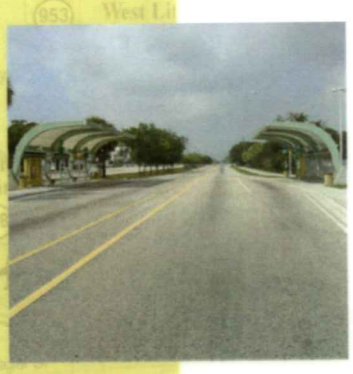
MIAMI-DADE COUNTY MPO



FINAL REPORT

South Dade Managed Lanes Study

Prepared for

Miami-Dade County
Metropolitan Planning Organization

Prepared by

Kimley-Horn and Associates, Inc.
Fort Lauderdale, Florida

©Kimley-Horn and Associates, Inc.
September 2008
040829015
51330101.08

RECEIVED
FEB 02 2009
MIAMI DADE
EXPRESSWAY AUTHORITY

South Dade Managed Lanes Study

Prepared for:

Miami-Dade County
Metropolitan Planning Organization (MPO)

Prepared by:

Kimley-Horn and Associates, Inc.
Fort Lauderdale, Florida

Kimley-Horn
and Associates, Inc.

©Kimley-Horn and Associates, Inc.
September 2008
040829015

{This page is intentionally left blank}

Executive Summary

Objective and Concept

The objective of the *South Dade Managed Lanes Study* is to assess the feasibility of managed lanes concepts in the right-of-way for the South Dade Busway and to evaluate the revenue generating potential for improving the corridor. The concept for managed lanes in the South Dade Busway corridor involves (1) enhancing the existing level of transit service in the corridor and (2) allowing tolled private vehicles to use excess capacity in the corridor with congestion pricing to maintain a high level of service in the corridor. The managed lanes would allow reliable travel to tolled private vehicles to by-pass areas of severe traffic congestion along U.S. 1.

The South Dade Busway parallels U.S. 1 (South Dixie Highway) and extends from the Dadeland South Metrorail Station to SW 344th Street. Both express bus routes and local bus routes operate along the Busway. The number of buses operating in the Busway ranges from 10 to 27 per peak hour per direction.

South Dade Busway

Background

The South Dade Busway is located along the old Florida East Coast (FEC) Railroad corridor right-of-way. The Florida Department of Transportation (FDOT) acquired the corridor's right-of-way between the Dadeland South Metrorail Station and Florida City from the FEC Railroad in December 1988. Later, the right-of-way ownership was transferred to Miami-Dade County. In February 1997, Phase 1 of the Busway was opened between Dadeland

South and SW 112th Avenue. The 8.3-mile Phase 1 Busway was constructed at a cost of $21 million using Federal Highway Administration (FHWA) funds. During Phase 2, the Busway was extended by a further 11.5 miles to Florida City. A five-mile segment of the Phase 2 Busway extending to SW 264th Street was opened in April, 2005. The final 6.5-mile segment of Phase 2 opened in December 2008. The construction of Phase 2 is funded through Federal Discretionary and State funds. The total investment for construction of Phase 2 is estimated at $74 million and includes funding from the Federal Transit Administration (FTA).

Need

The U.S. 1 corridor is currently operating well beyond its maximum theoretical capacity in the northern segment of the corridor and is approaching its theoretical capacity in the southern segment. As a result, person-movement capacity improvements are needed. According to the Miami-Dade MPO's 2030 Long Range Transportation Plan, the highest growth in the County between 2000 and 2030 is projected to occur in the South Transportation Planning Area (generally defined as the area south of Kendall Drive). The demographic and transportation data projections for the south county indicate an 83 percent population growth, a 45 percent employment growth, an 88 percent increase in auto ownership, and a 67 percent increase in trips between 2000 and 2030. As population growth in the south county continues to outpace employment, its residents will have to travel out of the area for employment. Such regional travel demand will further deteriorate level of service (LOS) on U.S. 1. As a result, the Miami-Dade MPO's future traffic projections indicate significant growth in the study area. However, no capacity enhancing projects are currently programmed along U.S. 1.

Alternatives

The following alternatives were developed for detailed evaluation:

- **Alternative 1. Two-lane at-grade alternative.** Allow private vehicles to utilize the existing South Dade Busway for a toll, with improvements made to signalization and signage.

- **Alternative 2. Grade separation of managed lanes at the locations identified in the Locally Preferred Alternative for the South Link Study.** Seven grade separation structures were recommended across a total of ten cross-streets in the South Link Study. The remainder of the Alternative 2 managed lanes corridor would be at-grade. Three typical cross sections were identified:
    - Alternative 2A. Three-lane cross section with reversible center lane to provide two lanes in the peak direction during the peak period.
    - Alternative 2B. Four-lane cross section with two lanes each direction.
    - Alternative 2C. Two-lane cross section (hybrid between Alternative 1 and 2).
- **Alternative 3. Four-lane fully elevated cross section of managed lanes with two lanes in each direction and no at-grade intersections.**

Analysis Summary

Private vehicle access to managed lanes is limited to the termini and two intermediate access points recommended at SW 152nd Street and SW 117th Avenue. The southern terminus of the managed lanes was recommended at SW 304th Street to better capture demand from Homestead and Florida City. Therefore, the length of the managed lane facility between SW 304th Street and Dadeland South is 16.7 miles. Additional bus-only access locations may be provided as needed. The managed lanes analysis was based on the following criteria:

- Maintain satisfactory travel conditions for buses operating on the Busway/managed lanes.
- Maintain level of service C for the managed lane users.

It is assumed that all private vehicles will have to pay a toll, whereas buses will be allowed to use the facility for free. A summary of the analysis is presented in the table below. Please note that assistance was received from Miami-Dade Expressway Authority (MDX) staff and consultants in preparing the revenue forecasting and cost estimations.

Summary of Alternatives Analysis

	Alternative 1	Alternative 2A	Alternative 2B	Alternative 2C	Alternative 3
Average Daily Traffic	4,900	12,500	12,500	6,130	24,100
Peak hour, peak-direction capacity	900	1,800	1,800	900	2,940
Construction Cost (2008 $)	$23 million	$496 million	$531 million	$186 million	$1,537 million
Annual Revenue (2030 $)	$11.2 million	$21.8 million	$21.8 million	$14.0 million	$37.2 million
Annualized Const. Cost (assuming 30-year term)	$1.4 million	$30.3 million	$32.5 million	$12.0 million	$93.4 million
Annual Operational Cost (2008 $)	$0.82 million	$1.5 million	$1.5 million	$0.97 million	$2.3 million
Peak direction toll per mile (2030 $)	$0.75	$0.60	$0.60	$0.75	$0.75
Estimated (2030) daily volume on US 1[1]	143,000	137,200	137,200	141,800	133,000

The results indicate that the two-lane cross sections have a greater chance for cost recovery within a typical 30-year term. However, the two-lane alternatives will have less mobility benefits for transit vehicles and show minimal reduction in estimated daily volume on U.S. 1 compared to the no-build volume of 143,500 vehicles per day. The three-lane or four-lane alternatives provide greater revenue but would need to be supplemented by alternative funding sources. Alternative 3 provides significantly greater overall mobility benefits since the fully elevated alternative would remove at-grade intersections along the managed lanes.

Policy Decisions

The analysis identified options for operating managed lanes within the right-of-way of the South Dade Busway. However, the advancement of managed lanes concept hinges upon the following key policy decisions:

- Funding mechanism – As the analysis indicated, the implementation of managed lanes requires a significant investment, except in the case of the minimal-build

[1] US 1 volume between Dadeland South and SW 152nd Street.

Alternative 1. Therefore, potential funding sources need to be identified, including the possibility of MDX funding the project, public-private partnerships, and bonding.

- Percent of revenue reserved for transit improvement – A key impetus for investigating the feasibility of implementing managed lanes is to determine if managed lanes could generate sufficient revenue to partially fund transit operations and enhancements in the corridor. While preliminary analysis indicates a relatively long term return of investment period, a policy decision could be taken to allocate a portion of the revenue for transit improvements.
- Envelope for Metrorail extension – The Locally Preferred Alternative of the South Link study calls for long-term extension of Metrorail to Florida City as demand warrants. Therefore, consideration should be given to plan the construction of managed lanes in such a way to accommodate future Metrorail service within the corridor. Another key policy decision would be to determine whether to continue/discontinue/ or scale back the operation of managed lanes if Metrorail is extended.

{This page is intentionally left blank}

Table of Contents

Introduction 1
Background 1
Organization of Report 4
Purpose and Need 6
Literature Research 8
South Florida Projects 8
National Projects 11
Summary of Literature Review 16
Existing and Future Conditions 18
Socio-economic Conditions 18
Right-of-Way Conditions 21
Transportation Network 22
Traffic Volume Data 24
Level of Service (LOS) and Volume-to-Capacity (V/C) Ratio 27
Traffic Safety Data 30
Transit Data 31
Bicycle/Pedestrian Conditions 34
Summary of Analysis 38
Demand Analysis 39
Managed Lanes Options 43
Key Issues 43
Options 45
Options Screening 48
Summary 55
Features of Managed Lanes Alternatives 56
Common Features of Alternatives 56
Alternative 1. Two-Lane At-Grade Alternative 61
Alternative 2A. Three-Lane Reversible Alternative with Partial Grade Separation 62
Alternative 2B. Four-Lane Alternative with Partial Grade Separation 65
Alternative 2C. Two-Lane Alternative with Partial Grade Separation 67
Alternative 3. Four-Lane Elevated Alternative 68
Planning Level Cost Estimate 71
Construction Cost Estimate 71
Operations Cost Estimate 72
Demand and Revenue Analysis 73
Traffic Demand 74
Traffic Impacts 74
Travel Time for Buses 77
Toll Technology 79
Toll Sensitivity Analysis 79
Revenue Analysis 81
Summary of Alternatives Evaluation 82
Investment Analysis 84
Transit Funding from Project Revenue 84
Policy Decisions 84
Implementation Plan 85

List of Tables

Table 1: Historical AADT on U.S. 1 (1997-2006) 26
Table 2: Peak Period Level of Service and V/C Ratios on Approaches to Intersections 29
Table 3: Busway Crashes Summarized by First Harmful Event, 2003 – 2005 31
Table 4: A.M. Peak Hour Headway (Dadeland South) 32
Table 5: A.M. Peak Hour Headway (South Miami-Dade Government Center) 32
Table 6: A.M. Peak Hour Headway (Florida City) 32
Table 7: South Miami-Dade Busway 2004 Daily Boarding-Alighting Data 33
Table 8: U.S. 1 Corridor Peak Hour Capacity Analysis for Existing (2007) and Future (2030) Conditions 41
Table 9: U.S. 1 Corridor Future (2030) Laneage Deficiencies 42
Table 10: Typical Sections Evaluation Matrix 50
Table 11: Access Strategy Evaluation Matrix 52
Table 12: Intersection Control Type Evaluation Matrix 54
Table 13: Planning Level Construction Cost 72
Table 14: Planning Level Operations Cost for Toll System 72
Table 15: Estimated (2030) Daily Volume on Managed Lanes 74
Table 16: 2030 Daily Volume on US 1, Level of Service, and Percent Change in Comparison to No-Build Conditions 75
Table 17: Change in Estimated (2030) A.M. Peak Hour Traffic Volume 76
Table 18: Change in Estimated (2030) P.M. Peak Hour Traffic Volume 76
Table 19: Estimated Travel Time for Buses on Managed Lanes 79
Table 20: Estimated (2030) Revenue by Alternative 81
Table 21: Summary of Alternatives Analysis 83
Table 22: South Dade Managed Lanes Implementation Plan 86

List of Exhibits

Exhibit 1: Typical Cross Section of the Busway at a Station 22
Exhibit 2: Reversing Lanes 46
Exhibit 3: Typical Cross Section of the Two-Lane Alternative at a Station 62
Exhibit 4: Typical Cross Section of the Three-Lane Alternative at a Station 63
Exhibit 5: Typical Cross Section of the Three-Lane Alternative 63
Exhibit 6: Typical Cross Section of the Four-Lane Alternative at a Station 65
Exhibit 7: Typical Cross Section of the Four-Lane Alternative 66
Exhibit 8: Typical Cross Section of the Four-Lane Elevated Alternative at a Station 70
Exhibit 9: Typical Cross Section of the Four-Lane Elevated Alternative 70

List of Figures

Figure 1: Study Area 2
Figure 2: Features of Managed Lanes Alternatives 60
Figure 3: Summary of Busway Travel Time Data 77

Appendices

Appendix A. Review of Previous Work

Appendix B. Data Collection Map Series

Appendix C. Full Access Interchange Concept

Appendix D. Managed Lanes Access Ramps

Appendix E. HNTB Memo

Appendix F. Planning Level Cost Estimates

Appendix G. Wilbur Smith Associates (WSA) Memo

{This page is intentionally left blank}

Introduction

The objective of the *South Dade Managed Lanes Study* is to determine if reasonable alternatives exist for developing managed lanes in the right-of-way for the South Dade Busway and to evaluate the revenue generating potential of such alternatives. The South Dade Busway parallels U.S. 1 (South Dixie Highway) and extends from the Dadeland South Metrorail Station to SW 344th Street in Florida City (see Figure 1). The concept for managed lanes in the South Dade Busway corridor involves congestion pricing to maintain a high level of service (LOS) in the corridor. The managed lanes would allow reliable travel to certain user groups, who would be required to pay a toll, to by-pass areas of traffic congestion during peak periods of travel. The conversion of the dedicated busway to managed lanes would result in buses and toll-paying private vehicles sharing the facility. Several improvements are necessary to implement managed lanes and to ensure satisfactory level of service for buses and private vehicles. This study examines potential demand, capacity and operational enhancements, access locations to managed lanes, capital and operational costs, toll options and revenue, and potential funding strategies.

Background

The South Dade Busway is located along the old Florida East Coast (FEC) Railroad corridor right-of-way. The Florida Department of Transportation (FDOT) acquired the corridor's right-of-way between the Dadeland South Metrorail Station and Florida City from the FEC Railroad in December, 1988. Later, the right-of-way ownership was transferred to Miami-Dade County. In February 1997, Phase 1 of the Busway was opened between Dadeland South and SW 112th Avenue. This 8.3-mile segment was constructed at a cost of $21 million and Federal Highway Administration (FHWA) funds were utilized for Phase 1. During Phase 2, the Busway is being extended by a further 11.5 miles to Florida City. A five-mile segment of the Busway Phase 2 extending to SW 264th Street was opened in April, 2005. The remaining 6.5-mile segment of Phase 2 was opened in December, 2008. The construction of Phase 2 is funded through Federal Discretionary and State funds. The total investment for construction of Phase 2 is estimated at $74 million and it includes funding from the Federal Transit Administration (FTA).

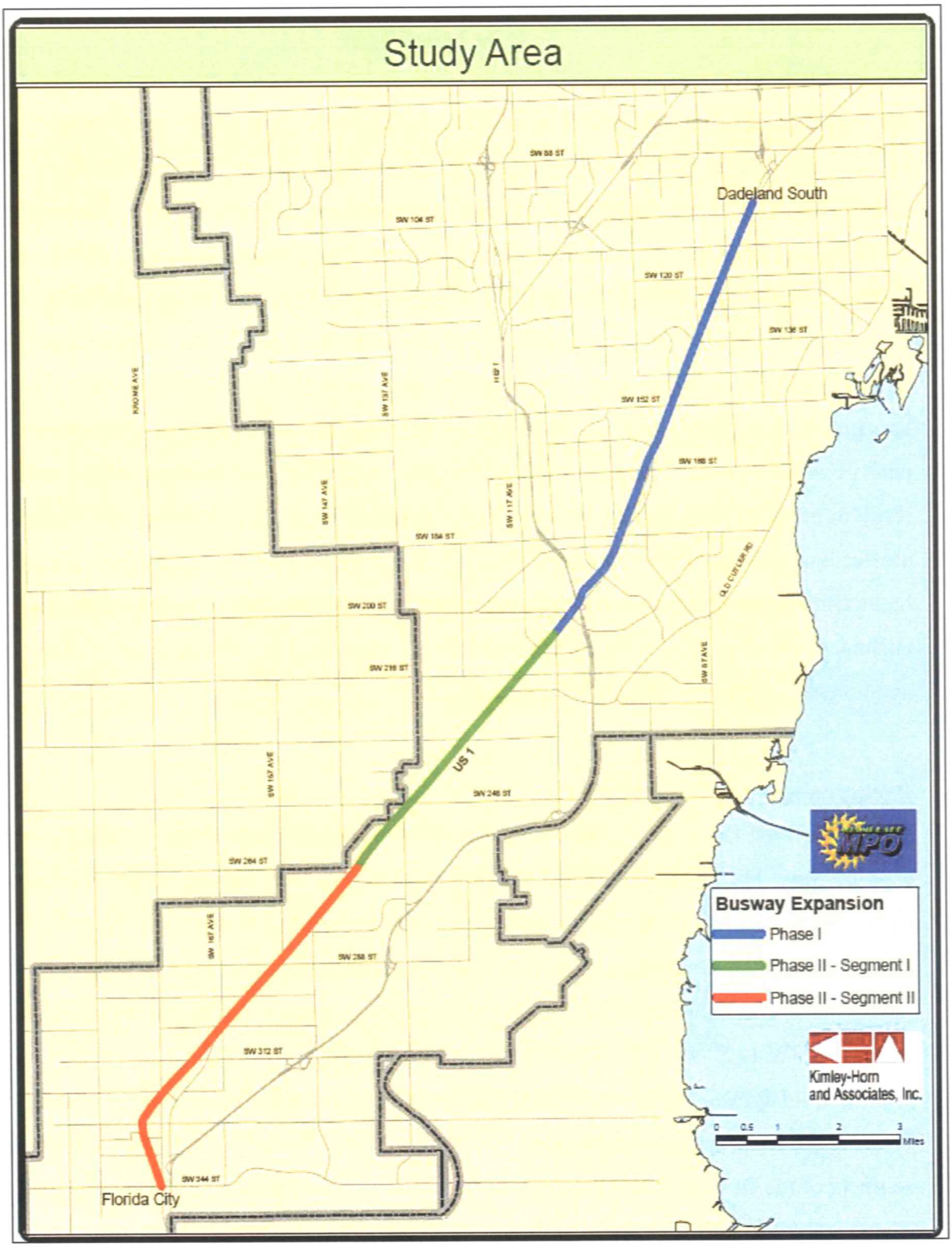


Figure 1: Study Area

The recently completed *South Miami-Dade Corridor (South Link) Alternatives Analysis* examined transit alternatives along the South Dade Busway corridor as a potential measure to alleviate mobility deficiencies. Although there is support for a Metrorail extension along the corridor between Dadeland South and Florida City, the projected ridership along the corridor was not enough to offset the significant cost of the project. Therefore, the Miami-Dade Metropolitan Planning Organization (MPO) is considering alternative measures for providing additional mobility in the South Miami-Dade area and strategies to help fund and accelerate the development of a future Metrorail extension in the corridor. The *South Dade Managed Lanes Study* examines the possibility of operating managed toll lanes on the South Dade Busway to relieve congestion on U.S. 1 and to generate revenue that can be utilized for transit operations or enhancements in the corridor.

South Dade Busway at SW 296th Street

A funding strategy was developed in the *South Link Alternatives Analysis* for the "Modified Enhanced Bus Rapid Transit Alternative," which was designated the Locally Preferred Alternative. The recommended improvements were segmented into three components as listed below.

- Enhanced Bus Rapid Transit
- Metrorail Extension
- Grade Separation

The Enhanced Bus Rapid Transit component consists of proposed improvements to the Busway such as transit signal priority (TSP), automated fare collection system, real-time passenger information system, feeder buses on surface streets (route restructure), increased park-and-ride facilities, and low-floor stylized buses with a specific branding theme. The Metrorail Extension component consists of an approximately 4,500-feet extension of Metrorail from its current southern terminus at Dadeland South to SW 104th Street with a possible future extension as demand warrants. The purpose of the Metrorail Extension is to relieve congestion in the Dadeland area and to serve latent parking demand experienced in the corridor. The Grade Separation component consists of constructing elevated grade separation for the Busway to remove seven major at-grade intersections, which will improve travel time for transit patrons in the corridor and reduce traffic congestion on cross-streets. It should be noted that grade separation improvements may also be studied in key locations as a measure to provide the mobility enhancements needed for a managed lanes concept in the Busway corridor.

Organization of Report

This report is divided into the following chapters:

- Purpose and Need – presents reasons for examining managed lanes on the South Dade Busway.
- Literature Research – summarizes similar projects in South Florida and select projects in other areas of the country.
- Existing and Future Conditions – presents socio-economic, transportation network, traffic volume, traffic safety, and transit data for the study area.
- Demand Analysis – assess the potential demand for managed lanes. Capacity and level of service of US 1 is determined to determine the need for additional capacity, which is used as a surrogate measure of demand for managed lanes.
- Managed Lanes Options – a set of managed lanes options are developed and a screening analysis is performed to identify the options that are better suited for serving the study objectives.

- Features of Managed Lanes Alternatives – presents characteristics of alternatives such as typical sections, access locations, termini, vehicle eligibility, and demand regulation.
- Planning Level Cost Estimate – presents a planning level construction and operations cost estimate performed for the alternatives to assess if managed lanes could self-finance and/or generate excess revenue to support future transit enhancements along the Busway corridor.
- Demand and Revenue Analysis – presents travel demand forecast for managed lanes, traffic impacts, travel time assessment, toll sensitivity analysis, and revenue estimate.
- Summary of Alternatives Evaluation – presents a summary demand, capacity, costs, revenue, an assessment of the alternatives to recover capital expenditures through toll revenue, and a potential implementation plan.

Purpose and Need

South Miami-Dade County, generally defined as the area to the south of SW 104th Street, is the fastest growing region in the County. According to the Miami-Dade MPO's 2030 Long Range Transportation Plan (LRTP), the population in Miami-Dade County is expected to increase 43 percent by 2030. Comparatively, the population in the southern area is projected to increase by 83 percent. One reason for higher growth in the south county is the availability of undeveloped land. During the same period, employment is expected to increase 45 percent. Based on the 2000 Census data, employment opportunities in South Miami-Dade County was approximately 63 percent of the workforce. Therefore, many people have to travel out of the region to major employment centers such as Downtown Miami and Miami International Airport. The continued growth in South Miami-Dade and imbalance between employment and workforce raise the need for roadway capacity and mobility options.

U.S. 1 is the only major road that connects South Miami-Dade County with major employment centers in Downtown Miami. However, U.S. 1 is already operating at or above capacity in its entire length. A planning level analysis presented in this report for 2030 traffic conditions indicates that as many as three additional lanes are required on certain segments of U.S. 1 during the peak period to maintain LOS D, which is the desired LOS of U.S. 1. However, the opportunities for enhancing the capacity of U.S. 1 to meet the projected demand are virtually non-existent. The South Dade Busway, a two-lane dedicated transit facility that parallels U.S. 1, is identified as a potential corridor to provide additional capacity and travel options.

Currently Miami-Dade Transit (MDT) operates several Metrobus routes on the Busway. According to MDT, total ridership on the Busway is approximately 20,000 passengers per day. The number of buses operating on the Busway ranges from 10 to 27 per direction in the peak hour (higher frequency is observed in the northern segment). Some bus routes operate during peak period only and excess capacity is available on the Busway. An on-board travel survey performed as part of the study indicated that the average travel time from Dadeland

South to Florida City was approximately 60 minutes and 80 minutes, respectively for express and non-express buses. The signal delay was approximately 25 minutes, which accounted for 30 to 40 percent of total travel time. There are approximately 45 at-grade intersections along the Busway. Therefore, in spite of operating in a dedicated corridor, buses currently experience high delay at traffic signals. The concept of managed lanes along the Busway would likely include several enhancements such as transit signal priority at at-grade intersections, grade separation of major intersections, and additional capacity (lanes) on the Busway. As such, future managed lanes on the Busway could provide benefits for both transit and automobile users.

The *South Dade Managed Lanes Study* examines the possibility of operating managed toll lanes on the South Dade Busway to relieve congestion on U.S. 1. The study also examines the revenue generation potential of managed lanes to partially fund the extension of Metrorail to Florida City, which is the locally preferred long-term alternative of the recently completed South Link Study.

Literature Research

Value pricing is a relatively new concept introduced as part of the Transportation Efficiency Act for the 21st Century (TEA-21). The program suggested the use of High Occupancy Toll (HOT) lanes as an operational strategy to manage congestion during different times of day while maintaining a high level of service for users who are prepared to pay a premium. Conversion of existing High Occupancy Vehicle (HOV) lanes to HOT lanes is the most common approach observed thus far. The HOT lane concept allows unused capacity in the HOV lane to be used by vehicles that do not meet the minimum occupancy requirement by paying a toll for access to the lane(s). The price may be set fixed or may change by time of day, or it may change dynamically in response to the current level of congestion. HOT lanes use both vehicle eligibility and pricing to regulate demand.

According to the Texas Transportation Institute (TTI), there are six managed lane programs with a pricing component as of February, 2007 (see Appendix A). These projects are located in California, Texas, Colorado, Minnesota, and Utah. In addition, two projects are under construction and thirty other projects are under development.

In South Florida, both the FDOT and Miami-Dade Expressway Authority (MDX) have previous and ongoing studies that consider the feasibility of managed lanes. Details of select South Florida and national managed lane initiatives are presented below.

South Florida Projects

This section reviews initiatives taken by FDOT and MDX to assess feasibility of managed lanes in Miami-Dade and Broward Counties. The projects that are discussed under this segment include:

- 95 Express project on I-95
- S.R. 836 (Dolphin Expressway) Bus Rapid Transit / Value Pricing Lanes Concept

95 Express

FDOT is planning to operate a pilot managed lane/express bus project on I-95 between the I-395 interchange in Miami-Dade County and I-595 interchange/Broward Boulevard in Broward County. Please refer to Figure A-1 in Appendix A (source: FDOT) for the study limits of the *95 Express* study and possible future expansions of the managed lane corridors into a regional network. The United States Department of Transportation (USDOT) announced on August 14, 2007, that South Florida was one of five regions in the country to receive a grant for managed lanes projects. FDOT is expected to receive a $62.9 million grant to help cover the estimated $248 million cost of converting the existing HOV lanes to an electronic HOT lanes facility.

This 24-mile managed lanes project is aimed at providing congestion relief to motorists, facilitating regional express bus service, and generating revenue for financing the project. The pilot project would convert the existing HOV lanes on I-95 to HOT lanes. With minor modifications and restriping, two HOT lanes would be provided in each direction. Managed lanes would have variable value pricing based upon the level of congestion to maintain a minimum operating speed of 50 mph on HOT lanes at all times. However, buses, vanpools, and carpools with a minimum occupancy of three persons would be allowed to use the managed lanes free of charge. It has been estimated that potential time savings within the 24-mile segment during the peak periods could be up to 38 minutes. The northbound project is planned to be completed by the end of 2008.

95 Express also includes facilitating the development of an express bus network for the South Florida region. A key component of the express bus network is creating an inter-county bus service that utilizes the proposed managed lanes on I-95. The inter-county bus route will operate between the park-and-ride facilities at Broward Boulevard and the Golden Glades interchange. The current Route 95 Express bus route that operates between the Golden Glades interchange and Downtown Miami will also operate in the managed lanes.

The S.R. 836 (Dolphin Expressway) Express Bus / Value Pricing Lanes Concept

As part of major capacity improvements being planned along S.R. 836, MDX is proposing to use new capacity as Express Bus / Value Pricing Lanes (Bus/VPL). The managed lanes concept envisioned for S.R. 836 is a four-lane, bi-directional, free-flowing Busway, shared with, and paid for by, toll-paying motorists in private vehicles. Buses would have direct "toll free" access to the managed lanes via express bus centers and park-and-ride facilities. Free flow travel conditions would be ensured through variable pricing of private vehicles wishing to utilize the time savings afforded by the Bus/VPL lanes. Express Bus vehicles would be "guaranteed" a certain level of service by managing the pricing of other vehicles to maintain free-flow conditions. Therefore, sale of remaining capacity to other vehicles would be on a market basis.

Future plans for the S.R. 836 cross-section include four general purpose lanes and two managed lanes in each direction. Fee collection would be limited to SUNPASS users to maintain continuity throughout the region. The managed lanes would be available at no charge to transit vehicles, certified vanpools, and emergency vehicles.

As of November 2003, the S.R. 836 Bus/VPL lanes were planned to open in phases beginning in 2011. When fully implemented, the new lanes will provide a new free flowing connection on S.R. 836 between the Homestead Extension of Florida's Turnpike (HEFT) and Miami International Airport, including connections to the new Miami Intermodal Center (MIC) and S.R. 112 (Airport Expressway). An electronic tolling zone for the managed lanes is being planned somewhere between NW 72nd Avenue and LeJeune Road. Intermediate access is also planned with S.R. 826 (Palmetto Expressway) in the future. By providing a time savings alternative to congested travel lanes, free-flow travel opportunities for buses, plus direct access to the new MIC, the Bus/VPL lanes are expected to provide new opportunities for multimodal travel solutions in the S.R. 836 corridor including a framework for express bus service to and from the western suburbs. Please note that MDX is continuing to refine the managed lanes concept being planned for S.R. 836.

National Projects

The following sections describe operational features of three prominent managed lane projects in the U.S.:

- I-15 FasTrak in San Diego, California
- I-10 and U.S. 290 QuickRide in Houston, Texas
- S.R. 91 Express Lanes in Orange County, California

I-15 FasTrak, San Diego

This eight-mile, four-lane HOT lane facility is located in the median of I-15. There are four reversible toll lanes and on typical weekdays, all lanes allow southbound traffic between 5:45 AM and 11:00 AM, whereas between 12:00 PM and 7:00 PM, only northbound traffic is allowed. Originally started as an HOV facility in 1988, it was opened to Single Occupancy Vehicles (SOV) in 1996 for a fee. Carpools, vanpools, and transit vehicles use FasTrak lanes for free.

The toll-collection system in *I-15 FasTrak* is different from many other systems. Initially, SOVs were required to purchase a fixed price monthly pass, but in 1997, transponders were introduced. In 1998, flat monthly fees were replaced with variably priced per trip tolls. Today, FasTrak uses a dynamic, real-time tolling structure. Typically the tolls range from $0.50 to $4.00, but tolls could be increased up to $8.00 during severe congestion. Toll rates could be adjusted as often as every 6 minutes in response to real time traffic conditions. A real-time message sign posted in advance of the entrance indicates the current fee. Toll collection occurs when motorists travel at highway speeds through the tolling zone. The overhead antennas scan the windshield-mounted transponders and deduct the appropriate toll.

I-15 FasTrak Tolling Real-time Message Sign

As with other successful HOT lane projects, extensive public outreach and political champions were keys to the implementation of *I-15 FasTrak* lanes. Public opinion surveys formed the basis for pricing and customer communication strategies. Strong commitment from politicians helped clear difficult hurdles including legislative actions to allow SOVs on HOV lanes (California law stipulates that only two-plus carpools are permitted in HOV lanes.)

In 2006, the average daily usage of FasTrak was around 15,600 vehicles, of which 4,000 were SOV paying a toll. The carpool violation rate was around five percent, which is said to be low in comparison to other facilities in the region. The average daily traffic on I-15 varied between 170,000 to 295,000 vehicles. The excess toll revenue is used to fund express transit bus service on I-15.

Another 12 miles of FasTrak facility have been planned to be built by 2012. Part of the funding for the expansion comes from the *TransNet* half-cent sales tax. Once completed, FasTrak will feature bi-directional movement with a movable barrier to allocate additional lanes for peak direction of travel. In addition, multiple access points to general purpose travel lanes and direct access ramps for bus rapid transit are planned.

I-10 QuickRide, Houston

I-10, commonly known as the Katy Freeway, is a major expressway that extends 40 miles west from the Central Business District (CBD) of Houston. Originally built to carry approximately 80,000 vehicles per day, it was carrying nearly 207,000 vehicles per day in 2002. Severe congestion is experienced more than 11 hours each day and even during weekends. Financial estimates indicate the cost of traffic delays to commuters, residents, and businesses at $85 million per year.

To address the congestion problem, a 13-mile HOV lane was constructed along the median in 1984. It was originally constructed with the FTA support and was dedicated for transit. It is interesting to note that even though the Katy Freeway is owned and operated by the Texas Department of Transportation (TxDOT), the QuickRide lane and other HOV facilities in the

area are owned and operated by the Harris County Metropolitan Transit Authority (Houston Metro). Underutilization as a transit facility resulted in opening the corridor for HOV vehicles. With two-person carpools, congestion was deemed unacceptable, whereas restricting two-person carpools resulted in some excess capacity. In an effort to maintain acceptable level of service while serving more commuters, the operators introduced a value pricing pilot project on the existing HOV lane in 1998. The basic features of the HOT lane are summarized below.

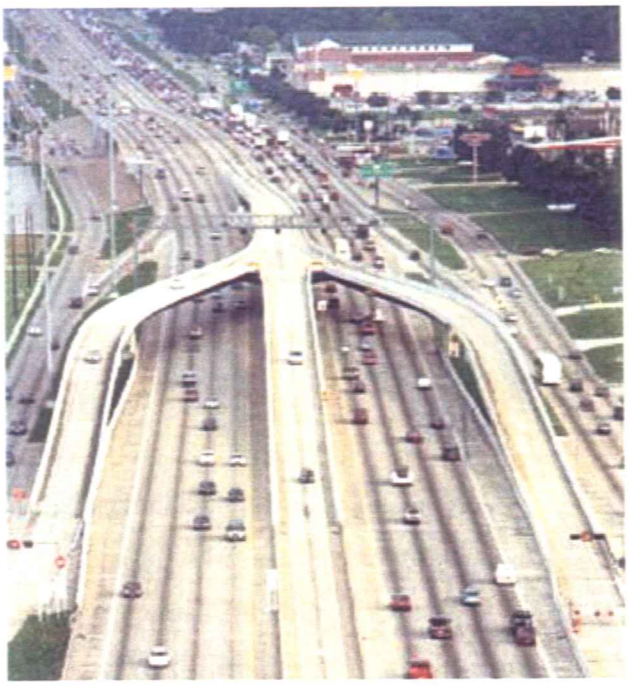
- Single reversible lane of 13 miles built along the median of I-10 (Katy Freeway).
- Physically separated from general purpose lanes with three intermediate ingress/egress points.
- Transit vehicles and three-plus carpools get free access to the facility all the time; two-person cars have to pay $2 for use between 6:45 AM and 8:00 AM and between 5:00 PM and 6:00 PM. During other times, two-person cars use the lane without charge. SOVs are prohibited from using at all times.
- The QuickRide system uses fully automated toll collection. Purchasing transponders is necessary for the use of the facility by two-person carpools. Overhead transponder readers deduct the tolls from the user accounts. The accounts are automatically recharged when the balance falls below $10. According to Houston METRO, the current number of QuickRide accounts was approximately 2,000 (as of May 2007) and gross revenue is approximately $160,000 annually. It should be noted that these transponders are valid for accessing both the Katy Freeway and Northwest Freeway (U.S. 290) QuickRide managed lanes.
- Combined QuickRide trip volume on both the Katy Freeway and Northwest Freeway is approximately 200 trips per day, or approximately 10 percent daily participation.
- Dynamic message signs placed on approaches to the QuickRide lane inform when tolls are in effect.

Spurred by the success of the Katy Freeway managed lane, the operators converted a 13.5-mile HOV lane on the Northwest Freeway (U.S. 290) as a QuickRide lane in late 2000. The operation of this lane is similar to the Katy Freeway facility.

Before and after studies performed on the Katy Freeway HOT lanes indicate the following benefits:

- Increased three-plus carpools during peak periods.
- Redistributed two-person carpools to before and after the peak periods when a toll is not required for the use of the managed lane.
- Increased level of service and speeds on the HOT lane.
- Transported same number of passengers more efficiently (in comparison to the HOV lane).

Several institutional challenges are reported in the operation of QuickRide lanes. FTA, which funded the HOV facility on the Katy Freeway, prohibits SOVs from using the current facility. In addition, if Houston Metro desires to change occupancy requirements or toll rates, approval from TxDOT needs to be obtained. There are plans to expand the number of QuickRide facilities to four in the future. These expansions require approval and coordination with the FHWA and FTA.



QuickRide Lane Direct Connection Ramps

S.R. 91 Express Lanes, Orange County

Riverside Freeway (S.R. 91) is a 12-lane facility connecting the employment centers of Orange County to the residential developments of Riverside County. The average daily traffic on this congested corridor was around 250,000 vehicles in 2002. To find a solution to the increasing congestion on S.R. 91, a four-lane toll facility (*S.R. 91 Express Lanes*) was built in the median of the freeway. The toll expressway lanes are approximately 10 miles in

length and there are no intermediate access points to the toll lanes. Starting operation in late 1995, *S.R. 91 Express Lanes* was the first variable pricing project in the U.S. and is also the first privately financed toll road in the U.S. in more than 50 years. In addition, it is claimed to be the world's first fully-automated toll facility.

S.R. 91 Express Lanes

The roadway was constructed through a 35-year lease agreement between Caltrans and California Private Transportation Company (CPTC), a private consortium. The project was built entirely from private funds. Two major reasons for the successful public-private partnership were:

- Extensive public outreach efforts were conducted from the early stages of the project.
- State and local officials championed the project, which helped to tackle complex issues associated with public-private partnerships.

The users were required to have a transponder to access the facility. Three different types of user accounts were created based on the level of use of the facility. The transponder holders are eligible for discounts at over 150 partner businesses such as hotels, shopping entities, and recreational facilities. The original toll structure was modified several times. Initially, tolls were not levied on three-plus carpools. Later, three-plus carpools were required to pay 50

percent of the regular toll. In late 2003, the tolls on three-plus carpools were removed. Tolls were structured based on time of day and day of week and the current toll rates vary from $1.20 to $9.50. Overhead dynamic message signs at approaches to express lanes indicate current toll rates. Toll violations are detected automatically. Recent figures indicate that around 170,000 transponders have been issued for use of the express lanes. Fiscal year 2006 data places revenues from the facility at $44 million. The daily usage of the facility is between 35,000 and 40,000 vehicles.

The public-private partnership resulted in several institutional issues. One of the most contentious issues was the non-compete clause that was part of the agreement. As a result, any capacity additions to the general purpose lanes of S.R. 91 could not be implemented without consulting the CPTC. With public resentment growing due to the non-compete clause and other litigations, the Orange County Transportation Authority (OCTA) purchased the facility from CPTC in July 2003. The operation of the publicly owned facility is now being performed by a private firm. Since OCTA purchased the facility, restrictions to capacity improvements of S.R. 91 and tolls on three-plus carpools have been removed.

Summary of Literature Review

The literature review indicates that existing managed toll lane projects are on freeways or expressways. Even though the *I-10 QuickRide Lanes* were originally constructed as a dedicated transit facility and later converted to HOT lanes, the potential managed lanes on the South Dade Busway corridor are significantly different from other projects. The characteristics that make the proposed South Dade Busway managed lanes unique include:

- At-grade crossings along the Busway require traffic signal control, whereas existing managed lanes projects are on continuous flow facilities.
- Providing signal priority for buses and managed lanes patrons would require careful planning.
- Bus turning movements at some intersections would need to be maintained.
- Bus stations are located along the Busway, whereas on *I-10 QuickRide*, buses have to exit the freeway via dedicated direct-connection ramps to access transit stations.

- Bus stations along the Busway would need to be designed such that buses can re-enter travel lanes that will be shared with non-transit vehicles without significantly impacting flow.
- Bus stations along the Busway exhibit a considerable amount of pedestrian activity. No known existing managed lanes project operates in areas where pedestrians frequently cross the lanes to access bus stations.

The important lessons learned from existing HOT lane projects that are useful for the South Dade Managed Lanes project are summarized below.

- HOT lanes, when efficiently managed, can maximize the use of capacity while maintaining acceptable level of service.
- HOT lanes can offer reliable travel times particularly during peak periods.
- Increased carpooling was observed in the three projects described in this chapter.
- Increased utilization and revenue generation make HOT lanes more attractive than underutilized/unsatisfactory HOV facilities that run the risk of elimination due to public pressure.
- Equity of HOT lanes is a major issue that is being debated. The HOT lanes are available to some road users only if they are willing to pay or carpool.
- Extensive public outreach during all phases of the study is vital for success. Consensus building, assessing market demand, price structure, and nature of operation are key functions of public outreach.
- Recruiting political champion(s) are also vital to gaining consensus, maintaining momentum, and clearing institutional and legislative barriers.
- Innovative funding methods can be used to implement HOT lane projects. Private funding brings access to capital sources; however, issues such as high private debt service costs and a non-compete clause in the *S.R. 91 Express Lanes* project could give rise to future problems.
- Partnerships and/or reciprocity with other toll agencies are advantageous and should include data and equipment compatibility (e.g., transponders).

Existing and Future Conditions

This section of the report describes the collection and analysis of socio-economic, transportation network, traffic, and transit data for the existing and future corridor conditions. The previously collected data for the *South Link* and *Arterial Grid Analysis* studies were used when possible. If more recent data were available, the data tables and/or analyses performed in the above-mentioned study reports were updated. The types of data collected and analyzed in this chapter are summarized below.

- Socio-economic data – future (2030) population, workforce, employment, income, and household data
- Right-of-way conditions – sample cross section, ownership, intersections
- Transportation network data – functional classification and number of lanes
- Traffic volume data – existing annual average daily traffic (AADT) on major streets, historical growth trend of AADT on U.S. 1, and directional distribution of traffic flow
- LOS and volume-to-capacity (V/C) ratio analysis for approaches on 10 major intersections along the U.S. 1 corridor
- Traffic safety data for the South Dade Busway
- Transit data – transit routes, service frequency, stations, and park-and-ride lots
- Bicycle/pedestrian conditions – South Dade Trail, bike lanes, paved paths, South Dade Greenways Master Plan, and pedestrian facilities

Socio-economic Conditions

Population

Both the 2000 Census data and 2030 demographic data developed for Miami-Dade's LRTP were utilized in this study. The *South Link* Study was also examined for socio-economic data relative to the South Dade Corridor.

According to the *South Link* Study, approximately 140,000 people lived within 0.75 miles on either side of the South Dade Corridor in 2000. The population distribution within the study corridor identified in the *South Link* Study is presented below.

- North section - Pinecrest, Palmetto Bay, and Cutler Ridge (39 percent of corridor's population)
- Central section – Naranja, Goulds, and the Redlands (27 percent)
- South section – Homestead and Florida City (34 percent)

According to the 2030 LRTP, the population of Miami-Dade County is expected to increase 43 percent by 2030. Comparatively, the population in the South Transportation Planning Area (south of SW 104th Street) is projected to increase by 83 percent, which is the highest expected growth of any of the six planning areas of Miami-Dade County.

Figure B-1 in Appendix B presents projected 2030 population density by traffic analysis zone (TAZ). As seen from Figure B-1, the population density of the majority of the TAZs abutting the U.S. 1 corridor is projected to exceed 5,000 residents per square mile. Several TAZs are projecting 2030 population densities in excess of 10,000 residents per square mile.

The 2030 population data include several new planned community urban centers (CUCs) along the South Dade Corridor including Goulds (in the area of SW 216th Street and U.S. 1), Princeton (in the area of SW 248th Street and U.S. 1), Naranja (in the area of SW 264th Street and U.S. 1), and Leisure City (in the area of SW 288th Street and U.S. 1). Additionally, neighborhood revitalization strategies are being planned for Perrine (west of U.S. 1 between SW 168th Street and Marlin Road) and Downtown Cutler Ridge (in the area around the Cutler Ridge Mall and SW 211th Street).

Overall, the above data indicate that the population along the corridor is expected to grow at a much faster rate than the rest of Miami-Dade County. Therefore, the congestion in the U.S. 1 corridor is expected to worsen unless alternative travel options or facilities are provided.

Employment and Workforce

Based on the 2000 Census data, the *South Link* Study indicates that employment and workforce along the U.S. 1 corridor (1.5-mile buffer only) is balanced. That is, the employment opportunities and workforce living within the corridor are similar. This is due to the commercial nature of the corridor. However, when the entire South Miami-Dade area is considered, employment was only approximately 63 percent of the workforce. Therefore, many people have to travel out of the region to major employment centers such as the CBD and Miami International Airport.

Furthermore, according to the 2030 LRTP, employment in the South Transportation Planning Area is expected to increase 45 percent by 2030. However, as presented in the previous section, population in the South Transportation Planning Area is expected to increase by 83 percent. Clearly, many people in South Miami-Dade are expected to have to continue traveling out of the area for employment. The imbalance between employment and workforce in South Miami-Dade further highlight the need for travel options in the area.

Figures B-2 and B-3 in Appendix B show projected 2030 workforce and employment densities by TAZ. In South Miami-Dade, the workforce density of the majority of TAZs within the urban development boundary (UDB) is projected to exceed 1,000 per square mile, with several TAZs exhibiting more than 5,000 workforce members per square mile. The employment density in South Miami-Dade is not as high as the workforce density. In addition, as shown in Figure B-3, employment density is much more tied to certain key areas including the U.S. 1 Corridor, the Kendall Drive Corridor, and the area around the Kendall-Tamiami Airport. Because the projected workforce in South Miami-Dade is greater than the projected employment, people will continue to travel out of the area for work.

Income and Households

The *South Link* Study analysis indicates that the income level of the population living along the South Dade Corridor decreases from north to south. The average income in the north, central, and south sections of the corridor based on the 2000 Census data are listed below:

- North section - $58,015
- Central section - $33,397
- South section - $27,756

Overall, income has a strong correlation with automobile ownership. In addition, automobile ownership has a strong reverse correlation with transit ridership. Therefore, people living in the central and southern sections of the corridor are more likely to use transit options for travel than people living in the northern section.

Right-of-Way Conditions

As mentioned in the Introduction chapter, the Busway right-of-way was purchased by FDOT from the FEC Railroad. After the purchase, the ownership of the corridor was transferred to Miami-Dade County. The South Dade Busway corridor, for the most part, is located parallel to U.S. 1. The length of the Busway between Dadeland South and Florida City is 19.8 miles. Between Dadeland South and Florida City, there are 45 at-grade intersections along the Busway. Some of the major east-west streets that intersect with the Busway include:

- SW 104th Street
- SW 112th Street
- SW 136th Street
- SW 152nd Street
- SW 168th Street
- SW 184th Street
- SW 186th Street
- Marlin Road
- SW 200th Street
- SW 112th Avenue
- SW 211th Street / SW 117th Avenue
- SW 216th Street
- SW 248th Street
- SW 288th Street

- SW 312th Street
- SW 344th Street

The width of the Busway corridor right-of-way is approximately 100 feet. Exhibit 1 depicts a typical section of the Busway at a station. Typical geometry of the Busway consists of one 12-foot lane in each direction, a painted median buffer, swale on both sides, and the South Dade Trail on the west side of the corridor. At stations, a bus bay and a platform with shelter are provided for each direction. At some stations, the platforms are located opposite to each other, and at other stations, the platforms are staggered.

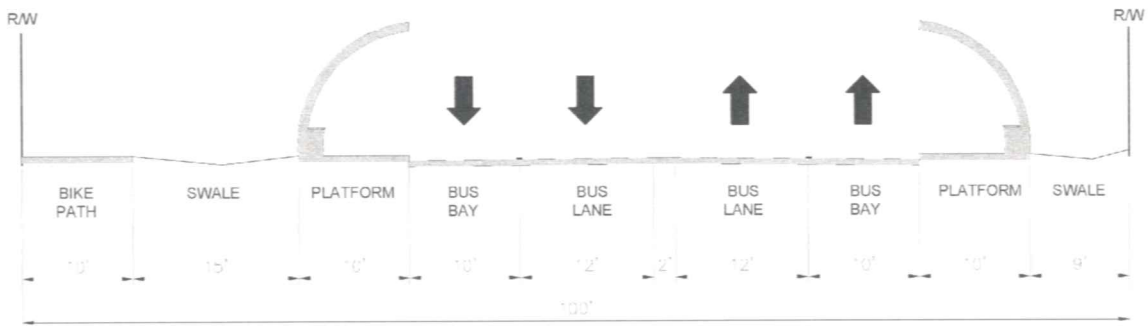


Exhibit 1: Typical Cross Section of the Busway at a Station

Transportation Network

Connectivity

The roadway network in much of Miami-Dade County is comprised of a grid system of arterial roadways, collectors, and local streets. A well-connected grid system provides many travel benefits including alternative trip routes and an easily-definable functional hierarchy centered around section and half-section line roadways. However, a study of the roadway network in the general study area indicates that discontinuities are common on many roadways.

More roadway discontinuities in an area make it more likely that drivers will tend to use arterial roadways for all trips, including short local trips. In addition, typical suburban land

use patterns concentrate commercial land use along arterial roadways. Therefore, arterial roadways, such as U.S. 1, serve both an access function for surrounding commercial land use and mobility function for through trips. This combination of trip purposes and the presence of discontinuities in the grid system contributes to recurring traffic congestion on U.S. 1. Therefore, the proposed managed lanes along the Busway would complement U.S. 1 by providing an alternative, which is more suited for long distance travel.

Roadway discontinuities tend to occur because of several factors, including both physical barriers (such as canals or major roadway corridors) and land use barriers (such as large parks, golf courses, airports, and modern suburban residential developments). Roads with discontinuities typically have low capacity and speed. It is apparent that the east-west street system is more developed in the study area in comparison to the north-south street system. Therefore, the east-west streets intersect U.S. 1 approximately at half-mile intervals, whereas the north-south streets intersect U.S. 1 approximately at one-mile intervals. An example of north-south roadway discontinuity in the study area is caused by the C-100 Canal (Cutler Drain). The U.S. 1 / Busway corridor is the only north-south roadway facility that crosses the C-100 Canal between SW 117th Avenue and Old Cutler Road. This severely limits north-south mobility options in the northern portion of the study area.

The southern third of Miami-Dade County has only three continuous north-south arterials: Krome Avenue through the far western agricultural areas, HEFT, and the U.S. 1 / Busway (South Dade Corridor). Only the South Dade Corridor provides access to employment centers in the central part of the County.

Functional Classification

Figure B-4 in Appendix B presents functional classification of major roadways. This map was prepared based on the county-wide functional classification map prepared for the *Arterial Grid Analysis* study, which was based on the FDOT functional classification. As is evident from Figure B-4, the northeast-southwest oriented U.S. 1 is the most prominent principal arterial in the study area. The principal arterials primarily serve regional mobility, whereas collectors serve local travel and accessing principal arterials. The collector and

minor arterial streets, which are primarily oriented east-west, feed into U.S. 1. The functional classification map further highlights the limited north-south corridors for regional travel in South Miami-Dade County.

Number of Lanes

Figure B-5 in Appendix B presents the existing bi-directional number of travel lanes for study roadway segments. This map was prepared based on the bi-directional number of lanes map prepared for the *Arterial Grid Analysis* study. As shown in Figure B-5, U.S. 1 is a four-lane road south of SW 112th Avenue, and is a six-lane road north of SW 112th Avenue. In addition, all roadways south of SW 211th Street have four lanes or fewer.

Traffic Volume Data

This section presents existing AADT of major streets within the study area, historical AADT of U.S. 1, and directional distribution of traffic volume on U.S. 1 during the peak periods. The objectives of reviewing the traffic volume data are to identify high volume roadways that intersect U.S. 1, variation of traffic volume along U.S. 1, and growth trends of AADT.

Annual Average Daily Traffic

Figure B-6 in Appendix B shows AADT of state and major county/city roadways in the study area. The daily volume on U.S. 1 decreases from north to south, which corresponds to the available capacity in the corridor. When east-west streets are considered, AADT on the majority of streets to the south of SW 184th Street is less than 15,000 vehicles. SW 152nd Street carries the highest AADT among east-west streets that intersect U.S. 1. HEFT, a high volume expressway, intersects U.S. 1 near SW 200th Street. SW 152nd Street and HEFT intersections/interchanges are important in the design of managed lanes as these are potential intermediate access locations to future managed lanes.

Historical AADT on U.S. 1

FDOT's historical traffic volume data along the U.S. 1 corridor were reviewed. Table 1, which is an update of Table 2-23 of the *South Link* Study, shows the variation of traffic volumes along U.S. 1 during the 10-year period between 1997 and 2006.

Daily traffic volumes on U.S. 1 range from 26,500 in the four-lane segment near the southern end of the corridor to 89,000 in the six-lane segment near the northern end of the corridor. According to FDOT's 2007 Generalized Level of Service Tables, the LOS E capacity of an arterial six-lane divided roadway with average signal spacing is 51,800 vehicles per day. The LOS E capacity of an arterial four-lane divided roadway with average signal spacing is approximately 34,500 vehicles per day. A major portion of the corridor (north of SW 248th Street) is operating above its maximum theoretical capacity and is approaching its theoretical capacity in other areas. As a result, person-movement capacity improvements are needed.

The most of the traffic growth over the 10-year period occurred in the southern end of U.S. 1. For example, traffic grew by approximately 11 percent near S.R. 826 (northern end of study corridor) during the 10-year period and the corresponding growth near SW 308th Street (near southern end of study corridor) is approximately 44 percent. Further, 2030 LRTP indicates that vehicular trips in the South Transportation Planning Area are expected to increase 67 percent between 2000 and 2030. Therefore, travel demand is expected to continue to grow in South Miami-Dade County resulting in congestion and deteriorating travel conditions, which indicate the need for capacity enhancements and travel options.

Table 1: Historical AADT on U.S. 1 (1997-2006)

LOCATION	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997
US 1/SR 826 (NB)	45,000	44,000	46,000	46,000	44,000	40,500	46,500	44,000	40,500	40,500
US 1/SR 826 (SB)	44,000	45,000	49,000	48,000	45,000	43,000	45,000	40,500	43,500	40,000
AADT	**89,000**	**89,000**	**95,000**	**94,000**	**89,000**	**83,500**	**91,500**	**84,500**	**84,000**	**80,500**
US 1/SW 112 St (NB)	37,500	38,500	35,500	33,500	36,500	33,000	36,500	34,000	38,000	35,000
US 1/SW 112 St (SB)	37,000	37,000	31,500	34,500	36,500	33,500	33,000	31,500	38,000	34,500
AADT	**74,500**	**75,500**	**67,000**	**68,000**	**73,000**	**66,500**	**69,500**	**65,500**	**76,000**	**69,500**
US 1/SW 152 St (NB)	35,000	35,500	38,500	37,000	36,500	32,500	34,000	34,000	32,000	31,500
US 1/SW 152 St (SB)	34,000	34,500	35,500	34,000	34,500	30,000	31,000	30,500	32,000	29,500
AADT	**69,000**	**70,000**	**74,000**	**71,000**	**71,000**	**62,500**	**65,000**	**64,500**	**64,000**	**61,000**
US 1/SW 173 St (NB)	31,500	31,000	29,500	32,000	NA	NA	NA	NA	NA	NA
US 1/SW 173 St (SB)	31,000	30,500	32,500	29,500	NA	NA	NA	NA	NA	NA
AADT	**62,500**	**61,500**	**62,000**	**61,500**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
US 1/SW 112 Ave. (NB)	29,500	26,000	27,000	25,000	24,000	25,000	21,500	25,500	24,500	24,500
US 1/SW 112 Ave. (SB)	20,000	22,500	25,500	24,500	22,500	23,500	23,000	19,500	22,000	26,000
AADT	**49,500**	**48,500**	**52,500**	**49,500**	**46,500**	**48,500**	**44,500**	**45,000**	**46,500**	**50,500**
US 1/SW 232 St (NB)	21,500	18,500	21,000	19,500	20,000	22,000	21,500	22,000	21,500	20,000
US 1/SW 232 St (SB)	20,500	17,000	20,500	19,000	18,500	20,500	20,000	21,500	21,500	19,500
AADT	**42,000**	**35,500**	**41,500**	**38,500**	**38,500**	**42,500**	**41,500**	**43,500**	**43,000**	**39,500**
US 1/SW 288 St (NB)	17,500	18,500	16,000	16,500	20,000	18,500	19,000	18,500	17,500	15,000
US 1/SW 288 St (SB)	16,500	18,000	15,500	16,000	20,000	18,000	19,500	18,000	17,500	15,500
AADT	**34,000**	**36,500**	**31,500**	**32,500**	**40,000**	**36,500**	**38,500**	**36,500**	**35,000**	**30,500**
US 1/SW 308 St (NB)	18,000	17,500	18,000	18,000	18,500	15,500	16,000	15,500	14,000	12,000
US 1/SW 308 St (SB)	13,000	14,000	14,500	14,500	14,500	12,500	13,000	12,500	13,500	9,600
AADT	**31,000**	**31,500**	**32,500**	**32,500**	**33,000**	**28,000**	**29,000**	**28,000**	**27,500**	**21,600**
US 1/SW 328 St (NB)	16,000	15,000	15,500	15,500	14,000	13,000	11,500	11,000	9,700	8,300
US 1/SW 328 St (SB)	14,000	14,000	14,500	14,500	13,500	12,000	14,000	11,500	10,000	8,300
AADT	**30,000**	**29,000**	**30,000**	**30,000**	**27,500**	**25,000**	**25,500**	**22,500**	**19,700**	**16,600**
US 1/SW 344 St (NB)	13,000	13,000	13,000	10,500	11,000	10,500	9,800	11,500	10,500	8,700
US 1/SW 344 St (SB)	13,500	13,000	13,500	10,500	12,500	10,000	10,000	11,500	9,500	9,100
AADT	**26,500**	**26,000**	**26,500**	**21,000**	**23,500**	**20,500**	**19,800**	**23,000**	**20,000**	**17,800**

Directional Distribution of Traffic Flow

The A.M. and P.M. peak hour directional distribution of traffic in the U.S. 1 corridor was determined using the data collected for the *South Link Study*. The estimated directional distribution data are presented below.

- A.M. Peak: 63/37 (northbound/southbound)
- P.M. Peak: 58/42 (southbound/northbound)

These results indicate a high directionality of traffic during the peak periods, especially during the A.M. peak period. A high directionality of traffic generally indicates that excessive traffic congestion is likely in the peak direction of travel. These results will be considered when managed lanes options are evaluated in subsequent chapters.

Level of Service (LOS) and Volume-to-Capacity (V/C) Ratio

Figure B-7 in Appendix B presents the existing LOS of section line and half-section line roadways within the study area. This map was prepared based on the existing conditions (2005) level of service map prepared for the *Arterial Grid Analysis* study. As indicated in Figure B-7, U.S. 1 to the north of SW 248th Street currently operates at LOS F. The majority of the roadway segments that operate at LOS F are located in the northern two-thirds of the study area. However, as noted in previous sections, traffic volume on the southern segment of U.S. 1 has been growing rapidly, and the 2030 LRTP projections indicate continued growth of vehicular trips in South Miami-Dade County.

V/C ratio and LOS of approaches to major intersections along the U.S. 1 corridor were evaluated. The objective of this analysis is to identify roadway segments that are either operating at or above the capacity during the peak travel periods. The results of the analysis for approaches at ten major intersections are presented in Table 2. Please note that this table is based on the data provided in Table 2-25 of the *South Link* Study.

As indicated in Table 2, during the A.M. peak hour, the northbound approach on U.S. 1 at the intersections of SW 152nd Street and to the north operates at LOS E or F. During the P.M.

peak hour, the southbound approach on U.S. 1 at the same intersections operates at LOS E or F. The results of the volume-to-capacity analysis is similar to that of level of service analysis; several approaches of U.S. 1 in the northern section experience a V/C ratio at or above the capacity in the peak direction. High peak period directionality and intersection delays along U.S. 1 do not provide favorable conditions for long-distance travel. Therefore, future managed lanes on the Busway with potential grade separation at major intersections would provide an alternative for regional mobility.

Table 2: Peak Period Level of Service and V/C Ratios on Approaches to Intersections

	Intersection	Direction	Classification [1]	Lanes	Count [2]		Capacity [3]		V/C Ratio [4]		Level of Service [5]	
					AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
1	U.S. 1 at SW 312th Street	Northbound	State Two-Way Arterial - Interrupted Flow Class I	3	1,221	1,712	2,790	2,790	0.44	0.61	B	B
		Southbound	State Two-Way Arterial - Interrupted Flow Class I	3	1022	1,637	2790	2,790	0.37	0.59	B	B
		Eastbound	Major City/County Road	2	700	1,049	1720	1,720	0.41	0.61	C	C
		Westbound	Major City/County Road	2	934	1,308	1720	1,720	0.54	0.76	C	D
2	U.S. 1 at SW 117th Avenue/SW 211th Street	Northbound	State Two-Way Arterial - Interrupted Flow Class II	2	1876	1,511	1800	1,800	1.04	0.84	F	D
		Southbound	State Two-Way Arterial - Interrupted Flow Class II	2	963	2,030	1800	1,800	0.53	1.13	C	F
		Eastbound	Major City/County Road	2	1087	747	1720	1,720	0.63	0.43	C	C
		Westbound	Major City/County Road	2	609	831	1720	1,720	0.35	0.48	C	C
3	U.S. 1 at SW 200th Street	Northbound	State Two-Way Arterial - Interrupted Flow Class II	3	1653	1,550	2710	2,710	0.61	0.57	C	C
		Southbound	State Two-Way Arterial - Interrupted Flow Class II	3	1060	2,329	2710	2,710	0.39	0.86	C	D
		Eastbound	Major City/County Road	2	551	624	1720	1,720	0.32	0.36	C	C
		Westbound	Major City/County Road	2	816	1,045	1720	1,720	0.47	0.61	C	C
4	U.S. 1 at Marlin Road	Northbound	State Two-Way Arterial - Interrupted Flow Class II	3	2073	1,806	2710	2,710	0.76	0.67	C	C
		Southbound	State Two-Way Arterial - Interrupted Flow Class II	3	1139	2,159	2710	2,710	0.42	0.80	C	D
		Eastbound	Major City/County Road	2	465	857	1720	1,720	0.27	0.50	C	C
		Westbound	Major City/County Road	2	690	601	1720	1,720	0.40	0.35	C	C
5	U.S. 1 at SW 186th Street	Northbound	State Two-Way Arterial - Interrupted Flow Class II	3	1878	1,674	2710	2,710	0.69	0.62	C	C
		Southbound	State Two-Way Arterial - Interrupted Flow Class II	3	1323	2,396	2710	2,710	0.49	0.88	C	D
		Eastbound	State Two-Way Arterial - Interrupted Flow Class II	2	514	724	1800	1,800	0.29	0.40	C	C
		Westbound	Major City/County Road	2	254	414	1720	1,720	0.15	0.24	C	C
6	U.S. 1 at SW 184th Street	Northbound	State Two-Way Arterial - Interrupted Flow Class II	3	2090	1,990	2710	2,710	0.77	0.73	C	C
		Southbound	State Two-Way Arterial - Interrupted Flow Class II	3	1449	2,494	2710	2,710	0.53	0.92	C	D
		Eastbound	Major City/County Road	2	882	756	1720	1,720	0.51	0.44	C	C
		Westbound	Major City/County Road	2	635	754	1720	1,720	0.37	0.44	C	C
7	U.S. 1 at SW 152nd Street	Northbound	State Two-Way Arterial - Interrupted Flow Class II	3	2678	1,861	2710	2,710	0.99	0.69	E	C
		Southbound	State Two-Way Arterial - Interrupted Flow Class II	3	1502	2,823	2710	2,710	0.55	1.04	C	F
		Eastbound	State Two-Way Arterial - Interrupted Flow Class II	2	1377	1,118	1800	1,800	0.77	0.62	D	C
		Westbound	Major City/County Road	2	467	866	1720	1,720	0.27	0.50	C	C
8	U.S. 1 at SW 136th Street	Northbound	State Two-Way Arterial - Interrupted Flow Class II	3	3047	2,178	2710	2,710	1.12	0.80	F	D
		Southbound	State Two-Way Arterial - Interrupted Flow Class II	3	1567	2,704	2710	2,710	0.58	1.00	C	E
		Eastbound	Major City/County Road	2	650	826	1720	1,720	0.38	0.48	C	C
		Westbound	Major City/County Road	2	327	668	1720	1,720	0.19	0.39	C	C
9	U.S. 1 at SW 112th Street	Northbound	State Two-Way Arterial - Interrupted Flow Class II	3	3153	2,367	2710	2,710	1.16	0.87	F	D
		Southbound	State Two-Way Arterial - Interrupted Flow Class II	3	1610	2,895	2710	2,710	0.59	1.07	C	F
		Eastbound	State Two-Way Arterial - Interrupted Flow Class II	1	387	451	850	850	0.45	0.53	C	C
		Westbound	Major City/County Road	1	259	328	810	810	0.32	0.41	C	C
10	U.S. 1 at SW 104th Street	Northbound	State Two-Way Arterial - Interrupted Flow Class II	3	3008	2,310	2710	2,710	1.11	0.85	F	D
		Southbound	State Two-Way Arterial - Interrupted Flow Class II	4	1870	3,678	3500	3,500	0.53	1.05	C	F
		Eastbound	Major City/County Road	2	755	566	1720	1,720	0.44	0.33	C	C
		Westbound	Major City/County Road	2	357	504	1,720	1,720	0.21	0.29	C	C

Notes:
(1) Classifications were made consistent with guidance provided by FDOT's 2007 Level of Service Handbook
(2) Count data obtained from Turning Movement Counts collected in March 2005 and grown to 2007 using Synchro grow rates.
(3) Peak directional volumes and capacities
(4) "V/C Ratio" is the ratio of peak period count volume to peak hour directiona capacity (LOS E)
(5) Level of Service (LOS) is based upon the Generalized Tables contained in FDOT's 2007 LOS Handbook

Legend:

V/C
<= 0.80
0.80 - 0.89
0.90 - 0.99
>= 1.00

LOS
A, B and C
D
E
F

Traffic Safety Data

Traffic crashes reported along the South Dade Busway between January 1, 2003, and December 31, 2005, were analyzed. The crash data were obtained from the FDOT. The data were available for the segment of the Busway between the Dadeland South Metrorail station and Caribbean Boulevard. Each crash record was reviewed to determine if the crash occurred on the Busway or was influenced by a Busway grade crossing.

After the review, a total of 66 crashes that occurred along the Busway were identified. These crashes resulted in one fatality and 28 injuries. The fatal crash involved a bus and an automobile. In addition to the fatality, 14 injuries were attributed to the same crash. This fatal crash was the only crash that involved a bus during the 3-year period included in FDOT's crash data. However, there were nine crashes involving a bicycle. It should be noted that a dedicated bike path (South Dade Trail) is located along the Busway. The locations of crashes are presented in Figure B-8 in Appendix B. The majority of the crashes occurred at the intersections. As indicated in Figure B-8, the highest number of crashes was reported at SW 152nd Street followed by SW 186th Street.

Table 3 summarizes the crashes by the first harmful event. As indicated in Table 3, approximately 41 percent of the crashes were rear-end crashes. Another 27 percent of the crashes were angle crashes. Sideswipe was cited as the first harmful event in 12 percent of the crashes. Please note that the first harmful event of crashes involving bicycles is not always coded as "Collision with Bicycle".

It should be noted that following the Busway's opening in 1997, several crashes were attributed to operational problems caused by the close proximity of automobiles on U.S. 1 and cross-streets with buses traveling on the Busway. Priority signals for the Busway were initially installed, but were eliminated due to the safety concerns after several crashes. The loss of transit signal priority has significantly reduced the anticipated travel time savings for the Busway, especially for the express bus service.

Table 3: Busway Crashes Summarized by First Harmful Event, 2003 – 2005

First Harmful Event	Number of Crashes	Percent of Crashes
Rear-End	27	41%
Angle	18	27%
Sideswipe	8	12%
Collision with Bicycle	2	3%
Left-Turn	2	3%
Right-Turn	1	2%
Backed Into	1	2%
Collision with Pedestrian	1	2%
Utility/Light Pole	1	2%
Collision with Fixed Object Above Road	1	2%
Fire	1	2%
All Other	3	5%
Total	**66**	**100%**

Transit Data

Routes

Currently Miami-Dade Transit (MDT) operates several Metrobus routes on the Busway corridor. Figure B-9 in Appendix B shows bus routes that currently operate on the Busway. Two routes (Busway Flyer and Busway Max) operate the length of the Busway between the Dadeland South Metrorail station and SW 344th Street. In addition, several bus routes operate on a portion of the Busway. Therefore, buses enter and exit from the Busway at several locations. Tables 4 and 5 indicate bus routes that currently operate on the Busway at two select locations and headways during the A.M. peak hour. Table 6 indicates the bus route and A.M. peak hour headway information at Florida City, the southern terminus of the Busway.

Table 4: A.M. Peak Hour Headway (Dadeland South)

Route	Northbound Headway (min)	Southbound Headway (min)
1	24	30
31 Busway Local	15	15
34 Busway Flyer	15	15
38 Busway Max	10	15
52	30	30
65	N/A	30
136	30	30
252 Coral Reef Max	15	15
287 Saga Bay Max	30	30

Table 5: A.M. Peak Hour Headway (South Miami-Dade Government Center)

Route	Northbound Headway (min)	Southbound Headway (min)
1	24	30
31 Busway Local	15	15
35	30	30
38 Busway Max	10	15
52	35	30
70	30	30
137 West Dade Connector	30	40
216 Goulds Connector	30	30

Table 6: A.M. Peak Hour Headway (Florida City)

Route	Northbound Headway (min)	Southbound Headway (min)
34 Busway Flyer	15	15
35	30	30
38 Busway Max	10	20
70	30	40

Based on the data provided in Tables 4, 5, and 6, the number of buses operating on the Busway in the peak hour can be calculated. The number of buses operating on the Busway ranges from 10 to 27 per peak hour per direction.

The number of bus routes operating on the Busway is listed below.

- Nine (9) bus routes operate between Dadeland South and SW 104th Street
- Eight (8) bus routes operate between SW 104th Street and SW 136th Street.
- Seven (7) bus routes operate between SW 136th Street and SW 152nd Street
- Five (5) bus routes operate between SW 152nd Street and SW 168th Street
- Three (3) bus routes operate between SW 168th Street and SW 200th Street
- Two (2) bus routes operate between SW 200th Street and SW 344th Street

Stations

A ridership study was conducted by MDT at Busway stations in 2004. A summary of the daily boarding and alighting data is presented in Table 7. The highest boarding-alighting activity was observed at Dadeland South where transfer to Metrorail is provided. The other locations with notable boarding-alighting activity observed include the South Dade Government Center, SW 200th Street, SW 168th Street, SW 152nd Street, and SW 136th Street.

Table 7: South Miami-Dade Busway 2004 Daily Boarding-Alighting Data

Location	Boardings	Alightings
Dadeland South	3930	3878
SW 104th Street	172	171
SW 112th Street	54	103
SW 117th Street	106	91
SW 124th Street	84	98
SW 128th Street	99	99
SW 136th Street	350	364
SW 144th Street	344	254
SW 152nd Street	570	398
SW 160th Street	302	295
SW 168th Street	402	333
SW 173rd Street	222	170
W Indigo Street	174	129
SW 184th Street	260	259
Marlin Road	235	291
SW 200th Street	674	493
SW 112th Avenue	211	100
Government Center	550	562

Source: *South Link* Study

It should be noted that many transit passengers on the Busway are not counted in the data provided in Table 7 because several routes exit the Busway and serve bus stops in the surrounding community. According to MDT data, total ridership on the Busway is approximately 20,000 passengers per day.

Figure B-10 in Appendix B contains MDT's map of the South Dade Busway including stations.

Park-and-Ride Lots

Five park-and-ride facilities are located along the corridor, as shown below along with their current capacities and average occupancy percentage according to Miami-Dade Transit's May 2007 Ridership Technical Report.

- SW 152nd Street – 126 spaces (98.4 percent average occupancy)
- SW 168th Street – 149 spaces (97.3 percent average occupancy)
- SW 200th Street – 131 spaces (99.2 percent average occupancy)
- SW 244th Street – 95 spaces (53.7 percent average occupancy)
- SW 296th Street – 117 spaces (11.1 percent average occupancy)

Bicycle/Pedestrian Conditions

South Dade Trail

The South Dade Trail is a dedicated bicycle facility that is located on the west side of the existing South Dade Busway. The bicycle path extends the entire length of the Busway from the Dadeland South Metrorail Station to SW 344th Street in Florida City.

South Dade Trail

Connections from the South Dade Trail to Metrorail are available at Dadeland South. Both the Busway and the South Dade Trail have been built along the former railroad line previously used by the Florida East Coast (FEC) Railroad. Figure B-11 in Appendix B contains a map of bicycle and pedestrian facilities. The South Dade Trail needs to be maintained in future design considerations of managed lanes along the Busway Corridor. The following sections describe other bicycle and pedestrian facilities that are expected to be connected to the South Dade Trail.

Bike Lanes

The only notable bike lanes located in the vicinity of the study area are along SW 137th Avenue (Tallahassee Road) from SW 328th Street to SW 288th Street. This bike facility is approximately two miles in length and is eventually planned to be extended to the South Dade Trail along SW 137th Avenue. Bikeway signs have already been installed at the intersection of U.S. 1 and Tallahassee Road, where the South Dade Trail will meet the proposed Tallahassee Road bike facility, which has been designated as Bike Route 9 by Miami-Dade County.

Tallahassee Road Bike Lane Route 9 at the South Dade Trail

Paved Paths

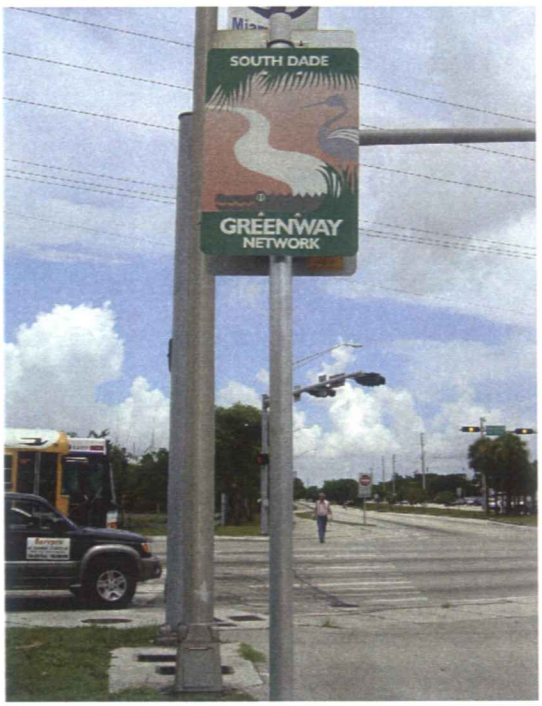
Paved paths are located outside travel lanes, separated by a buffer zone and meant for walking and bicycling. The primary paved paths connecting to the west side of the corridor are along SW 152nd Street and Black Creek Trail (C-1 Canal). The primary paved paths on

the east side of the study area are along Old Cutler Road, SW 288th Street, and SW 312th Street.

South Dade Greenway Network Master Plan

The *South Dade Greenway Network Master Plan* was developed to identify the most appropriate corridors for a series of greenways in Miami-Dade County south of SW 88th Street (Kendall Drive). The greenways are intended to cater to bicycling and walking for both transportation and recreation purposes. Several greenway trails have already been implemented or are undergoing a design process including the South Dade Trail, Biscayne Trail, and Black Creek Trail. Ten greenway trails were identified in the *South Dade Greenways Master Plan*, of which, six greenway trails are located either along the study corridor or intersect the study corridor.

- South Dade Trail – located along the west side of the South Dade Busway
- Black Creek Trail – C-1 Canal, crosses south of SW 211th Street
- Princeton Trail – C-102 Canal, crosses north of SW 244th Street
- Tallahassee Connector Trail – crosses at the SW 137th Avenue intersection
- Mowry Trail – C-103 Canal, crosses north of SW 296th Street
- Everglades Trail – crosses at the SW 344th Street intersection



South Dade Greenway Network Sign along South Dade Trail

The locations where greenway trails intersect the study corridor are located in the southern segment of the corridor (south of SW 112th Avenue). It should be noted that the alignment of the Black Creek Trail (Bike Route 7) diverts from the C-1 Canal to cross U.S. 1 and the South Dade Busway at the SW 211th Street signalized intersection.

Pedestrian Facilities

To consider walking as a realistic transportation alternative, existing conditions need to be favorable for pedestrian use. In addition, most transit trips in the corridor are also pedestrian trips, as the majority of Busway patrons must walk to the bus station. The majority of the northern portion of the study area is densely developed with residential, commercial, and institutional establishments. Sidewalks are available on most major streets within this area. However, on some local streets, sidewalks are discontinuous.

The most significant obstacles to pedestrian access to the corridor exist from the east side, where pedestrians have to cross U.S. 1 to access the South Dade Busway. U.S. 1 acts as a significant barrier to east-west pedestrian mobility within the study area. Crosswalks are available at most Busway intersections, especially on the west side within the South Dade Trail alignment. However, pedestrians accessing bus stations sometimes cross the Busway outside of designated crosswalks. This tendency for pedestrians to cross the Busway outside of designated crosswalks is an important consideration for any managed lanes option within the corridor. Well-defined and efficient pedestrian paths are needed to promote proper walking to and from the existing stations. In particular, safe pedestrian access to stations should be a major consideration in the design of managed lanes, because of the expected increase in traffic on the Busway Corridor.

Pedestrian Access to a Busway Station via an Improper Crossing

Summary of Analysis

Population and travel needs of South Miami-Dade County are expected to grow at a faster pace than the rest of the County. The southern portion of the county continues to experience a larger workforce than employment opportunities. Currently U.S. 1 is the only major corridor that links the south region with major employment centers in the County. However, U.S. 1 is already operating at or above capacity in its entire length. Therefore, capacity enhancements and regional mobility options are necessary to sustain growth in the south region. As such, next chapters present an evaluation of the potential for operation of managed lanes along the South Dade Busway, which parallels U.S. 1, to provide options for regional mobility.

Demand Analysis

Data analysis presented in the previous chapter indicated that the U.S. 1 corridor is currently operating well beyond its maximum theoretical capacity in the northern segment and is approaching its theoretical capacity in the southern segment. As a result, person-movement capacity improvements are needed.

According to the Miami-Dade MPO's 2030 Long Range Transportation Plan, the highest growth between 2000 and 2030 is projected to occur in the South Transportation Planning Area of the county. It is generally defined as the area south of Kendall Drive including the cities of Homestead and Florida City, the villages of Palmetto Bay and Pinecrest, and community urban centers such as Cutler Ridge, Goulds, Naranja, Princeton, Leisure City, and South Allapattah. The demographic and transportation data projections for the south county indicate an 83 percent population growth, a 45 percent employment growth, an 88 percent increase in auto ownership, and a 67 percent increase in trips between 2000 and 2030. As population growth in the southern region continues to outpace employment, its residents will have to travel out of the area for employment. Such regional travel demand will further deteriorate LOS on U.S. 1.

The deteriorating level of service on U.S. 1 can be viewed as an opportunity to enhance travel options for the public by operating managed lanes on the South Dade Busway, where excess capacity is available. Therefore, an analysis was performed to determine the existing and future traffic levels on several segments along U.S. 1 within the study area. The analysis presented in Table 8 determines the number of lanes required on U.S. 1 under existing (2007) and future (2030) A.M. and P.M. peak hour traffic conditions to maintain LOS D, which is the adopted level of service standard for U.S. 1 by the FDOT. Table 9 identifies laneage deficiencies on U.S. 1 under the future (2030) peak period traffic conditions to maintain LOS D. The results presented in Tables 8 and 9 are summarized below.

Existing Conditions:

- The greatest need for additional capacity is evident north of SW 152nd Street (Coral Reef Drive) in the northbound direction during the A.M. peak period and southbound direction during the P.M. peak period to maintain LOS D.
- In most locations where capacity deficiencies are indicated, one additional lane would be sufficient to restore LOS D conditions.

Future (2030) Conditions:

- During the A.M. peak period, the northbound direction of the study corridor is shown to require additional capacity to maintain LOS D.
- During the P.M. peak period, both northbound and southbound directions are shown to require additional capacity to maintain LOS D.
- During the A.M. peak period, the northbound direction of U.S. 1 north of SW 152nd Street would require at least two additional lanes to maintain LOS D. South of SW 152nd Street, one additional northbound lane would be sufficient to maintain LOS D.
- During the P.M. peak period, in the southbound direction two additional lanes would be required to maintain LOS D north of SW 117th Avenue. One additional southbound lane would be adequate during the P.M. peak period south of SW 117th Avenue. During the P.M. peak period, the northbound direction of U.S. 1 would require one additional lane to maintain LOS D.

The analysis presented in Tables 8 and 9 indicate that to maintain satisfactory level of service on the U.S. 1 corridor, additional capacity is required. The 2030 Long Range Transportation Plan does not identify any capacity projects for U.S. 1. Moreover, U.S. 1 will continue to serve as one of the major arterials for regional travel for the south county residents. Therefore, the need for extra capacity on U.S. 1 can be seen as an opportunity to operate managed lanes on the South Dade Busway, which parallels U.S. 1.

Table 8: U.S. 1 Corridor Peak Hour Capacity Analysis for Existing (2007) and Future (2030) Conditions

Intersection	Direction	Existing Lanes	LOS Group (1)	Available Capacity (LOS D)	Existing (2007) Conditions				Future (2030) Conditions			
					Peak Hour Volume(2)		Lanes Required to Maintain LOS D		Peak Hour Volume(3)		Lanes Required to Maintain LOS D	
					AM	PM	AM	PM	AM	PM	AM	PM
U.S. 1 at SW 312th Street	Northbound	2	I	1860	1221	1712	2	2	1799	2523	2	3
	Southbound	2	I	1860	1022	1637	2	2	1506	2412	2	3
U.S. 1 at SW 117th Avenue/ SW 211th Street	Northbound	2	I	1860	1876	1511	3	2	2764	2227	3	3
	Southbound	2	I	1860	963	2030	2	3	1419	2991	2	4
U.S. 1 at SW 200th Street	Northbound	3	II	2570	1653	1550	2	2	2436	2284	3	3
	Southbound	3	II	2570	1060	2329	2	3	1562	3432	2	5*
U.S. 1 at SW 184th Street	Northbound	3	II	2570	2090	1990	3	3	3080	2932	4	4
	Southbound	3	II	2570	1449	2494	2	3	2135	3675	3	5*
U.S. 1 at SW 152nd Street	Northbound	3	II	2570	2678	1861	4	3	3946	2742	5*	4
	Southbound	3	II	2570	1502	2823	2	4	2213	4160	3	5*
U.S. 1 at SW 136th Street	Northbound	3	II	2570	3047	2178	4	3	4490	3210	6*	4
	Southbound	3	II	2570	1567	2704	2	4	2309	3985	3	5*
U.S. 1 at SW 112th Street	Northbound	3	II	2570	3153	2367	4	3	4646	3488	6*	5*
	Southbound	3	II	2570	1610	2895	2	4	2373	4266	3	6*
U.S. 1 at SW 104th Street	Northbound	3	II	2570	3008	2310	4	3	4433	3404	6*	5*
	Southbound	4	II	3330	1870	3678	3	5*	2756	5420	4	7*

Notes:

(1) - LOS group determined based on traffic signal spacing.

(2) - 2007 count data estimated from turning movement counts collected in March 2005.

(3) - Assuming an annual growth rate of 1.7 percent.

* These values were estimated based on average per lane LOS D capacity for an 8-lane facility.

Color Code

Excess capacity
Adequate capacity
Inadequate capacity

LOS Group	Lanes Directional	LOS D Capacity
I	2	1860
I	3	2790
I	4	3540
II	2	1710
II	3	2570
II	4	3330

Source: FDOT's 2007 Generalized Q/LOS Table 4-7

Table 9: U.S. 1 Corridor Future (2030) Laneage Deficiencies

Intersection	Direction	Existing Lanes	LOS Group (1)	Available Capacity (LOS D)	2030 Peak Hour Volume		Lanes Required to Maintain LOS D		Laneage Deficiency	
					AM	PM	AM	PM	AM	PM
U.S. 1 at SW 312th Street	Northbound	2	I	1860	1799	2523	2	3	0	1
	Southbound	2	I	1860	1506	2412	2	3	0	1
U.S. 1 at SW 117th Avenue/ SW 211th Street	Northbound	2	I	1860	2764	2227	3	3	1	1
	Southbound	2	I	1860	1419	2991	2	4	0	2
U.S. 1 at SW 200th Street	Northbound	3	II	2570	2436	2284	3	3	0	0
	Southbound	3	II	2570	1562	3432	2	5	0	2
U.S. 1 at SW 184th Street	Northbound	3	II	2570	3080	2932	4	4	1	1
	Southbound	3	II	2570	2135	3675	3	5	0	2
U.S. 1 at SW 152nd Street	Northbound	3	II	2570	3946	2742	5	4	2	1
	Southbound	3	II	2570	2213	4160	3	5	0	2
U.S. 1 at SW 136th Street	Northbound	3	II	2570	4490	3210	6	4	3	1
	Southbound	3	II	2570	2309	3985	3	5	0	2
U.S. 1 at SW 112th Street	Northbound	3	II	2570	4646	3488	6	5	3	2
	Southbound	3	II	2570	2373	4266	3	6	0	3
U.S. 1 at SW 104th Street	Northbound	3	II	2570	4433	3404	6	5	3	2
	Southbound	4	II	3330	2756	5420	4	7	0	3

Notes:

(1) - LOS group determined based on traffic signal spacing.

* These values were estimated based on average per lane LOS D capacity for an 8-lane facility.

LOS Group	Lanes Directional	LOS D Capacity
I	2	1860
I	3	2790
I	4	3540
II	2	1710
II	3	2570
II	4	3330

Source: FDOT's 2007 Generalized Q/LOS Table 4-7

Color Code

No deficiency
Need one lane
Need two or more lanes

Managed Lanes Options

The previous section established the need for additional throughput on the U.S. 1 corridor. However, the lack of right-of-way makes it difficult to widen U.S. 1 to provide extra capacity. Therefore, the existing South Dade Busway, which parallels U.S. 1 and has excess capacity, is identified for potential operation of managed lanes to provide travel options. This section identifies key issues that need to be considered when developing alternatives for managed lanes. After the identification of key issues, several preliminary managed lanes concepts are developed and evaluated for the South Dade Busway corridor. The preliminary screening will be used to identify a short-list of options that will be evaluated in detail in the next chapters.

Key Issues

Several factors that influence the development of options for managed lanes on the Busway are identified below.

- Existing busway operations. As many as nine (9) bus routes operate in the northern portion of the Busway, which amounts to approximately 27 buses in the peak-hour peak-direction. Two of those bus routes operate the entire length of the corridor. The estimated daily ridership on the Busway is approximately 20,000. One of the key design considerations is to maintain satisfactory operating conditions for buses when private vehicles and buses share future busway/managed lanes.
- Right-of-way constraints. The width of the Busway right-of-way is approximately 100 feet. The opportunities for right-of-way acquisition are very limited due to the proximity to U.S. 1 and other land uses. The South Dade Trail is also located within the Busway right-of-way and should be included in all managed lane options. Drainage is an important consideration within the corridor. Swales are provided on both sides of the Busway. The right-of-way constraints impacts managed lanes design concepts such as number of lanes (capacity), typical sections, access locations, and interchanges.

- Intersections. Between Dadeland South and Florida City, there are 45 at-grade intersections along the Busway. The closely-spaced intersections typically result in lower travel speeds, which would negatively impact managed lanes. To maintain continuous flow for transit and private vehicles using managed lanes, intersection control strategies and improvements such as grade separations will be required.
- Traffic signal operation. For a major part, the Busway and U.S. 1 run very close to each other. Therefore, intersections along the Busway and U.S. 1 are under the same signal controller. If private vehicles are allowed while maintaining at-grade intersections, the Busway will require green signal phase more frequently and for a longer duration than today. This will impact side-streets as well as turning movements on U.S. 1. The control strategy of at-grade intersections, desired level of service for managed lanes, traffic volume on side-streets, and system capabilities of traffic signals need to be considered when developing managed lanes.
- Safety. Since U.S. 1 and Busway signals are located very close to each other, warning signs will be required so that vehicles on side-streets do not block the Busway. Another consideration is the safety of bicyclists using the bike trail and transit users accessing bus stations. Pedestrian safety considerations are paramount because pedestrians access bus stops along the Busway; therefore, pedestrians must be separated from managed lanes vehicles while maintaining access to bus stops.
- Access to busway. Private-vehicle access to managed lanes will be limited to a few locations to maintain satisfactory level of service. These locations will be determined based on land use, demand, major intersections/interchanges, right-of-way needs, and level of service/travel speed criteria for the Busway. In addition, illegal entry of private vehicles onto managed lanes from side-streets needs to be prevented through signage and design.
- Busway/managed lanes demand and level of service. The number of managed lanes provided will depend upon several factors, including cost, right-of-way, demand, and desired level of service/speed. Traffic volume in the northern part of the corridor is higher than the southern part. Therefore, more managed lanes in the northern part of the corridor could be considered. Another consideration is the need to maintain minimum level of service at all times for the managed lanes users. During peak

periods, this could be done through variable tolls and dynamic message signs located at entry locations.

- Vehicle eligibility and toll system. One of the objectives of the managed lanes is to generate revenue to partially fund long-term extension of Metrorail along the corridor. The type of vehicles allowed on the Busway, occupancy considerations, and toll mechanism need to be identified. It is expected that the toll system implemented on the I-95 managed lanes will be utilized for the Busway managed lanes. The toll collection system will be compatible with SunPass.
- Metrorail Extension. The right-of-way requirement for the potential extension of Metrorail along the Busway needs to be considered. This analysis assumes that a two-lane managed lane facility would be maintained after the extension of Metrorail.

Options

The following four categories of options were identified in an effort to develop a system of managed lanes.

- Typical sections
- Access strategies
- Intersection control strategies
- Vehicle eligibility/demand regulation

Typical Sections

- Two-lane shared use busway/managed lanes. This alternative essentially represents the no-build condition. A modified two-lane option, which includes grade separation of the Busway/managed lanes at locations identified in the South Link Study, was added to the evaluation during later stages of the study.
- Three lanes where the center lane is reversible during peak periods. This alternative will provide two travel lanes in the peak direction. Several options exist for reversing flow of the center lane including dynamic message signs, "zipper lane" techniques, and/or gates that define use of the center lane. Exhibit 2 illustrates the shifting of median barriers to reverse lanes in the "zipper lane" technique. If dynamic message

signs are utilized, the reversible lane should be barrier separated. As a result, access to the reversible lane will be limited to entry/exit locations of managed lanes.

- Four-lane divided facility with staggered bus stations. Bus stations will have to be staggered due to right-of-way limitations. In the southern segment, the number of lanes may be reduced based on the demand.
- Five lanes in the northern portion of the corridor where the center lane is reversible during peak periods. In the southern portion, the number of lanes may be reduced based on the demand.
- U.S. 1/Busway hybrid alternative. This complex concept utilizes the right-of-way of both the Busway and U.S. 1 to develop general purpose and managed lanes. It is assumed that two managed lanes in each direction and three general purpose lanes in each direction would be provided. The managed lanes would likely be located in the median of the facility. Slip ramps will be provided between managed lanes and general purpose lanes.

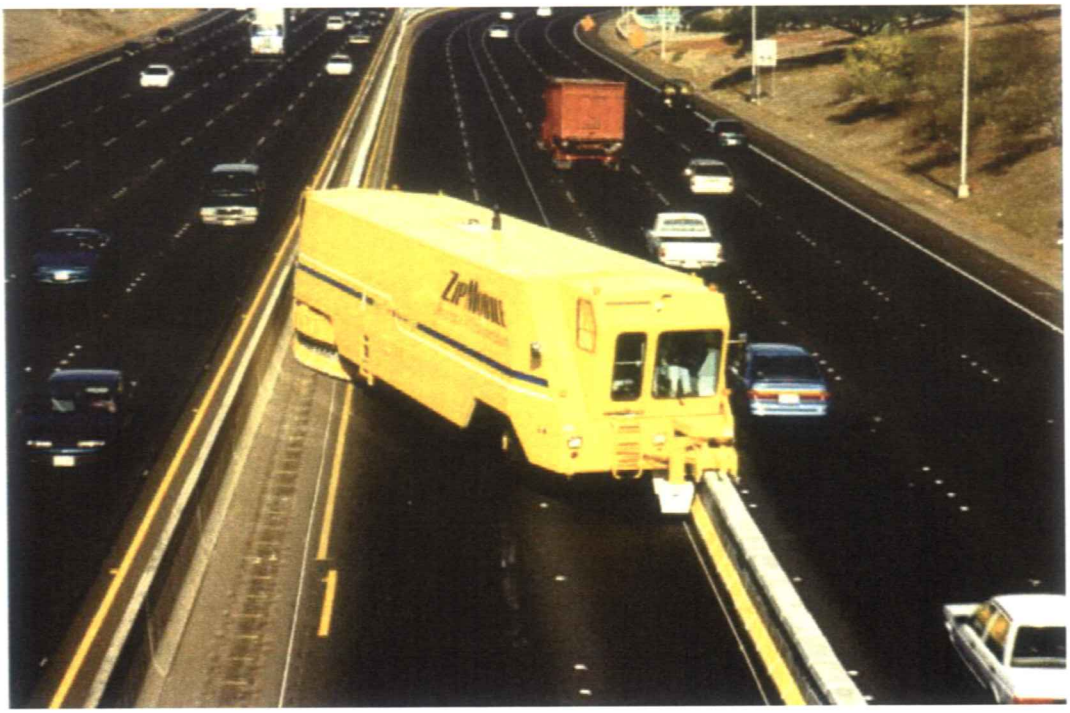


Exhibit 2: Reversing Lanes

Source. C.S. Papacostas. *Honolulu's Zipper Lane: A Movable Barrier HOV Application.* ITE District 6 Annual Meeting, San Diego. June 2000.

Access Strategies

Potential access strategies are listed below.

- Full access at at-grade intersections. This option would allow both buses and private vehicles to access the Busway at any of the signalized side-streets. Between Dadeland South and Florida City, there are 45 at-grade intersections along the Busway.
- Full access at at-grade intersections for buses; limited access at major intersections for private vehicles.
- Limited access at major roadways for buses and private vehicles.
- Private vehicle access only at terminals of managed lanes and a maximum of one midpoint; buses access at major roadways.
- Buses and private vehicles access only at terminals of managed lanes and a maximum of one midpoint.

Intersection Control Strategies

The following intersection control strategies were identified for the corridor. Please note that the final implementation plan may use a combination of the following strategies.

- At-grade signalized
  - With transit signal priority (TSP)
  - Without TSP
- Grade separation
  - Managed lanes only
  - Full facility (managed lanes and buses)
  - Side-street
- Side-street closures

Vehicle Eligibility/Demand Regulation

Buses will always use the facility for free. Factors such as available capacity, demand, and level of service criteria will determine the regulation of private vehicle usage. The following eligibility strategies are considered for managed lanes in the South Dade Busway.

- All private vehicles tolled
- 2+ high-occupancy vehicles (HOVs) free; all others tolled
- 3+ HOVs free; all others tolled
- Trucks allowed and tolled (depends upon intersection control strategies such as grade separation)

Options Screening

Matrices were developed to screen the options developed in the previous section. The objective of the screening is to eliminate options that do not satisfactorily address basic issues identified for the corridor and managed lanes. Tables 10, 11, and 12 present the screening of typical sections, intersections, and access options.

Typical Sections

The following criteria were used in Table 10 to screen typical sections:

- Capacity Based on LOS C. The peak-hour peak directional capacity corresponding to LOS C given in FDOT's Generalized LOS tables was used to estimate the capacity of managed lanes.
- Potential Peak Direction Demand. Difference between peak-hour directional volume and capacity of U.S. 1 is used as a proxy for the potential demand for managed lanes. The U.S. 1 corridor was divided into two segments due to the difference in observed volume. SW 152nd Street was considered to be the dividing line. The peak direction volume was compared with peak direction capacity to determine if typical section options provide insufficient, adequate, or excessive capacity. Please note that a detailed demand analysis for select alternatives is presented in the Demand and Revenue Analysis section of the report.

- Continuous Flow Potential. The ability for vehicles to travel in an uninterrupted manner in a mid-block location (between intersections) while maintaining the guaranteed travel speed is defined as the continuous flow potential. A single managed lane that does not provide passing opportunities would be considered as having "low" continuous flow potential.
- Metrorail Feasibility. The ability to extend Metrorail along the Busway corridor to Florida City. Once Metrorail is extended, it is assumed that only two managed lanes would be operated (one in each direction).
- Potential Environmental/Drainage Impacts. The need for relocating drainage system and environmental evaluations associated with the widening of busway were assessed qualitatively.
- Cost. The construction and operational costs were assessed qualitatively.

Based on Table 10, the two-lane typical section appears to be inadequate for the north segment. In the south segment, while one peak direction lane is adequate during the A.M. peak period, one lane may be insufficient during the P.M. peak period. In general, the two-lane option has low continuous flow potential due to lack of passing opportunities. However, the two-lane option is the least expensive of all options as the existing corridor could be retrofitted to operate managed lanes. Both three-lane reversible and four-lane options provide adequate peak direction capacity for the 2030 traffic conditions. The five-lane reversible alternative, which would provide three lanes in the peak direction, appears to be excessive based on potential demand. The U.S. 1/Busway hybrid alternative, which requires the reconstruction of U.S. 1, would be extremely costly, time consuming, and would likely experience significant maintenance of traffic issues during construction. In addition, several segments of the Busway bifurcate from U.S. 1, making continuity of this alternative impractical for the entire study corridor as a whole. Therefore, the two-lane, three-lane and four-lane typical sections are selected for detailed evaluation based on the options screening. Please note that a Florida Standard Urban Transportation Model Structure (FSUTMS) based demand analysis for the selected managed lanes options is presented in the Demand and Revenue Analysis section of this report.

Table 10: Typical Sections Evaluation Matrix

Alternative	LOS C Capacity[1] (peak-hour peak-direction)	Potential 2030 Peak Direction Demand[2]		Continuous Flow Potential	Metrorail Feasibility	Potential Environmental /Drainage Impacts	Cost
		North Segment (AM/PM)	South Segment (AM/PM)				
Two lanes	900	1,810/1,700	360/910	Low	Yes	Low	Low
Three-lane reversible	1,810	1,810/1,700	360/910	Medium	Yes[3]	Medium	Medium
Four lanes	1,810	1,810/1,700	360/910	High	Yes[3]	Medium	High
Five-lane reversible	2,720	1,810/1,700	360/910	High	Yes[3]	Medium	High
U.S. 1/Busway hybrid	1,810	1,810/1,700	360/910	Medium	Yes[3]	High	Very High

1. LOS C Capacity based upon FDOT's Generalized Level of Service Tables. Grade separation and access restrictions would further increase the corridor capacity.
2. Difference between volume and capacity on U.S. 1 for the north (of SW 152nd Street) and south (of SW 152nd Street) segments. Based on volume and capacity data presented in Table 9. Please note that these volumes are used for preliminary screening of options. A detailed demand analysis for managed lanes alternatives is presented in the Demand and Revenue Analysis section of the report.
3. Number of managed lanes will be reduced to two.

Access Strategies

The following criteria were used in Table 11 to screen access strategies:

- Approximate Number of Access Points. Bus and private vehicle access to the Busway are considered.
- Continuous Flow Potential. The ability for vehicles to travel in an uninterrupted manner in a mid-block location while maintaining the guaranteed travel speed is defined as the continuous flow potential. Closely located access points would result in higher friction and hence low continuous flow potential.
- Busway Accessibility for Buses. The at-grade access options have the highest flexibility for buses to access the Busway.
- Operational Complexity. The operational complexities of access strategies are assessed. Full access for private vehicles would be the most complicated option as toll mechanisms would be required frequently along the corridor.
- Impact on Local Traffic Operation. The impacts of access options on side-streets and U.S. 1 are assessed. At-grade access options give rise to conflicts with local traffic, whereas limited access options eliminate those conflicts.
- Additional right-of-way (ROW) Needs. The need to acquire additional land to construct access configurations is assessed.
- Demand Potential. The private vehicle demand for managed lanes is assessed.

Based on Table 11, full access (buses and private vehicles) to managed lanes at at-grade intersections was eliminated due to low continuous flow potential, high operational complexity, and low demand. The other access strategies will be further evaluated. Please note that phased development of managed lanes is possible.

Table 11: Access Strategy Evaluation Matrix

Alternative	Approx. # of Access Points		Continuous Flow Potential	Busway Accessibility for Buses	Operational Complexity	Impact on Local Traffic Operation	Demand Potential
	Buses	Private Vehicles					
Buses and private vehicles – full access	45	45	Low	High	High	High	Low[1]
Buses – full access; private vehicles – limited access	45	5/6	Medium	High	Medium	Medium	High
Buses and private vehicles – limited access	5/6	5/6	High	Medium	Medium	Medium	High
Buses – limited access; private vehicles – terminals and one midpoint	5/6	2/3	High	Medium	Low	Low	Medium
Buses and private vehicles – terminals and one midpoint	2/3	2/3	High	Low	Low	Low	Medium

1. Demand potential is expected to be low due to frequent access points, lower speeds, and low continuous flow potential.

Intersection Control Strategies

The following criteria were used in Table 12 to screen intersection control strategies:

- Pedestrian Accessibility. The ease of accessing bus stations was assessed. At-grade managed lanes would make pedestrian access most difficult. Elevated bus stations would require vertical circulation for pedestrian access.
- Delay for Transit Vehicles. At-grade intersections without transit signal priority would result in highest delays for buses. Transit signal priority could minimize delays. Grade separation would result in least delays.
- Continuous Flow Potential. The managed lane users will experience delays at intersections. Grade separation facilitates continuous flow.
- Impact on Local Traffic. Intersections with transit signal priority would have a greater impact than intersections without transit signal priority. The closure of minor streets would also result in significant impact for local traffic.
- Operational Complexity. At-grade intersections along Busway will need to be coordinated with intersections on U.S. 1. To implement transit signal priority, advanced vehicle detection and signal control systems will be needed. Grade separation of side-street would result in accessibility and right-of-way issues.
- Potential Environmental/Drainage Impacts. The environmental considerations associated with constructing intersection control measures are assessed.
- Additional ROW Needs. The need to acquire additional land to construct intersection control options is assessed.
- Cost. The cost for constructing and operating intersection control strategies is assessed.

The side-street grade separation option is eliminated due to significant right-of-way requirement. At-grade intersections without transit signal priority could result in significant delays for transit vehicles, when using the Busway with private vehicles. The intersection control types other that side street grade separation will be evaluated on a location basis.

Table 12: Intersection Control Type Evaluation Matrix

Alternative	Pedestrian Accessibility	Delay for Transit Vehicles	Continuous Flow Potential	Impact on Local Traffic Operation	Operational Complexity	Potential Environmental/ Drainage Impacts	Additional ROW Needs	Cost
At-grade – no transit signal priority	Low	High	Low	Low	Medium	Low	Low	Low
At-grade – with transit signal priority	Low	Medium	Low	Medium	High	Low	Low	Medium
Grade separate managed lanes	High	Medium	High	Medium	Medium	High	High	High
Grade separate full facility	Medium	Low	High	Low	Low	High	Medium	High
Grade separate side-street	Low	Low	High	Low	High	High	High	High
Close minor side-streets	Low	Low	High	High	Low	Low	Low	Medium

Summary

A summary of the options screening is presented below.

- Typical Sections. The two-lane, three-lane reversible and four-lane options were selected for further analysis. The two-lane alternative, despite its capacity limitations, will be considered as a possible low-cost managed lanes option where variable toll rates (demand management) techniques could be used to regulate private vehicles on the facility thereby maintaining desired level of service. The five-lane reversible and U.S. 1/Busway hybrid alternatives were eliminated.
- Access Strategies. Four options that would provide private vehicles limited access to the Busway were selected for further analysis. In one of the four selected options, buses would be provided full access at at-grade intersections. The other three options would provide buses access to the Busway at a limited number of intersections. The option that allows private vehicles full access at at-grade intersections was eliminated.
- Intersection Control Strategies. At-grade intersections with transit signal priority, grade separation of managed lanes, grade separation of full-facility, and the closure of minor side-street options were retained for further analysis. At-grade intersections without transit signal priority and grade separation of side-streets were eliminated.
- Vehicle Eligibility and Tolling System. The tolling system and vehicle eligibility criteria that will be implemented on I-95 Managed Lanes will be adopted for the Busway. Accordingly, all buses and private vehicles with three or more occupants will be able to use managed lanes for free.

Features of Managed Lanes Alternatives

After evaluating the results of Managed Lanes Options, comments received from the Study Advisory Committee (SAC), and discussions with MPO staff, the following alternatives were selected for detailed evaluation:

- Alternative 1. Two-lane at-grade alternative. Allow private vehicles to utilize the existing South Dade Busway for a toll, with improvements made to signalization and signage.
- Alternative 2. Grade separation of managed lanes at locations identified in the Locally Preferred Alternative for the South Link Study. The locations identified for grade separation in the South Link Study are presented under the detailed description of Alternative 2. The remainder of the Alternative 2 managed lanes corridor would be at-grade. Three typical cross sections were identified:
    - Alternative 2A. Three-lane cross section with reversible center lane to provide two lanes in the peak direction during the peak period.
    - Alternative 2B. Four-lane cross section with two lanes each direction.
    - Alternative 2C. Two-lane cross section. This alternative was proposed by HNTB to MDX in a memorandum titled "US 1 Managed Lanes Study, Hybrid Alternative," dated June 20, 2008.
- Alternative 3. Four-lane fully elevated cross section of managed lanes with two lanes each direction.

Please note that Alternative 1 would assume speed limit of 45-mph, which is the existing speed limit on the Busway, and Alternatives 2 and 3 would assume speed limit of 50-mph.

Common Features of Alternatives

The features common to all alternatives are listed below.

- Termini – Managed lanes would extend from Dadeland South to SW 304th Street. The length of managed lanes would be approximately 16.7 miles. Please note that the

southern terminus of the existing Busway is located at SW 344th Street in Florida City. Managed lanes, unlike the Busway, would be accessible from a limited number of locations. To minimize the need for potential managed lane users in the southern part of the corridor from having to travel even farther south to access the managed lanes, SW 304th Street was identified as the potential southern terminus. SW 304th Street would provide convenient access to managed lanes for residential communities in the Homestead/Florida City area.

- Access points – In addition to the two termini, the following access locations were identified:
    - Bus only access points – SW 104th Street, SW 128th Street, SW 168th Street, and SW 216th Street. These access locations were selected based on recommended re-orientation of feeder bus routes in the South Link Study. If needed, additional bus-only access locations may be considered during the design stages.
    - Private vehicle and bus access points – SW 152nd Street and SW 117th Avenue/SW 211th Street (South Dade Government Center). The typical full access interchange concept for the four-lane option is illustrated in Appendix C. "Center drop" ramps are recommended to construct managed lanes within the existing Busway right-of-way and to create one at-grade intersection of ramps with east-west streets (instead of two intersections that would result from a traditional diamond interchange).
    - Connections to Palmetto Expressway and U.S. 1. To minimize the congestion at the northern terminus and facilitate easy connections to two of the likely roadways that managed lane users transfer to in Dadeland South, managed lanes are proposed to be connected to the Palmetto Expressway and U.S. 1. A slip ramp from managed lanes should be connected to the existing northbound ramp to the Palmetto Expressway from U.S. 1. Another slip ramp is proposed from managed lanes to U.S. 1. These ramp concepts are illustrated in Appendix D. Please note that a direct connection to the Palmetto Expressway is not assumed for Alternatives 1 and 2C. However, Alternative 1 assumes an at-grade slip ramp to U.S. 1 at SW 104th Street.

- Vehicle eligibility – Buses and passenger vehicles will be allowed to use managed lanes. Trucks should not be allowed to use managed lanes due to safety, acceleration and deceleration characteristics, and turning radii limitations at access points.
- Tolls – All vehicles using managed lanes with the exception of buses should be tolled. A planning level revenue analysis is presented in the Demand and Revenue Analysis section of this report to estimate the revenue generation potential of managed lanes under each alternative.
- Level of service/demand regulation – Managed lanes should provide LOS C for its users. A demand regulation mechanism such as restriction of access or variable pricing may be required to maintain LOS C during peak periods.
- Intersection control strategies – Alternatives 1 and 2 would require transit signal priority (TSP) for buses on managed lanes at at-grade intersections. In addition, transit signal priority is recommended at access points to managed lanes (Alternatives 2 and 3) where buses may be required to leave managed lanes to access at-grade bus stations and cross side-street to get back to managed lanes.
- Bus station locations – The bus station locations identified in the Locally Preferred Alternative for South Link Study are recommended to be maintained. The locations where bus stations identified in the South Link Study for the segment between Dadeland South and SW 304th Street are listed below.
    - SW 104th Street
    - SW 112th Street
    - SW 117th Street
    - SW 124th Street
    - SW 128th Street
    - SW 136th Street
    - SW 144th Street
    - SW 152nd Street
    - SW 160th Street
    - SW 168th Street
    - Banyan Street
    - SW 184th Street

- Marlin Road
- SW 200th Street
- SW 112th Avenue
- SW 216th Street
- SW 224th Street/Miami Avenue
- SW 232nd Street
- SW 244th Street
- SW 264th Street
- SW 272nd Street
- SW 288th Street
- SW 296th Street

Figure 2 illustrates the alignment of managed lanes, termini, and access points. The following sections describe alternative-specific characteristics.

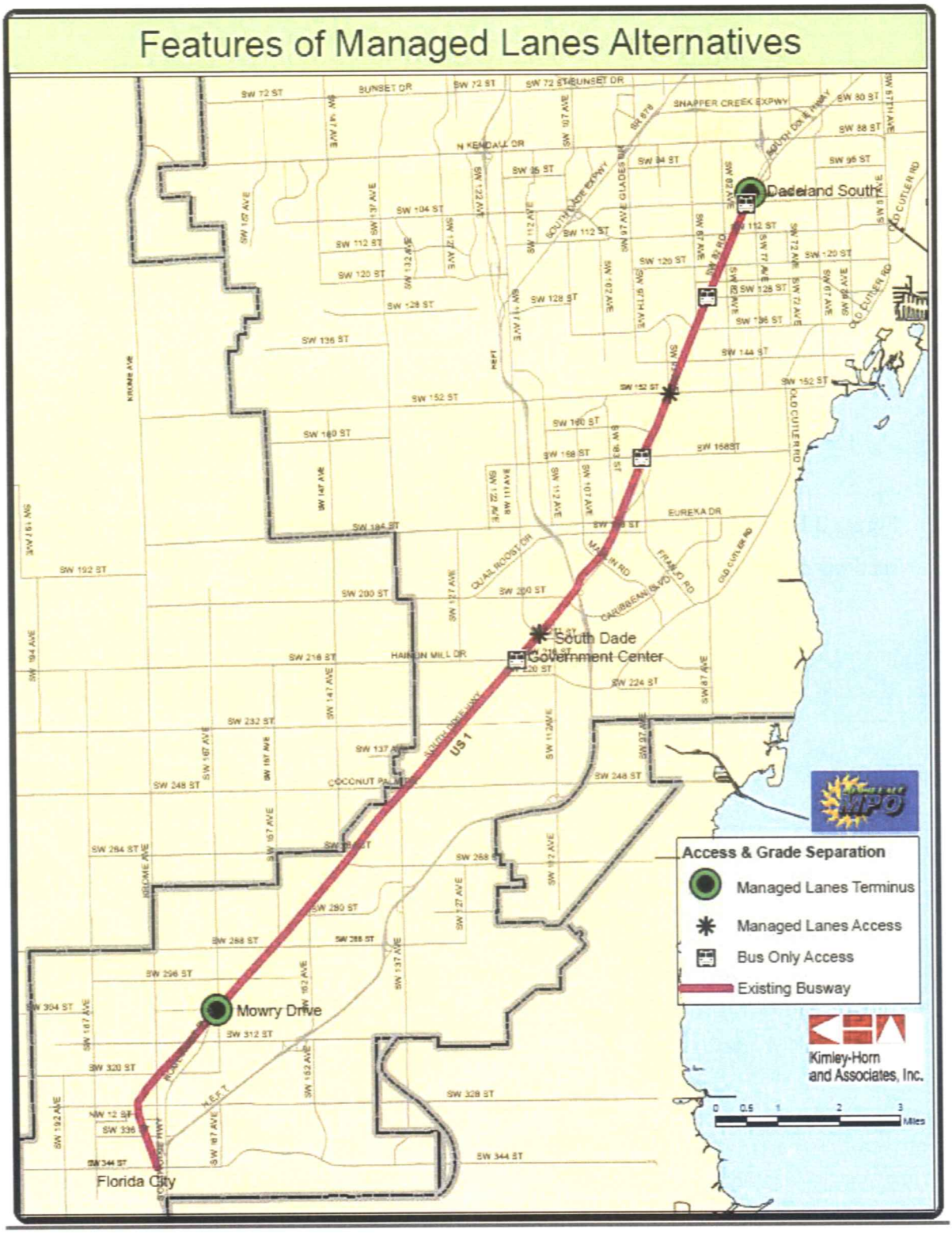


Figure 2: Features of Managed Lanes Alternatives

Alternative 1. Two-Lane At-Grade Alternative

This alternative essentially represents a minimum build option to implement managed lanes using the existing Busway. A typical section of the two-lane alternative at a bus station is depicted in Exhibit 3. The private vehicle access to managed lanes will be limited to locations identified in Figure 2. Thirty four at-grade intersections exist along the Busway between Dadeland South and SW 304th Street. Therefore, transit signal priority should be provided for buses on managed lanes.

The directional capacity of the corridor is approximately 900 vehicles per hour (FDOT Q/LOS Table 4-7). The advantages and disadvantages of Alternative 1 are listed below.

Advantages

- Low capital cost due to minimal changes to the existing Busway.
- Minimal impact on Busway operation during its conversion to managed lanes.
- Closely located at-grade intersections make it easy for incident management and Busway access by emergency response vehicles.

Disadvantages

- Low capacity. Therefore, the revenue generation potential is lower than other alternatives.
- Frequent intersections lead to higher delays and lower level of service.
- Buses would have to share the two-lane Busway with private vehicles without capacity enhancement. Therefore, bus operating speeds may be reduced.
- Inability to pass slow-moving vehicles.
- Signalization modifications would be required to significantly enhance green time for the Busway. Would reduce capacity for side street movements and southbound right-turn from U.S. 1.
- Potential violations of access restrictions to managed lanes. Signage is recommended to restrict access to managed lanes at at-grade intersections. However, more resources may be required to enforce violation of managed lanes.

Exhibit 3: Typical Cross Section of the Two-Lane Alternative at a Station

<u>Alternative 2A. Three-Lane Reversible Alternative with Partial Grade Separation</u>

This alternative would require reconstruction of the existing Busway. An addition of a reversible center lane, grade separation of the Busway at major side-streets, access ramps to managed lanes, and elevated bus stations at select locations are major features of this alternative. For reversing the center lane, dynamic message signs would be required. Additional traffic control measures may be required where access is provided to managed lanes. Typical sections of this alternative are depicted in Exhibits 4 and 5. The private vehicle access to managed lanes will be limited to locations identified in Figure 2. The locations identified for grade separation are listed below.

- SW 112th Street
- SW 136th Street
- SW 152nd Street
- SW 184th Street & SW 186th Street & Marlin Road (one grade separated structure over three roadways)
- SW 200th Street
- SW 211th Street/SW 117th Avenue
- SW 216th Street

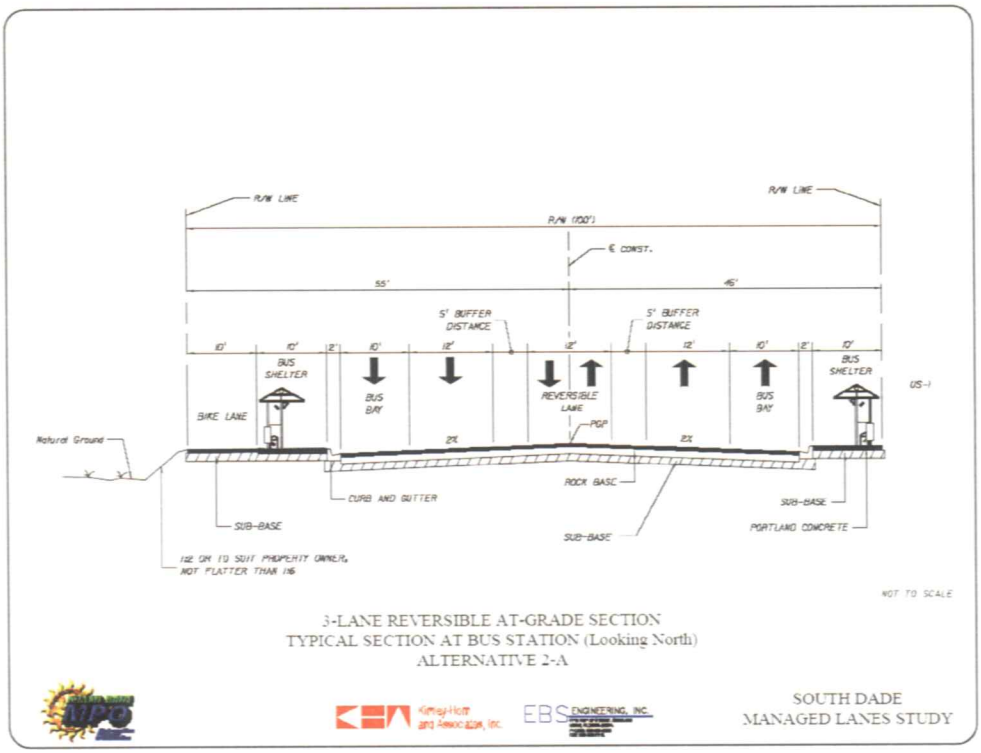


Exhibit 4: Typical Cross Section of the Three-Lane Alternative at a Station

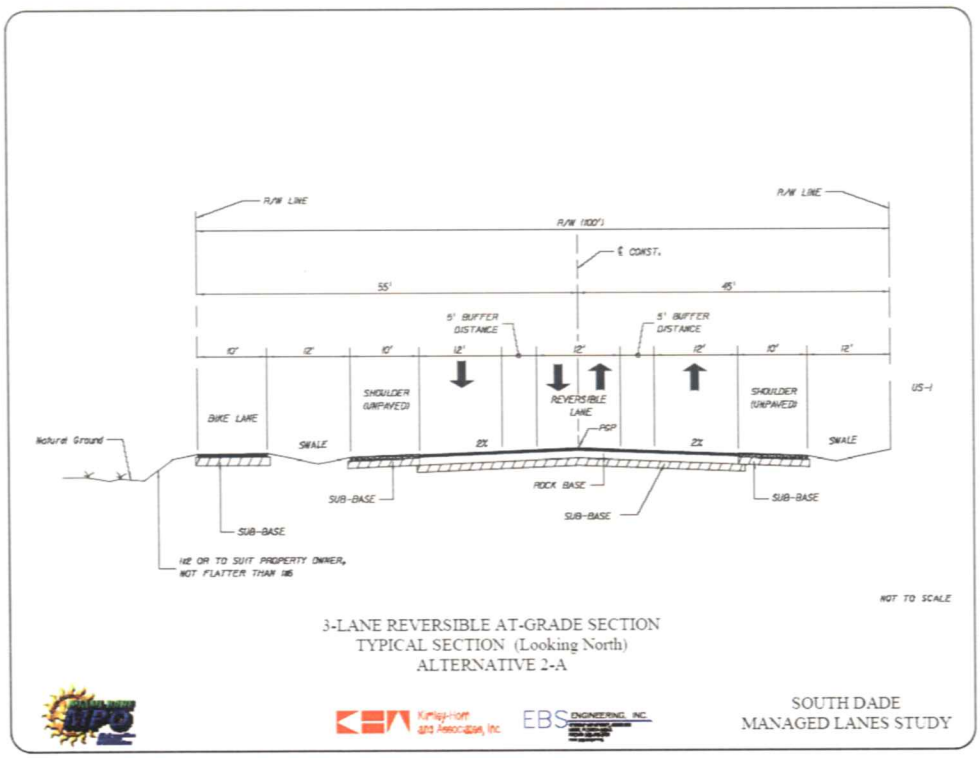


Exhibit 5: Typical Cross Section of the Three-Lane Alternative

This alternative would result in 25 at-grade intersections exist along the Busway between Dadeland South and SW 304th Street. Transit signal priority should be provided for buses on managed lanes at those at-grade intersections. The majority of bus stations would be located at-grade along the Busway/managed lanes. Where managed lanes are separated, bus stations may be elevated; where managed-lane or bus-only access is provided, bus stations may be located at side-street level.

The estimated directional capacity of the corridor is 1,800 vehicles per hour in the peak direction and 900 vehicles in the off-peak direction (FDOT Q/LOS Table 4-7). The advantages and disadvantages of Alternative 2A are listed below.

Advantages

- Grade separation of managed lanes at high-volume roadways deceases travel times for transit vehicles, managed-lane users, and side-streets.
- Higher capacity in the peak direction.
- Direct connections to U.S. 1 and the Palmetto Expressway.

Disadvantages

- The reversible lane operation requires dynamic message signs, clearance period before lane reversal, and enforcement. In addition, access to the reversible lane might be limited to managed lane access locations, which results in underutilization of reversible lane.
- A buffer may be required between reversible lanes and other lanes. Therefore, right-of-way requirement for the three-lane option is similar to the four-lane option.
- In off-peak direction where only one lane is provided, opportunities do not exist to pass slow-moving vehicles.
- Signalization modifications would be required to significantly enhance green time for the Busway at at-grade intersections. Would reduce capacity for side street movements and southbound right-turn from U.S. 1.
- Frequent at-grade intersections lead to higher delays and lower level of service.

- Potential violations of access restrictions to managed lanes. Signage is recommended to restrict access to managed lanes at at-grade intersections. However, more resources may be required to enforce violation of managed lanes.
- Significant disruption to Busway operation during construction.
- Right-of-way acquisition required to provide connections to U.S. 1 and the Palmetto Expressway.
- Need to widen the existing bridges along the Busway.
- Difficult pedestrian access to at-grade bus stations on the west side of the Busway.

Alternative 2B. Four-Lane Alternative with Partial Grade Separation

This alternative would require reconstruction of the existing Busway. Grade separation of the Busway at major side-streets, access ramps to managed lanes, and elevated bus stations at select locations are major features of this alternative. Typical sections of this alternative at an at-grade section are depicted in Exhibits 6 and 7. Where managed lanes are elevated, typical section will be similar to Alternative 3 (see Exhibits 8 and 9). Private vehicle access to managed lanes will be limited to locations identified in Figure 2. The grade separation locations identified under Alternative 2A were assumed for this alternative as well.

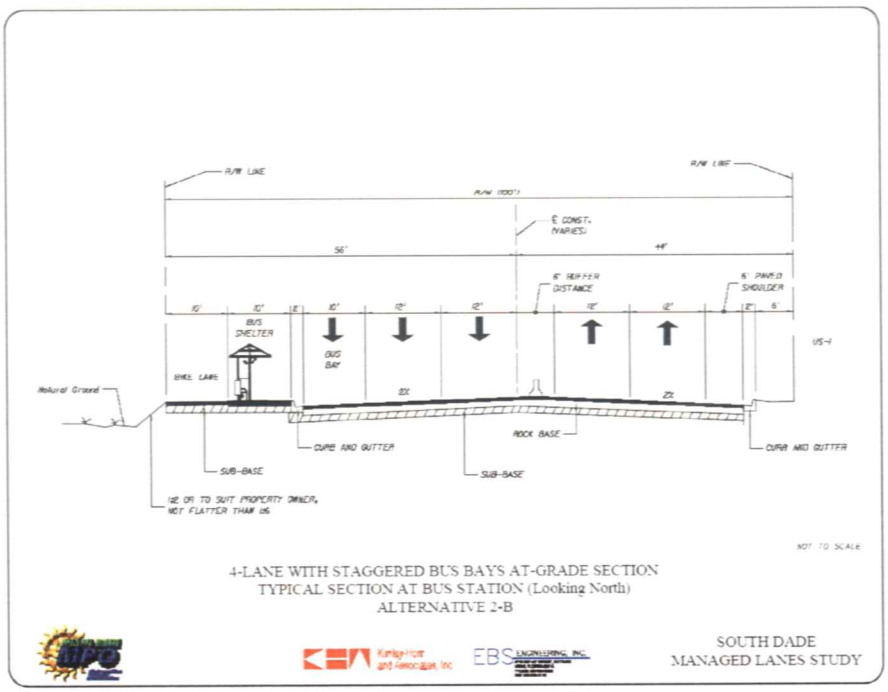


Exhibit 6: Typical Cross Section of the Four-Lane Alternative at a Station

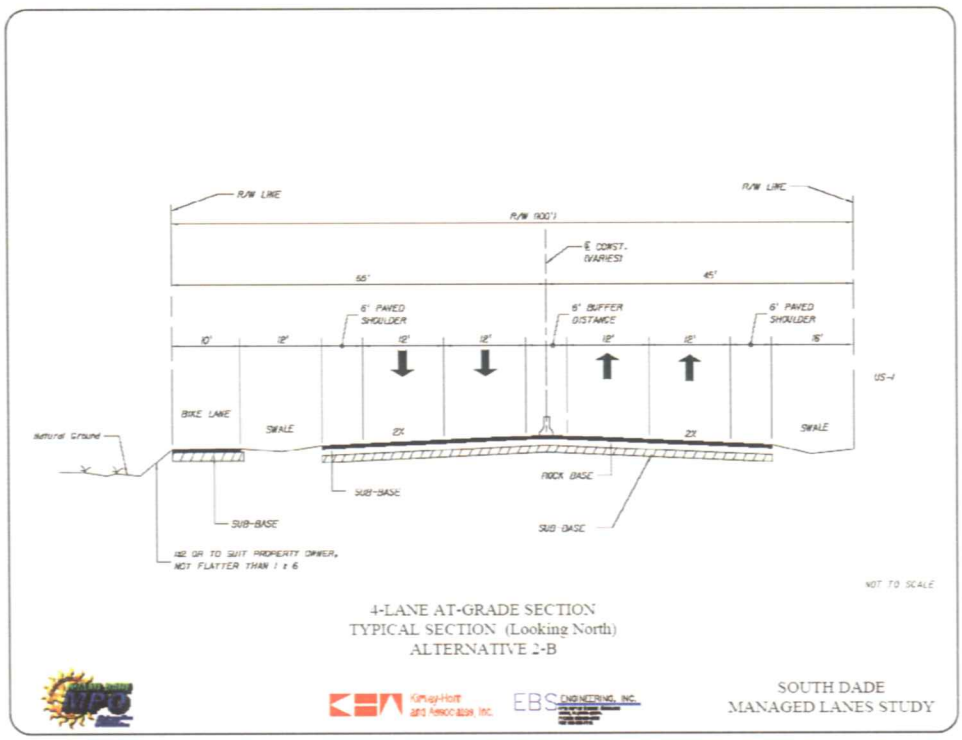


Exhibit 7: Typical Cross Section of the Four-Lane Alternative

Similar to Alternative 2A, this alternative would also result in 25 at-grade intersections along the Busway between Dadeland South and SW 304th Street. Transit signal priority should be provided for buses on managed lanes at those at-grade intersections. The majority of bus stations would be located at-grade along the Busway/managed lanes. Where managed lanes are grade separated, bus stations may be elevated; where managed-lane or bus-only access is provided, bus stations may be located at side-street level.

The estimated directional capacity of the corridor is 1,800 vehicles per hour in the peak direction and 1,800 vehicles in the off-peak direction (FDOT Q/LOS Table 4-7). The advantages and disadvantages of Alternative 2B are listed below.

Advantages

- Grade separation of managed lanes at high-volume roadways deceases travel times for transit vehicles, managed-lane users, and side-streets.

- Operationally less complex than Alternative 2A.
- Opportunities for passing slow-moving vehicles provided in both peak and off-peak directions.
- Direct connections to U.S. 1 and the Palmetto Expressway.

Disadvantages

- Signalization modifications would be required to significantly enhance green time for the Busway at at-grade intersections. Would reduce capacity for side street movements and southbound right-turn from U.S. 1.
- Frequent at-grade intersections lead to higher delays and lower level of service.
- Potential violations of access restrictions to managed lanes. Signage is recommended to restrict access to managed lanes at at-grade intersections. However, more resources may be required to enforce violation of managed lanes.
- Significant disruption to Busway operation during construction.
- Right-of-way acquisition required to provide connections to U.S. 1 and the Palmetto Expressway.
- Need to widen the existing bridges along the Busway.
- Difficult pedestrian access to at-grade bus stations on the west side of the Busway.

Alternative 2C. Two-Lane Alternative with Partial Grade Separation

Alternative 2C was proposed by HNTB in its memorandum to MDX on June 20, 2008 (see Appendix E). This alternative would maintain the existing two-lane Busway, limited grade separations identified in the South Link Study would be incorporated. The typical section of Alternative 2C is similar to that of Alternative 1 shown in Exhibit 3. The private vehicle access to managed lanes will be limited to locations identified in Figure 2.

Similar to Alternatives 2A and 2B, this alternative would also result in 25 at-grade intersections along the Busway between Dadeland South and SW 304th Street. Transit signal priority should be provided for buses on managed lanes at at-grade intersections. The majority of bus stations would be located at-grade along the Busway/managed lanes. Where

managed lanes are grade separated, bus stations may be elevated; where managed-lane or bus-only access is provided, bus stations may be located at side-street level.

The estimated directional capacity of the corridor at a typical at-grade section is 900 vehicles per hour (FDOT Q/LOS Table 4-7). The advantages and disadvantages of Alternative 2C are listed below.

Advantages

- Grade separation of managed lanes at high-volume roadways deceases travel times for transit vehicles, managed-lane users, and side-streets.
- Low capital cost in comparison to Alternatives 2A and 2B.
- Moderate impact on Busway operation during its conversion to managed lanes.
- Widening of existing bridges is not required

Disadvantages

- Low capacity. Therefore, the revenue generation potential is low.
- Frequent intersections lead to higher delays and lower level of service.
- Buses have to share the existing Busway with private vehicles without significant capacity enhancement.
- Inability to pass slow-moving vehicles.
- Potential violations of access restrictions to managed lanes. Signage is recommended to restrict access to managed lanes at at-grade intersections. However, more resources may be required to enforce violation of managed lanes.
- Signalization modifications would be required to significantly enhance green time for the Busway at at-grade intersections. Would reduce capacity for side street movements and southbound right-turn from U.S. 1.

Alternative 3. Four-Lane Elevated Alternative

This alternative would require reconstruction of the existing Busway. Elevated managed lanes, access ramps to managed lanes, and elevated bus stations are major features of this

alternative. Typical sections of this alternative are illustrated in Exhibits 8 and 9. Private vehicle access to managed lanes will be limited to locations identified in Figure 2.

The elevation of managed lanes should be reduced where it passes under the HEFT. The majority of bus stations would be located elevated along the Busway/managed lanes. Where managed-lane or bus-only access is provided, bus stations may be located at side-street level.

The estimated directional capacity of the corridor is 2,940 vehicles per hour in the peak direction and 2,940 vehicles in the off-peak direction (FDOT Q/LOS Table 4-7). The advantages and disadvantages of the alternative are listed below.

Advantages

- Elevated managed lanes provide the highest capacity and lowest travel times.
- Decrease in delays for side-streets and turning movements from U.S. 1.
- Opportunities for passing slow-moving vehicles provided in both peak and off-peak directions.
- Direct connections to U.S. 1 and the Palmetto Expressway.
- Easiest control of vehicles entering managed lanes.

Disadvantages

- Highest construction cost of all options.
- Significant disruption to Busway operation during construction.
- Right-of-way acquisition required to provide connections to U.S. 1 and the Palmetto Expressway.

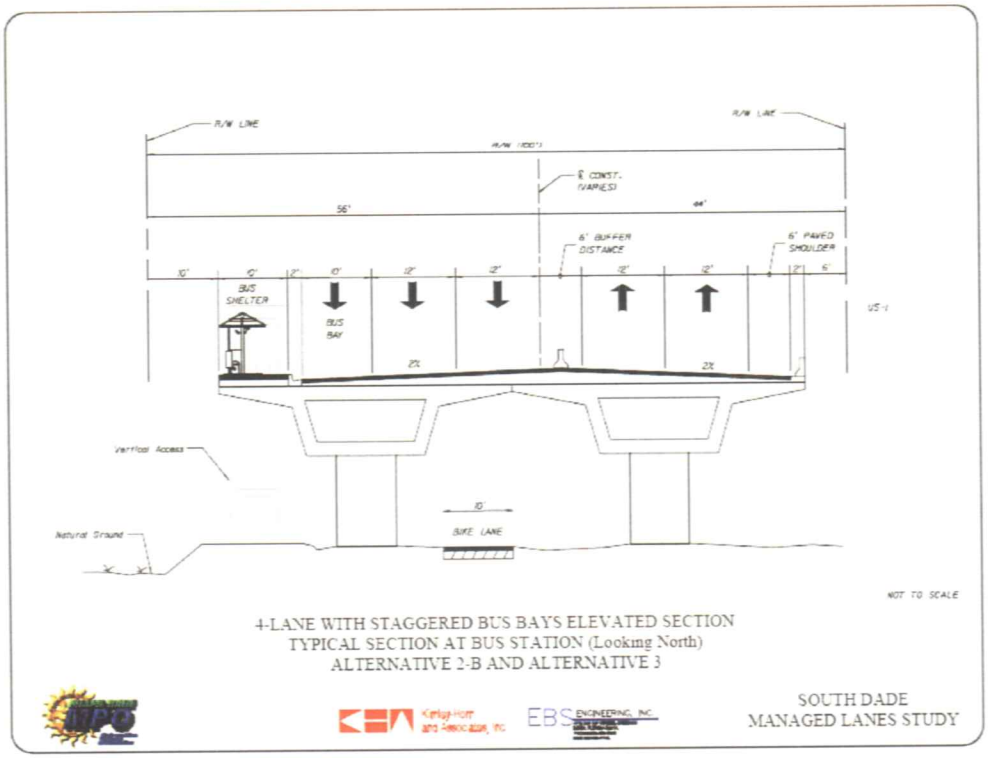


Exhibit 8: Typical Cross Section of the Four-Lane Elevated Alternative at a Station

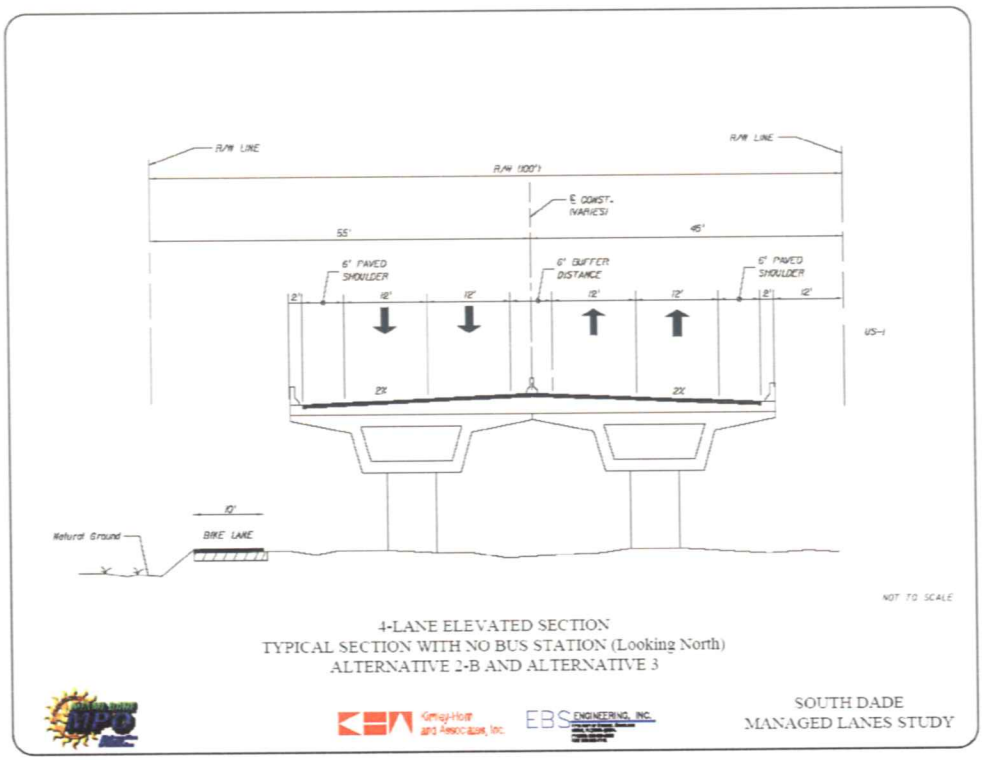


Exhibit 9: Typical Cross Section of the Four-Lane Elevated Alternative

Planning Level Cost Estimate

A planning level construction and operations cost estimate was developed for the alternatives presented in the previous chapter. These cost estimates were developed to determine funding needs for implementing manages lanes and to assess the revenue generation potential of managed lanes to partially fund transit operations and enhancements along the Busway corridor.

Construction Cost Estimate

Construction cost estimates are based on several published literature and assumptions were made where necessary. The documents referenced to derive unit cost estimates include:

- Unit cost analysis provided by the Miami-Dade Expressway Authority, March 2008.
- South Link Study, Miami-Dade Metropolitan Planning Organization, June 2006.
- Highway Construction Costs, Florida Department of Transportation District 7, August 2007.

Please note that the year of cost estimates in the above referenced documents varies slightly. In general, these costs correspond to current (2008) dollars. A summary of construction cost estimates is presented in Table 13. A detailed cost analysis is presented in Appendix F. The two-lane at-grade alternative is the least expensive of all options. The two-lane limited grade separation alternative is approximately 10 times more expensive than the two-lane at-grade alternative. The three-lane and four-lane limited grade separation alternatives are estimated to cost approximately $500 million and the elevated four-lane alternative is estimated at approximately $1,450 million.

Table 13: Planning Level Construction Cost

Alternative	Total Construction Cost	Construction Cost per Mile
Alternative 1: Two-Lane At-Grade	$23 million	$1.4 million
Alternative 2A: Three-Lane Partial Grade Separation	$496 million	$29.7 million
Alternative 2B: Four-Lane Partial Grade Separation	$531 million	$31.8 million
Alternative 2C: Two-Lane Partial Grade Separation	$186 million[2]	$11.1 million
Alternative 3: Four-Lane Elevated	$1,450 million	$86.8 million

Operations Cost Estimate

Wilbur Smith Associates (WSA) through a separate contract with MDX performed a capital and operational cost estimate for the toll collection system. The following table summarizes estimated annual operations and maintenance (O & M) cost estimate for the anticipated toll collection system for each alternative. A detailed cost estimate that includes capital and operational cost is provided in Appendix F.

Table 14: Planning Level Operations and Maintenance Cost for Toll System

Segment	O & M Cost (2008 $)
Alternative 1: Two-Lane At-Grade	$823,016
Alternative 2A: Three-Lane Partial Grade Separation	$1,464,286
Alternative 2B: Four-Lane Partial Grade Separation	$1,464,286
Alternative 3: Four-Lane Elevated	$2,297,059

[2] Cost estimate for Alternative 2C was provided by HNTB

Demand and Revenue Analysis

WSA performed a planning level traffic estimate and a revenue analysis for the managed lanes alternatives. The analysis evaluated the 2030 (design year) conditions using the Miami-Dade MPO's Florida Standard Urban Transportation Model Structure (FSUTMS). A letter report submitted by WSA to MDX dated June 2, 2008, is included in Appendix G. At the time the WSA memo was prepared, Alternative 2C was not under consideration. Therefore, WSA did not evaluate Alternative 2C. However, for planning purposes, interpolation of the results for Alternatives 1 and 2B would provide approximate estimates for Alternative 2C.

The analysis presented below divides the 16.7-mile Busway between Dadeland South and SW 304th Street into three segments:

- Segment 1 from SW 211th Street to SW 304th Street
- Segment 2 from SW 211th Street to SW 152nd Street
- Segment 3 from SW 152nd Street to Dadeland South

The varying traffic characteristics along US 1, which was evident from the existing conditions data analysis, make it logical to divide the corridor into three segments. As explained later, the same segments have been used to establish separate toll rates for each segment.

The analysis breaks the daily operations into four time periods:

- A.M. peak period – three (3) hours
- P.M. peak period – three (3) hours
- Midday period – six (6) hours
- Nighttime – 12 hours. In general, the analysis assumes the demand for managed lanes to be insignificant during nighttime.

A summary of the WSA analysis is presented below.

Traffic Demand

Based on the 2030 FSUTMS model, the traffic volume on managed lanes was estimated by WSA for the three alternatives. A summary of the daily volume on managed lanes is presented in Table 15. Based on the preliminary model runs, WSA determined that the traffic volumes in Alternatives 2A (Three-Lane Reversible with Limited Grade Separation) and 2B (Four Lanes with Limited Grade Separation) are similar. Therefore, the results were combined and presented as Alternative 2. Even though the southern segment of managed lanes is indicated to have the lowest demand, the incremental demand diminishes in central and northern segments. Therefore, the majority of the managed lane trips are shown to originate in the southern segment. This result is intuitively plausible given the fact that greater travel time savings are expected when using managed lanes for long distance trips in comparison to US 1.

Table 15: Estimated (2030) Daily Volume on Managed Lanes

Segment	Alternative 1	Alternative 2	Alternative 3
#3 - Dadeland South to SW 152nd Street	5,900	13,500	26,200
#2 -SW 152nd Street to SW 211th Street	5,400	12,600	25,200
#1 - SW 211th Street to SW 304th Street	3,400	11,300	21,000
Average Daily Traffic	4,900	12,500	24,100

Traffic Impacts

The impact of managed lanes on traffic volume on major roadways was estimated. For this purpose, both daily and peak hour volumes were examined. The estimated 2030 daily volume on US 1 is presented in Table 16. As indicated in Table 16, Alternative 3 would result in the highest reduction in daily traffic volume on US 1. Nevertheless, the estimated reduction in daily traffic volume on US 1 is less than 10 percent for each alternative. In general, the highest percent reduction in US 1 traffic volume is indicated in the southern segment. This observation is consistent with traffic demand for managed lanes presented in Table 15. Based on the 2030 traffic data, US 1 will continue to operate at level of service F both in no-build and build conditions.

Table 16: 2030 Daily Volume on US 1, Level of Service, and Percent Change in Comparison to No-Build Conditions

Segment	No-Build	Alternative 1		Alternative 2		Alternative 3	
		Volume	Percent Change	Volume	Percent Change	Volume	Percent Change
#3 - Dadeland South to SW 152nd Street	143,500 (LOS F)	143,000 (LOS F)	<0.5%	137,200 (LOS F)	4.5%	133,000 (LOS F)	7.5%
#2 - SW 152nd Street to SW 211th Street	68,800 (LOS F)	65,000 (LOS F)	5.5%	66,000 (LOS F)	4.0%	63,400 (LOS F)	8.5%
#1 - SW 211th Street to SW 304th Street	66,700 (LOS F)	62,400 (LOS F)	6.5%	61,200 (LOS F)	8.0%	60,800 (LOS F)	9.0%

The estimated change in peak-period traffic volume on U.S.1, HEFT, and major east-west streets within the study area was estimated. The three-hour A.M. and P.M. peak period data provided by WSA for a typical weekday was used to develop the peak-hour traffic volumes. To estimate peak hour volumes from the three-hour traffic data, FDOT's traffic count data for US 1 and major east-west corridors were utilized. Typical conversion factors applied to three-hour traffic data ranged between 0.34 and 0.39. Tables 17 and 18 summarize the change in peak-hour traffic volume in comparison to the no-build conditions. Please note that Alternative 2C was not considered in the analysis.

Table 17: Change in Estimated (2030) A.M. Peak Hour Traffic Volume

Street	No-Build	Alternative 1	Alternative 2	Alternative 3
US 1 - Dadeland South to SW 152nd Street	9,186	-1,157	-1,529	-1,798
US 1 - SW 152nd Street to SW 211th Street	3,711	-376	-409	-446
US 1 - SW 211th Street to SW 304th Street	3,893	-302	-452	-528
SW 152nd Street W of US 1	2,571	+117	+298	+365
SW 211th Street W of US 1	1,856	+100	+255	+1
SW 304th Street W of US 1	543	+95	+257	+348
HEFT N of SW 184th Street	18,728	-154	-317	-553

The A.M peak hour data indicate a moderate increase in traffic volumes on SW 152nd Street, SW 211th Street, and SW 304th Street. These three streets are located at access points to the managed lanes. Therefore, an increase in volume is expected. Conversely, the HEFT, a potential alternative to managed lanes, is showing a slight decrease in traffic volume in comparison to the no-build conditions. On US 1, the highest reduction in volume is shown in the northern segment.

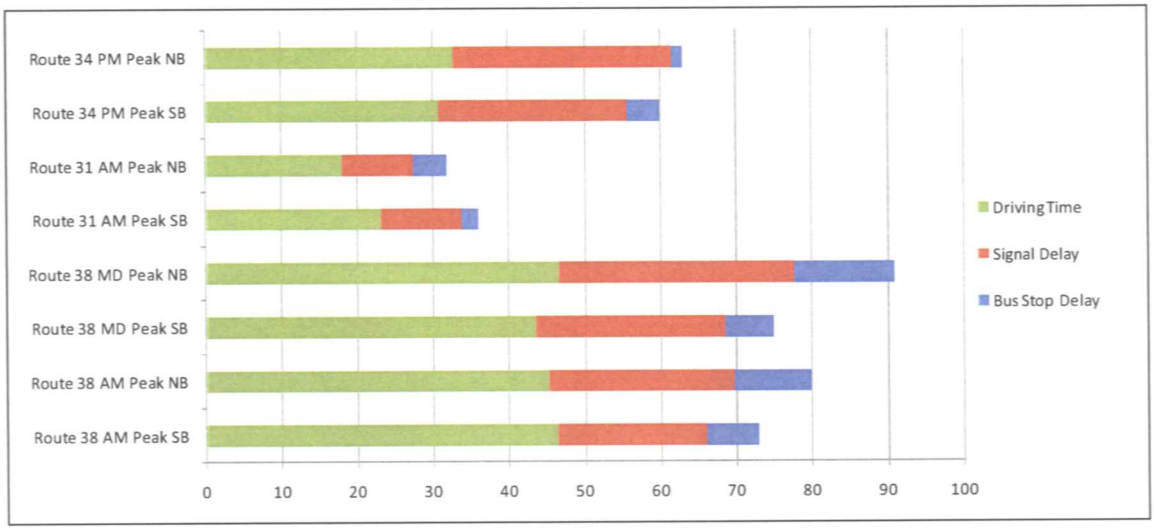
Table 18: Change in Estimated (2030) P.M. Peak Hour Traffic Volume

Street	No-Build	Alternative 1	Alternative 2	Alternative 3
US 1 - Dadeland South to SW 152nd Street	7,761	-140	-492	-670
US 1 - SW 152nd Street to SW 211th Street	4,852	-597	-596	-841
US 1 - SW 211th Street to SW 304th Street	3,976	-2	-178	-215
SW 152nd Street W of US 1	3,534	-248	+320	-53
SW 211th Street W of US 1	2,814	+600	-171	-8
SW 304th Street W of US 1	832	+10	+34	+66
HEFT N of SW 184th Street	20,574	-71	-285	-453

The P.M peak hour data indicate inconsistent results, especially on SW 152nd Street and SW 211th Street. However, similar to the A.M. peak hour conditions, a slight decrease in traffic volume is indicated on the HEFT during the P.M. peak hour in comparison to the no-build conditions. A slight reduction in volume is indicated in all three segments on US 1.

Travel Time for Buses

An on-board travel survey was performed to determine typical travel times for buses on the Busway. The driving time, stop delay, and signal delay data were recorded. Based on the study, the average travel time from Dadeland South to Florida City was approximately 80 minutes for a non-express bus, and the travel time for an express bus was approximately 60 minutes. The signal delay was approximately 25 minutes, which accounted for 30 to 40 percent of total travel time. A summary of travel time data is presented below.



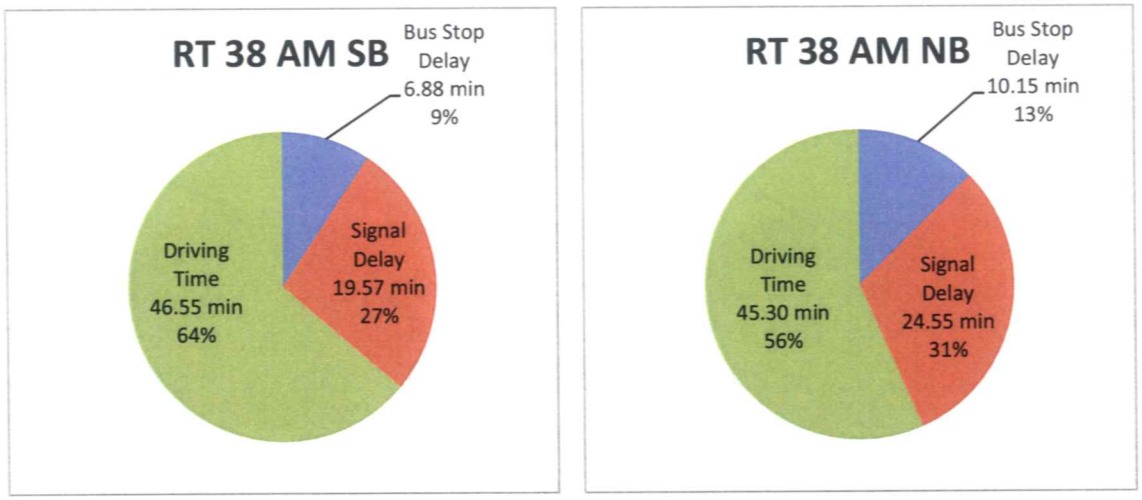
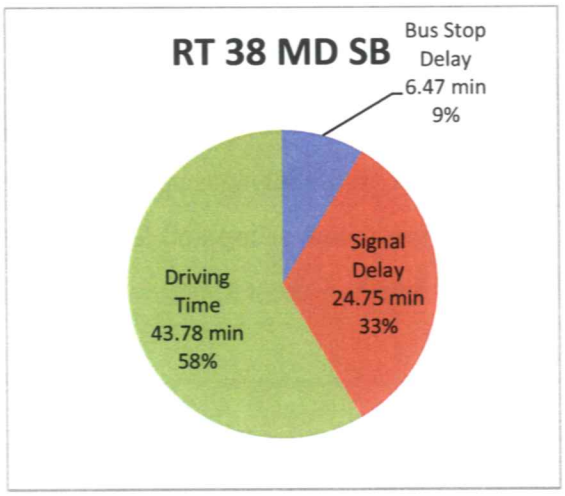
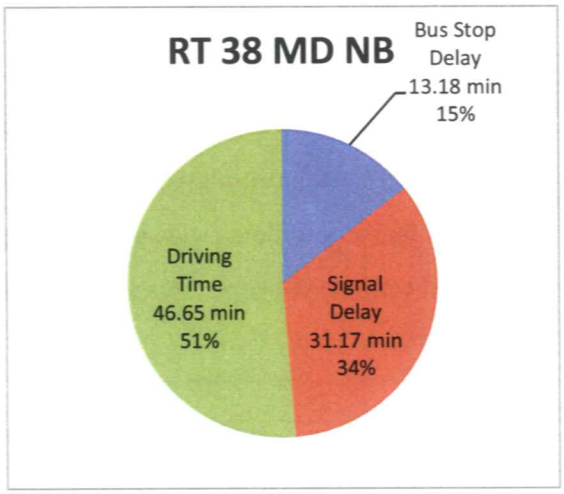
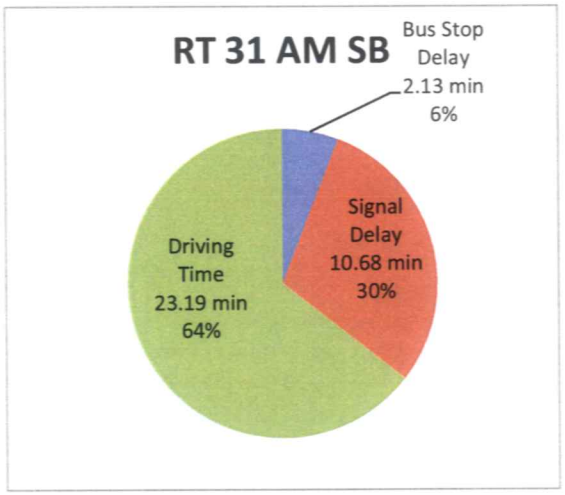


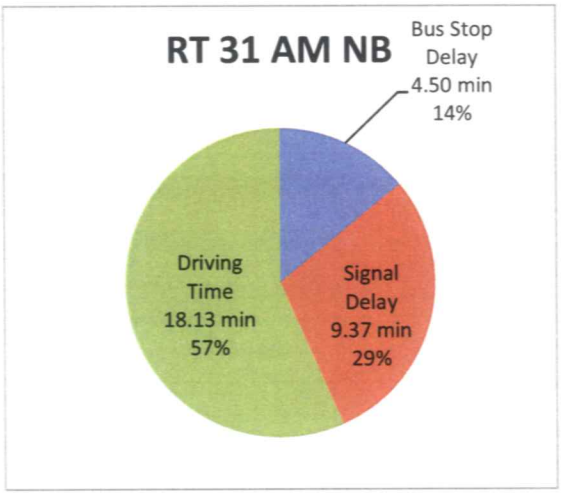
Figure 3: Summary of Busway Travel Time Data

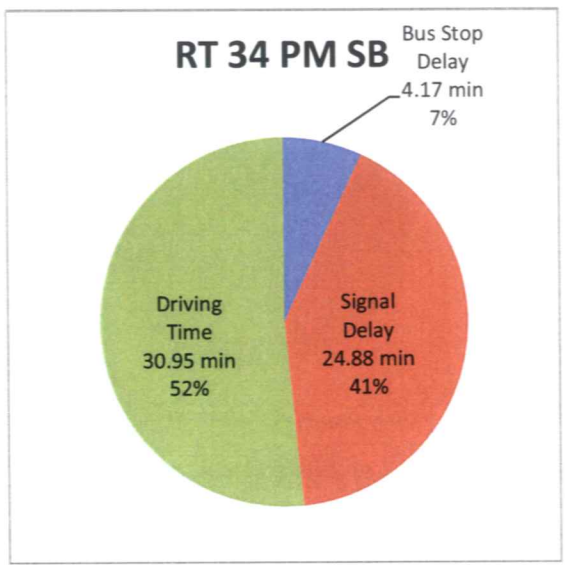
Figure 3 continued….

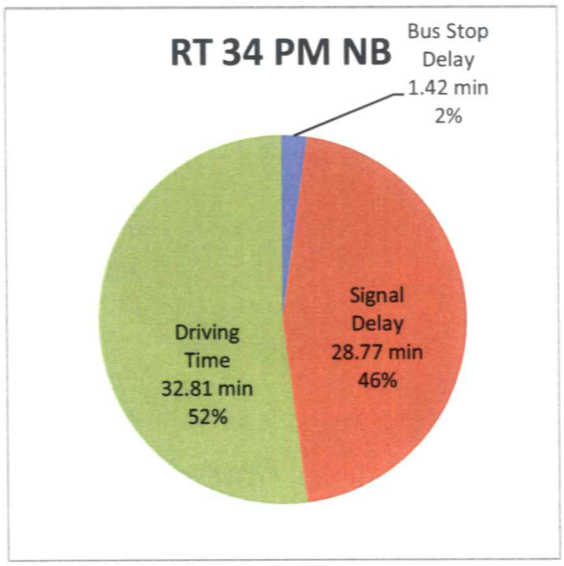












Based on the existing travel times, approximate travel times for buses when managed lanes were built were estimated. To estimate travel times, factors such as managed lanes capacity, peak period demand, number of lanes, at-grade and grade separated were taken into consideration. Table 19 presents approximate travel times for buses.

Table 19: Estimated Travel Time for Buses on Managed Lanes

Segment	Bus Service	No-Build	Alternative 1	Alternative 2	Alternative 3
Busway from Dadeland South to Florida City	Regular	80 min	80 – 90 min	65 – 75 min	50 – 60 min
	Express	60 min	60 – 70 min	50 – 55 min	40 – 50 min

A slight increase in travel time for buses is possible in Alternative 1 when private vehicles are allowed to use the Busway without capacity enhancements. However, the implementation of transit signal priority at at-grade intersections would help minimize delays for buses. Alternative 2 (assumes a four-lane typical section) is expected to reduce transit travel time due to additional capacity, grade separation of major intersections, and transit signal priority. Alternative 3, which provides four elevated managed lanes, is expected to result in the highest reduction in transit travel time.

Toll Technology

Toll technology for the managed lanes should be consistent with the toll technology being utilized by FDOT and MDX. Tolling will be SunPass only with open road tolling gantries. The toll should vary based on real-time congestion conditions. Real-time information should be communicated to motorists through dynamic message signs. It is assumed that HOVs will pay the same toll as other vehicles.

Toll Sensitivity Analysis

WSA performed a toll sensitivity analysis to maximize toll revenue while maintaining free-flow bus operations conditions (50-mph). The toll sensitivity analysis has been performed by dividing the managed lanes corridor into three segments as explained previously. The optimum toll rates for each segment are presented in Table 2 of the WSA memo for the A.M.

peak, midday, P.M. peak, and nighttime. These toll rates vary by direction (northbound or southbound) and by alternative.

2030 Toll Rates

WSA analysis was based on year 2030 and a summary of toll rates is presented below.

- Alternative 1 – toll rate varies between $4.25 per segment during the P.M. peak hour and $0.50 per segment during the nighttime.
- Alternative 2 (A & B) – toll rate varies between $3.75 per segment during the P.M. peak hour and $0.75 per segment during the nighttime.
- Alternative 3 – toll rate varies between $4.25 per segment during the P.M. peak hour and $0.75 per segment during the nighttime.

Please note that proposed toll rates are constant across the three segments. Therefore, a managed lanes user traveling the entire length of the corridor would have to pay three times the toll rate per segment. In general, higher toll rates are required in Alternatives 1 and 3 to maintain satisfactory flow conditions for bus operation. At the highest toll rate of $4.25 per segment, a potential managed lane user would pay $0.76 per mile in 2030 dollars to travel the entire length of the corridor.

2008 Toll Rates

Toll rates developed by WSA for year 2030 were converted to present value (2008) by applying a discount rate of 5 percent. The corresponding 2008 toll rates are presented below. Please note that discounted toll rates were rounded to the nearest 25 cent.

- Alternative 1 – toll rate varies between $1.50 per segment during the P.M. peak hour and $0.25 per segment during the nighttime.
- Alternative 2 (A & B) – toll rate varies between $1.25 per segment during the P.M. peak hour and $0.25 per segment during the nighttime.
- Alternative 3 – toll rate varies between $1.50 per segment during the P.M. peak hour and $0.25 per segment during the nighttime.

Revenue Analysis

A revenue analysis was performed based on the estimated traffic volume and recommended toll rates. The weekend revenue was assumed to be two percent of the weekday revenue, based on revenue patterns of the existing managed lanes. As presented below, Alternative 3 would generate the highest daily revenue, approximately $153,000 per day in 2030 dollars. Alternative 2 would generate approximately $90,000 per day in 2030 dollars, and Alternative 1 would generate approximately $46,000 per day in 2030 dollars.

Table 20: Estimated (2030) Revenue by Alternative

Segment	Daily Revenue				Annual Revenue
	Segment 1	Segment 2	Segment 3	Total	
Alternative 1	$8,500	$18,400	$19,200	$46,100	$11,180,000
Alternative 2	$21,100	$34,100	$34,800	$90,000	$21,821,000
Alternative 3	$36,400	$58,400	$58,400	$153,000	$37,164,000

Summary of Alternatives Evaluation

This study presented a planning level analysis of potential alternatives for managed lanes on the existing Busway Corridor between Dadeland South and SW 304th Street. The approximate length of the corridor is 16.7 miles. Based on the analysis, the following potential alternatives were identified for managed lanes, which are expected to be further evaluated in more detail in a subsequent alternatives evaluation/environmental assessment study to select the preferred alternative:

- Alternative 1. Two-lane at-grade alternative. Allow private vehicles to utilize the existing South Dade Busway for a toll, with improvements made to signalization and signage.
- Alternative 2. Grade separation of managed lanes at locations identified in the Locally Preferred Alternative for the South Link Study. The locations identified for grade separation in the South Link Study are presented under the detailed description of Alternative 2. The remainder of the Alternative 2 managed lanes corridor would be at-grade. Three typical cross sections were identified:
    - Alternative 2A. Three-lane cross section with reversible center lane to provide two lanes in the peak direction.
    - Alternative 2B. Four-lane cross section with two lanes each direction.
    - Alternative 2C. Two-lane cross section.
- Alternative 3. Four-lane fully elevated cross section of managed lanes with two lanes each direction.

Private vehicle access to managed lanes is limited to the termini and two intermediate access points recommended at SW 152nd Street and SW 117th Avenue. Additional bus-only access locations may be provided. The managed lanes analysis was based on the following criteria:

- Maintain satisfactory travel conditions for buses operating on the Busway/managed lanes.

- Maintain level of service C for the managed lane users. This translates to approximately 900 vehicles per hour per lane for Alternatives 1 and 2, and approximately 1,450 vehicles per lane for Alternative 3.

It is assumed that all private vehicles will have to pay a toll, whereas buses will be allowed to use the facility for free. A summary of the analysis is presented in Table 21.

Table 21: Summary of Alternatives Analysis

	Alternative 1	Alternative 2A	Alternative 2B	Alternative 2C	Alternative 3
Average Daily Traffic	4,900	12,500	12,500	6,130	24,100
Peak hour, peak-direction capacity	900	1,800	1,800	900	2,940
Construction Cost (2008 $)	$23 million	$496 million	$531 million	$186 million	$1,537 million
Annual Revenue (2030 $)	$11.2 million	$21.8 million	$21.8 million	$14.0 million	$37.2 million
Annualized Const. Cost (assuming 30-year term)	$1.4 million	$30.3 million	$32.5 million	$12.0 million	$93.4 million
Annual Operational Cost (2008 $)	$0.82 million	$1.5 million	$1.5 million	$0.97 million	$2.3 million
Peak direction toll per mile (2030 $)	$0.75	$0.60	$0.60	$0.75	$0.75
Estimated (2030) daily volume on US 1[3]	143,000	137,200	137,200	141,800	133,000

Note: When WSA performed demand and revenue projections, Alternative 2C was not under consideration. HNTB, which proposed the concept for Alternative 2C, provided a construction cost estimate. In general, characteristics of Alternative 2C are similar Alternative 1 except for the grade separation of managed lanes at major intersections. To provide a planning level estimate of demand and revenue for Alternative 2C, projections for Alternative 1 were multiplied by 1.25 to account for the increased attractiveness of Alternative 2C due to the grade separation of managed lanes at major at-grade intersections. The operations cost for Alternative 2C was estimated using a similar approach.

[3] US 1 volume between Dadeland South and SW 152nd Street.

Investment Analysis

The preliminary analysis indicates the implementation of managed lanes requires a significant investment, except in the case of Alternative 1. Therefore, the investor would have to identify a funding mechanism and perform a cost feasibility analysis to determine the financial viability of the project. In addition, a 30-year bond analysis will be required if funds are raised through a bond.

Transit Funding from Project Revenue

A major reason for examining managed lanes along the Busway is to assess the revenue generation potential for partially funding transit operations or enhancements in the corridor. As part of the project implementation, coordination will be required with MDT to determine what portion of revenue would be allocated for transit operations and enhancements within the corridor.

Policy Decisions

The analysis provided in this report identified options for operating managed lanes within the right-of-way of the South Dade Busway. However, the advancement of a managed lanes concept hinges upon the following key policy decisions:

- Funding mechanism – As the analysis indicated, the implementation of managed lanes requires a significant investment, except in the case of Alternative 1. Therefore, potential funding sources need to be identified, including the possibility of MDX funding the project, public-private partnerships, and bonding.
- Percent of revenue reserved for transit improvement – A key impetus for investigating the feasibility of implementing managed lanes is to determine if managed lanes could generate sufficient revenue to partially fund transit operations and enhancements along the Busway corridor. While preliminary analysis indicates a relatively long term return of investment period, a policy decision could be taken to allocate a portion of the revenue for transit improvements.
- Envelope for Metrorail extension – The Locally Preferred Alternative of the South Link Study calls for long-term extension of Metrorail to Florida City. Therefore, consideration should be given to plan the construction of managed lanes in such a

way to accommodate future Metrorail service within the corridor. Another key policy decision would be to determine whether to continue/discontinue/ or scale back the operation of managed lanes if Metrorail is extended.

- Consistency with local visioning – More detailed project development efforts must address the impacts of an elevated facility through the communities and need to be consistent with the community plans that have been developed along the facility.

Implementation Plan

An implementation plan was developed for the managed lanes alternatives. The major tasks of each alternative and approximate implementation timeframe were identified. The implementation plan includes environmental studies, design, and construction. At this stage of the study, all alternatives are maintained as viable alternatives. As indicated in Table 22, Alternative 1, which requires minimal improvements to the existing Busway, could potentially be implemented within three years. Alternative 2, which requires reconstruction of the Busway and grade separation of major intersections, would require approximately five years. Alternative 3, which requires an elevated facility, would take approximately eight years to implement. For Alternatives 2 and 3, which are more capital intensive in comparison to Alternative 1, phased implementation should be considered based on the demand and availability of funding.

Table 22: South Dade Managed Lanes Implementation Plan

Time Frame	Alternative	Activities
1 – 3 Years	#1	Environmental documentation
		Design and construct southern termini at SW 304th Street and managed lane access ramps
		Design and construct system-wide elements such as toll collection system and transit signal priority
	#2	Environmental documentation
		Design grade separations
		Design four-lanes of at-grade managed lanes
		ROW acquisition for Palmetto Expressway ramps
		Design US 1 and Palmetto Expressway ramps at Dadeland South
		Design southern termini
		Design system-wide elements
	#3	Environmental documentation
		Design grade separations and interchange ramps
		Design four-lanes of elevated managed lanes
		ROW acquisition for Palmetto Expressway ramps
		Design US 1 and Palmetto Expressway ramps at Dadeland South
3 – 5 Years	#2	Demolish existing busway and relocate utilities
		Construct four-lanes of at-grade managed lanes
		Construct grade separations and interchange ramps
		Construct ramps to Palmetto Expressway and US 1
		Construct southern termini
		Construct system-wide elements
		Reconstruct bike path
	#3	Demolish existing busway and relocate utilities
		Construct four-lanes of elevated managed lanes between Dadeland South and SW 211th Street
		Construct grade separations and interchange ramps between Dadeland South and SW 200th Street
		Construct ramps to Palmetto Expressway and US 1
		Construct system-wide elements between Dadeland South and SW 211th Street
		Reconstruct bike path between Dadeland South and SW 211th Street
5 – 8 Years	#3	Construct four-lanes of elevated managed lanes between SW 211th Street and SW 304th Street
		Construct grade separations and interchange ramps between SW 200th Street and SW 304th Street
		Construct southern termini
		Construct system-wide elements between and SW 211th Street and SW 304th Street
		Reconstruct bike path between SW 211th Street and SW 304th Street

APPENDICIES

South Dade Managed Lanes Study

Prepared for:

Miami-Dade County
Metropolitan Planning Organization (MPO)

Prepared by:

Kimley-Horn and Associates, Inc.
Fort Lauderdale, Florida

Kimley-Horn
and Associates, Inc.

©Kimley-Horn and Associates, Inc.
September 2008
040829015

{This page is intentionally left blank}

List of Appendices

Appendix A. Review of Previous Work

Appendix B. Data Collection Map Series

Appendix C. Full Access Interchange Concept

Appendix D. Managed Lanes Access Ramps

Appendix E. HNTB Memo

Appendix F. Planning Level Cost Estimates

Appendix G. Wilbur Smith Associates (WSA) Memo

{This page is intentionally left blank}

APPENDIX A

Review of Previous Work

Figure A-1
I-95 Managed Lanes Pilot Project Limits

U.S. Managed Lane Projects With Pricing Component

Location	Name	Length (Miles)	Total Lanes	Website
OPERATING				
Houston, TX	Katy I-10 QuickRide	13	1	http://www.quickride.org/
	Northwest US 290 QuickRide	13.5	1	http://www.quickride.org/
Minneapolis, MN	I-394 MNPASS	11	2	http://www.mnpass.org/
San Diego, CA	I-15 FasTrak	8	2	http://www.sandag.org/index.asp?classid=29&fuseaction=home.classhome
Orange County, CA	SR 91 Express Lanes	10	4	http://www.91expresslanes.com/
Denver, CO	I-25 HOT Lanes	6.5	2	http://www.dot.state.co.us/cte/expresslanes/tollmain.cfm
Salt Lake City, UT	I-15 Express Lanes	38	2	https://secure.utah.gov/expresslanes/action/public/index
UNDER CONSTRUCTION				
Houston, TX	Katy Freeway I-10	23	4	http://www.katyfreeway.org/
Maryland	I-95 Kennedy Expressway Express Toll Lanes	9	4	http://www.I-95ExpressTollLanes.com
UNDER DEVELOPMENT				
Austin, TX	Loop 1 (MoPac)	11	2	http://www.dot.state.tx.us/local_information/austin_district/mopac_1/default.htm
Dallas / Ft. Worth, TX	I-635 LBJ Managed Lanes	24	4	http://www.lbjproject.net/
	I-30 Managed Lanes	60	2	http://www.dot.state.tx.us/FTW/mis/ih30/project.htm
	I-820/SH183 Managed Lanes	27	2	http://www.dot.state.tx.us/dal/mis/sh183stage2/index.htm ; http://www.dot.state.tx.us/ftw/mis/ih820/project.htm
	I-35W Managed Lanes	20	2	http://www.dot.state.tx.us/FTW/mis/ih35w/project.htm
Houston, TX	SH 288 Managed Lanes	18	4	http://www.dot.state.tx.us/HOU/mis/sh288_us59/default.htm
Seattle, WA	I-405 Managed Lanes	30	4	http://www.wsdot.wa.gov/Projects/i405
	SR 167 HOT Lanes	9	2	http://www.wsdot.wa.gov/Projects/SR167/HOTLanes/
San Diego, CA	I-15 FasTrak Expansion	20	4	http://www.keepsandiegomoving.com/i15about.html

February 19, 2007

	I-5 HOT Lanes	32	4+	http://www.sandag.org/index.asp?projectid=219&fuseaction=projects.detail
	I-805 Managed Lanes	27	4	http://www.sandag.org/index.asp?projectid=219&fuseaction=projects.detail
San Francisco Bay Area, CA	I-680 HOT Lane	14	2	http://www.accma.ca.gov/pages/index.aspx
Denver, CO	US 36 Express Toll Lanes	25	4	http://www.rtd-denver.com/Projects/us36/index.html
	I-70 Express Toll Lanes	10	4	http://www.dot.state.co.us/
	C-470 Express Toll Lanes	14	4	http://www.c470.info/
	I-25 North Express Toll Lanes	26	2 to 4	http://www.dot.state.co.us/cte/expresslanes/tollmain.cfm
	I-70 Mountain Corridor	35	2	http://www.mesalek.com/colo/i70.html
Miami, FL	I-95 HOT to HOT Express Toll Lanes	12	3	
Ft. Lauderdale, FL	I-595 Express Lane	13	2	http://www.i-595.com/
Atlanta, GA	I-285 HOT Lanes	14	2	http://www.dot.state.ga.us/DOT/plan-prog/planning/studies/i-285/index.html
	I-75/I-575 HOT Lanes	36	4	http://www.georgiatolls.com/SRTAExternal/jsp/content/studiesPrograms.jsp
	GA 400 HOT Lanes	20	4	http://www.georgiatolls.com/SRTAExternal/jsp/content/studiesPrograms.jsp
Maryland	Intercounty Connector (ICC)	18.8	6	www.iccproject.com/
	I-270 Express Toll Lanes	23	2 to 4	http://www.mdot.state.md.us/Planning/Express%20Toll%20Lanes/ETL%20Maryland%20Project%20News
	I-495 Capital Beltway Express Toll Lanes	42	2	http://www.mdot.state.md.us/Planning/Express%20Toll%20Lanes/ETL%20Maryland%20Project%20News
Raleigh/Durham, NC	I-40 HOT Lanes	20	1	http://www.ncdot.org/projects/hov/i40.html
Portland, OR	Highway 217 Express Toll Lanes	8	2	http://www.metro-region.org/article.cfm?articleid=3518
Salt Lake City, UT	I-15 Express Lane Extension	9.5	2	http://www.udot.utah.gov/i15now/
Virginia	I-495 Capital Beltway HOT Lanes	12	4	http://www.vdot.virginia.gov/projects/ppta-defaultHOTLANESCapitalBeltway.asp
	I-95/I-395 HOT Lanes	54	3 and 2	http://www.virginiadot.org/projects/ppta-I-95_I-395HOTLanes.asp

APPENDIX B

Data Collection Map Series

Figure B-1
Future (2030) Population Density by Traffic Analysis Zone (TAZ)

Projected (2030) Population Density by TAZ

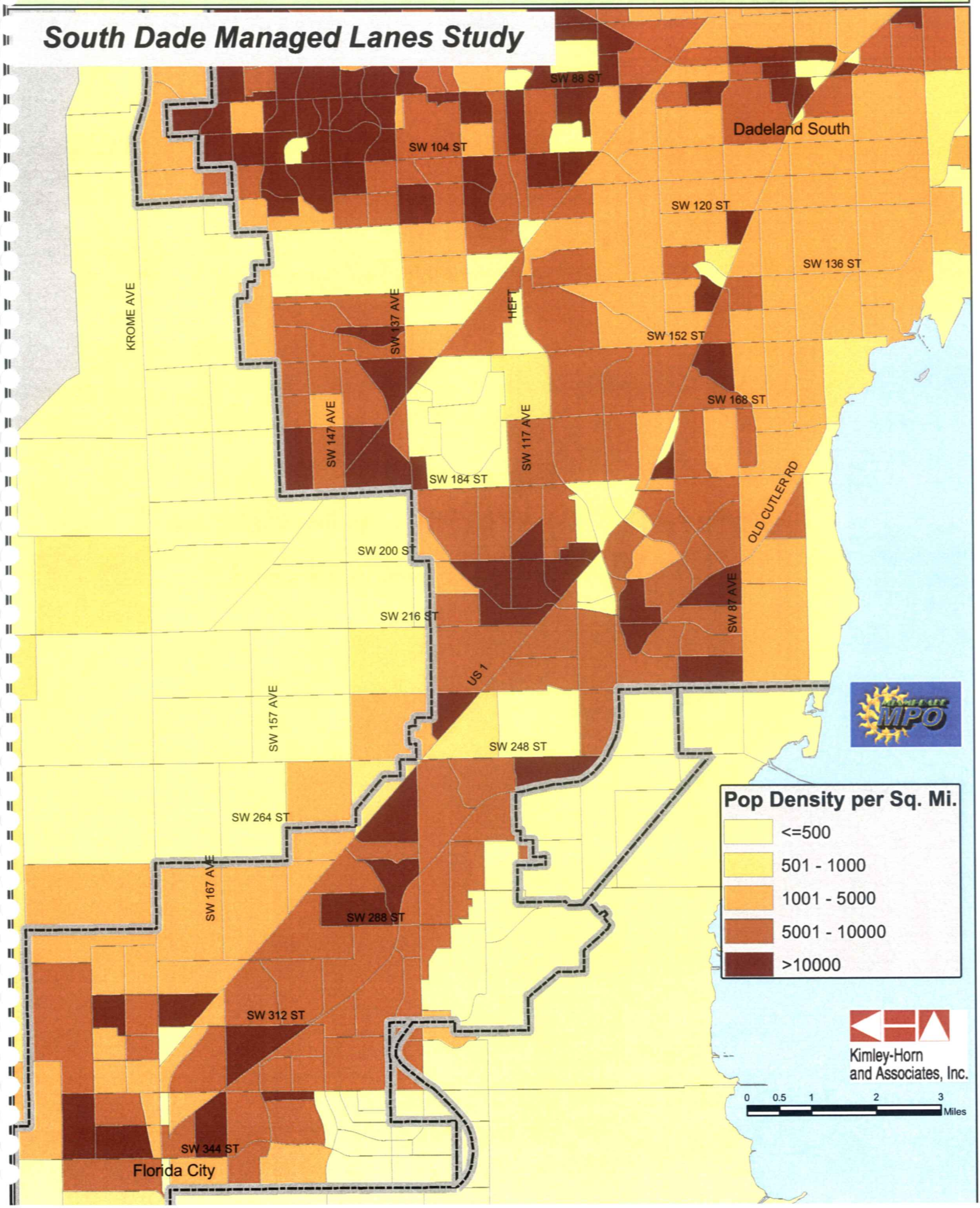


Figure B-2
Future (2030) Workforce Density by Traffic Analysis Zone (TAZ)

Projected (2030) Workforce Density by TAZ

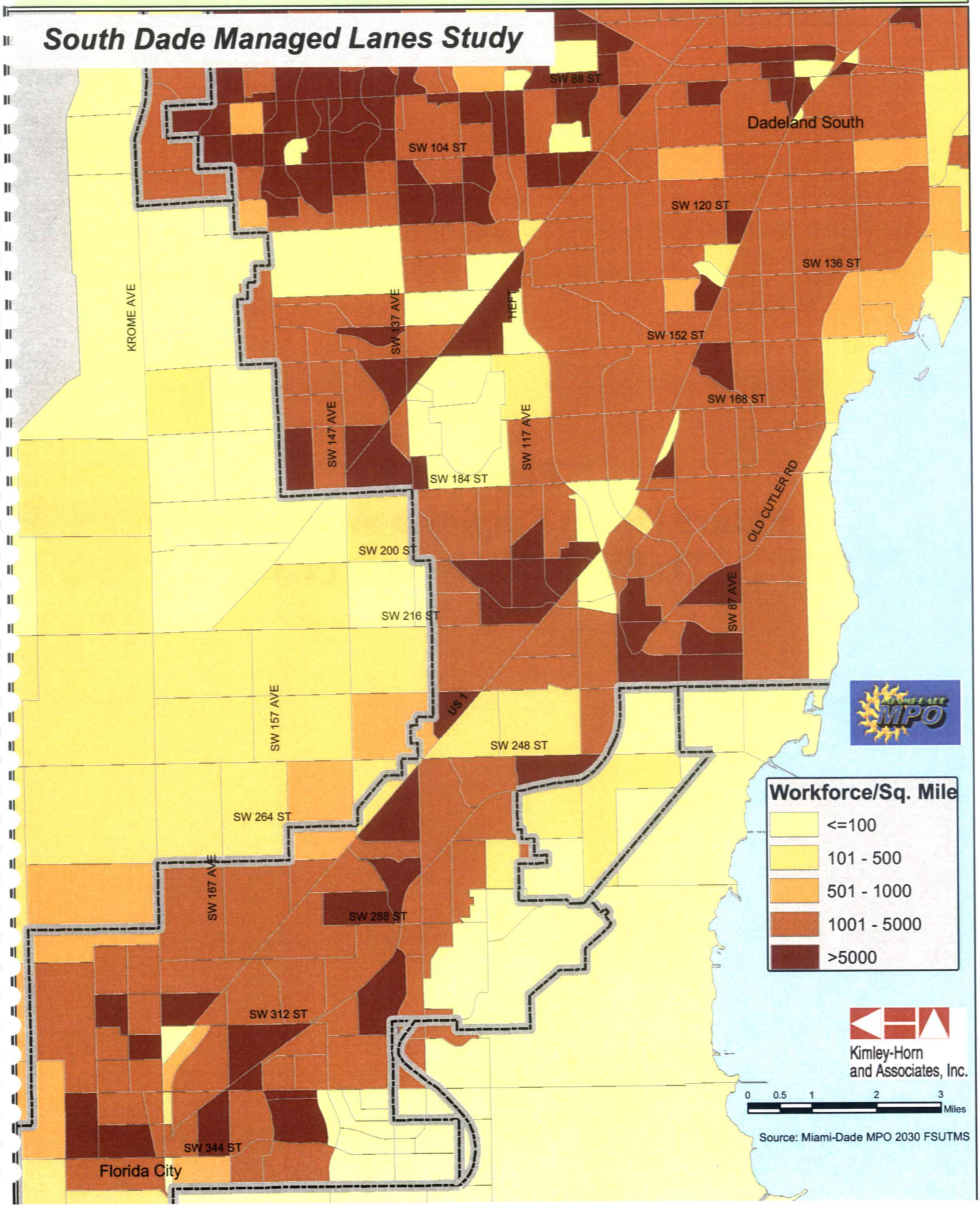


Figure B-3
Future (2030) Employment Density by Traffic Analysis Zone (TAZ)

Projected (2030) Employment Density by TAZ

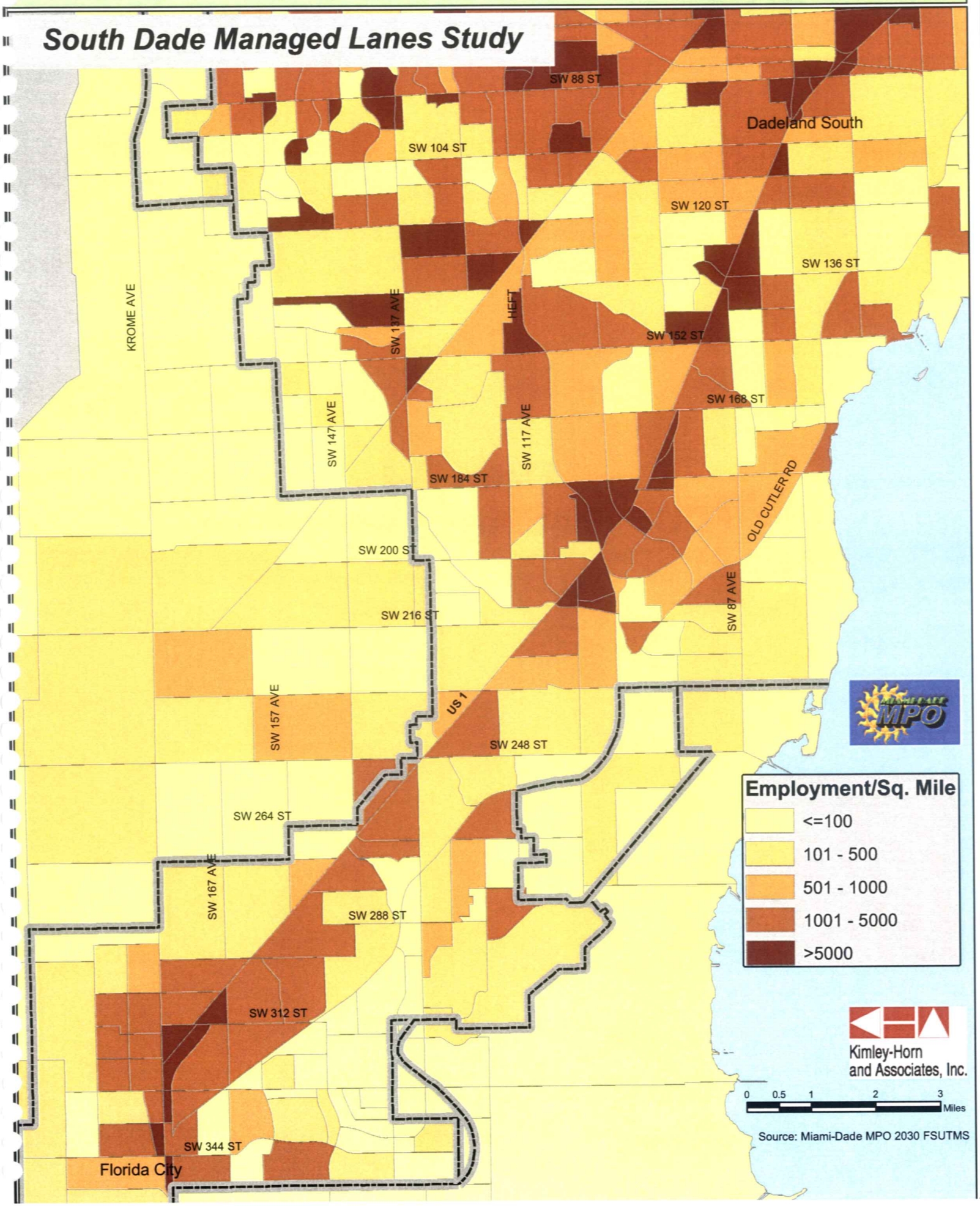


Figure B-4
FDOT Functional Classification

FDOT Functional Classification

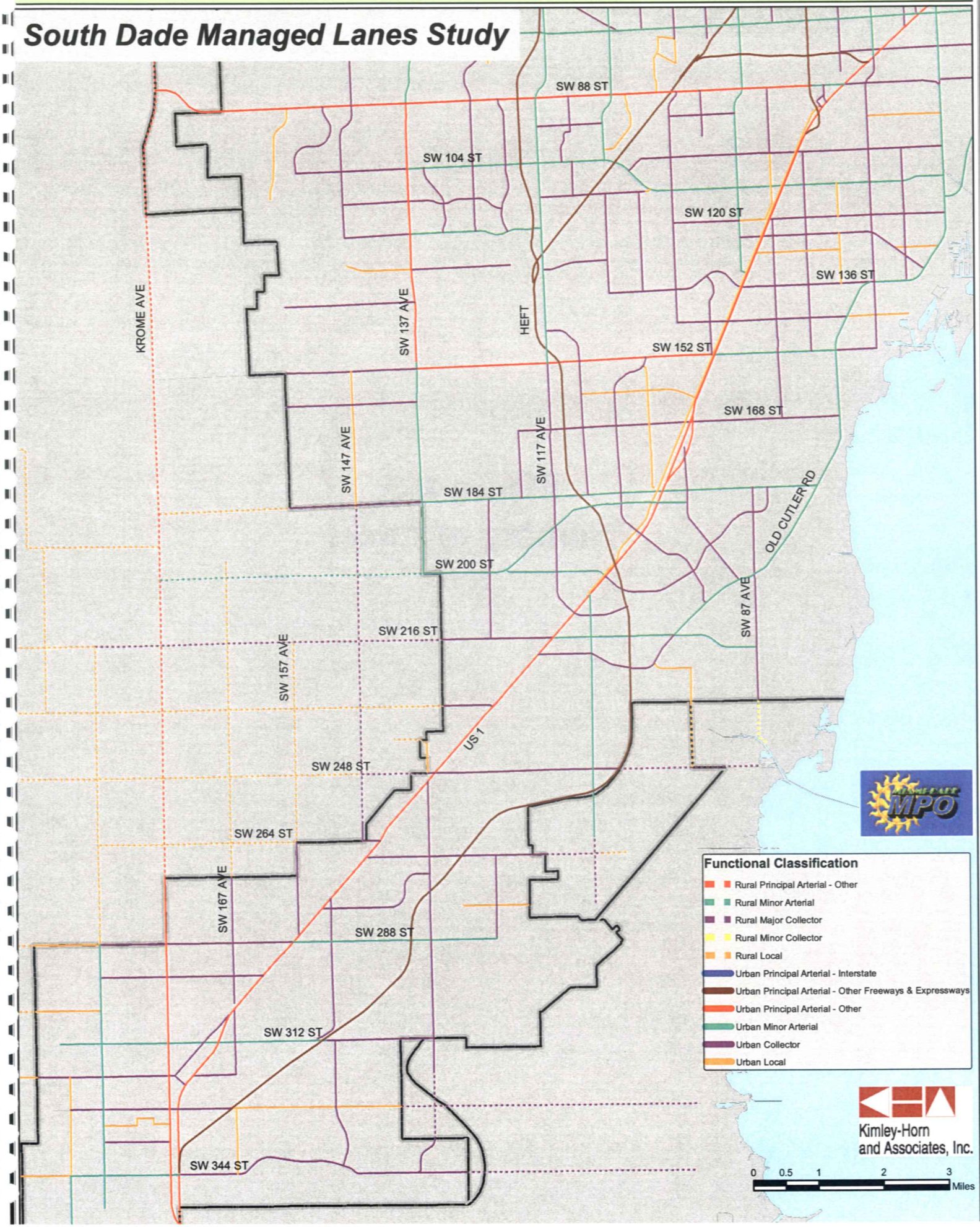


Figure B-5
Number of Lanes

Bi-directional Number of Lanes

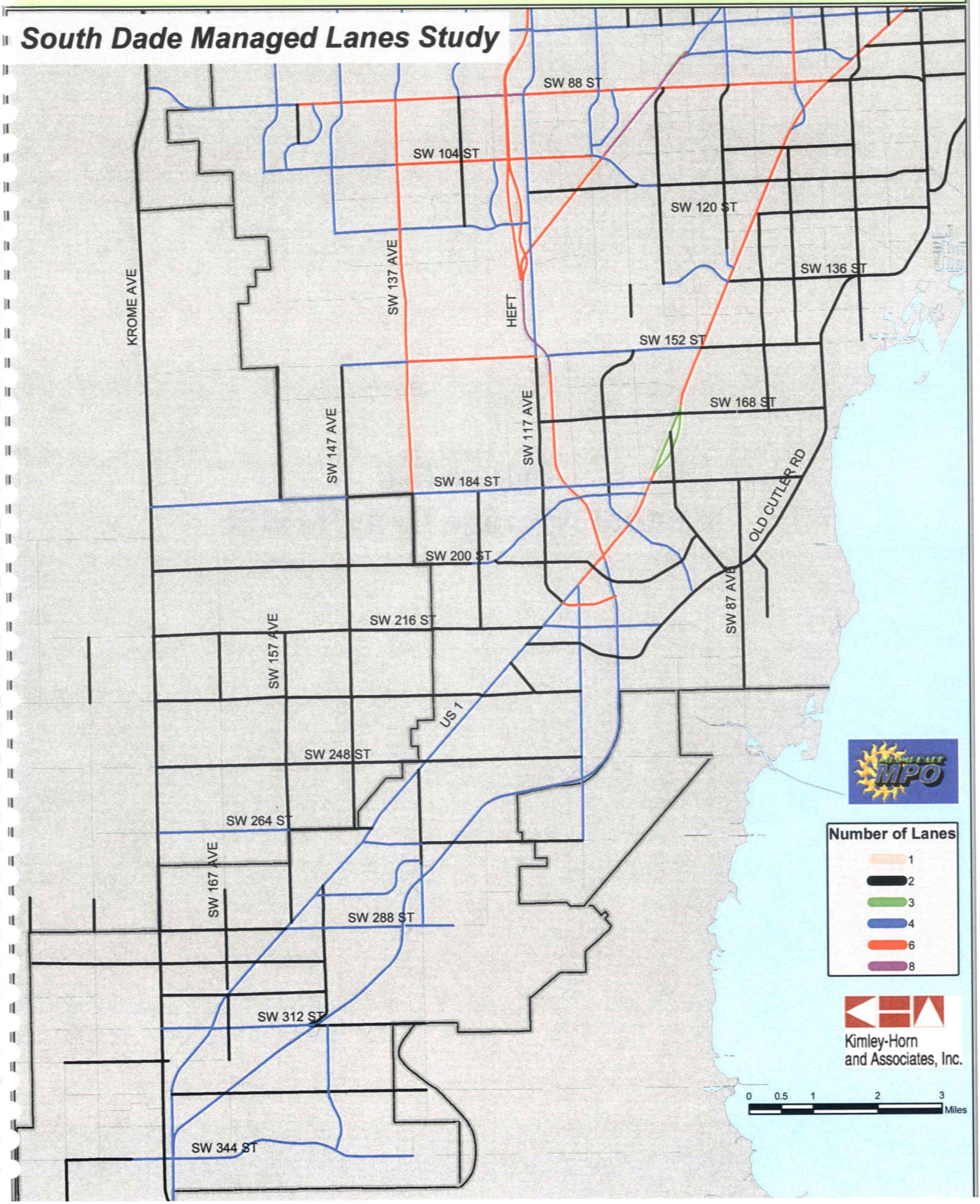


Figure B-6
Annual Average Daily Traffic

Annual Average Daily Volume (2005)

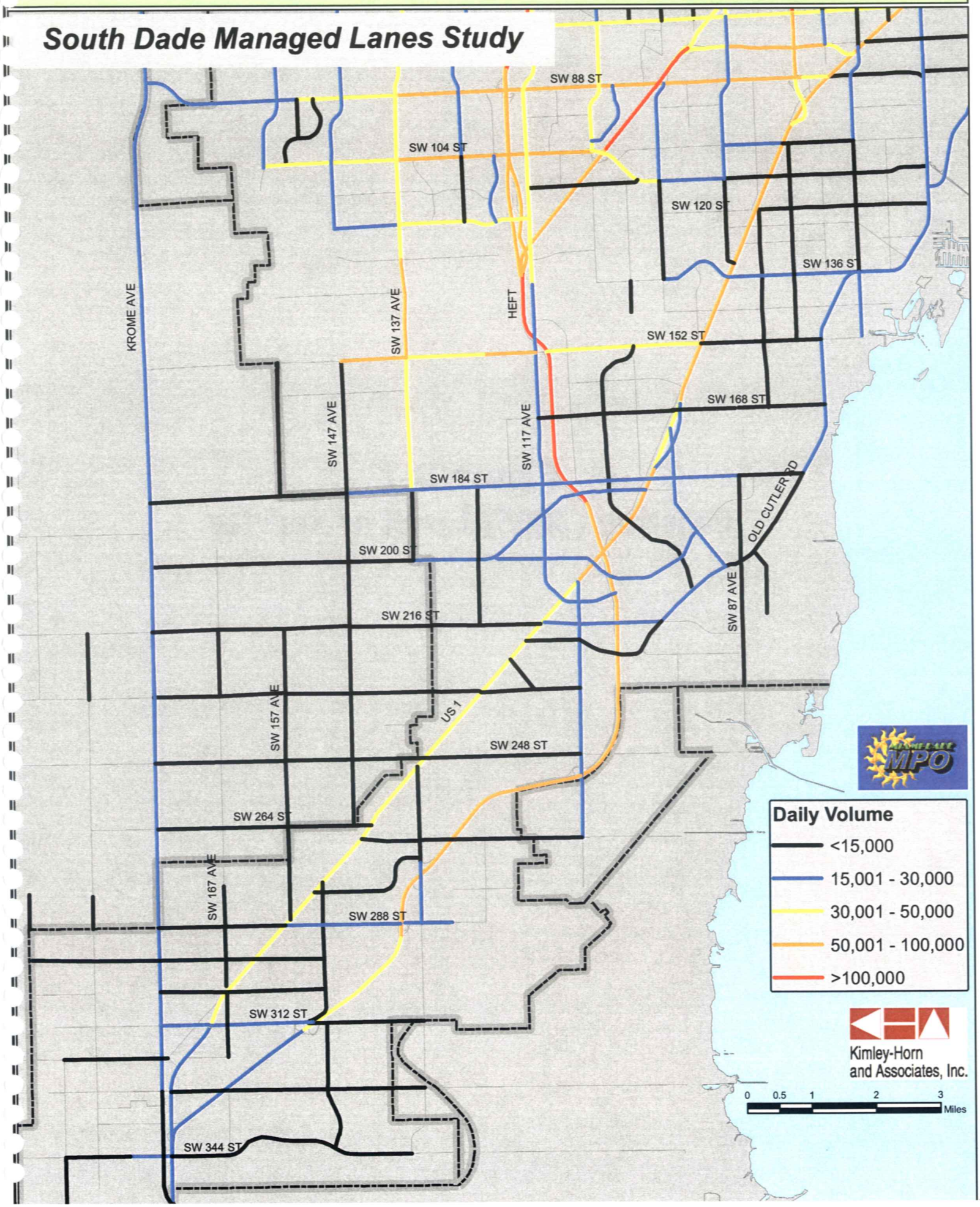


Figure B-7
Existing (2005) Level of Service

Level of Service (2005)

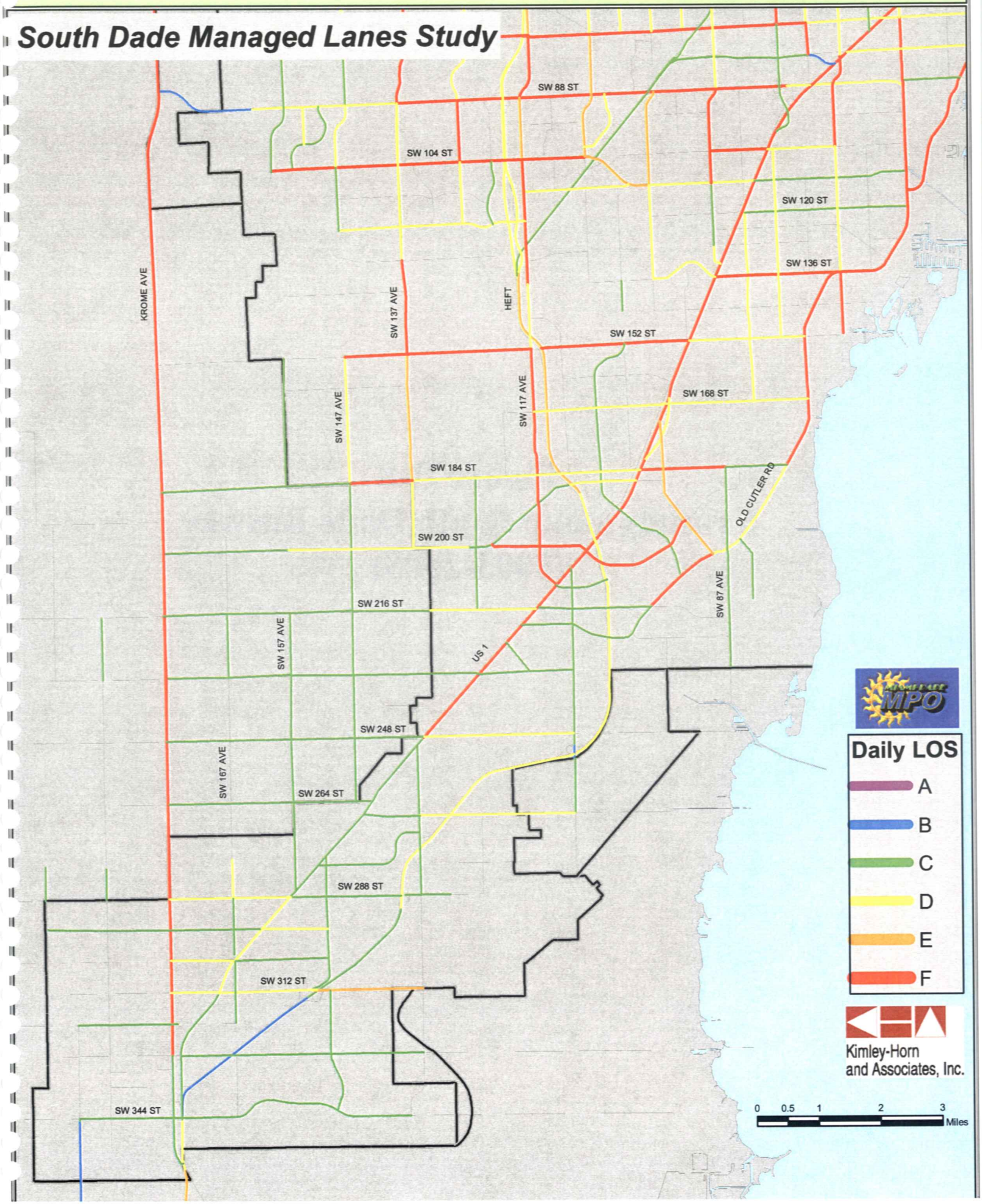


Figure B-8
Crashes along South Dade Busway
(2003-2005)

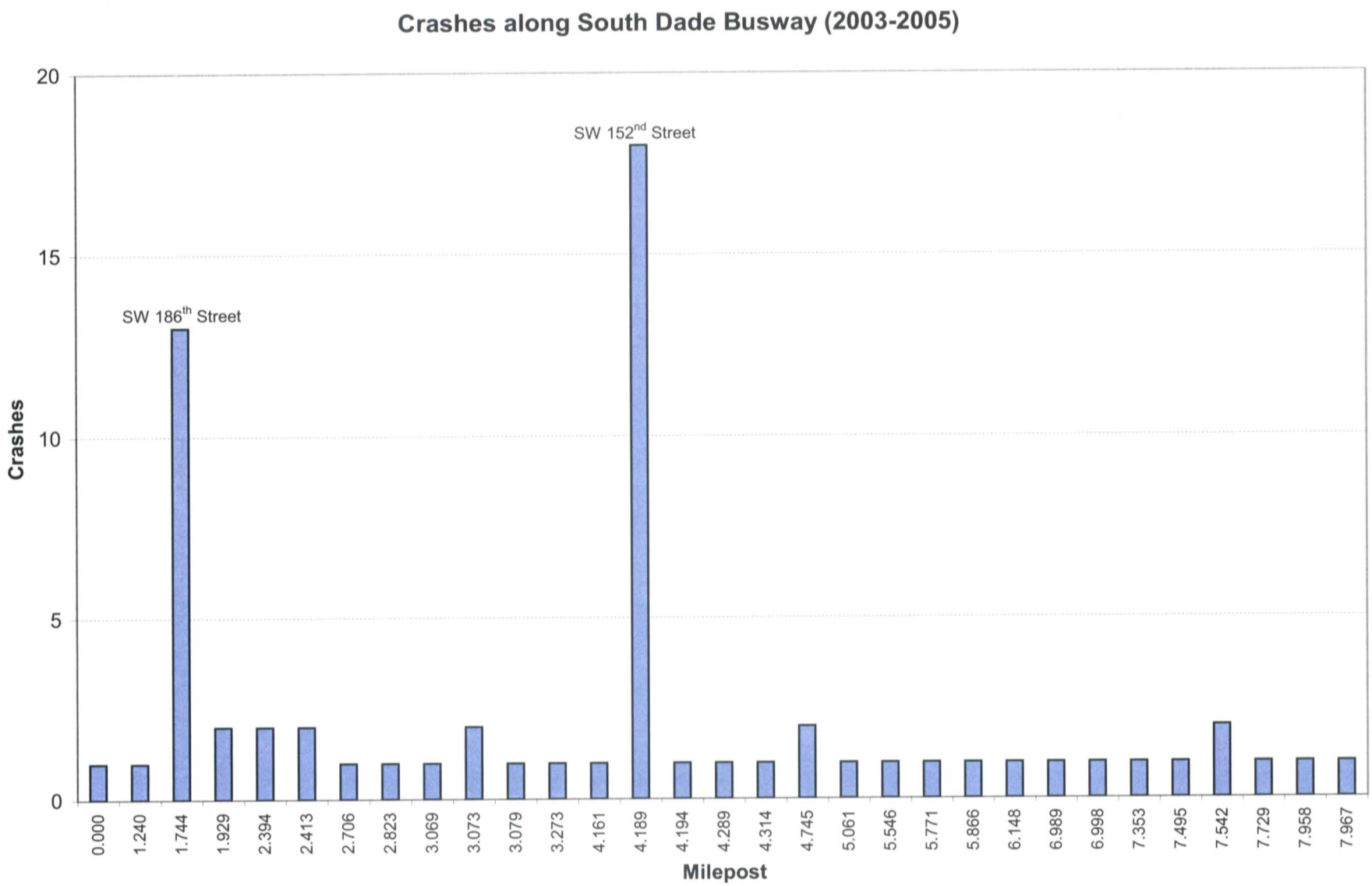

Crashes along South Dade Busway (2003-2005)
Crashes
20
15
10
5
0
SW 186th Street
SW 152nd Street
0.000
1.240
1.744
1.929
2.394
2.413
2.706
2.823
3.069
3.073
3.079
3.273
4.161
4.189
4.194
4.289
4.314
4.745
5.061
5.546
5.771
5.866
6.148
6.989
6.998
7.353
7.495
7.542
7.729
7.958
7.967
Milepost

Figure B-9
Existing Bus Routes

Existing Bus Routes

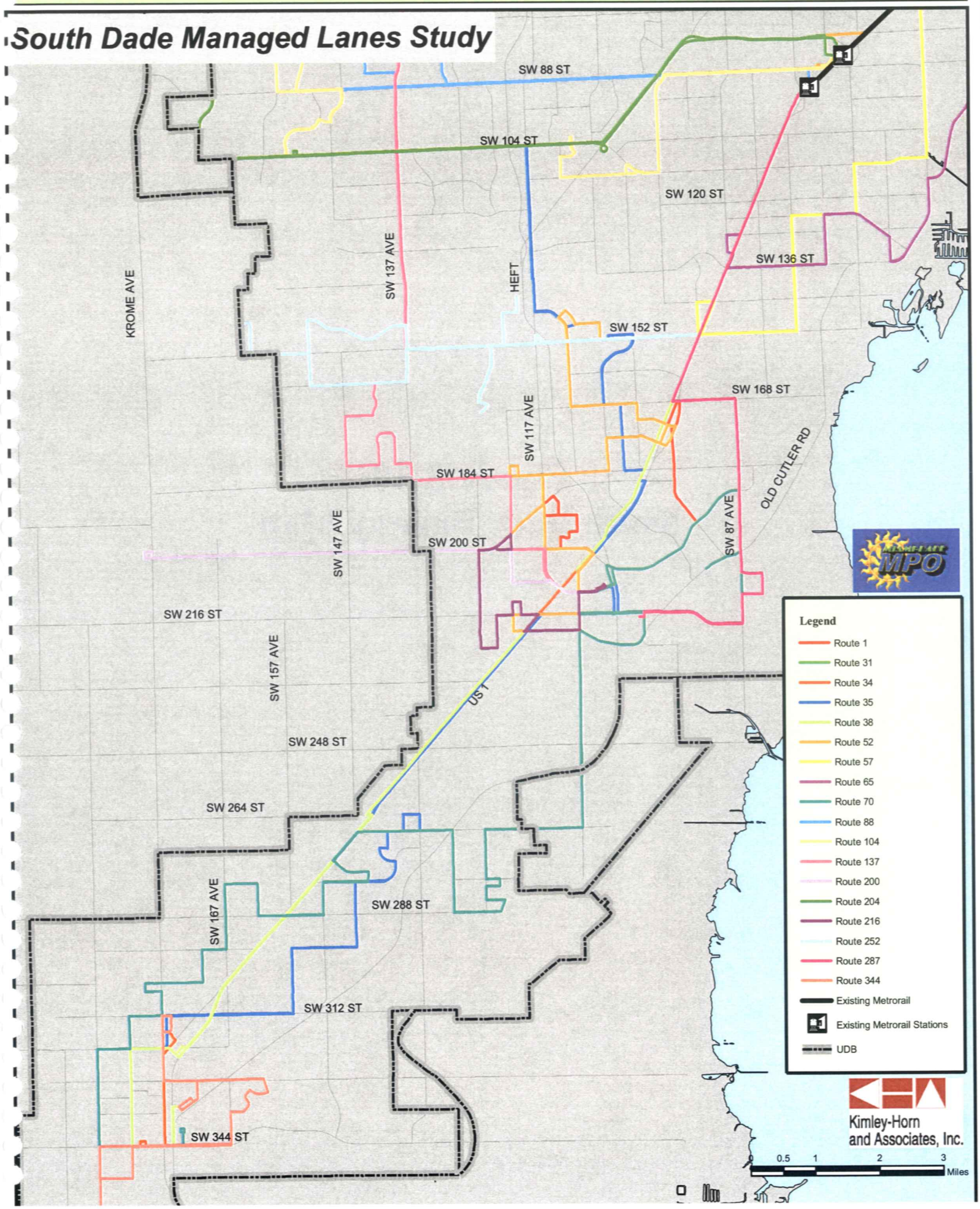


Figure B-10
South Dade Busway Map

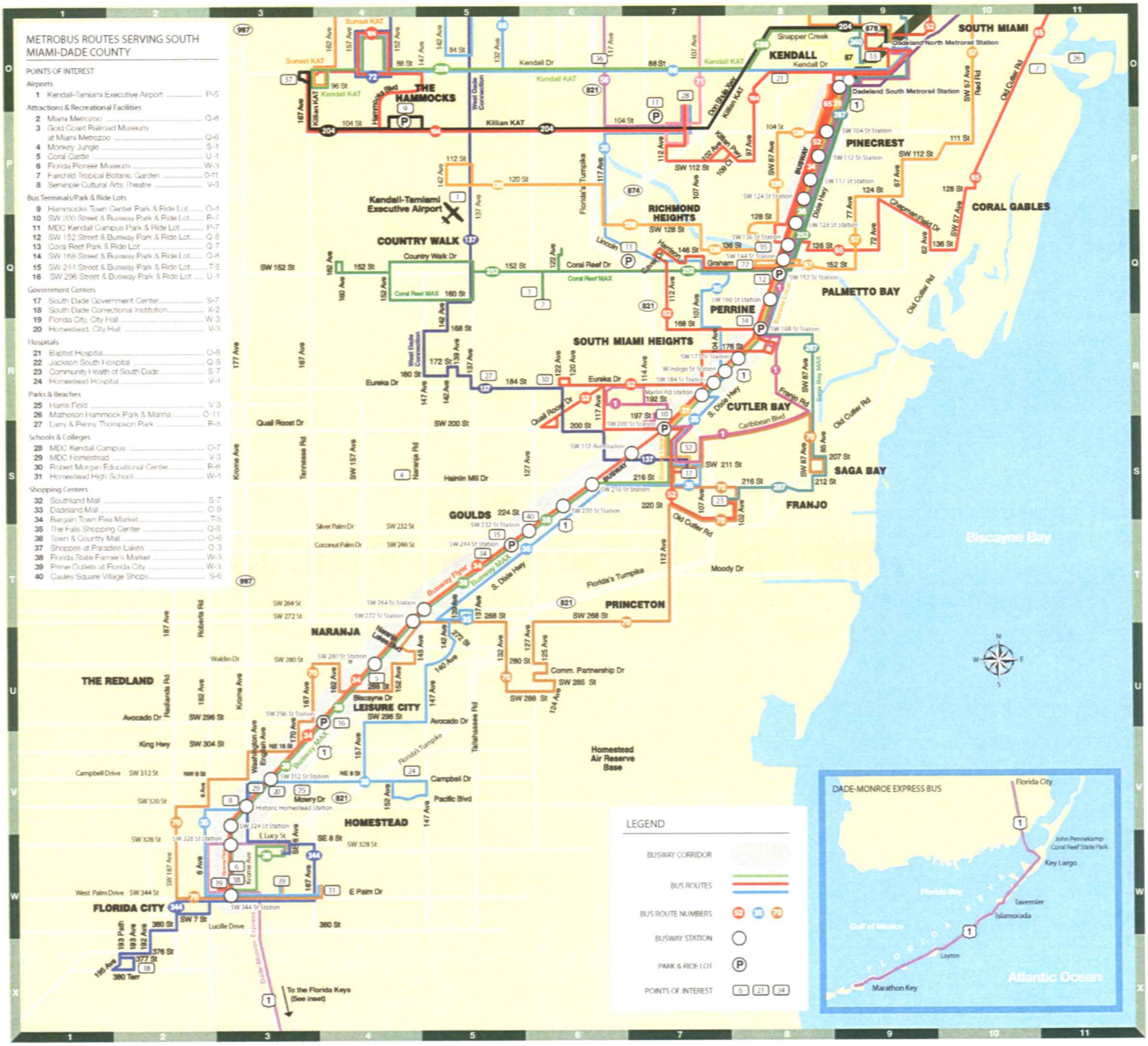
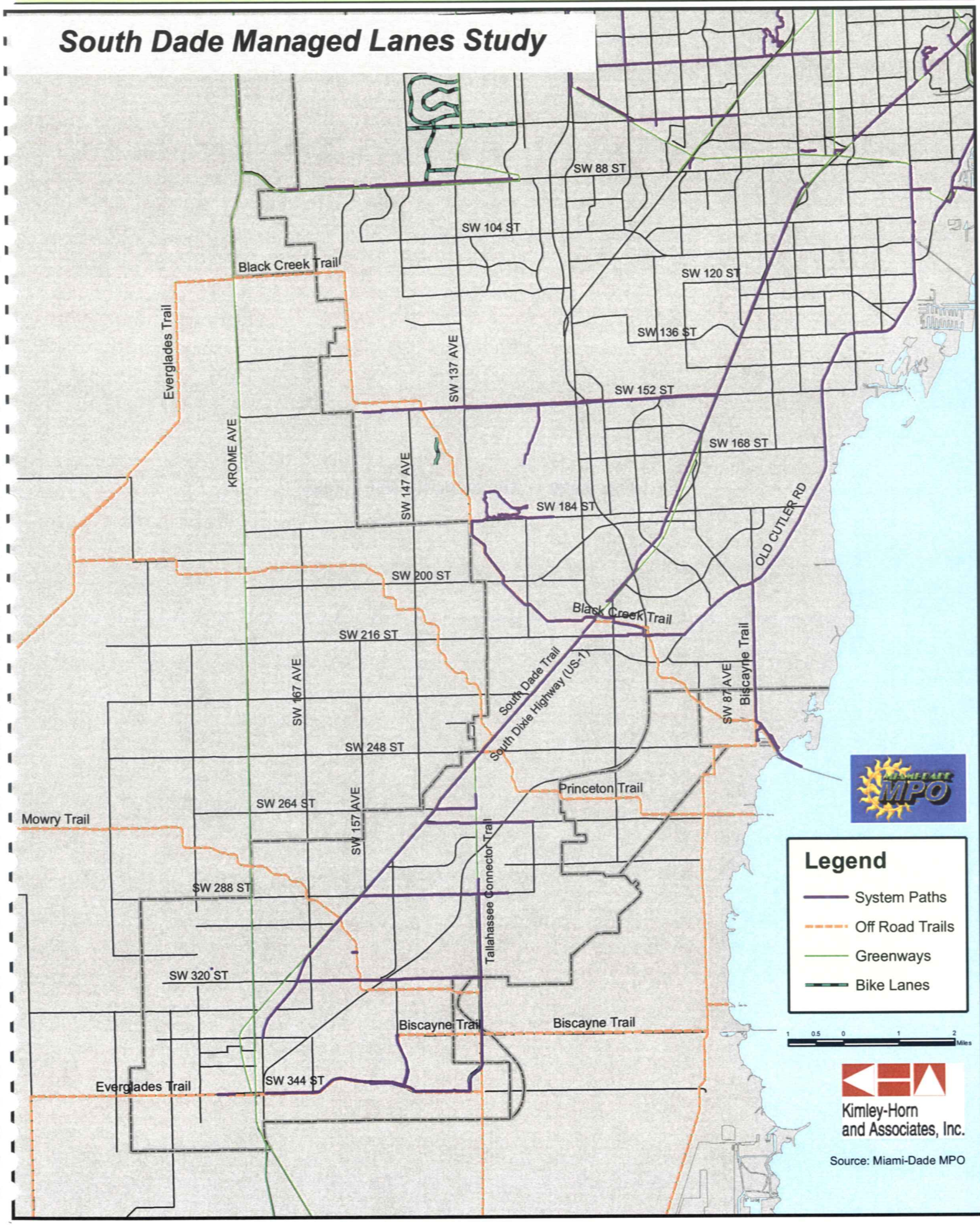

METROBUS ROUTES SERVING SOUTH MIAMI-DADE COUNTY
POINTS OF INTEREST
Airports
1 Kendall-Tamiami Executive Airport P-5
Attractions & Recreational Facilities
2 Miami Metrozoo Q-8
3 Gold Coast Railroad Museum at Miami Metrozoo Q-6
4 Monkey Jungle S-1
5 Coral Castle U-1
6 Florida Pioneer Museum W-3
7 Fairchild Tropical Botanic Garden O-11
8 Seminole Cultural Arts Theatre V-3
Bus Terminals/Park & Ride Lots
9 Hammocks Town Center Park & Ride Lot O-1
10 SW 200 Street & Busway Park & Ride Lot R-7
11 MDC Kendall Campus Park & Ride Lot P-7
12 SW 152 Street & Busway Park & Ride Lot Q-8
13 Coral Reef Park & Ride Lot Q-7
14 SW 168 Street & Busway Park & Ride Lot Q-8
15 SW 211 Street & Busway Park & Ride Lot T-5
16 SW 296 Street & Busway Park & Ride Lot U-1
Government Centers
17 South Dade Government Center S-7
18 South Dade Correctional Institution X-2
19 Florida City, City Hall W-3
20 Homestead, City Hall V-3
Hospitals
21 Baptist Hospital O-8
22 Jackson South Hospital Q-8
23 Community Health of South Dade S-7
24 Homestead Hospital V-1
Parks & Beaches
25 Harris Field V-3
26 Matheson Hammock Park & Marina O-11
27 Larry & Penny Thompson Park R-5
Schools & Colleges
28 MDC Kendall Campus O-7
29 MDC Homestead V-3
30 Robert Morgan Educational Center R-4
31 Homestead High School W-1
Shopping Centers
32 Southland Mall S-7
33 Dadeland Mall O-9
34 Bargan Town Flea Market T-5
35 The Falls Shopping Center Q-8
36 Town & Country Mall O-6
37 Shoppes at Paradise Lakes O-3
38 Florida State Farmer's Market W-3
39 Prime Outlets at Florida City W-3
40 Cauley Square Village Shops S-6
SOUTH MIAMI
KENDALL
THE HAMMOCKS
PINECREST
CORAL GABLES
Kendall-Tamiami Executive Airport
COUNTRY WALK
RICHMOND HEIGHTS
PALMETTO BAY
PERRINE
SOUTH MIAMI HEIGHTS
CUTLER BAY
SAGA BAY
FRANJO
GOULDS
PRINCETON
NARANJA
THE REDLAND
LEISURE CITY
HOMESTEAD
FLORIDA CITY
Homestead Air Reserve Base
Biscayne Bay
Atlantic Ocean
To the Florida Keys (See inset)
LEGEND
BUSWAY CORRIDOR
BUS ROUTES
BUS ROUTE NUMBERS
BUSWAY STATION
PARK & RIDE LOT
POINTS OF INTEREST
DADE-MONROE EXPRESS BUS
Florida City
John Pennekamp Coral Reef State Park
Key Largo
Tavernier
Islamorada
Layton
Marathon Key
Florida Bay
Gulf of Mexico
Atlantic Ocean

Figure B-11
Bicycle and Pedestrian Facilities

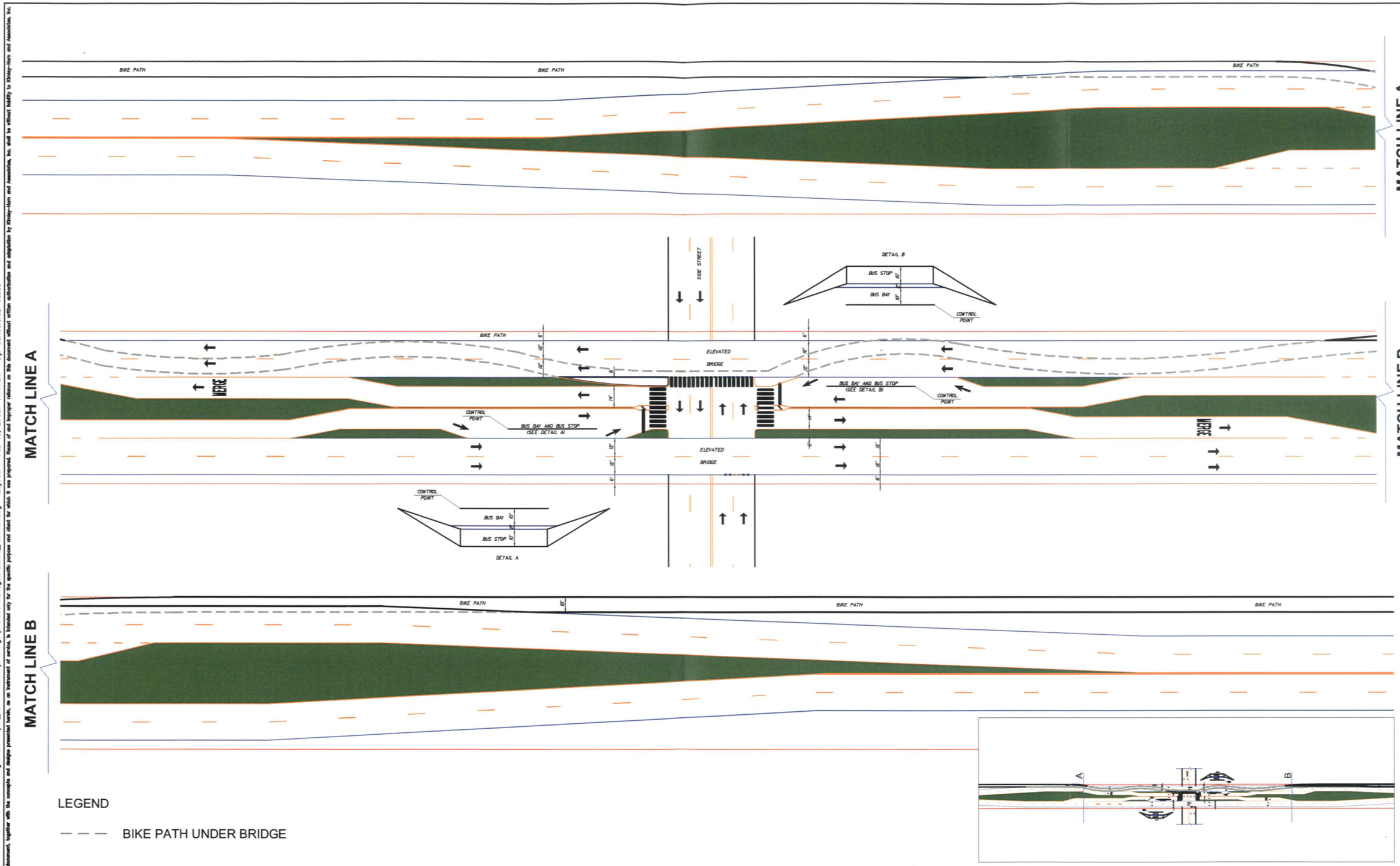
Bicycle and Pedestrian Facilities



{This page is intentionally left blank}

Appendix C
Full Access Interchange Concept

{This page is intentionally left blank}



LEGEND

— — — BIKE PATH UNDER BRIDGE

Drawing name: G:\040829015-MPO S Dade Managed Lanes\CD_12-04-2007\Drawings\S Dade Managed Lanes_recover.dwg Layout1 Feb 13, 2008 11:47am by: carlos.cruz-casas

This document, together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.

EBS ENGINEERING, INC.
4715 NW 157 STREET, SUITE 202
MIAMI, FLORIDA-33014.
PHONE: 305-625-5252
FAX: 305-625-7110.

Kimley-Horn and Associates, Inc.
5200 NW 33RD AVENUE, SUITE 109
FT. LAUDERDALE, FL 33309
PHONE (954) 535-5100 FAX (954) 739-2247
WWW.KIMLEY-HORN.COM CA 00000696

© 2008 KIMLEY-HORN AND ASSOCIATES, INC.

MIAMI-DADE MPO

SOUTH DADE MANAGED LANES STUDY

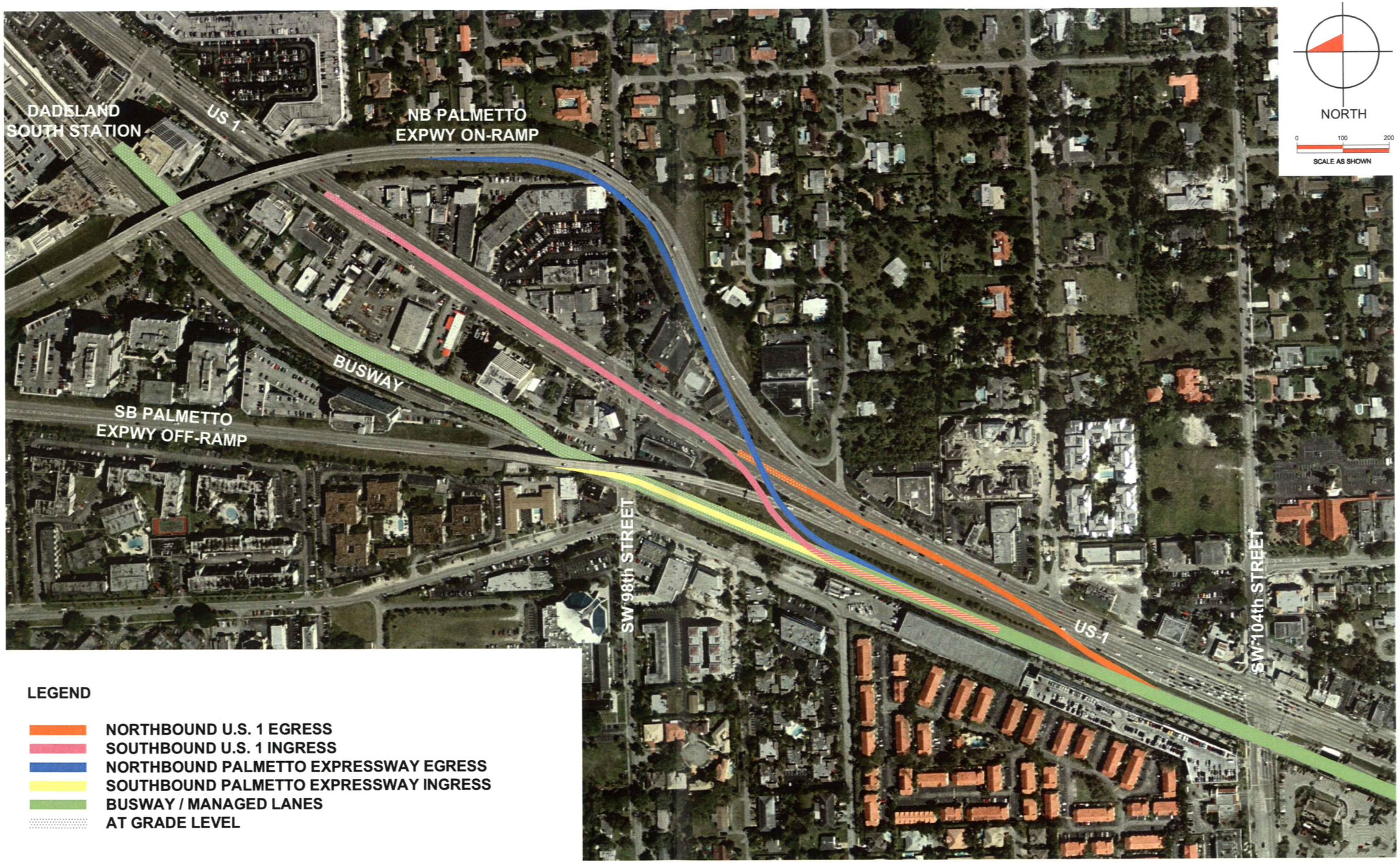
DATE 02/08

PROJECT NO. 040829015

POTENTIAL FULL ACCESS INTERCHANGE CONCEPT

SHEET NUMBER 1

Appendix D
Managed Lanes Access Ramps



LEGEND

- NORTHBOUND U.S. 1 EGRESS
- SOUTHBOUND U.S. 1 INGRESS
- NORTHBOUND PALMETTO EXPRESSWAY EGRESS
- SOUTHBOUND PALMETTO EXPRESSWAY INGRESS
- BUSWAY / MANAGED LANES
- AT GRADE LEVEL

Kimley-Horn and Associates, Inc.
5200 NW 33RD AVENUE, SUITE 109
FT. LAUDERDALE, FL 33309
PHONE (954) 535-5100 FAX (954) 739-2247
WWW.KIMLEY-HORN.COM CA 00000696

© 2008 KIMLEY-HORN AND ASSOCIATES, INC.

MIAMI-DADE MPO

SOUTH DADE
MANAGED LANES STUDY

DATE
02/08

PROJECT NO.
040829015

CONCEPTUAL MANAGED LANES RAMPS

SHEET NUMBER
1

Drawing name: G:\040829015-MPO S Dade Managed Lanes\CD_12-04-2007\Drawings\S Dade Managed Lanes_recover.dwg Layout1 (3) Feb 13, 2008 10:51am by: carlos.cruz-casas
This document, together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.

Appendix E
HNTB Memo

HNTB Corporation
Engineers Architects Planners

8700 West Flagler Street
Suite 200
Miami, Florida 33157

Telephone (305) 551-8100
Facsimile (305) 551-2800
www.hntb.com

Date
6/20/08

To:
Mayra Diaz

HNTB
General Consultants to the
Miami-Dade Expressway Authority

PROJECT
CORRESPONDENCE

From:
Mary H. Conway, P.E.

Subject:
20002, US 1 Managed Lanes Study
Hybrid Alternative

This memorandum proposes an alternative for consideration to the options presented in the South Dade Managed Lanes Study, Technical Memorandum # 2, Options for Managed Lanes prepared by Kimley-Horn and Associates (KHA) on November 2007 and the Traffic and Revenue Analysis prepared by WilburSmith and Associates (WSA) on June 2, 2008. This alternative was prepared by HNTB and was included in the Congestion-Reduction Demonstration Initiative application submitted to the Office of the Assistant Secretary for Transportation Policy, USDOT.

Based on the KHA study, US-1 would require at least two additional lanes to maintain a level of service D, especially on the section north of SW 152 Street. HNTB's proposed alternative will not completely address this need, however, our alternative focused on providing an option to the drivers along US-1 and reducing some of the congestion at a lower cost than the other alternatives..

The proposed alternative is a more feasible alternative as it will reduce existing vehicular congestion on US 1 (using controlled congestion pricing on the Busway) while improving Bus Rapid Transit along the Busway. HNTB's alternative is a hybrid of Alternatives 1 and 2 as indicated on the KHA study. This hybrid alternative maintains the existing two-lane facility and provides grade separation at the seven major intersections identified in the KHA report.

The following are the major differences between this proposed alternative and the KHA Alternative 2:

- Right-of-way acquisition and mainline bridge widening are no longer required, thereby reducing the project schedule and cost.
- Potential utility conflicts are reduced.
- Mainline Busway widening is no longer required, thereby reducing the project schedule and cost.
- Construction time and impacts to bus operations are significantly reduced.
- A majority of the bike path along the western right-of-way line is preserved.

Our preliminary cost estimate for this hybrid alternative is $228,008,070 and is attached for your reference. Please let me know if you need any additional information prior to the proposed follow up meeting with the MPO and KHA.

xc: Gary Walsh, Rene de Huelbes, Gorky Charpentier HNTB

M:\TECHPROD\MDX 5 year Work Program Projects\20002\U.S. 1 Managed Lanes\Alternative-Memo6-18-08.doc

Appendix F
Planning Level Cost Estimates

Alternative 1. Two Lane Alternative (At-grade)

	Work Category/Description	QTY		Unit Costs		Total Cost
10	**Site Work, Demolition,Reconstruction and Special Conditions**					
	Clearing and grubbing					$100,000.00
	Maintenance of traffic (MOT) (Through duration of Work)	3	MI	$50,000.00		$150,000.00
20	**Stations**					
	New Southern Terminus at SW 304th Street	1	EA	$1,220,000.00		$1,220,000.00
30	**New Roadway**					
	At-grade access to managed lanes including ramps	2	EA	$2,800,000.00		$5,600,000.00
	SW 104th Street managed lanes access ramps	1	EA	$2,800,000.00		$2,800,000.00
40	**System-wide Elements**					
	Toll Gantry (Mainline)	3	EA	$250,000.00		$750,000.00
	Toll Collection System	3	EA	$1,000,000.00		$3,000,000.00
	Transit Signal Priority	34	EA	$50,000.00		$1,700,000.00
	Toll Rate Dynamic Message Signs (Access Ramps)	8	EA	$70,000.00		$560,000.00
	Dynamic Message Signs (Mainline)	6	EA	$220,000.00		$1,320,000.00
	CCTV Camera and vehicle detection equipment	21	EA	$20,000.00		$420,000.00
60	**ROW**					
70	**Miscellaneous**					
	Construction Sub-total					**$17,620,000.00**
100	**Contingency**					
	Design/Administration/Prof. Services - 15 %	15	%			$2,643,000.00
	Construction Contingency - 10 %	10	%			$1,762,000.00
	Mobilization - 5%	5	%			$881,000.00
	Total					**$22,906,000.00**

Alternative 2A. Three Lane Alternative (limited grade separation)

	Work Category/Description	QTY		Unit Costs		Total Cost
10	**Site Work, Demolition,Reconstruction and Special Conditions**					
	Demolish & Remove Existing Roadway 2 lanes and Ped Way	3.46	MI	$731,200.00		$2,529,952.00
	Earthwork & Grade Preparation	3.46	MI	$274,560.00		$949,977.60
	Site Utilities and Relocation	3.46	MI	$190,080.00		$657,676.80
	Maintenance of traffic (MOT) (Through duration of Work)	7	MI	$50,000.00		$350,000.00
20	**Stations**					
	Construct New Ground Level Bus Stations	24	STA	$500,000.00		$12,000,000.00
	Construct New Elevated Bus Stations	20	STA	$2,292,000.00		$45,840,000.00
	New Southern Terminus at SW 304th Street	1	EA	$1,220,000.00		$1,220,000.00
30	**New Roadway**					
	Three Lanes of At-Grade Managed Lanes	13.24	MI	$11,620,000.00		$153,848,800.00
	Managed Lanes Access Interchanges with Ramps	2	EA	$36,400,000.00		$72,800,000.00
	Bus Only Access Interchanges with Ramps	1	EA	$36,400,000.00		$36,400,000.00
	Grade Separations w/MSE - 5700 x 60 ft w/300 ft center spans	1	EA	$14,385,000.00		$14,385,000.00
	Grade Separations w/MSE - 2100 x60 ft w/100 ft center spans	3	EA	$5,300,000.00		$15,900,000.00
	Palmetto Expressway On-Ramp	0.4	MI	$7,000,000.00		$2,800,000.00
	Palmetto Expressway Off-Ramp	0.12	MI	$7,000,000.00		$840,000.00
	U.S. 1 On-Ramp at Dadeland South	0.2	MI	$7,000,000.00		$1,400,000.00
	U.S. 1 Off-Ramp Dadeland South	0.2	MI	$7,000,000.00		$1,400,000.00
40	**System-wide Elements**					
	Toll Gantry (Mainline)	3	EA	$250,000.00		$750,000.00
	Toll Collection System	3	EA	$1,000,000.00		$3,000,000.00
	Transit Signal Priority	28	EA	$50,000.00		$1,400,000.00
	Dynamic Message Signs (Reversible Lane and Mainline)	6	EA	$220,000.00		$1,320,000.00
	Toll Rate Dynamic Message Signs (Access Ramps)	8	EA	$70,000.00		$560,000.00
	CCTV Camera and vehicle detection equipment	21	EA	$20,000.00		$420,000.00
60	**ROW**					
	ROW for Palmetto Expressway Connection					$10,500,000.00
70	**Miscellaneous**					
	Reconstruct 10-foot Bike Lane	16.7	MI	$350,000.00		$5,845,000.00
	Construction Sub-total					**$381,271,406.40**
100	**Contingency**					
	Design/Administration/Prof. Services - 15 %	15	%			$57,190,710.96
	Construction Contingency - 10 %	10	%			$38,127,140.64
	Mobilization - 5%	5	%			$19,063,570.32
	Total					**$495,652,828.32**

Alternative 2B. Four Lane Alternative (limited grade separation)

	Work Category/Description	QTY		Unit Costs		Total Cost
10	**Site Work, Demolition,Reconstruction and Special Conditions**					
	Demolish & Remove Existing Roadway 2 lanes and Ped Way	3.46	MI	$731,200.00		$2,529,952.00
	Earthwork & Grade Preparation	3.46	MI	$274,560.00		$949,977.60
	Site Utilities and Relocation	3.46	MI	$190,080.00		$657,676.80
	Maintenance of traffic (MOT) (Through duration of Work)	7	MI	$50,000.00		$350,000.00
20	**Stations**					
	Construct New Ground Level Bus Stations	24	STA	$500,000.00		$12,000,000.00
	Construct New Elevated Bus Stations	20	STA	$2,292,000.00		$45,840,000.00
	New Southern Terminus at SW 304th Street	1	EA	$1,220,000.00		$1,220,000.00
30	**New Roadway**					
	Four-Lanes of At-Grade Managed Lanes	13.24	MI	$13,242,000.00		$175,324,080.00
	Managed Lanes Access Interchanges with Ramps	2	EA	$36,400,000.00		$72,800,000.00
	Bus Only Access Interchanges with Ramps	1	EA	$36,400,000.00		$36,400,000.00
	Grade Separations w/MSE - 5700 x 60 ft w/300 ft center spans	1	EA	$14,385,000.00		$14,385,000.00
	Grade Separations w/MSE - 2100 x60 ft w/100 ft center spans	3	EA	$5,300,000.00		$15,900,000.00
	Palmetto Expressway On-Ramp	0.4	MI	$7,000,000.00		$2,800,000.00
	Palmetto Expressway Off-Ramp	0.12	MI	$7,000,000.00		$840,000.00
	U.S. 1 On-Ramp at Dadeland South	0.2	MI	$7,000,000.00		$1,400,000.00
	U.S. 1 Off-Ramp Dadeland South	0.2	MI	$7,000,000.00		$1,400,000.00
40	**System-wide Elements**					
	Toll Gantry (Mainline)	3	EA	$250,000.00		$750,000.00
	Toll Collection System	3	EA	$1,000,000.00		$3,000,000.00
	Transit Signal Priority	28	EA	$50,000.00		$1,400,000.00
	Dynamic Message Signs (Mainline)	6	EA	$220,000.00		$1,320,000.00
	Toll Rate Dynamic Message Signs (Access Ramps)	8	EA	$70,000.00		$560,000.00
	CCTV Camera and vehicle detection equipment	21	EA	$20,000.00		$420,000.00
60	**ROW**					
	ROW for Palmetto Expressway Connection					$10,500,000.00
70	**Miscellaneous**					
	Reconstruct 10-foot Bike Lane	16.7	MI	$350,000.00		$5,845,000.00
	Construction Sub-total					**$408,591,686.40**
100	**Contingency**					
	Design/Administration/Prof. Services - 15 %	15	%			$61,288,752.96
	Construction Contingency - 10 %	10	%			$40,859,168.64
	Mobilization - 5%	5	%			$20,429,584.32
	Total					**$531,169,192.32**

POTENTIAL CONSTRUCTION COST BREAKDOWN FOR SOUTH DADE MANAGED LANES

HYBRID Alternative

As indicated on the Application to USDOT

						Segment 1		Segment 2		Segment 3		
	Work Category/Description	**QTY**		**Unit Costs**	**Total Cost**	**QTY**	**Total Cost**	**QTY**	**Total Cost**	**QTY**	**Total Cost**	**Remarks**
10	**Site Work, Demolition,Reconstruction and Special Conditions**					**1.0**		**3.0**		**3.0**		
	Demolish & Remove Existing Roadway 2 lanes and Ped Way	4.00	MI	$600,000.00	$2,400,000.00	0.6	$342,857.14	1.7	$1,028,571.43	1.7	$1,028,571.43	
	Earthwork & Grade Preparation	4.00	MI	$275,000.00	$1,100,000.00	0.6	$157,142.86	1.7	$471,428.57	1.7	$471,428.57	
	Site Utilities and Relocation	4.00	MI	$200,000.00	$800,000.00	0.6	$114,285.71	1.7	$342,857.14	1.7	$342,857.14	
	Maintenance of traffic (MOT)	7.00	EA	$500,000.00	$3,500,000.00	1.0	$500,000.00	3.0	$1,500,000.00	3.0	$1,500,000.00	
20	**Stations**											
	Reconstruct New Ground Level Bus Stations	14.00	STA	$100,000.00	$1,400,000.00	2.0	$200,000.00	6.0	$600,000.00	6.0	$600,000.00	
30	**New Roadway**											
	Two lane undivided	4.00	MI	$5,110,285.00	$20,441,140.00	0.6	$2,920,162.86	1.7	$8,760,488.57	1.7	$8,760,488.57	
	Grade Separations at major intersections	7.00	EA	$15,840,000.00	$110,880,000.00	1.0	$15,840,000.00	3.0	$47,520,000.00	3.0	$47,520,000.00	
40	**System-wide Elements**											
	Toll Gantry (Mainline)	3.00	EA	$250,000.00	$750,000.00			1.0	$250,000.00	2.0	$500,000.00	Mainline toll gantries between managed lanes access points along the corridor.
	Toll Collection System (every 4 miles)	3.00	EA	$1,000,000.00	$3,000,000.00	0.4	$428,571.43	1.3	$1,285,714.29	1.3	$1,285,714.29	Toll collection on mainline only.
	Transit Signal Priority	28.00	EA	$50,000.00	$1,400,000.00	16.0	$800,000.00	6.0	$300,000.00	6.0	$300,000.00	
	Dynamic Message Signs (Mainline) every two miles	6	EA	$220,000.00	$1,320,000.00	1.0	$220,000.00	2.0	$440,000.00	3.0	$660,000.00	Between ML access points and tolling locations.
	Toll Rate Dynamic Message Signs (Access Ramps)	10.00	EA	$70,000.00	$700,000.00					10.0	$700,000.00	Three at Dadeland South; two at Coral Reef; two at 117th Ave; and one at 304th Street.
	CCTV Camera and vehicle detection equipment	30.00	EA	$20,000.00	$600,000.00					30.0	$600,000.00	At entrance and exit ramps, and toll booths.
60	**ROW**											
	ROW for constr. of at-grade separations		LS									
70	**Miscellaneous**											
	Reconstruct 10-foot Bike Lane	0.60	MI	$350,000.00	$210,000.00	0.1	$30,000.00	0.3	$90,000.00	0.3	$90,000.00	
	Construction Sub-total				**$148,501,140.00**		**$21,553,020.00**		**$62,589,060.00**		**$64,359,060.00**	
100	**Contingency**											
	Design/Administration/Prof. Services - 15 %	15.00	%		$22,275,171.00	15.00%	$3,232,953.00	15.00%	$9,388,359.00	15.00%	$9,653,859.00	
	Construction Contingency - 10 %	10.00	%		$14,850,114.00	10.00%	$2,155,302.00	10.00%	$6,258,906.00	10.00%	$6,435,906.00	
	Mobilization (5% Construction Cost)	5.00	%		$7,425,057.00	5.00%	$1,077,651.00	5.00%	$3,129,453.00	5.00%	$3,217,953.00	
	Total				**$186,626,425.00**		**$26,941,275.00**		**$78,236,325.00**		**$80,448,825.00**	

Alternative 3. Four Lane Alternative (Elevated)

	Work Category/Description	QTY		Unit Costs		Total Cost
10	**Site Work, Demolition,Reconstruction and Special Conditions**					
	Demolish & Remove Existing Roadway 2 lanes and Ped Way	16.7	MI	$731,200.00		$12,211,040.00
	Earthwork & Grade Preparation	16.7	MI	$274,560.00		$4,585,152.00
	Site Utilities and Relocation	16.7	MI	$190,080.00		$3,174,336.00
	Maintenance of traffic (MOT) (Through duration of Work)	16.7	MI	$50,000.00		$835,000.00
20	**Stations**					
	Construct New Ground Level Bus Stations at Intermediate Access Points	11	STA	$500,000.00		$5,500,000.00
	Construct New Elevated Bus Stations	34	STA	$2,292,000.00		$77,928,000.00
	New Southern Terminus at SW 304th Street	1	EA	$1,220,000.00		$1,220,000.00
30	**New Roadway**					
	Four Lane Elevated Managed Lanes btn. Dadeland South and SW 304 Street	11	MI	$74,000,000.00		$814,000,000.00
	Managed Lanes Access Interchanges with Ramps	2	EA	$36,400,000.00		$72,800,000.00
	Bus Only Access Interchanges with Ramps	3	EA	$36,400,000.00		$109,200,000.00
	Palmetto Expressway On-Ramp	0.4	MI	$7,000,000.00		$2,800,000.00
	Palmetto Expressway Off-Ramp	0.12	MI	$7,000,000.00		$840,000.00
	U.S. 1 On-Ramp at Dadeland South	0.2	MI	$7,000,000.00		$1,400,000.00
	U.S. 1 Off-Ramp Dadeland South	0.2	MI	$7,000,000.00		$1,400,000.00
	Grade Separations w/MSE - 2100 x60 ft w/100 ft center spans	7	EA	$5,300,000.00		$37,100,000.00
	Grade Separations w/MSE - 5700 x 60 ft w/300 ft center spans	1	EA	$14,385,000.00		$14,385,000.00
40	**System-wide Elements**					
	Toll Gantry (Mainline)	3	EA	$250,000.00		$750,000.00
	Toll Collection System	3	EA	$1,000,000.00		$3,000,000.00
	Transit Signal Priority	5	EA	$50,000.00		$250,000.00
	Dynamic Message Signs (Mainline)	6	EA	$220,000.00		$1,320,000.00
	Toll Rate Dynamic Message Signs (Access Ramps)	8	EA	$70,000.00		$560,000.00
	CCTV Camera and vehicle detection equipment	21	EA	$20,000.00		$420,000.00
60	**ROW**					
	ROW for Palmetto Expressway Connection					$10,500,000.00
70	**Miscellaneous**					
	Reconstruct 10-foot Bike Lane	16.7	MI	$350,000.00		$5,845,000.00
	Construction Sub-total					**$1,182,023,528.00**
100	**Contingency**					
	Design/Administration/Prof. Services - 15 %	15	%			$177,303,529.20
	Construction Contingency - 10 %	10	%			$118,202,352.80
	Mobilization - 5%	5	%			$59,101,176.40
	Total					**$1,536,630,586.40**

South Dade Managed Lane Study
Summary of Estimated Toll System Capital and M&O Costs
August 14, 2008

	Alternative 1	Alternative 2a	Alternative 2b	Alternative 3
Toll System Capital Costs				
Equipment/Communications				
ETC Equipment	$ 162,000	$ 464,400	$ 464,400	$ 464,400
Plaza Equipment	$ 80,400	$ 80,400	$ 80,400	$ 80,400
TCS Host	$ 360,000	$ 360,000	$ 360,000	$ 360,000
Test Bench Simulator	$ 48,000	$ 50,400	$ 50,400	$ 50,400
Spare Equipment	$ 54,000	$ 133,200	$ 133,200	$ 133,200
Communications	$ -	$ -	$ -	$ -
Subtotal:	**$ 704,400**	**$ 1,088,400**	**$ 1,088,400**	**$ 1,088,400**
System Development/Deployment				
Software	$ 1,002,000	$ 1,002,000	$ 1,002,000	$ 1,002,000
Maintenance Online Management System	$ 36,000	$ 36,000	$ 36,000	$ 36,000
Training/Project Management	$ 420,000	$ 420,000	$ 420,000	$ 420,000
Warranty	$ 180,000	$ 180,000	$ 180,000	$ 180,000
Documentation	$ 120,000	$ 120,000	$ 120,000	$ 120,000
Hardware Installation	$ 108,000	$ 324,000	$ 324,000	$ 324,000
DMS	$ 612,000	$ 612,000	$ 612,000	$ 612,000
Subtotal:	**$ 2,478,000**	**$ 2,694,000**	**$ 2,694,000**	**$ 2,694,000**
Total Capital Cost:	**$ 3,182,400**	**$ 3,782,400**	**$ 3,782,400**	**$ 3,782,400**
Annual Toll System Maintenance and Operations Costs				
Labor	$ 200,000	$ 400,000	$ 400,000	$ 400,000
Parts	$ 30,000	$ 60,000	$ 60,000	$ 60,000
Communications	$ -	$ -	$ -	$ -
Transaction Processing	$ 593,016	$ 1,004,286	$ 1,004,286	$ 1,837,059
Total:	**$ 823,016**	**$ 1,464,286**	**$ 1,464,286**	**$ 2,297,059**

Assumptions:

1. Cost are estimated at 2008 USD.
2. 20% Contingency Included in all estimates except Maintenance Costs
3. Estimates do not include Civil Costs.
4. Communications not include in estimate.
5. Enforcement assumed to be revenue neutral.
6. Transaction Processing assumed to be $0.11 per trip.

Appendix G
Wilbur Smith Associates (WSA) Memo

June 2, 2008

Mr. Alfred Lurigados, PE
Director of Engineering
Miami Dade Expressway Authority
3790 N.W. 31st Street
Miami, FL 33142

Re: US 1 Managed Lanes Preliminary Traffic and Revenue Analysis

Dear Mr. Lurigados:

Wilbur Smith Associates (WSA) is pleased to submit this letter report for professional services for the Miami-Dade Expressway Authority. The purpose of this study was to provide a preliminary estimate of the traffic and revenue impacts associated with implementing a managed lanes concept on the South Dade Bus-way operated by the Miami-Dade Transit Authority (MDTA). Under this concept personal vehicles would be allowed to utilize the existing bus-way for a toll.

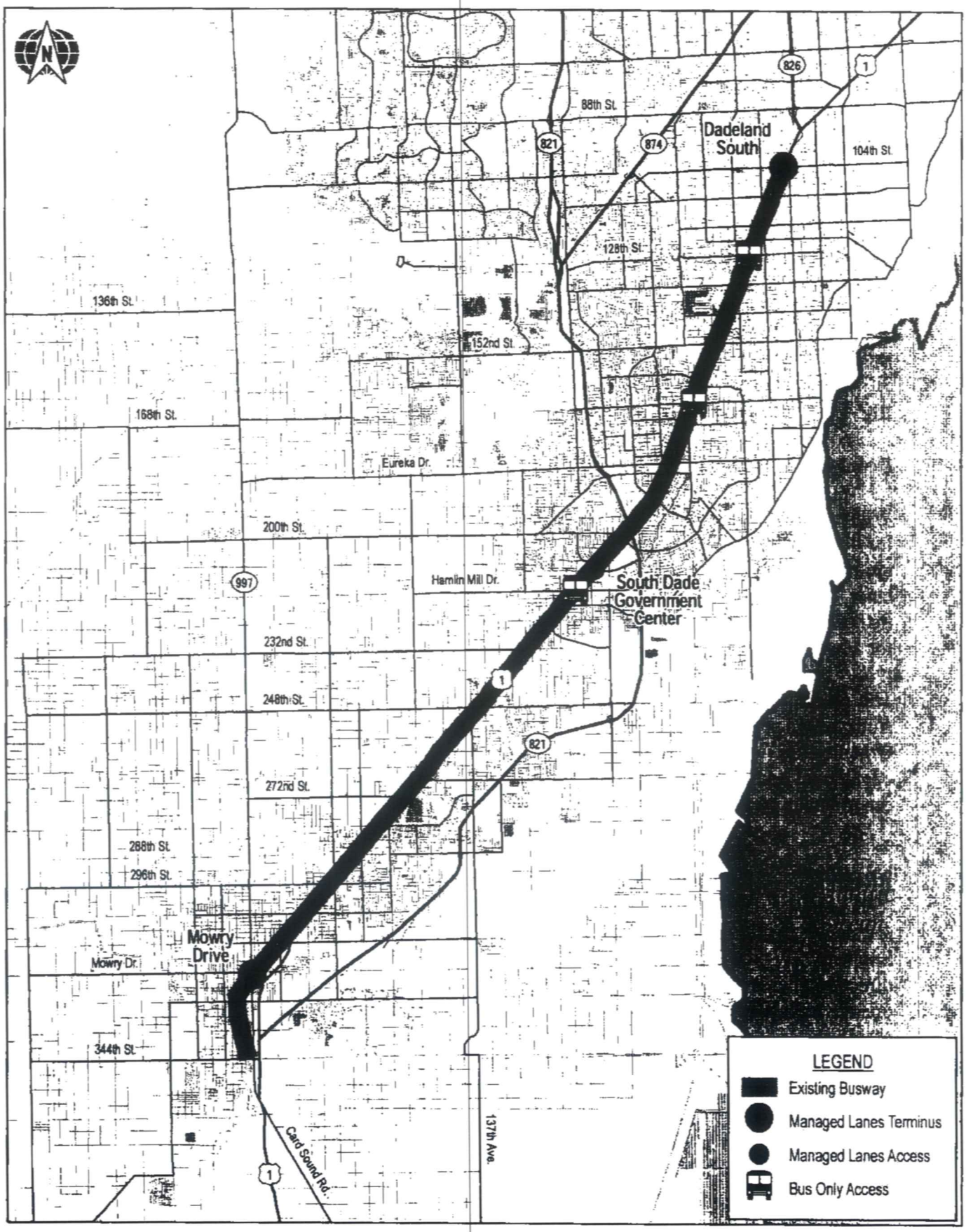
The preliminary estimates developed by WSA in this report are to be included in an ongoing study being performed by Kimley-Horn Associates for the Miami-Dade Metropolitan Planning Organization (MPO). In addition to estimates of traffic, WSA is to assist in the development, and operational costs for the proposed facility. The findings of this effort will also be included in the report under preparation by Kimley Horn.

PROJECT STUDY AREA AND STUDY ELEMENTS

As shown in Figure 1, the Miami-Dade Transit Authority operates a bus-way from Dadeland South to SW 304th Street. The 16.2 mile bus-way consists of two travel lanes, one in each direction, that is parallel to, but separated from traffic on US 1. The facility allows the MDTA to operate enhanced transit service by separating the Authority's vehicles from interactions with other vehicles on US 1 that could impede transit operation. MDTA currently operates 26 vehicles per hour on the facility during the peak period. However, this rapid transit service is limited by the fact that MDTA vehicles are still subject to delays from traffic signals on cross streets..

Several alternatives for the operation of this facility were studied as part of the South Link study that led to the creation of the South Dade Bus-way. One of the alternatives examined in the South Link Study included a partial grade separating the facility from US 1. This alternative

900 Chapel Street, Suite 1400 New Haven, Connecticut 06510
203.865.2191 f 203.624.0484 www.WilburSmith.com



WilburSmith ASSOCIATES

US 1 MANAGED LANE LOCATION AND ACCESS POINTS

FIGURE 1

examined enhancing the bus-ways operations by eliminating the need for buses utilizing the bus-way to be delayed at the most heavily congested intersections within the corridor. Another alternative examined during the South Link Study was constructing the bus-way as a completely grade separated facility parallel to US 1. The South Link Study determined that both of these alternatives would improve the operation of the bus-way, however, neither of these alternatives proved to be financially feasible. Part of the purpose of this study is to determine, if the bus-way were opened to toll paying passenger cars, would the revenue generated by the toll be sufficient to pay for upgrading the bus-way under either alternative (grade separations at selected locations or constructing a completely grade separated facility). A third alternative considered in this study was to allow toll paying customers to use the facility in its current configuration to begin generating revenue for the eventual upgrade of the bus-way.

One of the primary concerns brought out in discussions with the Miami-Dade MPO and MDTA is that in considering allowing private vehicles to use the bus-way, the operation of transit vehicles on the bus-way could not be degraded by the introduction of personal vehicles. This concern is addressed in the study by the managed lanes idea, i.e., that a sufficiently high toll rate will keep the volume of traffic on the facility low enough that transit operations on the facility would be unaffected by the addition of paying users. Another key concern was the potential for relieving congestion on US 1 with the introduction of the managed lanes on the bus-way. WSA designed the study of potential traffic and revenue for the use of the bus-way to address these concerns.

STUDY ALTERNATIVES

ACCESS CONFIGURATION

For all alternatives, access to the proposed project would be limited to the following locations:

1. Termini (passenger cars and buses)
    a. Northern Terminus: Dadeland South
    b. Southern Terminus: SW 304th Street

2. Managed Lanes and Bus Access Points (passenger cars and buses):
    a. SW 152nd Street
    b. SW 211th Street/SW117th Ave. (South Dade Government Center)

3. Bus Only Access Points:
    a. SW 104th Street
    b. SW 128th Street
    c. SW 168th Street
    d. SW 216th Street

The managed lane access points are shown on Figure 1. For the purposes of this report, the bus-way/managed lanes have been divided into three segments corresponding to the access points for passenger cars: Segment 1 refers to the southernmost segment, from SW 304th Street to SW 211th Street (South Dade Government Center); Segment 2 is the central segment, from SW 211th Street (South Dade Government Center) to SW 152nd Street; and Segment 3 is the northern segment, from SW 152nd Street to the northern terminus. Segment 1 is the longest, spanning about 8 miles along US 1; Segment 2 is approximately 4.6 miles; and Segment 3 is approximately 3.6 miles.

Tolling Assumptions

It was assumed that variable pricing by time of day and direction would be used for non-transit vehicles on any of the alternatives for the proposed facility. This assumption would assure that free-flow speeds on the bus-way would be maintained and that high level of service for transit operations on the facility would not be degraded with the introduction of passenger cars. It was also assumed that all tolls would be collected through electronic toll collection and all passenger cars would be required to have a transponder to use the facility.

Another important assumption was that commercial trucks would not be allowed to use the managed lanes and that transit vehicles on the bus-way would not pay a toll.

Description of Alternatives

Alternative 1 - This alternative includes only minimal physical improvements to the existing bus-way. The improvements made would be to allow the use of the facility by personal vehicles. Personal vehicles utilizing the facility would not be allowed to make a left turn as they exited the facility.

Alternative 2 - Like Alternative 1, this alternative is essentially at-grade, except that it includes grade separations at seven intersections selected from the South Link Study prepared for the Miami-Dade MPO. There were initially two alternatives for the amount of capacity to be studied under this scenario. Under Sub-Alternative A the bus-way would be widened to include two lanes in each direction. Sub-Alternative B included a reversible third lane within the bus-way. This reversible lane would provide an additional travel lane in the peak direction. In evaluating the daily model used for this preliminary study it was determined that the traffic and revenue generated by Sub-Alternative A would be approximately equivalent for both alternatives, therefore for the purposes of a preliminary evaluation the figures presented in this document adequately represent the impacts of both alternatives.

The grade separated intersections utilized in this study are listed below:

1. SW 152nd Street (Segments 1 and 2)
2. SW 117th Ave./SW 211th St. & SW 216th Street (Segment 2)
3. SW 184th St. & SW 186th St. & Marlin Street (Segment 2)

4. SW 312th St. (Segment 3)
5. SW 136th St. (Segment 1)
6. SW 112th St. (Segment 1)
7. SW 200th St. (Segment 2)

Alternative 3 - This alternative would be a four lane completely grade-separated elevated bus-way constructed within the existing right-of-way. Traffic would be able to travel the entire length of the bus-way without stopping.

STUDY METHODOLOGY

MODEL DEVELOPMENT

This study was conducted using the most recent version of the Miami-Dade MPO's FSUTMS model developed for the Urban Area's 2030 Long Range Transportation Plan update. This model was used to help insure coordination with the MPO's Long Range Transportation Plan. The future-year highway networks were checked to make sure they include significant highway improvements through 2030. A list of projects that are coded into the model for this purpose is included in Appendix A. Traffic counts taken in the project area by the Miami-Dade Public Works Department and the Florida Department of Transportation were used as points of comparison with the model output to determine the models accuracy in the study area in the 2007 base year model.

The Miami-Dade MPO model as it currently exists is developed for a 24-hour weekday condition. As part of other work for MDX, WSA has developed peaking factors to divide the 24-hour trip table into a.m., p.m., and off-peak conditions. It should be noted that the original intent of this disaggregation was to provide a more accurate representation of the variations in travel conditions during the different times of day. While this rough breakdown into time-of-day periods has proven to be effective, it was based on data from other work and was not calibrated specifically for this model. It did, however, help improve the validation on a daily basis for the tolled facilities.

Since this is a very preliminary study, no complete formal validation of the model was performed. However, as time allowed, a small series of validation runs were performed to insure that traffic volumes on US 1 and the Homestead Extension of Florida's Turnpike (HEFT) were adequately represented. The HEFT was evaluated because it is the most obvious competitor for traffic with US 1. Model input speeds and capacities were adjusted along US 1 to improve the validation under these model conditions.

The model travel speeds for 2007 were compared to travel times for US 1 provided by Kimley-Horn Associates (Appendix B). Table 1 below shows the results of this comparison:

Table 1
Comparison of Results of Observed and Calibrated Travel Speed

Segment	2007 AM Observed NB	2007 AM Observed SB	2007 AM Calibration NB	2007 AM Calibration SB	2007 PM Observed NB	2007 PM Observed SB	2007 PM Calibration NB	2007 PM Calibration SB
1. SW 88th Street and SW 152nd Street (SR 992)	7	29	22	33	27	12	30	18
2. SW 152nd Street (SR 992) and SW 211th Street	27	24	24	32	31	20	31	21
3. SW 211th Street and SW 296th Street	33	29	32	37	28	30	36	31
4. SW 296th Street and NE 7th Street	33	34	37	37	22	31	37	37

Figures are miles per hour

The project alternatives were coded as separate links in the highway network and were connected to US 1 at the locations specified earlier in this report. For the purposes of the modeling, the free-flow speed of the managed lanes under Alternative 1 was assumed to be 40 mph, after taking into account the impact of signal delay. The free-flow speed of Alternative 2 was assumed to be 45 mph, and the free-flow speed of Alternative 3 was assumed to be 55 mph. Similarly, the capacity of the links for Alternatives 1 and 2 were coded at 1,200 vph and Alternative 3 were coded at 1,600 vph.

In order to assure that the operations of the bus-way were not degraded by the introduction of personal vehicles to the facility, the total capacity of the lanes in this study was restricted to approximately 900 vehicles per hour in accordance with preliminary findings from Kimley-Horn Associates for the draft South Dade Managed Lanes Study prepared for the Miami-Dade MPO. Kimley-Horn estimates that this volume of traffic on cross-sections of three or four lanes will provide Level of Service C conditions for the managed lanes facility.

Assumptions on Willingness-to-Pay

The model has been modified to work with tolling algorithms that are more appropriate for managed lane facilities. The main difference in the methodology used to address managed lanes facilities and conventional toll roads is that the algorithms used by WSA to study managed lanes facilities are designed to be more sensitive to small changes in travel times than the algorithms used for conventional toll roads. This is because, by nature, managed lanes often share the same alignment as its alternate free routes and the choice to use the managed lanes vs. the free route is driven solely by time savings. The difference in travel distance is minimal.

For this analysis, WSA used a base value-of-time that is 25 percent lower than typically used for the MDX facilities to reflect the relatively lower income levels in this corridor. This value-of-time was then further reduced to reflect the attractiveness of each alternative in relation to other managed lanes and tolled facilities that are constructed as freeways. Alternative 3 was considered to be the closest operationally to a more typical managed lanes facility, both in terms of access control and design, in which the two lanes in each direction would allow for passing of slower vehicles. However, traffic using the managed lanes under Alternatives 1 and 2 were assumed to have a lower level of willingness-to-pay since they would still encounter some delay at traffic signals. As such, the value-of-time used to analyze Alternative 1 was assumed to be 33 percent lower than under Alternative 3 and the value-of-time assumed for drivers under Alternative 2 was assumed to be 20 percent less than Alternative 3. These values-of-time were then inflated to 2030 levels at 3.0 percent per year.

WilburSmith

TOLL SENSITIVITY ANALYSIS

A series of toll traffic assignments was performed for each time period. Tolls were initially assumed to be charged on a per-mile basis. Rates from toll free to $1.50 per mile were run in $0.05 to $0.10 increments for each alternative to identity the approximate sensitivity to tolling. A review of these initial runs indicated that very high per-mile rates would be needed to manage demand in Segments 2 and 3, the central and northern segments, respectively, due to the higher levels of congestion in that part of the study area. The most southern portion of the facility (Segment 1) has the lowest overall congestion and therefore, highest sensitivity to tolling. A lower per-mile rate would be needed to encourage usage of the managed lanes in the southern segment. Additionally, Segment 1 is about twice as long as the other two segments, resulting in a higher total toll for the segment under a rate per-mile arrangement.

As such, a different tolling configuration was then tested. A flat rate per segment was tested, where the toll is the same on each segment. This results in a lower effective per-mile rate on the different segments due to their lengths. For example, a $1.00 toll for travel on each of the three segments would be equivalent to about $0.12 per mile on Segment 1, $0.22 per mile on Segment 2 and $0.28 per mile on Segment 3.

A second set of toll sensitivity runs were conducted. These were reviewed to identify the toll rates that would optimize revenues in each time period. Traffic loading on the managed lanes were then reviewed and compared to allowable maximum loadings that would maintain the 50 mph speed targets for bus operations. During peak periods in the peak direction, the toll rates needed to manage demand to ensure free-flow bus operations were slightly higher than the toll rates that would optimize revenues.

The 2030 toll rates selected for each segment by time period and direction for each alternative are shown in Table 2. A final set of model runs using these combinations were then performed. Alternatives 1 and 3 would require the highest toll to manage demand, at $4.25 per segment during the p.m. peak period in the southbound direction. If a potential user traveled the entire 16.2 mile length of the project during the p.m. peak, the effective per-mile rate would be approximately $0.79 per mile. The lowest anticipated toll rate of $0.50 per segment would be charged during the a.m. peak in the southbound direction and at night on Alternative 1, when there is very little congestion.

WilburSmith

Table 2
Toll Rates By Segment and Time Period On the US 1 Busway/ Managed Lanes

Alternative 1: All At-Grade Intersections - 1 Managed Lane Per Direction

	Northbound Toll Rates				Southbound Toll Rates			
Tolling Segment (1)	AM Peak Period	Midday	PM Peak Period	Night	AM Peak Period	Midday	PM Peak Period	Night
Segment 3	$3.25	$0.75	$0.50	$0.50	$0.50	$0.75	$4.25	$0.50
Segment 2	3.25	0.75	0.50	0.50	0.50	0.75	4.25	0.50
Segment 1	3.25	0.75	0.50	0.50	0.50	0.75	4.25	0.50

Alternative 2: Partially Grade Separated- 4 Lane and 3 Lane Reversible

	Northbound Toll Rates				Southbound Toll Rates			
Tolling Segment (1)	AM Peak Period	Midday	PM Peak Period	Night	AM Peak Period	Midday	PM Peak Period	Night
Segment 3	$2.75	$0.75	$0.75	$0.75	$0.75	$0.75	$3.75	$0.75
Segment 2	2.75	0.75	0.75	0.75	0.75	0.75	3.75	0.75
Segment 1	2.75	0.75	0.75	0.75	0.75	0.75	3.75	0.75

Alternative 3: Completely Grade Separated - 2 Managed Lanes Per Direction

	Northbound Toll Rates				Southbound Toll Rates			
Tolling Segment (1)	AM Peak Period	Midday	PM Peak Period	Night	AM Peak Period	Midday	PM Peak Period	Night
Segment 3	$3.25	$0.75	$0.75	$0.75	$0.75	$0.75	$4.25	$0.75
Segment 2	3.25	0.75	0.75	0.75	0.75	0.75	4.25	0.75
Segment 1	3.25	0.75	0.75	0.75	0.75	0.75	4.25	0.75

Note: All toll rates are shown in 2030 Dollars.
1) Segment 3 is from Dadeland South to SW 152 Street.
Segment 2 is from SW 152 Street to SW 211 Street/SW 117 Avenue.
Segment 1 is from SW 211 Street to SW 304 Street.

WilburSmith

STUDY FINDINGS

TRAFFIC IMPACTS

Alternative 1 - Figure 2 illustrates the traffic volumes on both US 1 and the bus-way under Alternative 1. Table 3 illustrates the anticipated traffic and revenue for the facility. Overall, it is anticipated that Alternative 1 would have approximately 14,700 tolled transactions during an average weekday. The anticipated total traffic on Segments 2 and 3 are close with Segment 2 anticipated to carry approximately 5,400 vehicles on an average weekday and Segment 3 anticipated to carry approximately 5,900 vehicles on an average weekday. Segment 1 is anticipated to carry less traffic with approximately 3,400 vehicles on an average weekday.

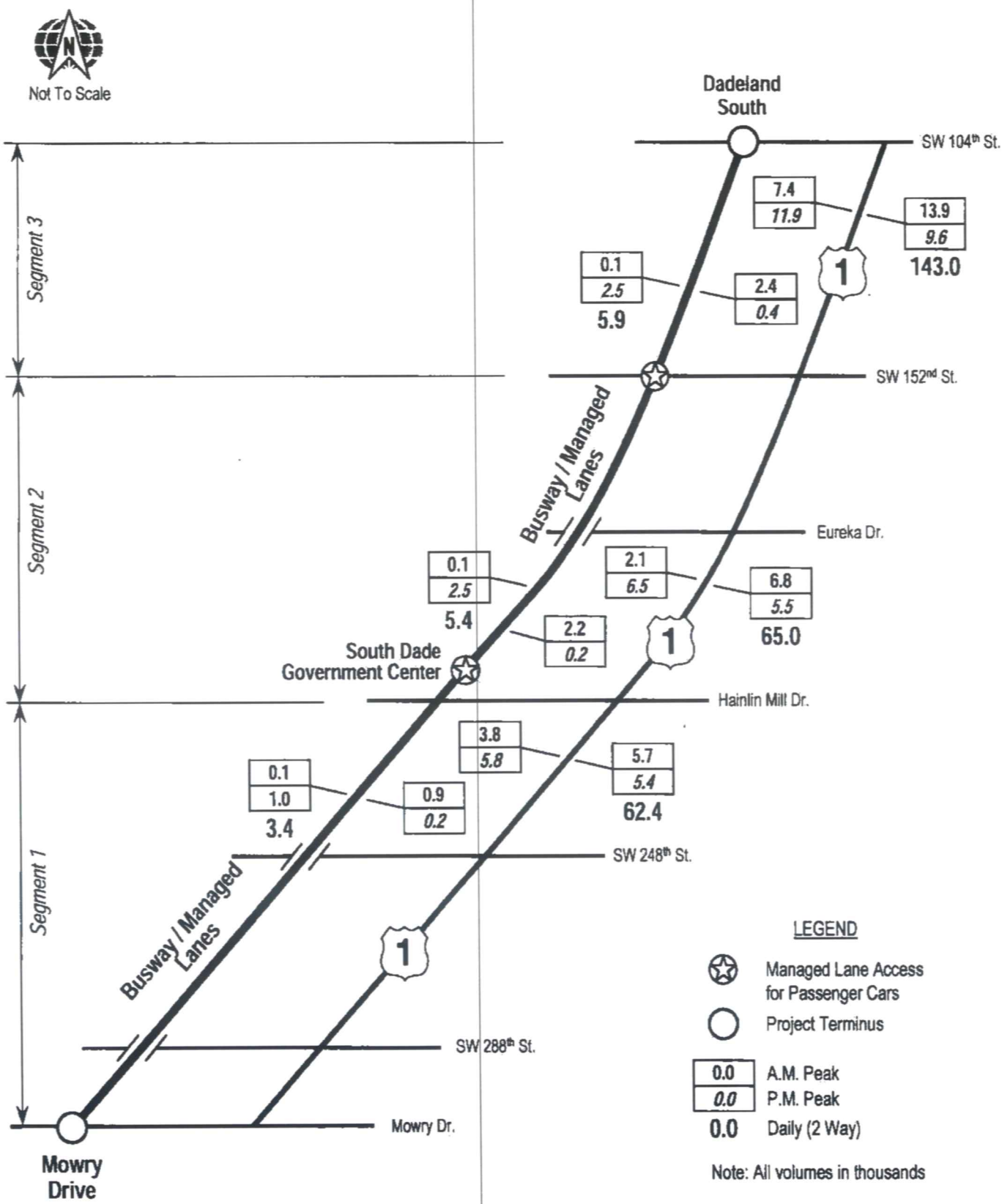
Alternative 2 - Figure 3 illustrates the traffic volumes on both US 1 and the bus-way under Alternative 2. Table 4 illustrates the anticipated traffic and revenue for this alternative. The initial work on this Alternative included evaluating two potential sub-alternatives, Alternative 2A would be a four-lane facility with two lanes in each direction. Alternative 2B would be a three-lane section with the center lane reversible to provide two lanes of capacity in the peak direction.

In reviewing the initial results of the modeling exercise to determine the toll rates the peak period traffic volumes for both alternatives were essentially identical. In reviewing the volumes on Figure 4 it becomes apparent that this is a logical outcome for this facility, as the traffic in the non-peak direction on the two lanes provided in Alternative A is approximately 1,000 transactions for a three-hour period. This volume of traffic is much less than the capacity of the single lane that would be provided for this direction in Alternative B. It is also apparent from Table 5 that the reversible lane alternative would not be significantly different from the mid-day peak traffic on the four-lane alternative with total traffic in either direction totaling approximately 4,800 transactions over a six hour period, which is well below the capacity of a single lane for this length of time.

For these reasons WSA determined that the traffic for these alternatives could be combined to provide a preliminary estimate of the traffic and revenue generated under this scenario. The only caveat to this treatment is that the mid-day period revenue for the reversible lane alternative would be slightly less than the revenue for the four-lane alternative due to the need to close the lane to traffic for a short period to change directions.

Both Alternatives 1 and 2 are not anticipated to reduce total daily traffic on US 1 significantly in Segments 1 or 2. On along Segment 3, the daily volume on US 1 is estimated to be 6,000 vehicles lower in Alternative 2 than Alternative 1. This differential may be explained by the increased attractiveness provided by the grade separations at major intersections in this segment.

FL 102441 / Graphics / Busway Managed Lanes.ppt / 4-29-08



2030 ESTIMATED WEEKDAY TRAFFIC VOLUME ALTERNATIVE 1

WilburSmith ASSOCIATES

FIGURE 2

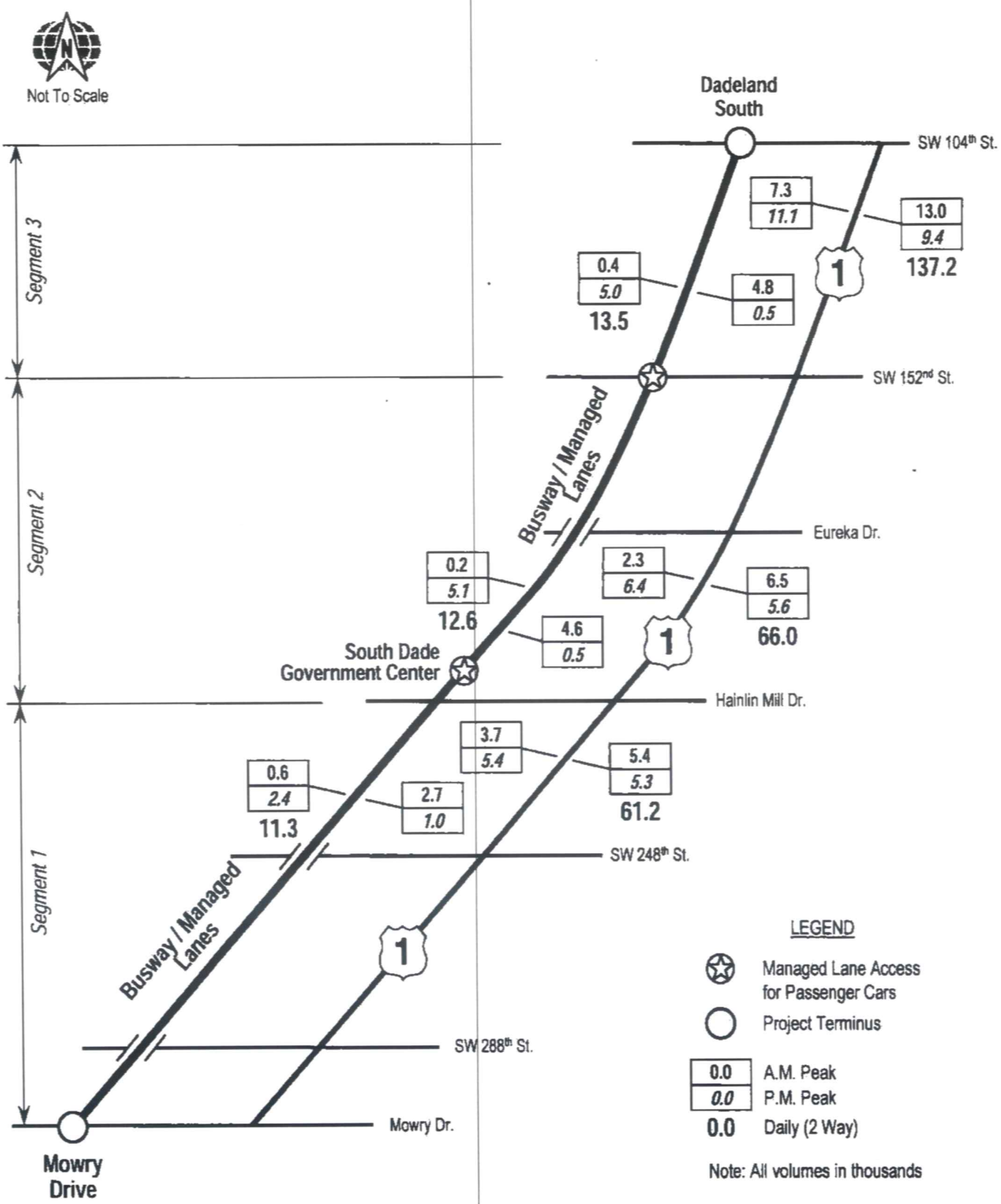
Table 3
Estimated Weekday and Annual Total Toll Revenue (1)
Alternative 1: All At-Grade Intersections - 1 Managed Lane Per Direction

			US 1 Busway/Managed Lanes Weekday Period Tolled Traffic Volumes and Estimated Revenue by Segment							
			Roadway Segment (2)							
Time Period	Direction	Segment Toll Rate (1) (3)	Segfment 3 Traffic	Seg. 3 Revenue	Segment 2 Traffic	Seg. 2 Revenue	Segment 1 Traffic	Seg 1 Revenue	Total	Total Toll Revenue (1)
AM (3 Hours)	Northbound	$3.25	2,490	$8,093	2,210	$7,183	990	$3,218	5,690	$18,493
	Southbound	0.50	120	60	80	40	100	50	300	150
PM (3 Hours)	Northbound	0.50	420	210	230	115	260	130	910	455
	Southbound	4.25	2,470	10,498	2,530	10,753	1,030	4,378	6,030	25,628
Midday (6 Hours)	Northbound	0.75	240	180	200	150	630	473	1,070	803
	Southbound	0.75	190	143	170	128	410	308	770	578
				$19,183		$18,368		$8,555		

Estimated 2030 Average Weekday Tolled Traffic	$46,105
Estimated 2030 Average Weekday Toll Revenue (4)	14,770
Estimated Weekend Day Revenue (4) Estimated at 2 percent of weekday toll revenue	$922
Estimated 2030 Annual Toll Revenue (4) Assumes 240 working days and 125 weekend/holidays	$11,180,463

Note: The estimated traffic and toll revenues assume no significant toll evasion.
1) All toll rates and estimated toll revenues are shown in 2030 Dollars.
2) Segment 3 is from Dadeland South to SW 152 Street.
Segment 2 is from SW 152 Street to SW 211 Street/SW 117 Avenue.
Segment 1 is from SW 211 Street to SW 304 Street.
3) All managed lane segments are tolled at the same toll rate per time period.
4) Assumes no significant toll revenues are collected at night.

FL 102441 / Graphics / Busway Managed Lanes.ppt / 4-29-08



2030 ESTIMATED WEEKDAY TRAFFIC VOLUME ALTERNATIVE 2

WilburSmith ASSOCIATES

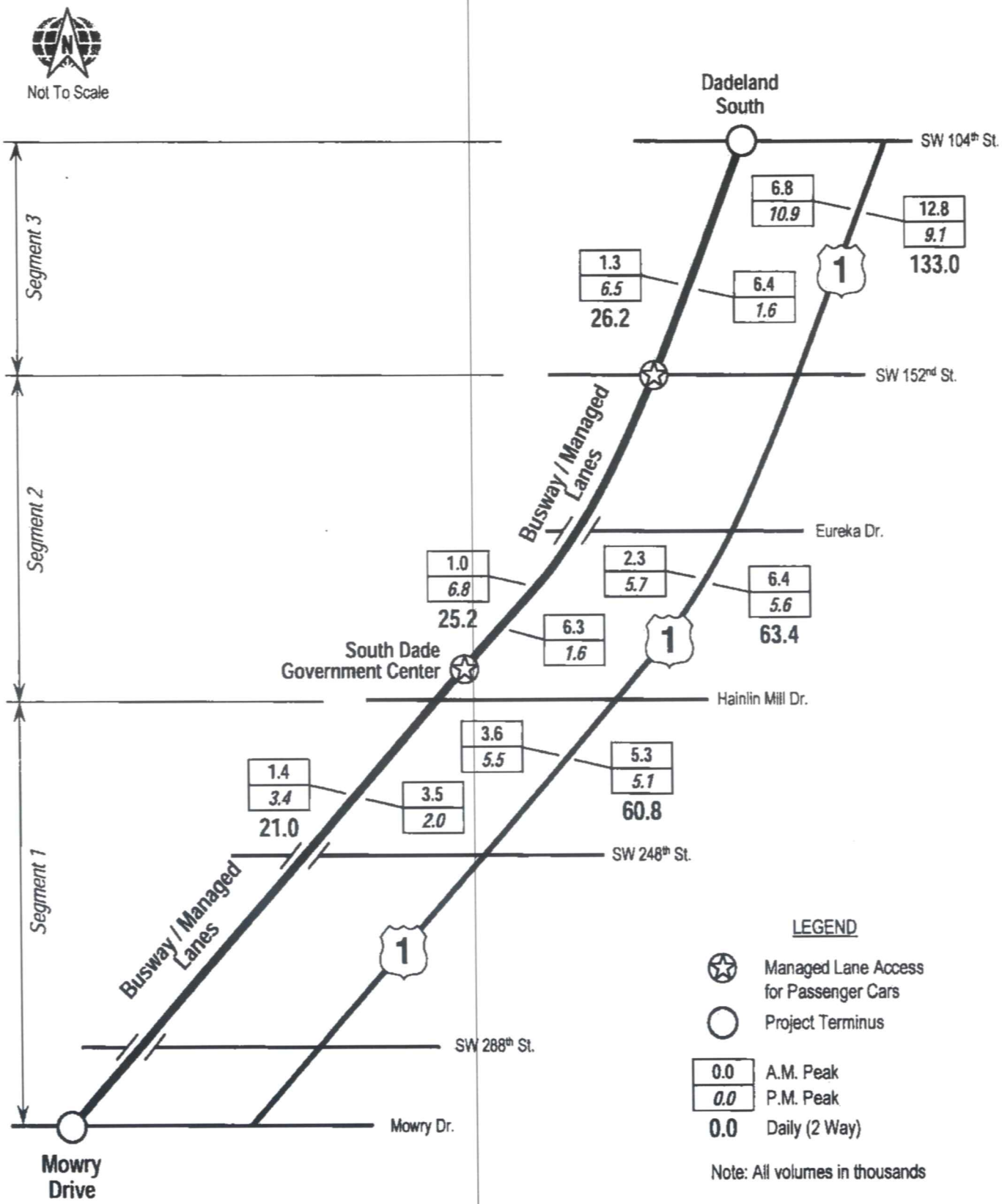
FIGURE 3

Table 4
Estimated Weekday and Annual Total Toll Revenue (1)
Alternative 2: Partially Grade Separated - 2 Managed Lanes Per Direction

US 1 Busway/Managed Lanes
Weekday Period Tolled Traffic Volumes and Estimated Revenue by Segment

Time Period	Direction	Segment Toll Rate (1) (3)	Roadway Segment (2) Segment 3 Traffic	Segment 3 Revenue	Segment 2 Traffic	Segment 2 Revenue	Segment 1 Traffic	Segment 1 Revenue	Total	Total Toll Revenue (1)
AM (3 Hours)	Northbound	$2.75	4,840	$13,310	4,610	$12,678	2,710	$7,453	12,160	$33,440
	Southbound	0.75	400	300	210	158	580	435	1,190	893
PM (3 Hours)	Northbound	0.75	560	420	470	353	950	713	1,980	1,485
	Southbound	3.75	5,000	18,750	5,120	19,200	2,400	9,000	12,520	46,950
Midday (6 Hours)	Northbound	0.75	1,050	788	1,000	750	2,680	2,010	4,730	3,548
	Southbound	0.75	1,670	1,253	1,240	930	1,980	1,485	4,890	3,668
				$34,820		$34,068		$21,095		
Estimated 2030 Average Weekday Tolled Traffic									37,470	
Estimated 2030 Average Weekday Toll Revenue (4)										$89,983
Estimated Weekend Day Revenue (4) Estimated at 2 percent of weekday toll revenue										$1,800
Estimated 2030 Annual Toll Revenue (4) Assumes 240 working days and 125 weekend/holidays										$21,820,756

Note: The estimated traffic and toll revenues assume no significant toll evasion.
1) All toll rates and estimated toll revenues are shown in 2030 Dollars.
2) Segment 3 is from Dadeland South to SW 152 Street.
Segment 2 is from SW 152 Street to SW 211 Street/SW 117 Avenue.
Segment 1 is from SW 211 Street to SW 304 Street.
3) All managed lane segments are tolled at the same toll rate per time period.
4) Assumes no significant toll revenues are collected at night.



2030 ESTIMATED WEEKDAY TRAFFIC VOLUME ALTERNATIVE 3

WilburSmith ASSOCIATES

FIGURE 4

Table 5
Estimated Traffic and Toll Revenue (1)
Alternative 3: Fully Grade Separated - 2 Managed Lanes Per Direction

			US 1 Busway/Managed Lanes Weekday Period Tolled Traffic Volumes and Estimated Revenue by Segment							
			Roadway Segment (2)							
Time Period	**Direction**	**Segment Toll Rate (1) (3)**	Segment 3 Traffic	Segment. 3 Revenue	Segment 2 Traffic	Segment 2 Revenue	Segment 1 Traffic	Segment1 Revenue	Total	**Total Toll Revenue (1)**
AM (3 Hours)	Northbound	$3.25	6,410	$20,833	6,270	$20,378	3,540	$11,505	16,220	$52,715
	Southbound	0.75	1,350	1,013	990	743	1,390	1,043	3,730	2,798
PM (3 Hours)	Northbound	0.75	1,590	1,193	1,580	1,185	2,000	1,500	5,170	3,878
	Southbound	4.25	6,490	27,583	6,820	28,985	3,370	14,323	16,680	70,890
Midday (6 Hours)	Northbound	0.75	4,200	3,150	4,020	3,015	5,570	4,178	13,790	10,343
	Southbound	0.75	6,200	4,650	5,490	4,118	5,150	3,863	16,840	12,630
				$58,420		$58,423		$36,410		
Estimated 2030 Average Weekday Tolled Traffic									72,430	
Estimated 2030 Average Weekday Toll Revenue (4)										$153,253
Estimated Weekend Day Revenue (4) Estimated at 2 percent of weekday toll revenue										$3,065
Estimated 2030 Annual Toll Revenue (4) Assumes 240 working days and 125 weekend/holidays										$37,163,731

Note: The estimated traffic and toll revenues assume no significant toll evasion.
1) All toll rates and estimated toll revenues are shown in 2030 Dollars.
2) Segment 3 is from Dadeland South to SW 152 Street.
Segment 2 is from SW 152 Street to SW 211 Street/SW 117 Avenue.
Segment 1 is from SW 211 Street to SW 304 Street.
3) All managed lane segments are tolled at the same toll rate per time period.
4) Assumes no significant toll revenues are collected at night.

Alternative 2 is expected to carry over three times the traffic of Alternative 1 on Segment 1. This result may be attributable to the attractiveness of utilizing Alternative 2 for long distance trips to avoid the major at-grade intersections and the additional capacity for travel in the peak direction.

Alternative 3 - Figure 4 illustrates the anticipated traffic volumes on both US 1 and the Bus-way under Alternative 3. Table 5 illustrates the anticipated traffic and revenue for this alternative, as expected, since it has the greatest overall capacity, this Alternative is anticipated to carry the most traffic. In the most heavily traveled portion, Segment 3, this alternative is anticipated to carry approximately 26,000 vehicles per day on an average weekday. Alternative 3 reduces traffic on US 1 by approximately 4,000 vehicles on an average day when compared to Alternative 2, although the difference between the volumes on the managed lanes between these alternatives is more than 10,000 vehicles per day. In reviewing the assignment results, it appears that the greatest net traffic impact is on the HEFT, which is the closest limited access facility for the southern portion of the project. There is also the potential that when traffic is reduced on US 1 that the excess capacity is filled by residual demand that was previously on other local roads.

Travel Time Impact - Table 6 illustrates the impact to the travel speed of US 1 in the vicinity of the project during the time periods modeled. As may be seen in the figure Alternative 1 does not appear to significantly improve the operation of US 1 in the vicinity of the project when compared to the no-build condition. Alternatives 2 and 3 both appear to improve the operational speed of US 1 in 2030 with Alternative 3 having the most significant impact on three segments during the a.m. peak period.

TRAFFIC AND REVENUE PROJECTIONS

A summary of the traffic and revenue estimates for all three alternatives is shown on Table 7. Alternative 3 is projected to carry the most traffic, approximately 72,000 transactions on a typical weekday basis while generating approximately $153,000 on a daily basis and approximately $37 million on an annual basis, in 2030 dollars. The toll rates established for this alternative are approximately equal to the revenue maximizing toll rates for the facility.

Alternative 2 is projected to carry approximately 37,500 transactions per weekday, generating approximately $90,000 on a daily basis and approximately $22 million on an annual basis, in 2030 dollars. It is anticipated that utilizing the approximately 900 vehicles per hour per lane capacity established for the operation of the facility for the Miami-Dade MPO Study would reduce traffic by between 100 and 150 vehicles per peak period when compared to the revenue maximization point for Alternative 2.

Alternative 1 would attract roughly 15,000 transactions per weekday while generating approximately $46,000 a day and $11.2 million per year in 2030 dollars. It is anticipated that utilizing the approximately 900 vehicles per hour per lane capacity established for the operation

Table 6
Anticipated Travel Speeds 2030

Segment	2030 No Build AM NB	2030 No Build AM SB	2030 No Build PM NB	2030 No Build PM SB	Alternative 1 AM NB	Alternative 1 AM SB	Alternative 1 PM NB	Alternative 1 PM SB
1. SW 88th St and SW 152nd St (SR 992)	13	29	26	9	13	29	26	9
2. SW 152nd St (SR 992) and SW 211th St	14	31	29	11	14	31	29	11
3. SW 211th St and SW 296th St	20	37	34	14	20	37	34	14
4. SW 296th St and NE 7th St	37	37	37	37	37	37	37	37

Segment	Alternative 2 AM NB	Alternative 2 AM SB	Alternative 2 PM NB	Alternative 2 PM SB	Alternative 3 AM NB	Alternative 3 AM SB	Alternative 3 PM NB	Alternative 3 PM SB
1. SW 88th St and SW 152nd St (SR 992)	13	29	27	9	14	29	27	9
2. SW 152nd St (SR 992) and SW 211th St	14	31	29	11	15	31	29	11
3. SW 211th St and SW 296th St	21	37	35	19	22	37	35	18
4. SW 296th St and NE 7th St	37	37	37	37	37	37	36	37

Table 7
Summary of Alternatives
Estimated Weekday and Annual Total Toll Revenue (1)

Time Period	Direction	Alternative 1 Segment Toll Rate (1) (2)	Total Traffic	Total Toll Revenue (1)	Alternative 2 Segment Toll Rate (1) (2)	Total Traffic	Total Toll Revenue (1)	Alternative 3 Segment Toll Rate (1) (2)	Total Traffic	Total Toll Revenue (1)
AM (3 Hours)	Northbound	$3.25	5700	$18,500	$2.75	12,200	$33,000	$3.25	16,000	$52,800
	Southbound	0.50	300	200	0.75	1,200	900	0.75	3,700	2,800
PM (3 Hours)	Northbound	0.50	900	500	0.75	2,000	1,500	0.75	5,200	3,900
	Southbound	4.25	6000	26,000	3.75	12,500	47,000	4.25	17,000	70,900
Midday (6 Hours)	Northbound	0.75	1100	800	0.75	4,700	3,500	0.75	14,000	10,300
	Southbound	0.75	800	600	0.75	4,900	3,700	0.75	17,000	12,600
Daily Total			14,800	$46,600		37,500	$89,600		72,900	$153,300
Estimated 2030 Annual Toll Revenue (3)				$11,180,000			$21,821,000			$37,164,000

Note: The estimated traffic and toll revenues assume no significant toll evasion.
1) All toll rates and estimated toll revenues are shown in 2030 Dollars.
2) All managed lane segments are tolled at the same toll rate per time period.
3) Assumes no significant toll revenues are collected at night.

of the facility for the Miami-Dade MPO Study traffic would be reduced by between 100 and 150 vehicles during the peak periods when compared to the revenue maximizing toll rate for Alternative 1.

For the purposes of this analysis, it was assumed that revenues collected on weekends would be minimal, at 2 percent of weekday revenues, based on some recent experience of managed lanes elsewhere. Annualization factors assumed 125 weekend days and holidays per year, and 240 working days.

DISCLAIMER

Current professional practices and procedures were used in the development of these findings. However, there is considerable uncertainty inherent in future traffic and revenue forecasts for any toll facility. There may sometimes be differences between forecasted and actual results caused by events and circumstances beyond the control of the forecasters. These differences could be material. Also, it should be recognized that traffic and revenue forecasts in this document are intended to reflect the overall estimated long-term trend. Actual experience in any given year may vary due to economic conditions and other factors.

* * *

Wilbur Smith Associates appreciates the opportunity to work with the Miami-Dade Expressway Authority, and the Miami-Dade Metropolitan Planning Organization. We look forward to assisting the Authority in future endeavors.

Respectfully submitted,

WILBUR SMITH ASSOCIATES

J. William B. Austin

J. William B. Austin
Senior Project Manager