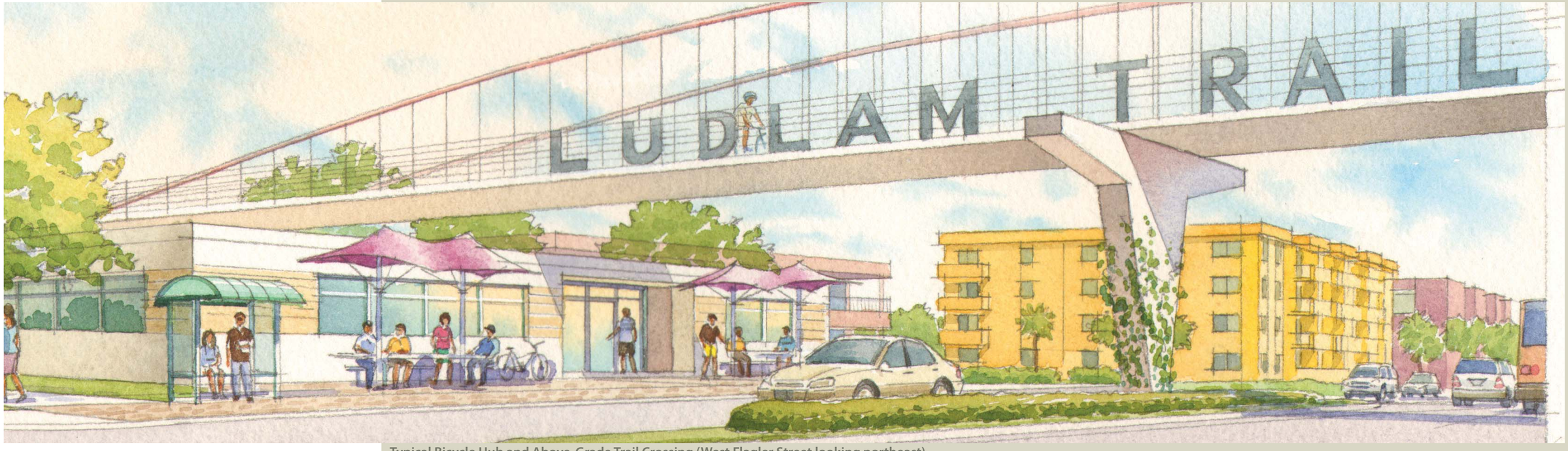
# *Section One:*
# RESEARCH *&* ANALYSIS

*"Nothing compares with the simple pleasure of a bike ride"*

**JOHN F. KENNEDY, Thirty-fifth US President (1961—63)**




Typical Bicycle Hub and Above-Grade Trail Crossing (West Flagler Street looking northeast)

# *Section One* RESEARCH & ANALYSIS

## 1.1 PURPOSE

The purpose of the Miami-Dade County Trail Design Guidelines and Guidelines: Ludlam Trail Case Study is to provide specific guidance for the design and development of the Ludlam Trail and provide general guidelines for non-motorized urban shared-use trails throughout Miami-Dade County by building upon the Miami-Dade County Parks and Open Space System Master Plan Great Greenways, Trails and Water Trails Vision. These guidelines and standards were developed to work in concert with other regional and corridor specific studies and planning efforts. In addition, these guidelines and standards intend to inform decision markers on future designs of non-motorized urban shared-use trails within Miami-Dade County.

The needs of a wide array of users have been researched and consolidated into a set of recommendations and standards for Ludlam Trail and non-motorized urban shared-use trails throughout Miami-Dade County.

*SW 64th St. : Cyclists using the undeveloped Ludlam Trail Corridor*

## 1.2 METHODOLOGY

Trail guidelines and standards help determine the specific needs of users and the community at large. Although no standard methodology exists for trail guidelines and standards, using a transparent, methodical approach tends to yield a thorough set of guidelines. The techniques used in this set of guidelines include the following:

### 1.4 Research of Official Documents

Existing reports and studies with regional and corridor specific emphasis were reviewed. Previous studies that could influence the development of the trails, such as governing codes and ordinances, regional transportation studies, and corridor specific studies were reviewed under the direction of the steering committee.

### 1.5 Existing Conditions

The AECOM and Rails-to-Trails Conservancy team visited and photographed the Ludlam Trail corridor to document present conditions and identify potential opportunities and constraints for eight Ludlam Trial specific conditions.

### 1.6 Comparable Trails

Comparable national and Florida specific urban trails and trail components that have achieved success and have demonstrated best practices in overall principles were identified and researched.

### 1.7 Best Practice Principles

A set of overall trail development principles which include user needs, crossing techniques and security solutions was developed.

### 1.8 Lessons Learned

Lessons learned were identified from a national search of best practices for urban trails and components.

### 1.9 Recommendations and Standards

The findings of the comparable research and lessons learned were compiled into a set of recommendations and trail standards which include trail placement, trail width, amenities and other design elements.

### 2.1 Design Guidelines

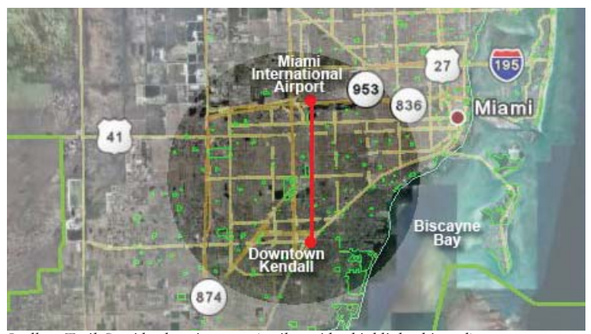
AECOM prepared graphical design guidelines in the form of plans, sections and perspective sketches for each of the eight Ludlam Trail specific conditions identified in the existing conditions.

## 1.3 BACKGROUND INFORMATION

The Ludlam Trail corridor, which is owned by Flagler Development Group from Perimeter Road south, has been the subject of several regional and local transportation studies. These studies have identified the corridor as an opportunity for a regionally significant trail and greenway on this property. Previous studies by the Miami-Dade County Park and Recreation Department (MDPR) and Metropolitan Planning Organization (MPO), along with Trust for Public Lands, have built a grassroot level of support throughout central Miami-Dade County for a public trail within the corridor known as Ludlam Trail.

Facing the same issues as other large urban areas, Miami-Dade County has developed a new 50 year unifying vision for a livable, sustainable community. Anchored by the Miami-Dade County Parks and Open Space System Master Plan, this new vision creates a long-term guide to future park and trail development and stewardship. Most pertinent to this study is the component Great Greenways, Trails and Watertrails. This component seeks to provide an interconnected trail system which offers transportation alternatives and reduces traffic congestion, creates new recreation opportunities, increases property values, protects natural resources, and encourages tourism and business development. The Trail Design Guidelines document aspires to provide the necessary information for decision makers to develop a trail which will improve the quality of life for all Miami-Dade County residents.

The Ludlam area of Miami-Dade County grew when Mr. Walter Ludlam teamed with fellow neighbors to fund the construction of Ludlam Road in 1914. Following the same principles, the Ludlam Trail will link the surrounding communities and provide vital neighborhood connections.

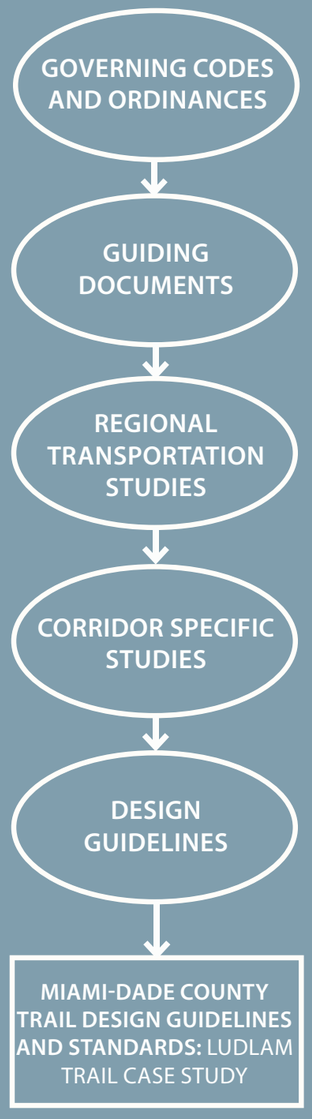



*Ludlam Trail Corridor location map (trail corridor highlighted in red)*

## MIAMI-DADE COUNTY

At 113 years old, Miami has grown into the nation's eleventh largest metropolitan area. Incorporated in 1896, Miami is the only major municipality in the U.S. conceived of and founded by a woman, Julia Tuttle. It is also generally believed that Julia Tuttle convinced Henry Flagler to continue his railroad south to Miami and eventually on to Key West. According to the U.S. Census Bureau, Miami's population in 1900 was 1,700 people. Today, it is a City rich in cultural and ethnic diversity with 60% of residents being foreign-born. In physical size, the City is not large, encompassing only 34 square miles. In population, Miami is the largest of the thirty (30) municipalities that make up Miami-Dade County. The Ludlam Trail corridor is a 6.2-mile alignment located in the heart of Miami-Dade County running from the Dadeland Mall north to the Miami International Airport boundary at Perimeter Road.

## RESEARCH INFLUENCE DIAGRAM




## 1.4 RESEARCH OF OFFICIAL DOCUMENTS

In an effort to build upon the work of previous planning studies and to ensure the coordination with other official documents that could influence the development of the Miami-Dade County Trail Design Guidelines and Standards, AECOM has researched multiple sources of information. The documents reviewed can be classified into five broad categories; governing codes and ordinances, guiding documents, regional transportation studies, corridor specific studies and design guidelines. The studies reviewed include:

### 1.4.1 GOVERNING CODES AND ORDINANCES

- City of Miami Comprehensive Plan and Land Development Regulations
- City of South Miami Comprehensive Plan and Land Development Regulations
- Miami-Dade County Comprehensive Development Master Plan and Land Development Regulations
- Miami-Dade County Zoning Codes and Ordinance
- SFWMD Volume V - Permit Information Manual (1999)

### 1.4.2 GUIDING DOCUMENTS

- City of Miami Bicycle Network Plan (2009)
- Miami-Dade County Aesthetics Master Plan (2008)
- Miami-Dade County Parks and Open Space System Master Plan (2008)
- The Recreational Trail Opportunity Maps For The State of Florida (2008 Update)
- North Dade Greenways Master Plan (1997)
- Greenways for Dade (1994)

### 1.4.3 REGIONAL TRANSPORTATION STUDIES

- 2010 Campaign Statement for Active Transportation in Miami-Dade County (2008)
- Florida East Coast Transit Connection Study (2008)
- Kendall Corridor Transportation Alternative Analysis (2007)
- MD MPO 2025 Bicycle / Pedestrian Plan (update 2007)
- North Corridor Metrorail Extension (2006)
- South Florida East Coast Corridor Transit Analysis Study (2006)
- Florida Transportation Trends and Conditions (2005)
- People's Transportation Plan (2004)
- Rail Convertibility Study (2004)
- Palmetto Corridor Light Rail Transit Feasibility Study (1997)


*Examples of official documents researched*

### 1.4.5 CORRIDOR SPECIFIC STUDIES

- MPO Ludlam Corridor Study (2009)
- A.D. Barnes Park Proposed General Plan (2008)
- Ludlam Trail Railroad Bridge Assessment at A.D. Barnes Park (2008)
- Ludlam Trail Acquisition Analysis (2006)
- Ludlam Trail Non-Motorized Corridor Planning and Environmental Study (2003)

### 1.4.6 DESIGN GUIDELINES

- Americans with Disablities Act Accessible Guidelines (ADAAG) (2004 and 2009 ed.)
- Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), (2003 ed. and 2009 ed.)
- American Assoication of State Highway and Transportation Officials (AASHTO) Guide for the Planning, Design and Operation of Pedestrian Facilities (2004)
- Florida Department of Transportation: Bicycle Facilities Planning and Design Handbook (2000)
- American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (1999)
- FHWA - Rails-with-Trails Study: Lessons Learned
- Rails-to-Trails Conservancy - Rail-to-Trail Report

These documents, together with multiple sources of information pertaining to the best and most current practices in bicycle and pedestrian planning and design, will serve as the basis for Ludlam Trail Design Guidelines. Following is a summary of the key elements of the reviewed documents:

### 1.4.1 GOVERNING CODES AND ORDINANCES

The Ludlam Trail corridor is primarily located in unincorporated Miami-Dade County. A portion of the northern part of the corridor is within the City of Miami and a small segment in the vicinity of A.D. Barnes Park is adjacent to the City of South Miami, however the Miami-Dade County codes and ordinances are more restrictive and, therefore, take precedence. Following is a summary of the applicable sections of the Comprehensive Development Master Plan (CDMP) that set forth the goals, objectives and policies that encourage the development of greenways and trails, followed by several of the most significant zoning codes and ordinances that will need to be considered in the development of the Ludlam Trail.

***MIAMI-DADE COUNTY COMPREHENSIVE DEVELOPMENT MASTER PLAN RECREATION - RECREATION AND OPEN SPACE ELEMENT***

Goal:

Develop, program and maintain a comprehensive system of parks and recreational open spaces offering quality and diversity in recreational experiences while preserving and protecting valuable natural resources, unimpaired, for present and future generations.

Objective ROS-3:

Access to parks and recreational facilities will be improved in Miami-Dade County by 2010.

Policies:

- ROS-3B. The County shall improve and promote non-motorized access to existing park and recreation open spaces by implementing the North Dade Greenway Master Plan and South Dade Greenway and Blueway Network, as well as improved sidewalks and trails, to improve connectivity between parks and residences, schools, activity centers, and transportation nodes.

### *MIAMI-DADE COUNTY COMPREHENSIVE DEVELOPMENT MASTER PLAN - TRANSPORTATION ELEMENT*

Goal:

Develop and maintain an integrated multimodal transportation system in Miami-Dade County to move people and goods in a manner consistent with overall county land use and environmental protection goals.

Objective TE-2:

In furtherance of pedestrianism as a mode of transportation encouraged in the planned urban area, by 2008 Miami-Dade County shall enhance its transportation plans, programs and development regulations as necessary to accommodate the safe and convenient movement of pedestrians and non-motorized vehicles, in addition to automobiles and other motorized vehicles.

Policies

- TE-2A. The County shall continue to promote and assist in the creation of a Countywide system of interconnected designated bicycle ways, and promote the implementation of the Miami-Dade Bicycle Facilities Plan.
- TE-2B. By 2008, the County shall develop a comprehensive countywide greenways network providing continuous corridors for travel by pedestrians and non-motorized vehicles incorporating elements of the adopted South Dade Greenway Network Master Plan and the North Dade Greenways Master Plan.
- TE-2E. The County shall require accommodation of bicycle travel and pedestrian needs in plans for future arterial and collector road construction, widening or reconstruction projects where designated by the Bicycle Facilities Plan, wherever feasible.
- TE-2F. The County shall consider the use of utility easements and transit or railroad rights-of-way as locations for bicycle ways linking major urban activity centers.

### *MIAMI-DADE COUNTY ZONING CODES AND ORDINANCES*

**Sec. 18A-2. Landscaping**

It is the intent of this section to establish minimum landscape standards for Incorporated and Unincorporated Miami-Dade County that enhance, improve and maintain the quality of the landscape, and to:

(A) Promote xeriscape principles through the use of drought-tolerant landscape species, grouping of plant material by water requirements, the use of irrigation systems that conserve the use of potable and nonpotable water supplies and restrictions on the amount of lawn areas.
(B) Use landscape material, specifically street trees, to visually define the hierarchy of roadways, and to provide shade and a visual edge along roadways.
(C) Prevent the destruction of the community's existing tree canopy and promote its expansion.
(D) Provide for the preservation of existing natural forest communities and specimen sized trees in conformance with Section 24-60, as may be amended from time to time; re-establish native habitat where appropriate, and encourage the appropriate use of native plant material in the landscape.
(E) Promote the use of trees and shrubs for energy conservation by encouraging cooling through the provision of shade and the channeling of breezes, thereby helping to offset global warming and local heat island effects through the added absorption of carbon dioxide and reduction of heat islands.
(F) Contribute to the processes of air movement, air purification, oxygen regeneration, ground water recharge, and stormwater runoff retention, while aiding in the abatement of noise, glare, heat, air pollution and dust generated by major roadways and intense use areas.
(G) Improve the aesthetic appearance of commercial, industrial and residential development through the use of plant material, thereby protecting and increasing property values within the community, and protecting designated historic landscapes.
(H) Reduce the negative impacts of exotic pest plant species and prohibit the use of noxious exotic plants which invade native plant communities.
(I) Promote the use of trees to protect and buffer the effects of high winds on structures.
(J) Promote the concept of planting the right tree or plant in the right place to avoid problems such as clogged sewers, cracked sidewalk and power services interruptions. (Ord. No. 95-222, § 2, 12-5-95; Ord. No. 98-13, § 1, 1-13-98)

**Sec. 33-11. Fences, walls, bus shelters and hedges**

(c) Height at intersection. Fences, walls, bus shelters or hedges shall not exceed two and one-half (2.5) feet in height within the safe sight distance triangle, as defined below. The height of fences, walls, bus shelters and hedges shall not exceed two and one-half (2.5) feet in height within ten (10) feet of the edge of a driveway leading to a public right-of-way.
The safe sight distance triangle area shall not contain obstructions to cross-visibility at a height of two and one-half (2.5) feet or more above pavement; potential obstructions include, but are not limited to, structures, grass, ground covers, shrubs, vines, hedges, trees, rocks, walls and fences. The following table represents minimum criteria for determining the required area of cross-visibility:

(h) Heights in RU and EU-M Districts. In the RU and EU-M Districts, the height of any fence or wall shall not exceed six (6) feet. In the RU and EU-M Districts, the height of any hedge shall not exceed seven (7) feet. In the RU-5 and RU-5A Districts, fences, walls and hedges shall conform to these regulations, except as may otherwise specifically be required by the District regulations.
(Ord. No. 69-62, § 1, 9-17-69; Ord. No. 70-20, § 1, 3-11-70; Ord. No. 80-127, § 1, 11-4-80; Ord. No. 82-31, § 1, 4-20-82; Ord. No. 85-31, § 2, 5-7-85; Ord. No. 89-109, § 1, 11-7-89: Ord. No. 95-25, § 1, 2-7-95; Ord. No. 95-199, § 1, 11-7-95; Ord. No. 03-159, § 1, 7-8-03; Ord. No. 05-77, § 1, 4-19-05)

**Sec. 16A-2. Historic preservation**

The purpose of the historic preservation policy is the protection, enhancement and perpetuation of properties of historical, cultural, archeological, paleontological, aesthetic and architectural merit in the interests of the health, prosperity and welfare of the people of Miami-Dade County. The policy is intended to:

(1) Effect and accomplish the protection, enhancement and perpetuation of buildings, structures, improvements, landscape features, paleontological and archeological resources of sites and districts which represent distinctive elements of the County's cultural, social, economic, political, scientific, religious, prehistoric and architectural history;

## SUMMARY OF GOVERNING CODES

The Miami-Dade County Comprehensive Development Master Plan (CDMP) and Land Development Regulations - Recreation and Open Space element states the following:

*"ROS-3B. The County shall improve and promote non-motorized access to existing park and recreation open spaces by implementing the North and South Dade Greenway and Blueway Network, as well as improved sidewalks and trails, to improve connectivity between parks and residences, schools, activity centers, and transportation nodes."*

Ludlam Trail will achieve these goals by connecting two transportation nodes and connecting neighborhoods with city and county parks, schools and activity centers such as the Dadeland Mall and the Bird Road Art District.

## VISION SUMMARY

The North Dade Greenways Master Plan and the Miami-Dade County Parks and Open Space System Master Plan - Great Greenways, Trails and Water Trails are visions of accessibility. Both plans envision providing an interconnected system with transportation alternatives to reduce traffic congestion; creates new recreation opportunities; increases property values; protects natural resources; and encourages tourism and business development.

Ludlam Trail will help achieve this vision through the interconnections of neighborhoods and business areas. Offering a direct route between Miami International Airport and the Dadeland Mall, Ludlam Trail will help reduce community traffic congestion and increase local and regional recreation opportunities and transportation alternatives.


Miami-Dade County Parks and Open Space System Master Plan, 2008

(2) Safeguard the County's historical, cultural, archeological, paleontological and architectural heritage, as embodied and reflected in such individual sites, districts and archeological zones;
(3) Foster civic pride in the accomplishments of the past;
(4) Protect and enhance the County's attraction to visitors and the support and stimulus to the economy thereby provided; and
(5) Promote the use of individual sites and districts for the education, pleasure and welfare of the people of Miami-Dade County.
(Ord. No. 81-13, § 2, 2-17-81; Ord. No. 03-38, § 1, 3-11-03)

### *MIAMI-DADE COUNTY ZONING ORDINANCE*

**Article 10 Sign Regulations**

10.5.2. PR Parks, Recreation and Open Space.

Location of signs:

Location of park identification signs shall comply with the visibility clearance standards as set forth in Section 10.4. Signs for identification of accessory establishments shall be located directly on, or adjacent to, such establishments.

Size:

There shall be no limitation as to the size of park identification signs, however, such signs shall not exceed a reasonable size to identify the park to the population it is intended to serve; neighborhood parks signs shall be unobtrusive and non-illuminated, while regional park signs may be larger and contain sufficient illumination to read the park signs from adjacent rights-of-way. In addition, regional parks shall also be allowed commercial sponsorship messages not to exceed twenty-five (25) percent of the total sign area of the principal park identification sign; such commercial messages must be incorporated into the park sign and may not be displayed on their own.

### *SFWMD VOLUME V - PERMIT INFORMATION MANUAL*

The South Florida Water Managerment Distirct Permit Information manual states operational zones of 100' located upstream and downstream of each bridge must be maintained.

## 1.4.2 GUIDING DOCUMENTS

### *MIAMI-DADE COUNTY AESTHETICS MASTER PLAN*

The Miami-Dade County Aesthetics Master Plan was developed by the Community Image Advisory Board (CIAB). The purpose of the plan was to advance the mission of the CIAB by establishing clear guidelines and standards for improving the visual appearance and image of the County. The plan set forth a series of goals and objectives for gateways, corridors, and facilities as well as recommendations for specific architectural, hardscape and landscape elements that will contribute to the overall aesthetic quality of the County. All elements of the plan are applicable to the ultimate design of trails, however, those pertaining to pedestrians are most pertinent.

Goals and Objectives for Pedestrian Corridors:

- Promote pedestrian-oriented uses that contribute to a shift away from automobile traffic
- Provide and maintain a safe, convenient and enjoyable walking environment that responds to the varied needs of a diverse walking population
- Integrate into the County's greenway system
- Promote and foster coordination between jurisdictions in the planning and implementation of bicycle, trails, transit, pedestrian and other alternative transportation modes
- Develop a variety of educational programs to promote the benefits of pedestrian-oriented design
- Preserve healthy, mature trees and/or vegetation adjacent to pedestrian corridors
- Clearly defined special paving at crosswalk and high pedestrian areas
- Link primary transportation related pedestrian facilities to other pedestrian support facilities

In addition, each of the design recommendations for architectural, hardscape and landscape elements will be considered in the development of the final recommendations.

### *MIAMI-DADE COUNTY PARKS AND OPEN SPACE SYSTEM MASTER PLAN*

**Greenways, Trails and Water Trails Vision**

The Miami-Dade County Parks and Open Space System Master Plan is a 50 year unifying vision for a livable, sustainable Miami-Dade County. An integral part of that vision is the development of a seamless system of greenways, trails and water trails. This vision builds upon the corridors described in the North Dade Greenways Master Plan and South Dade Greenway Network Master Plan, and goes further in linking these into a holistic, seamless system. Its corridors weave through new parks, tie into bike lanes, and act as verdant channels that draw people into natural resource areas. It is envisioned as an interconnected system that provides transportation alternatives and reduces traffic congestion; creates new recreational opportunities; increases property values; protects natural resources; encourages tourism and business development; and strengthens connections to adjacent counties.

Key elements of the Great Greenways, Trails and Water Trails Vision include:

- Consistent, upgraded trail connections throughout the entire System
- Water Access points that are conducive to small craft launching with parking and neighborhood access
- A Greenways and Water Trails Signage/Graphics/Marker System that establishes an identity for the System; informs users and passers-by regarding trail names, access points, locations and distances; and reduces conflicts by informing both trail users and motorists regarding trail crossings
- A continuous canopy of large shade trees to provide opportunities for users to escape the hot sun
- Safe, well-marked roadway crossings throughout the System to ensure connectivity across major roads
- Picnic shelters, rest areas, drinking water stations, map kiosks and other amenities throughout the system to enhance the quality of users' experiences
- Increased levels of trails maintenance and law enforcement to help ensure the quality of the greenways and water trails user experience
- Increased user participation and voluntarism in trail improvements and maintenance

Ultimately, it is a vision of accessibility: no matter where someone lives in the County, he or she is no more than a fifteen (15) minute trip from a greenway and/or water trail.

### *THE RECREATIONAL TRAIL OPPORTUNITY MAPS FOR THE STATE OF FLORIDA*

The State of Florida Office of Greenways and Trails maintains a set of maps that have been compiled and subsequently updated to help institutionalize the vision for creating a statewide interconnected system of trails. For trail corridor projects to be

eligible for funds from the Florida Forever Greenways and Trails Program, they must be identified on the State's opportunity map.

Ludlam Trail is currently included on the State's recreational trail opportunity map, however, it is listed as a low priority, primarily because of the high cost of acquisition.

### *NORTH DADE GREENWAYS MASTER PLAN*

The North Dade Greenways Master Plan was developed in 1997 and attempted to set forth a comprehensive master plan for greenways and trails in north Miami-Dade County. The plan was developed in a two step process including public involvement and a review phase. The plan identified the Ludlam Trail as a critical part of the trail system and set forth a series of opportunities and constraints for regions along the corridor. Specific opportunities and constraints identified in the plan included:

Opportunities to:

- Develop a passive open space park at the junction of the Ludlam Trail and the Perimeter Trail around the Miami-Dade International Airport
- Create a connection to Robert King High Park/ Carlos Arboleya Picnic area and campgrounds, located adjacent to the trail at Flagler Street
- Develop a trail head at A.D. Barnes Park
- Create a linkage to Palmer Park, located on Ludlam Road (SW 67th Avenue). Palmer Park is a community park for the City of South Miami and is adjacent to South Miami Elementary and South Miami Middle Schools
- Develop an intermodal connection point at the Dadeland North Metrorail Station

Constraints of:

- Crossing major streets
- Crossing the Tamiami (C-4) Canal, Coral Gables (C-3) Canal, and Snapper Creek (C-2) Canal
- Alignment and connectivity difficulties at the convergence of the Ludlam Trail with the Snapper Creek Trail, the M-Path Extension and the Dadeland North Metrorail Station

The opportunities and constraints identified in the North Dade Greenways Master Plan will be explored further as part of this study. Specific recommendations will examine how to maximize the potential opportunities and overcome the possible constraints.

## REGIONAL TRANSPORTATION PLANS

### *2010 CAMPAIGN CASE STATEMENT FOR ACTIVE TRANSPORTATION IN MIAMI-DADE COUNTY*

In support of the long term physical planning effort, the Miami-Dade County 2010 Case Statement for Active Recreation states the urgency of creating more alternative transportation modes in Miami-Dade County. The study outlines how the dependence on automobile centralized transportation is unsustainable and the urgency to provide alternative modes of transportation. Specifically, this report makes the case for more bicycle and pedestrian facilities.

### *KENDALL CORRIDOR TRANSPORTATION ALTERNATIVES ANALYSIS*

Numerous transportation studies have been conducted for the regional area around the Ludlam Trail corridor culminating in the comprehensive Kendall Corridor Transportation Alternatives Analysis Study, completed in September 2007. The purpose of this study was to develop short, medium, and long range rapid transit recommendations within the Kendall area of Miami-Dade County. The goal was to identify cost-effective, productive and affordable means to use major transit capital investments and service improvements to strengthen mobility connections between the Kendall area and other key regional activity centers in the County and beyond.

The study recommends a rapid transit strategy comprised of both Bus Rapid Transit (BRT) and Diesel Light Rail Transit (DLRT) as depicted in Figure 1.

This strategy seeks to provide the best combination of user benefits and increase mobility. Transit operations would be prioritized along one of the most important commercial and residential corridors in southwest Miami-Dade County. The significance to the Miami-Dade County Trail Design Guidelines : Ludlam Trail Case Study study is that the Ludlam Trail corridor is not identified as a preferred route for any of the transit modes. This reinforces the appropriateness of the Ludlam corridor as a trail facility.

Also significant in this study is the identification of a tier one station at the northern terminus of the Ludlam Trail at the Miami International Airport. This convergence of travel modes provides an additional opportunity to enhance the effectiveness of the Ludlam trail as a integral part of an integrated, regional transportation solution for the County.

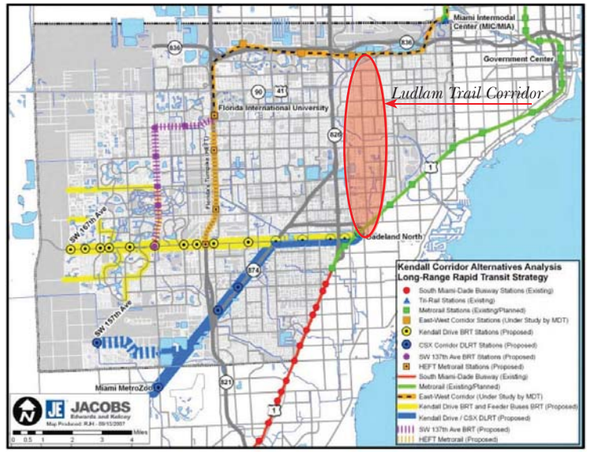



*Figure 1: Kendall Corridor Alternatives Analysis*

### *MIAMI-DADE COUNTY MPO 2025 BICYCLE FACILITIES PLAN*

The purpose of the 2025 Bicycle Facilities Plan is to achieve a higher percentage of non-motorized trips by identifying areas in greatest need of bicycle improvements and focusing improvements where they are most needed. It is a stated intention of federal transportation policy to increase non-motorized trips to at least fifteen (15) percent of all trips and to reduce the number of non-motorized users killed in traffic crashes by at least ten (10) percent. The 2025 Bicycle Facilities plan uses industry standard techniques for measuring level of service for all modes: automobile, bicycle, pedestrian, transit and trucks.

The purpose of the 2025 Bicycle Plan is to:

- Update the 1997 Bicycle Plan;
- Identify bicycle facility needs based on quantitative analysis;
- Identify candidate projects to address the bicycle facility needs;
- Prioritize bicycle facility projects; and
- Develop a Minimum Revenue Plan based on projected funding

## REGIONAL PLANS SUMMARY

Several regional transportation plans have been prepared for the Ludlam and South Miami areas. The most comprehensive plan, the Kendall Corridor Transportation Alternatives Analysis, concludes the need for regional transportation alternatives such as Bus-Rapid Transit (BRT) and Diesel Light Rapid Transit (DLRT), however, the Ludlam Trail corridor is not identified as a preferred route for either due to projected lack of ridership.

## CORRIDOR STUDIES SUMMARY

A thorough study of the Ludlam Trail corridor has been conducted through the Ludlam Trail Non-Motorized Corridor Study, Ludlam Trail Acquisition Analysis, Bridge Assessment Report and a recently concluded alternate transportation study by the Miami-Dade Metropolitan Planning Organization. Each corridor study was the result of considerable research and analysis, as well as extensive public involvement. The Miami-Dade County Trail Design Guidelines: Ludlam Trail Case Study will build on each of these documents.


*A.D. Barnes Park General Plan, 2009*

The most significant finding of the 2025 Bicycle Facilities Plan as it pertains to the Miami-Dade County Trail Design Guidelines, is the identification of latent demand in the neighborhood areas surrounding the corridor. As a community's population density increases, the number of short trips (those less than one mile) increases. These trips can often be made easily by walking or bicycling as opposed to driving. As a community becomes more dense, the construction of bicycle and pedestrian facilities as an alternative to automobile travel becomes more important to maintain mobility within the community.

Currently the area around the Ludlam Trail corridor is of medium to medium-high latent demand and is within close proximity to the high demand areas of the more urban portions of the county. The development of the Ludlam Trail could provide significant opportunities to satisfy this latent demand.

## CORRIDOR SPECIFIC STUDIES

### *MPO CORRIDOR STUDY*

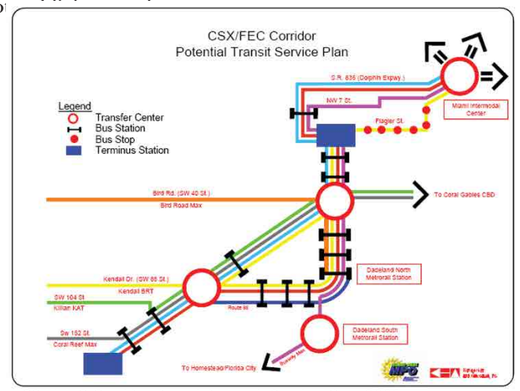
The FEC Ludlam Transit Connection Study presented a planning level analysis of potential transit connection alternatives on the FEC Ludlam Corridor between Miami International Airport and the Dadeland North Metrorail station.

The busway alternative was found to be a viable alternative to provide transit service from MIA to Dadeland North Metrorail Station for several reasons:

- The ability of right-of-way to accommodate the busway option
- Relative flexibility of bus service
- Opportunity to extend the South Dade Busway service
- Lower implementation costs than other transit options
- Opportunity to provide signalized intersection crossings to enhance trail safety

The at-grade rail alternative was also found to be similarly viable with a faster travel speed although at a higher cost, with less flexibility of routes and schedules, and less system-wide compatibility.

The analysis provided in this report identified transit alternatives for operating on the FEC Ludlam corridor right-of-way. However, the advancement of these possible options requires significant investment. Therefore potential funding sources need to be identified for implementation of any of these alternatives. In addition, right-of-way ownership needs to be addressed before any public use is implemented as the majority of the corridor is no




*CSX/FEC Corridor Potential Transit Service Plan, 2009*

### *LUDLAM TRAIL RAILROAD BRIDGE ASSESSMENT AT A.D. BARNES PARK*

This study assessed the structural integrity of the Railroad bridge at A.D. Barnes Park and evaluated the potential reuse of the bridge for pedestrian traffic. It was concluded that the bridge could be converted for pedestrian use. Specific recommendations were proposed and an opinion of probable cost was determined. The Ludlam Trail Railroad Bridge study provides a valuable solution to the critical constraint of crossing the Coral Gables (C-3) Canal.

### *LUDLAM TRAIL ACQUISITION ANALYSIS*

The Ludlam Trail Acquisition Analysis is a study to explore the Florida East Coast Railroad (FEC) corridor's attributes and recommends specific strategies to convert the corridor to a public linear park. The study analyzes and prioritizes potential acquisitions, identifies possible funding strategies and recommends operating and management models. The acquisition analysis is based on the premise that the corridor would be acquired in phases. The corridor itself is active and under the jurisdiction of the Surface Transportation Board. Any potential sale would have to include language that preserved the right for end-to-end access and prevent any break in the ability to use the corridor at some point in the future. This is unless a complete purchase is indeed made, thus no longer leaving any need for end-to-end access.

### *A.D. BARNES PARK PROPOSED GENERAL PLAN*

A.D. Barnes Park is a significant regional park adjacent to the proposed Ludlam Trail corridor. In an effort to meet the needs of the surrounding community, the Miami-Dade County Park and Recreation Department has recently completed a planning program plan for the park. This program plan was the result of research and planning efforts as well as an extensive public involvement process. Ludlam Trail is an integral part of the park's future plan and is intended to serve as a critical hub for the trail as the park plan below shows.

### *LUDLAM TRAIL NON-MOTORIZED CORRIDOR STUDY*

The Ludlam Trail Non-Motorized Corridor Study Planning and Environmental Study (Phase I) includes all data collection, as well as the development and evaluation of alternatives. Phase I also initiated an extensive agency and public involvement program that involved coordination with various stakeholders along the corridor. This study evaluated the options for converting the existing rail line corridor to trail exclusively and also explored the option of integrating a trail with the existing rail line. Although the study set forth no specific recommendation, it does verify the validity of either a rails-to-trails or rails with trails approach and suggests the consideration of a hybrid solution that keeps the southern portion of the corridor as a trail and a portion of the northern portion as a joint rail and trail facility. These proposals will be further evaluated as a part of the Miami-Dade County Trail Design Guidelines.

## DESIGN GUIDELINES

AECOM utilizes several other sources for guidelines in design and safety. Specific sources include:

- Florida Department of Transportation – Bicycle Facilities Planning and Design Handbook
- American Association of State Highway and Transportation Officials (AASHTO) – Guide for the Development of Bicycle Facilities
- AASHTO – Guide for the Planning, Design and Operation of Pedestrian Facilities
- (ADAAG) Americans with Disabilities Act Accessible Guidelines
- Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), 2003 ed. and 2009 ed.
- FHWA – Rails-with-Trails Study: Lessons Learned

## 1.5 EXISTING CONDITIONS

### FIELD REVIEW

Overall, the corridor has a track record of being well maintained and a crew was present during the review performing regular maintenance activities. The project team departed from A.D. Barnes Park and the tour, itself, started at the southern end of the corridor at Dadeland Mall and worked north along the corridor to Perimeter Road. For purposes of this description, the corridor is being broken into the following three (3) segments from the south to north.

#### *1. DADELAND MALL TO A.D. BARNES PARK (SOUTHERN BOUNDARY)*

Starting at the corridor's southern terminus at the Dadeland Mall, the trail's potential as a community connector quickly becomes obvious. The trail would not only connect local residents to a major shopping area, but also could connect into two (2) existing trails: one located within the Metrorail corridor (M-Path Trail) running north and the other running south to Homestead (South Dade Trail). A trail connection here along the Ludlam Trail would greatly extend non-motorized transportation options to the surrounding communities.

Traveling north, the corridor crosses the Snapper Creek (C-2) Canal and Snapper Creek Expressway (S.R. 878) and then travels predominantly through residential areas consisting of single-family homes. South Miami Elementary School/ South Miami Middle School and South Miami High School are located directly adjacent to the corridor, making it a direct route for students to commute safely on the trail between school and home. As the corridor approaches Bird Road, adjacent commercial use begins on the western boundary. There can be access into A.D. Barnes Park north of commercial use located at the intersection of the corridor and Bird Road. The track and ties have been removed from this entire section and this is part of the abandoned corridor.

#### *2. A.D. BARNES PARK (NORTHERN BOUNDARY) TO ROBERT KING HIGH PARK*

Continuing north, the corridor passes alongside A.D. Barnes Park and crosses the Coral Gables (C-3) Canal. Here is where the aforementioned trestle and North Waterway Drive access point are located. Between North Waterway Drive and Coral Way, the western boundary is predominately commercial use and the eastern residential. The corridor passes within a block of Coral Terrace Elementary School.

After crossing Coral Way, the adjacent land uses again become predominantly dense residential until nearing the intersection with Tamiami Trail, which is also where the active rail line begins. Within one block of this intersection are the Fairlawn Library and a U.S. Post Office. Past the Tamiami Trail, the corridor traverses back through a combination of residential and commercial land uses. After crossing West Flagler Street, the corridor passes alongside the eastern boundary of Robert King High Park before crossing the active railroad trestle.

#### *3. ROBERT KING HIGH PARK TO PERIMETER ROAD*

This section of the corridor is surprisingly scenic with the park to the west and Lake Mahar to the east. Although this section is rather short compared to the two (2) other segments, it does provide access north via the underpasses at NW 7th Street and the Dolphin Expressway. The FEC railway meets up with an active CSX line just north of NW 7th Street and a crossing would be required. Typically, trail crossings are difficult to obtain from CSX regardless if the corridor is a mainline or spur line; however, FDG representatives have indicated that they are the underlying property owners and this may be useful in leveraging an easement or license more easily than is normally the case with this Class I carrier. After this crossing, the alignment continues north then widens as it approaches the ending point at Perimeter Road.

### CURRENT USES

There are two (2) main uses occurring on the property at this time. Those uses are rail service on the active portion of the line and a handful of lease holders described below on the abandoned portion of the line. As stated previously, a 5-mile portion of the overall line has been officially abandoned by FEC and is no longer under STB jurisdiction.

#### *RAIL SERVICE*

The existing customers are located along the northern portion of the corridor from just south of Coral Way to Perimeter Road. A search of the STB website indicated (as of 2005) that there are two (2) remaining shippers - Best Truss Company, Inc. and Gulfside Supply, Inc. Direct contact with these shippers has not occurred nor has an evaluation to determine if the nearby and parallel CSX rail line could be used effectively by them.

#### *EXISTING LEASES*

A listing of current lease holders has been requested from FDG, but has not been received. A search of the FDG website does indicate active marketing of sub-surface facilities underneath all of the railroad lines from Jacksonville to Miami and there are markers along the property that identify existence of underground uses, such as fiber optics. Several surface leases are known to exist on the abandoned portion and these are mainly oriented towards vehicle parking and storage of goods.

#### *BILLBOARDS*

There are four (4) billboards located in the corridor, two (2) each at Coral Way and Bird Road. These bring in significant revenue for the company. The Central Office of the Florida Department of Transportation does have a program that allows for the purchase of billboards with the purpose of eliminating them. It is funded with Transportation Enhancements dollars from the 10 percent set aside and retained by the Central Office in Tallahassee.

*Coral Way existing billboards*


*Bird Road existing billboards*

#### *ADJACENT DEVELOPMENT AND USES*

The corridor passes through a variety of different land uses, which is typical for rail corridors and rail-trails alike. The width of the right-of-way and its physical separation from the adjacent land uses makes it particularly conducive for use as a non-motorized linear park. Because the history of the corridor affected past development patterns around it, and that until fairly recently it had trains running on it, there are far fewer intersections along the length when compared to many of the surrounding roadways.

### FIELD REVIEW SUMMARY

A field review of the corridor was conducted on the afternoon of February 23, 2009, and participants included representatives from Miami-Dade County Park and Recreation Department, AECOM, Rails-to-Trails Conservancy, Flagler Development Group, and other County departments including the MPO and Miami-Dade County Public Works Department. Access to the corridor was pre-arranged with Flagler Development Group representatives.

Map:

## EXISTING CONDITIONS SUMMARY

The Ludlam Trail corridor faces many challenges as the demand for open space for development increases in Miami-Dade County. Complete removal of existing railroad tracks, corridor encroachment and conflicting land uses are examples. The most important issue facing Ludlam Trail involves potential user safety. The corridor's north/south layout travels perpendicular to the grain of traffic for the south-central area of the County, creating several unique street crossings. These crossing will require extensive planning efforts and proactive safety measures to ensure public safety.

## EXISTING CORRIDOR CONDITIONS

The Ludlam Trail corridor links two (2) important nodes of the Miami-Dade community: the Miami International Airport area and Downtown Kendall/Dadeland Mall. Currently the northern terminus at the South Dade Trail is near the North Dadeland Metrorail Station at SW 85th St. Regional transportation plans include an additional station on the future Metrorail Orange Line - Phase Two expansion route near the northern terminus of the trail near NW 7th St. In between these two stations, the corridor pass through historic neighborhoods, crosses major arterial roads, and connections to employment centers.

Portions of the corridor have been abandoned by FDG from SW 12th St. south (below right). This includes the removal of the railroad track and the securing of bridges. North of SW 12th St., the corridor is still used by freight trains approximately 3-4 times per month although no signs of rail activity has been observed since July, 2009 (below left)

*West Flagler St. existing tracks*

*SW 12th St. end of existing railroad tracks*

Encroachment has been and will continue to be a problem along the corridor as the removal of the railroad tracks may indicate to neighbors an opportunity to expand backyards into the corridor as observed below. Efforts will need to be taken to secure the corridor property limits by working with adjoining neighbors.

*Residential fence encroachment*

*Illegal dumping within corridor*

### *ROADWAY CROSSINGS*

Roadway crossings are usually the most difficult elements to design for trails as most impact traffic patterns and involve safety concerns for both trail users and drivers. Attention was paid to what types of crossings are along the corridor and how future transportation plans will impact them. Several types of crossings were identified, including: arterial crossings, collector street crossings and local/neighborhood street crossings. Within each of these categories falls several different conditions. This includes whether the crossing will be between existing signalized intersections (mid-block crossing) or if the crossing is near an existing signalized intersection.

*SW 85th St. crossing at signalized intersection*

Three (3) street crossings of arterial roadways with annual daily traffic counts of approximately 40,000 or more exist. They include the following:

- West Flagler Street
- SW 8th St. (Tamiami Trail)
- SW 40th St. (Bird Road)

*West Flagler Street existing railroad crossing with nearby signaled intersection*

*SW 8th St. existing railroad crossing with high traffic count*

*SW 40th St. with wide boulevard and high traffic count*

The corridor also crosses three collector/minor arterial roadways with annual daily traffic counts of approximately 10,000 to 40,000. Collector/minor arterial street crossings include:

- SW 24th St. (Coral Way)
- SW 56th St. (Miller Drive)
- SW 72nd St. (Sunset Drive)

*SW 24th St. existing roadway view with landscaped median without pedestrian refuge island*

*SW 56th St. existing corridor condition with no pedestrian refuge*

*SW 72nd St. existing roadway condition with landscaped median and lack of pedestrian refuge island*

Additional crossings include eight local or neighborhood streets with annual daily traffic counts less than 10,000. Local or neighborhood street crossings include:

- SW 4th St.
- SW 12th St.
- SW 16th St.
- SW 21st St.
- SW 22nd St.
- North Waterway Drive
- SW 60th St.
- SW 64th St. (Hardee Drive)

*SW 4th St. existing railroad crossing*

*SW 12th St. existing local street crossing*


*SW 16th St. local street crossing with high speed*


*SW 21st St. existing corridor condition with railroad crossing striping and signage*

*SW 22nd St. existing corridor condition with railroad crossing striping*

*North Waterway Drive with no sidewalk access*

*SW 60th St. with lack of street edge definition*

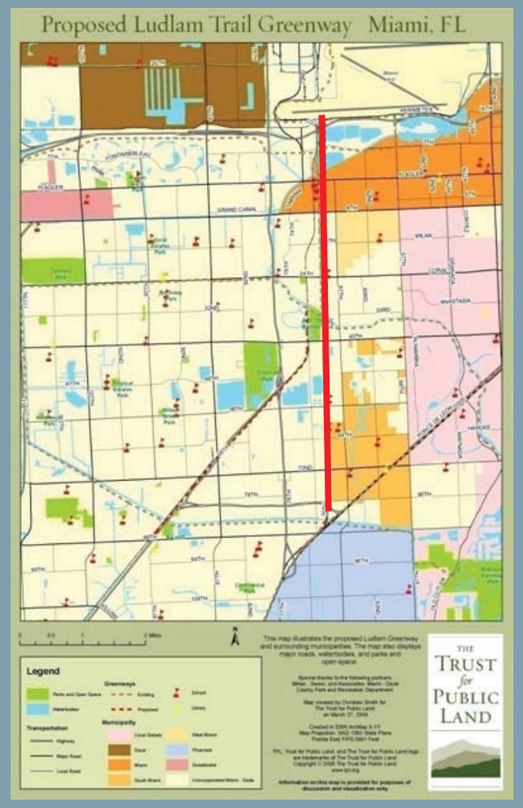
*SW 64th St. local street crossing with high speed*

## CROSSINGS SUMMARY

Within 6.2 miles, the Ludlam Trail corridor crosses seventeen (17) streets of various sizes. Three (3) street crossing are of arterial roadways with 40,000+ annual daily trips which present complex safety issues. Other street crossings include divided and undivided roadways and two lane local streets. Many local streets have speeds posted in excess of 30 MPH which are not ideal for pedestrian safety. Few trails are presented with as many opportunities to engage the community through crossing points.

## EXISTING CONNECTIONS SUMMARY

The Ludlam Trail offers opportunity to connection five (5) schools, three (3) parks, and twelve (12) neighborhood areas to a regional greenway system. Inspiring meaningful alternatives to transportation, Ludlam Trail will offer a safe route to school or work for approximately 34,000 County residents who live within 1/2 mile of the corridor.




Trust for Public Lands Ludlam Trail Greenway Map, 2007
Ludlam Trail shown in red

Other corridor crossings include local streets with existing traffic signals near the corridor. These crossings offer the opportunity for Ludlam Trail to cross at an existing intersection, therefore, offering a different set of solutions than typical mid-block local street crossings. The select opportunities include the following roadway crossings:

- SW 80th St.
- SW 81st St.
- SW 85th St.

*SW 80th St. contains a wide intersection crossing opportunity*

*SW 81st St. existing corridor condition with roadway intersection*

*SW 85th St. with existing striped crosswalk*

### *EXISTING CONNECTIONS*

Neighborhood connections are a vital part of a successful urban trail. Ludlam Trail corridor presents several opportunities to provide neighborhood connections at locations where perpendicular street's right-of-ways abut the corridor. These select locations offer the opportunity to develop a rest stop (comfort station) or other types of amenities which would bring two formerly disconnected neighborhoods together. Each location observed contained grass paths through the corridor and limited dead-end parking adjacent to the corridor. Many locations had encroachment within the corridor. Twelve (12) opportunities are currently existing and include:

- SW 6th St.
- SW 19th St.
- SW 23rd St.
- South Waterway Drive
- SW 44th St.
- SW 48th St..
- SW 62nd St
- SW 66th St.
- SW 68th St.
- SW 74th St.
- SW 76th St.
- SW 78th St.



*SW 6th St. with residential encroachment of corridor*

*SW 19th St. existing neighborhood disconnected street end*

*SW 23rd St. disconnected local street with no existing sidewalk access across corridor*

*South Waterway Drive existing corridor connection*

*SW 44th St. dead-end residential street*

*SW 48th St. existing corridor connection*

*SW 62nd St. street dead-end with illegal dumping*

*SW 76th St. existing 50' neighborhood grass path connection across corridor*


*Coral Terrace Elementary sign*

*Signaled pedestrian crosswalk near Coral Terrace Elementary on busy Coral Way*

*SW 66th St. existing neighborhood corridor connection*

*SW 78th St. existing corridor connection with landscape encroachment*

*South Miami Elementary view from Ludlam Trail corridor*

*Parent pickup traffic at South Miami Elementary at SW 60th St.*

*SW 68th St. existing neighborhood corridor connection*

*SW 74th St. existing corridor connection with landscape encroachment*

### *SCHOOL CONNECTIONS*

School connections are an integral part of the communities that Ludlam Trail will need to serve in order to be successful. There are four (4) schools within 500 feet of the corridor, three of which are immediately adjacent. Special attention is needed to planning a potential higher level of trail use immediately surrounding each school. Adjacent schools include:

- Coral Terrace Elementary
- South Miami Elementary School
- South Miami Middle School
- South Miami Senior High School

Additionally, Ludlam Elementary on SW 72nd St. is within a quarter mile of the corridor. Minimum to no existing connections to the corridor exist for each school.


*South Miami Middle School sign*


*South Miami K-8 Expressive Arts Center located adjacent to South Miami Middle*


*South Miami Senior High School sign*

*Mid-block signaled pedestrian crossing on SW 56th St. near South Miami Senior High*

## SCHOOL CONNECTIONS SUMMARY

Ludlam Trail corridor has direct connection to three school; South Miami Elementary, South Miami Middle School and South Miami Senior High School; and access to a fourth school, Coral Terrace Elementary. Most of these schools are located on busy arterial or collector streets with little existing opportunity for children to safely travel to school. Existing conflicts include pedestrian crossings with minimal signalization and pedestrian priority and traffic congestion near school entrances.

## SCHOOLS AND PARKS SUMMARY

Schools and parks are at the center of communities in terms of activities. With a total of 4 schools and three (3) parks along the 6.2 mile corridor, Ludlam Trail will enjoy high demand for short trips. Connections to schools and parks should be able to accommodate an increased level of traffic with eight foot wide sidewalks, appropriate signage and proper safety features such as pedestrian lighting, emergency phones and 'eyes on the trail.' Limited existing connections can only be found for the South Miami Senior High School along Southwest 56th St., Miller Drive, in the form of an eight foot wide sidewalk.

School connections should be carefully planned to include increased levels of traffic on the trail near each school. Safe routes include user friendly facilities separated from auto traffic. Existing school connections include a ten (10) foot wide green and white sidewalk along SW 56th St. (Miller Drive) to South Miami Senior High School. This width provides room for students to walk side-by-side and bikers to pass. Other school connections include a pedestrian mid-block signaled crossing on SW 56th St. and a potential connection from SW 53rd St. to the trail.

*SW 56th St. existing 10' school sidewalk connection*

*SW 53rd St. corridor access point adjacent to South Miami Senior High*

Some neighborhoods have taken safe route planning into their own hands. Examples of this include a paved path from SW 21st St. to SW 22nd St. (pictured below). Connections like this encourage the use of the corridor for safe routes to nearby schools; in this case, Coral Terrace Elementary school. Crossings should be planned for a high level of young trail users, both pedestrians and bikers.

*Safe Route to School sidewalk near SW 22nd St.*

*Existing crosswalk with signage*

### *BRIDGES*

The Ludlam Trail corridor passes over three canals: Tamiami (C-4) Canal, Coral Gables (C-3) Canal and the Snapper Creek (C-2) Canal. The Tamiami and Coral Gables canals both have existing wood trestle bridges which could be utilized by the future trail. A structural integrity assessment has been conducted by the MDPR on the Coral Gables bridge and it concluded that the bridge could be converted for pedestrian use. Each bridge will needs to be individually evaluated.

*Coral Gables C-3 Canal Bridge*

*Tamiami C-4 Canal Bridge*

Crossing the Snapper Creek (C-2) Canal will require the construction of a new bridge. Conditions are different for the Snapper Creek Canal as the width averages approximately 100 feet in the area compared to approximately 50 to 75 feet for the other canal crossings. The Snapper Creek Canal crossing presents another constraint as that the corridor is within 100 feet of an existing roadway bridge for Southwest 70th Avenue. South Florida Water Management District (SFWMD) restricts building structures within 100 feet due to needed maintenance access. Any design solution should be planned in coordination with SFWMD.

*Tamiami C-4 Canal has direct access to Lake Mahar and Blue Lagoon*

*Coral Gables C-3 Canal contains steep rock banks characteristic of the area*

*Snapper Creek C-2 Canal is the widest of the three canals at over 100'*

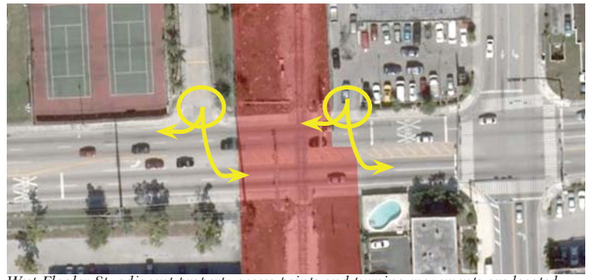
### *DRIVEWAYS*

Adjacent driveways are of particular concern for trail user safety along Ludlam Trail. Adjacent driveways present a set of constraints which should be taken into consideration during the planning process. Commercial driveways located within 100 feet of the trail corridor are of greatest concern as vehicles turning into or out of parking lots may not be able to observe safe crossing conditions for the entire trail before making a turning movement.

This type of condition has three (3) potential solutions: restricting turning movements to right-in or right-out only (least impact); removal of driveway which would require a second access point to be present or a monetary payment to the property owner due to potential business implications (moderate impact), or an above-grade crossing to ensure trail user safety (highest impact). All three solutions would require coordination with adjacent property owners. Locations where driveways are present include:

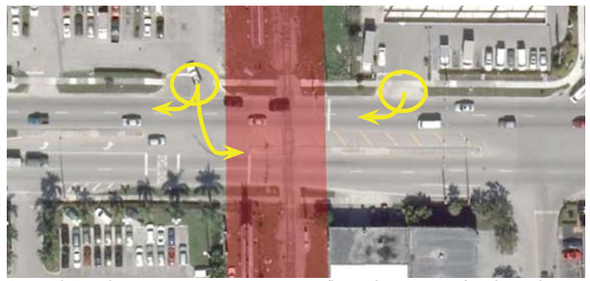
- West Flagler Street
- SW 8th St. (Tamiami Trail)
- SW 24th St. (Coral Way)
- SW 40th St. (Bird Road)

# *Section One* **EXISTING CONDITIONS**

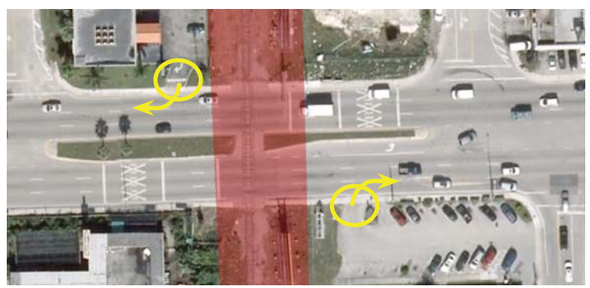


*West Flagler St. adjacent property access points and turning movements are located close to the corridor*

*SW 8th St. adjacent properties access points do not conflict with Ludlam Trail corridor*



*SW 24th St. adjacent property access points conflict with proximity of trail corridor*



*SW 40th St. adjacent properties' access points do not conflict with trail corridor*
*Ludlam Trail corridor highlighted in red, access and movements highlighted in yellow*

### *LAND USE*

Land uses along the Ludlam Trail corridor primarily include estate and single family residential. North of SW 44th St., increased adjacencies of light industrial and commercial land uses exist. Examples include a warehouse district between SW 44th St. and SW 40th St. (Bird Road). North of SW 12th St., the Ludlam Trail corridor adjacent land use is primarily light industrial and commercial, shown below. This area includes several abandoned railroad spurs and potential safety concerns such as mid-block crossings of the remaining active railroad exist.


*SW 8th St. adjacent commercial land use*

Adjacent parking lots are located in several places along the Ludlam Trail corridor. Examples include an existing parking lot for the Bird Road Post Office branch and a church parking lot immediately north of SW 16th St. In all cases, the parking lots are fenced with no existing access points to the corridor. Access points to institutional parking lots should be planned to encourage use of the trail and provide access for patrons of each institution.

*Parking adjacent to Ludlam Trail corridor near SW 16th St.*

### *ACCESS*

Neighborhood access to the Ludlam Trail corridor includes minimum existing sidewalks traveling through the corridor right-of-way. Most sidewalks end at the corridor right-of-way and limit pedestrian access. Examples of complete sidewalks are on SW 16th St. while incomplete examples include SW 80th St.

*Example of existing sidewalk extended through Ludlam Trail corridor*

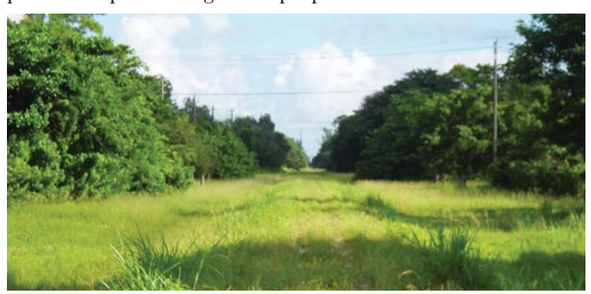
*Example of disconnected sidewalk near SW 80th St.*

Few private gates exist along the corridor. Examples pictured below were taken at various ends of the corridor. Opportunities to install access gates should be left to the private land owners, but, still be encouraged to increase the level of ownership of the trail and neighborhood surveillance of the corridor.

*Examples of existing private access gates to Ludlam Trail corridor*

### *VIEWSHED*

Existing corridor viewsheds consist of elongated, framed views. Throughout the residential areas, the corridor is lined with existing vegetation which should be preserved and enhanced where needed to provide necessary screening of homes. North of SW 44th St., the corridor will need additional vegetative screening of conflicting land uses to maintain a proper viewshed. Currently, there are no shade trees within the corridor that could provide ample shading of the proposed trail.



*Ludlam Trail corridor viewshed from SW 80th St. showing existing vegetation*

## ACCESS SUMMARY

Trail access should be primarily through the use of sidewalk connections; however, where possible, private access points should be allowed along the corridor. With sidewalk connections of six feet in width, vital neighborhood connection can be made and universal access can be provided. Currently, limited existing sidewalk access is provided to the corridor.

Transit access along the corridor rarely utilizes the corridor for bus stops or shelters. Several bus stops exist within 250' of the corridor and should be encouraged to be relocated within or immediately adjacent to the corridor to best serve trail users. Existing transit facilities such as SW 8th St., Tamiami Trail, should be improved to include a covered bus shelter and seating.

## COMPARABLE TRAILS

Several comparable trails were evaluated which pertained to three areas of influence; national comparable trails; Florida comparable trails; and comparable trail facilities. Two national trails studied were the Burke-Gilman Trail, located in Seattle, Washington and the Fred Marquis Pinellas Trail, located in Pinellas County, Florida. Both trails have received numerous awards and recognition for providing both transportation and recreational opportunities.

Two local or Florida based trails were also selected for further study and included the Seminole-Wekiva Trail in Seminole County and the West Orange Trail in Orange County. Both trails offered valuable research on safe roadway crossings and types of trail amenities. A unique, yet comparable trail facility was also selected for research. The Chicago Bike Hub, known as the McDonald's Cycle Center, offers a unique opportunity for transit and trail users to a bike-hub complete with bike lockers, a repair center, restrooms, retail and vending areas. By reviewing these successful examples of trails and trail facilities, several best practices were identified for further research.

## 1.6 COMPARABLE TRAILS

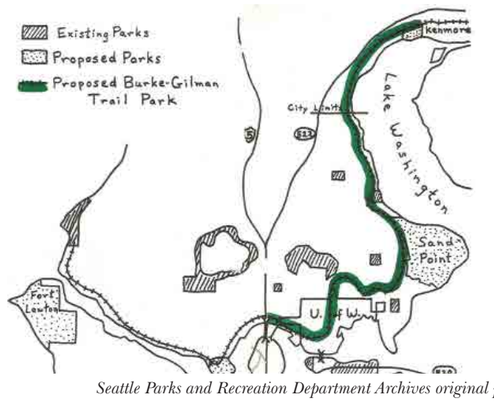
### 1.6.1 BURKE-GILMAN TRAIL

The Burke-Gilman Trail is an eighteen (18.8) mile shared-use urban trail located in King County, Washington. The trail connects the City of Seattle to the City of Bothell located in northern King County. It is a heavily used commuter trail with high levels of rush hour cyclist commuters and skaters. The City of Seattle Parks and Recreation Department has noted pedestrians walking next to the paved trail on stabilized shoulders at rush hour times due to the high level of cyclist commuters.

*Burke-Gilman Trail at Interstate 5*

*Divided trail segment*

The vision for the Burke-Gilman Trail started when the former Seattle, Lake Shore and Eastern railroad corridor was abandoned by Burlington Northern in 1971. The City of Seattle acquired the corridor for public biking and walking. The trail was jointly developed by City of Seattle, University of Washington and King County and dedicated in 1978. Original plans from 1970 for the Burke Gilman Linear Park are shown below.




*Seattle Parks and Recreation Department Archives original plan*

The trail has developed into a major urban transportation corridor which serves thousands of commuters daily. Horses and motorized vehicles are not allowed on the trail. Dogs and their walkers are popular along the trail with select areas of the trail offering disposal stations.

Originally 12.1 miles in length, the trail has been expanded with connector trails to become a continuous 42 mile recreation trail, though only 18.8 miles are officially called Burke-Gilman Trail. King County is currently planning and constructing a 'missing link' segment which passes through an industrial area (Ballard Corridor Design Study). Area residents are worried about the convergence of trains, trucks, cyclists and pedestrians. The trail enjoys a high level of community support through the formation of the non-for-profit organization 'Friends of the Burke-Gilman Trail' which has funded traffic studies and design plans. The organization includes anniversary celebrations and trail clean-up days.

In 2007, the Burke-Gilman Trail Redevelopment Project was launched after a 2004 study identified a two (2) mile section of the trail which needed to be redeveloped for better safety and at the request of adjoining homeowners. The redevelopment consisted of widening the trail from ten (10) feet to twelve (12) feet in width with a three (3) foot stabilized shoulder on the east side of trail for pedestrians and one (1) foot shoulders on both sides for a total trail zone width of seventeen (17) feet. The trail's twelve (12) foot trail width was determined by assessing trail volume and because it allows people to walk in pairs or ride two bikes abreast. Before and after images are provided below courtesy of the Friends of the Burke-Gilman Trail

*24th Ave. before image*

*24th Ave. after image*

The trail is jointly maintained by Seattle Department of Transportation Bike Resources and Seattle Parks and Recreation Department. King County, however, states they are responsible for all construction, improvements, and maintenance of the trail.

#### *TRAIL OWNER/MANAGER AND CONTACT*

Owner: King County
Department of Transportation
201 South Jackson St.
Seattle, WA 98104
(206) 263-4741

Manager:
Seattle Department of Transportation - Bike Resources
(206) 684-5108

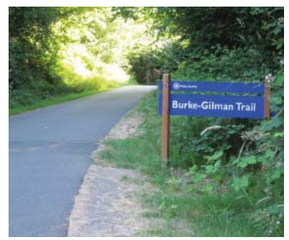
#### *TRAIL DESIGN*

Trail length: The Burke-Gilman Trail is currently 18.8 miles in length.
Corridor width: Fifty (50) foot in commercial/industrial areas with some places 25' or less; typically 100' in residential areas.
Trail details:

- Portions of the trail are non-separated/shared-use with an eight (8) to twelve (12) foot width
- In other ares, there is a paved path five (5) feet in width with an additional three (3) feet wide unpaved shoulder, and second five (5) feet wide paved trail separated by a three to five (3-5) feet wide grass median.
- It is expected that the trail will be expanded to a width of twelve (12) feet
- Additionally, there is signage along trail to assist with identification and wayfinding

Surface: The trail is paved with soft-surface shoulders and is striped only at crossing areas.

*Cyclists on asphalt surface*




*Trail signage*

#### *TRAIL AMENITIES*

Number of Trailheads: Currently, there are no designated, single-use trailheads along the trail, however there are three (3) connections into adjacent parks that provide trailheads.

Amenities provided at trailheads: Connections into adjacent parks that provide restrooms, parking, water fountains, benches, and picnic tables are available.

Bike storage facilities: Facilities available are limited bike racks as no formal storage facilities or bike rentals are provided at the trailheads, however there are private vendors nearby offer similar products and services.

Gateway features: Currently, no gateway features exist.

### *TRAIL CONNECTIONS*

Other trail connections: The trail provides direct connections to a single, adjacent trail, however there are no formal traffic control measures in place.

Transit connections: Although several bus stops exist along roadways adjacent to the trail, a facilitated pedestrian connection to those stops is typically missing.

Park connections: There are park connections along the trail to three (3) parks. These connections typically occur near the parking areas and consist of directional signs and a paved walk linking the trail to the park. In some cases, the trail is identified through signs within the park. The informal trailhead at Gas Works Park that serves as the starting point for the original segment of trail has parking, restrooms, seating and picnic areas. The best park connection exists at Tracy Owens Station Park which serves as the terminus of the trail's original segment and includes the trail as part of the park's circulation, in addition to providing a restroom facility for trail users.

*Example of park connection for the Burke-Gilman Trail with seating*

School connections: Direct connections to the University of Washington campus and University of Washington Medical campus currently exist and typically include a connection to the campus sidewalk network and trail signage. There is an above-grade connection to the medical campus due to a grade difference.

Neighborhood connections: The trail passes through several neighborhoods whose quiet residential streets provide direct access, however few sidewalks exist in most neighborhoods north of the University of Washington. South of the campus, concrete sidewalks (typically five (5) feet in width) connect to the trail near roadway crossings.

Shopping facility connections: Direct sidewalk connections to the University Village Shopping Center exist and there are transit stops adjacent to the 25th Ave NE crossing.

Urban or civic connections: Trail links are currently under construction for the segments traveling through the industrialized area. Parking impact studies have been conducted to determine the impact of the trail on local parking needs. In addition, urban connections were made to the Google Earth campus with minimum trail corridor width of approximately twenty-five (25) feet.

*Burke-Gilman urban connection to Google Earth campus with minimum trail width of 25' feet*

### *TRAIL CROSSINGS*

Below-grade:

- At this time, one below-grade crossing exists and is located at 68th Ave. NE and Bothell Way. The tunnel was constructed from 2007-2008 after a transportation engineering report determined a need for a below-grade crossing due to the proximity of an adjacent roadway intersection. The tunnel is approximately sixteen (16) feet in width and ten (10) feet in height. The existing approach ramps are straight and contain no landings. In addition, they appear to exceed ADA slope requirements for accessible ramps.

*Below-grade crossing at 68th Ave. NE with wide tunnel width*

Above-grade:

- One above-grade crossing exists; a connection to the University of Washington Medical campus. This crossing consists of an eight (8) foot bridge and does not support the main trail's traffic volume

At-grade:

- A total of 32 at-grade roadway crossings exist along the Burke-Gilman Trail. The largest roadway crossed is a four lane collector street with a center turn lane. Most crossings are local residential streets or industrial access roads
- A 2004 traffic engineering report evaluated on-trail volume/crossings, and subsequently recommended that all trail stop signs for driveways or local roads be removed per best practice traffic engineering standards
- A similar report recommended that all motorists yield to trail users. Washington State law requires all motorists to yield at marked crosswalks and crossings. The Burke-Gilman Trail (2004) study indicates a strong pedestrian priority stance at all crossings. Florida State law [Statue 316.130(7)] is of similar stance
- The 2007 redevelopment plans include several 'alerts' for crossings that include signage, pavement markings, distinctive surfacing through the crossing, and tactile warning strips across the trail width

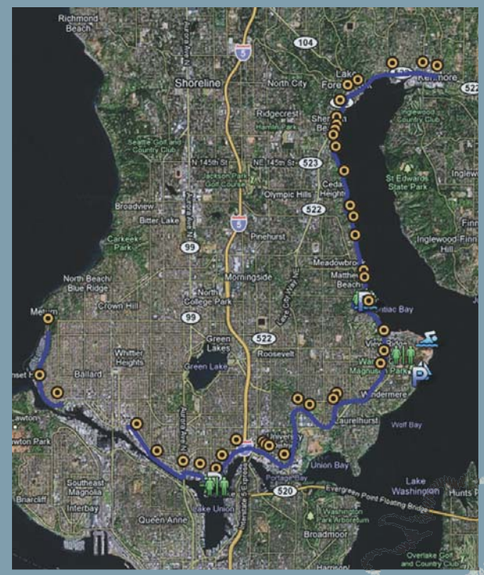

*Trail MUTCD signage*

*Example of at-grade crossing with push button traffic signal*

## NATIONAL COMPARABLE TRAILS SUMMARY

The Burke-Gilman Trail is a highly used commuting trail located in Seattle, Washington. The trail is so popular, expansion plans have been prepaid and are under construction to widen the trail due to trail volume and user safety. Connecting the City of Seattle to the northern suburban community of Bothell, the trail experiences morning and evening rush hours due to its success.

Trail Map:




*Burke-Gilman Trail highlighted in blue.*

## NATIONAL COMPARABLE TRAILS SUMMARY

The Fred Marquis Pinellas Trail is a unique, urban multi-use trail in Pinellas County, Florida. From picturesque parks to residential neighborhoods and historic urban downtowns, this nationally recognized and awarded trail has plenty to offer those seeking recreational facilities or a convenient alternative transportation option.

### 1.6.2 FRED MARQUIS PINELLAS TRAIL

The Fred Marquis Pinellas Trail is a thirty-five (35) mile, urban non-motorized paved shared-use trail that travels from Tarpon Springs to downtown St. Petersburg. The trail is very popular, with approximately 1.2 million users annually, making the Fred Marquis Pinellas Trail the third most heavily used rail-trail in the country. Primary use of the trail is recreational, but due to its urban location, the trail is also used for some local commuting, especially by school children.

The vision for the trail first came in 1984 from bike enthusiasts looking to develop safe bicycle and walking routes within the county. The Pinellas County Metropolitan Planning Organization's (MPO) Bicycle Advisory Committee and the Pedestrian Safety Committee joined forces to construct the first five (5) mile section of the Pinellas Trail in 1990. This segment and the remaining trail construction has been funded through a 'Penny-for-Pinellas' sales tax referendum (approved in 1989). Last year, the Pinellas Board of County Commissioners approved plans for a Pinellas Trail Loop to connect the trail from downtown St. Petersburg to the East Lake Tarpon. Once completed the Fred Marquis Pinellas Trail loop will travel over 75 miles around Pinellas County.

The trail was inducted into the Rail-Trail Hall of Fame by the Rails-to-Trails Conservancy in 2008 and has won numerous awards and designations, including; the National Recreation Trail by the U.S. Department of Interior, National Park Service (2003); Best Trail of Florida Award, Office of Greenways and Trails (2003); Millennium Trail of 2000 by the White House Millennium Council; and Florida Greenway designation by the Florida Greenways Commission (1995).

The trail travels through the communities of St. Petersburg, Gulfport, Seminole, Largo, Belleair, Clearwater, Dunedin, Palm Harbor, and Tarpon Springs. It was developed on an abandoned CSX rail right-of-way, and its current adjacencies are primarily dense residential and commercial areas. The trail crosses a number of large roadways, and a total of ten (10) overhead trail bridges provide safe, above-grade crossings at these locations. Well-organized on-line trail maps and the Guide to the Pinellas Trail book make the use of this trail very easy for residents and visitors alike.

The Fred Marquis Pinellas Trail also has a public art program that promotes and displays art along the trail. The current installation consists of nine sculptures that are next to and arc over the trail. The sculptures provide wayfinding to trail users as 'community markers' at key points along the trail. The pieces also playfully illustrate elements of the trail's history as a railroad line.

Pinellas Trails, Inc., a 501(c)3 not-for-profit corporation consisting solely of volunteers, helps the County with planning events, overseeing the trail website, managing neighborhood relations, promoting art along the trail, supporting the Auxiliary Ranger Program (Courtesy Patrol), and fund-raising to provide site furnishings, mile markers, and trail maps along the trail.

*Bicycle traffic on the Pinellas Trail near Tarpon Springs, divided trail segment and sculpture*

#### *TRAIL OWNER/MANAGER AND CONTACT*

Pinellas County Parks and Recreation
Trail Office
12020 Walsingham Road
Largo, FL 33778
(727) 549-6099

#### *TRAIL DESIGN*

Trail length: The Fred Marquis Pinellas Trail is currently 35 miles in length with plans to expand to 75 miles with the addition of the Pinellas Loop route through eastern Pinellas County.

Corridor width: Corridor width varies between 50 - 100 feet.

Trail details:

- Portions of the corridor consist of a single, non-separated/ shared-use trail that is fifteen (15) feet in width
- Other portions of the corridor contain a pedestrian trail that is five (5) feet in width and a ten (10) foot wide bicycle/ skate trail that is separated by a four (4) foot wide grass strip.
- Signage and graphics are used to help demonstrate trail use and are placed at the trail separation points
- Signs along trail demonstrate that pedestrians are to utilize one side of the path while skaters and bikers are to use the other side
- The length of the trail is paved asphalt
- In addition to the grass median, the crossing ares are striped to divide pedestrian and cyclists/skaters
- Additional striping exists at the beginning and the end of the trail separations
- Safety bollards are set back from crossings approximately thirty-five (35) feet and consist of two (2) bollards within trail and two (2) bollards on outside of trail

*Pavement markings*


*Bollards at controlled entrances*

#### *TRAIL AMENITIES*

Number of Trailheads: Currently, there are no designated, single-use trailheads, however connections into adjacent parks that provide trailheads exist.

Amenities provided at trailheads: It is possible to connect into parks with restrooms, parking facilities, water fountains, benches, and picnic tables.

Bike storage facilities: There are no bicycle storage facilities provided.

Gateway features: Overhead trail crossings are used as gateway features and provide a location for identification signs. Sculptures placed along the trail as it passes through different cities act as iconic wayfinding features. These features help to create a more user-friendly scale, provide whimsy, and assist in wayfinding for trail users. In addition, speed limit and trail division signs regulate trail users and station markers exist along the trail for wayfinding and emergency services.


*Pinellas Trail park connection*


*Trail traffic signage*

### *TRAIL CONNECTIONS*

Other trail connections: Currently, no connections to other trails exist.

Transit connections: Although there are existing bus stops along roadways adjacent to the trail, there are very few direct connections from the trail to those stops.

Park connections: There are numerous park connections along trail, each typically consisting of directional signage, a paved pathway connecting the trail to park, and the identification of the trail through signs within park. These connections typically occur near parking areas. The best park connection exists at Wall Springs Park, where a gateway plaza was created along the park.

School connections: There is a direct connection to Ozona Elementary where pervious pavers link the trail directly to school walkways. The school is fenced, and the gate that accesses the trail is locked during school hours. A bike storage area is directly adjacent to trail and within the school fenced area; this storage area is also locked during school hours. There is an indirect connection to another school near Taylor Park where the trail is used as an egress route for children leaving school.

*School egress route to trail*

*Direct connection to Ozona Elementary*

Neighborhood connections: There are several direct connections to adjacent neighborhoods and their sidewalk networks. These connections typically consist of a paved walk of five (5) feet in width that links the trail to the existing pedestrian network within the neighborhood. These connections typically occur at or near roadway intersections.

Shopping facility connections: Although there is a direct connection to a Publix shopping center, an opportunity to connect to a large shopping center along Hwy. 19 was never realized.

Urban or civic connections: There are several wonderful examples of weaving the trail into the the existing urban fabric in Dunedin and Tarpon Springs. In these locations, the trail becomes part of Main Street and has subsequently influenced the design of adjacent plazas and commercial areas.

### *TRAIL CROSSINGS*

Below-grade:

- A total of three (3) below-grade crossings exist, each of which is a 25 to 30 feet wide tunnel structure that allows for ample clear-space on both sides of trail. With a roof height of over fifteen (15) feet, the crossings feel vehicular in nature.

*Below-grade crossing typical tunnel with 25-30' width and 15'+ height*

Above-grade:

- There are a total of nine (9) above-grade crossings. Each of these structures is of fifteen (15) feet in width and has a ceiling height of approximately ten (10) to (12) twelve feet. These structures are 'caged' with chain-link fencing which leaves the user feeling very exposed due to the lack of a low wall or heavier anchoring structure. In addition, there are no areas where users can 'pull off' of trail within structure if need to rest or would like to enjoy the views.

*Ramp approach to bridge with stairs*

*'Caged' bridge structure*

At-grade:

- While there are several types of crossings, they typcially consist of a striped crosswalk preceded by bollards, trail division striping, as well as a stop sign/bar. In addition most provide truncated dome paving along the road edge. The majority of at-grade crossings are located at four-way stops


*At-Grade crossing traffic signage*


*Bollards at each At-Grade crossing*

- Crossings in conjunction with traffic signals are typically required for exiting adjacent neighborhoods. These crossings consist of a striped crosswalk within roadway area, bollards, some division striping, and a push-button signal trip.

*Signaled At-Grade crossing with push button activation*

- There is a highly marked crossing near the mall area that provides crosswalk warning signs, a sign mandating motorists to stop prior to the crossing, and double crosswalk warning signs.

*Highly marked mid-block crossing with stutter signals (flashing beacons) and bus stop*

Fred Marquis Pinellas Trail Map:


*Existing route highlighted in green, planned phases for loop multi-colored, Pinellas County Parks and Recreation Department*

## FLORIDA COMPARABLE TRAILS SUMMARY

The Seminole-Wekiva Trail is one of Seminole County's showcase trails because of its length, beauty and universal accommodation of all users. Connecting four (4) parks and two (2) schools are a central aspect of why this trail is considered a success by the Florida Department of Transportation and Seminole County.


Seminole-Wekiva Trail Map (Seminole County Public Works - Engineering Division, 2009)

### 1.6.3 SEMINOLE-WEKIVA TRAIL

The Seminole-Wekiva Trail is a fourteen (14) mile trail that travels from Lake Mary to Altamonte Springs through dense residential and commercial areas. The trail is used recreationally, for walkers, runners, and inline-skaters, and has equestrian access in northern portions of the trail.

The trail is part of the Florida National Scenic Trail and connects regionally to the Cross Seminole Trail via a beautiful, gateway bridge over Interstate 4 (I-4). The trail also connects Westmonte Park, Sylvan Lake Park, Sanlando Park, and the Seminole County Softball Complex and provides access to two (2)elementary schools and the Wekiva Springs River Nature Preserve. A future southern connection to the West Orange Trail is proposed to fulfill the vision for a 'Central Florida Loop' trail. The trail is owned by Seminole County and the Florida Department of Transportation and is maintained by Seminole County Leisure Services Department and the Department of Public Works Trails and Greenways Division.

The trail was built on the Orange Belt Railway with the first phase opened in 2000, from State Route (SR) 436 to SR 434. Other milestones include the opening of the $3.5-million 1000' foot suspension bridge over I-4 in 2003, the SR 434 underpass completion in 2008, and the proposed underpass at Lake Mary Blvd. and International Pkwy. in 2010. The trail has been funded by a $25 million bond referendum that was approved in 2000 for trail development and acquisition of natural lands.


*Typical trail corridor section*


*Typical Seminole crossing*

#### *TRAIL OWNER/MANAGER AND CONTACT*

Seminole County Leisure Services Department
Trails and Greenways
Bryan Nipe, Manager
Streetscapes and Trails
(407)321-1693

#### *TRAIL DESIGN*

Trail length: The Seminole-Wekiva Trail is currently 14 miles in length.
Corridor width: Corridor width varies from fifty (50) to one hundred (100) feet.
Trail details:

- The Seminole-Wekiva Trail is a non-separated/shared-use trail that varies in width from 12 to 15 feet
- The trail is paved throughout its length
- Striping, which consists of double yellow line, painted, and divides trail equally, can be found in some areas of the trail, specifically those north of CR 46A. Additionally, arrows indicate direction
- No bollards are used on this trail


*Typical Seminole crossing markings*


*Typical raised landscape trail median*

#### *TRAIL AMENITIES*

Number of Trailheads: Currently, there are three (3) trailhead along the trail.
Amenities provided at trailheads:

- The existing trailheads offer users paved parking, overflow unpaved parking, picnic areas, benches, pavilions, bike racks, restrooms, signage/maps, and water fountains,
- Additionally, at Markum Trailhead users can find an equestrian parking area with a water trough


*Typical trailhead amenities*

Bike storage facilities: There are currently no bike storage facilities along the Seminole-Wekiva Trail.
Gateway features:

- I-4 crossing most significant gateway, with identification sign facing traffic with trail name

#### *TRAIL CONNECTIONS*

Other trail connections: None currently exist.
Transit connections: Currently, there are no notable transit connections
Park connections:

- At present, there is a poor connection to Westmonte Park. This connection is fenced off from the main park and is often locked. Although the connection could be unlocked, there is no path from the park to the trail. In addition, a restroom building faces trail, but is also locked
- A direct connection occurs at Sanlando Park through gate that is locked when the park is closed. This walk connects directly to park office and water fountains. There are also signs along trail that indicate park information and the presence of a connection
- The Softball Complex has a a mini-trailhead and a pathway connecting it to the main portion of the trail. Here, trail users can take advantage of the shared paved parking offered by the complex, picnic pavilions, seating, bike racks, informative signage, and a water fountain at the connection point

School connections: Currently there are two connections to adjacent schools.

Neighborhood Connections: There is a direct connection via boardwalk from the trail to the existing neighborhood pedestrian network. Signs along trail indicate the presence of these local connections.

Shopping facility connections: There is a wonderful interface with a shopping center/restaurants area near Lake Mary Blvd. Panera Bread has a patio facing trail that offers users bike racks and additional informative signage. Additionally, there is a plaza adjacent to the trail in this location.

Urban or civic connections: Other than the aforementioned shopping plaza, no urban interface exists

*Typical urban connection*

### *TRAIL CROSSINGS*

Below-grade:

- There is a great example of a below-grade crossing at the newly constructed Hwy 434 tunnel. This tunnel has ramps that maintain a 5% slope, offer landings ever thirty (30) linear feet, and provides handrails along both sides of the trail. The path is twelve (12) feet wide with ceiling of ten to twelve (10-12) feet in height. This passageway is gated to control access on a as-needed basis. The grating/fencing used allows for both protection and the use of natural light. Additionally, the trail is striped continuously down the centerline with arrows on either side indicating direction.


*Hwy 434 tunnel entrance ramp and gate*

*Hwy 434 tunnel entrance*

Above-grade:

- There is a major above-grade crossing over I-4 which also has 5% ramps, landings every thirty (30) feet, and handrails along both sides of trail. The thirteen (13) foot wide trail is divided by a painted centerline only at ramp turns. A 42 inch high guard rail/fence runs along the ramp. The elevated portions of the trail have a fenced enclosure with a ceiling twelve (12) feet high

*I-4 above-grade crossing*

*I-4 ADA compliant bridge*

At-grade:

- At-grade roadway crossings are typically divided by curbed landscape medians. At these points, the trail divides into a seven (7) feet wide trail and a raised median four (4) feet wide. Lean bars are provided at most crossings. At these locations, roadway areas are striped and pedestrian crossing warning signs are installed at and prior to crossing point.


*Typical Seminole At-Grade crossing with landscaped medians and bike lean rails*

## 1.6.4 WEST ORANGE TRAIL

The West Orange Trail is a twenty-two (22) mile long trail that travels through a number of small communities in north Orange County, including Apopka, Ocoee, Clarcona, Oakland, and Winter Garden. It has won the National Department of Transportation's 'One of the America's 25 Best Enhancement Projects' as well as deemed a 'Great Public Space' by the Project for Public Spaces. It is a well-used trail with approximately 540,000 users per year. The trail was funded by P2000 and ISTEA funding, with the Rails-to-Trails Conservancy assisting with land acquisition and the adjacent communities assisting with design and planning. Phase 1 opened in 1994.

There are four (4) major trailheads and (5) five minor outposts along the trail, as well as ten (10) miles of equestrian use along the trail. Future plans include expansion to connect with other regional trails to form the 'Central Florida Loop' trail. The trail is used predominately for recreation.

*Urban section of West Orange Trail*

*Iconic bridge along West Orange Trail*

### *TRAIL OWNER/MANAGER AND CONTACT*

Orange County Park and Recreation Department
Chapin Station Main Office
501 Crown Point Cross Road
Winter Garden, FL 34787
(407) 654-1108

*Urban segment in downtown Winter Garden, Florida with gateway feature*

*ADA accessible ramp to pedestrian bridge*

### *TRAIL DESIGN:*

Trail length: The West Orange Trail is currently 22 miles.
Corridor width: Corridor width for the West Orange Trail varies throughout the length of the trail.
Trail details:

- This trail consists of a single, non-separated/shared-use path that varies from twelve to fifteen (12-15) feet in width, and paved throughout its length

## FLORIDA COMPARABLE TRAILS SUMMARY

The West Orange Trail is an immensely popular rail-to-trail located just west of metropolitan Orlando. Connecting the communities of Oakland, Winter Gardens, Ocoee and Apopka, the trail is noted by Project for Public Spaces as a good example of the use of public space with its unique trailheads and 'outposts.' Funded in large by the Florida Greenways and Trails Program, Orange County assisted with acquisition.


West Orange Trail Map (Orange County Parks and Recreation Department)

## WEST ORANGE TRAIL (CONTINUED)

- The trail is striped in some areas, specifically those north of CR 46A. Striping consists of double yellow line, painted, and divides trail equally. Additionally, arrows indicate direction
- The use of bollards is limited to a few areas, most of which are in the center of the trail at crossings. Two (2) bollards have been removed at each location on the edge of the trail

*Single center bollard used at each at-grade crossing approach*

### *TRAIL AMENITIES*

Number of Trailheads: There are four (4) full stations (major trailhead parks), four (4) outposts (minor trailheads), and one horse-park outpost.

Amenities provided at trailheads:

- At the stations, trail users can expect to find a trailhead building with restrooms, rental/shop and office area, playground, picnic tables, pavilions, benches, water fountains, bike racks, paved parking, unpaved overflow parking, and a map/kiosk sign.
- Outposts have fewer amenities than the stations, which include unpaved parking, wayfinding signage, benches and in some cases a pavilion

Bike storage facilities: Currently, there are no bicycle storage facilities offered.

Gateway features: In downtown Apopka, there is a wonderful example of an overhead crossing used as a trail. There is also a downtown gateway with a new bridge structure. The design of these features is modern but timeless, and reminiscent of a railroad trestle.

*Trailhead amenity center*

*Trail amenities include a covered picnic table and wayfinding*

### *TRAIL CONNECTIONS:*

Other trail connections: There are no direct connections at this time.

Transit connections: There are no direct connections from transit routes to the trail at this time.

Park connections: Other than to station trailheads, there are no connections to any adjacent parks. At these stations, the park space is separated from the trail by split rail fence in locations that activity areas are close to trail.

*Park connection with no separation of trail from activity area*

School connections: No direct connections were observed.

Neighborhood connections: No direct connections were observed.

Shopping facility connections: No direct connections were observed.

Urban or Civic connections:

- In downtown Apopka, restaurants along the trail welcome trail users with outdoor seating and bike racks. In addition, there is a connection from on-street parking areas to the front doors of many businesses. Apopka has a great cross-sectional relationship of parallel parking, four (4) foot of planting and car exiting area, twelve (12) foot trail, and four (4) foot planting/buffer area between trail and restaurant edge
- The public library at the edge of downtown Winter Garden faces the trail and has a direct walk connection from its front door/entry plaza to the trail
- In Winter Garden, the trail enters the downtown area to the east as a widened sidewalk along angled parking. A good cross-sectional relationship of angled parking, four (4) foot clearance zone for overhang, lighting, signs, and a ten (10) foot clear for trail use is maintained throughout
- Once in downtown Winter Garden, the trail is in the middle of Plant Street (the main street), and also maintains a good cross-sectional relationship of seven foot from face of curb to trail edge on either side of trail, consisting of either lawn or low ground cover plantings. In this area, the trail, itself, maintains a twelve (12) foot width

*Winter Garden, Florida City Hall adjacent to trail*

*On-street parking adjacent to trail*

### *TRAIL CROSSINGS:*

Below-grade: No below-grade crossings were observed

Above-grade:

- A modified railroad trestle bridge was converted to pedestrian a crossing for the trail. The bridge is of good visual character, especially when observed from the roadway below. This crossing serves as gateway thanks to its unique character and signage. Internally, the corridor is not ideal due to the existing utility line sharing space with the trail

*Re-purposed trestle bridge*

*Utility lines interfere with trail width*

- The best example of overhead crossing can be found in downtown Apopka. The crossing is ADA compliant, and incorporates bulbouts allowing for views of City Hall, and is complimented by the landscape located on ground level

*Above-Grade crossing in Apopka, Florida*

*ADA accessible ramps for Above-Grade crossing*

At-grade:

- A crossing of this type typically uses central bollard, a painted centerline with stop bar, and a stop sign for trail users. Additionally, some areas have crossings that are striped within roadway


*At-Grade crossing with push button crosswalk signal and minimum refuge island*

### 1.6.5 CHICAGO BIKE HUBS

The McDonald's Cycle Center (once named the Millennium Park Bicycle Station) opened in the summer of 2005 to create Chicago's premier example of a modern-day bike commuter facility. The station's primary purpose is to provide secure, indoor parking and services such as lockers, showers, and changing facilities for bike commuters. The facility also provides bike rentals, bike pooling and sharing programs, a bike repair shop open seven (7) days a week, bike tours, and IGO car sharing. The station is also home to Chicago's Police Lakefront Bicycle Patrol Unit, whose presence and use of the facilities assist with overall security of the station.

*McDonald's Cycle Center (bike hub) facility with outdoor seating* *www.nycc.org*

The 1200-SF facility offers 300 secure bike spaces and 210 bike lockers for members and 100 pay lockers for general use. Membership is offered at approximately $150 annually or $25 monthly to Illinois residents for use of secure parking, lockers, showers, and participation in the shared bike program. Discounts on repairs, retail purchase, and IGO car use is also offered to members. Free bike parking is offered to the general public. The Bike Patrol also has 400 bikes housed in the station.

Space efficient bike parking in double tier racks is utilized in most bike parking areas. All bathrooms are automatic but have private dressing areas to feel more personal. There is congestion in the bathrooms during the station's peak times between 7:30 and 9:00 am, but there are plans to expand these facilities.

The construction cost of the facility was $3.1 million and was funded by federal TEA-21 Act funds through the Congestion Mitigation and Air Quality Program of the U.S. Department of Transportation. The station was designed by the Chicago-based architecture firm Muller and Muller to be a beacon for cyclists and an example structure of sustainable architecture for the City. It includes 120 solar panels to provide much of the station's electricity. Chicago's Department of Transportation owns the facility and currently employs a third party vendor, 'Bike Chicago', to operate the facility. McDonald's purchased naming rights for a price that will cover operational costs of the facility for the next fifty (50) years.

Other bike commuter stations exist around the Country, but none appear to offer the wide spectrum of services, particularly bathroom and locker facilities, as the McDonald's station. Other such examples have been developed by 'BikeStation' and include locations in Washington DC, Long Beach, CA, Palo Alto, CA, Santa Barbara, CA, and Seattle, WA.

Beyond the bike commuter station, Chicago also offers indoor bike parking at 66 of their Chicago Transit Authority bus stations. Other cities, such as Boston, are also providing secure, covered, unmanned bike parking stations associated with transit stops.

McDonald's Cycle Center
239 E. Randolph Street
Chicago, IL 60601

*Indoor bike storage facilities* *www.nycc.org*

*Retail and repair center within bike hub* *www.nycc.org*

## COMPARABLE TRAIL FACILITIES SUMMARY

The Chicago Bike Hubs report are an offspring of the Bike 2015 Plan prepared by the City of Chicago in 2005. A primary goal of the plan is to provide convenient connections between cycling and transit. Strategies include: providing bicycle access in the planning, design and operation of all new and refurbished Chicago Transit Authority (CTA) stations and publicizing the bike to transit connections. The plan calls for the creation of additional bike hubs with potential services including: day and overnight bike parking; showers and/or changing facilities; lockers; bicycle rentals; repairs; and sales. The plan also calls for the creation of 3-5 large bike parking facilities at popular transit stations which provide covered and safe space for bikes.

Following the comparable and best practice research on national trails, Florida trails, and trail facilities, lessons learned will be developed. This information will help in the formation of Ludlam Trail specific recommendations.

## BEST PRACTICES SUMMARY

Intending to assist designers and decisions makers on principles, performance measures and best practices, this section provides observational research on how people use trails best. It explores thresholds and enhance criteria to help guide decision-makers on levels of care in designing and placing a variety of trail elements and creating street crossings.

## 1.7 BEST PRACTICE PRINCIPLES

### 1.7.1 PEDESTRIAN NEEDS

As a group, pedestrians exhibit a wide range of needs. They vary greatly in age, height, physical ability, visual acuity, awareness of their surroundings and reaction time. Therefore, it is important to understand that there is no single 'design pedestrian.' Shared-use trails should be designed to be intuitive and allow people to stroll, jog, bike and converse in comfort. As with all other types of travel, this requires people to see and predict an event at least six (6) seconds from where they are located, which does not take into consideration their physical ability to do so.

A person's age, physical ability and cognitive capacity influence how they behave and react. People are confronted by a wide range of physical conditions that can affect their mobility. Children have limited capacity to process the information they receive and may not make appropriate decisions or demonstrate prudent behavior or risk management on the street.

*Adults walking a dog on an eight foot wide asphalt trail*

Adults age 60 or higher have a variety of special needs as pedestrians. Research shows that people over age 60 walk more, yet in some cases may have impaired mobility. Florida is the nation's bell weather state for aging. A large percentage of trail users are approaching or are over age 65, and many are over 70 or 80. Limitations to mobility occur at every age. Abilities change from day to day. Yet, exercise is increasingly important as the population ages.

As we consider the design of Ludlam Trail, we need to keep in mind the international mix of residents that make up Miami-Dade County, each of whom grew up with differing traffic conditions.

Children's thought processes are different from the average adult. They have less experience and ability to handle complex, multi-faceted tasks. Anyone who has not driven a car, driven one extensively, has little or no perception what the motorist is able to do, or likely to do. Is this adult really looking for a cyclist, or multi-tasking? Is the glare on this motorist's windscreen hiding the pedestrian or cyclist from his/her view? These are not part of the thought processes of a young non-driving child. Even adults who have not driven, are not fully able to relate to the complex decisions facing the driver.

Among those limitations of young children, those below age 13, that designers need to be aware of:

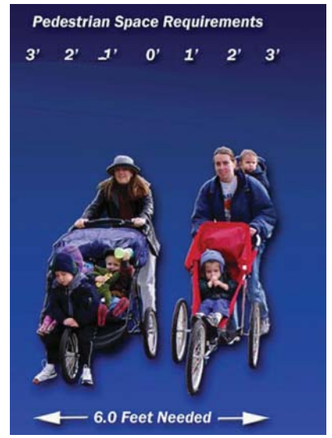
- Children focus on only one thing at a time
- Young children focus on immediate threats (slipping on gravel may seem more important than an approaching car)
- Children have one-third (1/3) less peripheral vision
- Children lack experience in traffic
- Children trust that adults will make smart decisions
- Children lack experience, and often do not see what adults with experience search for, detect and respond to

*A group of children walking on a trail demonstrates the need to focus children's attention and their lack of experience in walking on trails*

*A child riding a bike to school through traffic while talking on a cell phone*

### *PEDESTRIAN SPACE NEEDS*

Just as pedestrians have a wide range of abilities, they also have unique considerations when it comes to space requirements. When pedestrians are jogging together they need more space than when walking together. When transporting children they need more space. When conversing with others they need more space to intermingle. At intersections, pedestrians need opportunities to casually meet one another while they pass.




*Pedestrian spatial needs have many factors*

Pedestrians need a minimum of 4.67 feet of trail width to pass one another as stated by Florida Department of Transportation Guide for the Planning, Design, and Operation of Pedestrian Facilities. This width does not take into consideration higher levels of pedestrian traffic on urban trails, walkers with baggage, canes or people who walk with a sway. When all abilities are taken into consideration, a minimum pedestrian trail width of 6 feet should be planned.

*Two adults jogging at a comfortable distance apart from one another*

### 1.7.2 CYCLISTS / WHEELED DEVICES NEEDS

The space occupied by a cyclist is relatively modest. Generally, bicycles are between 24 and 30 inches wide from one end of the handlebars to the other. An adult tricycle or a bicycle trailer, on the other hand, is approximately 32 to 40 inches wide. The length of a typical bike is approximately 70 inches while a simple trailer can increase the length to between 102 to 110 inches.

Each cyclist takes up approximately three (3)to four (4) feet of width, including wobble room. As trail traffic increases, the width should increase to allow room for passing or side by side casual biking. When trail shoulders are flush and stable, cyclists are able to ride as close as three (3) to six (6) inches from the edge of pavement. When trail shoulders are not flush and stable, users tend to allow a two (2) foot shy spaces for comfort, effectively decreasing the available trail width by almost eighteen (18)inches.


*Manhattan's Battery Park Trail mixes cyclist with heavy pedestrian traffic*

Cyclists ride with a different frame of mind, and take up different space based on who they are with, or if they are riding solo. They also ride more closely when conditions require them to do so. Cyclists (and other trail users) also either focus or fail to focus on elements of traffic depending on whether they are alone or with others. Although a single cyclist does well with as little as four (4) feet of space, two (2) cyclists take up a full eight (8) feet of trail width. If trail volumes are exceptionally light (opposing cyclist once every 20 minutes), a trail or trail connector can be reduced to eight (8) feet. However, almost all trails have higher volumes, and should thus increase their dimension to ten (10), twelve (12) or fourteen (14) feet. A twelve (12) foot wide trail allows two cyclists to ride together and still allow a solo rider to pass them in the opposite direction. Manhattan's Battery Park Trail (pictured below) provides added width to allow cyclists to pass one another creating an overall width of 18 to 22 feet. Ludlam Trail can meet the same needs with a lessor width of between ten (10) and fourteen (14) feet and still provide a comfortable ride.

Trail designs must accommodate various cycling and wheeled devices. For example, parents riding with children, or special commercial or home made equipment. The image below illustrates a not so common wheeled device for when a trail is designed for comfort, relaxation and a wide range of uses. Other common wheeled users include in-line skaters which typically take a wider swath than cyclists. Space needs vary based on the presence of others but a simple six (6) foot travel path is a safe width which allows for different skater's needs and conditions.

*An uncommon wheeled device demonstrates a unique trail user need*

Cyclists on a trail and in traffic require width, buffers to moving objects and separations from one another. When planning for median storage areas or pedestrian refuge islands, overall length should be considered. A typical bike is just under six (6) feet in length while a tandem bike with a trailer can reach over twelve (12) feet in length.

*Manhattan's Battery Park Trail provides wheeled devices with a six foot striped lane*

The wheels and tires of a bicycle are narrow and sensitive to variations, imperfections and debris on the riding surface. In addition, the pressure in a bicycle tire is high compared to other, larger vehicles. This makes bicycle tires more susceptible to damage and punctures from potholes, small pieces of glass, sharp stones and pieces of metal. Sensitive to these characteristics, cyclists sometimes must suddenly swerve to avoid an obstacle in their path, a maneuver that may appear unpredictable or erratic to a motorist sharing the same lane. For Ludlam Trail, this means that edges need to be well defined by edge lines, transitions to edge materials need to be 'mountable' and trail maintenance needs to address conditions, such as storm events. A three (3) foot clear zone on both sides of a trail should be free of all debris, vegetation and signs.

Overall the cyclist design envelope includes the following:

- Riding width (per rider) 4.0 feet
- Shy distance to edges 2.0 feet
- Lateral clearance to objects 4.0 feet
- Lateral clearance to steep grades 6.0 feet
- Vertical clearance 8.0 feet
- Clear Zone (unpaved) 3.0 feet
- Psychological clearance (tunnels) 10.0 feet

*Every wheeled device user does not share the same level of experience and spatial needs*

## PEDESTRIAN AND WHEELED DEVICES NEEDS SUMMARY

Just as people have a wide range of abilities, pedestrian and wheeled trail users have differing spatial needs. When designing a successful non-motorized urban shared-use trail, individual users needs along with casual space requirements and planning for the uncommon user must all be considered.

Pedestrians use trails for jogging, walking or a casual stroll. Each type of use requires a varying trail width. A minimum pedestrian trail width of six feet allows room for two adults to casually walk side by side with a comfortable level of sway.

Cyclists and other wheeled devices require more trail width than pedestrians in large part due to faster speeds and more space needed for reaction times. A typical cyclist needs a minimum of four (4) feet of space to ride. In urban conditions, the need for wheeled users to pass one another should be recognized, therefore, increasing the spatial needs to a minimum twelve (12) feet to allow users to be passed in either direction and allow for in-line skaters of varying abilities to use the trail.

## UNIVERSAL DESIGN SUMMARY

All pedestrian paths, sidewalks, stairways and ramps shall be designed to provide continuous passage, and meet the requirements of the Americans with Disabilities Act Accessible Guidelines (ADAAG).

A trail is: "*a route that is designed, designated or constructed for recreational pedestrian use or provided as a pedestrian alternative to vehicular routes within a transportation system* (ADAAG)."

### 1.7.3 AMERICANS WITH DISABILITIES ACT / UNIVERSAL DESIGN

The Americans with Disabilities Act (ADA) was enacted to ensure all Americans have access to facilities. The ADA requires pedestrian facilities used by the general public to be planned, designed, constructed, and maintained for use by a wide range of people, including those with disabilities.

New construction must be fully accessible, and follow the ADA Accessible Guidelines (ADAAG). The highest degree of accessibility is expected in new construction, when the cost of providing accessible features is nominal compared to the overall cost of construction or subsequent retrofitting.

*Examples of persons with disabilities*

New and altered public sidewalks and street crossings must accommodate people with disabilities so they may use the pedestrian routes that connect buildings, facilities, and transportation systems.

While the ADAAG establishes standards for ADA access, it does not contain all the design issues and specifications that may be encountered by persons with disabilities in the pedestrian environment. Yet, entities are still required to do the best they can to meet Title II accessibility requirements of the Americans with Disabilities Act even if the current ADAAG has not addressed various design specifications.

The ADAAG are continually being updated and refined and current versions should be reviewed as part of the design process for every project. The latest report of the Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas includes soon-to-be ADAAG requirements for trails, outdoor recreational access routes, beach access routes, and picnic and camping facilities

Paving is not required as long as the surface is 'firm and stable.' While handrails and edge protection are not required, when they are provided, they should meet appropriate standards and codes.

The accessibility guidelines apply to trails designed and constructed for pedestrian use. Accessibility guidelines apply to trails used as non-motorized transportation facilities for cyclists, skaters and pedestrians. However, cyclists and skaters have design needs that exceed the minimum guidelines for ADA accessible trails. In some cases, the AASHTO Guide (1999) may require a greater level of accessibility than the ADA trail guidelines. The appendix of the United States Access Board report compares the AASHTO guide with the ADA trail guidelines.

*ADA accessible path along the Pinellas Trail*

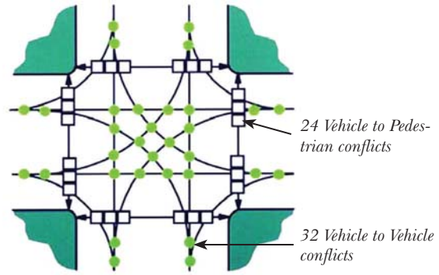
### 1.7.4 INTERSECTIONS AND CROSSINGS

Motorists, pedestrians and bicyclists perform best when the number of conflicts they encounter in a given location is kept low. The three illustrations to the right show each of the conflicts possible at a 4-way intersection, a tee intersection and at a roundabout location for all three user groups.

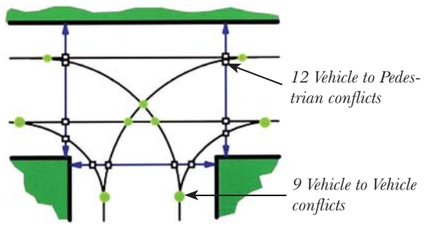
Complicating the sheer number of conflicts is the speed of the traffic, how many vehicles, pedestrians and bicyclists are involved at a given moment, sight lines (ease of seeing the conflict), climatic conditions, lighting and other factors.

Based on this conflict analysis, the ideal intersection to treat bicycle and pedestrian crossings would be a roundabout. This would be followed by use of a tee intersection, with the last consideration being a standard four legged intersection.

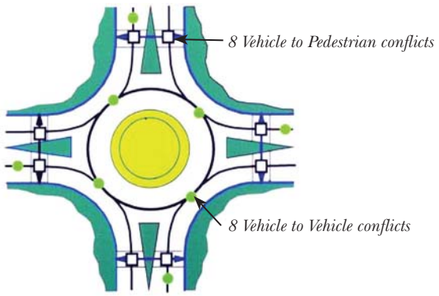
Conflicts at a Four-Way Intersection:




Conflicts at a Tee Intersection:




Conflicts at a Roundabouts:



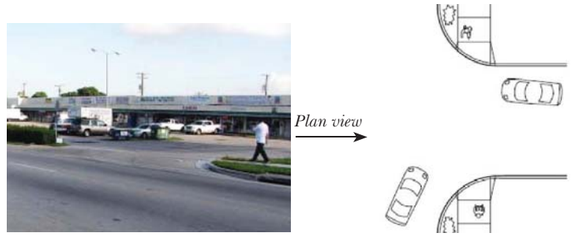

Not shown above is a mid-block crossing which reduces potential crashes, compared with a three or four legged intersection crossing, since there are only two possibilities for a collision, and with a median, these can only come from one direction at a time.

Traffic engineers have been tasked with designing many things, intersections and driveways included, to get motorists into and out of the street with the least amount of time and at higher speeds. As Miami-Dade County shifts from primarily motorized transportation to walking, cycling and transit, designs shift to lower speeds for pedestrian safety. The redesign of some existing driveways near trails, and other accommodations may be needed to provide for improved transportation.

Examples of recommendations:

- Narrow the openings of driveways
- Increase the grade of driveways to slow traffic
- Reduce the radius of driveways to slow speeds
- Use color and contrast to make it easier for motorists to realize they are intruding into pedestrian space.
- Use landscaping (low groundcover) and trees to emphasize driveways and correct use of space.


*The above images show a good example of driveway access management by slowing turn movements and increasing visibility*




*The above images show a poor example of driveway access management which encourages high speeds turns and poorly defines crosswalk area*

### *BENEFITS OF ACCESS MANAGEMENT*

Pedestrians and cyclists attempting to cross an uncontrolled three (3), five (5) or seven (7) lane road often have difficulties doing so quickly. Motorists find the complexities of a multi-lane roadway or one with two-way left turn lanes too complex to predict. Some ways to negate these issues are to control turning access. Among the many benefits of controlling turning access are:

- Maintains travel efficiency.
- Reduces the number of conflicts points, particularly where center medians are used as refuge islands.
- Pedestrian's crossing opportunities are enhanced with an accessible raised median.
- Easier to accommodate people with disabilities with a reduction in need for special treatments at driveway cuts.


*Example of refuge island and crosswalk markings for an arterial crossing*

### *MANAGING CONFLICT*

Low volume neighborhood streets, and even low volume collector roadways (1,000-10,000 Annual Average Daily Trips, (AADT), can be traffic calmed through several techniques. Lanes are narrowed to minimal widths, wide medians are used, and landscaping and related materials are placed to identify and feature the crossing. In some cases, grade separated (speed tables or raised intersections) can be used.

The photo below has excellent low speed geometrics. However, a classic mistake was made. Use of a 4-way stop was seen as a stronger safety measure, but in this application, there was confusion when bicyclists do not stop. As a general rule, one direction of traffic should consistently yield. Traffic engineering rules award the right-of-way to the highest volume of traffic. Sometimes this is the trail user; other times it is the motorist.


*Example of in-correct four-way stop sign use*

### *BASIC FEATURES FOR CONTROLLING SPEEDS*

Geometric changes to non-arterial roadways can reduce speeds to a level where yielding rates to trail users are high (15-20 mph). Motorist stopping distances are greatly reduced at this speed, and their ability to react to an unpredictable event go up significantly. If a crash were to occur, injury rates are much lower at controlled speeds. When hit at a speed of twenty (20) mph, pedestrians have a 95% survival rate, but at 30 mph survival rates drop to 50% and at forty (40) mph, rates fall to 15%.

*Proper geometrics for a non-arterial crosswalk with an angled pedestrian refuge island*

### *BASIC FEATURES FOR CROSSINGS*

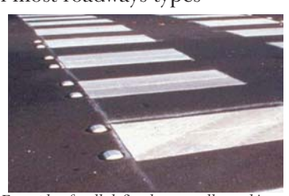
Simple mid-block crossings can perform well with basic controls. These controls include:

- Minimal crossing distances (20-30 feet)
- Low speed traffic (15-20 mph)
- Light volumes of motorized traffic (1,000-10,000 AADT)
- Good to excellent sight lines for both motorists and trail users (six or more seconds of open view)

In order to address basic crossings, there is still potential for either the trail user, the motorist or both to err in their judgement. For these reasons, it is suggested that the following design elements be included:

- Well defined high emphasis crosswalk markings
- All signs and pavement markings specified
- Speed tables or short medians can be used to bring speeds down to acceptable levels on most roadways types

*Example of well defined crosswalk signage*



*Example of well defined crosswalk markings*

## INTERSECTION AND CROSSINGS SUMMARY

Intersections and crossings require a high level of planning to ensure user safety. At-grade crossings are often the simplest, most convenient, efficient and cost effective means for making a street crossing. However, they have specific design features that must be met. Separated grade crossings are expensive, they often create out-of-route travel, security issues and other problems. In determining the need for grade crossings types, traffic volumes, trail volumes, traffic speeds, proximity to signalized intersections, complex driveways that cannot otherwise be addressed, and other factors shall be taken into consideration.

## OVERALL PRINCIPLES

Planning for intersections and crossings should include improvements to access management and a reduction in conflicts. This may require the use of basic and advanced traffic calming such as controlling speeds and signalization to improve the safety and performance of trail crossings.

### *BASIC FEATURES OF TWO (2) OR THREE (3) LANE CROSSINGS*

Even when trail users only need to cross a single lane at a time, or to cross a simple one-way with just two lanes, motorists often misjudge their movements. To guide appropriate actions, designs should bring motorist speeds to 25 mph or less. This can be achieved with a number of treatments, including but not limited to standard engineering practices. Additional treatments include:

- Use of median islands
- Keep asphalt portion of roadway at eight (8) feet wide, then allow up to thirteen (13) feet of actual space by using wider gutter pans
- Use of ground cover to create added visual narrowing (maintained at no higher than 30")
- Advance crossings signs
- Multiple crossing signs at the crossing
- Use of extra signs to "double the message" in the crossing island

The photo below shows that the pedestrian is seeking the narrowest crossing point and this is not the crossing. Designers here used a chicane to slow motorists, but they made the mistake of having a wide opening (tangent) to support a downstream bus bay. Pedestrians routinely cross where this pedestrian is standing.

*Example of improper use of a chicane to slow motorist with adjacent bus bay leading to unsafe crossings*

### *MEDIAN CROSSING ISLANDS*

The preferred design of medians and refuge islands follows ITE's Design and Safety of Pedestrian Facilities guidelines:

- Crossing islands have a preferred width of ten (10) to twelve (12) feet and a minimum width of eight (8) feet to hold wheelchairs propelled by attendants, cyclists pulling trailers, and people with strollers outside the travel lanes

In some cases, smaller width crossing islands may be acceptable where there is a severely constrained right-of-way. In order to obtain an appropriate median width, travel lanes can be narrowed to minimum widths. This can have the added effect of slowing motor vehicle speeds at the crossing location.

### *MULTI-LANE CROSSINGS*

Research by the Federal Highway Administration (FHWA) reveals that multiple-lane roadways require more treatments than simple marked crosswalks and signs.

The level and sophistication of geometric features and traffic control devices goes up as volume and speeds increase. As speeds increase (above 25 mph), it is essential that the following features be designed to improve the comfort and safety of the crossing:

- Raised median
- Traffic signals
- Roadway narrowings
- Enhanced overhead lighting
- Improved sight lines
- Properly placed stop lines
- Enhanced markings
- Curb extensions

*Push button activated stutter signal (flashing beacon)*

*Enhanced crosswalk markings*

*Angled refuge island*

Mean-while, with volumes under 40,000 AADT, with speeds consistently at or below 30 mph, and with reasonable platooning of motorists with up and downstream signals, at-grade treatments can be adequate and much more efficient than separated grade crossings. As several factors increase, at-grade features will not be sufficient to ensure safety.

These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks and what level of engineering is offered.

Crossings of multi-laned roadways are highly complex. These crossings call for far more than a simple at grade mid-block or intersection crossing. Because so many trail users of all ages and abilities are utilizing the site, the treatments must consider and be designed for everyone, motorists included.

Although traffic signals are not always desired, or beneficial, many other conditions must be considered before leaving them out such as: traffic volume, speed of vehicles and location of other signals in the system.

*Example of a signalized crosswalk intersection with pedestrian refuge island*

### *MULTI-LANE UN-SIGNALIZED CROSSINGS*

The lowest grade multi-lane crossings require a median island but do not employ signals. This may be desirable in a number of lower speed locations. When signals are not used, pedestrians can move freely when gaps occur, and do not have to wait for a special cycle to let them cross. For this system to work, however, the following conditions apply:

Appropriate low travel speeds (25 mph or less).

- Advance crossings signs
- Crossing signs at the crossing
- Use of extra signs to "double the message" in the crossing island
- A third sign can be added on the back side of each sign. This doubles the number of signs that are seen on all approaches. Ideally, the motorists see either two or three separate signs
- Yield markings in the roadway set back forty (40) feet
- Overhead signing and lighting
- Clear, high emphasis crosswalk markings

Use of stutter signals is recommended for at-grade crossings. Pedestrians and other trail users activate the system. It is critical that motorists yield lines be sixty (60) feet back from the crossing for speeds of higher than 35 mph. Yield placements set closer

encourage motorists to come to a location where they set up a "screen" so that neither the trail user nor the motorist can see one another.

*Example of advance stop bar before a mid-block crossing*

### MULTI-LANE SIGNALIZED CROSSINGS

More complex multi-lane signalized crossings can be provided in a number of circumstances such as:

- No other signals are within 1,000 feet
- Minimal or no driveway influence
- Gap creation is needed by signals to offer opportunities for trail users to cross
- Clear, high emphasis crosswalk markings are used

When using a signal for a trail crossing, the following features are needed:

- Give a hot response (clearance interval is called in and trail users are underway without delay)
- Multiple signal displays are used (motorist sees a minimum of three (3) oversized twelve (12) inch signal heads
- Yield bars are placed forty-sixty (40-60) feet out
- Sight-lines meet or exceed FDOT requirements
- Crossing is made in two separate steps using a refuge island
- Push buttons for crosswalks signals should be 36" to 42" high and within one (1) foot of the right side of the path


*Example of 'hot response' push button for rapid flashing stutter signals*

### INTERSECTION APPROACH

As trails approach intersections, there should be multiple methods of alerting cyclists, pedestrians and others of a change in alertness. Although this includes basic measures, such as going to a double yellow line for a minimum of fifty (50) feet, it can also include other markings and materials. Shown below are a variety of treatments. Note the effectiveness of the aesthetic markings (bottom right photo)

*Example of effective intersection approach*

*Aesthetic markings at intersection approach*

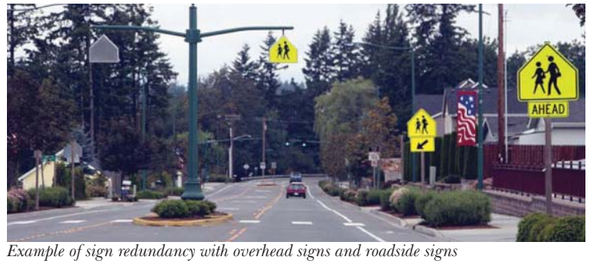
Intersections and other high conflict areas should be well lit and have ample stopping sight distance on all approaches. When this cannot be achieved with land form, consider use of a bicycle roundabout to slow and more safely merge traffic (below).

*Example of a bicycle roundabout*

### MOTORIST APPROACH TO TRAILS

In most street crossings, motorist volumes will be higher than the trail. In this condition, the trail user is expected to yield to the motorist. In some cases, however, it is necessary to have the motorist yield. These treatments are recommended for consideration to alert motorists to their approach and duties at a trail crossing:

- Provide motorists with advance information on a straight approach, allowing them to see they are coming to a crossing at least six (6)seconds out
- Provide signage in advance, as well as a second sign showing where the crossing can be expected
- Eliminate any possible parking at least thirty (30) feet out with sixty (60) feet preferred
- If a crossing is around a corner, whether around an intersection or at a commercial driveway, use signage that illustrates where conflict can be expected
- Provide high visibility markings indicating to the motorist where the crossing will occur such as high contrast pavers.
- When possible, provide sign redundancy by placing added signs in a median or overhead location
- Use of standard yellow warning signs is acceptable, but strong fluorescent yellow-green signing is preferred, in order to call attention to the crossing




*Example of sign redundancy with overhead signs and roadside signs*

### QUEUING FOR THE CROSSING

In order to make a safe crossing, a pedestrian should be able to determine their approach and actions for each intersection, no matter how minor, at the earliest possible time. Trail users must recognize each intersection and its special challenges as they arrive, then make a full search for traffic before making an at-grade crossing. Several best practices exist:

- Create a special cluster of trees and landscape materials associated with a change in conditions
- Create an easy-to-ride-over tactile color band that acts as an identifier of an intersection approach
- Separate bicyclists through use of a median, forcing each rider to make their own independent decision on when it is safe to cross

*Bike lean bar*

*Examples of intersection identifiers such as tactile bands and landscaped median*

## INTERSECTION AND CROSSINGS
(CONTINUED)

## GRADE SEPARATED CROSSING SUMMARY

Grade-separated crossings should only be planned when advanced traffic calming techniques are not permitted or desired. Once an at-grade crossing is deemed inadequate through the careful consideration of all traffic calming techniques available, an above-grade crossing should be considered. Due to the common increased costs of constructing a tunnel in South Florida, above-grade crossings can be achieved in minimum corridor widths and serve as gateway features for the trail and community. Below-grade crossings are the final option to consider when roadway or corridor viewsheds must be preserved or when site topography permits.

### 1.7.5 GRADE SEPARATED CROSSINGS

Portions of the trail that have low volumes of traffic and low speeds with adequate gaps in traffic should be treated with the list of best practices below. In almost all cases, a crossing island is recommended as a minimal treatment. To the extent practicable, speeds should be lowered (using traffic calming methods or other controls) to 15-20 mph. Best practices include:

- Lighting on crossing
- Well marked crossing
- Low speed environment (15-20 MPH)
- Only one lane to cross at a time
- Crossing island

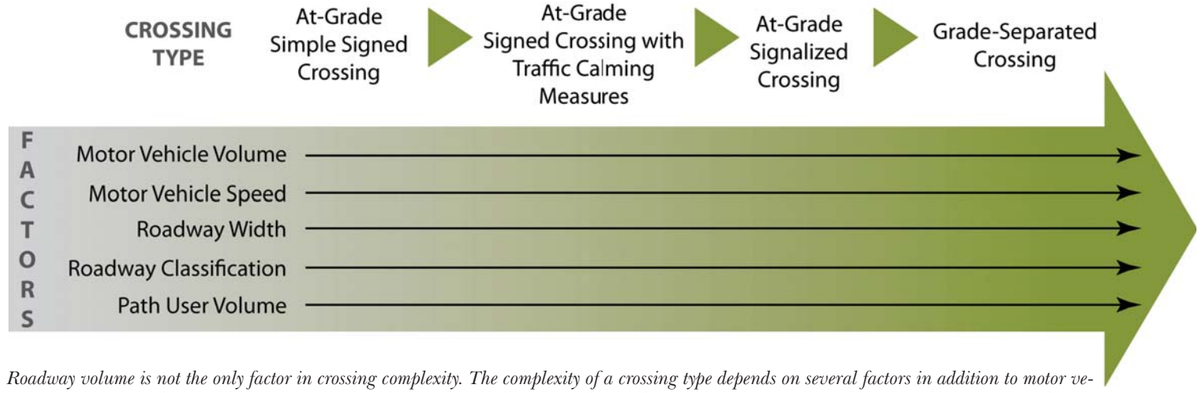
When volumes and speeds reach higher levels, around 21,000 AADT and speeds exceed 30 mph, crossings should be treated with the following best practices below:

- Multiple signals combining side, overhead and mast arm signals as appropriate
- Use twelve (12) inch high visibility globes and sun screens to reduce glare on traffic signals
- Use a minimum of two (2) crossing signs and two (2) advance signs when possible
- High emphasis crosswalk markings
- Low groundcover plantings to add visibility and detection of island
- Median crossing island of ten (10) to twelve (12) feet minimum
- Advance stop bars of forty to sixty (40-60) feet from crosswalk
- Use of trees or other vertical fixtures to enhance detection of island

As an alternative, speeds and volumes can be brought under control therefore reducing the need for additional tools.

When speeds exceed forty (40) mph, or volumes exceed 40,000 AADT additional treatments from above should be used or a separate grade crossing considered. No book has been written on the threshold for determining grade separated crossings, however, in specific cases, an engineering study is recommended to determine traffic impacts, costs and design requirements.

The above diagram shows the need to consider multiple factors when determining at-grade or grade-separated crossings. With the absence of a national or state standard for trail crossing




*Roadway volume is not the only factor in crossing complexity. The complexity of a crossing type depends on several factors in addition to motor vehicle volume. As the factors, which influence user safety conditions, (listed on left side of graphic) increase numerically or by volume; the type of crossing must change. Each crossing must be independently evaluated and the level or number of factors found to be acceptable should be considered.*

grade determination, separation should be determined on a case-by-case basis when more than one condition is present such as high vehicle volume and a multi-lane roadway or high trail user volume and high roadway speed.

*Example of an above-grade trail crossing along the West Orange Trail, Orlando Florida*

Overpasses must accommodate all people as required by ADAAG. There measures include ramps or elevators. The extensive ramping required to accommodate wheelchairs will also accommodate bicyclists. Underpasses work best when designed to feel open and accessible; it is essential that they are well lit to address security concerns of pedestrians.

Underpasses, in addition to being ADA compliant, should have ample lighting, either by redundant security lighting or by skylights, and have plenty of activity near the openings. Although the functional width of a tunnel may not need to be more than fourteen(14) feet, the taller and wider the opening, the more inviting and well-used the tunnel will be. If a tunnel is not well-used, security issues will arise.

There are advantages and disadvantages to underpass and overpass structures. Underpasses typically require a minimum eight (8) to ten (10) foot vertical clearance with a three (3) to five (5) foot utility corridor above or none at all. Overpasses typically require a minimum seventeen (17) feet of vertical clearance to roadway and twenty-three (23) feet for railroad tracks. This may require up to five-hundred (500) feet of ramps on either end of the crossing to meet the ADAAG standard, five (5) percent grade. With an advantage of between two (2) to six (6) feet less in grade change, underpasses require less distance in ramps.

Grade separated crossing should follow minimum trail widths of eight (8) to twelve (12) feet for bicycle trails and a minimum of six (6) feet for pedestrian trails. In addition, bicycle travel lanes should have a minimum two (2) foot shy zone on the outside edge of the travel lane for user comfort and safety.

*Example of a tunnel skylight located in a roadway median*

*Natural light can make a tunnel seem safe and inviting*

### 1.7.6 TRAIL SECURITY

It is essential that trails do not become places for automobiles or other mechanized equipment, however, ambulances, maintenance equipment and other approved motorized equipment need access. A popular tool for maintaining controls has been a set of bollards or poles at motorized access points. For most conditions, this is acceptable. However, they can be incorrectly designed and placed. If emergency access or maintenance access is desired, incorrectly placed bollards may become an obstacle. The correct layout is a single bollard in a median of the trail. Assume that most materials will not be seen at night, or in low light, or by a member of a group that is riding behind others. Other options are to use any of the following:

- Reflective bollards, lighting, or lit bollards
- Special indicators on approach
- Special use of a solid yellow line for the final 50 to 75 feet
- Median islands with low ground cover and trees
- Additional emphasis landscaping
- Large planters (rather than bollards)

*Use of one bollard in center of trail to control traffic near entrance points*

*Use of large planters to control entrance points to pedestrian areas*

Trail use requires many links or connectors (access points). Ideally, people will be able to access trails through well designed, constructed and maintained connecting trails. In general, such connectors require the following:

- At least one (1) side of a property must watch over the connector for 'eyes on the trail'
- Keep connectors wide (forty (40) foot minimum)
- Landscape areas do not allow for any hiding places
- If property owners permit, use low or no fencing. Instead, use landscape materials to separate public from private space
- Use lighting, as appropriate
- When possible, add commercial connectors to the trail

Make use of color, texture and other materials to naturally guide pedestrians and cyclists to areas of the trail that best suit their needs.

Use of yellow or double yellow lines are appropriate in a number of cases that include, but are not limited to:

- Steering around objects
- Keeping trail users focused on conflict areas
- Approaches to intersections
- Around curves

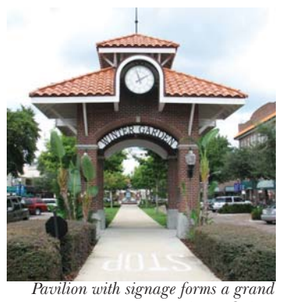
In some applications the yellow line, crosswalk markings, symbols such as those used on the Seminole-Wekiva Trail help slow and alert cyclists to a pedestrian crossing zone. This is a common application where pedestrian conflicts are high.

*Example of 'eyes on the trail' for a neighborhood connector path*

### 1.7.7 GATEWAYS

Gateways to trails are a great location to provide orientation, information, a sense of place and identity with the history of the place, culture of the people and significance of the railroad, roadbed or community.

*Low oolitic limestone wall forms a simple gateway feature*



*Pavilion with signage forms a grand gateway feature*

Overpasses can serve as gateways to trails while they provide a simple way to clear a complex intersection without delay. In any event, overpasses can be designed to add an iconic image to trails. Below are photos of a pedestrian bridge in Solano Beach, California, a trail that has received numerous awards for its gateway and iconic qualities.

*Iconic pedestrian bridge in Solano Beach, California*

Below, is an overpass paid for by a large Seattle corporation. The bridge can be see from both the harbor and throughout the industrial complex and much of the coastal trail. The overpass not only helps people over the railroad, but serves as a public amenity and work of art. Trails that span important streets are prime locations for iconic overpasses. Overpasses should be context sensitive or if the roadway viewshed is of importance, a tunnel should be considered.

*Iconic pedestrian bridge in Seattle, Washington*

## TRAIL SECURITY SUMMARY

Trail security is more than just about installing night-time lighting. It includes the safety of all trail users, pedestrians and wheeled users. Consideration must be given to all design features which could impact the safe use of the trail and amenities. Generally, open views which allow neighbors to observe the trail corridor offer the highest level of security.

## GATEWAYS SUMMARY

Gateways features are identifying elements of a trail which also serve the community. These features could be of a timeless design or touch on the historical roots of the community and trail corridor. Designed well, gateway features can serve as tourist attractions for the region.

Each of these best practice principles can be identified at both the state and national level on successful rails-to-trails facilities (1.8).

## LESSONS LEARNED SUMMARY

Through the review and analysis of best practices, lessons learned can be compiled and opportunities identified for the design of Ludlam Trail. These lessons learned will be included in forming recommendations specific to the Ludlam Trail.

Trail Width: For shared-used trail widths varied from twelve (12) to fifteen (15) feet. Separated trail widths were five (5) feet for pedestrian paths and ten (10) feet for bicycle/ skater paths.

Separation of Trail Facilities: All trails observed had some degree of trail facilities separation and ranged from a center trail marking to a grass median.

Corridor Width: A minimum fifty (50) foot in corridor width was observed for most shared-use paths, however, in extreme cases a twenty-five (25) foot width was used along the Burke-Gilman Trail.

Corridor Edge Treatment: Split-rail fence was used for define the West Orange Trail corridor while existing vegetation was preserved for all trails observed.

Trail Surface Material: All trails observed were primarily asphalt surfaced with some cases of stamped or color concrete near focal points along trails.

Bollards: Two trails observed used bollards to control trail access, however, problems have emerged and in one case bollards have been removed for emergency vehicle access and trail user safety.

Pavers: Pavers were utilized to establish pedestrian priority zones at non-signalized crosswalk to highlight the trail.

## 1.8 LESSONS LEARNED FROM COMPARABLES

### *TRAIL WIDTHS*

Trail widths of shared use/single trails ranged typically from twelve (12) to fifteen (15) feet in width. Within urban, constricted areas, some trail widths were reduced to a clear zone of ten (10) feet for short periods of length. Typically, these constricted areas have separate paved areas that contain street lighting, signs, etc. so that the trail area remains unobstructed.

Trail widths for separated trails were five (5) foot wide for the pedestrian trail zone and ten (10) foot wide for the bicycle/skater trail zone, with a four foot width separation of grass area between the two trails.

*Example of separated trails along the Fred Marquis Pinellas Trail*

### *SEPARATION OF TRAIL FACILITIES*

The West Orange Trail did not have trail division markings or signs, and it was commented by one biker that the lack of separation of traffic was problematic at times. The Seminole-Wekiva trail separated the trail with a central stripe for a portion of the trail, and in these areas it was observed that users adhered to 'their side' of the trail, even if no other users were in sight. The Pinellas Trail was a divided trail in many areas. Although there were not many users observed, those on the trail did not seem to follow the rules related to facility separation as noted by the signs.

Perhaps the best example of trail separation is the Burke-Gilman trail which is currently undergoing an expansion. The trail is currently a shared-use trail of ten (10) feet in width. Expansion plans call for a trail width of twelve (12) feet with a three (3) foot stabilized shoulder for pedestrian use, creating a separate trail.

### *CORRIDOR WIDTHS*

Corridor widths are varied along each trail and between the different sections. Typically, corridor widths were between 35'-100', although in some areas, widths were wider or narrower. A minimum fifty (50) foot wide corridor width worked well for allowing the trail to be a 'space unto itself', provide enough room for landscaping or existing woods to provide adequate shade, and to be close enough to adjacent uses that visible and well-functioning connections could occur. This width was observed along the Fred Marquis Pinellas Trail and West Orange Trail in several sections where good neighborhood and adjacent use connections were made to Senior Centers, adjacent parks, and shared parking.

### *CORRIDOR EDGE TREATMENTS*

Typically, masses of existing trees and growth existed between the trail edge and adjacent uses. This strip was beneficial as it provided needed shade and a cooler microclimate along the trail. This wooded area also makes the trail feel 'more natural', creating an oasis for recreation and commuting within busy residential and commercial/industrial areas. It also provided a buffer to noise, smells, and views of less desirable 'back of house' areas common to each corridor's edge.

Some areas along the West Orange Trail were defined by a split rail fence, which was primarily used as a divider between the trail and adjacent trailhead activity and parking areas. Other edges were defined by adjacent property owners.

### *TRAIL SURFACE MATERIALS*

All trails observed were primarily asphalt-surfaced. Exceptions were in urban settings or roadway crossings in which surfacing at times converted to concrete. This switch was typically due to connecting into existing walks at intersections or the need for concrete structurally for above-grade crossings.

One exception was specialty concrete paving at the Seminole County Softball Park along the Seminole-Wekiva Trail. This paving was integral color concrete that was specialty-jointed for patterning and was in a circular shape that centered on the trail and extended beyond the typical trail width. The change in pavement material was not a safety concern for bikers and skaters but a decorative element.

### *BOLLARDS*

The purpose of trail access barriers is to prevent motorized vehicles from entering the trail, intentionally or unintentionally. Several trails studied have fixed or removable bollards at intersections, but two primary problems have emerged: 1) the bollards hinder emergency response vehicles (police, fire, medical) if they cannot be quickly removed or crossed; and 2) cyclists and skaters crash into the bollards, causing significant injuries.

The Fred Marquis Pinellas Trail crossings typically consisted of four (4) bollards spaced five (5) feet apart located in a concrete band. All bollards had twelve (12) inch bands of reflective tape and white warning rectangles painted onto the trail surface. West Orange Trail had three bollards at most crossings but has since eliminated all but a single bollard located in the middle of the trail at most crossings. The single bollard was typically located at the trail stop bar or thirty (30) to forty (40) feet back from the crossing.

*Example of removed bollards along West Orange Trail*

### *PAVERS*

The Fred Marquis Pinellas Trail utilized speciality pavers at non-signalized trail crossings in some urban areas. Crosswalks consisted of pick-toned concrete pavers in a herringbone pattern with flush concrete bands on either side. This highlighted the crosswalks and established a pedestrian priority zone.

### *TRAIL FURNISHINGS AND AMENITIES*

Typical furnishings provided along the trail consisted of benches, trash cans, water fountains, and bike racks. These amenities were typically clustered together and located at trail hubs, such as parking areas or trailheads. If a trail map or directional sign was present, it was also clustered with these furnishings. Benches by themselves along the trails were not observed. It was noted that in most cases, trash cans were located directly next to benches. This arrangement may not be desirable if trash pickup does not occur daily.

### *TRAIL LIGHTING*

Trail lighting typically occurred only within urban areas, as part of the street or walk lighting, or near trailhead or parking areas and consisted of low level lighting to allow for security without interfering with neighboring homes.

### *TRAIL VEGETATION*

Typically, trail edges were not landscaped beyond the existing landscape that remained in the trail's right-of-way area. Exceptions were noted at roadway intersections, trailheads, and decision making areas. Native species were common which allowed for lower maintenance costs and did not require watering.

### *TRAIL INTERSECTIONS*

Trail intersections were observed such as spurs stemming from the main trail to access adjacent or nearby parks. These intersections were a 'T' trail intersection with directional signage and markings to warn of the intersection.

### *AT-GRADE STREET CROSSINGS*

Several at-grade crossings were observed and researched for each comparable. For crossings at signaled intersections, trail users had a pedestrian traffic signal with push button and a well defined painted crosswalk. At non-signalized crossings, the Seminole-Wekiva Trail utilized a raised landscape median in the trail to separate trail traffic from a shared fifteen (15) foot width to separated seven (7) foot trails. The landscape median measured four (4) feet in width and consisted of low groundcover landscaping. At the start of the trail enlargement for the division, the trail changed to concrete surfacing. Arrows painted on the trail indicated direction on either side of the median, and the centerline typical to this trail connected to the warning lines at the edge of the median. The median terminated fifteen (15) feet from the edge of the roadway, and between the nose of the median and the roadway was another median area, uncurbed, delineating the trail separation but allowing for trail users to turn around prior to the roadway.

Crossings had a lean bar with a top bar at approximate four (4) feet in height that was located two (2) feet from the edge of the trail and eight (8) feet from the edge of the roadway. A stop bar and stop sign was also located at most trail intersections, both located four (4) feet from the roadway edge. Within the roadway, three (3) parallel bands three (3) feet wide and twelve (12) inches thick of white thermoplastic paint marked the trail's crossing, at either side of the crossing and along the centerline and is known as a 'Seminole Crossing Marking.' The roadway was marked with a 'Trail Xing' warning on either side of the crossing, at approximately one-hundred (100) feet from the crossing. Pedestrian crossing warning signs were also located facing on-coming vehicular traffic at the trail crossing and one-hundred and fifty (150) feet on either side of the crossing. In one case, the roadway was divided at the crossing by a raised landscape median. The median provided traffic calming and alerted drivers to the trail crossing.

This type of crossing was well used in terms of trail users following the traffic patterns it established. The benefit to this type of crossing is twofold. The separation of trail traffic in either direction reduces the risk of user crashes within the intersection. More importantly, the curbed median requires users to enter the intersection single file and thus each user is required to pay attention to the crossing and oncoming traffic. The divided trail also requires users to slow down as they approach the intersection.

*Seminole-Wakiva Trail crossing with raised median and divided crossing approach*

### *ABOVE-GRADE CROSSINGS*

Two (2) types of above-grade crossings were observed. The West Orange Trail and Seminole-Wekiva Trail include an iconic gateway bridge. The West Orange Trail bridge located at Hwy. 441 in Apopka was context sensitive in design, pulling in pieces of the city's and railroad's history. The bridge included turn-back ramps on either side to allow trail users quick access to the street below and required users to slow their speed when using the bridge. Trail width on the bridge was fifteen (15) feet with continuous handrails and had 'bulbouts' for users to stop to rest or enjoy the view.

The Seminole-Wekiva Trail included an iconic suspension bridge over I-4. This type of bridge was required to cross over 1,000 feet without support columns within the roadways's right-of-way. Approach ramps were eight (8) percent inclines with landings every thirty (30) feet. Large identification signs were located on the bridge highlighting Seminole County.

The second type of above-grade crossing were located along the Fred Marquis Pinellas Trail. Above-grade crossings consisted of simple chain-link cage enclosures with an inside dimensions of ten (10) foot in height by fifteen (15) foot in width. Ramps rose at a consistent grade of ten (10) to twelve (12) percent, which are not ADA compliant. Warning signs were located at the start of ramps warning trail users of the high grade. Cyclists were observed coming down the ramps at high speeds and skateboarders are prohibited on the ramps. Stairs are provided at each end of the bridge with direct ties into the sidewalk network.

*Above-Grade crossing in Apopka, Florida*

*Above-Grade crossing in Pinellas, Florida*

### *BELOW-GRADE CROSSINGS:*

Typical below grade crossings were either provided by a structural bridge underpass, similar to those used for vehicular use, or an actual trail tunnel. The structural bridge underpasses were successful when their width allowed for at least six (6) feet on either side of the trail, and their vertical clearance was very high so that the trail felt 'open' and views through to the other side of the under pass were clear.

The best example existed at the SR 434 underpass of the Seminole-Wekiva Trail. This tunnel was twelve (12) foot wide with a twelve (12) foot ceiling. Users could see the end of the true tunnel area from the other side, thus making the tunnel feel more safe. Security lighting was installed within the tunnel proper. Open fencing/grating covered the tunnel areas where structural ceilings were not required and allowed for natural light penetration. Gates were open but provided at either entry point. The ramps down to the tunnel proper were ADA compliant, at eight (8) percent maximum and with landings every thirty (30) feet. The centerline of the tunnel was striped with a single yellow line prohibiting passing within the tunnel.


*Seminole Wakiva Trail Below-Grade crossing tunnel entrance*

## LESSONS LEARNED SUMMARY

Trail Lights: Low-level pedestrian lighting was observed on several trails within urban areas or near trail access points and street crossings.

Trail Vegetation: Trail edges were typically free of vegetation except for existing vegetation within the trail corridor.

Trail Intersections: Most trail intersection observed were typical 'T' designed intersection with spurs connections to nearby schools or parks.

At-Grade Crossings: The Seminole Wekiva Trail utilized a divided trail approach with a raised landscaped median, safety signage and markings, and bike lean rails.

Above-Grade Crossings: Iconic bridges were used on two trails observed and included context sensitive designs which added to the trail experience.

Below-Grade Crossings: Wide tunnels provide for ample natural lighting. ADA compliancy and controlled access were designed into each tunnel.

## RECOMMENDATIONS AND STANDARDS SUMMARY

These are recommendations made for specific conditions of the Ludlam Trail. A methodical approach has been made to analyze existing corridor conditions, research comparable trails, develop best trail practices, and develop lessons learned to provide decision makers with sound recommendations for the Ludlam Trail. Each recommendation is incorporated into the design guidelines in the next section.

Trail Alignment Relationship: The Ludlam Trail is recommended to take full advantage of the corridor with large radius curves while maintaining a minimum five (5) foot clearance to all property limits.

Trail Corridor Edge Treatment: Corridor edge treatments should include a combination of existing private fences and where applicable, a typical two-rail wood fence in addition to native hedge and tree species.

Trail Width: Under normal conditions Ludlam Trail should be planned to included a twelve (12) foot multi-purpose shared-use path for cyclists and skaters and a separate six (6) foot path for pedestrians in respect to minimum spatial needs for passing and trail use. In constrained conditions the minimum trail width should become a single fourteen (14) foot trail with an eight (8) foot two (2) lane multi-purpose shared-use path for cyclists and skaters and an adjacent six (6) foot pedestrian path.

Trail Surface Material: Asphalt is the recommended trail surface because of low installation and maintenance costs along with a smoother surface for trail users. Speciality concrete pavers or stamped concrete/ asphalt should be used at crossings or areas of imterest.

Trail Striping: Trail markings should follow all MUTCD and FDOT requirements with appropriate center trail striping and stop bars.

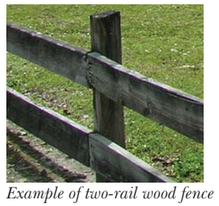
## 1.9 RECOMMENDATIONS AND STANDARDS

### *TRAIL ALIGNMENT RELATIONSHIP*

Ludlam Trail's alignment is recommended to take full advantage of the corridor width, allowing separate trail facilities. Large radius curves of 1,000 feet or more should be planned into the design of the trails to help reduce speeds of trail users and allow for visual changes. All trail elements should be a minimum of five (5) feet from property limits to allow for landscape screening and fencing if necessary. Designs should include opportunities for open green space near neighborhood connections for recreational activities. Examples of this can be found along the Burke-Gilman and Seminole-Wekiva Trails with connections to nearby parks.

### *TRAIL CORRIDOR EDGE TREATMENTS*

Edge treatments are recommended to include a combination of existing fences and barriers where applicable and typical two rail wood Miami-Dade County Park and Recreation Department fence in locations where encroachment issues exist. Adjacent property owners should be permitted to install privacy fences and gates as needed. Glatting Jackson recommends the use of native landscape hedges and shade trees species for screening in addition to fencing. Most examples studied included this type of edge treatment.



*Example of two-rail wood fence*

*Example of typical wood privacy fence*

### *TRAIL WIDTH*

The rule of thumb for trail width is "the wider the better". The widths of the trails used as comparable include:

- Burke-Gilman Trail, Seattle: 10'; planned expansion to 12' plus 3' refuge.
- Fred Marquis Pinellas Trail, Pinellas Co., FL: 10' + 5' Pedestrian trail
- Seminole-Wekiva Trail, Altamonte Springs, FL: 12-15'
- West Orange Trail, Winter Gardens, FL: 12-15'

The ideal trail scenario is a twelve (12) to fourteen (14) foot paved multi-purpose trail for cyclists and skaters, with a separate six (6) to eight (8) foot shared-use asphalt trail for walkers and runners. AASHTO requirements indicate a minimum ten (10) foot bicycle trail width while Florida Department of Transportation calls for a minimum twelve (12) foot trail width. For a separate bicycle trail, the width needs to allow for passing and maintenance resulting in a twelve (12) foot trail width made up of two (2) six (6) foot lanes separated by a dashed center stripe. A separate pedestrian trail, where right-of-way width allows, should be a minimum six (6) foot in width to allow for two (2) side-by-side pedestrians or two (2) people to pass one another. Combining these two trail components results in eighteen (18) feet of overall width.

At points of constraint such as bridges, tunnels, trail junctions and roadway crossings, bicyclist may be expected to travel single file allowing for a minimum eight (8) foot trail width along with a minimum six (6) foot pedestrian lane. A two (2) foot shy zone is recommended for the outside bicycle lane at bridges and tunnels for a total trail width of sixteen (16) feet.

*Example of separated trails along the Pinellas Trail*

### *TRAIL SURFACE MATERIALS*

Asphalt is the most commonly used trail surface material among the studied trails and is recommended for the Ludlam Trail due to its lower costs, smooth surface and ease of repair. Asphalt patches can be used to repair small areas that have cracked or become worn; the entire trail should be re-surfaced approximately every ten (10) years, depending on the level of use.

Concrete can be considered, but is generally more expensive than asphalt; has a rougher surface; and has expansion joints that make skating less enjoyable and potentially more dangerous. Asphalt is also preferred by joggers and runners because it has more "give" than concrete allowing for less joint impact.

Many walkers and hikers prefer a softer, more natural trail surface such as compacted clay or crushed aggregate. These trails are more difficult to maintain than asphalt; grass and weeds must be continuously trimmed or removed, and the trail materials must be periodically replenished. Therefore, most trail agencies prefer to use asphalt trails even for pedestrians; the only example of natural surface trails within urban areas studied is the Burke-Gilman Trail which plans to include a three (3) foot stabilized gravel edge on one side of a twelve (12) foot trail for pedestrian refuge during high bicycle traffic times.

Speciality concrete pavers or stamped asphalt should be utilized at all at-grade crossings, with a high level of color contrast for vehicular and trail users identification. Pavers should identify pedestrian priority zones and trail alignment as identified along the Fred Marquis Pinellas Trail.

*Example of trail markings*

*Example of concrete pavers*

### *TRAIL STRIPING*

Ludlam Trail is recommended to have a single twelve (12) foot shared-use path with a yellow dashed center stripe. At areas of right-of-way or trail constraint, the designated bike path should be separated from the pedestrian path by a solid white line. Appropriate stop bars and traffic roadway stripes should be included as specified by MUTCD.

### *TRAIL ACCESS BARRIER TREATMENTS*

A single bollard is recommended (in the center of the trail) where some type of barrier is absolutely essential; emergency vehicles simply drive around the bollard when necessary. At trail crossings, a raised landscape median in the trail serves as a traffic control device which can be driven over in the case of an emergency. This is sampled after successful access control devices along the Seminole-Wekiva Trail.

*Example of barrier treatment on Seminole Wekiva Trail*

### *TRAIL LIGHTING*

Trails are generally treated as linear parks, open from dawn to dusk, and closed at night. Most departments cannot monitor trail use at night; therefore, most trails are not lit. Low level/ security lighting should be provided at trailheads, parking lots and crossings to discourage loitering and undesirable behavior, to allow passers-by and law enforcement to observe the sites at night, and to make people aware of the presence of the trail. Lighting should be limited to within fifty (50) feet of decision making areas or one-hundred and fifty (150) feet of crossings.

### *TRAIL RELATIONSHIP TO PARKING*

Parking areas do not have to be associated with a dedicated trailhead. Parks, city halls, libraries and other civic sites can provide parking; ideally, a number of spaces are dedicated for trail use. Dedicated parking should be made for Ludlam Trail at A.D. Barnes Park, Robert King High Park, Palmer Park, North Dade Metrorail Station and the Dadeland Mall through the formation of a joint-use agreement. A parking study should be conducted to understand Ludlam Trail's impact on nearby existing parking facilities.

Other commercial sites such as office parks and shopping centers can also be used for trail parking through joint-use agreements with the property owners. Parking for the Cady Way Trail in Orlando, for example, is provided at the Fashion Square Mall while the Fred Marquis Pinellas Trail relies on a Publix Supermarket parking lot for parking and trail access.

Parking at trailheads, rest areas and institutional properties should have a direct access route of a minimum six (6) feet in width to the Ludlam Trail. This encourages trail users to park at existing facilities and offers a safe ADA accessible route to the trail.

### *TRAIL RELATIONSHIP TO TRANSIT*

It is desirable to provide seamless connections between various modes of travel including bikes, buses, transit and automobiles. Transit information and directional signs should be placed at all trailheads, including bus/transit schedules if possible. Directional signs throughout the Ludlam Trail corridor should identify the locations of the nearest bus/ transit stops; and signs at the transit stops should inform riders regarding how to access the trail.

Amenities should be provided to encourage multi-modal use. Bicycle parking should be provided at transit stops, along with transit shelters and benches. Most trails studied fell short in providing a fully connected network to transit; however, the Chicago Bike Hubs from the 2015 Bike Plan offer examples of successful integration of bikes and transit.

### *TRAIL SIGNAGE AND WAYFINDING*

Ludlam Trail should incorporate standard MUTCD markings and signage at all intersections and crossings. See appendix E for reference to MUTCD: Part 9 - Traffic Control for Bicycle Facilities. These represent basic requirements to maximize user safety throughout the corridor. Beyond required safety signs and markings, Ludlam Trail should provide informational signs along the corridor that inform users about distance to trailheads, points of historical/ cultural/ environmental interest along the corridor, and adjacent uses. Signs should be consistent with the Miami-Dade County Park and Recreation Sign Implementation Manual wayfinding program for trails.

Ideally, wayfinding signs will also identify nearby destinations including neighborhoods, parks, civic sites and commercial centers, similar to roadway signage and inform trail users about the history of the Ludlam and South Miami areas. While it is not desirable to "litter" the corridor with signs, the goal is to integrate the trail corridor into the fabric of the adjacent land uses.


### *TRAIL FURNISHINGS AND AMENITIES*

Trail furnishings and amenities for Ludlam Trail should allow trail users the opportunity to sit in a shaded space, provide access to drinking fountains and inform the user of trail destinations and features. At the very minimum, the following trail furnishings should be included along the trail corridor:

- Directional/ informational signs
- Shaded benches or seating areas at nodes
- Grab rails for skaters
- Mileage markers
- Low level pedestrian lighting in select areas

If budget allows, other desirable amenities to consider include:

- Air stations
- Dog watering stations
- Picnic tables
- Picnic shelters
- Shade trees and landscaping
- Playgrounds
- Interpretive signs and exhibits – historical/environmental
- Food, beverage and/or rental (bike, skate) concessions
- Public art and sculpture
- Fountains
- Decorative lighting

Trail furnishings and amenities can make the difference between a heavily-used and little-used trail. Designers should provide the most comprehensive amenity "package" that they can afford to install and maintain. Because of the costs of regularly monitoring and maintaining trails, site furnishings and amenities should be constructed of sturdy, weather-resistant and vandal-resistant materials.

*Example of bike rack*

*Example of ADA accessible drinking fountain*

### *TRAIL REST AREAS*

With medium to medium-high density along the corridor, rest areas should be spaced one (1) to two (2) miles apart at neighborhood, school or park connections to maximize the opportunities for trail users and nearby neighborhoods to use such facilities. Comparable trails studied tended to be destination trails where users drove to a parking facility to use the trail. As a vital transit network element, Ludlam Trail will need to serve both destination and transit oriented users. This can be achieved by offering frequent opportunities for trail users to seek shelter or meet friends for a walk.

**Trail Access Barriers:** Trail access barriers should work in conjunction with corridor access control. A raised and/or landscape median should be used at crossings while a single bollard located in the middle of the trail access route should be used in conditions where corridor width does not allow for a median.

**Trail Relationship to Parking:** Parking for Ludlam Trail is encouraged to be designated at adjacent parks and a minimum six (6) foot ADA accessible route to the trail should be provided.

**Trail Relationship to Transit:** Trail planning should encourage multi-modal use with bicycle parking, transit stop connections and route/ schedule information posted along the corridor.

**Trail Signage and Wayfinding:** All signage and wayfinding is to follow MUTCD, FDOT and the Miami-Dade County Park and Recreation Sign Implementation Manual wayfinding program for trails requirements.

**Trail Furnishings and Amenities:** At a minimum the Ludlam Trail should provide directional signage, shaded benches or seating, bike lean rails, mileage markers, and low-level lighting.

**Trail Rest Areas:** Rest Areas should be planned with a maximum spacing of one (1) to two (2) miles at focal points along the trail. Rest areas should include shaded seating, be ADA accessible and utilize the trail corridor.

## RECOMMENDATIONS AND STANDARDS SUMMARY

Trail Corridor Vegetation: Vegetation within the corridor should be native, drought tolerant species with special emphasis given to Rockland Hammock species. Vegetation should include a mixture of sod, groundcovers, shrubs, palms, ornamental trees, and shade trees. Planting should be completed at the beginning of the rainy season in May to provide best survival rates.

### 1.9 RECOMMENDATIONS AND STANDARDS (CONTINUED)

#### *TRAIL CORRIDOR VEGETATION*

Corridor vegetation should be limited to native species of the South Florida region. In addition, close attention should be paid to the various micro-climate conditions along the corridor such as near canals, roadways and to existing vegetation. Rockland Hammocks have been observed at A.D. Barnes Park and should be taken into consideration when planning landscaping.

Native low groundcover plantings should be utilized at roadway crossings areas, within the dividing medians of the trail. There is an opportunity within this area for colorful planting for additional attention to the intersection by both drivers and trail users. Shade trees should be planted in clusters intermittently along the trail at a minimum distance of four (4) feet to edge of pavement to provide shade with no more than 150 feet between clusters. Palms should be used to define spaces and as an identifying feature at decision making areas.

Trailheads should be well landscaped around parking areas, which in some cases, such as the Seminole-Wekiva Trail, were adjacent to the trail. Plantings in these areas should follow CPTED (Crime Prevention Through Environmental Design) principles with few shrub plantings and open views between two (2) and six (6) feet. Surrounding neighborhoods and schools should be active in the selection of final plants and could help in the maintenance of select areas.

#### *NATIVE SHADE TREES*

Live Oak
(*Quercus virginiana*)

Size: Up to 100’ tall, 150’ spread
Use: Great for sitting under or providing shade.

Gumbo Limbo
(*Bursera simaruba*)

Size: Up to 60’ in height
Use: Provides a large canopy for shade.

American Sycamore
(*Platanus occidentalis*)

Size: Up to 100’ in height
Use: Tolerant of wet soils. Provides a dense crown with exfoliating bark.

Red Mulberry
(*Morus rubra*)

Size: Up to 40’ in height
Use: Great tree for wildlife. A flowering tree which tolerates wet soil conditions.

Pigeon Plum
(*Coccoloba diversifolia*)

Size: Up to 50’ in height
Use: Evergreen shade tree with berries. Dense round crown with flowers.

#### *NATIVE PALMS*

Cabbage Palm
(*Sabal palmetto*)

Size: Up to 30’ in height
Use: Evergreen palm designated as Florida’s state tree.

Florida Silver Palm
(*Coccothrinax argentata*)

Size: Up to 25’ in height
Use: Threatened palm with silver fronds.

#### *NATIVE SHRUBS*

Beautyberry
(*Callicarpa americana*)

Size: Up to 10’ in height
Use: Excellent source of food for birds, great lavender blooms in the fall.

Bloodberry
(*Cordia globosa*)

Size: Between 6’ - 8’ in height
Use: Excellent source of food for butterflies. Drought tolerant.

Bougainvillea
(*Bougainvillea*)

Size: Up to 20’ spread
Use: Non-native shrub but adapted to South Florida. Full of color from summer to fall. Do not plant adjacent to trail.

Yaupon Holly
(*Ilex vomitoria*)

Size: Up to 25’ in height
Use: Common hedge, screen or windbreak. Drought and disease resistant.

Firebush
(*Hamelia patens*)

Size: Between 10’ - 15’ in height
Use: Red flowers that are popular with butterflies and hummingbirds.

Florida Privet
(*Forestiera segretata*)

Size: Between 10' - 15' in height
Use: Great for bird nests. Semi-deciduous with greenish yellow leaves.

Red Tip Cocoplum
(*Chrysobalanus icaco*)

Size: Up to 15' in height
Use: Great for hedges this lush shrub forms edible plums for wildlife.

Saw Palmetto
(*Serenoa repens*)

Size: Up to 10' in height
Use: Great shrub for borders and screening.

Tropical Sage
(*Salvia coccinea*)

Size: Up to 2' in height
Use: A reseeding perennial that is popular with butterflies.

Wax Myrtle
(*Myrica cerifera*)

Size: Up to 20' in height, 10' spread
Use: Evergreen hedge or border shrub. Excellent for birds.

Wild Coffee
(*Psychotria nervosa*)

Size: Between 5' - 10' in height
Use: Lush low growing shrub. An excellent source of bird feed.

### *NATIVE GRASSES*

Fakahatchee Grass
(*Tripsacum dactyloides*)

Size: Up to 6' in height
Use: An evergreen grass known for great rich green color. Ideal for massing or borders.

Muhly Grass
(*Muhlenbergia capillaries*)

Size: Up to 3' in height
Use: A low maintenance plant for border plantings or massing.

Sea Oats
(*Uniola paniculata*)

Size: Up to 6' in height
Use: Characteristic of sand dunes this grass can tolerant most dry conditions.

### *NATIVE GROUNDCOVERS*

Coontie
(*Zamia pumila*)

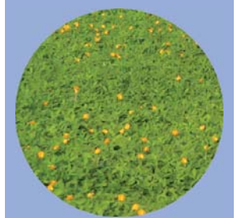
Size: Up to 3' in height
Use: Great for full sun or shade; this plant can be used for groundcover or median plantings.

Beach Sunflower
(*Helianthus debilis*)

Size: Up to 1' in height, 3' spread
Use: Blooms year-round, this plant is great for massings as a groundcover.

Blue Porterweed
(*Stachytarpheta jamaicensis*)

Size: Up to 2' in height, 3' spread
Use: Blooms year-round. Great for butterflies and hummingbirds.



Ornamental Peanut
(*Arachis Glabrata*)

Size: Up to 6" in height
Use: Low-maintenance drought tolerant ground cover.

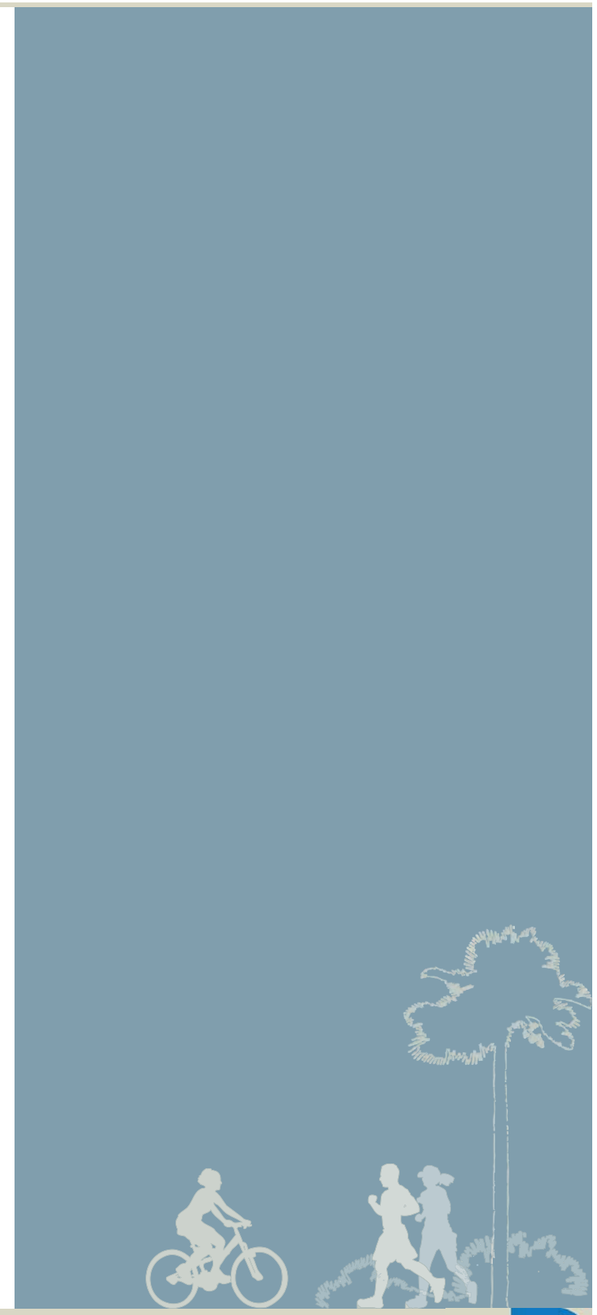
Liriope
(*Liriope muscari*)

Size: Up to 18" in height
Use: Non-native for massings or borders.

### *SOD*

Bahiagrass
(*Paspalum notatum*)

Use: A low-maintenance grass for infertile soil.



## RECOMMENDATIONS AND STANDARDS SUMMARY

Trailheads: A.D. Barnes Park should be planned as a typical trailhead facility to Ludlam Trail. Minimum requirements for trailheads should be informational signage, shaded benches/ seating, drinking fountain, restroom facilities, parking and security lighting.

Trail Intersections: Trail roundabouts should be utilized for trail intersection to encourage safe and smooth flow of trail traffic at high use areas such as school or park connections.

Street Crossings: At-Grade street crossings should be the first type considered when planning a crossing. Based on several factors for safety, either an above-grade or below-grade crossing should be considered in extreme cases.

At-Grade Crossings: At-Grade crossings for Ludlam Trail should follow the Seminole-Wekiva Trail example with a raised and/or landscaped median for the trail.

Above-Grade Crossings: This type of crossing should be ADA compliant with a maximum 5% slope with a two (2) foot shy zone on the edges for cyclists. All above-grade crossings should meet FDOT requirements.

Below-Grade Crossings: Below-grade crossings should be a minimum fourteen (14) foot trail clearance with a two (2) foot shy zone for cyclists and a minimum twelve (12) foot height.

School and Park Connections: This type of trail connection should be a minimum eight (8) foot in width for higher traffic volumes.

Trail Marketing: Online information and printed brochures should be made available to potential users to encourage a high level of success.

## 1.9 RECOMMENDATIONS AND STANDARDS (CONTINUED)

### *TRAILHEADS*

Trailheads are the 'front door' to most trails. Either located at a community park or civic space, most trailheads studied offer the following items:

- Information sign or kiosk
- Shaded benches or seating areas
- Drinking fountain or spigot
- Restroom facility
- Parking
- Security lighting

For Ludlam Trail, the best opportunity to develop a trailhead is at A.D. Barnes Park. The existing park contains parking, a proposed visitor center and Eco-Hub, restrooms and a drop-off area. Additional shaded seating, bike racks and a minimum eight (8) foot connection path with pedestrian lighting should be made to the A.D. Barnes Park facilities. Trailheads along the West Orange Trail offered bike rentals which can be a successful addition to Ludlam Trail to increase user amenities for those seeking temporary bicycle or skate rentals.

### *TRAIL INTERSECTIONS*

Trail intersections for Ludlam Trail should follow best practices for intersections with the planning of trail roundabouts. Intersections are typically high traffic areas of trails with an increased level of potential conflict, similar to typical roadway intersections. By planning a trail roundabout, trail users will be able to easily merge with other trail traffic and make smooth turns into and out of neighborhood connections and other trails.

*Example of trail roundabout which promotes safe smooth turns in high traffic areas*

Each trail roundabout should consist of a minimum twelve (12) foot wide trail roundabout with minimum trail standards of fourteen (14) feet in width and minimum eight (8) foot school connections and six (6) foot neighborhood connections radiating out. An example is below:

### *STREET CROSSINGS*

At-grade crossings should be considered first when planning a roadway crossing. As roadway conditions deteriorate either by high levels of vehicular traffic, signal proximity, driveway access points, or high trail volumes, above-grade crossings and lastly below-grade crossings should be considered. Below-grade crossings should be considered only when roadway viewsheds or favorable topography permits ease of construction.

### *AT-GRADE CROSSINGS*

At-grade crossings should follow the Seminole-Wekiva model of crossing, with the trail divided and made into single-lanes by a raised median at the crossing, a lean bar, and an area to turn around between the curbed median and the roadway. Striping should continue across the roadway and be bold enough to denote the crossing area to vehicular users or be highlighted by contrasting pavers. Trail crossing warning signs should be installed at the crossing and one-hundred and fifty (150) feet prior to the crossing on either side of the trail intersection in accordance with all MUTCD and local/ state requirements. Trail crossing warning thermoplastic pavement marking on the roadway surface should be utilized along the Ludlam corridor. The roadway should be separated by a raised landscape median, flared at the crossing for traffic calming and provide a minimum eight (8) foot, preferably twelve (12) foot, pedestrian refuge island.

### *ABOVE-GRADE CROSSINGS*

Above grade crossings along Ludlam Trail should be ADA-compliant, with a maximum five (5) percent slope as well as continuous handrails along the crossing. 'Bulbouts' should be provided along the bridge area to provide rest-stops as permitted. The trail bridge width should have a minimum of sixteen (16) foot clearance. Bike lanes adjacent to railings should have a two (2) foot shy zone. A 'heavier' bracing or low wall should be provided along bridge edges up to 42" to provide for a strong anchor to the trail edge to avoid feelings of acrophobia. The space below the bridge should be used for trail purposes, such as a rest-stop area or to incorporate a structure or transit stop.

### *BELOW-GRADE CROSSINGS*

Below grade crossings for Ludlam Trail should use the SR 434 underpass tunnel of the Seminole-Wekiva Trail as an example. Trail width through the tunnel should be a minimum fourteen (14) feet wide with a clearance of twelve (12) foot minimum. The tunnel opening should include a two (2) foot shy zone on both sides of the trail to allow trail users to travel away from the tunnel walls.

Users should be able to clearly see the other end of the tunnel from the entry to the tunnel. Safety/security lighting should be provided within the tunnel. Skylights should be used in roadway medians to provide additional natural light into the tunnel's and to create a sense of openness. The tunnel inside surface should be textured to prevent vandalism and graffiti. Security cameras should be considered if crime is of an issue.

### *SCHOOL CONNECTIONS*

School connections should be a minimum eight (8) foot in width and directly connect to the Ludlam Trail. A secured area for student bike parking should be located near the school and trail. Pedestrian low-level lighting on twelve (12) foot poles, should be located at each school connection.

### *PARK CONNECTIONS*

The Ludlam Trail should connect to each park within 250' of the corridor with an eight (8) foot minimum paved path. The main trail to park connection should tie into the park's trail network or perimeter path. Park connections should be made near a point of activity such as a visitor or recreation center, or a maintenance area where park staff are present and can provide additional trail security. Six (6) foot paved paths should connect to any nearby parking facilities. Natural areas within parks adjacent to the Ludlam Trail should be fenced to prevent trail users from disturbing natural resources.

### *TRAIL MARKETING*

Ludlam Trail should be marketed with online information and printed brochures available to all trail and park users. Successful trails such as the Burke-Gilman or Fred Marquis Pinellas Trail offer extensive online maps and information on trail points of interest and nearby civic facilities and events. Private businesses and trail vendors need to promote the use of the trail as a destination and critical transportation route.