking	Shoulder widening possible, constrained across bridge, return access via NW 8th Street or trail connection at Industrial Avenue
Alternate Route North (West of I-95)			
Old Boynton Road			
Congress Avenue	Boynton Beach Boulevard	Existing facility sufficient	
Alternate Route North (east of I-95)			
Ocean Avenue			
NW 3rd Street	Seacrest Boulevard	Existing facility sufficient	Curb extensions could calm traffic further, connection via NW 3rd St.
Seacrest Boulevard	Federal Highway	Existing facility sufficient	Low volume street
Federal Highway	Ocean Drive	Existing facility sufficient	Existing bike lane

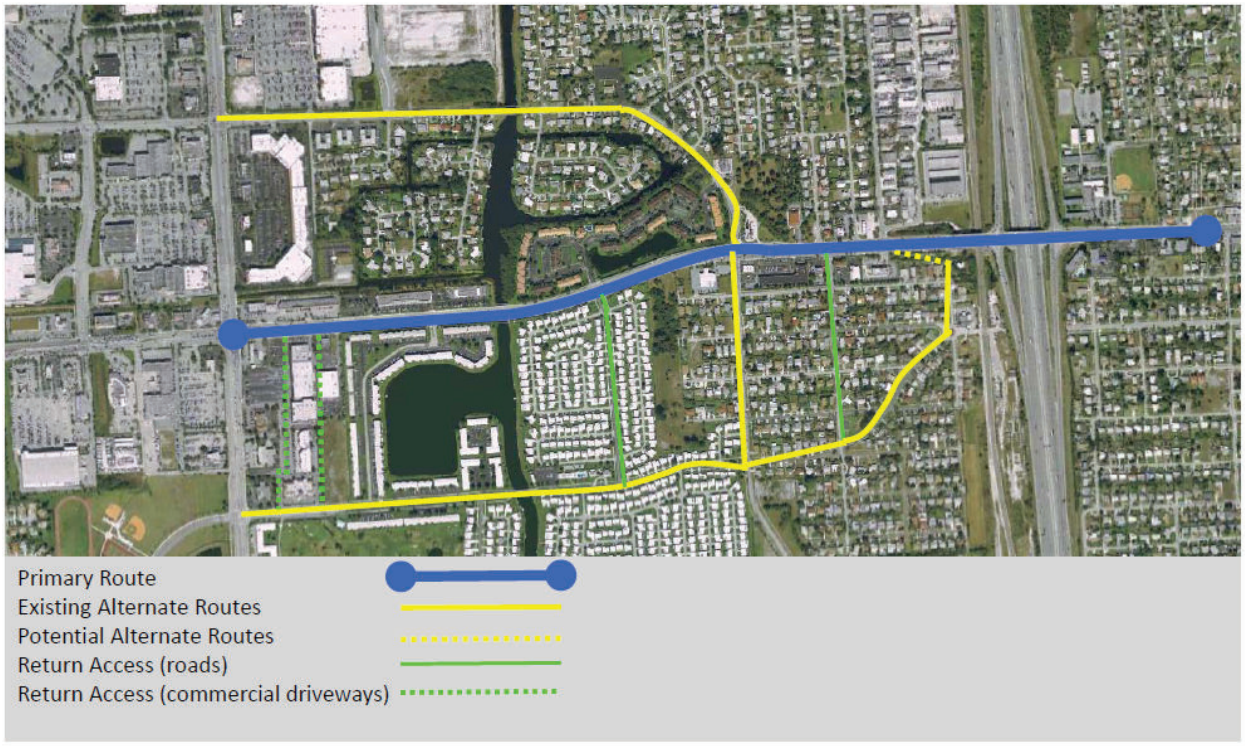

Figure 5A.28: Potential alternate routes near Boynton Beach Boulevard (west of I-95)

Figure 5A.29: View of Ocean Drive

by the addition of shared lane markings or by construction of a widened shoulder; if shoulders were widened, bicycle traffic would still have to share the lanes across the narrow canal bridge between SW 18th Street and SW 13th Street. An alternate route along Ocean Drive would still provide access to most commercial destinations on the south side of Boynton Beach Boulevard, the most substantial of which is a shopping plaza at the southeast corner of Boynton Beach Boulevard and Congress Avenue, which has access to Ocean Drive along its south frontage. Bicyclists travelling to or from points east of I-95 would likely connect back to Boynton Beach Boulevard via NW 8th Street; the signalized intersection at NW 8th Street and

Boynton Beach Boulevard would provide the easiest opportunity for westbound bicyclists to cross Boynton Beach Boulevard. There is also a signalized intersection at Boynton Beach Boulevard and Industrial Avenue. There may be a possibility to make a trail connection from this intersection to the north end of NW 6th Street, which would allow for an additional ¼ mile of travel away from Boynton Beach Boulevard, but such connection would likely involve significant regrading along the embankment for the I-95 overpass.

On the north side of Boynton Beach Boulevard, Old Boynton Road has been recently reconstructed to include bike lanes between Boynton Beach Boulevard and Congress Avenue. The roadway is four lanes with a two-way center left turn lane west of the canal bridge between Venice Drive and Coral Drive, and reduces to two lanes with a center left turn lane east of the bridge (Figure 5A.30). These conditions, together with the reported traffic volume of over 12,000 vehicles per day combine for a Bicycle Level of Service of “C” on this potential alternate route. The reduced traffic and wider facilities will make this an attractive alternate to Boynton Beach Boulevard, however those who choose to use this route will not have return access to Boynton Beach Boulevard before Congress Avenue, limiting access to commercial parcels along the north side of Boynton Beach Boulevard. Eastbound bicyclists continuing across I-95 would be able turn onto eastbound Boynton Beach Boulevard at the signalized intersection of Old Boynton Road and Boynton Beach Boulevard.

On the east side of I-95, Ocean Avenue could serve as a south-side alternate route to Boynton Beach Boulevard between NW 3rd

Figure 5A.30: Buffered bike lane through curve on Old Boynton Road

Street and Federal Highway (Figure 5A.31). Connection for eastbound travelers can be made via NW 3rd Street which is already designated as a bike route by means of a D11-1 (Bike Route) sign. As Boynton Beach Boulevard is a divided roadway where it intersects NW 3rd Street, a diagonal median cut and refuge would be necessary to facilitate access to for westbound travelers from NW 3rd to Boynton Beach Boulevard.

Along Ocean Avenue, between NW 3rd Street and Seacrest Boulevard, the street is approximately 39 feet wide, with a posted and speed limit of 25 miles per hour. This roadway is very accommodating of bicyclists, and, if desired, that experience could be enhanced further with the construction of curb extensions (to match the streetscape east of Seacrest Boulevard) and further calm the motor vehicle traffic.

The proposed bike route along Ocean Avenue crosses Seacrest Boulevard, a four lane roadway with a two way left turn lane, a 45 mile per hour speed limit and a daily traffic

count of over 12,000 vehicles per day. While bicyclists using Ocean Avenue will need to exercise caution when crossing Seacrest, the current traffic control (STOP signs directed at Ocean Avenue only) should be sufficient for most bicyclists. If a more protected crossing is desired, a concrete median could be installed within the two-way left turn lane across the intersection with Ocean Avenue, providing a refuge for through bicyclists. This solution would require prohibiting through movements by motorists on Ocean Avenue and left turns from Seacrest Boulevard onto Ocean Avenue.

East of Seacrest, Ocean Avenue was among the roadways evaluated in the Existing Conditions report. Each of the segments was calculated to perform very well for bicyclists, earning grades of "A" or "B" in the Bicycle Level of Service evaluation. The roadway between Seacrest and Federal Highway is still primarily residential and, despite its narrow lanes and no shoulder space, would remain at Bicycle Level of Service "A" up to a volume of over 1,400 vehicles per day. The sections from Federal Highway, across the bridge and to Ocean Drive all have bike lanes, which provide an excellent bicycle accommodation on a roadway with traffic volumes of just over 7,000 vehicles per day.

An alternate route was explored on the north side of Boynton Beach Boulevard, via NW 3rd Street to NW 4th Street, across Seacrest Boulevard to NE 1st Street and Back to Boynton Beach Boulevard. While this route travels mostly residential streets and provides good bicycling conditions, it does not connect through to Federal Highway and accesses no significant destinations. While it does provide good neighborhood mobility, it is not recommended as an alternate route to Boynton Beach Boulevard.

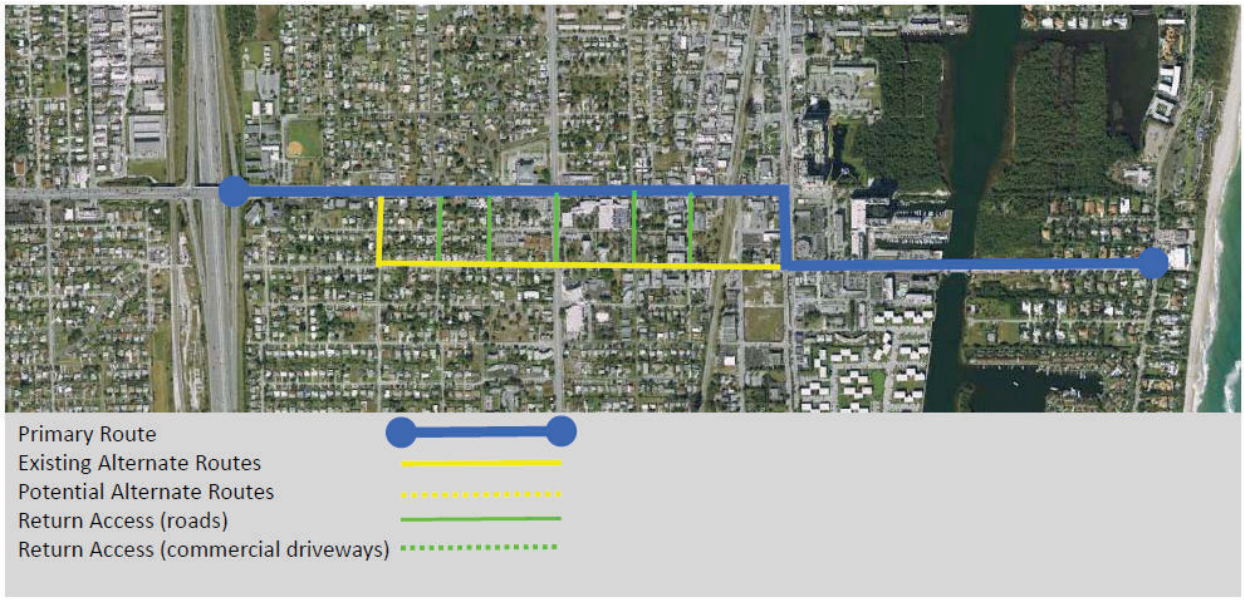

Figure 5A.31: Potential alternate routes near Boynton Beach Boulevard (east of I-95)

5A.8 SUMMARY

These pilot studies have identified a variety of strategies to improve bicycling conditions in the six selected corridors. These strategies include restriping to provide room for bicycle facilities, widening shoulders where feasible, constructing pathway connections and identifying parallel routes which serve destinations within the subject corridors, as well as enhanced signage and marking to increase awareness of bicyclists in constrained environments. The strategies presented here should not only provide the agencies responsible for these specific corridors with ideas of how to better accommodate bicycling, but will also serve as case study examples for the County and other member jurisdictions of the Palm Beach MPO for similar corridors around the county, especially those that have been indicated for more detailed study in the recommendations described in Chapter 5.

Chapter 6: Implementation Process and Recommendations

6.1 INTRODUCTION

This chapter proposes an action plan for improving bicycle transportation in Palm Beach County. Chapter 2 assessed existing conditions across the County with respect to the performance of existing infrastructure. Chapter 3 examined those existing conditions in the context of the County's future aspirations and Chapter 4 established locations for needed improvements. Chapter 5 identified segment-specific infrastructure projects which could improve the performance of specific roadways where needed. The questions remaining, then, are how to order the implementation of these projects in a way that is consistent with the vision, goals and objectives described in Chapter 2, and also responsive to the diverse needs of different areas within the County and the County's financial constraints.

This chapter describes a method by which the recommended infrastructure projects are prioritized and grouped for phased implementation in response to those priorities. This chapter also recommends policy and program initiatives that can be undertaken by the MPO, the County, and local municipalities. These policies and programs will contribute toward the Plan's vision by addressing conditions and issues other than roadway infrastructure that also affect the overall safety and convenience of bicycling in Palm Beach County.

The recommended infrastructure improvements identified in Chapter 5 are prioritized in this chapter, and then stratified into five tiers, each representing what could be accomplished with investments phased in increments of $30 million. This prioritization will allow the Palm Beach MPO to discern which projects to support with funding assistance, and to easily identify bicycle infrastructure needs with respect to other transportation projects. The projects identified for Tier 1 have been found to offer the most potential benefit relative to their potential cost, and would amount to over 220 miles of improved on-street bicycle conditions, if implemented. When added to the roadways that already operate at their expected performance threshold, these projects will result in approximately two-thirds of the arterial and collector roadways across the County operating at acceptable levels for bicycling. Together with the recommended policies and programs, these projects will make a substantial contribution towards the realization of the vision described in this Plan.

6.2 COST AFFORDABLE PLAN OF INFRASTRUCTURE PROJECTS

The vision of this Plan calls for Palm Beach County to become a place where bicycling is experienced as a safe and convenient transportation option and an attractive form of recreation. The improvement of infrastructure performance with respect to bicycling can assist in the realization of this vision. The performance thresholds described in Chapter 3 represent a consensus opinion, regarding the level of infrastructure performance consistent with the vision, derived from

public input, steering committee members, and MPO staff. The needs described in Chapter 4 are identified in relation to those performance thresholds, and the facility recommendations described in Chapter 5 were selected specifically for each facility in order to bring them into compliance with the performance thresholds. The total list of these recommendations can be understood as a "needs plan," in that it encompasses all infrastructure improvements needed to bring all roads to the designated performance thresholds. However, the total estimated costs for all such improvements exceeds $140 million, and given the financial constraints faced by the County, FDOT, and local municipalities, completing these projects will take decades. What is necessary is a "cost affordable plan," which will identify those projects of highest priority, especially in the context of the goal statements that support the Plan's vision. Once the overall list of projects has been prioritized, the leading projects can then be identified as the ones most appropriate to implement first, with a given budget and timeframe. The criteria by which projects were prioritized and their subsequent grouping in priority tiers to guide their ultimate implementation schedule are described below.

PRIORITIZATION PROCESS

The projects identified in Chapter 5 were compared using a "neo-traditional benefit/ cost index," wherein a number of benefits were calculated to be realized if a project was implemented, and the sum of these benefits was then divided by an estimated project cost, producing a resulting priority score, which can be used to order the priority of all projects with respect to one another. Each of the benefits calculated for the projects is related to goals identified in Chapter 2, which, if achieved, will assist in the realization of the Plan's vision. The benefit criteria include various measures of demand as well as the magnitude of improved segment performance to be gained by the project. The demand for segment improvement is composed of several discrete elements including population density, employment density, proximity to schools, proximity to transit, and identification in previous planning projects.

The costs for each project are based on the recommendation types: restriping for bike lanes, adding shoulders, and detailed corridor studies. The following sections describe the rationale and methodology used to calculate both benefits and costs.

Benefits

Response to public demand

It makes intuitive sense to prioritize facility improvements in response to some measure of demand, that is, to invest in areas where the bicycle facilities are likely to be used. This prioritization approach applies several different data sources to help ensure that facility investment resources are focused on roadways and areas where there is a reasonably clear need. These demand indicators include:

- direct public input;
- previous countywide planning initiatives;
- previous local planning initiatives;
- a density measure based on demographic data;

- proximity to schools; and
- proximity to transit.

These six indicators are described in detail in the following paragraphs.

Direct public input:

This plan uses direct public input, derived from public workshop meetings held in various parts of the county in April 2010. Participants at these meetings were given the opportunity to mark roadway maps with strips of tape, indicating the roadways upon which they most wanted to see improved bicycling conditions. To focus their responses on their true highest priorities, these participants were limited to marking only five miles of roadway each. These public responses identified desired improvements on 216 individual roadway segments. A total of 312 "votes" were cast across these segments, with 47 segments receiving 2 or more votes. The highest vote-getter received six votes. These votes were recorded in the database and used to compare demand from workshop participants in the prioritization process.

Previous countywide planning initiatives:

The draft plan developed in 2000 also considered which roadways should be of highest priority for improved bicycling conditions. The list of bike routes developed for that plan was reviewed by the current plan's steering committee, and the segments of this updated list were awarded points - equivalent to 10 votes from the public - for use in calculating the prioritization scores.

Previous local planning initiatives:

This plan recognizes the efforts and input of local agencies who have adopted bicycle plans that identify corridors on which improved bicycling conditions are needed. Roadways on this Plan's study network that coincide with these locally identified corridors also received the equivalent of 10 votes in the prioritization tally.

Density measure:

Because no public input process can ever reach every potential user of the transportation network, additional demand measures were also studied to augment the input received at the public workshops. Demographic data (population and employment) from the MPO's travel demand model was analyzed at the Traffic Analysis Zone (TAZ) level. A population and employment density score was calculated for each TAZ ((population x employment)/ area). This density score approximates where bicycling may be an especially useful mode due to a high number of trip origins (residences, represented by the population figure) in close proximity to trip destinations (places of employment, represented by the employment figure). A higher number of each within a given TAZ should indicate a higher potential for bicycling, because the proximity of origins to destinations is close enough that bicycling may be seen as a convenient mode if conditions are perceived to be safe. These density scores were applied proportionately to segments as they border or pass through TAZs, allowing for a comparative measure of bicycle trip potential for each segment.

Proximity to schools:

Bicycling is a mode of transportation available to a wide variety of users, including school children who may be too young to drive, and college students who may not be able to afford a car, or find bicycling more convenient on campuses where parking spaces are at a premium. Lifelong bicycling habits may be developed if opportunities for safe bicycling are available to school aged children, and bicycling to school is a form of physical activity that could become a healthy habit for children who may otherwise lead increasingly sedentary lifestyles. For these reasons, proximity to schools and universities is a prioritization factor for the improvements considered in this Plan. The school enrollment information (including college) contained in the MPO's travel demand model was analyzed at the TAZ level to calculate an enrollment density relative to the TAZ area. The density scores of any TAZs that intersected with a ½ mile buffer around each segment were applied proportionately to the segments to allow a comparative measure of proximity to schools.

Proximity to transit:

The segments of the study network were analyzed for their proximity to major transit hubs as a factor in their prioritization. All segments within one mile of either a Tri-Rail station or a Palm Tran Timed Transfer Location were given a tally in this regard, to add to their cumulative benefit score in the prioritization process. Bicycle access to important transit nodes can greatly benefit the utility of transit as a mode choice for many users. Good bicycle access can extend the range at which transit is understood to provide convenient access to homes and destinations, and can increase the length of trips to which bicycles contribute. This prioritization with transit in mind is in accordance with the Plan's vision of making bicycling a convenient transportation option - making bicycling a viable choice for a greater variety of trip types and serving a broad variety of users, including those with less access to personal motor vehicles.

These measures of demand, applied to the project prioritization for this Plan, are responsive to the vision of bicycling as a viable form of transportation in Palm Beach County. Bicycle facilities located where people have requested them or where they are likely to serve more trips will be experienced as more convenient.

Improved segment performance:

Individual segments were evaluated for how well they accommodate bicycle travel using the Bicycle Level of Service Model, as described in Chapter 2. These existing conditions results are expressed as both numeric scores (generally between 0 and 7, with two decimal places) and pseudo-academic letter "grades" (A-F). Every segment then, has a numeric value representing its existing Bicycle Level of Service. Two values representing desired future performance thresholds were also designated (3.5 for Bicycle Level of Service "C" and 4.5 for Bicycle Level of Service "D"), and one or the other was assigned to each segment, according to criteria described in Chapter 3. The difference between these two scores, the existing condition and the desired future condition, can be understood to be a

measure of the improvement gained by the successful implementation of the project.

Implementing a project on a roadway whose existing score is three points from its appropriate threshold score will have a more significant benefit than implementing a project on a road that is only one point from its designated threshold. Additionally, segments of the study network are of various lengths. Some segments are mere fractions of a mile, while others are several miles long. The length of a project impacts the magnitude of the benefit. Longer projects generally provide greater mobility, so the length is also a direct factor in calculating a degree of improvement that can be compared across projects.

The prioritization method in this Plan uses an improvement score in its benefit tally for each candidate project. That score is the result of multiplying the value of the positive change in the segment's Bicycle Level of Service score (ΔLOS) by the length of the project (in miles). Two example calculations are shown in Table 6.1.

Using this approach to compare the relative need for improvement and the performance benefit to be gained by each facility investment allows the candidate projects to be prioritized in response to the Plan's vision of bicycling becoming a safe and convenient transportation option, specifically addressing the goal of providing bicycle facilities that meet the performance threshold expected by the community.

Composite benefit score

The scores for each of the benefit criteria described above were normalized to a 100 point scale (the highest score for each was given a value of 100, then all other scores were recalculated as a proportion of that 100 point scale). The scores of each category were then multiplied by weighting factors selected by MPO staff in consultation with the Plan's steering committee:

Table 6.1: Example calculations of infrastructure improvement magnitude

Sample Road A	Existing Bicycle LOS	Performance Threshold (Desired future Bicycle LOS	Length
	5.34 = E	3.50 = C	0.5 miles
	ΔLOS : 5.34 -3.5 = **1.84**		
	Improvement Score = ΔLOS x length(miles)		
	Improvement Score: 1.84x 0.5 =**0.92**		

Sample Road B	Existing Bicycle LOS	Performance Threshold (Desired future Bicycle LOS	Length
	4.77 = E	4.5 = D	1.75 miles
	ΔLOS : 4.77 -4.5 = **0.27**		
	Improvement Score = ΔLOS x length(miles)		
	Improvement Score: 0.27 x 1.75 = **0.47**		

- 70% for all demand indicators;
- 15% for public votes (including bonuses for inclusion in prior plans);
- 20% for density score;
- 25% for proximity to schools;
- 10% for proximity to transit;
- 30% for facility improvement; and
- Costs.

Typical cost estimates were developed for three types of projects to represent the facility recommendation categories. These costs were based on FDOT standard pay items for Area 12 and recent local project experience, with multipliers built in for mobilization, maintenance of traffic and contingency percentages representing unknown variables. Roadway restriping for bike lanes is estimated based on removal of existing markings and reapplication of bike lane markings. Paved shoulder estimates were based on the addition of five foot shoulders on both sides of the roadway, with alternate costs depending upon the degree of earthwork anticipated adjacent to the roadway (minimal or minor regrading). Projects designated as needing a Detailed Corridor Study (DCSN) are represented by the most expensive possible option, which is the construction of a pathway parallel to the roadway, similarly differentiated by the anticipated intensity of earthwork (minimal, minor, or major regrading). The costs estimated for each of the recommendation categories are shown in Table 6.2.

These typical per mile costs were then multiplied by the length of each segment to which the appropriate recommendation was applied, resulting in an estimated project cost for each segment analyzed in the Plan's study network.

Prioritization: benefits measured against costs

The ultimate purpose of this prioritization process is to identify those projects which deliver the greatest benefit in relation to the degree of investment required to provide those benefits. This emphasis on benefits relative to costs will help ensure that the MPO and implementing agencies receive value in return for their investments. A "neo-traditional benefit to cost ratio" was calculated for each candidate project, by dividing the total benefit score by the estimated project cost. The full formula for this calculation is shown in Figure 6.1.

Table 6.2: Typical costs of recommended facilities

Facility Type	Per mile cost with minimal regrading	Per mile cost with minor regrading	Per mile cost with major regrading
Re-stripe for bike lanes	$16,000	n/a	n/a
Add 5' paved shoulders	$198,000	$218,000	n/a
Construct a 12' concrete sidepath (proxy for DCSN projects)	$358,000	$398,000	$430,000
Note: All costs rounded to nearest $1000			

$$\frac{(70\%\ (\text{demand indicators})) + (30\%\ (\Delta\ \text{LOS} \times \text{length}))}{\text{typical cost} \times \text{length}}$$

where:

Demand Indicators = the sum of:

- Public votes = the number of votes received for the listed project through public input processes, plus 10 for identification in a prior planning initiative (15%)
- Density score = TAZ-based (pop x emp)/area applied to adjacent segments (20%)
- Schools Score = TAZ based enrollment/area applied to adjacent segments (25%)
- Transit Score= 100 if segment is within 1 mile of Tri-rail station or PalmTran timed transfer station, 0 if not (10%)

Δ LOS = the numeric difference between the existing bicycle Level of Service and the value of the selected performance threshold

Typical cost = the estimated per mile cost of the appropriate recommended facility type

Length = segment length in miles

Figure 6.1: Prioritization formula

The formula described above calculated the neo-traditional benefit-to-cost ratio for each segment. These results were then normalized to a 100 point scale (the highest result was given a value of 100 and all other results were recalculated to be expressed proportionately to that 100 point scale.) This scaled result is called the “priority score” in the tables published in Appendix C .

Cost Affordable Plan of implementable projects

The prioritization process evaluated all recommended projects for both the benefit they would provide if implemented, based on various criteria derived from the Plan’s vision and goals, and for the degree of investment needed to realize them. The resulting priority scores allow comparison between potential projects that will guide the sequence of their implementation. While the priority score is calculated for each individual project, the Cost Affordable Plan stratifies these results into five priority tiers. This more generalized stratification will allow the MPO, the County, and municipalities a degree of flexibility when selecting individual projects while still clearly ordering the projects based on how well they serve the priorities that support the Plan’s vision and goals.

The tiers of the Cost Affordable Plan are stratified into incremental investment phases of $30 million. The total estimated cost to meet all the needs identified in this plan (with stand-alone retrofit projects) is approximately $147 million. These projects are then stratified into the five tiers at $30 million intervals.

Because of the benefit-to-cost methodology used for the prioritization process, the highest priority tier covers significantly greater

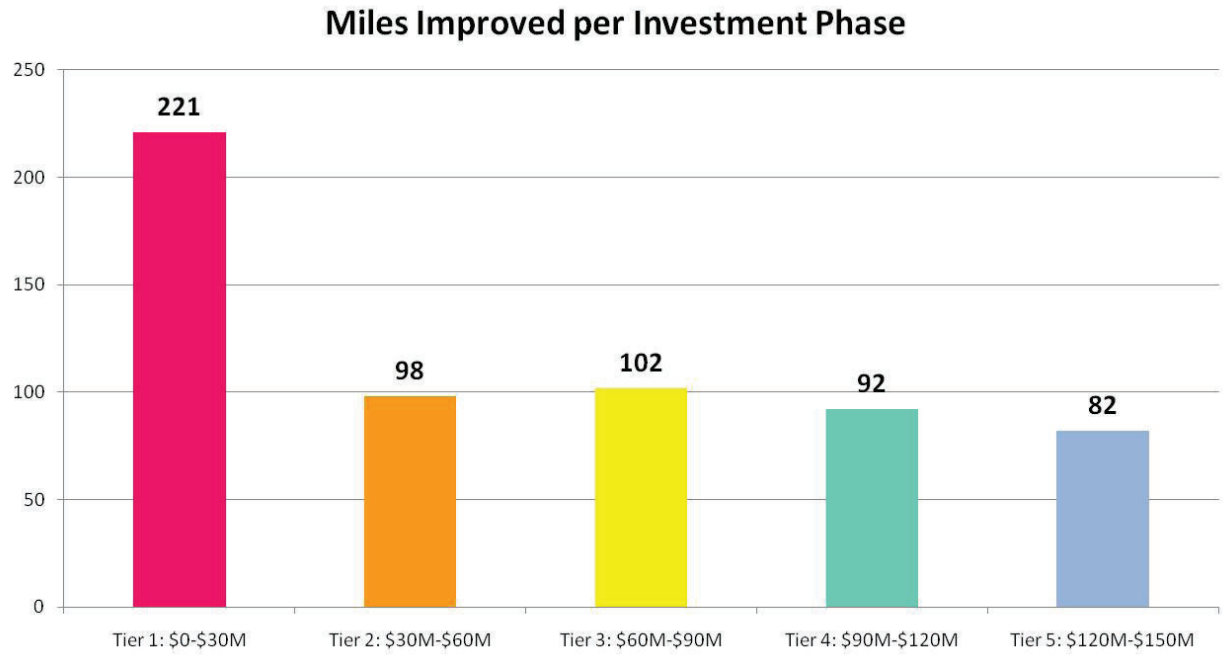

Figure 6.2: Distribution of improvement (in miles) across priority tiers

mileage than the lower priority tiers, as the more cost-effective, high-benefit plans will have been sifted into the higher priority tiers. For example, the projects identified in Tier 1 will help over 220 miles of roadway meet the performance standard, while each of the remaining Tiers will improve between 80-105 miles. The average cost per mile of the Tier 1 projects is approximately $136,000, while the average cost per mile of each of the remaining tiers is over $290,000. A map depicting the distribution of the projects in the priority tiers is shown in Figure 6.12 (page 6-19); the distribution of mileage across the tiers is illustrated in Figure 6.2. A list of the roadway segments and their priority tier assignments is published separately as Appendix C.

Tier 1 projects

The projects within Tier 1 will likely be the first ones whose development the MPO will support, and they represent projects where the greatest benefits can be realized (contributing to the vision of the Plan) in the most cost effective manner. This leads to a particular emphasis on project types that are relatively inexpensive and towards areas that have the intensity of demand indicators that justify more significant investments. The Tier 1 projects will include approximately 131 miles of bike lane restriping projects, 30 miles of shoulder widening, and 60 miles of roadway which will require more detailed corridor studies. These represent 92% of all identified roadway restripe projects, 21% of all shoulder widening projects, and 19% of all detailed corridor study projects. This distribution is shown in Figure 6.3. The cost of Tier 1 projects by type is $2.11 million for restriping, $6.06 million for shoulder widening and $21.71 million for detailed corridor study segments. This distribution is shown in Figure 6.4.

Figure 6.3: Distribution of Tier 1 project types

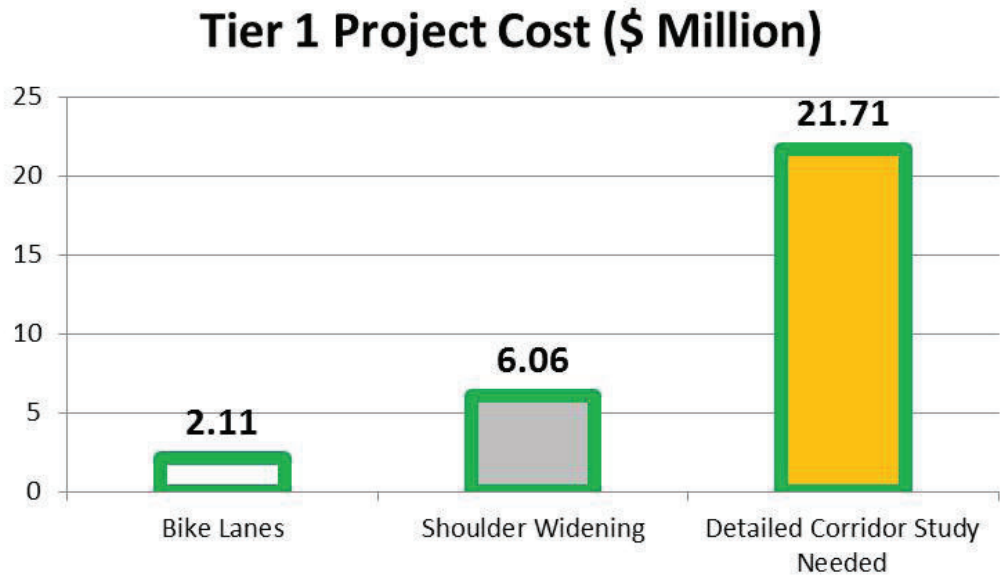

Figure 6.4: Distribution of Tier 1 project costs

While the ultimate implementation sequence of all projects will be determined in process, as the various implementing agencies develop them and nominate them for funding assistance, this prioritization process will help the MPO determine which projects will best contribute to the countywide vision of safer and more convenient bicycling.

If implemented, the Tier 1 projects will provide a major contribution to the vision of a Palm Beach County where bicycling is experienced as a safe and convenient recreation option, and an attractive form of recreation. As depicted in the map in Figure 6.13 (page 6-20), the Tier 1 projects will add 221 miles of bicycle accommodations to the existing roadways that currently meet their designated performance thresholds. The addition of the miles associated with these Tier 1 projects will raise the proportion of roadways meeting their performance expectation for bicycling from under one-half to almost two-thirds, as shown in Figures 6.5 and 6.6. This trend would continue with the implementation of Tier 2 projects, which would bring the total roadway

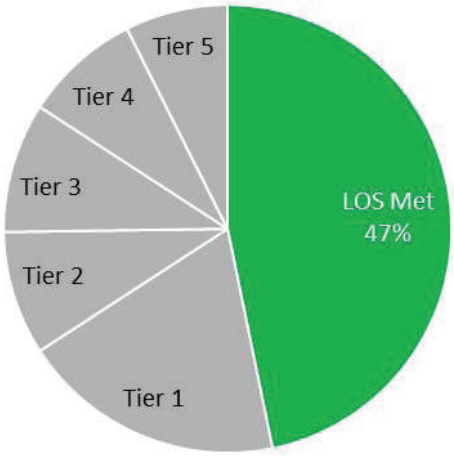

Figure 6.5: Existing share of total network meeting performance standards

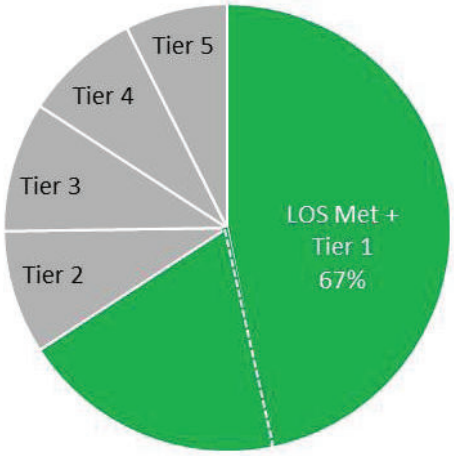

Figure 6.6: Share of total network meeting performance standards after implementation of Tier 1 projects

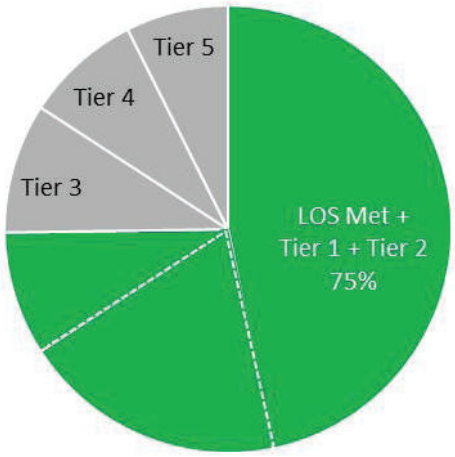

Figure 6.7: Share of total network meeting performance standards after implementation of Tier 1 and Tier 2 projects

miles meeting their bicycle performance expectation to 75%, as shown in Figure 6.7.

6.3 POLICY RECOMMENDATIONS

The vision, goals and objectives of this Plan will provide the Palm Beach MPO and its member jurisdictions with tangible aspirations and attainable milestones as they work together to improve bicycling conditions countywide. To achieve the identified goals and objectives, governing policies must be adopted by the MPO, as well as FDOT, Palm Beach County, and municipal agencies alike.

Policies and programs that encourage bicycling are numerous and varied. This section describes some of those policies and programs and how they generally work. These, and other bicycle friendly policies, can be adopted by local jurisdictions as standalone policies, or as part of a local comprehensive bicycle plan. Adoption of local plans is encouraged by the Palm Beach MPO, and is recognized as a contributing factor in the bicycle project prioritization process described previously in this chapter.

POLICY RECOMMENDATION: ENCOURAGE LOCAL BICYCLE PLANS

The Palm Beach MPO encourages its member jurisdictions to adopt bicycle plans that identify and prioritize local needs; establish design guidance for their engineering departments; and associated policies and programs to encourage bicycling as a useful mode of local travel. Currently, the Cities of Boca Raton and Lake Worth, and the Town of Jupiter have adopted bicycle plans. The MPO encourages other communities in the County to follow their lead. Each community will articulate its aspirations and needs differently, but a concerted effort of seriously considered bicycle planning across the county will provide significant momentum to the countywide vision identified in this Plan and the goals that support it.

The MPO will recognize these efforts from member jurisdictions by awarding extra points in its countywide prioritization process for bicycle projects. The MPO should consider ways to recognize these and other bicycle friendly initiatives during other prioritization processes, such as consideration of candidate projects for the Transportation Improvement Plan (TIP).

POLICY RECOMMENDATION: DESIGNATE SHOULDERS THAT MEET THE CRITERIA FOR BIKE LANES

Research has shown that the availability of rideable shoulder space contributes significantly to a bicyclist's perception of safety and comfort, whether or not that shoulder is designated as a bike lane. The designation of a shoulder as a bike lane, provided it meets the design criteria applicable to the implementing agency, is a relatively low cost option to raise the profile of bicycle facilities available in a community. This increased visibility of bicycle facilities may encourage new cyclists and extend the travel range of existing cyclists. The presence of designated bicycle lanes may also increase motorists' awareness of bicyclists.

The operative design guidance for state roads is the FDOT *Plans Preparation Manual* (PPM); all other roadways are subject to the criteria specified in the *Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways* (commonly known as the "Florida Greenbook").

POLICY RECOMMENDATION: DESIGN NEW BICYCLE FACILITIES TO COMPLY WITH THE PERFORMANCE EXPECTATIONS IDENTIFIED IN THIS PLAN

Beyond the minimum design criteria for bike lanes and shoulders described in the *Plans Preparation Manual* and the *Florida Greenbook*, implementing agencies should examine the overall bicycle accommodation provided on specific roadways (as measured with the Bicycle Level of Service model used in this Plan) and ensure that newly constructed roadways, reconstructed and redeveloped segments, and retro-fitted existing facilities meet the performance expectations described in Chapter 3 of this Plan (i.e. Bicycle Level of Service "C" for priority corridors, and Bicycle Level of Service "D" elsewhere). Meeting these performance expectations on higher speed and higher volume roadways may require facilities wider than the minimum dimensions described in the applicable design documents, or other corridor-specific accommodations as appropriate.

POLICY RECOMMENDATION: IDENTIFY ADDITIONAL SOURCES OF FUNDING FOR BICYCLE FACILITY IMPROVEMENTS

At present the MPO's primary sources for funding bicycle facility improvements are through their inclusion in larger roadway projects (routine accommodation), and through the FDOT Transportation Enhancements Program. Routine accommodation is a very effective way of funding the construction of new bicycle facilities, as it incorporates the relatively small incremental cost of bicycle facilities into significantly larger overall budgets for roadway construction or redevelopment projects. A clear expectation of bicycle accommodation (such as the performance thresholds defined in this Plan), and vigilant oversight to make sure projects meet that expectation, will result in a significant number of new facility miles, accounted for in general transportation budgets.

These general roadway projects, however, have their own prioritization and implementation schedules. To better accommodate bicycling according to the bicycle-specific priorities identified in this Plan, specific additional funding sources should be identified. This will allow the MPO and local implementing agencies to begin the work of implementing stand-alone bicycle projects independently of the schedules dictated by other transportation and development projects.

POLICY RECOMMENDATION: ENCOURAGE THE DEVELOPMENT OF END-OF-TRIP AND BICYCLE PARKING FACILITIES

The MPO should encourage its member jurisdictions to require or incentivize the development of bicycle parking and other end-of-trip facilities through their land development codes. The projects outlined in this Plan will significantly improve the experience of riding a bicycle along roadways in Palm Beach County, however, the utility of bicycling as practical mode of transportation is also dependent upon the ability to securely park that bicycle at one's destination.

Short term parking is usually placed in front of commercial properties, often in the buffer area between the sidewalk and the street. Short term parking allows bicyclists to make quick stops at shops and other businesses, and is not intended to be occupied by the same user for an extended period of time. In a dense urban commercial corridor, short term parking can consist of single bike racks (which can accommodate two bikes) placed at intermittent locations within each block. At malls, shopping centers, big-box stores, and other locations with large parking lots, bike parking should be convenient to major entrances and may consist of multiple racks to accommodate more bicycles. Whatever the environment, short term bicycle parking should be highly visible to encourage use and to heighten security.

Availability of long term bicycle parking is an important aspect of encouraging bicycle commuting. Commuters need a secure place to leave their bicycles for the length of their work shift. If the bicycle will not need to be accessed for four hours or more, it is less critical that long term parking be convenient to entrances to the final destination, but it should be relatively close. Long term parking is often less visible than short term parking, and should therefore be more physically secure, perhaps in the form of a bike locker or a secure room within a building.

Observation of codes in many metropolitan areas in the United States confirms that required bicycle parking as part of land development projects is increasingly common. Frequently, such parking requirements state that bicycle parking should represent a percentage of the required automobile parking (e.g., 3-5%) for the development. Specifications regarding the location of required parking facilities should also be made in consideration of building access, security, user maneuverability, and shelter.

In contrast to the provision of bicycle parking, workplace bicycle lockers, changing rooms, and/or shower facilities are generally not being required or constructed. There are two options to change this situation: adopt incentives to entice developers to build them, or mandate the facilities. Several approaches to the first option are outlined below.

The continued investment in bicycle transportation infrastructure by Palm Beach County's member jurisdictions can be significantly leveraged by offering compelling incentives to developers. There are a number of incentives that can be offered to the (private) sector developing and managing land use. Many of these incentives can be offered

at little or no expense to the jurisdictions. There are phases in which incentives can be most effective: upon initial land development, or during tenant build-out and/or maintenance.

Among the compelling incentives for construction of bicycle lockers, changing, and shower facilities at initial land development are the following:

- Trip generation (traffic impacts) reduction during traffic impact assessments (e.g., up to five percent of total trip generation, depending on land use);
- Floor Area Ratio (FAR) bonus (e.g., up to five percent for office development);
- Reductions in required yard/setbacks (e.g., up to 20 percent for facilities with the capacity to serve up to five percent of employees);
- Variance for parking lot dimension(s); and
- Greenspace (for vehicle utilization area (VUA)) requirement reduction, (e.g., up to twenty times the square footage of the building dedicated to the bicycle commuters' shower or locker facility).

Incentives for conditions subsequent to initial development (i.e., tenant build-outs and building maintenance) include ad valorem tax exclusion of at least two times the square footage of the building dedicated to the locker/changing/shower facility. This exclusion could be increased if the tenant businesses participate in additional transportation demand management programs.

6.4 PROGRAM RECOMMENDATIONS

PROGRAM RECOMMENDATION: BICYCLE CONDITIONS MAP

The MPO should encourage bicycling by disseminating information about bicycling conditions across the county in the form of a Bicycle Conditions Map which can be supplemented with bicycle safety tips and other information. The Bicycle Level of Service data gathered for this plan can form the basis of an informative map that will allow bicyclists looking to travel around Palm Beach County to make route decisions that best serve their trip plans and their comfort level in various types of conditions. The overall bicycling conditions (accommodation level as measured by Bicycle Level of Service) can be stratified to a simpler three-level system and can be supplemented with information on the presence of facilities and show connections to trails and greenways. Production costs could be offset by sale of advertising panels on the map to local bicycle shops and other businesses who have an interest in reaching bicyclists.

PROGRAM RECOMMENDATION: BICYCLE ROUTE DESIGNATIONS

The MPO should further encourage bicycling by identifying a series of preferred bicycle routes, serving recreational destinations and major activity centers. These routes will serve the needs of local residents and visitors alike who are interested in exploring Palm Beach County by bicycle. Bicycle wayfinding systems can also encourage bicycling by highlighting routes that have been identified as amenable to general bicycling, thereby increasing awareness of bicycling as a transportation and recreational option.

Wayfinding system studies are most practically scoped at a scale much smaller than the countywide approach taken in the present study. As such, they can identify more focused needs for improvement and explore alternative options to serve important community destinations, including the use of relatively minor local streets, pathway connections, etc. A successful program of wayfinding studies could establish a route signage protocol and then identify multiple focus areas for study, which over time would grow into a cohesive countywide system of routes.

PROGRAM RECOMMENDATION: COUNTYWIDE SAFETY COUNTERMEASURES

Crash data and trends were discussed in Chapter 2, having been drawn from databases maintained by the MPO and the state Department of Highway Safety and Motor Vehicles (DHSMV). This data could describe some general trends, but is not sufficient to develop roadway-specific countermeasures which would have required detailed review of actual crash reports to reveal roadway specific conditions. However, some crash countermeasures can be recommended based upon inferred information from the limited dataset available in the MPO database. These include engineering, educational, and enforcement countermeasures. Each of these types is discussed in detail below.

Engineering countermeasures

Intersection signage

Intersection signage can remind motorists of their obligation to yield to pedestrians (or bicycles riding on the sidewalk). Among the crash types identified in Palm Beach County were intersection crashes. These could include collisions with vehicles making an opposing left turn and angle turns, some of which could involve bicycles on sidewalks colliding with motor vehicles emerging from side streets. Signs such as the NO RIGHT ON RED WHEN PEDESTRIANS PRESENT or the LEFT TURNING VEHICLES YIELD TO PEDS signs have been found to be effective in reducing pedestrian conflicts and crashes between pedestrians and motor vehicles.[18] It is reasonable to expect that these signs could also reduce the conflicts between motorists and bicyclists riding on the sidewalk (or on a sidepath). However, even if these signs are found to be effective tools in reducing crashes, they should be used sparingly and only where there is a documented problem and relatively constant pedestrian and bicycle use of the intersection. The overuse of signs, or the use of the signs where pedestrians and/or cyclists are not using the crosswalks, dilutes the signs' ability to command the attention of motorists and eventually result in the signs being just background visual clutter.

"Blank out" signs are connected to some sort of detection mechanism or call button; they are dark until actuated and only then display their message (Figure 6.8). Because they are *real time* traffic control devices, they maintain effectiveness by only alerting motorists when a conflict is actually present. If motorists see a YIELD TO PEDS sign hung next to a permissive left turn signal, they will also see a pedestrian crossing the conflicting crosswalk at the same

18 K. Pécheux,; J. Bauer; and P. McLeod; Pedestrian Safety and ITS-Based Countermeasures Program for Reducing Pedestrian Fatalities, Injury Conflicts, and Other Surrogate Measures; US DOT, 2009.

time. This *real-time* aspect of blank out signs allows for them to be placed at locations where conflicts are not frequent or constant enough to make a static sign appropriate.

Figure 6.8: Blank out sign

Shared Lane Symbol

The Shared Lane Symbol (sometimes incorrectly referred to as a “sharrow”) has the potential to reduce several different types of crashes and is being used in several jurisdictions across the country (Figure 6.9). Research has shown that bicyclists tend to position themselves over the center of the symbol, which, if properly placed, puts them out of the conflict zone with the open doors of parked cars. This may make the marking useful in reducing “dooring” crashes that may occur in areas with on-street parking. Research on shared lane symbols of a slightly different design found the treatment helped reduce wrong way riding and riding on the sidewalk, and helped bicyclists claim a position a bit farther from the curb in the travel lanes.

Reducing wrong way riding and sidewalk riding could reduce the occurrence of motorists failing to yield to bicyclists on sidewalks, which are possible circumstances of angle crashes and opposing left turn crashes type intersection crashes. Positioning riders away from the curb could cause motorists to give a wider berth to bicyclists they pass. If the bicyclist is hugging the curb, the motorist may try to pass while remaining in the same lane. This could help reduce crashes that do not occur at intersections.

Educational countermeasures

Educational countermeasures will have a greater effect if they are implemented across the urbanized area of the County. Consequently, we recommend a broad application of these campaigns, but with greater saturation within the high crash areas.

The dangers of riding against traffic, yield to sidewalk traffic

Riding against traffic, either on the sidewalk or on the roadway, is a common practice across

Figure 6.9: Shared lane symbol *(Photo: Aaron Naparstek)*

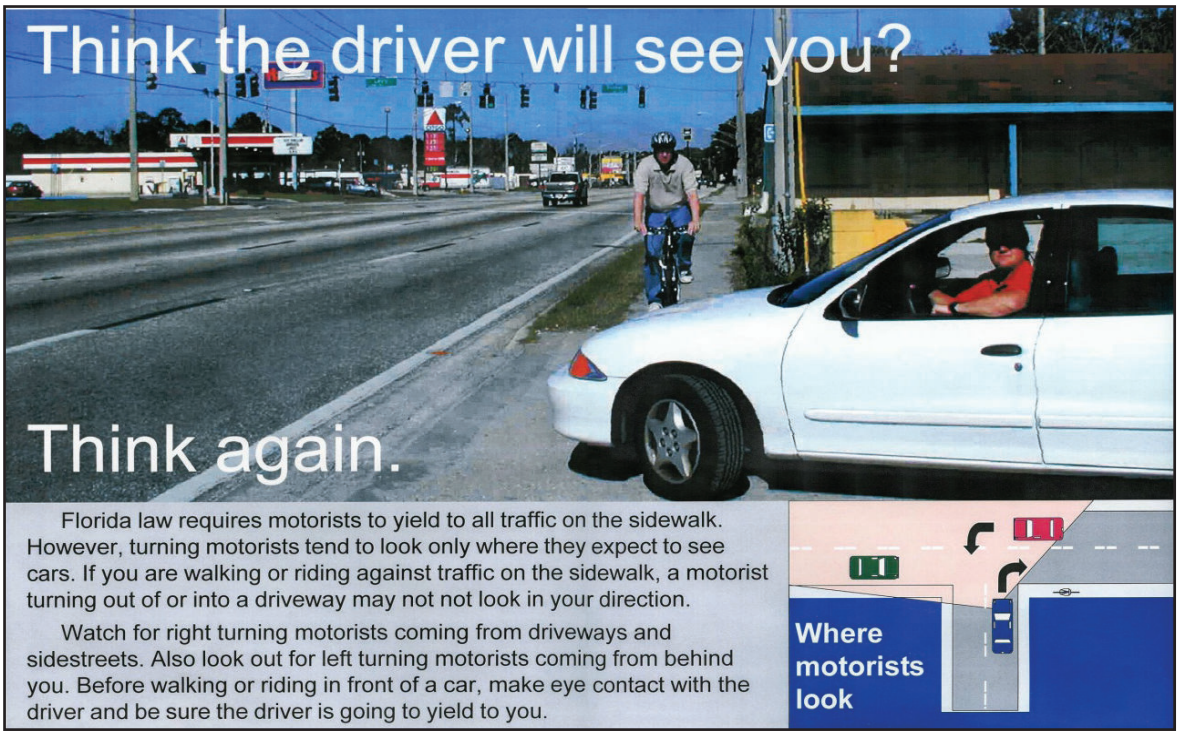

Figure 6.10: PSA warning of the dangers of riding against traffic

the country, and has been found to contribute to nearly one third of all crashes between bicycles and motor vehicles. Sidewalk riding will continue, however, because many people simply are not comfortable riding bikes on a roadway with motor vehicles. Additionally, cyclists cannot be expected to cross a multi-lane roadway to get to a sidewalk so they can ride in the same direction as cars in the adjacent travel lane. Thus, it is imperative that cyclists who choose to ride on the sidewalk be aware of the hazards associated with this practice. It is also important to make drivers aware of the need to scan for traffic on the sidewalk. Driver- and cyclist-targeted campaigns are recommended. These campaigns should feature graphics depicting recognizable local sites and be tailored to local demographics, including translation into Spanish or other languages where appropriate (Figure 6.10). To maximize the potential for reducing crashes, these campaigns for bicyclists and motorists must be run concurrently in adjacent jurisdictions.

The dangers of riding at nght without lights and walking at night

Bicyclists operating at night without lights are nearly invisible to motorists – until it is too late. Even if a bicycle is properly fitted with reflectors, motorists coming from a side street will not see the cyclists in time for the driver to react. If bicyclists choose to ride at night without lights, they must be made aware of the dangers they face in the dark. Several as-yet-unpublished research papers show that a pedestrians' awareness of how well they can be seen by motorists at night can be increased by a relatively brief exposure to

Figure 6.10: Relative reflectivity of clothing on dark roadways

information illustrating their conspicuity along a nighttime roadway.

The development of informational posters showing sight distances for various colors of clothing, and illustrating the limitations of reflectors is recommended (Figure 6.10). Such materials may provide cyclists (and pedestrians) the information they need to make better choices when choosing gaps to cross the road, or when anticipating driver behaviors at driveways and intersections.

Enforcement countermeasures

The effort to enforce traffic laws as they relate to bicycle safety should be addressed in an overall, countywide, coordinated, bicycle enforcement campaign. Sporadic enforcement will not result in significant improvements to cyclist behavior and will likely result in resentment of law enforcement personnel. Behaviors to be targeted should be determined at the outset of the law enforcement campaign. The following behaviors should be targeted:

- riding at night without lights;
- violating traffic signals; and
- riding against traffic on the roadway.

These three behaviors were chosen for two reasons. First, they represent particularly hazardous behaviors that result in many crashes. Secondly, and very importantly, the enforcement of these behaviors is easy to justify to the public. When enforcement measures are coupled with, and preceded by, large scale education campaigns, the public will likely understand the importance of the campaign and is more likely to accept the enforcement activity.

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Martin County

Lake Okeechobee

Hendry County

Broward County

Glades Area Inset (see below)

East Coast Inset (see right)

NORTH

0 2 4 8 Miles

US Highway 27

East Coast Inset

Indiantown

Pratt Whitney

Alexander

Jupiter Farms

Bee Line

Seminole Pratt Whitney

Temple

Hall

140th

Coconut

Orange

Avocado

60th

Sycamore

Okeechobee

State Road 80

Southern

Paddock

Greenview Shores

Big Blue

Forest Hill

Wellington

Aero Club

Greenbriar

South Shore

Pierson

Stribling

120th

Royal Palm Beach

SR 7

State Road 7

Lyons

Sansbury's

Benoist Farms

Skees

Pike

Drexel

Military

Gun Club

Summit

Davis

Forest Hill

Jog

Purdy

Cresthaven

Kirk

10th

Pinehurst

57th

Haverhill

Lake Worth

2nd

Melaleuca

6th

Florida Mango

Bowell

Dixie

7th

12th

Lantana

Hypoluxo

High Ridge

Overdook

Le Chalet

Lawrence

Miner

Gateway

Federal

Boynton Beach

Old Boynton

Hagen Ranch

Woolbright

Golf

23rd

Pipers Glen

Coconut

Congress

Seacrest

George Bush

El Clair Ranch

Via Delray

Lake Ida

Sims

Berwick

Atlantic

Lowson

Linton

Lindell

Ocean

Boca Chase

Clint Moore

Yamato

Coral Ridge

Kimberly

Glades

Spanish River

Potomac

St Andrews

Bulls

Florida Atlantic

Country Club

Palmetto Park

Camino Real

Boca Rio

Powerline

Judge Winikoff

Ponderosa

18th

12th

9th

20th

13th

15th

2nd

5th

Mizner

Military

Jog

Central

Donald Ross

Alternate A1A

Frederick Small

University

Ocean

Hood

PGA

Ryder Cup

Palm Beach Gardens

Military

RCA

Burns

Holly

Prosperity Farms

Ellison Wilson

Lighthouse

Garden

Park

Lake Park

Old Dixie

Broadway

Blue Heron

Dyer

Riviera Beach

Australian

45th

Shiloh

West Palm Beach

Roebuck

Shenandoah

Congress

Haverhill

Village

Palm Beach Lakes

Elmhurst

Belvedere

Parker

Flagler

Dixie

Quadrille

Tamarind

Okeechobee

Worth

County

Cocoanut

Palm Beach

Indian Creek

Central

Loxahatchee River

Island

Tequesta

County Line

Beach

Center

Toney Penna

Jupiter

Indiantown

Seminole Pratt Whitney

Royal Palm Beach

Crestwood

Wellington

Big Blue

Forest Hill

Aero Club

Greenbriar

South Shore

Paddock

Greenview Shores

Pierson

Stribling

120th

Southern

State Road 7

Lyons

Sansbury's

Benoist Farms

Skees

Pike

Drexel

Military

Gun Club

Summit

Davis

Forest Hill

Jog

Purdy

Cresthaven

Kirk

10th

Pinehurst

57th

Haverhill

Lake Worth

2nd

Melaleuca

6th

Florida Mango

Bowell

Dixie

7th

12th

Lantana

Hypoluxo

High Ridge

Overdook

Le Chalet

Lawrence

Miner

Gateway

Federal

Boynton Beach

Old Boynton

Hagen Ranch

Woolbright

Golf

23rd

Pipers Glen

Coconut

Congress

Seacrest

George Bush

El Clair Ranch

Via Delray

Lake Ida

Sims

Berwick

Atlantic

Lowson

Linton

Lindell

Ocean

Boca Chase

Clint Moore

Yamato

Coral Ridge

Kimberly

Glades

Spanish River

Potomac

St Andrews

Bulls

Florida Atlantic

Country Club

Palmetto Park

Camino Real

Boca Rio

Powerline

Judge Winikoff

Ponderosa

18th

12th

9th

20th

13th

15th

2nd

5th

Mizner

Military

Jog

Central

Donald Ross

Alternate A1A

Frederick Small

University

Ocean

Hood

PGA

Ryder Cup

Palm Beach Gardens

Military

RCA

Burns

Holly

Prosperity Farms

Ellison Wilson

Lighthouse

Garden

Park

Lake Park

Old Dixie

Broadway

Blue Heron

Dyer

Riviera Beach

Australian

45th

Shiloh

West Palm Beach

Roebuck

Shenandoah

Congress

Haverhill

Village

Palm Beach Lakes

Elmhurst

Belvedere

Parker

Flagler

Dixie

Quadrille

Tamarind

Okeechobee

Worth

County

Cocoanut

Palm Beach

Indian Creek

Central

Loxahatchee River

Island

Tequesta

County Line

Beach

Center

Toney Penna

Jupiter

Indiantown

0 1 2 4 Miles

Legend

PB MPO Bike Plan Study Network

Priority Tiers

- Tier 1: $0-$30M
- Tier 2: $30M-$60M
- Tier 3: $60M-$90M
- Tier 4: $90M-$120M
- Tier 5: $120M-$150M
- LOS MET
- Under Construction

metropolitan planning organization PALM BEACH MPO

Glades Area Inset

Martin County

Lake Okeechobee

Hendry County

US Highway 441

US Highway 27

US Highway 98

Everglades

Main

Muck City

Belle Glade

Curlee

Gator

Duda

Canal

Hatton

Sam Senter

State Road 80

State Road 15

County Road 880

County Road 827A

16th

5th

3rd

1st

NORTH

0 1.25 2.5 5 Miles

Master Comprehensive Bicycle Transportation Plan for Palm Beach County

Cost Affordable Plan: Priority Tiers

Sprinkle CONSULTING Active Transportation Planners+Engineers

American Consulting Engineers of Florida

Figure 6.12: Network-wide priority tiers

Martin County

Lake Okeechobee

NORTH

Glades Area Inset (see below)

Hendry County

Broward County

0 2 4 8 Miles

East Coast Inset (see right)

East Coast Inset

NORTH

metropolitan planning organization PALM BEACH MPO

Legend

Tier One Projects

Facility Recommendation

- Re-Stripe Candidate
- Add Paved Shoulder
- Detailed Corridor Study Needed

Remaining Roadways

- **LOS Met**
- **Tiers 2-5**

Glades Area Inset

Martin County

Lake Okeechobee

NORTH

Hendry County

0 1.25 2.5 5 Miles

0 1 2 4 Miles

Master Comprehensive Bicycle Transportation Plan for Palm Beach County

Bicycle Facility Recommendations TIER 1

Sprinkle CONSULTING Active Transportation Planners+Engineers

American Consulting Engineers of Florida

Figure 6.13: Tier 1 Projects and roadways currenlty meeting performance thresholds

Chapter 7: Evaluation Process

An important aspect of any plan process is the monitoring of its recommendations and objectives after it has been adopted. The true measure of a plan is not how it looks as a finished document or even the ambition of its recommendations, but rather the degree to which its recommendations are implemented. As such, in three years, five years, or ten years, the results of the Plan may be seen around the community as built infrastructure or as successful programs and policies with tangible impacts on bicycle safety and that have encouraged more people to ride their bikes. This chapter sets a framework so the Palm Beach MPO and its member jurisdictions can track the Plan's progress, and report back its performance to residents and decision makers. The evaluation process has three basic steps that can be applied to the objectives described in Chapter 1: establish a benchmark of the objective's existing status, record any efforts made toward that objective, and periodically review and report the progress towards those objectives relative to the initial benchmark.

Several benchmarks were specifically covered in the current conditions sections described in Chapter 2 and the needs as described in Chapter 4. For example, the objectives that support the Goal S1 include increasing the mileage of roadways that achieve their designated performance threshold. The needs report identified 523 miles of roadways across the county currently meeting their performance expectation and 596 miles that are not. Thus, 523 miles would be the benchmark value of roadways meeting their designated threshold. Recording new efforts would occur as new facilities are implemented and performance is improved on more roadways. The mileage of those improvements should be recorded and added to the benchmark value. This should be done on an annual basis, so that each year a new mileage total for roadways meeting or exceeding their performance expectation can be calculated.

Updated totals could then be reported on a periodic basis to the MPO's Bicycle, Greenways, Pedestrian Advisory Committee (BGPAC) and the MPO Board. The pace of progress can be discussed and assessed, in light of budgetary conditions and other MPO priorities, to determine if efforts should be maintained or increased during the next review period.

A benchmark value for each of the objectives identified in Chapter 1 should be established, so that progress can be recorded and evaluated. Values to be recorded as benchmarks are suggested for the Plan's objectives in Table 7-1 on the following page. Some objectives will be easier to track than others, but any measurable activity that serves a specific goal will be useful in telling the story of Palm Beach County's progress toward the vision articulated in this Plan.

Table 7.1 Suggested benchmark values for plan objectives

Objectives Supporting Transportation Goals for Safety	
Objective	**Suggested Benchmark Measure**
Increase mileage of roadways meeting their designated performance threshold	Mileage of roadways meeting appropriate threshold
Plan and fund regular maintenance	Frequency of maintenance, levels of designated funding
Plan and fund educational campaigns	Number of initiatives begun, literature distributed, number of participants
Plan, fund, and promote bicycle facilities that provide access to destinations	Mileage of high priority roadways improved (Tier 1, Tier 2), mileage of pathways constructed from NENA, South County Greenways plans
Train law enforcement officers, encourage enforcement of laws related to common crash factors	Number of programs or participants, number of citations for riding without lights, wrong way riding, etc.
Regular review of progress on objectives	Annual reports on objective measures, biannual discussion of vision, goals, and objectives
Objectives Supporting Transportation Goals for Convenience	
Objective	**Suggested Benchmark measure**
Improve facilities for a broad variety of users	Mileage of high priority projects implemented
Plan and fund encouragement programs	Funding/Staff time set aside for programs, number of employer encouragement programs and initiatives, number of participants in programs
Increase bicycle parking facilities	Number of development codes with bike parking provisions, number of bike racks installed
Promote use of bicycle facilities	Number of wayfinding routes identified, number of maps distributed, funding for maps, wayfinding studies
Enforce traffic laws with regard to specific behaviors by bicyclists and/or motorists	Number of warnings and/or citations in response to targeted behaviors
Monitor bicycling activity	Count bicyclists before and after improving roadways, tally participation in encouragement events

Objectives Supporting Recreation Goals	
Objective	**Benchmark Measure**
Provide on-street access to greenways and trails	Mileage of high-performing roadways connecting to NENA, South County Greenways, other plans
Highlight greenways and trails on maps and within wayfinding systems	Number of wayfinding routes identified, number of maps distributed, funding for maps, wayfinding studies
Coordinate promotion of on-street facilities and greenways with tourism industry	Number of contacts and distribution points, number of maps distributed
Plan and fund education about safety	Number of participants in events, number of safety brochures distributed
Monitor recreational riding	Count users on trails and greenways, maintain list of organized rides