

2014 I-95 Managed Lanes Monitoring Report

final report

prepared for

**Florida Department of Transportation
District Four Office of Modal Development and
District Six Multimodal Planning Office**

prepared by

Cambridge Systematics, Inc.

Draft report

2014 I-95 Managed Lanes Monitoring Report

prepared for

Florida Department of Transportation

prepared by

Cambridge Systematics, Inc.
500 East Broward Boulevard, Suite 1160
Fort Lauderdale, FL 33394

date

March 31, 2015

Table of Contents

Executive Summary	1
Introduction.....	1
Findings:.....	3
Trends.....	3
Volumes	3
Travel Speeds	3
Time Savings	4
Average Vehicle Occupancy	4
Person Throughput	4
Enforcement.....	4
Multi-modal Assessment.....	4
Recommendations	4
1.0 Introduction	1-1
1.1 System Overview	1-2
1.2 Performance Measures.....	1-5
1.3 Data Collection.....	1-5
1.4 The detailed data collection process is described in each data analysis section. Enforcement Overview.....	1-6
2.0 Traffic Volumes and LOS	2-1
2.1 Data Collection.....	2-1
2.2 2014 Results – Traffic Volume Profiles	2-4
2.3 Trends and Comparisons with Previous Years	2-7
2.4 LOS Analysis	2-10
3.0 Travel Time and Delay Analysis	3-1
3.1 Data Collection.....	3-1
Travel-Time Runs	3-1
3.2 2014 Results	3-4
Travel Time.....	3-4
Travel Speeds	3-4
3.3 Trends and Comparisons with Previous Years	3-8
Travel Time Savings	3-8
Travel Speeds	3-10

4.0 Vehicle Occupancy4-1

4.1 Data Collection.....4-1

 Average Vehicle Occupancy4-3

4.2 2014 Results4-4

4.3 Trends and Comparisons with Previous Years4-4

5.0 Person Throughput.....5-1

5.1 Methodology5-1

5.2 2014 Results5-2

5.3 Trends and Comparisons to Previous Years.....5-5

5.4 Change in Person Throughput Due to Express Bus Services and
Vanpool Program.....5-7

6.0 Enforcement.....6-1

6.1 Violation Rates6-1

6.2 Citations6-4

 Trends and Comparisons with Previous Years6-5

7.0 Corridor Multi-Modal Assessment7-1

7.1 Travel Time Comparison among Different Modes.....7-1

7.2 Travel Cost Comparison among Different Modes7-5

7.3 Corridor-wide Person Throughput.....7-6

8.0 Findings and Recommendations8-1

8.1 Findings.....8-1

 Traffic Characteristics8-1

 Travel Speeds8-2

 Travel Time Savings.....8-3

 Vehicle Occupancy8-3

 Person Throughput8-3

 Enforcement.....8-4

 Multi-Modal Assessment.....8-4

8.2 Recommendations8-5

 Recommendations Regarding ML Operation.....8-5

 Recommendations Regarding Multi-Modal Corridor
Performance.....8-6

 Recommendations Regarding Future Data Collection.....8-6

List of Tables

Table 1.1	I-95 ML Configurations for 2014 Count Locations	1-3
Table 1.2	ML Enforcement Restrictions	1-6
Table 2.1	I-95 Peak Hour Volumes During the Enforcement Periods	2-5
Table 2.2	Volume Comparison: <i>A.M. Peak Hour – 2012 and 2014</i>	2-8
Table 2.3	Volume Comparison: <i>P.M. Peak Hour – 2012 and 2014</i>	2-9
Table 2.4	Speed, Volume, and LOS	2-11
Table 3.1	ML and GPL Travel Speeds	3-6
Table 3.2	ML Year-on-Year Time Savings <i>A.M. Peak period – 1998 to 2014</i>	3-9
Table 3.3	ML Year-on-Year Time Savings <i>P.M. Peak period – 1998 to 2014</i>	3-9
Table 3.4	Travel Speed Comparisons <i>A.M. Peak period – 1998 to 2014</i>	3-12
Table 3.5	Travel Speed Comparisons <i>P.M. Peak period – 1998 to 2014</i>	3-13
Table 4.1	AVO Current Enforcement Period (Persons per Vehicle)	4-4
Table 4.2	AVO Comparison - <i>A.M. Enforcement Period</i>	4-6
Table 4.3	AVO Comparison - <i>P.M. Enforcement Period</i>	4-7
Table 5.1	Person Throughput - AM Peak Hour	5-3
Table 5.2	Person Throughput - PM Peak Hour	5-4
Table 5.3	EL Change in Person Throughput Due to Express Bus Services	5-9
Table 5.4	EL Change in Person Throughput Due to Registered Vanpools	5-9
Table 6.1	ML Violation Rates	6-2
Table 6.2	Current HOV Violation Fine Amounts in Southeast Florida	6-5
Table 6.3	HOV Citations	6-6
Table 7.1	Average Travel Time and Speed Comparison between Different Modes	7-3
Table 7.2	Total Travel Costs by Component	7-5
Table 7.3	Average Travel Time Costs per Trip among Different Modes	7-6
Table 7.4	I-95 Corridor Person Throughput in the AM Peak Period	7-8
Table 7.5	I-95 Corridor Person Throughput in the PM Peak Period	7-9

List of Figures

Figure 1.1	Location of Existing ML in the I-95 Corridor in South Florida.....	1-4
Figure 2.1	Data Collection Points for the 2010, 2012, and 2014 I-95 MLs Monitoring Studies	2-3
Figure 2.2	Actual Observed Peak-Hours.....	2-6
Figure 2.3	LOS Map during AM Peak Period.....	2-13
Figure 2.4	LOS Map during PM Peak Period	2-14
Figure 3.1	Segments of Travel-Time Runs for the 2014 I-95 MLs Monitoring Study	3-3
Figure 3.2	Average Travel Speeds <i>Northbound</i>	3-7
Figure 3.3	Average Travel Speeds <i>Southbound</i>	3-8
Figure 3.4	ML Year-on-Year Travel Time Savings <i>A.M. Peak period – 1997 to 2014</i>	3-10
Figure 3.5	ML Year-on-Year Time Savings <i>P.M. Peak period – 1997 to 2014</i>	3-10
Figure 3.6	Year-on-Year Corridor Average Speed <i>A.M. Peak period – 2002 to 2014</i>	3-14
Figure 3.7	Year-on-Year Corridor Average Speed <i>P.M. Peak period – 2002 to 2014</i>	3-15
Figure 4.1	Vehicle Occupancy Locations for the 2010, 2012 and 2014 MLs Monitoring Study	4-2
Figure 4.2	Comparison of AVO for A.M. Period*	4-8
Figure 4.3	Comparison of AVO for P.M. Period*	4-10
Figure 5.1	Δ Person Throughput Comparisons Northbound Direction	5-6
Figure 5.2	Δ Person Throughput Comparisons Southbound Direction.....	5-7
Figure 6.1	HOV Violation Rate Comparison	6-3
Figure 6.2	HOV Violation Rate Comparison	6-4
Figure 7.1	Average Travel Time and Speed Comparison between Different Modes.....	7-4

List of Appendices

Appendix A: Traffic Counts

Appendix B: Travel Time Runs

Appendix C: Vehicle Occupancy Data

Appendix D: Express Bus Passenger Counts

Appendix E: Vanpool Passenger Counts

Appendix F: Tri-Rail Passenger Counts

Appendix G: HOV Enforcement Data

Appendix H: Travel Cost Comparison Among Different Modes

Executive Summary

INTRODUCTION

The Florida Department of Transportation (FDOT) defines managed lanes (MLs) as highway facilities or sets of lanes within an existing highway facility where operational strategies are proactively implemented and managed in response to changing conditions with a combination of tools. Types of managed lanes include high occupancy vehicle (HOV) lanes, high occupancy toll (HOT) lanes, truck only (TO) lanes, truck only toll (TOT) lanes, bus rapid transit (BRT) lanes, reversible lanes (RLs), and express lanes (ELs).

Existing MLs on Interstate 95 (I-95) are approximately 68 miles per direction, including about 59 miles of HOV lane between Indiantown Road and Broward Boulevard and nine miles of ELs between Golden Glades Interchange (GGI) and EL southern terminus. Another 14 miles of ELs are currently under construction. HOV lanes on I-95 are reserved for vehicles carrying two or more occupants. This vehicle occupancy requirement is enforced throughout the 59-mile corridor on weekdays during the a.m. peak period (7:00 a.m. to 9:00 a.m.) and the p.m. peak period (4:00 p.m. to 6:00 p.m.). I-95 ELs may be used free by registered carpools of three or more persons, registered hybrid vehicles, registered South Florida Vanpools, motorcycles, and transit, school and Greyhound buses. Trucks are prohibited, and all other vehicles are subject to a toll that varies in price based on the level of congestion at the time of travel.

FDOT has monitored operations of the I-95 ML facility in South Florida on a biannual basis starting from 1995. Major changes to the study scope have been increase in monitoring efforts as continuous constructions in Palm Beach County kept pushing HOV limit further north, and inclusion of ELs as conversion of HOV lanes to ELs started in 2008 in Miami-Dade and Broward Counties.

Definition of Managed Lanes: Managed Lanes are highway facilities or sets of lanes within an existing highway facility where operational strategies are proactively implemented and managed in response to changing conditions with a combination of tools.

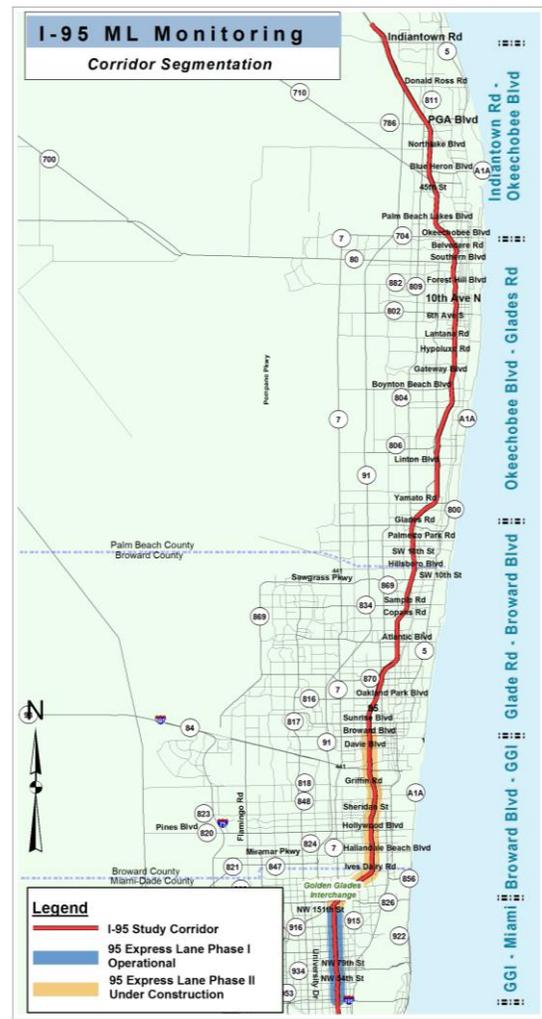


The methodology employed for monitoring the ML facility has been largely consistent since 1995, utilizing traffic volume counts, speed measurements and vehicle occupancy counts for approximately ten segments along the freeway. As data collection technologies and corridor conditions have changed, slight modifications have been made to the data collection method, and to the definition of segments along the corridor. Data sources in the 2014 study include:

- Volume¹: obtained from FDOT District Four Statistics Office and FDOT District Six Traffic Management Center;
- Travel Time and Speed: collected by conducting travel time runs during HOV enforced hours;
- Vehicle Occupancy: collected through field visual observations during HOV enforced hours;
- Transit Ridership: obtained from Broward County Transit (BCT) and Miami-Dade Transit (MDT);
- Transit Travel Time: MDT APC data;
- Transit Fare: transit agencies' websites.

Reporting of results has generally been consistent over the years, with slight enhancements to the format of data presentation.

The 2014 evaluation indicated that the



An average driver saved over 25 minutes in the southbound direction during the a.m. peak and over 28 minutes in the northbound direction during the p.m. peak from Indiantown Rd to the EL southern terminus using MLs as compared to traveling in the GPLs.

¹ Due to construction of 95 ELs Phase II, the count sites at South of Stirling Rd, Hollywood Blvd, and Ives Dairy Rd were turned off. 2012 counts at these locations were presented in this report instead.

average driver saved over 25 minutes in the southbound direction during the a.m. peak and over 28 minutes in the northbound direction during the p.m. peak throughout the monitored section (from Indiantown Road to the EL southern terminus) using MLs as compared to traveling in the GPLs. Additional findings are summarized below.

FINDINGS:

Trends

This report identified a number of trends in traffic conditions on I-95. They include:

- Traffic volumes have increased from 2012 on I-95 in South Florida during peak periods, particularly in the southbound direction.
- Total Express Bus ridership in the I-95 corridor has increased in 2014 compared with the ridership in 2012.
- Average vehicle occupancy (AVO) improved in ELs south of GGI compared with 2012, largely as a result of Express Bus.

Volumes

For the study section of I-95, volumes fluctuated throughout the corridor.

- I-95 has become more congested since 2012. Looking at all facilities (MLs and general-purpose lanes (GPLs)) in both directions, level of service (LOS) F occurred at a variety of times and directions in six of the 13 segments monitored in 2014 (a total of 13 instances) compared with 11 instances in 2012 and five instances in 2010. Please refer to Table 2.4 in Chapter 2 for more detail.
- Peak directions of locations in Palm Beach and Broward Counties are quite different due to their relative locations to Downtown West Palm Beach, Boca Raton, Florida Atlantic University (FAU), and Downtown Fort Lauderdale. Peak directions of locations in Miami-Dade County were uniformly southbound in the a.m. peak period and northbound in the p.m. peak period.
- A significant number of locations north of Broward Boulevard, highest volume hours are not completely covered by the HOV enforcement hours in the afternoon peak.

Travel Speeds

- The travel speed in MLs was higher than in GPLs. In some of the segments, travel speeds exceeded the recommended 15 mph speed differential between MLs and GPLs.

Time Savings

- The average driver saved over 25 minutes from Indiantown Rd (Palm Beach County) to SR 112 (Miami) southbound in the a.m. peak and over 28 minutes northbound in the p.m. peak.

Average Vehicle Occupancy

- AVO in the HOV lanes increased northbound in the p.m. from 2012 to 2014 in most segments, but decreased southbound in the a.m. in most segments. AVO in ELs increased in most cases since 2012.

Person Throughput

- MLs carries more people per lane than the average GPLs during the peak hour peak direction in most of the segments.
- The Express Bus services and Vanpool Program in Miami-Dade and Broward Counties contributed between 20 and 25 percent of the total person throughput in ELs in the a.m. and p.m. peak periods.

Enforcement

- Violation rates were higher in the a.m. peak than in the p.m. peak period in 2014. Compared with 2012, violation rates in 2014 were generally higher in the southbound direction.

Multi-modal Assessment

- Driving in MLs was the fastest amongst the available travel modes. Travel time driving in GPLs was the second fastest mode. Travel time for Tri-Rail and Metrorail was slower, due largely to the transfer time between Tri-Rail and Metrorail, and service frequency of Tri-Rail.
- Travel costs were lowest in the 3-person Carpool scenario and Tri-Rail-Express Bus scenario. Driving alone in both the GPL and the GPL-EL scenarios cost significantly more than all other scenarios, largely due to vehicle operating costs.

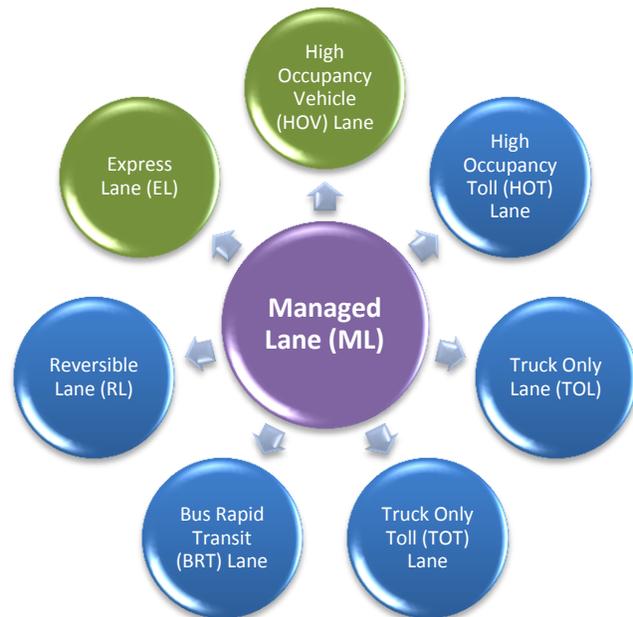
RECOMMENDATIONS

- District Four staff should continue to work with transit agencies in Broward and Palm Beach Counties to develop new Express Bus services or to expand existing Express Bus services on I-95 where it will meet travel demand needs and be a productive use of transit agency resources. This is particularly important with the expected completion of Phase II construction of 95 Express Lanes early 2015. District Four and Six should continue to encourage the use of Vanpools which can increase average occupancy in MLs.

- In 2014, Portable Traffic Monitoring Site (PTMS) and Telemetered Traffic Monitoring Site (TTMS) data were obtained from the FDOT District Four Statistics Office. ITS data were obtained from the FDOT Traffic Management Center. It is recommended that the study team coordinate with District Four ITS early to reconfigure all the ITS detectors along I-95 to cover all travel lanes, including auxiliary lanes. This would allow study team to utilize the ITS detector data to validate and supplement PTMS and TTMS data. Lane configuration should also be checked to make sure the counts of each lane are correctly reported. Districts Four and Six should review ITS detector data and PTMS/TTMS counts data to determine the data source for the next MLs monitoring study (2016).
- The HOV lanes should continue to be monitored for the potential to expand hours of enforcement north of Broward Boulevard, particularly for the afternoon enforcement, move more traffic than a GPL for a longer period.
- It's recommended that for the next MLs monitoring study (2016), historical vehicle occupancy data collection sites between Broward Blvd and GGI (SW 42nd St and Ives Diary Rd) be re-evaluated based on their relative positions to the entry and exit points of the Phase II 95 ELs. It is likely that one or both data collection sites need to be removed and new sites added to best measure the vehicle occupancy data for this segment.
- It is recommended that Tri-Rail and Metrorail continue to coordinate waiting time at the Metrorail/Tri-Rail transfer station, improve the overall travel time, and increase ridership.
- GPS (global positioning system) technology should continue to be used for all travel time runs. This technology was proved in this study to be a more efficient and flexible technology, particularly for data post-processing.
- Vehicle occupancy data collection has been difficult and expensive. In addition, Enforcement in ELs continues to be a challenge to FHP. A study should be done to explore available technologies and products for automatic vehicle occupancy detection.

1.0 Introduction

The Florida Department of Transportation (FDOT) defines managed lanes (MLs) as highway facilities or sets of lanes within an existing highway facility where operational strategies are proactively implemented and managed in response to changing conditions with a combination of tools. These tools may include accessibility, vehicle eligibility, pricing, or a combination thereof. Types of managed lanes include high occupancy vehicle (HOV) lanes, high occupancy toll (HOT) lanes, truck only (TO) lanes, truck only toll (TOT) lanes, bus rapid transit (BRT) lanes, reversible lanes (RLs), and express lanes (ELs). Existing MLs on Interstate 95 (I-95) are approximately 68 miles per direction, including about 59 miles of HOV lane between Indiantown Road and Broward Boulevard and nine miles of ELs between Golden Glades Interchange (GGI) and EL southern terminus. In addition, a 14-mile segment is currently under construction to convert HOV lane into ELs.

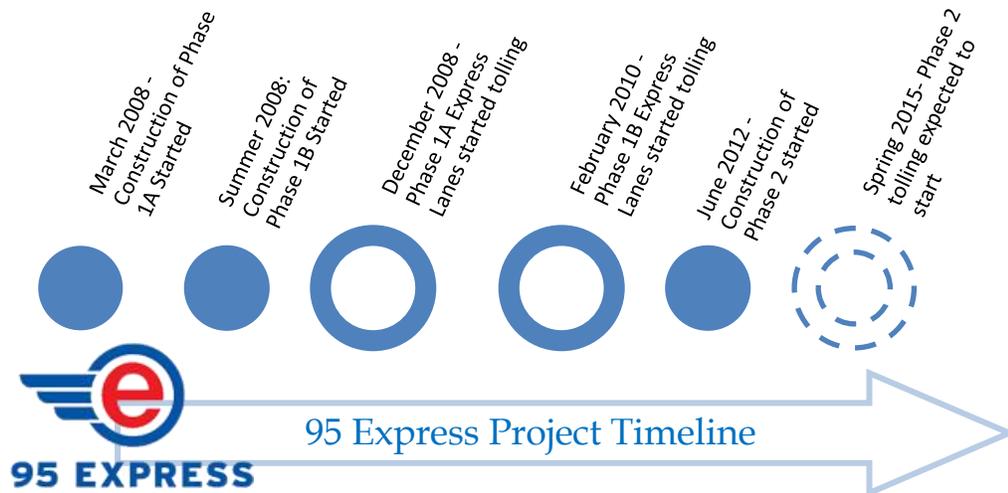


HOV lanes on I-95 are reserved for vehicles carrying two or more occupants. This vehicle occupancy requirement is enforced throughout the 59-mile corridor on weekdays during the a.m. peak period (7:00 a.m. to 9:00 a.m.) and the p.m. peak period (4:00 p.m. to 6:00 p.m.). I-95 ELs may be used free by registered carpools of three or more persons, registered hybrid vehicles, registered South Florida Vanpools, motorcycles, and transit, school and Greyhound buses. Trucks are prohibited, and all other vehicles are subject to a toll that varies in price based on the level of congestion at the time of travel.

FDOT has monitored operations of the I-95 HOV facilities in South Florida on a biannual basis starting from 1995. Early changes to the scope of monitoring efforts were inclusion of new HOV segments as HOV lanes in Palm Beach County kept expanding to the north. In late 2008, the HOV facility between SR 112 and GGI was widened to two lanes per direction and converted into ELs. To reflect this change, FDOT revised the scope of the study into I-95 ML operations monitoring. Subsequent to the completion of Phase 1B 95 Express in February 2010, the title of

the report was changed to *I-95 Managed Lanes Monitoring Report*, to reflect the change of scope.

Concurrent with the preparation of the 2012 Monitoring Report, construction of the 95 Express Phase II started. Upon completion of this project, expected in Spring 2015, 95 ELs will be extended 14 miles north from GGI in Miami-Dade County to the Broward Boulevard Park & Ride Lot in Broward County, converting the one HOV lane into two-lane ELs per direction, and making the full EL distance approximately 23 miles. During the course of the 2014 MLs Monitoring Study, volumes and vehicle occupancy data were not collected for the affected 14-mile segment due to construction of the Phase II project. Travel time data were collected for the left-most lane and its neighboring lane for the affected segment. A timeline for Phase I and II of the 95 Express project is presented below.



1.1 SYSTEM OVERVIEW

I-95 is a major north-south limited access freeway in Southeast Florida. As shown in Figure 1.1, MLs extend from south of SR 112 in Miami-Dade County (the southern terminus) to Indiantown Rd in Palm Beach County, approximately 81 miles long.

The speed limit in Palm Beach and Broward Counties is 65 mph. The speed limit in Miami-Dade County is 55 mph. The configuration of lanes for I-95 segments is listed in Table 1.1, shown by MLs and GPLs and split by northbound and southbound.

Table 1.1 I-95 ML Configurations for 2014 Count Locations

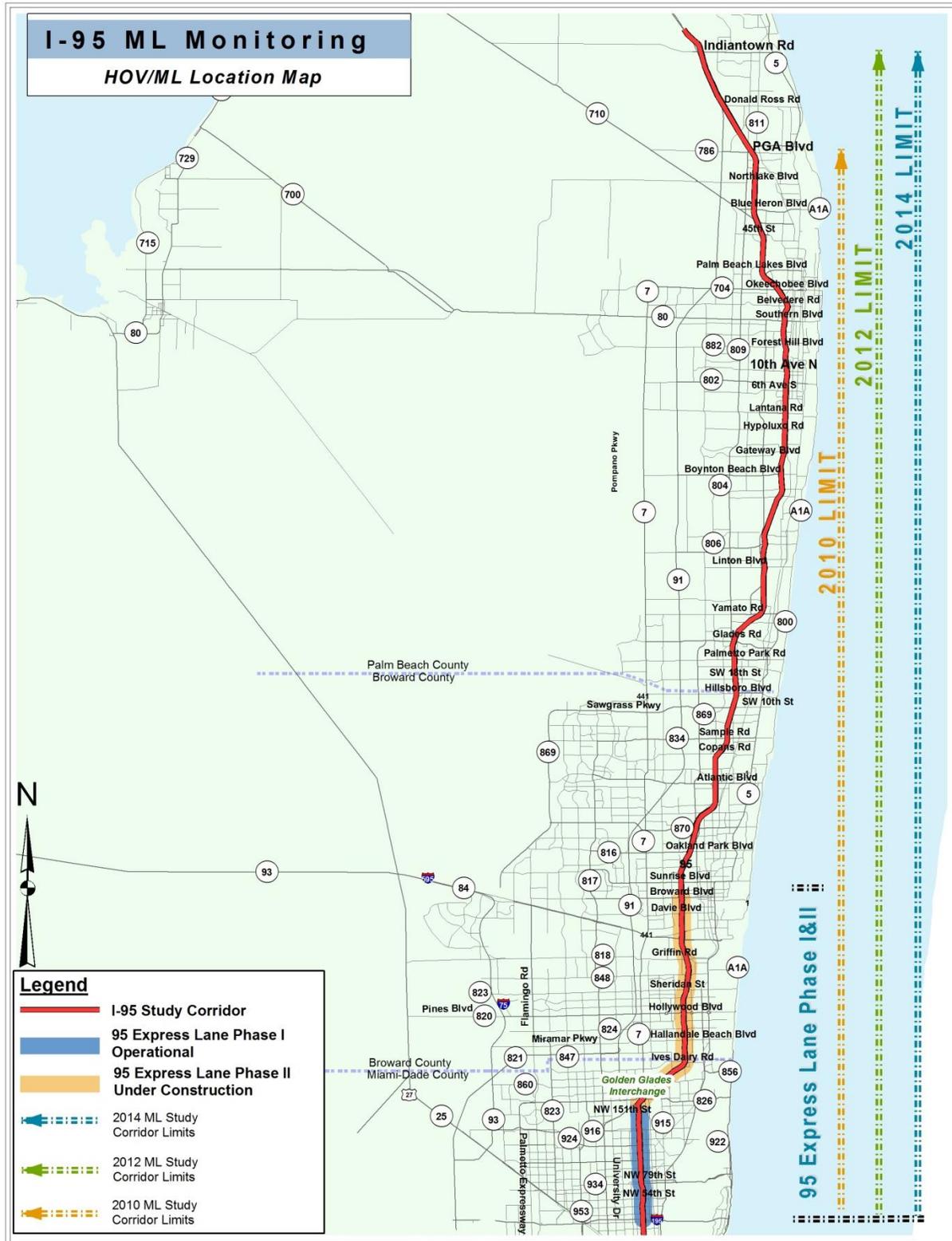
Site Location	Number of Northbound GPLs	Number of Northbound ML(s)	Number of Southbound GPLs	Number of Southbound ML(s)
North of Northlake Blvd	4	1	5	1
South of Palm Beach Lakes Blvd	5	1	5	1
North of Gateway Blvd	4	1	4	1
North of Glades Rd	3	1	3	1
South of Hillsboro Blvd	3	1	3	1
South of Atlantic Blvd	4	1	4	1
South of Sunrise Blvd	5	1	5	1
South of Stirling Rd*	5	1	5	1
South of Hollywood Blvd*	5	1	5	1
South of Ives Dairy Rd*	3	1	3	1
South of GGI	5	2	5	2
South of NW 65 th St	4	2	4	2

* Lane configurations at these locations reflect conditions prior to Phase II construction of 95 Express project.

Source: FDOT District Four Statistics Office Traffic Count Program

FDOT District Six Traffic Management Center

Figure 1.1 Location of Existing ML in the I-95 Corridor in South Florida



Source: Cambridge Systematics, Inc.

1.2 PERFORMANCE MEASURES

The objective of the monitoring effort is to document current operations of the ML facility and to determine if operational changes are warranted. Regularly measuring the performance of MLs and general-purpose lanes (GPLs) is important to support operation of the facility. Consistent with previous reports, the 2014 monitoring report evaluates the ML facility using the following mobility performance measures (PMs):

- Level of service (LOS);
- Travel time;
- Travel speed;
- Average vehicle occupancy (AVO);
- Person throughput; and
- HOV violations.

Trend analyses were also conducted to compare 2014 PMs with the ones from previous monitoring studies and identify changes in traffic conditions and travel behaviors on I-95.

Previous reports used in the comparative analysis are outlined below:

- 2012 I-95 Managed Lanes Monitoring Report;
- 2010 I-95 HOV Lane Monitoring Report;
- 2008 I-95 HOV Lane Monitoring Report;
- 2006 I-95 HOV Lane Monitoring Report;
- 2004 I-95 HOV Lane Monitoring Report;
- 2002 I-95 HOV Lane Monitoring Report;
- 2000 I-95 HOV Lane Monitoring Report;
- 1998 I-95 HOV Lane Monitoring Report;
- 1997 I-95 HOV Lane Monitoring Report; and
- 1995 I-95 HOV Lane Analysis 90-Day Program Assessment.

1.3 DATA COLLECTION

In 2014, data collection locations and methods were largely consistent with the 2012 study, with the following exceptions and clarifications:

- At South of Atlantic Blvd, Portable Traffic Monitoring Sites (PTMS) data were not collected in the southbound direction due to construction activities. ITS detector data were used instead, adjusted by northbound PTMS data.

- Due to Phase II construction of the 95 Express project (between Broward Blvd and GGI), counts and vehicle occupancy data at South of Stirling Rd, South of Hollywood Blvd, and South of Ives Dairy Rd were not collected.
- Traffic counts at South of GGI excluded counts in the auxiliary lanes.
- The results of traffic volume analyses in this study are based on one day data collected at chosen locations. For the segment between Broward Blvd and GGI where 2014 data were not collected, 2012 data were used to present a consistent reporting format.
- The results of the speed analysis in this report are based on travel time runs and reflect the average speed of defined segments. The resulted volumes and speeds for the section within FDOT District Six are not comparable to those reported by FDOT District Six Traffic Management Center (TMC). The detailed monthly report conducted by FDOT District Six can be found at its website (http://www.sunguide.org/index.php/tmc_reports/).
- GPS technology is utilized in this study, for the first time, to collect travel time.
- The detailed data collection process is described in each data analysis section.

1.4 ENFORCEMENT OVERVIEW

HOV lanes are reserved for vehicles with two or more occupants. This vehicle occupancy requirement is enforced throughout the 59-mile corridor with HOV lanes. The I-95 ELs between Downtown Miami and GGI are enforced 24 hours a day, seven days a week for toll violators. While ELs are barrier-separated from GPLs, HOV lanes are not physically separated and HOV lane access is uncontrolled. Enforcement activities occur on the inside shoulder throughout the corridor. Table 1.2 summarizes the specific weekday enforcement restrictions by county.

Table 1.2 ML Enforcement Restrictions

County	FDOT District	Enforcement Restrictions
Palm Beach	4	HOV lane is enforced Monday through Friday from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. in both directions; ELs are enforced 24/7.
Broward	4	
Miami-Dade	6	

2.0 Traffic Volumes and LOS

2.1 DATA COLLECTION

Consistent data collection is critical when analyzing trends. In the previous MLs monitoring studies, traffic volume data were collected through two sources: field data (Telemetered Traffic Monitoring Sites (TTMS) data and Portable Traffic Monitoring Sites (PTMS) data) and Intelligent Transportation Systems (ITS) detectors data. Field data and ITS detectors data provide comparable level of accuracy. However, the majority of ITS detectors located in District Four do not cover auxiliary lanes. Therefore, field data (TTMS and PTMS data) collected through the FDOT District Four Statistics Office's Annual Traffic Count Program were used for FDOT District Four count locations, while ITS detectors data continued to be used for locations in FDOT District Six. In 2014, data were not collected at South of Stirling Rd, South of Hollywood Blvd, and South of Ives Dairy Rd due to construction; data collected in 2012 were used instead.

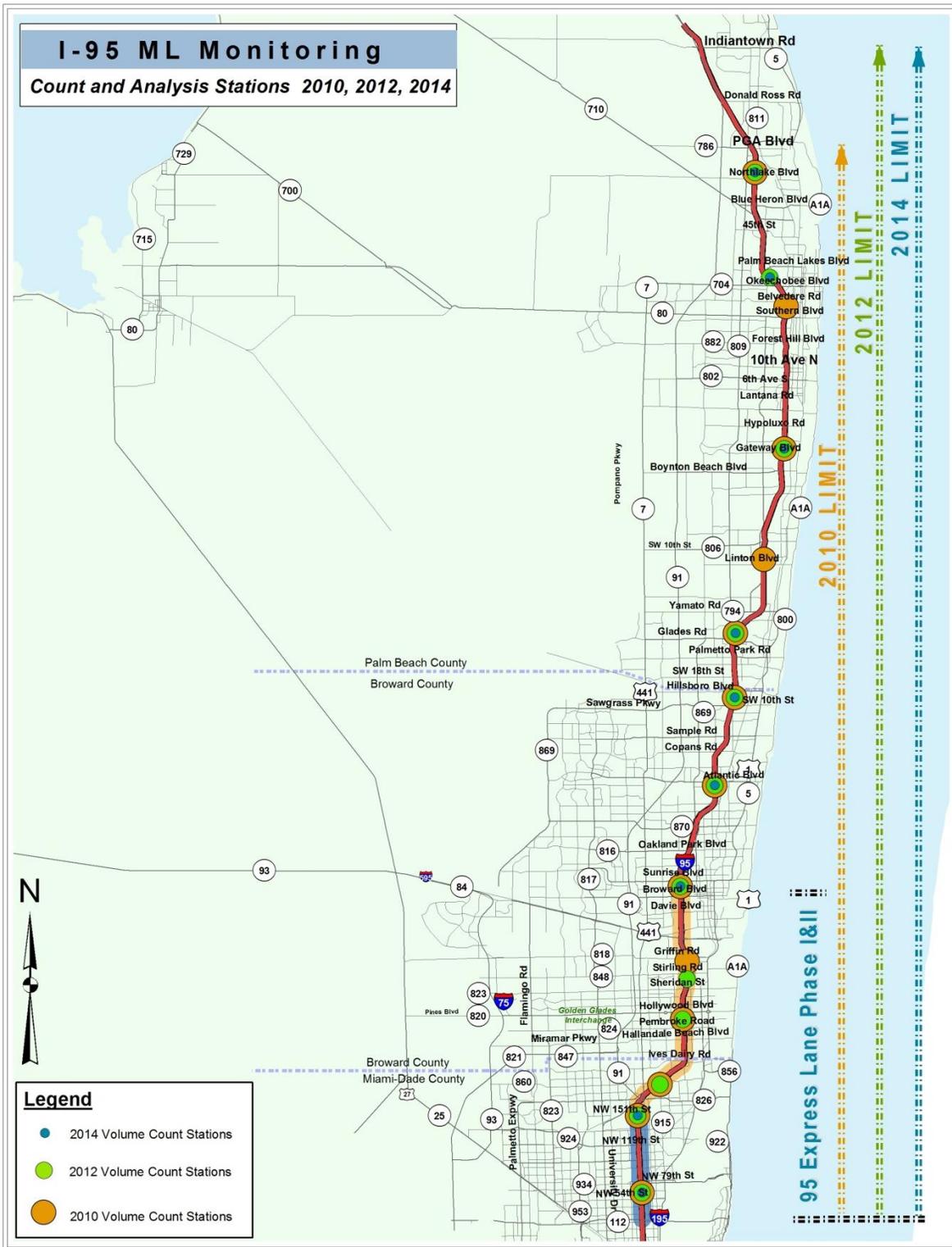
Figure 2.1 shows where data were collected in 2010, 2012 and 2014 and where volume comparisons and profiles were analyzed. The 12 sites (nine sites with 2014 data and three with 2012 data) were:

1. North of Northlake Blvd (PTMS site 93-2187);
2. South of Palm Beach Lakes Blvd (TTMS site 93-0174);
3. North of Gateway Blvd (PTMS site 93-2222);
4. North of Glades Rd (PTMS site 93-2191);
5. South of Hillsboro Blvd (TTMS site 86-0163);
6. South of Atlantic Blvd (NB: ITS detector FLD4095035.1NBSS; SB: PTMS site 86-2503);
7. South of Sunrise Blvd (PTMS site 86-2499);
8. South of Stirling Rd (2012 data: PTMS site 86-2455);
9. South of Hollywood Blvd (2012 data: TTMS site 86-0331);
10. South of Ives Dairy Rd (2012 data: ITS detectors DS-0107N & RMS-012S);
11. South of GGI/NW 146th St (ITS detectors DS-0089N & DS-0088S); and
12. South of NW 65th St (ITS detectors DS-0049N & DS-0049S).

In Miami-Dade, Broward and Palm Beach counties, 72-hour continuous counts between Tuesday and Thursday, April 8-10, 2014, were requested for TTMS sites and ITS detector sites. Traffic counts collected on a typical day between February and May in 2014 were used for all the PTMS sites. After volume data were collected, a quality

review was conducted. One typical day's data were selected where 72-hour counts are available. The traffic volume data collection and quality check methodology was mostly consistent with previous reports, and the data can be compared with confidence across the previous years.

Figure 2.1 Data Collection Points for the 2010, 2012, and 2014 I-95 MLs Monitoring Studies



Source: Cambridge Systematics, Inc.

2.2 2014 RESULTS – TRAFFIC VOLUME PROFILES

Table 2.1 shows the observed peak hours and volumes at each of the count locations in the northbound and southbound directions. The data collection dates and sources are also provided in the table. Along the whole corridor, the heaviest traffic was observed south of Sunrise Blvd in the southbound direction in the a.m. peak (10,867 vph) and p.m. peak (10,739 vph).

Figure 2.2 visually presents the peak hours and volumes at each location. According to Figure 2.2, peak hours in the p.m. southbound direction showed a more uniform pattern, with peak hours mostly starting at 4:15 p.m. or 5:00 p.m.

Two other traffic patterns on the study corridor were also observed in this analysis:

- Generally, peak directions of locations in Palm Beach and Broward Counties are quite different due to their relative locations to Downtown West Palm Beach, Boca Raton, Florida Atlantic University (FAU), and Downtown Fort Lauderdale. Peak directions of locations in Miami-Dade County were uniformly southbound in the a.m. peak period and northbound in the p.m. peak period. There were also a few locations that showed no change of peak directions during a.m. and p.m. peak hours: Glades Rd where northbound was the peak direction, Atlantic Blvd where northbound was the peak direction, and Sunrise Blvd where southbound was the peak direction.
- HOV enforcement hours north of Broward Blvd are between 7:00 to 9:00 in the a.m. and 4:00 to 6:00 in the p.m.. These enforced hours covered the peak hours at most locations, however, there were several exceptions, particularly in the afternoon, that the hours with the highest volume were not completely within the HOV enforcement hours (see Appendix A):
 - South of Sunrise Blvd in the p.m., the hours with the highest volume were 3:30 to 4:30 p.m. in both directions;
 - South of Hillsboro Blvd, the hours with the highest volume were 5:30 to 6:30 p.m. in both directions;
 - North of Glades Rd in the p.m., the hours with the highest volume were 3:30 to 4:30 p.m. in the northbound direction, and 11:00 a.m. to 12:00 noon and 6:15 to 7:15 p.m. in the southbound direction;
 - South of Palm Beach Lakes Blvd, the hours with the highest volume were 9:00 to 10:00 a.m. and 5:45 to 6:45 p.m. in the northbound direction; and 8:15 to 9:15 a.m. and 5:45 to 6:45 p.m. in the southbound direction.

Table 2.1 I-95 Peak Hour Volumes During the Enforcement Periods

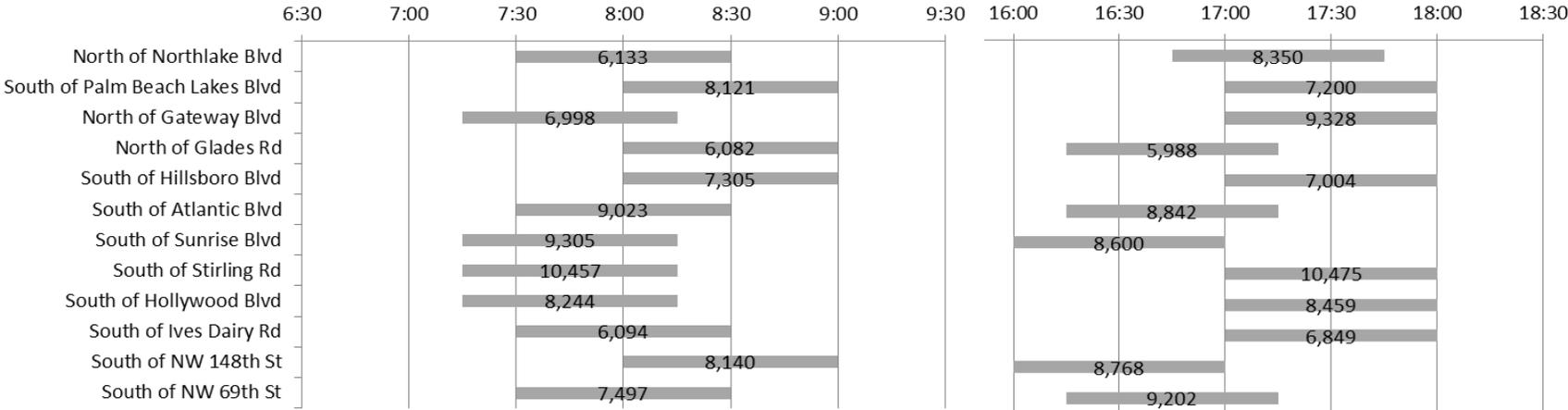
Section	I-95 Location	Data Source	Direction	A.M. Peak Hour	A.M. Peak Volume	P.M. Peak Hour	P.M. Peak Volume
Indiantown Rd- Okeechobee Blvd	South of Northlake Blvd	PTMS 2/11/2014	NB	7:30-8:30	6,133	16:45-17:45	8,350
			SB	7:15-8:15	7,902	16:15-17:15	5,865
	South of Palm Beach Lakes Blvd	TTMS 4/8/2014	NB	8:00-9:00	8,121	17:00-18:00	7,200
SB			8:00-9:00	7,794	17:00-18:00	7,908	
Okeechobee Blvd- Glades Rd	North of Gateway Blvd	PTMS 2/13/2014	NB	7:15-8:15	6,998	17:00-18:00	9,328
			SB	7:00-8:00	8,966	16:15-17:15	7,389
	North of Glades Rd*	PTMS 5/8/2014	NB	8:00-9:00	6,082	16:15-17:15	5,988
SB			7:00-8:00	3,286	17:00-18:00	3,475	
Glades Rd- Broward Blvd	South of Hillsboro Blvd	TTMS 4/8/2014	NB	8:00-9:00	7,305	17:00-18:00	7,004
			SB	8:00-9:00	7,143	17:00-18:00	7,177
	South of Atlantic Blvd	PTMS and ITS Detector 4/8/2014	NB	7:30-8:30	9,023	16:15-17:15	8,842
			SB	7:15-8:15	8,508	16:15-17:15	7,870
	South of Sunrise Blvd	PTMS 3/19/2014	NB	7:15-8:15	9,305	16:00-17:00	8,600
SB			7:15-8:15	10,867	16:15-17:15	10,739	
Broward Blvd- GGI**	South of Stirling Rd	PTMS 3/21/2012	NB	7:15-8:15	10,457	17:00-18:00	10,475
			SB	8:00-9:00	8,998	17:00-18:00	9,965
	South of Hollywood Blvd	TTMS 3/21/2012	NB	7:15-8:15	8,244	17:00-18:00	8,459
			SB	7:15-8:15	8,383	16:45-17:45	8,267
	South of Ives Dairy Rd	ITS Detector 3/21/2012	NB	7:30-8:30	6,094	17:00-18:00	6,849
SB			7:15-8:15	6,506	16:15-17:15	5,796	
GGI - EL southern terminus	South of NW 148 th St	ITS Detector 4/8/2014	NB	8:00-9:00	8,140	16:00-17:00	8,768
			SB	7:30-8:30	8,630	16:15-17:15	8,164
	South of NW 65 th St	ITS Detector 4/8/2014	NB	7:30-8:30	7,497	16:15-17:15	9,202
			SB	7:45-8:45	10,146	16:15-17:15	7,919

* Traffic counts were collected in May, when Summer semester had started at FAU. Traffic counts in early April should be higher than May and traffic pattern was probably different.

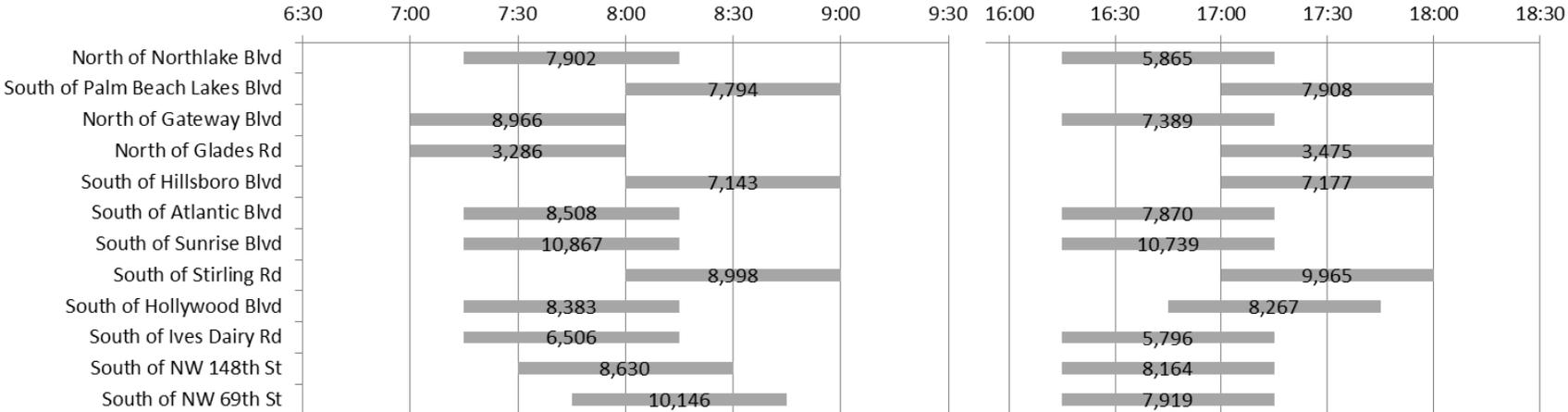
** 2012 data were used in place of 2014 data for this segment due to disabled count sites during construction.

Source: Cambridge Systematics, Inc.

Figure 2.2 Actual Observed Peak-Hours



■ Northbound AM/PM Peak



■ Southbound AM/PM Peak

2.3 TRENDS AND COMPARISONS WITH PREVIOUS YEARS

The study corridor generally distinguishes five segments in terms of traffic characteristics as listed below. When compared with the traffic counts in 2012, the term “minor” is used to indicate a change in traffic volumes less than 10 percent; “moderate” is used to indicate a change in traffic volumes from 10 to 20 percent; and “significant” is used to indicate a change in traffic volumes of 20 percent or more. For detailed volume trends and comparison, please refer to Table 2.2 and Table 2.3.

I-95 Segments	Southbound AM	Northbound PM
Corridor-Wide	<ul style="list-style-type: none"> - MLs: varying traffic increase at most of the locations - All lanes: varying traffic increase at most of the locations except for Glades Rd and the southern-most segment 	<ul style="list-style-type: none"> - MLs: traffic showed different trend throughout the corridor, with significant increase at Gateway Blvd and significant decrease at Hillsboro Blvd - All lanes: varying traffic decrease at most of the locations except for Northlake Blvd, Gateway Blvd, and Atlantic Blvd
Indiantown Rd - Okeechobee Blvd	<ul style="list-style-type: none"> - MLs: significant traffic increase at Palm Beach Lakes Blvd - All lanes: moderate traffic increase at Northlake Blvd 	<ul style="list-style-type: none"> - MLs: minor traffic change at Palm Beach Lakes Blvd - All lanes: minor traffic increase
Okeechobee Blvd - Glades Rd	<ul style="list-style-type: none"> - MLs: moderate to significant traffic increase - All lanes: significant traffic decrease at Glades Rd 	<ul style="list-style-type: none"> - MLs: significant traffic increase at Gateway Blvd - All lanes: moderate traffic decrease at Glades Rd
Glades Rd - Broward Blvd	<ul style="list-style-type: none"> - MLs: minor to moderate traffic increase - All lanes: minor traffic increase at most locations 	<ul style="list-style-type: none"> - MLs: significant traffic decrease at Hillsboro Blvd - All lanes: moderate traffic decrease at Sunrise Blvd
Broward Blvd - GGI	<ul style="list-style-type: none"> - Data were not collected in 2014 due to construction 	<ul style="list-style-type: none"> - Data were not collected in 2014 due to construction
GGI - EL southern terminus	<ul style="list-style-type: none"> - MLs: minor traffic increase - All lanes: minor traffic decrease 	<ul style="list-style-type: none"> - MLs: minor to moderate traffic increase - All lanes: minor traffic decrease

To better understand the traffic trend over the years, 2012 and 2014 traffic volumes in GPLs and MLs at 12 locations are presented in Table 2.2 and Table 2.3. Please note that due to construction activities, no count data were collected between Broward Blvd and GGI in 2014.

Table 2.2 Volume Comparison: A.M. Peak Hour – 2012 and 2014

I-95 Segments	2012			2014			Difference 2012 to 2014		% Change 2012 to 2014		
	AM Peak	GPL	ML	AM Peak	GPL	ML	AM Peak	ML	AM Peak	ML	
Northbound											
Indiantown Rd - Okeechobee Blvd	North of Northlake Blvd	5,084	4,892	192	6,133	5,876	257	1,049	65	20.6%	33.9%
Okeechobee Blvd - Glades Rd	South of Palm Beach Lakes Blvd	7,216	6,839	377	8,121	7,469	652	905	275	12.5%	72.9%
Okeechobee Blvd - Glades Rd	North of Gateway Blvd	6,169	5,812	357	6,998	6,465	533	829	176	13.4%	49.3%
	North of Glades Rd*	7,145	6,203	942	6,082	4,503	1579	-1063	637	-14.9%	67.6%
Glades Rd - Broward Blvd	South of Hillsboro Blvd	7,344	6,147	1,197	7,305	5,736	1,569	-39	372	-0.5%	31.1%
	South of Atlantic Blvd	7,586	6,535	1,051	9,023	7,829	1,194	1,437	143	18.9%	13.6%
	South of Sunrise Blvd	10,650	9,199	1,451	9,305	8,000	1,305	-1,345	-146	-12.6%	-10.1%
Broward Blvd – GGI**	South of Stirling Rd	10,457	9,234	1,223	10,457	9,234	1,223	0	0	0.0%	0.0%
	South of Hollywood Blvd	8,244	7,366	878	8,244	7,366	878	0	0	0.0%	0.0%
	South of Ives Dairy Rd	6,094	5,191	903	6,094	5,191	903	0	0	0.0%	0.0%
GGI - EL southern terminus	South of GGI	8,491	6,833	1,658	8,140	6,102	2,038	-351	380	-4.1%	22.9%
	South of NW 65 th St	7,591	5,717	1,874	7,497	4,427	3,070	-94	1196	-1.2%	63.8%
Southbound											
Indiantown Rd - Okeechobee Blvd	North of Northlake Blvd	6,672	6,418	254	7,902	7,679	223	1,230	-31	18.4%	-12%
Okeechobee Blvd - Glades Rd	South of Palm Beach Lakes Blvd	6,805	6,501	304	7,794	7,428	366	989	62	14.5%	20.4%
Okeechobee Blvd - Glades Rd	North of Gateway Blvd	9,018	8,395	623	8,966	8,054	912	-52	289	-0.6%	46.4%
	North of Glades Rd*	6,947	5,973	974	3,286	2,157	1,129	-3,661	155	-52.7%	15.9%
Glades Rd - Broward Blvd	South of Hillsboro Blvd	7,182	5,740	1,442	7,143	5,700	1,443	-39	1	-0.5%	0.1%
	South of Atlantic Blvd	8,128	6,757	1,371	8,508	6,994	1,514	380	143	4.7%	10.4%
	South of Sunrise Blvd	10,382	8,990	1,392	10,867	9,402	1,465	485	73	4.7%	5.2%
Broward Blvd – GGI**	South of Stirling Rd	8,998	7,915	1,083	8,998	7,915	1,083	0	0	0.0%	0.0%
	South of Hollywood Blvd	8,383	7,488	895	8,383	7,488	895	0	0	0.0%	0.0%
	South of Ives Dairy Rd	6,506	4,945	1,561	6,506	4,945	1,561	0	0	0.0%	0.0%
GGI - EL southern terminus	South of GGI	9,389	5,960	3,429	8,630	5,123	3,507	-759	78	-8.1%	2.3%
	South of NW 65 th St	10,827	7,577	3,250	10,146	6,627	3,519	-681	269	-6.3%	8.3%

Note: * Traffic counts were collected in May, when Summer semester had started at FAU. Traffic counts in early April should be higher than May and traffic pattern was probably different.

** 2012 data were used in place of 2014 data for this segment due to construction.

Table 2.3 Volume Comparison: P.M. Peak Hour – 2012 and 2014

I-95 Segments		2012			2014			Difference 2012 to 2014		% Change 2012 to 2014	
		PM Peak	GPL	ML	PM Peak	GPL	ML	PM Peak	ML	PM Peak	ML
Northbound											
Indiantown Rd -	North of Northlake Blvd	7,539	7,009	530	8,350	7,811	539	811	9	10.8%	1.7%
Okeechobee Blvd	South of Palm Beach Lakes Blvd	7,625	7,114	511	7,200	6,707	493	-425	-18	-5.6%	-3.5%
Okeechobee Blvd	North of Gateway Blvd	8,954	7,985	969	9,328	8,051	1,277	374	308	4.2%	31.8%
- Glades Rd	North of Glades Rd*	7,266	5,636	1,630	5,988	4,490	1,498	-1278	-132	-17.6%	-8.1%
Glades Rd -	South of Hillsboro Blvd	7,471	5,745	1,726	7,004	5,707	1,297	-467	-429	-6.3%	-24.9%
Broward Blvd	South of Atlantic Blvd	8,470	6,866	1,604	8,842	7,103	1,739	372	135	4.4%	8.4%
	South of Sunrise Blvd	10,541	8,819	1,722	8,600	6,990	1,610	-1,941	-112	-18.4%	-6.5%
Broward Blvd –	South of Stirling Rd	10,475	9,177	1,298	10,475	9,177	1,298	0	0	0.0%	0.0%
GGI**	South of Hollywood Blvd	8,459	7,147	1312	8,459	7,147	1312	0	0	0.0%	0.0%
	South of Ives Dairy Rd	6,849	5,286	1563	6,849	5,286	1563	0	0	0.0%	0.0%
GGI - EL southern	South of GGI	9,552	6,862	2,690	8,768	5,928	2,840	-784	150	-8.2%	5.6%
terminus	South of NW 65 th St	9,517	6,598	2,919	9,202	5,923	3,279	-315	360	-3.3%	12.3%
Southbound											
Indiantown Rd -	North of Northlake Blvd	5,620	5,418	202	5,865	5,632	233	245	31	4.4%	15.3%
Okeechobee Blvd	South of Palm Beach Lakes Blvd	8,184	7,665	519	7,908	7,290	618	-276	99	-3.4%	19.1%
Okeechobee Blvd	North of Gateway Blvd	7,929	7,250	679	7,389	6,624	765	-540	86	-6.8%	12.7%
- Glades Rd	North of Glades Rd*	7,176	5,788	1,388	3,475	1,743	1,732	-3701	344	-51.6%	24.8%
Glades Rd -	South of Hillsboro Blvd	7,648	5,982	1,666	7,177	5,592	1,585	-471	-81	-6.2%	-4.9%
Broward Blvd	South of Atlantic Blvd	8,294	6,702	1,592	7,870	6,295	1,575	-424	-17	-5.1%	-1.1%
	South of Sunrise Blvd	10,759	9,421	1,338	10,739	9,418	1,321	-20	-17	-0.2%	-1.3%
Broward Blvd –	South of Stirling Rd	9,965	8,558	1,407	9,965	8,558	1,407	0	0	0.0%	0.0%
GGI**	South of Hollywood Blvd	8,267	7,146	1,121	8,267	7,146	1,121	0	0	0.0%	0.0%
	South of Ives Dairy Rd	5,796	4,508	1,288	5,796	4,508	1,288	0	0	0.0%	0.0%
GGI - EL southern	South of GGI	8,315	6,664	1,651	8,164	6,306	1,858	-151	207	-1.8%	12.5%
terminus	South of NW 65 th St	7,929	6,016	1,913	7,919	5,947	1,972	-10	59	-0.1%	3.1%

Note: * Traffic counts were collected in May, when Summer semester had started at FAU. Traffic counts in early April should be higher than May and traffic pattern was probably different.

** 2012 data were used in place of 2014 data for this segment due to construction.

2.4 LOS ANALYSIS

The LOS analysis was performed based on the methodology described in Chapter 23 of the Highway Capacity Manual (HCM) 2000, “Basic Freeway Segments”. FDOT is in the process of transitioning to the Highway Capacity Manual 2010, in which version the LOS methodology and threshold are the same as the 2000 version.

The three measures of LOS - speed, density, and flow or volume are interrelated. By knowing the values of two of these measures, the third can be determined. The volume data used to calculate LOS were described in Section 2.1 (Table 2.1 documents the volume data source and data collection date). After applying truck factors, the volume data were measured and converted to passenger car equivalent volumes (expressed in pc/ln/hr). From the travel-time runs, an average speed (expressed in mph) was calculated for each of the analysis segments.² The density was then determined using the following equation:

$$Density = \frac{Volume}{Speed} \quad (\text{pc/ln/mi})$$

According to the HCM 2000, the LOS thresholds for a basic freeway segment are:

LOS	Density Range (pc/ln/mi)
A	0-11
B	11-18
C	18-26
D	26-35
E	35-45
F	> 45

Basing on the above threshold, the LOS for the study corridor is calculated and summarized in Table 2.4. For all given segments, directions and enforced timeframe, the LOS in MLs was better than or equivalent to that of GPLs. Figure 2.3 and 2.4 present the LOS of MLs and GPLs during the peak periods. ML LOS was mostly D or better north of Broward Blvd, with a couple of exceptions: LOS was F between Sample Rd and Commercial Blvd in the MLs northbound in the a.m. peak; LOS was E between Linton Blvd and Palmetto Park Rd northbound in the p.m. peak period.

² See Section 3.0 of this report for more details on the calculation procedure.

Table 2.4 Speed, Volume, and LOS

Section		A.M.				P.M.			
		Southbound		Northbound		Southbound		Northbound	
		GPL	ML	ML	GPL	GPL	ML	ML	GPL
Average Speed (mph)									
Indiantown Rd- Okeechobee Blvd	Indiantown Rd - Okeechobee Blvd	73.1	77.6	79.8	63.0	67.3	76.9	73.0	62.4
	Okeechobee Blvd - 10 th Ave N	70.0	75.2	76.3	60.5	63.2	72.5	73.5	52.2
Okeechobee Blvd- Glades Rd	10 th Ave N – Gateway Blvd	67.9	75.1	77.7	60.3	64.6	71.9	75.4	59.4
	Gateway Blvd – Linton Blvd	65.7	73.8	80.1	62.8	68.6	74.3	73.1	54.3
Glades Rd- Broward Blvd	Linton Blvd – Palmetto Park Rd	60.7	69.8	73.2	49.3	57.3	63.6	43.5	34.3
	Palmetto Park Rd – Sample Rd	33.2	64.6	61.1	36.3	44.5	52.4	66.0	42.9
	Sample Rd – Commercial Blvd	37.5	57.5	36.7	22.2	46.7	51.2	63.6	52.3
	Commercial Blvd – Broward Blvd	44.2	47.5	61.1	37.8	53.3	56.7	58.5	46.4
Broward Blvd- GGI	Broward Blvd – Griffin Rd	58.2	68.0	65.9	46.4	52.2	56.3	70.7	58.9
	Griffin Rd – Ives Dairy Rd	51.8	53.1	54.5	48.9	44.9	48.3	66.8	56.0
	Ives Dairy Rd – GGI	27.6	23.6	65.3	61.9	28.8	44.4	59.2	44.5
GGI- EL southern terminus	GGI – 125 th St	27.2	41.3	65.1	60.6	41.7	59.8	47.4	37.7
	125 th St – SR 112 (I-195)	20.4	58.6	71.7	59.9	55.9	69.1	55.1	21.3
Volume (pc/hr/ln)									
Indiantown Rd- Okeechobee Blvd	Indiantown Rd - Okeechobee Blvd	1,567	306	472	1,537	1,341	441	535	1,709
	Okeechobee Blvd - 10 th Ave N	1,807	660	612	1,606	1,608	714	914	1,732
Okeechobee Blvd- Glades Rd	10 th Ave N – Gateway Blvd	2,089	946	553	1,677	1,718	794	1,325	2,088
	Gateway Blvd – Linton Blvd	1,415	1,057	1,093	1,614	1,158	1,293	1,437	1,817
Glades Rd- Broward Blvd	Linton Blvd – Palmetto Park Rd	780	1,225	1,713	1,629	630	1,879	1,625	1,624
	Palmetto Park Rd – Sample Rd	1,949	1,481	1,610	1,962	1,912	1,626	1,331	1,952
	Sample Rd – Commercial Blvd	1,798	1,557	2,114	1,791	1,618	1,619	1,788	1,826
	Commercial Blvd – Broward Blvd	1,929	1,307	1,339	1,642	1,933	1,355	1,652	1,434
Broward Blvd- GGI*	Broward Blvd – Griffin Rd ^a	1,777	1,307	1,297	1,768	1,844	1,399	1,492	1,659
	Griffin Rd – Ives Dairy Rd ^a	1,580	1,015	1,078	1,703	1,611	1,297	1,339	1,675
	Ives Dairy Rd – GGI	1,672	1,584	916	1,755	1,524	1,307	1,586	1,788
GGI- EL southern terminus	GGI – 125 th St	1,299	1,779	1,034	1,548	1,599	942	1,441	1,503
	125 th St – SR 112 (I-195)	1,681	1,785	1,557	1,123	1,508	1,000	1,663	1,502

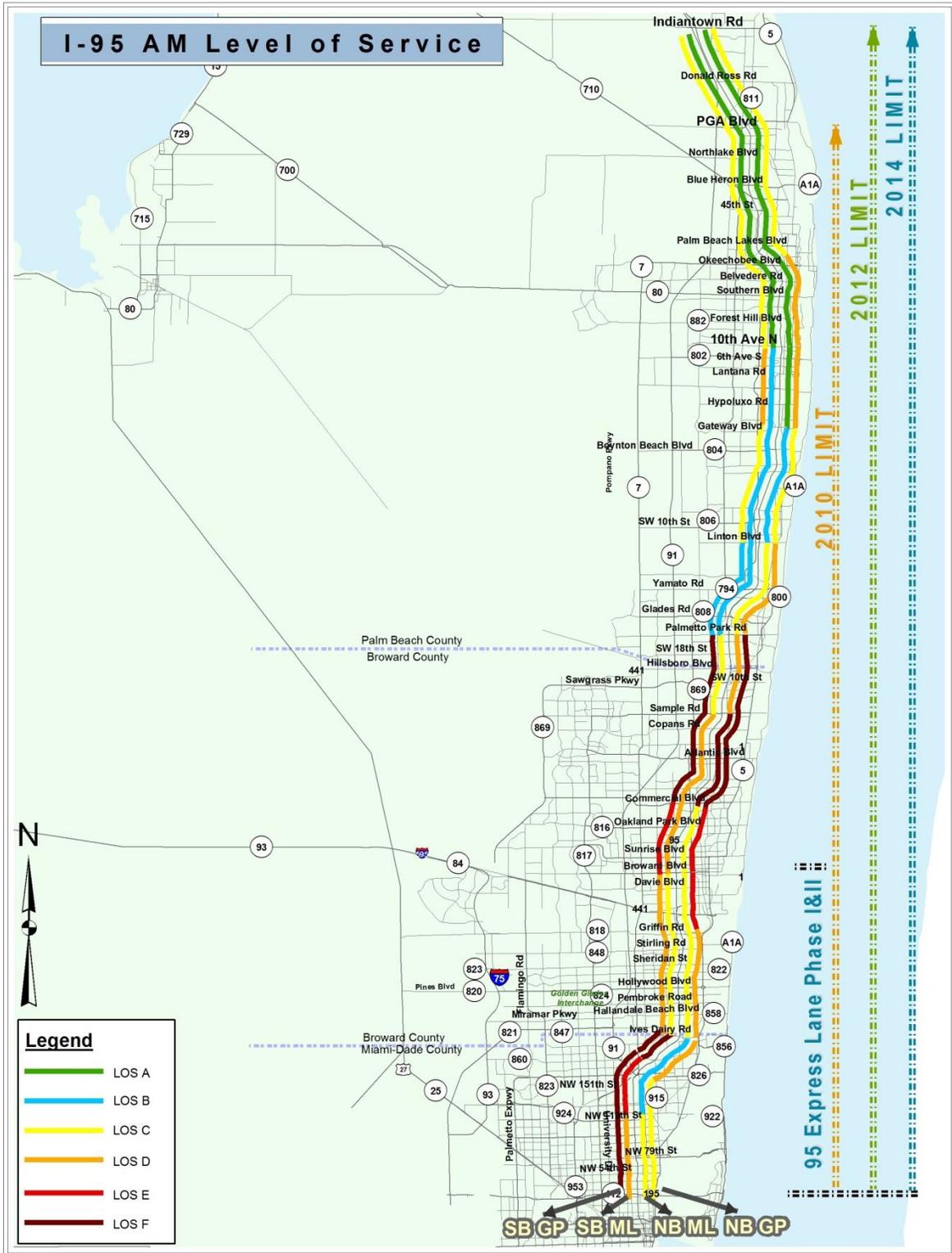
* 2012 data were used in place of 2014 data for this segment due to construction.

Table 2.4 Speed, Volume, and LOS (continued)

Section		A.M.				P.M.			
		Southbound		Northbound		Southbound		Northbound	
		GPL	ML	ML	GPL	GPL	ML	ML	GPL
Density (pc/mi/ln)									
Indiantown Rd- Okeechobee Blvd	Indiantown Rd - Okeechobee Blvd	21.4	3.9	5.9	24.4	19.9	5.7	7.3	27.4
	Okeechobee Blvd - 10 th Ave N	25.8	8.8	8.0	26.6	25.5	9.9	12.4	33.2
Okeechobee Blvd- Glades Rd	10 th Ave N – Gateway Blvd	30.8	12.6	7.1	27.8	26.6	11.0	17.6	35.2
	Gateway Blvd – Linton Blvd	21.5	14.3	13.6	25.7	16.9	17.4	19.7	33.4
Glades Rd- Broward Blvd	Linton Blvd – Palmetto Park Rd	12.8	17.5	23.4	33.0	11.0	29.5	37.4	47.3
	Palmetto Park Rd – Sample Rd	58.8	22.9	26.3	54.1	43.0	31.0	20.2	45.5
	Sample Rd – Commercial Blvd	48.0	27.1	57.6	80.6	34.7	31.6	28.1	34.9
	Commercial Blvd – Broward Blvd	43.7	27.5	21.9	43.4	36.2	23.9	28.3	30.9
Broward Blvd- GGI	Broward Blvd – Griffin Rd	30.5	19.2	19.7	38.1	35.4	24.8	21.1	28.2
	Griffin Rd – Ives Dairy Rd	30.5	19.1	19.8	34.8	35.9	26.8	20.0	29.9
	Ives Dairy Rd – GGI	60.7	67.2	14.0	28.4	52.9	29.5	26.8	40.2
GGI- EL southern terminus	GGI – 125 th St	47.8	43.1	15.9	25.5	38.4	15.8	30.4	39.9
	125 th St – SR 112 (I-195)	82.4	30.5	21.7	18.7	27.0	14.5	30.2	70.4
LOS									
Indiantown Rd- Okeechobee Blvd	Indiantown Rd - Okeechobee Blvd	C	A	A	C	C	A	A	D
	Okeechobee Blvd - 10 th Ave N	C	A	A	D	C	A	B	D
Okeechobee Blvd- Glades Rd	10 th Ave N – Gateway Blvd	D	B	A	D	D	B	B	E
	Gateway Blvd – Linton Blvd	C	B	B	C	B	B	C	D
Glades Rd- Broward Blvd	Linton Blvd – Palmetto Park Rd	B	B	C	D	B	D	E	F
	Palmetto Park Rd – Sample Rd	F	C	D	F	E	D	C	F
	Sample Rd – Commercial Blvd	F	D	F	F	D	D	D	D
	Commercial Blvd – Broward Blvd	E	D	C	E	E	C	D	B
Broward Blvd- GGI	Broward Blvd – Griffin Rd	D	C	C	E	E	C	C	D
	Griffin Rd – Ives Dairy Rd	D	C	C	D	E	D	C	D
	Ives Dairy Rd – GGI	F	F	B	D	F	D	D	E
GGI- EL southern terminus	GGI – 125 th St	F	E	B	C	E	B	D	E
	125 th St – SR 112 (I-195)	F	D	C	C	D	B	D	F

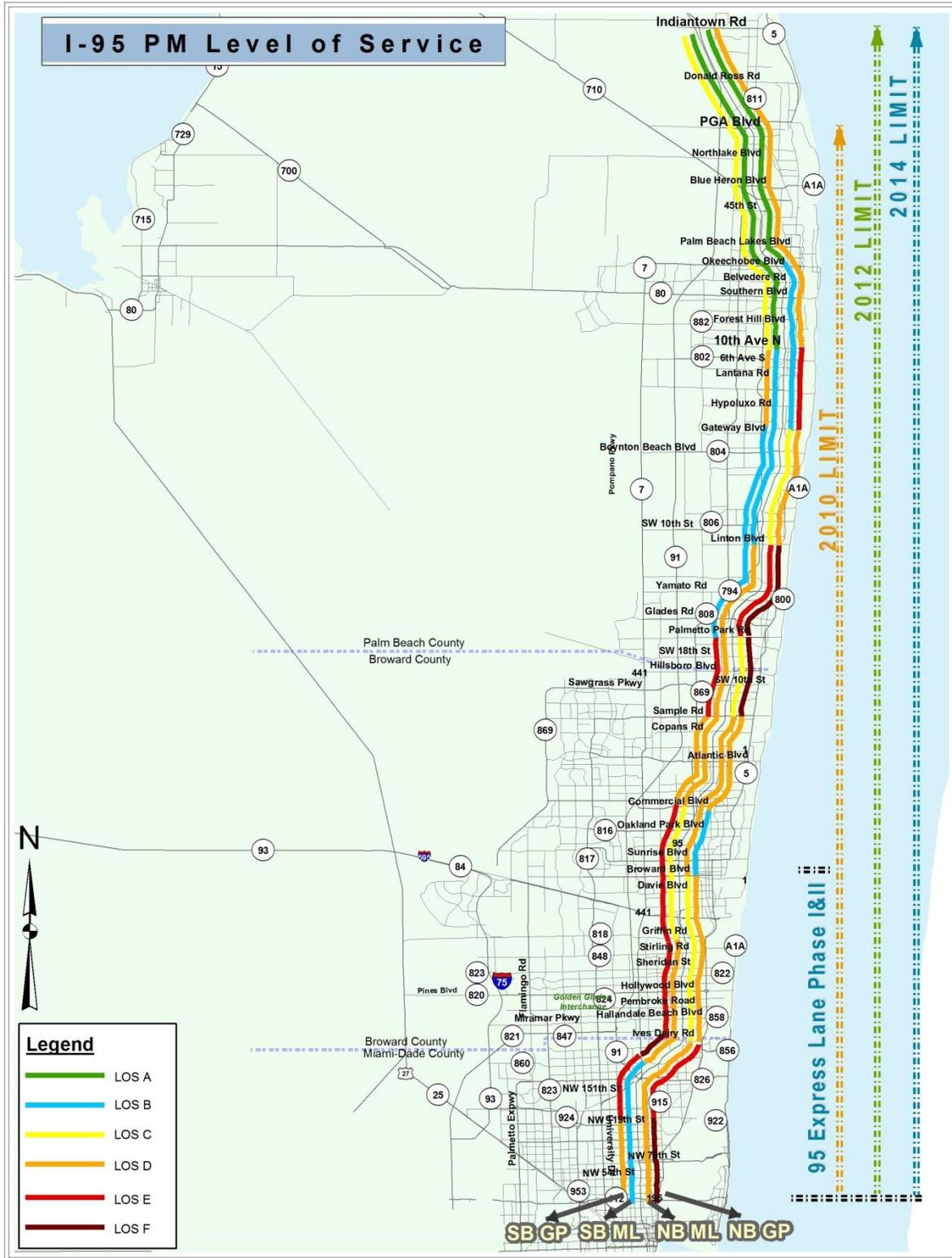
* 2012 data were used in place of 2014 data for this segment due to construction.

Figure 2.3 LOS Map during AM Peak Period



Source: Cambridge Systematics, Inc.

Figure 2.4 LOS Map during PM Peak Period



3.0 Travel Time and Delay Analysis

The objective of this part of the evaluation is to determine the travel-time benefits experienced by vehicles using the MLs during enforced times. In addition, starting from 2012, travel times were also compared among different modes for the I-95 corridor between West Palm Beach and Downtown Miami, including single-occupant vehicle, Express Bus, Commuter Rail, Metrorail, and Carpool/Vanpool.

The travel time runs were conducted on a selected Tuesday, Wednesday, or Thursday between April 8th and April 16th, 2014 for Miami-Dade, Broward, and Palm Beach Counties. Three runs were completed during both the a.m. peak period (7:00 a.m. to 9:00 a.m.) and p.m. peak period (4:00 p.m. to 6:00 p.m.), in each direction (northbound and southbound), and in two lane types (MLs and GPLs). The travel time reported between each waypoint was reviewed to determine that it was reasonable. Similar to previous studies, runs were to be excluded from analysis if they proved to be significant outliers caused by crashes and/or construction work which resulted in non-representative travel speeds, or if they showed very different pattern than their adjacent runs. No runs were excluded this year.

As shown in Figure 3.1, travel times were recorded for seven segments along the I-95 corridor, including five segments on I-95 and two short segments on the arterials. The two short segments on the arterials are shown in the two inserts in Figure 3.1. The summaries of travel speeds and travel times for each run are contained in Appendix B.

3.1 DATA COLLECTION

Travel-Time Runs

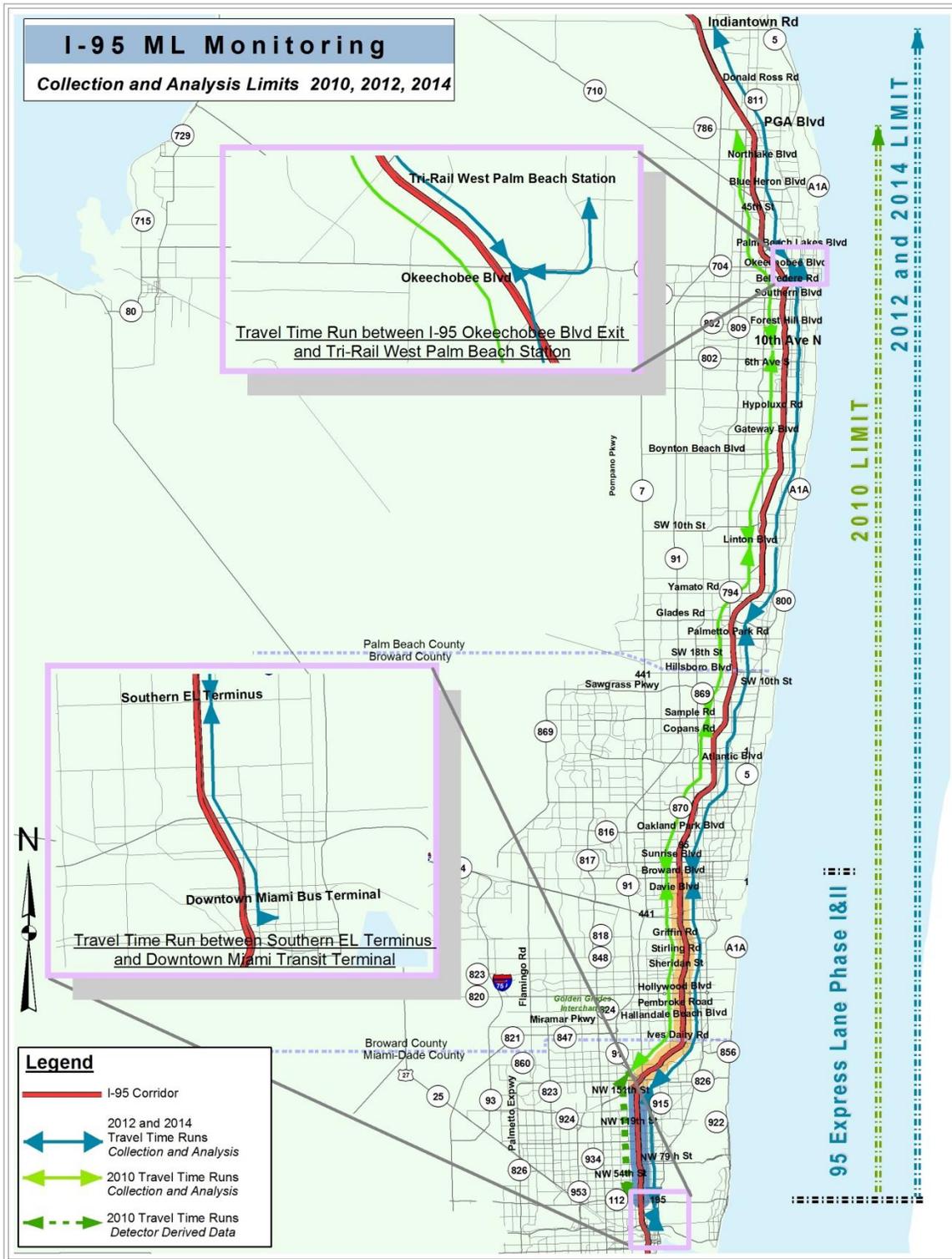
Floating car method, as defined in the *Manual on Uniform Traffic Studies (MUTS)*, was used to collect travel time data. Travel-time runs were performed for the entire length of MLs on I-95 from the northern limit of the HOV lanes (just south of Indiantown Rd, Palm Beach County) to the southern limit of I-95 ELs (south of SR 112, Miami-Dade County). Due to Phase II construction of 95 Express project, HOV lanes south of Broward Blvd were not enforced during data collection period. Travel time data were collected for the left-most lane and used as HOV lane travel time. 2014 travel time data are presented and analyzed in five segments as follows:

1. Indiantown Rd to Okeechobee Blvd;
2. Okeechobee Blvd to Glades Rd;
3. Glades Rd to Broward Blvd;
4. Broward Blvd to GGI; and

5. GGI to EL southern terminus.

In 2014, to serve the purpose of comparing travel time among different modes, travel-time runs were also conducted on two additional segments (as shown in Figure 3.1) to measure time traveled by vehicles: from Tri-Rail West Palm Beach station to I-95 Okeechobee Rd entrance/exit and from EL southern terminus to Downtown Miami Bus Terminal south of the Stephen P. Clark Government Center. With these two additional segments, travel time in GPLs and MLs can be calculated between West Palm Beach Tri-Rail Station and Downtown Miami Bus Terminal, and compared with other travel modes along I-95 corridor. The results of these travel time runs are summarized in Section 7.0 (page 7-1).

Figure 3.1 Segments of Travel-Time Runs for the 2014 I-95 MLs Monitoring Study



Source: Cambridge Systematics, Inc.

3.2 2014 RESULTS

Travel Time

Table 3.1 presents the travel-time savings provided by MLs. The National Cooperative Highway Research Program *HOV Systems Manual* states that HOV facilities should provide one-minute per mile in travel-time savings. It further suggests a minimum overall travel-time savings of at least five minutes per trip during the peak hour³. This threshold is a general guide. Some areas have different guidelines. For example, California Department of Transportation (Caltrans) District Seven used a travel time savings threshold of 0.5 minutes per mile for the peak period in the peak direction.

The 2014 study shows an overall travel-time savings of 25 minutes and nine seconds (00:25:09) southbound during the a.m. peak and 28 minutes and 24 seconds (00:28:24) northbound during the p.m. peak. In the off peak direction during the HOV enforcement hours, ML travel time savings were significant: travel-time savings were 27 minutes and three seconds (00:27:03) northbound in the a.m. peak and 12 minutes and two seconds (00:12:02) southbound in the p.m. peak. Thus travel time savings per mile of the entire 80-mile long study corridor were in the range of nine seconds per mile (southbound in the p.m. peak) and 21 seconds per mile (northbound in the p.m. peak). Being 80 mile in length, I-95 MLs encompass segments that are not very congested. However, at the section between GGI and SR 112, the travel-time savings were 86-second per mile southbound during the a.m. peak and 69-second savings per mile northbound during the p.m. peak. Both have exceeded the one-minute per mile threshold.

Travel Speeds

The average travel speeds calculated from the travel-time runs are also summarized in Table 3.1. The average travel speeds, as well as speed difference between the MLs and GPLs, are presented for each peak period per direction in GPLs and MLs. The arrows indicate whether the speeds in MLs are higher (↑) or lower (↓) than the speeds in GPLs. In all cases, the speeds were higher in MLs than in GPLs. In the segment between Broward Blvd and GGI in the a.m. southbound direction, the left-most lane (previous HOV lane) was slightly slower than the lane next to it. However, because the left-most lane was no longer an HOV lane due to construction, travel time savings in this segment do not reflect savings between HOV lanes and GPLs.

Figure 3.2 and 3.3 graphically depict the difference in speeds between MLs and GPLs for each segment.

³ National Cooperative Highway Research Program, *HOV Systems Manual*, Report 414, Transportation Research Board, National Research Council, Washington, D.C., February 1998.

Some general observation in travel speeds of the corridor are:

- Northbound in the a.m. peak, travel speeds were up to 20 mph faster in MLs than GPLs;
- Southbound in the a.m. peak, travel speeds were up to 27 mph faster in MLs than GPLs;
- Northbound in the p.m. peak, travel speeds were up to 26 mph faster in MLs than GPLs; and
- Southbound in the p.m. peak, travel speeds were up to 16 mph faster in MLs than GPLs.

Per the Federal Highway Administration (FHWA⁴), it is recommended that a 15 mph maximum speed differential not be exceeded until additional research can be conducted to quantify an optimum speed differential. If necessary and possible, the speed differential between HOV lanes and GPLs should be controlled, typically by two methods: ramp metering or dynamic speed control signing on the HOV lanes using the Variable Message Sign (VMS) boards. This recommendation applies to the segment between Indiantown Rd and Broward Blvd northbound in the a.m., between Okeechobee Blvd and Glades Rd northbound in the p.m., and between Glades Rd and Broward Blvd southbound in the a.m.. The speed differential south of Glades Rd will be resolved as part of Phase III of 95 Express Lanes project.

⁴ Report No. FHWA-RD-79-59, Safety Evaluation of Priority Techniques for High-Occupancy Vehicles.

Table 3.1 ML and GPL Travel Speeds

Section	Distance (miles)	A.M.				P.M.				
		GPL Speed (mph)	HOV Lane Speed (mph)	Speed Difference (mph)	Travel Time Savings (min:sec)	GPL Speed (mph)	HOV Lane Speed (mph)	Speed Difference (mph)	Travel Time Savings (min:sec)	
Northbound										
Indiantown Rd - Okeechobee Blvd	16.33	63.0	79.8	↑ 16.8	03:16	62.4	73.0	↑ 10.6	02:17	
Okeechobee Blvd - Glades Rd	24.42	59.2	76.8	↑ 17.6	05:41	49.9	67.0	↑ 17.1	07:29	
Glades Rd - Broward Blvd	17.85	29.8	49.9	↑ 20.0	14:24	44.2	57.1	↑ 12.9	05:28	
Broward Blvd - GGI*	13.74	50.2	59.5	↑ 9.4	02:35	54.0	66.2	↑ 12.2	02:49	
GGI - SR 112**	8.94	60.2	68.8	↑ 8.6	01:07	25.9	51.7	↑ 25.9	10:21	
Total	81.3				27:03				28:24	
Southbound										
Indiantown Rd - Okeechobee Blvd	16.33	73.1	77.4	↑ 4.2	00:44	67.3	76.9	↑ 9.7	01:50	
Okeechobee Blvd - Glades Rd	24.42	65.5	73.3	↑ 7.8	02:22	65.4	71.8	↑ 6.5	02:01	
Glades Rd - Broward Blvd	17.85	38.7	57.0	↑ 18.2	08:51	46.9	52.8	↑ 6.0	02:35	
Broward Blvd - GGI*	13.51	45.8	45.6	↓ -0.3	00:06	42.3	49.6	↑ 7.3	02:50	
GGI - SR 112**	9.17	22.8	49.8	↑ 27.0	13:06	48.9	64.9	↑ 15.9	02:46	
Total	81.3				25:09				12:02	

* This segment was under construction in 2014, HOV lanes were not enforced during data collection time.

** Travel time was collected between GGI and EL southern terminus

Note: The arrows indicate whether the speeds in MLs are higher (↑) or lower (↓) than the speeds in GPLs.

Figure 3.2 Average Travel Speeds
Northbound

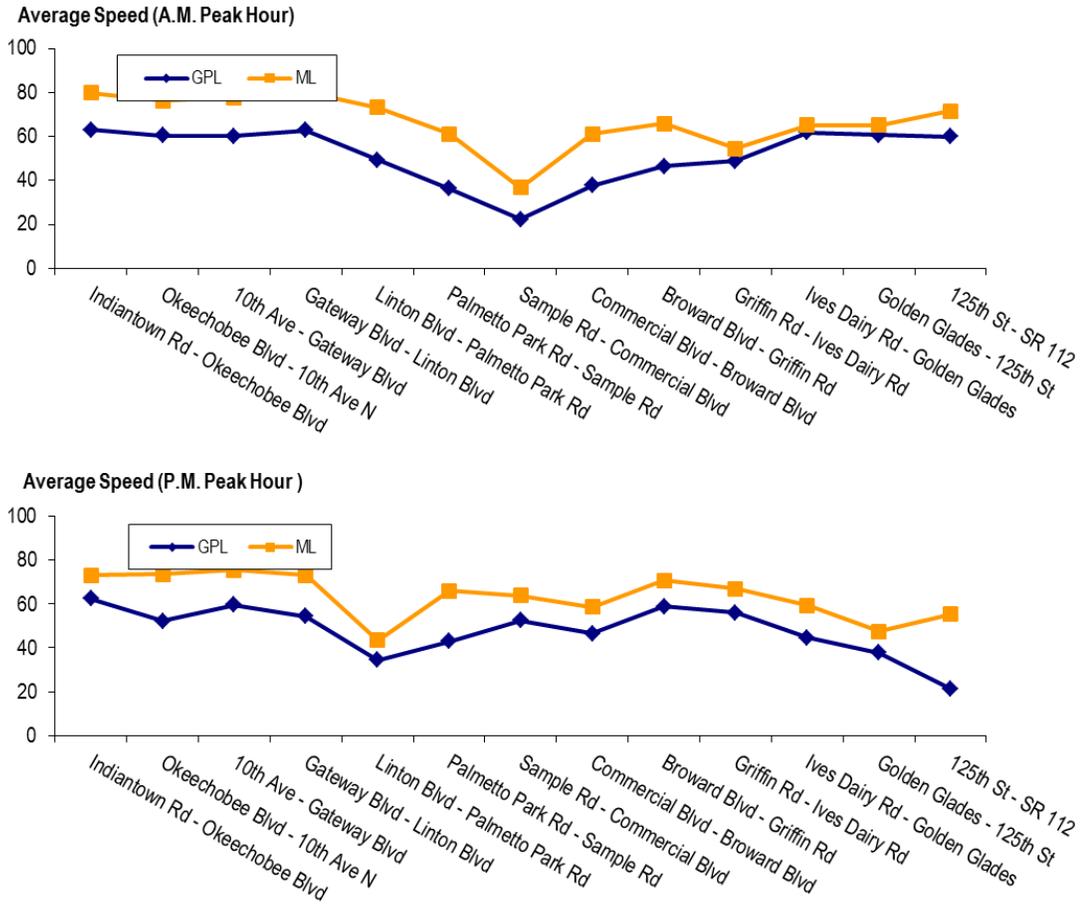
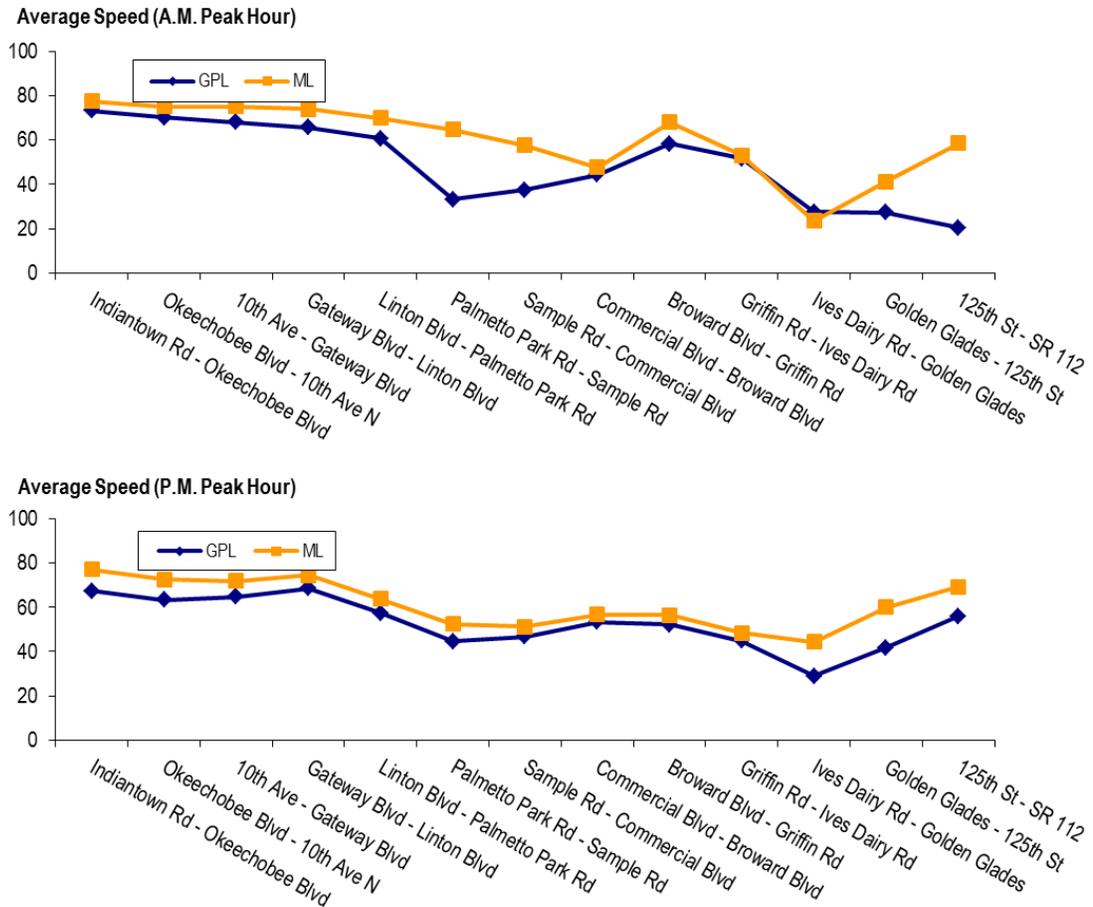


Figure 3.3 Average Travel Speeds Southbound



3.3 TRENDS AND COMPARISONS WITH PREVIOUS YEARS

Travel Time Savings

Tables 3.4 and 3.5 show travel time savings in MLs compared with the previous reports. Figure 3.4 and 3.5 visually present the travel time saving trend from 1997 to 2014. Please note that the travel time savings shown in these tables and figures are savings between PGA Blvd and SR 112, consistent with the segment used in 2010 and 2012. Travel time savings for the entire 2014 ML study corridor, as noted elsewhere in this report, are different from savings presented here.

As presented in these tables and figures, traveling southbound in the a.m. peak period, the travel time savings were higher than in 2012.

Table 3.2 ML Year-on-Year Time Savings
A.M. Peak period – 1998 to 2014

Total Corridor Savings	1998	2000	2002	2004	2006	2008	2010	2012	2014
Northbound	04:47	16:10	08:05	00:36	16:48	07:54	08:04	08:36	25:53
Southbound	15:40	12:10	07:13	15:17	13:18	17:07	09:46	16:19	24:41

*2014 travel time was evaluated between PGA Blvd to SR 112 (74 miles) for consistent corridor travel time savings comparison with 2012 and 2010.

Table 3.3 ML Year-on-Year Time Savings
P.M. Peak period – 1998 to 2014

Total Corridor Savings	1998	2000	2002	2004	2006	2008	2010	2012	2014
Northbound	04:10	06:51	09:27	07:07	13:00	06:52	08:49	19:18	24:57
Southbound	02:52	05:46	08:40	02:15	02:30	04:45	12:04	11:42	11:28

*2014 travel time was evaluated PGA Blvd to SR 112 (74 miles) for consistent corridor travel time savings comparison with 2012 and 2010.

Figure 3.4 ML Year-on-Year Travel Time Savings
A.M. Peak period – 1997 to 2014

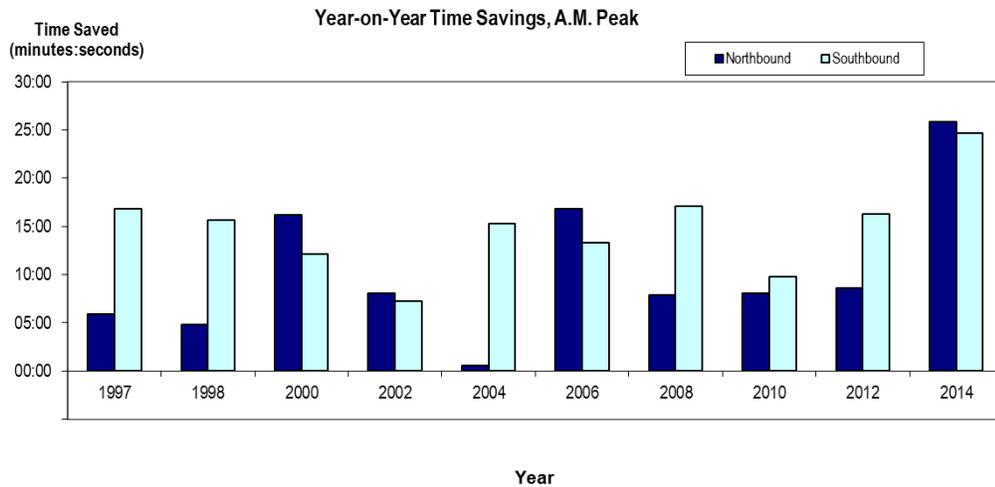
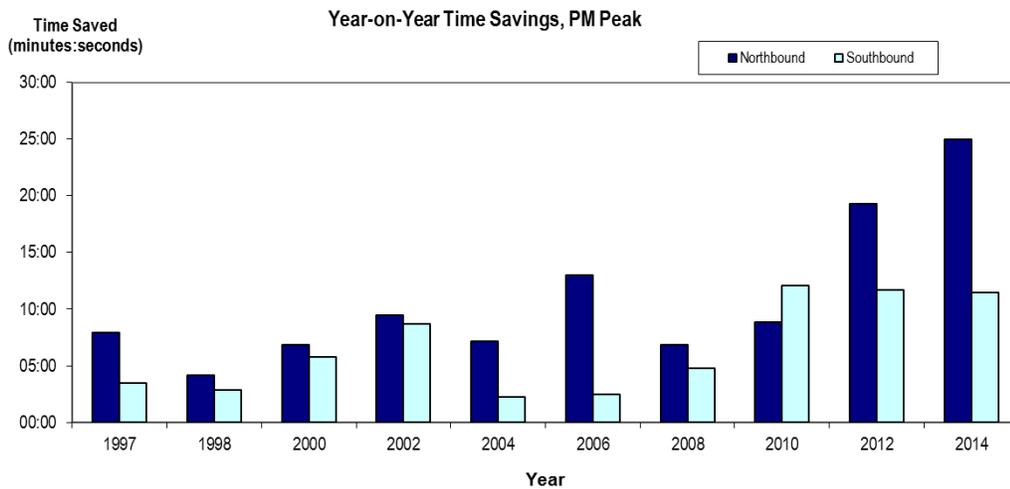


Figure 3.5 ML Year-on-Year Time Savings
P.M. Peak period – 1997 to 2014



Travel Speeds

The study corridor distinguishes five segments in terms of travel speed characteristics that are listed below. When compared with the travel speeds in 2012, the term “minor” is used to indicate a change in travel speeds less than 10 percent; “moderate” is used to indicate a change in travel speeds from 10 to 20 percent; and “significant” is used to indicate a change in travel speeds of 20 percent or more. For detailed travel speed trends and comparison, please refer to Table 3.4 and 3.3.

Compared with 2012, average travel speeds in MLs generally increased north of Sample Rd in both directions in both a.m. and p.m. peak hours; travel speeds in GPLs decreased from 10th Ave N. to Broward Blvd southbound in the a.m., Sample Rd northbound in the p.m., and decreased in the off-peak directions.

I-95 Segments	Southbound AM	Northbound PM
Corridor-Wide	<ul style="list-style-type: none"> - MLs: speeds generally increased north of Sample Rd and decreased south of it; - GPLs: speeds generally increased north of 10th Ave N. and decreased south of it. 	<ul style="list-style-type: none"> - MLs: speeds generally increased throughout the corridor; - GPLs: speeds generally decreased north of Sample Rd and increased south of it.
Indiantown Rd - Okeechobee Blvd	<ul style="list-style-type: none"> - Speeds increased moderately in both MLs and GPLs 	<ul style="list-style-type: none"> - MLs: moderate increase in speeds; - GPLs: minor decrease in speeds
Okeechobee Blvd - Glades Rd (south of Linton Rd)	<ul style="list-style-type: none"> - MLs: minor increase in speeds; - GPLs: speeds generally remained the same as 2012 	<ul style="list-style-type: none"> - MLs: minor to moderate increase in speeds - GPLs: moderate to significant decrease in speeds
Glades Rd - Broward Blvd	<ul style="list-style-type: none"> - MLs: moderate increase in speeds north of Sample Rd and minor decrease south of it; - GPLs: significant decrease in speeds south of Sample Rd 	<ul style="list-style-type: none"> - MLs: minor decrease in speeds north of Sample Rd, significant increase in speeds south of it; - GPLs: significant decrease in speeds north of Sample Rd, significant increase in speeds south of it
Broward Blvd - GGI	<ul style="list-style-type: none"> - MLs: minor decrease in speeds - GPLs: significant increase in speeds 	<ul style="list-style-type: none"> - MLs: minor increase in speeds - GPLs: significant increase in speeds
GGI - EL: southern terminus	<ul style="list-style-type: none"> - MLs: moderate decrease in speeds - GPLs: moderate decrease in speeds 	<ul style="list-style-type: none"> - MLs: minor decrease in speeds - GPLs: moderate increase in speeds

Table 3.4 and 3.3 show the changes in travel speeds in both GPLs and MLs over an sixteen-year period. The information is taken from the I-95 HOV lane/MLs monitoring studies conducted in 1998, 2000, 2002, 2004, 2006, 2008, 2010, 2012, and 2014. The arrows indicate whether the 2014 speeds are higher (↑) or lower (↓) than the 2012 speeds.

Table 3.4 Travel Speed Comparisons
A.M. Peak period – 1998 to 2014

Section	Percent Change 2012 to 2014		Spring 2014		Spring 2012		Spring 2010		Spring 2008		Spring 2006		Spring 2004		Spring 2002		Fall 2000		Spring 1998			
	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML		
Northbound																						
Indiantown Rd - Okeechobee Blvd	-6.5%	17.8%	63.0	↓	79.8	↑	67.3	67.7	-	-	-	-	-	-	-	-	-	-	-	-		
Okeechobee Blvd- 10 th Ave N	-11.1%	8.9%	60.5	↓	76.4	↑	68.1	70.2	70.4	71.0	-	-	-	-	-	-	-	-	-	-		
10 th Ave N - Linton Blvd	-10.8%	15.0%	61.7	↓	79.1	↑	69.2	68.8	70.4	71.9	71.4	65.2	56.9	74.3	-	-	-	-	-	-		
Linton Blvd - Sample Rd	-31.5%	3.4%	42.6	↓	67.4	↑	62.2	65.2	62.5	67.3	61.7	70.0	49.2	59.1	62.1	64.9	62.5	64.5	39.3	52.2	54.6	60.9
Sample Rd - Broward Blvd	-41.9%	-22.7%	27.0	↓	44.2	↓	46.4	57.2	59.0	64.7	57.9	64.1	36.6	51.9	57.6	59	56	61.1	35.4	49.9	50.7	61.6
Broward Blvd - GGI	-6.8%	-13.7%	49.4	↓	58.5	↓	53.0	67.8	46.1	61.2	39.4	53.1	45.0	58.4	62.8	67.3	46.6	61.4	55.6	65.6	62.6	60.6
GGI - SR 112	12.8%	-1.7%	61.7	↑	70.6	↓	54.7	71.8	61.3	70.9	64.6	68.5	58.1	61.9	63.1	67.1	50	65.8	43	62.4	59.2	62.7
Southbound																						
Indiantown Rd - Okeechobee Blvd	11.3%	20.0%	73.1	↑	77.6	↑	65.7	64.7	-	-	-	-	-	-	-	-	-	-	-	-	-	
Okeechobee Blvd- 10 th Ave N	1.9%	8.6%	70.1	↑	75.2	↑	68.8	69.3	71.6	72.5	-	-	-	-	-	-	-	-	-	-	-	
10 th Ave N - Linton Blvd	-2.4%	7.4%	66.6	↓	74.3	↑	68.2	69.2	43.8	56.0	66.2	69.8	69.4	73.7	-	-	-	-	-	-	-	
Linton Blvd - Sample Rd	-2.7%	13.4%	44.6	↓	67.5	↑	45.8	59.5	54.1	64.4	55.9	67.2	51.9	59.7	61.2	65.1	66.5	65.1	52.1	68.1	63.3	67.5
Sample Rd - Broward Blvd	-22.5%	-8.1%	40.1	↓	52.8	↓	51.7	57.5	51.1	60.3	56.6	63.3	47.6	60.0	55.5	60.2	56	63.6	63	69	53.5	65.1
Broward Blvd - GGI	27.8%	-3.1%	45.9	↑	45.6	↓	35.9	47.1	60.0	62.5	48.9	67.1	64.7	54.4	66.4	73.4	53.7	64.3	64.3	70.1	64.5	67.6
GGI - SR 112	-18.7%	-14.4%	22.8	↓	49.8	↓	28.0	58.1	54.2	60.9	15.2	20.3	16.5	22.8	18.4	36.8	33.8	41.4	26	38.1	25.4	44.2

Note: The arrows indicate whether 2014 values are higher (↑) or lower (↓) than the 2012 speeds. - Data not available.

Table 3.5 Travel Speed Comparisons
P.M. Peak period – 1998 to 2014

Section	Percent Change 2012 to 2014		Spring 2014		Spring 2012		Spring 2010		Spring 2008		Spring 2006		Spring 2004		Spring 2002		Fall 2000		Spring 1998			
	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML	GPL	ML		
Northbound																						
Indiantown Rd - Okeechobee Blvd	-7.1%	8.6%	62.4	↓	73.0	↑	67.2	67.3	-	-	-	-	-	-	-	-	-	-	-	-		
Okeechobee Blvd- 10 th Ave N	-22.6%	7.4%	52.2	↓	73.5	↑	67.5	68.4	67.8	71.1	-	-	-	-	-	-	-	-	-	-		
10 th Ave N - Linton Blvd	-16.7%	11.1%	56.3	↓	74.0	↑	67.5	66.6	66.1	70.0	70.3	68.5	52.6	63.4	-	-	-	-	-	-		
Linton Blvd - Sample Rd	-27.6%	-7.2%	37.6	↓	51.1	↓	52.0	55.1	51.9	58.0	62.4	65.2	56.3	62.5	55.9	54.7	57.8	66.7	58.6	64.4	64.2	67.4
Sample Rd - Broward Blvd	26.8%	30.6%	49.7	↑	61.4	↑	39.2	47.0	47.3	54.8	33.6	41.0	44.7	51.0	54.8	59.1	49.8	57.8	53.0	63.2	50.5	61.0
Broward Blvd - GGI	36.2%	5.1%	53.1	↑	65.2	↑	39.0	62.0	65.2	70.1	50.7	64.8	55.3	60.8	48.7	55.2	49.4	64.9	62.0	58.6	63.9	63.5
GGI - SR 112	18.4%	-8.0%	31.0	↑	53.0	↓	26.2	57.6	36.5	48.5	18.8	18.1	17.0	25.4	58.0	59.8	32.3	37.1	32.8	43.5	38.8	41.9
Southbound																						
Indiantown Rd - Okeechobee Blvd	-0.5%	15.1%	67.3	↓	76.9	↑	67.6	66.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Okeechobee Blvd- 10 th Ave N	-10.5%	7.2%	63.2	↓	72.5	↑	70.6	67.6	71.2	71.9	-	-	-	-	-	-	-	-	-	-	-	-
10 th Ave N - Linton Blvd	-3.3%	10.2%	66.9	↓	73.3	↑	69.2	66.5	56.0	70.8	68.3	71.8	74.4	68.0	-	-	-	-	-	-	-	-
Linton Blvd - Sample Rd	16.3%	9.8%	50.9	↑	58.2	↑	43.8	53.0	35.0	45.6	56.7	52.8	52.6	51.0	62.3	59.2	48.0	60.7	40.7	58.1	56.5	63.7
Sample Rd - Broward Blvd	-7.3%	-8.7%	49.3	↓	53.5	↓	53.2	58.6	60.3	59.9	49.0	60.1	35.5	46.0	45.2	59.5	48.6	51.7	49.4	48.1	54.5	60.2
Broward Blvd - GGI	7.2%	-16.5%	42.3	↑	49.7	↓	39.5	59.5	46.2	55.0	53.7	59.3	50.3	51.5	61.4	61.5	45.1	55.7	50.9	56.6	56.4	56.3
GGI - SR 112	-11.4%	-4.4%	48.9	↓	64.9	↓	55.2	67.8	57.9	67.6	52.8	62.0	45.0	51.1	26.5	35.1	49.3	57.5	51.0	56.9	58.9	61.1

Note: The arrows indicate whether 2014 values are higher (↑) or lower (↓) than the 2012 speeds. - Data not available.

To better understand the changes in travel time savings, average travel speeds of the study corridor between 2002 and 2014 are presented in Figure 3.6 and 3.7. It is an apparent trend that over the years, average speeds in GPLs of the corridor have decreased particularly in the peak direction; travel speeds in MLs, on the other hand, have remained almost the same. The increase in travel time savings over the years, therefore, is largely a result of increased travel time in GPLs.

Figure 3.6 Year-on-Year Corridor Average Speed
A.M. Peak period – 2002 to 2014

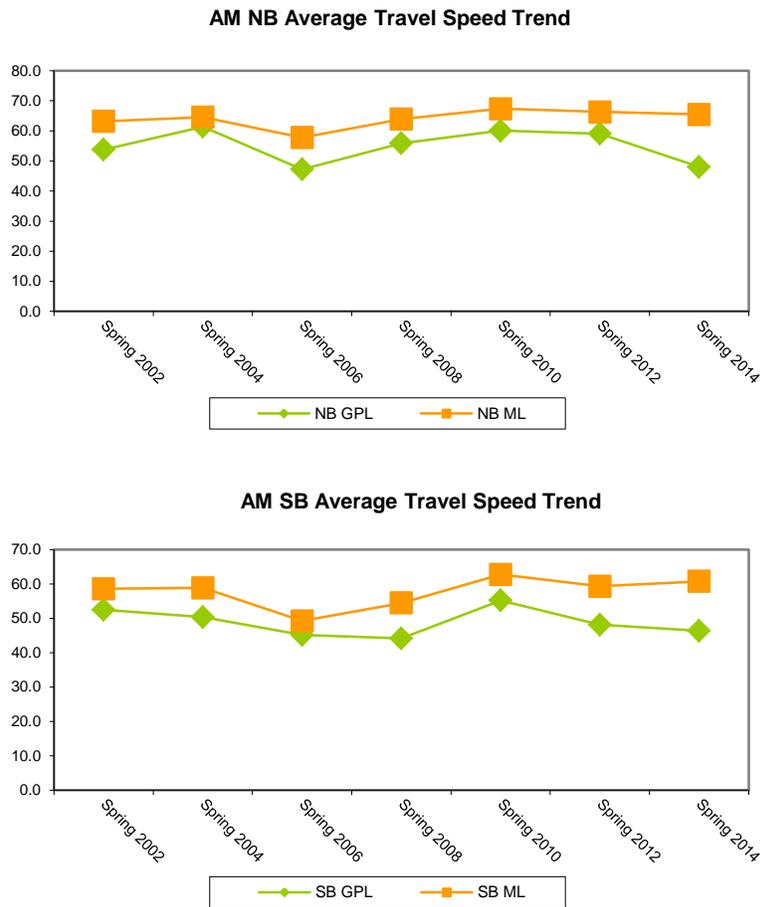
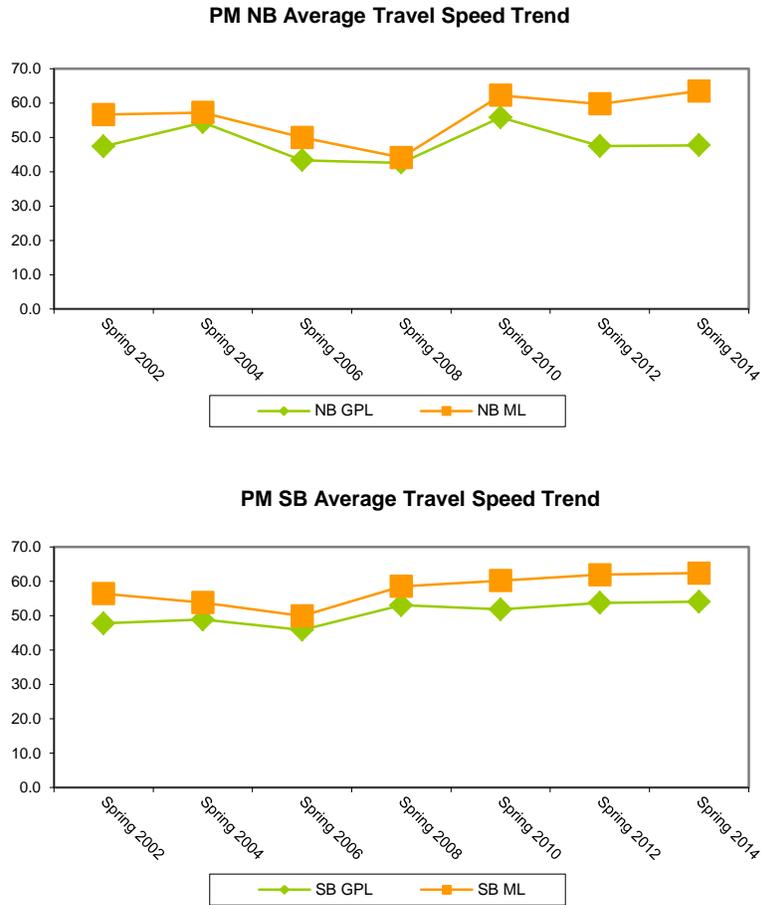


Figure 3.7 Year-on-Year Corridor Average Speed
P.M. Peak period – 2002 to 2014



4.0 Vehicle Occupancy

4.1 DATA COLLECTION

Vehicle occupancy surveys were conducted at six locations along the study corridor on April 8th and April 10th, 2014. Locations include:

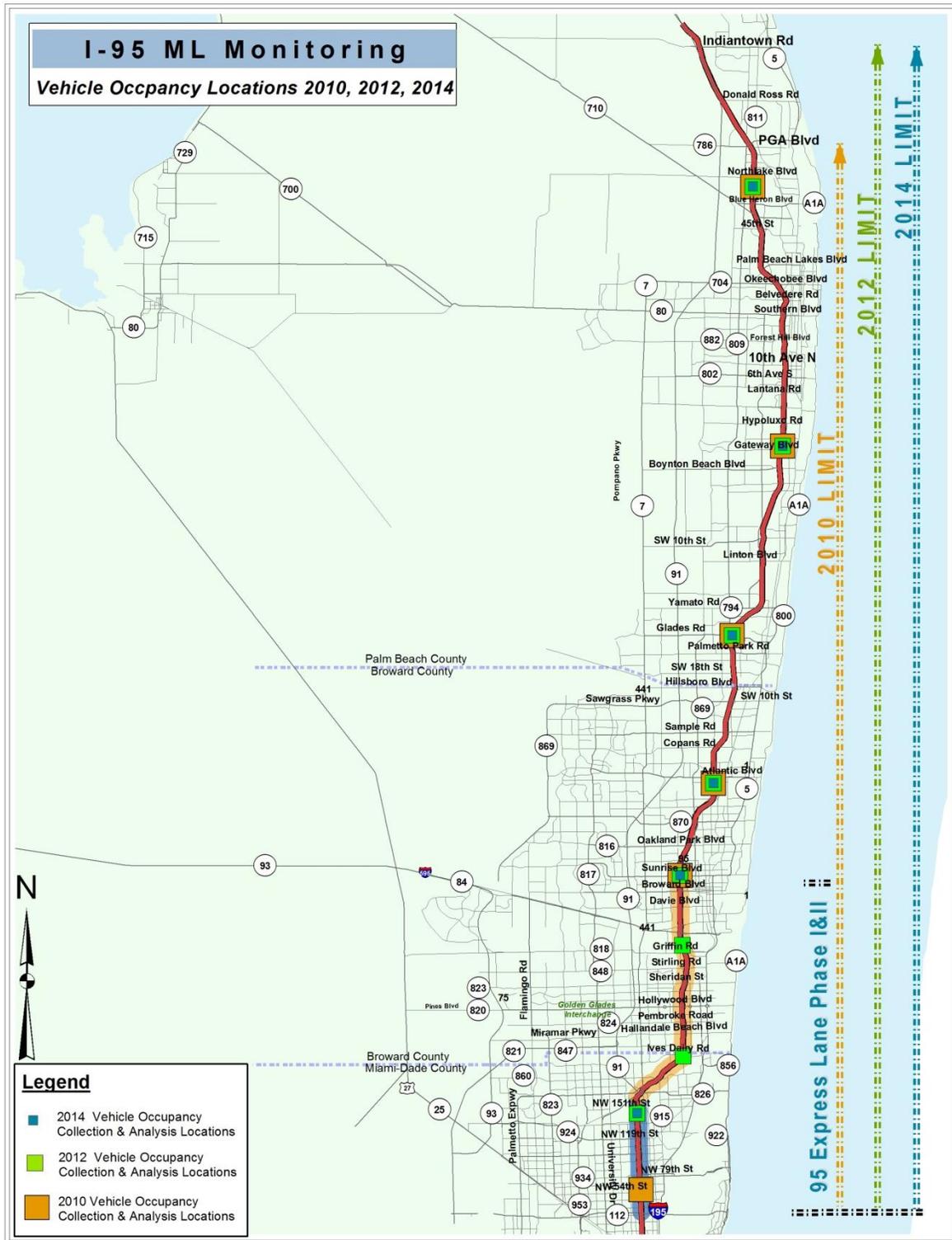
County	Location
Palm Beach	Northlake Blvd Overpass
	Gateway Blvd Overpass
	Glades Rd Overpass
Broward	SW 3 rd St (Atlantic Blvd)
	Sunrise Blvd Overpass
Miami-Dade	NW 146 th St Overpass*

* It was assumed that vehicle occupancy rate at NW 65th St was the same as the one at NW 146th St.

As shown in Figure 4.1, most locations were chosen because they were consistent with or close to previous monitoring efforts and because they provided favorable locations for visual observations. In 2014, due to Phase II construction of the 95 Express project, data was not collected at SW 42nd St in Broward County and Ives Dairy Rd in Miami-Dade County. 2012 AVO rates at these locations are reported in this report instead. It's recommended that for the next MLs monitoring study (2016), the two vehicle occupancy data collection sites at SW 42nd St and Ives Dairy Rd be re-evaluated based on their relative positions to the entry and exit points of the Phase II 95 ELs. It is likely that one or both data collection sites need to be removed and new sites added to best measure the vehicle occupancy data for this segment.

In this study, average vehicle occupancy was calculated using weighted average of single-occupant vehicles, two-person vehicles, and vehicles containing three or more persons within the traffic stream. Express buses and vanpools were included in the calculation for those segments in Miami-Dade and Broward County. Other vehicle types - including motorcycles, buses other than express buses, and trucks with three or more axles - were noted but not included in the calculation. The data reported in this section summarize AVO during the hours of HOV enforcement. The complete data summary worksheets are provided in Appendix C.

Figure 4.1 Vehicle Occupancy Locations for the 2010, 2012 and 2014 MLs Monitoring Study



Source: Cambridge Systematics, Inc.

Average Vehicle Occupancy

The vehicle occupancy survey data and Express Bus/vanpool ridership data were used to calculate the average vehicle occupancy (AVO) rate for the six locations.

For all six locations, the AVO without Express Bus services reflects the AVO of vehicles surveyed during the HOV enforced hours. When calculating AVO, 3.2⁵ is assumed as the combined average occupancy for vehicles containing three or more occupants. The equation used to calculate AVO is:

$$AVO = \frac{\sum_{i=1}^n AVO_i \times \text{Total number of "i-person" vehicles}}{\text{Total number of vehicles}} \quad (n \geq i \geq 1)$$

$$AVO_i = i \quad (i = 1 \text{ or } i = 2); \quad AVO_i = 3.2 \quad (i \geq 3)$$

i: number of occupants observed in a vehicle

For the locations covered by both Express Bus services and the Vanpool Program (NW 65th St, NW 146th St, Ives Dairy Rd, and South of Hollywood Blvd), the express bus and vanpool ridership data were used to calculate total person throughput and vehicle occupancy rate for the a.m. and p.m. peak periods. Please note that for Ives Dairy Rd and Hollywood Blvd, 2012 data were used instead.

Included Express Bus routes and data collection dates are described below:

Transit Agency	Route	Data Source	Data Collection Date(s)
Broward County Transit (BCT)	106: Miramar Regional Park to Civic Center	BCT farebox data	April 8 th , 2014
	107: University P&R to Downtown Miami		
	108: North Perry Airport to Civic Center		
	109: CB Smith Park/Ansin to Downtown Miami		
	110: Sunrise (BB&T Center) to Downtown Miami		
	114: Weston (Westgate Square) to Civic Center		
Miami-Dade Transit (MDT)	95 Golden Glades	MDT APC data	April 1 st to April 10 th , 2014
	95 Dade-Broward Express	MDT APC data	March 1 st to March 31 st , 2014

The latest vanpool data (updated in September 2014) were obtained from South Florida Commuter Services.

⁵ AASHTO Guide for HOV Facilities, Nov 2004.

4.2 2014 RESULTS

The vehicle occupancy rates during the enforcement periods (7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m.) are shown in Table 4.1. AVO a.m. in the southbound direction was 1.61; while AVO p.m. in the northbound direction was 1.79.

Table 4.1 AVO Current Enforcement Period (Persons per Vehicle)

Section	I-95 Location	A.M. Enforcement Period		P.M. Enforcement Period	
		GPL	ML	ML	GPL
Northbound					
Indiantown Rd- Okeechobee Blvd	Northlake Blvd	1.23	1.65	1.84	1.05
Okeechobee Blvd- Glades Rd	Gateway Blvd	1.09	1.47	1.89	1.05
	Glades Rd	1.04	1.69	1.74	1.06
Glades Rd- Broward Blvd	Atlantic Blvd	1.06	1.74	1.78	1.08
	Sunrise Blvd	1.08	1.55	1.73	1.19
Broward Blvd- GGI	SW 42 nd St ^b	1.02	1.57	2.18	1.25
	Ives Dairy Rd ^b	1.11	1.63	2.14	1.05
GGI - EL southern terminus	NW 146 th St ^b	1.26	1.16	1.74	1.23
	NW 65 th St ^b	1.26	1.16	1.74	1.23
<i>Average AVO N. of Broward Blvd</i>		1.10	1.62	1.79	1.09
<i>Average AVO S. of GGI</i>		1.26	1.16	1.74	1.23
Southbound					
Indiantown Rd- Okeechobee Blvd	Northlake Blvd	1.14	1.71	1.76	1.17
Okeechobee Blvd- Glades Rd	Gateway Blvd	1.08	1.61	1.78	1.12
	Glades Rd	1.17	1.59	1.82	1.10
Glades Rd- Broward Blvd	Atlantic Blvd	1.09	1.66	1.56	1.09
	Sunrise Blvd	1.04	1.49	1.65	1.07
Broward Blvd- GGI ^a	SW 42 nd St ^b	1.07	2.04	1.76	1.05
	Ives Dairy Rd ^b	1.05	1.97	1.68	1.08
GGI - EL southern terminus	NW 146 th St ^b	1.23	1.53	1.42	1.31
	NW 65 th St ^b	1.23	1.53	1.42	1.31
<i>Average AVO N. of Broward Blvd</i>		1.09	1.61	1.71	1.10
<i>Average AVO S. of GGI</i>		1.23	1.53	1.42	1.31

^a Reported numbers are 2012 AVO;

^b AVO with Express Bus services and Vanpool Program

4.3 TRENDS AND COMPARISONS WITH PREVIOUS YEARS

The study corridor generally distinguishes five segments in terms of AVO characteristics as listed below. When comparing with the AVO in 2012, the term “minor” is used to indicate a change in AVO of less than five percent; “moderate” is

used to indicate a change in AVO from five to 10 percent; and “significant” is used to indicate a change in AVO of 10 percent or more.

Between Indiantown Rd and Okeechobee Blvd, AVO decreased in the MLs in both directions comparing to 2012. One of the contributing factors was the express service provided by Palm Tran was discontinued after the 2012 study. Between GGI and Downtown Miami, AVO increases in MLs reflect influence of the expanded Express Bus services offered by MDT and BCT, which will be discussed separately in section 5.4.

I-95 Segments	Southbound AM	Northbound PM
Corridor-Wide	- MLs: minor to moderate AVO decreases at most of the locations - GPLs: minor to moderate AVO increases at most of the locations	- MLs: minor AVO increases at most of the locations - GPLs: minor AVO increase at most of the locations
Indiantown Rd - Okeechobee Blvd	- MLs: minor AVO decrease - GPLs: minor AVO increase	- MLs: minor AVO decrease - GPLs: minor AVO decrease
Okeechobee Blvd - Glades Rd	- MLs: minor AVO decreases - GPLs: minor to moderate AVO increases	- MLs: minor AVO increases - GPLs: minor AVO increases
Glades Rd - Broward Blvd	- MLs: moderate AVO decrease at Sunrise Blvd - GPLs: minor AVO changes	- MLs: minor AVO increases - GPLs: minor AVO increases
Broward Blvd - GGI	- Data not available in 2014	- Data not available in 2014
GGI - EL southern terminus	- MLs: minor AVO increases - GPLs: minor AVO increases	- MLs: minor AVO increases - GPLs: minor AVO increases

Table 4.2 and 4.3 provide the I-95 ML and GPL data for each site for the years 2000, 2002, 2004, 2006, 2008, 2010, 2012, and 2014 where data are available. Figure 4.2 and 4.3 visually depict changes occurring between 2010 and 2014. The arrows indicate whether 2014 values are higher (↑) or lower (↓) than the 2012 AVOs.

Table 4.2 AVO Comparison - A.M. Enforcement Period

Location	% Change 2010 ^a to 2012		2014		2012		2010		2008		2006		2004		2002		2000	
	GPL	ML	GPL	ML	GPL	ML	GPL	HOV										
Northbound																		
Northlake Blvd	2.3%	-13.5%	1.23↑	1.65↓	1.20	1.89	1.22	1.76	-	-	-	-	-	-	-	-	-	-
Gateway Blvd	3.1%	-12.5%	1.09↑	1.47↓	1.06	1.69	1.18	1.73	1.13	1.73	1.06	1.42	-	-	-	-	-	-
Glades Rd	1.9%	7.5%	1.04↑	1.69↑	1.02	1.56	1.08	1.63	1.24	1.41	1.03	1.59	1.06	1.38	1.06	1.66	1.05	1.69
SW 3 rd St	3.7%	9.2%	1.06↑	1.74↑	1.02	1.59	1.15	1.64	1.07	1.54	1.21	1.87	1.05	1.79	1.05	1.7	1.05	1.57
Sunrise Blvd	5.3%	-0.2%	1.08↑	1.55↓	1.01	1.56	1.22	1.65	1.14	1.54	1.31	2.05	1.11	1.54	1.05	1.65	1.06	1.5
SW 42 nd St	-	-	-	-	1.02	1.57	*	*	*	*	*	*	*	*	*	*	*	*
Ives Dairy Rd	-	-	-	-	1.11	1.63	*	*	*	*	1.06	1.98	*	*	*	*	*	*
NW 146 th St	6.6%	1.7%	1.26↑	1.16↑	1.19	1.14	1.09	1.13	1.40	1.63	1.10	1.91	-	-	-	-	-	-
NW 65 th St	6.6%	1.7%	1.26↑	1.16↑	1.19	1.14	1.09	1.13	1.13	1.50	1.11	1.86	-	-	-	-	-	-
Southbound																		
Northlake Blvd	4.7%	-2.4%	1.14↑	1.71↓	1.09	1.75	1.07	1.78	-	-	-	-	-	-	-	-	-	-
Gateway Blvd	0.6%	-2.3%	1.08↑	1.61↓	1.08	1.65	1.09	1.71	1.24	1.63	1.25	1.29	-	-	-	-	-	-
Glades Rd	12.6%	-3.6%	1.17↑	1.59↓	1.04	1.65	1.06	1.65	1.10	1.48	1.09	1.69	1.14	1.67	1.07	1.69	1.04	1.69
SW 3 rd St	3.2%	0.7%	1.09↑	1.66↑	1.05	1.64	1.07	1.64	1.12	1.62	1.01	1.76	1.05	1.82	1.05	1.68	1.04	1.65
Sunrise Blvd	-3.4%	-12.6%	1.04↓	1.49↓	1.08	1.69	1.08	1.63	1.10	1.57	1.34	1.86	1.05	1.67	1.06	1.74	1.03	1.3
SW 42 nd St	-	-	-	-	1.07	2.04	*	*	*	*	*	*	*	*	*	*	*	*
Ives Dairy Rd	-	-	-	-	1.05	1.97	*	*	*	*	1.03	1.96	1.08	1.76	1.07	1.84	1.07	1.88
NW 146 th St	3.4%	7.6%	1.23↑	1.53↑	1.19	1.43	1.17	1.35	1.15	2.19	1.03	2.41	1.06	2.33	1.04	2.21	1.04	2.41
NW 65 th St	3.4%	7.6%	1.23↑	1.53↑	1.19	1.43	1.17	1.35	1.07	2.15	1.11	1.96	1.06	2.22	1.06	2.11	1.05	2.07

Note: All HOV AVO calculation includes Express Bus data. 2010, 2012, and 2014 HOV AVO calculations include Express Bus and Vanpool data. The arrows indicate whether 2014 values are higher (↑) or lower (↓) than the 2012 speeds.

- No ML(s) at these locations

* Data not collected

Table 4.3 AVO Comparison - P.M. Enforcement Period

Location	% Change 2010 to 2012		2014		2012		2010		2008		2006		2004		2002		2000	
	GPL	ML	GPL	ML	GPL	ML	GPL	HOV										
Northbound																		
Northlake Blvd	-0.9%	-0.3%	1.05↓	1.84↓	1.06	1.84	1.28	1.81	-	-	-	-	-	-	-	-	-	-
Gateway Blvd	0.9%	7.4%	1.05↑	1.89↑	1.04	1.76	1.21	1.81	1.27	1.99	1.27	1.99	-	-	-	-	-	-
Glades Rd	2.5%	2.4%	1.06↑	1.74↑	1.03	1.70	1.19	1.88	1.21	1.80	1.16	1.81	1.12	1.47	1.15	1.67	1.11	1.48
SW 3 rd St	4.7%	0.1%	1.08↑	1.78↑	1.03	1.77	1.18	1.85	1.09	1.82	1.03	1.59	1.09	1.85	1.08	2.04	1.08	1.66
Sunrise Blvd	4.3%	1.1%	1.19↑	1.73↑	1.14	1.71	1.16	1.81	1.11	1.90	1.24	2.05	1.58	1.60	1.12	1.76	1.08	1.25
SW 42 nd St	-	-	-	-	1.25	2.18	*	*	*	*	*	*	*	*	*	*	*	*
Ives Dairy Rd	-	-	-	-	1.05	2.14	*	*	*	*	1.13	1.99	1.2	1.69	1.12	1.85	1.11	1.8
NW 146 th St	7.4%	7.9%	1.23↑	1.74↑	1.14	1.61	1.32	1.54	1.40	1.95	1.03	2.26	1.2	1.50	1.18	2.3	1.12	2.27
NW 65 th St	7.4%	7.9%	1.23↑	1.74↑	1.14	1.61	1.32	1.54	1.13	2.29	1.08	2.21	1.17	2.24	1.09	2.2	1.03	2.15
Southbound																		
Northlake Blvd	-4.9%	0.5%	1.17↓	1.76↑	1.23	1.75	1.20	1.80	-	-	-	-	-	-	-	-	-	-
Gateway Blvd	-2.9%	0.4%	1.12↓	1.78↑	1.15	1.77	1.18	1.76	1.32	1.71	1.45	1.45	-	-	-	-	-	-
Glades Rd	-1.9%	4.7%	1.10↓	1.82↑	1.12	1.74	1.09	1.70	1.16	1.60	1.11	1.72	1.18	1.77	1.09	1.7	1.06	1.75
SW 3 rd St	1.8%	-8.8%	1.09↑	1.56↓	1.07	1.72	1.08	1.75	1.12	1.73	1.14	1.77	1.13	1.8	1.09	1.76	1.11	1.67
Sunrise Blvd	0.4%	-4.8%	1.07↑	1.65↓	1.07	1.73	1.07	1.79	1.09	1.73	1.21	2.03	1.16	1.36	1.11	1.9	1.06	1.28
SW 42 nd St	-	-	-	-	1.05	1.76	*	*	*	*	*	*	*	*	*	*	*	*
Ives Dairy Rd	-	-	-	-	1.08	1.68	*	*	*	*	1.14	1.85	*	*	*	*	*	*
NW 146 th St	-0.9%	-5.4%	1.31↓	1.42↓	1.32	1.49	1.23	1.19	1.16	1.82	1.14	1.92	-	-	-	-	-	-
NW 65 th St	-0.9%	-5.4%	1.31↓	1.42↓	1.32	1.49	1.23	1.19	1.18	1.60	1.06	1.94	-	-	-	-	-	-

Note: All HOV AVO calculation includes Express Bus data. 2010, 2012, and 2014 HOV AVO calculations include Express Bus and Vanpool data. The arrows indicate whether 2014 values are higher (↑) or lower (↓) than the 2012 speeds.

- No ML(s) at these locations

* Data not collected

Figure 4.2 Comparison of AVO for A.M. Period*

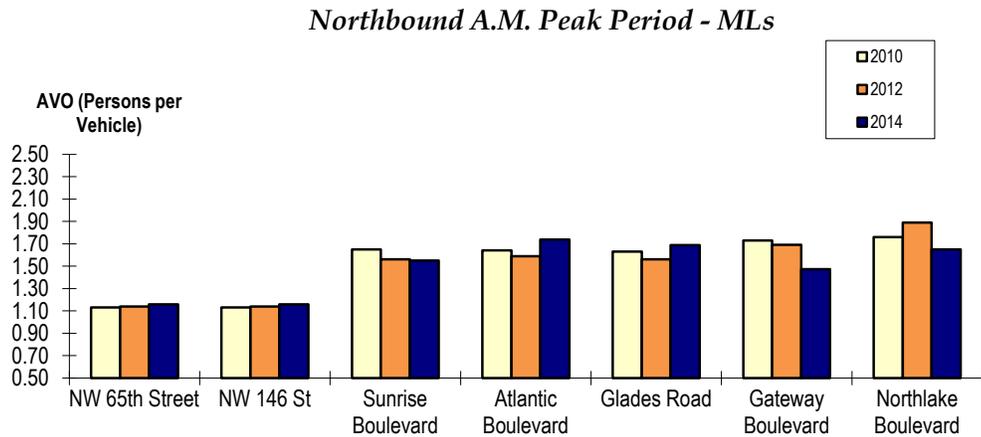
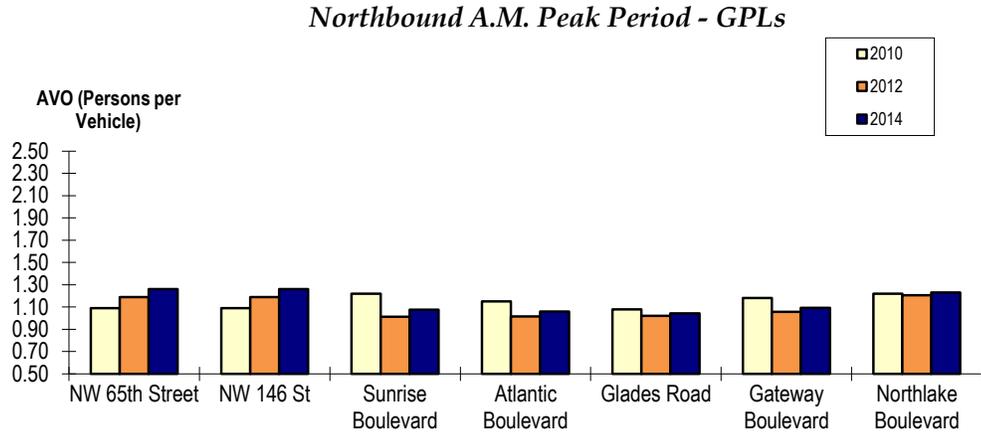
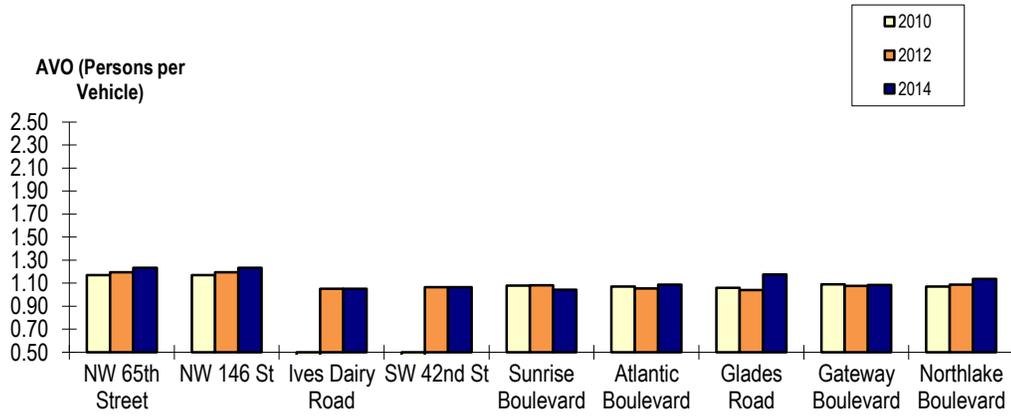


Figure 4.2 Comparison of AVO for A.M. Period (continued)*

Southbound A.M. Peak Period - GPLs



Southbound A.M. Peak Period - MLs

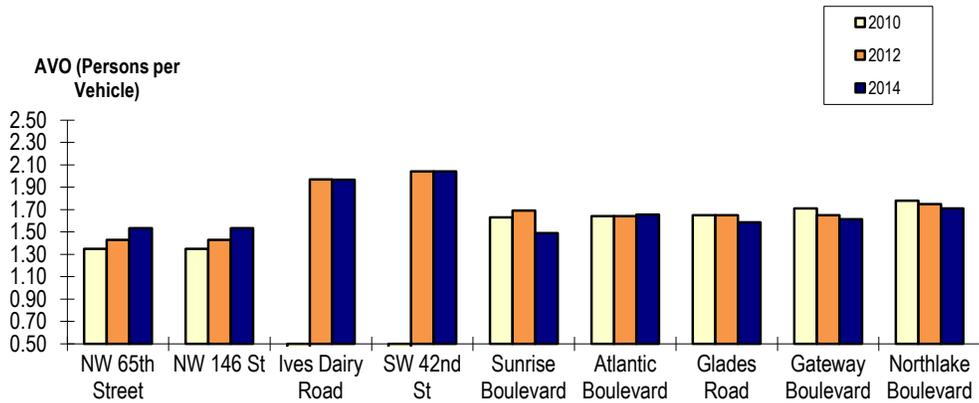


Figure 4.3 Comparison of AVO for P.M. Period*

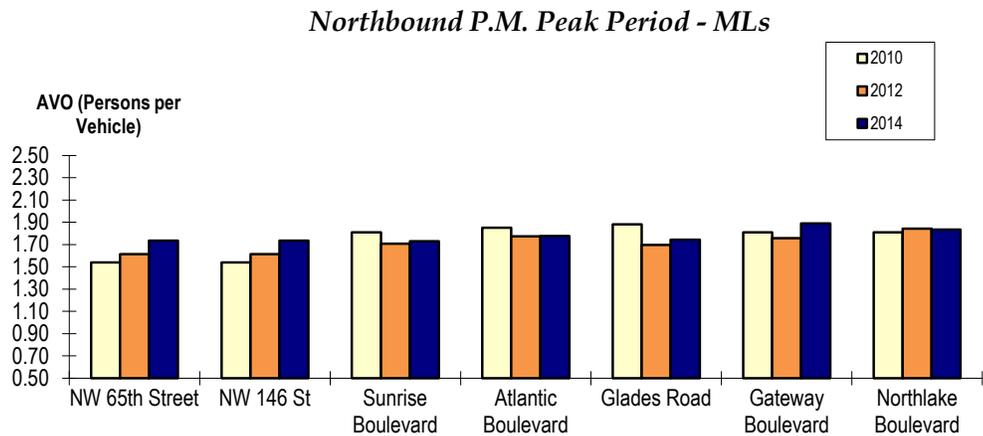
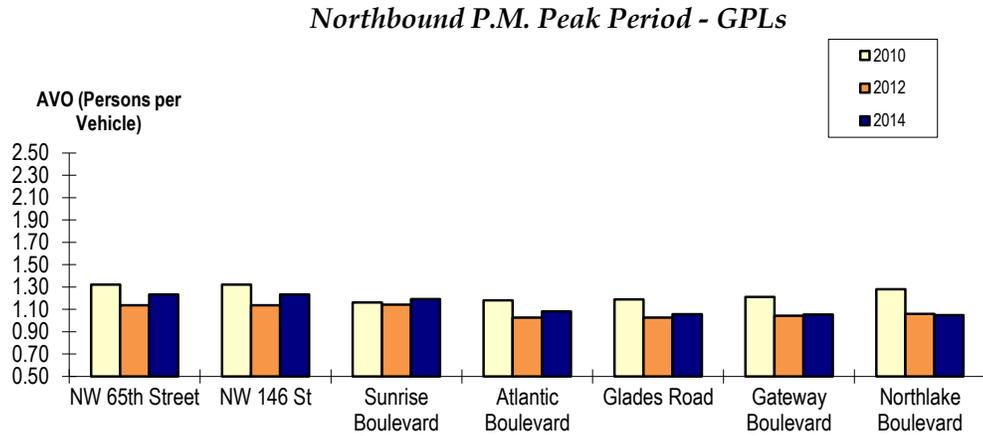
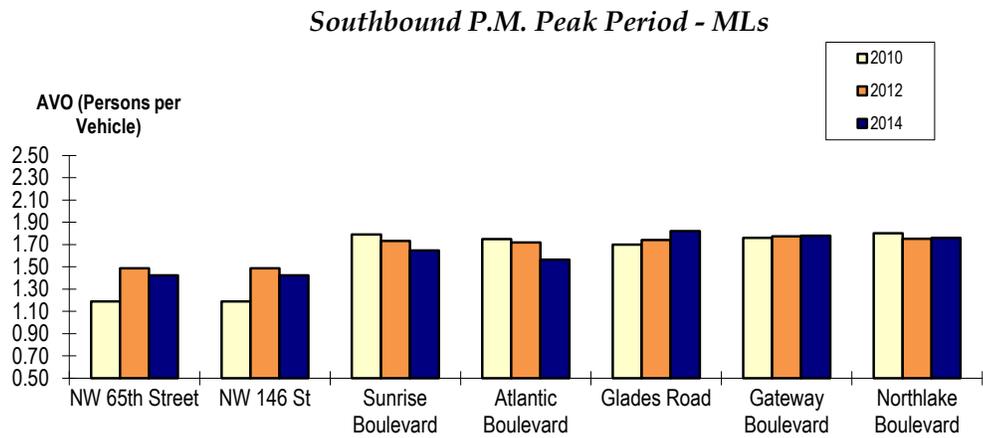
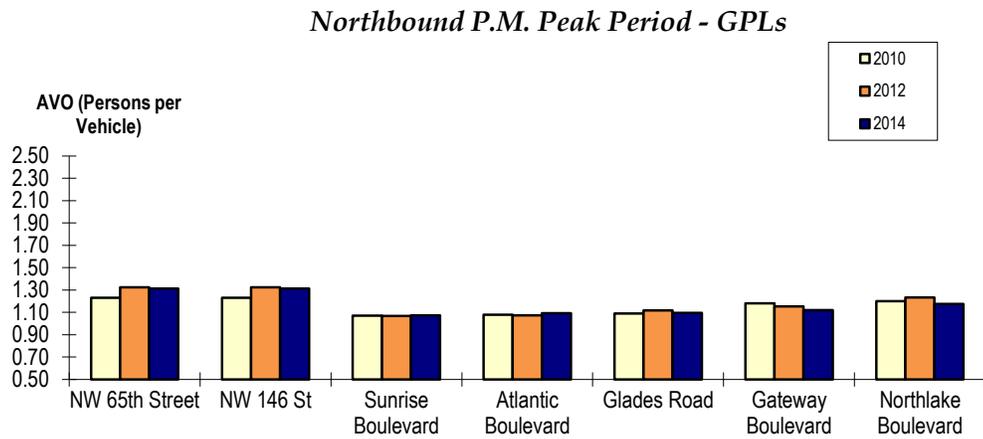


Figure 4.3 Comparison of AVO for P.M. Period*



5.0 Person Throughput

Managed lanes are designed to make more efficient use of road capacity by generating greater person throughput. They do so by carrying more people per vehicle than GPL and by carrying a minimum number of vehicles per hour. The National Cooperative Highway Research Program *HOV Systems Manual* states that the minimum operating thresholds for justifying HOV facilities should range from 400 to 800 vehicles per hour per lane (vphpl) or 900 to 1,800 persons per hour per lane (pphpl) during the peak hours.⁶

5.1 METHODOLOGY

AVO and traffic volume data were used to calculate the person throughput of I-95 HOV lanes at selected locations in South Florida. The methodology used was consistent with previous studies.

Table 5.1 and 5.2 show the 2014 results for peak period volume and person throughput for GPL and HOV lanes.

Each table summarizes the following data:

- Total peak hour volumes and total peak hour person throughput;
- GPL volumes;
- GPL AVO;
- GPL person throughput (calculated by multiplying the GPL volume by the AVO and dividing by the number of lanes);
- ML volumes ;
- ML AVO;
- ML person throughput (determined by multiplying the ML volume by the ML AVO and dividing by the number of lanes); and
- Additional person throughput (Δ Person Throughput) for MLs compared with the average for GPLs. For example, a number of 500 means that, in the peak period, 500 more people travel in an average ML per hour than travel in an average GPL at the same location. A negative value in the last column shows a negative net

⁶ National Cooperative Highway Research Program, *HOV Systems Manual*, Report 414, Transportation Research Board, National Research Council, Washington, D.C., February 1998.

difference in person throughput - a GPL is actually carrying more people than an ML at that location.

5.2 2014 RESULTS

The I-95 HOV lanes in South Florida are heavily utilized. At most data collection locations along the corridor, the number of vehicles per hour per lane met or exceeded the recommended threshold of 400 to 800 vphpl. The only exception was at Northlake Blvd northbound in the a.m. peak and southbound in the p.m. peak, where HOV lane volumes was below 400 vehicles per hour. Person throughput at all locations were significantly higher than the recommended pphpl threshold in peak direction during peak hour, with four exceptions.

- Southbound in the a.m. peak, HOV person throughput at Northlake Blvd fell under the recommended threshold of 900 to 1,800 pphpl. HOV person throughput at Gateway Blvd and Glades Rd fell within the recommended threshold.
- Northbound in the p.m. peak, HOV person throughput at Gateway Blvd fell within the recommended threshold.
- Corridor-wide, the location with the highest person throughput (3,154 pphpl) in an ML was at Glades Rd southbound in the p.m. peak. The greatest difference between GPL and HOV lane throughput (2,516 pphpl) was also at Glades Rd southbound in the p.m. peak.
- Between GGI and Downtown Miami, EL person throughput exceeded that of GPL in both a.m. southbound and p.m. northbound by over 30 percent. This is the result of the Express Bus services in peak direction during the peak. However, GPL person throughput exceeded that of EL in both a.m. northbound and p.m. southbound.
- Between Broward Blvd and GGI, 2012 data were used due to construction. In 2012, the HOV lane person throughput far exceeded that of GPL at all locations except for Ives Dairy Rd northbound in the a.m. peak.
- Between Glades Rd and Broward Blvd, the HOV lane person throughput exceeded that of GPL by over 10 percent in both directions in both a.m. and p.m. peak.
- Between Okeechobee Blvd and Glades Rd, GPL person throughput generally exceeded that of the HOV lane at all occasions except for Glades Rd in the p.m. peak. It is worth noting that, traffic counts at Glades Rd were collected in May, when Summer semester already started at FAU.
- Between Indiantown Rd and Okeechobee Blvd, GPL person throughput exceeded that of the HOV lane in all instances. This is a result of under-utilization of MLs in this segment.

Table 5.1 Person Throughput - AM Peak Hour

Section	I-95 Location	Total Volume	Total Person Throughput	GPL				ML				Δ Person Throughput (Per Hour)
				Volume	AVO	Number of Lanes	Lane Person Throughput	Volume	AVO	Number of Lanes	Lane Person Throughput	
A.M. Northbound												
Indiantown Rd-Okeechobee Blvd	Northlake Blvd	6,133	7,661	5,876	1.23	4	1,809	257	1.65	1	424	-1,385
Okeechobee Blvd-Glades Rd	Gateway Blvd	6,998	7,847	6,465	1.09	4	1,766	533	1.47	1	785	-981
	Glades Rd*	6,082	7,357	4,503	1.04	3	1,564	1,579	1.69	1	2,664	1,099
Glades Rd-Broward Blvd	Atlantic Blvd	9,023	10,358	7,829	1.06	4	2,071	1,194	1.74	1	2,074	3
Broward Blvd-GGI**	Sunrise Blvd	9,305	10,631	8,000	1.08	5	1,721	1,305	1.55	1	2,025	303
	SW 42nd St	10,457	11,314	9,234	1.02	5	1,879	1,223	1.57	1	1,916	37
GGI - EL southern terminus	Ives Dairy Rd	6,094	7,207	5,191	1.11	3	1,913	903	1.63	1	1,468	-445
	NW 146 St	8,140	10,055	6,102	1.26	4	1,923	2,038	1.16	2	1,181	-742
	NW 65th St	7,497	9,139	4,427	1.26	4	1,395	3,070	1.16	2	1,779	383
Corridor Person Throughput			81,570				16,043				14,315	
A.M. Southbound												
Indiantown Rd-Okeechobee Blvd	Northlake Blvd	7,902	9,108	7,679	1.14	5	1,745	223	1.71	1	381	-1,364
Okeechobee Blvd-Glades Rd	Gateway Blvd	8,966	10,199	8,054	1.08	4	2,182	912	1.61	1	1,471	-710
	Glades Rd*	3,286	4,323	2,157	1.17	3	844	1,129	1.59	1	1,791	947
Glades Rd-Broward Blvd	Atlantic Blvd	8,508	10,105	6,994	1.09	4	1,900	1,514	1.66	1	2,506	606
Broward Blvd-GGI**	Sunrise Blvd	10,867	11,991	9,402	1.04	5	1,962	1,465	1.49	1	2,181	219
	SW 42nd St	8,998	10,647	7,915	1.07	5	1,687	1,083	2.04	1	2,210	522
GGI - EL southern terminus	Ives Dairy Rd	6,506	8,267	4,945	1.05	3	1,733	1,561	1.97	1	3,070	1,337
	NW 146 th St	8,630	11,694	5,123	1.23	4	1,579	3,507	1.53	2	2,688	1,109
	NW 65 th St	10,146	13,567	6,627	1.23	4	2,043	3,519	1.53	2	2,697	654
Corridor Person Throughput			89,902				15,676				18,996	

*Traffic counts were collected in May, when Summer semester had started at FAU. Traffic counts in early April should be higher than May and traffic pattern was probably different.

**2012 data were used in place of 2014 data for this segment due to disabled count sites during construction.

Table 5.2 Person Throughput - PM Peak Hour

Section	I-95 Location	Total Volume	Total Person Throughput	GPL				ML				Δ Person Throughput (Per Hour)
				Volume	AVO	Number of Lanes	Lane Person Throughput	Volume	AVO	Number of Lanes	Lane Person Throughput	
<i>P.M. Northbound</i>												
Indiantown Rd-Okeechobee Blvd	Northlake Blvd	8,350	9,179	7,811	1.05	4	2,047	539	1.84	1	989	-1,058
Okeechobee Blvd-Glades Rd	Gateway Blvd	9,328	10,891	8,051	1.05	4	2,119	1,277	1.89	1	2,414	294
	Glades Rd*	5,988	7,353	4,490	1.06	3	1,581	1,498	1.74	1	2,610	1,029
Glades Rd- Broward Blvd	Atlantic Blvd	8,842	10,776	7,103	1.08	4	1,922	1,739	1.78	1	3,089	1,167
	Sunrise Blvd	8,600	11,113	6,990	1.19	5	1,666	1,610	1.73	1	2,783	1,117
Broward Blvd-GGI**	SW 42nd St	10,475	14,336	9,177	1.25	5	2,301	1,298	2.18	1	2,832	531
	Ives Dairy Rd	6,849	8,871	5,286	1.05	3	1,841	1,563	2.14	1	3,346	1,505
GGI - EL southern terminus	NW 146 St	8,768	14,711	5,928	1.23	4	1,829	2,840	1.74	2	2,465	637
	NW 65th St	9,202	15,848	5,923	1.23	4	1,827	3,279	1.74	2	2,847	1,019
Corridor Person Throughput			103,078				17,134				26,031	
<i>P.M. Southbound</i>												
Indiantown Rd-Okeechobee Blvd	Northlake Blvd	5,865	7,023	5,632	1.17	5	1,322	233	1.76	1	410	-912
Okeechobee Blvd-Glades Rd	Gateway Blvd	7,389	8,783	6,624	1.12	4	1,855	765	1.78	1	1,362	-493
	Glades Rd*	3,475	5,065	1,743	1.10	3	637	1,732	1.82	1	3,154	2,516
Glades Rd- Broward Blvd	Atlantic Blvd	7,870	9,339	6,295	1.09	4	1,719	1,575	1.56	1	2,462	743
	Sunrise Blvd	10,739	12,279	9,418	1.07	5	2,021	1,321	1.65	1	2,175	154
Broward Blvd-GGI**	SW 42nd St	9,965	11,486	8,558	1.05	5	1,803	1,407	1.76	1	2,471	668
	Ives Dairy Rd	5,796	7,022	4,508	1.08	3	1,621	1,288	1.68	1	2,160	539
GGI - EL southern terminus	NW 146 St	8,164	10,919	6,306	1.31	4	2,069	1,858	1.42	2	1,322	-747
	NW 65th St	7,919	10,610	5,947	1.31	4	1,951	1,972	1.42	2	1,403	-548
Corridor Person Throughput			82,526				14,999				16,918	

*Traffic counts were collected in May, when Summer semester had started at FAU. Traffic counts in early April should be higher than May and traffic pattern was probably different.

**2012 data were used in place of 2014 data for this segment due to disabled count sites during construction.

5.3 TRENDS AND COMPARISONS TO PREVIOUS YEARS

The study corridor generally distinguishes five segments in terms of different characteristics in person throughput between GPLs and MLs as listed below. For detailed person throughput comparison, please refer to Figure 5.1 and 5.2.

I-95 Segments	Southbound AM	Northbound PM
Corridor-Wide	- Different levels of Δ person throughput increase compared with 2012, with the exception of Northlake Blvd and Atlantic Blvd	- Different levels of Δ person throughput increase at all locations with the exception of Northlake Blvd.
Indiantown Rd - Okeechobee Blvd	- Δ person throughput decreased compared with 2012	- Δ person throughput decreased compared with 2012
Okeechobee Blvd - Glades Rd	- Δ person throughput increased compared with 2012	- Δ person throughput increased compared with 2012
Glades Rd - Broward Blvd	- Δ person throughput increased at Atlantic Blvd compared with 2012	- Δ person throughput increased at Sunrise Blvd compared with 2012
Broward Blvd - GGI	- No data available	- No data available
GGI - EL southern terminus	- Δ person throughput increased compared with 2012	- Δ person throughput increased compared with 2012

Figure 5.1 and 5.2 compare person throughput in 2014 to available data from 2012 and 2010. The figures show the difference in ML person throughput and GPL person throughput. A positive value indicates higher person throughput in the MLs, and a negative value indicates lower person throughput in the MLs when compared with the average GPLs.

Figure 5.1 Δ Person Throughput Comparisons Northbound Direction

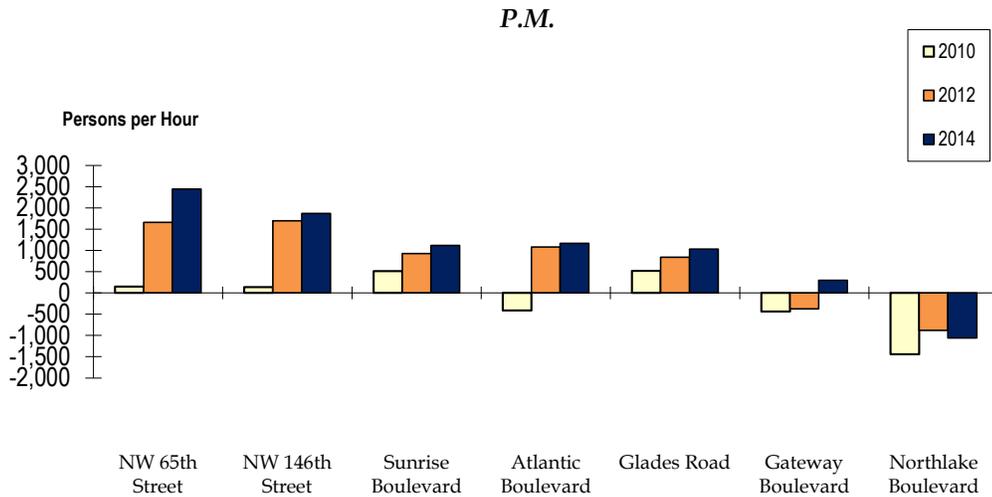
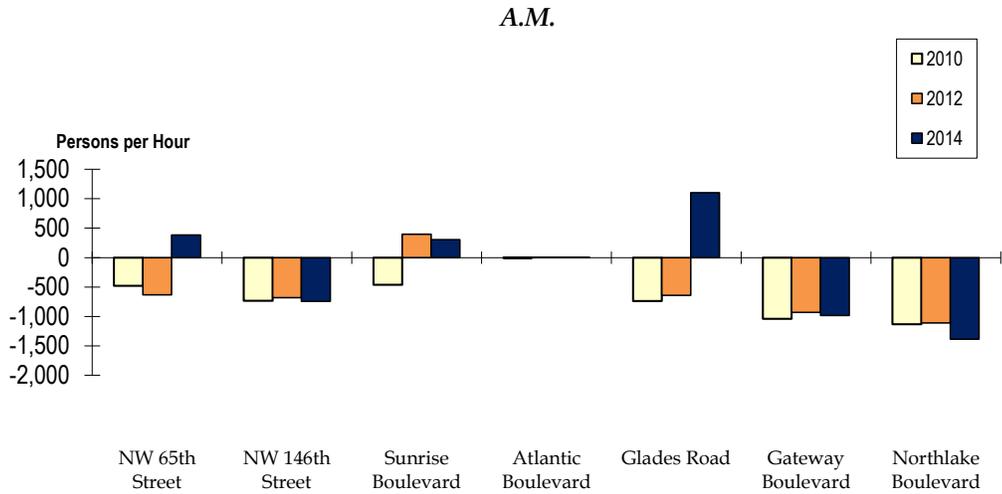
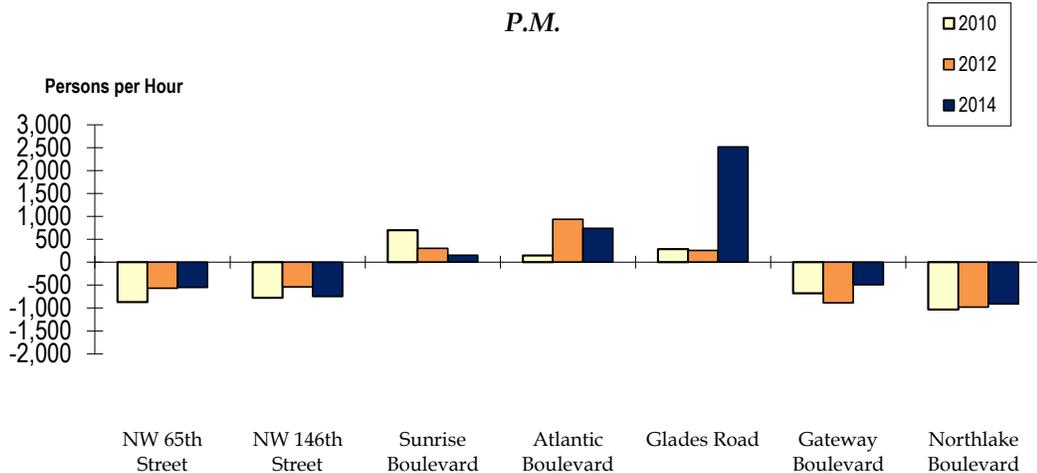
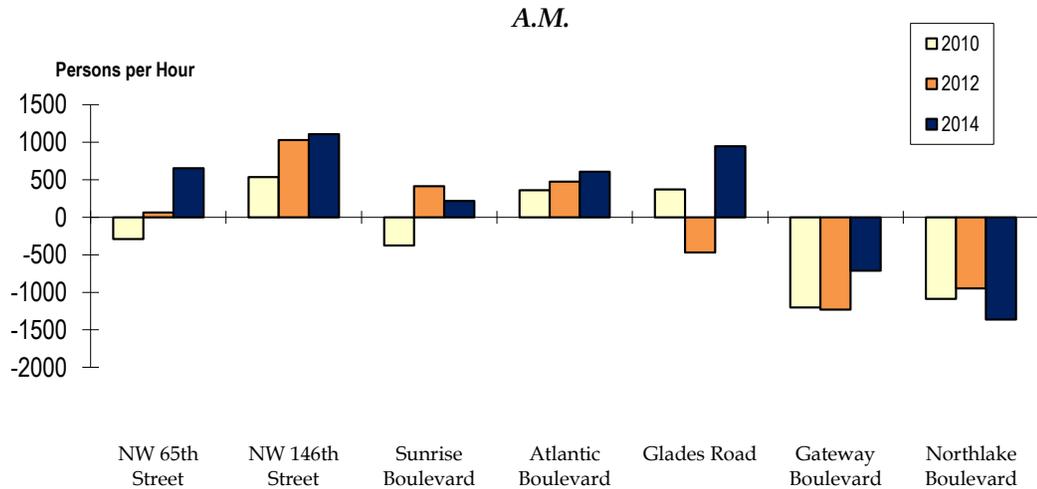


Figure 5.2 Δ Person Throughput Comparisons Southbound Direction



5.4 CHANGE IN PERSON THROUGHPUT DUE TO EXPRESS BUS SERVICES AND VANPOOL PROGRAM

As part of the 2014 MLs monitoring study, the 95 Golden Glades Express Bus, Dade-Broward Express Bus, and Express Bus services offered by BCT are included in the evaluation. Table 5.3 presents the impact of 95 Express Bus services on ML person throughput. As shown in Table 5.3, between GGI and Downtown Miami, the Express Bus services contributed about 20 percent of the total person throughput in

the EL southbound during the a.m. peak period and 25 percent northbound during the p.m. peak.

Table 5.4 presents the impact of South Florida Vanpool Program on ML AVO. As shown in Table 5.4, between GGI and Downtown Miami, the Vanpool Program south of GGI contributed about two percent of the total person throughput in EL southbound during the a.m. and northbound during p.m. peak.

Without the contribution from Express Bus services and Vanpool Program, the AVO south of GGI would have dropped from over 1.5 to less than 1.3.

Table 5.3 EL Change in Person Throughput Due to Express Bus Services

I-95 Location	Direction	Peak Period	ML AVO without Express Bus	Average Number of Persons per Bus	ML AVO with Express Bus	Difference in Person Throughput Due to Express Bus	Percent Increase of Total ML Person Throughput
South of GGI	SB	a.m.	1.22	26	1.51	989	20.0%
	NB	p.m.	1.30	29	1.71	1,035	24.9%

Source: Cambridge Systematics, Inc

Table 5.4 EL Change in Person Throughput Due to Registered Vanpools

I-95 Location	Direction	Peak Period	ML AVO without Express Bus	Average Number of Persons per Bus	ML AVO with Express Bus	Difference in Person Throughput Due to Express Bus	Percent Increase of Total ML Person Throughput
South of GGI	SB	a.m.	1.51	6	1.53	85	1.7%
	NB	p.m.	1.71	6	1.74	85	2.0%

Source: Cambridge Systematics, Inc

6.0 Enforcement

Florida Highway Patrol (FHP) Troop E enforces the I-95 HOV lane restrictions in Miami-Dade County and FHP Troop L enforces the restrictions in Broward and Palm Beach Counties. Enforcement ensures a reduction in violations of the HOV lane by single-occupant vehicles.

The vehicle-occupancy surveys described in Section 4.0 recorded the number of single-occupant vehicles observed in the HOV lane during the enforcement periods.

6.1 VIOLATION RATES

The violation rates for the I-95 corridor in 2014 are summarized in Table 6.1. The violation rate is defined as the percentage of the total HOV lane volume comprised of single-occupant vehicles. For example, Sunrise Blvd has a 32 percent violation rate northbound in the p.m. peak period. This indicates that 32 percent of vehicles in the HOV lane were single-occupant vehicles and 68 percent were in the HOV lane legally. Please note that these violation rates were calculated based on vehicle occupancy data collected for the peak periods of one day using visual observations, thus they may not be statistically representative.

HOV violation rates were generally higher in the a.m. peak than in the p.m. peak at most locations in 2014. The highest violation rate in 2014 was 56%, found at Gateway Blvd northbound in the a.m. peak period.

Figure 6.1 shows the violation rate profiles from 2010 to 2014. Compared with 2012 and 2010, violation rates in 2014 did not show a consistent pattern in the northbound, but were generally higher in the southbound. The following locations showed significant increase in violation rates:

- Northbound:
 - Gateway Blvd in the a.m. peak period
 - Glades Rd in the p.m. peak period
- Southbound:
 - Sunrise Blvd in both a.m. and p.m. peak periods
 - Atlantic Blvd in the p.m. peak period
 - Glades Rd in the a.m. peak period

The reported violation rates may be slightly higher than the true condition due to the data collection method. It is generally possible to see only the front seat occupants in a vehicle. Where no passenger was seen in a vehicle in the HOV lane, a violation was assumed. It is possible that one or more small children were seated in the rear of the vehicle invisible to the data collector, but qualifying the vehicle to use the HOV lane.

Table 6.1 ML Violation Rates

Section	I-95 Location	A.M. Peak		P.M. Peak	
		SB	NB	SB	NB
Indiantown Rd- Okeechobee Blvd	Northlake Blvd	46%	40%	39%	26%
Okeechobee Blvd- Glades Rd	Gateway Blvd	40%	56%	28%	20%
	Glades Rd	46%	38%	32%	38%
Glades Rd- Broward Blvd	Atlantic Blvd	37%	30%	45%	27%
	Sunrise Blvd	53%	50%	40%	32%
	SW 42 nd St	-	-	-	-
Broward Blvd- GGI*	Ives Dairy Rd	-	-	-	-
	NW 146 th St	-	-	-	-
GGI - EL southern terminus*	NW 65 th St	-	-	-	-

*No violation rates were calculated for south of Broward Blvd because the segment was not enforced.

Source: Data were collected in April of 2014.

Figure 6.1 HOV Violation Rate Comparison

Northbound

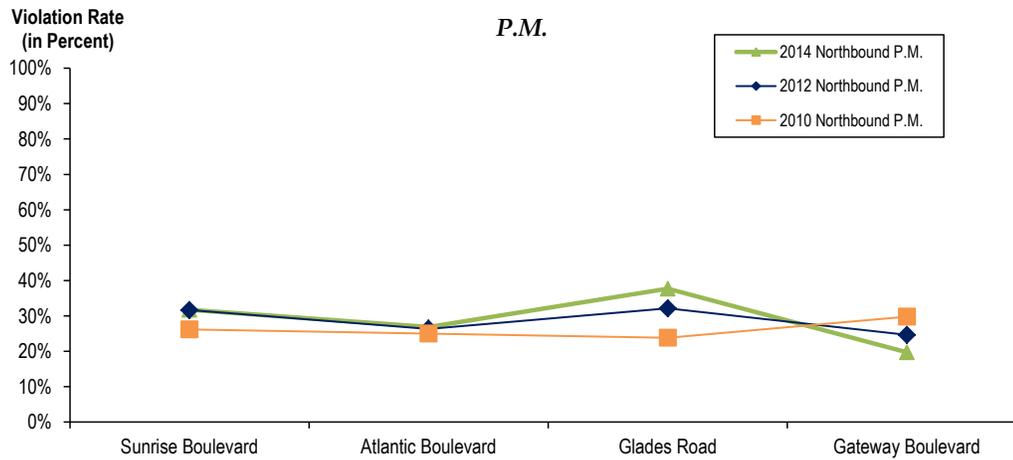
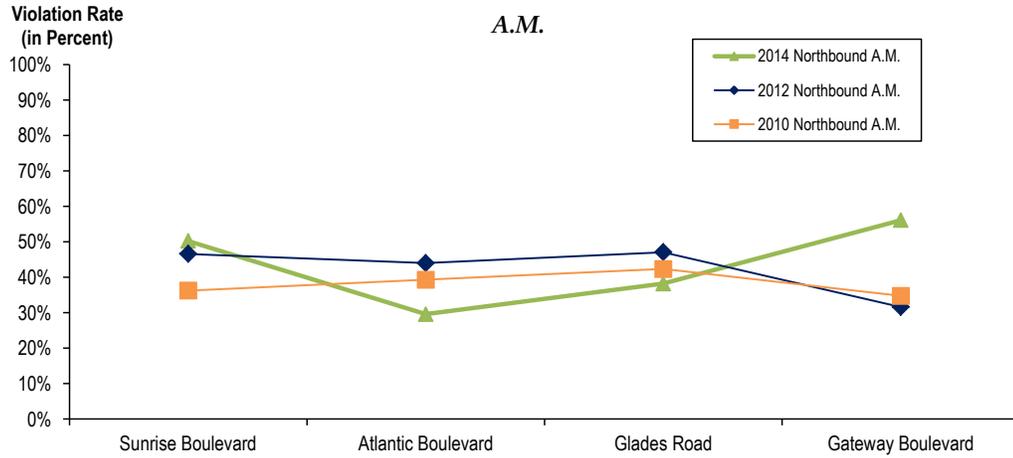
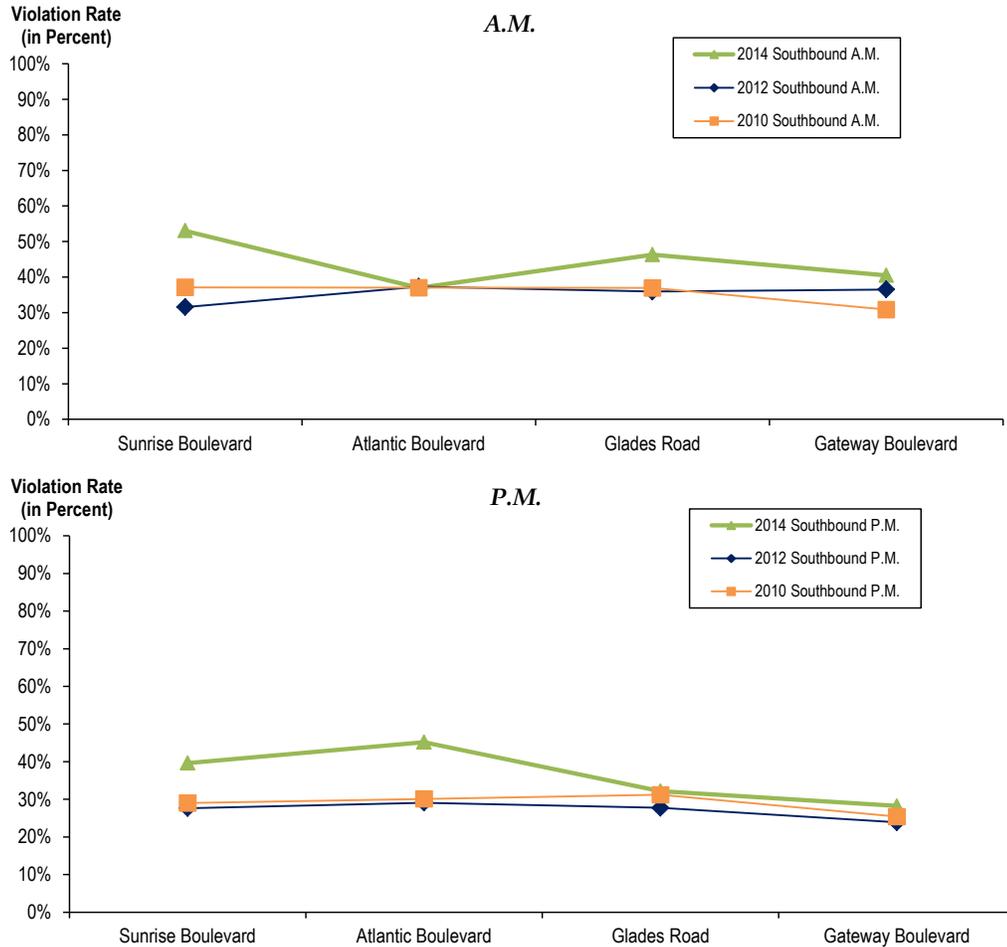


Figure 6.2 HOV Violation Rate Comparison

Southbound



6.2 CITATIONS

Florida Highway Patrol (FHP) Troop L enforces the I-95 HOV lane restrictions in Broward and Palm Beach Counties. The enforcement hours are from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. on weekdays in both the northbound and southbound directions. The HOV lanes are enforced by FHP Troop L officers through a “hireback” program with the Florida Department of Transportation (FDOT). This essentially means that the HOV lanes are enforced by officers working overtime outside of their regular duties. This enforcement is intended to reduce the number of single occupant vehicles who enjoy the benefits of the HOV lane by violating lane restrictions.

The HOV fine per violation have remained constant from 2012 to 2014. See Table 6.2 for fine amounts for drivers who violate the HOV lane restrictions.

Table 6.2 Current HOV Violation Fine Amounts in Southeast Florida

County	2012 Fine	2014 Fine
Broward County	\$165.00	\$165.00
Palm Beach County	\$166.00	\$166.00
Miami-Dade County	\$179.00	\$179.00

Source: Palm Beach Clerk of Courts, Broward County Clerk of Courts, Miami-Dade County Clerk of Courts

Trends and Comparisons with Previous Years

The numbers of citations issued in Broward and Palm Beach counties in 12-month periods from 1999 through 2014 are outlined in Table 6.3. The citation data for both Broward and Palm Beach County were provided by FHP Troop L. Citation data reported by FHP Troop E for Miami-Dade County no longer distinguishes between enforcement events in the HOV lanes and in the I-95 ELs starting from 2011; furthermore, the HOV lanes in Miami-Dade County have not been enforced since the construction of ELs between Broward Blvd and GGI early 2014. Therefore, citation data for Miami-Dade County have not been included to be compared with the data from Broward and Palm Beach counties since 2011.

In a typical one-month period, the average number of citations in Broward and Palm Beach counties was 450. This is up slightly from the 440 average citations in a one month period in the 2011-2012 timeframe. The 450 average number of citations per month breaks down to approximately 21 citations per weekday, or 11 citations per enforcement period. The most citations were given between October 25 and November 7 in 2013.

Table 6.3 HOV Citations

Time Period	Miami-Dade Citations	Broward and Palm Beach Citations
1999 - 2000	7,692	5,916
2000 - 2001	6,948	13,753
2001 - 2002	6,441	9,235
2002 - 2003	5,299	3,507
2003 - 2004	5,379	7,661
2004 -2005 ^a	3,700	3,571
2005 - 2006	4,266	3,917
2007 ^b - 2008 ^c	4,178	5,039
2009 ^d - 2010	72	5,214
2011 - 2012 ^e	NA	5,271
2012 - 2013 ^e	NA	3,947
2013 - 2014 ^e	NA	6,150

^a Palm Beach and Broward Counties both experienced lapses in HOV enforcement in 2004 and 2005 respectively.

^b 2007 data were collected from May 2007 to April 2008.

^c In Palm Beach County, only citation data from April 2008 to June 2008 were obtained. Extrapolation rates were calculated using Broward County's data to capture the seasonal trend.

^d There is a data error for one reporting period (11/13/2009 – 11/26/2009) for Palm Beach County, the error is not expected to have significant impact on the total number of citations.

^e Between 2011 and 2014, citation data reported by FHP Troop E for Miami-Dade County no longer distinguishes between enforcement events in the HOV lanes and in the 95 Express lanes; therefore, the Miami-Dade enforcement data cannot be consistently compared with the data from Broward and Palm Beach Counties.

7.0 Corridor Multi-Modal Assessment

Starting from 2012, a corridor-level analysis has been added to the ML evaluation to compare travel experience between the various modal options that exist in the I-95 corridor. Comparisons were made for trips between downtown West Palm Beach (Tri-Rail station) and downtown Miami bus terminal (SW 1st St and Miami Ave) southbound in the a.m., and the reverse northbound trip in the p.m.. Measures used in the evaluation include travel time, travel cost, and corridor-level person throughput.

7.1 TRAVEL TIME COMPARISON AMONG DIFFERENT MODES

For corridor level travel time comparison, seven combinations of travel modes were evaluated:

- I-95 GPL: driving in GPL between Tri-Rail West Palm Beach Station and Downtown Miami Bus Terminal (south of the Stephen P. Clark Government Center);
- I-95 GPL and Express Bus: driving in GPL between Tri-Rail West Palm Beach Station and Fort Lauderdale Tri-Rail Station, and taking Express Bus between Fort Lauderdale Tri-Rail Station and Downtown Miami Bus Terminal;
- I-95 GPL and EL: driving in EL wherever available between Tri-Rail West Palm Beach Station and Downtown Miami Bus Terminal, and driving in GPL for the remaining segments;
- 2-person Carpool: driving in HOV lane wherever available between Tri-Rail West Palm Beach Station and Downtown Miami Bus Terminal, and driving in GPL for the remaining segments;
- 3-person Carpool: driving in HOV lane and EL wherever available between Tri-Rail West Palm Beach Station and Downtown Miami Bus Terminal, and driving in GPL for the remaining segments;
- Tri-Rail and Metrorail: taking Tri-Rail between the downtown West Palm Beach station and the Tri-Rail/Metrorail Transfer Station, and taking Metrorail between the Transfer Station and Downtown Miami Government Center station (located next to Downtown Miami Bus Terminal); and

- Tri-Rail and Express Bus: taking Tri-Rail between the downtown West Palm Beach station and Fort Lauderdale station, and 95 Express Bus between Fort Lauderdale and Downtown Miami Bus Terminal.

As mentioned in Section 3.0 (page 3-1), travel time runs were conducted on two additional non I-95 segments: one connecting Tri-Rail West Palm Beach Station to I-95 via Okeechobee Blvd; and one connecting I-95 EL southern terminus to Downtown Miami Bus Terminal south of the Stephen P. Clark Government Center. Travel times for driving between Tri-Rail West Palm Beach Station and Downtown Miami Bus Terminal in the a.m. and p.m. peak period peak were then calculated separately for travel time runs using GPLs, HOV lanes, and ELs.

For transit modes, passenger arrival times before boarding were assumed: in the southbound direction, passengers were assumed to arrive at the Tri-Rail West Palm Beach Station at 6:00, 6:15, and 6:30 during the a.m. peak; in the northbound direction, passengers were assumed to arrive at the Downtown Miami Metrorail station and Downtown Miami Bus Terminal at 4:30, 4:45, 5:00, and 5:15 during the p.m. peak. One day's APC data on April 9, 2014, reported by MDT, were used to calculate the trip time between Fort Lauderdale Tri-Rail station and Downtown Miami Bus Terminal. Passenger on-board time was estimated by calculating the elapsed time between the bus arrival time at its trip end and the departure time at the trip start station of the same bus. On-board time and transfer time for Tri-Rail and Metrorail mode were calculated based on Tri-Rail and Metrorail schedules and walking distance between transfer stations.

Table 7.1 and Figure 7.1 summarize the average travel time and speed comparison between different modes.

As presented in Table 7.1 and Figure 7.1, driving in ML facility is the fastest travel mode among all. In the southbound direction during the a.m. peak, travel time driving in HOV and EL was one hour and 21 minutes; in the northbound direction during the p.m. peak, travel time in MLs was one hour and 17 minutes. Travel times driving in GPLs were approximately 25 and 23 minutes slower than those of MLs in southbound and northbound respectively. Taking Tri-Rail and Metrorail was the slowest among all modes, mostly due to the transfer time between Tri-Rail and Metrorail and service frequency of Tri-Rail. If riders plan their trip carefully using Tri-Rail and Metrorail schedules, shorter trip times are possible.

Table 7.1 Average Travel Time and Speed Comparison between Different Modes

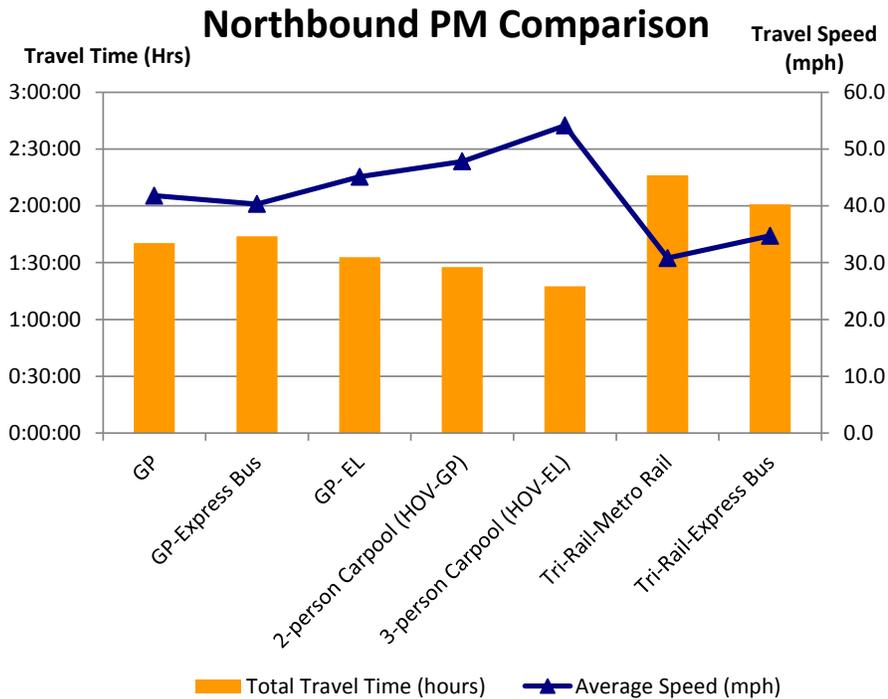
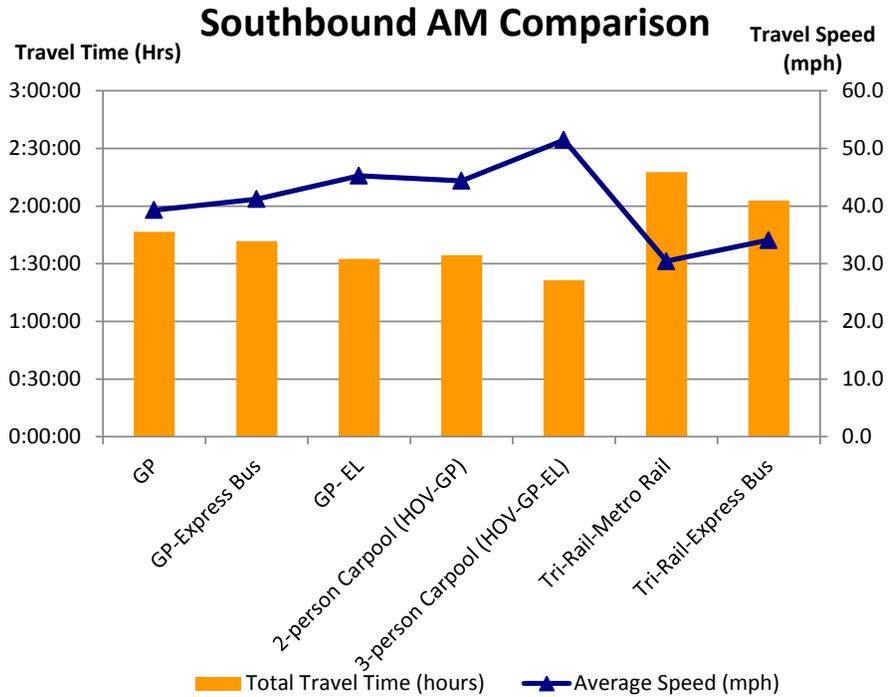
	Distance ^a (miles)	GPL	HOV	EL	Express Bus	Tri-Rail	Metrorail	Waiting and Transfer Time	Total Travel Time (hours)	Average Speed (mph)
Southbound AM										
GPL	69.7	1:46:38	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	1:46:38	39.3
GPL-Express Bus	69.7	0:53:52	0:00:00	0:00:00	0:42:51	0:00:00	0:00:00	0:05:00	1:41:43	41.2
GPL-EL	69.7	1:11:32	0:00:00	0:21:02	0:00:00	0:00:00	0:00:00	0:00:00	1:32:34	45.3
2-person Carpool (HOV-GPL)	69.7	0:51:49	0:42:35	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	1:34:24	44.4
3-person Carpool (HOV-EL)	69.7	0:17:47	0:42:35	0:21:02	0:00:00	0:00:00	0:00:00	0:00:00	1:21:24	51.5
Tri-Rail-Metrorail	69.7	0:00:00	0:00:00	0:00:00	0:00:00	1:39:00	0:21:00	0:17:40	2:17:40	30.4
Tri-Rail-Express Bus	69.7	0:00:00	0:00:00	0:00:00	0:42:51	1:01:00	0:00:00	0:19:00	2:02:51	34.1
Northbound PM										
GPL	69.7	1:40:20	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	1:40:20	41.8
GPL-Express Bus	69.7	0:57:51	0:00:00	0:00:00	0:41:06	0:00:00	0:00:00	0:05:00	1:43:57	40.3
GPL-EL	69.7	1:13:07	0:00:00	0:19:49	0:00:00	0:00:00	0:00:00	0:00:00	1:32:56	45.1
2-person Carpool (HOV-GPL)	69.7	0:42:28	0:45:11	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	1:27:39	47.8
3-person Carpool (HOV-EL)	69.7	0:12:27	0:45:11	0:19:49	0:00:00	0:00:00	0:00:00	0:00:00	1:17:27	54.1
Tri-Rail-Metrorail	69.7	0:00:00	0:00:00	0:00:00	0:00:00	1:35:34	0:19:00	0:21:34	2:16:08	30.8
Tri-Rail-Express Bus	69.7	0:00:00	0:00:00	0:00:00	0:41:06	0:58:00	0:00:00	0:21:37	2:00:43	34.7

^a Distance is determined by the driving distance collected from travel time runs.

Assumptions:

(1) Trains and buses arriving downtown Miami between 8:00 a.m. and 9:00 a.m. were included in the calculation in the a.m.; trains and buses leaving downtown Miami between 4:30 p.m. and 5:30 p.m. were included in the calculation in the p.m.. (2) Transit travel time was calculated using a uniform start time: in the a.m., the start times were 5:00 a.m., 6:00 a.m., 6:15 a.m., and 6:30 a.m.; in the p.m., the start times were 3:45 p.m., 4:00 p.m., 4:15 p.m., 4:30 p.m., 4:45 p.m., 5:00 p.m., 5:15 p.m. (3) Assuming average drivers will arrive at Fort Lauderdale Station 5 minutes ahead of time to catch Express Bus.

Figure 7.1 Average Travel Time and Speed Comparison between Different Modes



7.2 TRAVEL COST COMPARISON AMONG DIFFERENT MODES

Travel time costs were compared along the entire length of the corridor for the seven trip scenarios. The cost of each trip consisted of three components: auto vehicle operating cost (AVOC)⁷, travel time value (TTV)⁸, and Fare/Toll. The total AVOC is a product of trip distance and per mile AVOC of the specific length of the I-95 corridor for each scenario. AVOC was divided by total vehicle occupants to obtain per person AVOC. Total TTV is a product of travel time and per hour TTV. The travel time of the scenarios involving transit mode comprise the transit travel time and any applicable waiting or transfer time of the rider. The transit fare and express lane toll were added to the total AVOC and TTV for the total cost of the trip per scenario when applicable. The series of calculations and assumptions used to calculate the travel costs are summarized in Table 7.2.

Table 7.2 Total Travel Costs by Component

Components	Inputs
Total AVOC	Distance (mi) x AVOC
Total TTV	Time (hr) x TTV
Fare	Fare of respective Transit Agency, including transfer if applicable
Toll ⁹	Average Peak Period Monthly Toll for NB and SB direction
Total Costs=	Total AVOC + Total TTV + Fare/Toll

Travel costs by mode are presented in Table 7.3. In the southbound direction during the a.m. peak, travel costs were lowest for the Tri-Rail and Express Bus scenario costing \$34.26. The 3-person Carpool scenario came in close second costing \$34.69. In the northbound direction during the p.m. peak, travel costs were lowest for the 3-person Carpool (HOV+GPL+EL) scenario costing \$31.72. The Tri-Rail and Express Bus scenario came in second costing \$33.78. Driving alone in both the GPL and the GPL-EL were the most expensive scenarios. Their costs were significantly higher than all other scenarios— approximately \$32.00 more in the southbound peak and

⁷ Extracted from the Southeast Florida Road User Cost Calculator, FDOT District Four. Cost items include fuel cost, fuel tax, maintenance and repairs, tires, insurance, total depreciation, finance charges, license and registration.

⁸ The AVOC and TTV values are originally in 2010 values and adjusted by CPI Index from 2010 to 2014.

⁹ The average peak period tolls for the month of April 2014 were used for this report

\$33.00 more in the northbound peak than the lowest cost scenario, largely due to vehicle operating costs.

Table 7.3 Average Travel Time Costs per Trip among Different Modes

Scenario	Trip Cost	
	AM - SB	PM - NB
GPL	\$66.85	\$65.43
GPL-EL	\$66.14	\$66.89
GPL-Express Bus	\$52.57	\$53.07
2-person Carpool (HOV-GPL)	\$42.67	\$41.15
3-person Carpool (HOV-GPL-EL)	\$34.69	\$31.72
Tri-Rail-Metrorail*	\$39.10	\$38.75
Tri-Rail-Express Bus*	\$34.26	\$33.78

*The trip cost does not include the one-time cost for purchasing the reusable Easy Card used by Tri-Rail and MDT.

7.3 CORRIDOR-WIDE PERSON THROUGHPUT

The purpose of evaluating corridor level person throughput is to identify the contributions made to total traveler throughput by the different modes at locations along I-95 corridor. Tri-Rail is parallel to and within close vicinity of I-95 between Mangonia Park and GGI, therefore, the number of passengers on board Tri-Rail at different locations is an important component of the corridor person throughput. The same applies to express buses and vanpools where they operate in the corridor.

Person throughput in GPLs and MLs have been discussed in Section 5.0. Tri-Rail ridership has been added to the ML study since 2012. The number of passengers on board Tri-Rail on segments adjacent to vehicle occupancy data collection locations was obtained for April 8, 2014. To be consistent with the person throughput on I-95, the peak hour for the adjacent I-95 count segment was used to select the Tri-Rail ridership data. Please refer to Appendix G for detailed ridership data.

It is important to note here that for SW 42nd St and Ives Dairy Rd, the total person throughput without express buses and vanpools were based on the AVO rates in 2012 because the segment between Broward Blvd and GGI was not enforced due to construction of 95 EL Phase II project. Express Bus, Vanpool, and Tri-Rail ridership for these two locations are based on data collected in 2014.

Table 7.4 and 7.5 summarize the corridor person throughput for a.m. and p.m. peak periods respectively. As shown in Table 7.4 and 7.5, in the southbound direction during the a.m. peak period, 71% of the total commuters drove in GPL, 23.1% drove in the HOV lane and EL, 3.2% took Express Bus, and 2.6% took Tri-Rail; in the northbound direction during the p.m. peak period, 66% of the total commuters drove in GPL, 27.5% drove in the HOV lane and EL, 3% took Express Bus, and 3.5% took Tri-Rail. The highest throughput of the whole corridor in the peak direction

during the peak periods was observed at NW 65th St. Comparing the transit ridership data south of the Fort Lauderdale Tri-Rail Station, more commuters used Express Bus than Tri-Rail in the a.m. peak hour, while more commuters used Tri-Rail in the p.m. peak hour.

Table 7.4 I-95 Corridor Person Throughput in the AM Peak Period

I-95 AVO Data Collection Locations	Tri-Rail Stations	Peak Hour on I-95	GPL Person Throughput /Lane	GPL Person Throughput	ML Person Throughput/ Lane	ML Total Person Throughput w/o Express Bus and Vanpool	Total I-95 Person Throughput w/o Express Bus and Vanpool	95 Express Bus and Vanpool Ridership	Tri-Rail Ridership	I-95 Corridor Total Person Throughput
A.M. Northbound										
South of Northlake Blvd	Mangonia Park Station	7:30-8:30	1,809	7,237	424	424	7,661	0	0	7,661
North of Gateway	Lake Worth Station	7:15-8:15	1,766	7,062	785	785	7,847	0	653	8,500
Glades Rd	Boca Raton Station	8:00-9:00	1,564	4,693	2,664	2,664	7,357	0	340	7,697
Atlantic Blvd	Pompano Beach Station	7:30-8:30	2,071	8,285	2,074	2,074	10,358	0	489	10,847
South of Sunrise Blvd	Fort Lauderdale Station	7:15-8:15	1,721	8,606	2,025	2,025	10,631	0	488	11,119
SW 42 nd St*	Sheridan St Station	7:15-8:15	1,879	9,397	1,916	1,916	11,314	NA	444	11,758
Ives Dairy Rd	Golden Glades Station	7:30-8:30	1,913	5,739	1,468	1,468	7,207	NA	359	7,566
NW 146 th St	NA	8:00-9:00	1,923	7,694	1,181	2,362	10,055	NA	NA	10,055
South of NW 65 th St	NA	7:30-8:30	1,395	5,582	1,779	3,558	9,139	NA	NA	9,139
Total				64,295		17,275	81,570	NA	2,773	84,343
Percent to Total				76.2%		20.5%	96.7%		3.3%	100.0%
A.M. Southbound										
South of Northlake Blvd	Mangonia Park Station	7:15-8:15	1,745	8,726	381	381	9,108	0	107	9,215
North of Gateway	Lake Worth Station	7:00-8:00	2,182	8,727	1,471	1,471	10,199	0	373	10,572
Glades Rd	Boca Raton Station	7:00-8:00	844	2,532	1,791	1,791	4,323	0	423	4,746
Atlantic Blvd	Pompano Beach Station	7:15-8:15	1,900	7,599	2,506	2,506	10,105	0	431	10,536
South of Sunrise Blvd	Fort Lauderdale Station	7:15-8:15	1,962	9,810	2,181	2,181	11,991	0	405	12,396
SW 42 nd St*	Sheridan St Station	8:00-9:00	1,687	8,437	1,883	1,883	10,321	425	375	11,120
Ives Dairy Rd	Golden Glades Station	7:15-8:15	1,733	5,198	2,525	2,525	7,723	425	317	8,464
NW 146 th St	NA	7:30-8:30	1,579	6,318	2,147	4,295	10,613	1,074	NA	11,686
South of NW 65 th St	NA	7:45-8:45	2,043	8,173	2,155	4,310	12,482	1,074	NA	13,556
Total				65,521		21,344	86,864	2,996	2,431	92,291
Percent to Total				71.0%		23.1%	94.1%	3.2%	2.6%	100.0%

Source: Cambridge Systematics, Inc.

Table 7.5 I-95 Corridor Person Throughput in the PM Peak Period

I-95 AVO Data Collection Locations	Tri-Rail Stations	Peak Hour on I-95	GPL Person Throughput /Lane	GPL Person Throughput	ML Person Throughput /Lane	ML Total Person Throughput w/o Express Bus and Vanpool	Total I-95 Person Throughput w/o Express Bus and Vanpool	95 Express Bus and Vanpool Ridership	Tri-Rail Ridership	I-95 Corridor Total Person Throughput
P.M. Northbound										
South of Northlake Blvd	Mangonia Park Station	16:45-17:45	2,047	8,189	989	989	9,179	0	0	9,179
North of Gateway	Lake Worth Station	17:00-18:00	2,119	8,477	2,414	2,414	10,891	0	446	11,337
Glades Rd	Boca Raton Station	16:15-17:15	1,581	4,743	2,610	2,610	7,353	0	864	8,217
Atlantic Blvd	Pompano Beach Station	16:15-17:15	1,922	7,687	3,089	3,089	10,776	0	749	11,525
South of Sunrise Blvd	Fort Lauderdale Station	16:00-17:00	1,666	8,330	2,783	2,783	11,113	0	641	11,754
SW 42 nd St*	Sheridan St Station	17:00-18:00	2,301	11,504	2,268	2,268	13,772	455	516	14,742
Ives Dairy Rd	Golden Glades Station	17:00-18:00	1,841	5,524	2,639	2,639	8,163	455	473	9,091
NW 146 th St	NA	16:00-17:00	1,829	7,315	2,779	5,557	12,872	1,119	NA	13,991
South of NW 65 th St	NA	16:15-17:15	1,827	7,309	3,208	6,416	13,725	1,119	NA	14,844
Total				69,079		28,765	97,844	3,147	3,689	104,680
Percent to Total				66.0%		27.5%	93.5%	3.0%	3.5%	100.0%
P.M. Southbound										
South of Northlake Blvd	Mangonia Park Station	16:15-17:15	1,322	6,612	410	410	7,023	NA	80	7,103
North of Gateway	Lake Worth Station	16:15-17:15	1,855	7,421	1,362	1,362	8,783	0	492	9,275
Glades Rd	Boca Raton Station	17:00-18:00	637	1,911	3,154	3,154	5,065	0	514	5,579
Atlantic Blvd	Pompano Beach Station	16:15-17:15	1,719	6,877	2,462	2,462	9,339	0	511	9,850
South of Sunrise Blvd	Fort Lauderdale Station	16:15-17:15	2,021	10,105	2,175	2,175	12,279	0	484	12,763
SW 42 nd St*	Sheridan St Station	17:00-18:00	1,803	9,015	2,471	2,471	11,486	NA	444	11,930
Ives Dairy Rd	Golden Glades Station	16:15-17:15	1,621	4,862	2,160	2,160	7,022	NA	273	7,295
NW 146 th St	NA	16:15-17:15	2,069	8,276	1,322	2,644	10,919	NA	NA	10,919
South of NW 65 th St	NA	16:15-17:15	1,951	7,804	1,403	2,806	10,610	NA	NA	10,610
Total				62,883		19,643	82,526	NA	2,798	85,324
Percent to Total				73.7%		23.0%	96.7%		3.3%	100.0%

Source: Cambridge Systematics, Inc.

8.0 Findings and Recommendations

8.1 FINDINGS

The 2014 MLs Monitoring Report indicates that the I-95 Managed Lane (ML) facility in South Florida continues to operate well as indicated by the positive impacts on travel-time savings.

The following is a summary of conclusions for each of the performance measures used in the monitoring study.

Traffic Characteristics

The study corridor distinguishes five segments in terms of traffic characteristics delineated by the following interchanges:

- Okeechobee Blvd
- Glades Rd
- Broward Blvd
- GGI

For 2014, traffic on I-95 exhibits the following trends when compared with 2010:

- **Overall:** Traffic fluctuated throughout the corridor. In general, the segment south of Atlantic Blvd carried more traffic during peak periods than the segment north of it;
- **A.M. Peak Volume:** Southbound volumes in MLs increased at most segments by varying levels throughout the corridor. Total volumes in all lanes increased at most locations except for around Glades Rd and the south of GGI.
- **P.M. Peak Volume:** Northbound volumes in MLs increased south of GGI. Total volumes decreased at most segments.
- **LOS:** ML LOS was consistently better than or equal to that of GPLs. LOS on MLs was mostly D and above, with a couple of exceptions: LOS was F between Ives Dairy Rd and GGI in the HOV lane southbound in the a.m. peak; LOS was F between Sample Rd and Commercial Blvd northbound in the a.m. peak period. Looking at all facilities (MLs and GPLs) in both directions, there were 13 instances where LOS F is observed in 2014 compared with 11 instances in 2012.
- **Peak Directions:** Peak directions of locations in Palm Beach and Broward Counties are quite different due to their relative locations to Downtown West Palm Beach, Boca Raton, Florida Atlantic University (FAU), and Downtown Fort Lauderdale. Peak directions of locations in Miami-Dade County were uniformly southbound in the a.m. peak period and northbound in the p.m. peak period. There were also a

few locations that showed no change of peak directions during a.m. and p.m. peak hours: Glades Rd where northbound was the peak direction, Atlantic Blvd where northbound was the peak direction, and Sunrise Blvd where southbound was the peak direction.

- **HOV Enforcement hours:** The HOV enforcement hours covered highest volume hours at most locations; however, there were a few exceptions that experienced the highest volumes outside of the HOV enforced periods. They were:
 - South of Sunrise Blvd: 3:30 to 4:30 p.m. in both directions;
 - South of Hillsboro Blvd: 5:30 to 6:30 p.m. in both directions;
 - North of Glades Rd: 3:30 to 4:30 p.m. in the northbound direction, and 11:00 a.m. to 12:00 noon and 6:15 to 7:15 p.m. in the southbound direction; and
 - South of Palm Beach Lakes Blvd: 9:00 to 10:00 a.m. and 5:45 to 6:45 p.m. in the northbound direction; and 8:15 to 9:15 a.m. and 5:45 to 6:45 p.m. in the southbound direction.

Travel Speeds

- **Speed Range:** Overall, travel speeds along the study corridor differed significantly from segment to segment and from MLs to GPLs, ranging between approximately 20 mph to 80 mph;
- **A.M. Peak:** Southbound travel speeds on MLs were consistently higher than those on GPLs, with the greatest speed difference of 27 mph observed in the segment between GGI and SR 112. Northbound travel speeds were mostly higher in MLs than GPLs, with a speed difference up to 20 mph in the segment between Glades Rd and Broward Blvd.
- **P.M. Peak:** Northbound overall difference in travel speeds was consistently higher in MLs than GPLs, with the greatest speed difference of 26 mph observed in the segment between GGI and SR 112. In the southbound direction, all segments observed faster speeds in MLs than GPLs, with a speed difference up to 16 mph in the segment between GGI and SR 112.
- **2014 vs. 2012:** Compared with 2012, travel speeds in MLs have generally increased in peak hour peak direction north of Sample Rd, but decreased south of it.
- **Speed Differential:** Per FHWA¹⁰, it is recommended that a 15 mph maximum speed differential not be exceeded until additional research can be conducted to quantify an optimum speed differential. If necessary and possible, the speed

¹⁰ Report No. FHWA-RD-79-59, Safety Evaluation of Priority Techniques for High-Occupancy Vehicles.

differential between the HOV lane and GPL should be controlled, typically by two methods: ramp metering or using variable speed control signing on the HOV lanes using the VMS boards. This recommendation applies to the segment between Indiantown Rd and Broward Blvd northbound in the a.m., between Okeechobee Rd and Glades Rd northbound in the p.m., and between Glades Rd and Broward Blvd southbound in the a.m.

Travel Time Savings

- **Southbound in the A.M. Peak:** Travel-time saving was 25 minutes and nine seconds (00:25:09).
- **Northbound in the P.M. Peak:** Travel-time saving was 28 minutes and 24 seconds (00:28:24).
- **2014 vs. 2012:** Northbound travel-time savings increased from 2012 to 2014 in both the a.m. and p.m. peak; southbound travel-time savings increased from 2012 to 2014 in the a.m. peak, but decreased slightly southbound to Downtown Miami in the p.m. peak.
- **Historical Trend:** Increases in travel-time savings over years resulted mostly from decrease in travel speeds in GPLs.

Vehicle Occupancy

- **Overall:** AVO in MLs were higher than GPLs in most of the segments along the study corridor in both directions except for the segment between GGI and southern EL terminus northbound in the a.m..
- **A.M. Enforcement Period:** 2014 ML AVO ranged from 1.61 to 1.71 persons per vehicle southbound and 1.16 to 1.74 persons per vehicle northbound. (This excludes AVO in the segment between Broward Blvd and GGI due to construction).
- **P.M. Enforcement Period:** 2014 ML AVO ranged from 1.73 to 1.89 persons per vehicle northbound and 1.42 to 1.82 persons per vehicle southbound. (This excludes AVO in the segment between Broward Blvd and GGI due to construction).
- **2014 vs. 2012:** AVO in the HOV lanes increased northbound in the p.m. from 2012 to 2014 in most segments, but decreased southbound in the a.m. in most segments. AVO in ELs increased in all instances except for southbound in the p.m.. Increase in Express Bus ridership is the major contributing factor to AVO increase in ELs. AVO in GPLs generally increased from 2012 to 2014.

Person Throughput

- **Overall:** In 2014, person throughput per lane was mostly higher in MLs than in GPLs in peak hour peak direction throughout the corridor.

- **Express Bus and Vanpool:** The Express Bus services and Vanpool Program contributed between 20 and 25 percent of the total person throughput in ELs in peak hour peak direction.
- **2014 vs. 2012:** Person throughput generally increased from 2012 to 2014 in peak hour peak direction.

Enforcement

- **Violations:** HOV violation rates were generally higher in the a.m. peak than in the p.m. peak at most locations in 2014. Compared with 2012, violation rates in 2014 were generally higher in the southbound direction.
- **Citations:** The total number of citations issued in Broward and Palm Beach counties decrease in 2013, but increased significantly in 2014. Enforcement in Express Lanes continued to be a challenge due to

Multi-Modal Assessment

- **Travel Time:** Driving in MLs was the fastest amongst the available travel modes. In the southbound direction during the a.m. peak, travel time driving in HOV and EL was one hour and 21 minutes; in the northbound direction during the p.m. peak, travel time in MLs was one hour and 17 minutes. Travel time driving in GPLs was over 20 minutes slower than that of MLs. Taking Tri-Rail and Metrorail was the slowest, due largely to the transfer time between Tri-Rail and Metrorail, and service frequency of Tri-Rail. If riders plan their trip carefully using Tri-Rail and Metrorail schedules, shorter trip times are possible.
- **Travel Costs:** Travel costs were lowest in the Tri-Rail-Express Bus scenario southbound during the a.m. peak (\$34.62) and in the 3-person Carpool scenario northbound during the p.m. peak (\$31.72). Driving alone in both the GPL and the GPL-EL scenarios cost significantly more than all other scenarios, over \$32.00 more than the lowest mode option, largely due to vehicle operating costs.
- **Mode Split:** In the southbound direction during the a.m. peak period, 71% of all commuters drove in GPL, 23% drove in MLs, 3% took Express Bus, and 3% took Tri-Rail; in the southbound direction during the p.m. peak period, 66% of commuters drove in GPL, 28% drove in HOV lane and EL, 3% took Express Bus, and 4% took Tri-Rail. The highest throughput of the whole corridor in the peak direction during the peak periods was observed at NW 65th St. Comparing the transit ridership south of Fort Lauderdale Tri-Rail station, more commuters used Express Bus than Tri-Rail in the a.m. peak hour, while more commuters used Tri-Rail in the p.m. peak hour.

8.2 RECOMMENDATIONS

The MLs in South Florida are operating effectively, moving more people in less time during the periods of enforcement, and their operation should continue as the region grows and north-south travel demand increases.

If necessary and possible, the speed differential between HOV lanes and GPLs should be controlled, typically by two methods: ramp metering or dynamic speed control signing on the HOV lanes using the Variable Message Sign (VMS) boards.

Enforcement efforts should be increased in the a.m. peak, which showed higher violation rates than the p.m. peak. This will help reduce the number of vehicles using the lanes in violation of the law, and will further enhance the effectiveness of the facility.

The ML data for person throughput in Miami-Dade and Broward counties clearly shows the effectiveness of Express Bus services and Vanpool Program. As freeway facilities continue to experience increasing travel demand, instituting Express Bus services and the Vanpool Program in MLs is a way to move a greater number of people with the same roadway facility.

Recommendations Regarding ML Operation

- Districts Four and Six should continue working with FHP to increase enforcement. Enforcement is critical to control violation rates and is a function of the resources dedicated by the local Florida Highway Patrol (FHP) troop. Enforcement efforts should be encouraged in all counties.
- A study should be done to explore available technologies and products for automatic vehicle occupancy detection, as enforcement in ELs continued to be a challenge to FHP.
- District Four staff should continue to work with county transit agencies in Broward and Palm Beach counties to develop new Express Bus services and modify existing Express Bus services on I-95 where it will meet travel demand needs and be a productive use of transit agency resources. This is particularly important with the expected completion of Phase II construction of 95 Express Lanes.
- District Four and Six should continue to encourage the use of Vanpools which can increase average occupancy in MLs.
- The HOV lanes should continue to be monitored for the potential to expand hours of enforcement. As volumes increase and peak spreading occurs, the HOV lane will continue to move more traffic than a GPL for greater than the current two-hour peak periods.

Recommendations Regarding Multi-Modal Corridor Performance

- The Tri-Rail - Metrorail travel mode appears to be the slowest travel mode among all scenarios. One of the contributing factors is the transfer time between Tri-Rail and Metrorail. It is recommended that Tri-Rail and Metrorail continue working together on adjusting train schedules based on ridership patterns during in the peak periods, to reduce average commuter travel time.

Recommendations Regarding Future Data Collection

In 2014, PTMS and TTMS data were obtained from the FDOT District Four Statistics Office. ITS data were obtained from the FDOT Traffic Management Center. It is recommended that prior to the next MLs monitoring study the following efforts should be made to ensure improved data quality:

- Study team should coordinate with District Four ITS early to reconfigure all the ITS detectors along I-95 to cover all travel lanes, including auxiliary lanes. This would allow study team to utilize the ITS detector data to validate and supplement PTMS and TTMS data. Lane configuration should also be checked to make sure the counts of each lane are correctly reported. Districts Four and Six should review ITS detector data and PTMS/TTMS counts data to determine the data source for the next MLs monitoring study (2016).
- Global positioning system (GPS) technology was used for all the travel time runs in 2014 and was proved to be a more efficient and flexible technology, particularly for data post-processing. This technology should be carried on for future travel time data collection efforts.
- Data collection for vehicle occupancy is difficult and subject to error. A driver with no front seat passenger but one or more rear-seat passengers may easily be logged as a violator. AVO reported in this study is probably an under-estimate if the real AVO. Efforts should be made to identify alternatives and improvements to this data collection task, based on national research. This could be combined with the study on automatic vehicle occupancy detection technologies to facilitate EL enforcement.