

# 2004 I-95 High-Occupancy Vehicle Lane Monitoring Report

## final report

*prepared for*

**Florida Department of Transportation  
District VI Multimodal Planning Office and  
District IV Office of Modal Development**



*prepared by*

**Cambridge Systematics, Inc.**

*with*

**Kittelson & Associates, Inc.  
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*August 2004*

[www.camsys.com](http://www.camsys.com)

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*August 2004*

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# Executive Summary

## ■ Travel Speeds

- In most cases, the speeds in the HOV lanes are higher than the GP lanes, the exception is a construction zone.
  - The average driver is traveling one mph to 18 mph faster in the HOV lane depending on the segment, time and direction.

## ■ Time Savings

- Time savings while using the HOV lane are significant.
  - The average driver saves seven minutes heading north along the entire corridor in the afternoon and 15 minutes heading south to Miami in the morning.

## ■ Vehicle Occupancy

- Vehicle occupancy in the HOV lane has decreased since 2002, probably due to inadequate enforcement in some areas.

## ■ Person Throughput

- The HOV lane carries significantly more people in the peak hour.
  - In Miami-Dade the HOV lane carries from 540 to 2,620 more people compared to the average general-purpose lane.
  - In Broward in some segments the HOV lane carries 1000 more people.
  - In Palm Beach the HOV lane carries 400 to 1900 more people.

- Express Bus Service in Miami-Dade contributes 28 percent of the total person throughput by adding 900 to 1,300 additional people (approximately 13 bus loads) in the peak hour.

## ■ Effect of Enforcement

- Violation rates have increased significantly since 2002.
  - In Miami-Dade County
    - 14 to 44 percent Violation rate.
  - In Broward County
    - 21 to 64 percent Violation rate.
  - In Palm Beach County
    - 27 to 64 percent Violation rate.

# 1.0 Introduction

The Florida Department of Transportation (FDOT) monitors operations of the Interstate 95 High-Occupancy Vehicle (HOV) facility in South Florida on a biannual basis. The I-95 HOV facility extends from SR 112 in Miami-Dade County to just south of Linton Boulevard in Palm Beach County, a distance of approximately 46 miles. The objective of the monitoring effort is to document current operations of the HOV facility and to determine if operational changes are warranted. Regularly measuring the performance of the HOV and general-purpose lanes is important to support operation of the facility.

Consistent with previous reports, the 2004 monitoring report evaluates the facility in terms of the following mobility performance measures:

- Level of Service;
- Travel Time;
- Travel Speed;
- Vehicle Occupancy;
- Person Throughput; and
- Levels of Violation.

To identify trends and determine how well the system is operating, the results are compared with the previous five monitoring reports.

Previous reports used in the comparative analysis are outlined below:

- 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.

## ■ 1.1 System Overview

Interstate 95 is a major north-south limited access freeway. As shown in Figure 1.1, the HOV lanes extend from SR 112 in Miami-Dade County (the southern terminus) to south of Linton Boulevard in Palm Beach County (the northern terminus). FDOT currently is

extending the HOV lanes north into Palm Beach County; at the time of this study construction was underway at several locations. By 2006, HOV lanes will extend to PGA Boulevard and by 2009 to Donald Ross Road.

The HOV lanes are not physically separated from the general-purpose lanes; access is uncontrolled except at the Golden Glades interchange where the HOV lanes are separated by flyover ramps. Enforcement activities occur on the inside shoulder throughout the corridor. The lane configuration is shown in Table 1.1.

To monitor the lanes, data is collected at several stations along the HOV facility. While the 2004 report includes data from fewer points than the 2002 report, not all the data collected in 2002 was used. Therefore, to make the process more cost-effective, data in 2004 was collected only at points where analysis was needed, consistent with the points used for data collection in previous years. The data collection process is specifically described in each data/analysis section.

During the data collection period, the speed limit in Palm Beach and Broward counties was 65 mph. The speed limit in Dade County was 55 mph. The speed limit in areas under construction is as posted at the site, generally varying between 55 and 65 mph.

**Figure 1.1 Location of Existing HOV Lanes in the I-95 Corridor in South Florida**



**Table 1.1 I-95 HOV Lane Configuration for 2004 Count Locations**

Site Location	Direction	Number of General-Purpose (GP) Lanes	Number of HOV Lanes
South of NW 79 <sup>th</sup> Street	Both	4	1
South of NW 119 <sup>th</sup> Street	Both	4	1
South of Golden Glades Interchange	Both	5	1
South of Hollywood Boulevard	Both	5	1
South of Sample Road	Both	4	1
South of Hillsboro Road	Both	3	1
North of Glades Road	Both	3	1

## ■ 1.2 Enforcement Overview

The HOV lane is reserved for vehicles with two or more occupants. This vehicle occupancy requirement is enforced throughout the 46-mile corridor, where enforcement action occurs on the inside shoulder. Table 1.2 summarizes the specific weekday enforcement restrictions by county.

**Table 1.2 Current HOV Lane Enforcement Restrictions**

County	FDOT District	Current Enforcement Restrictions
Miami-Dade	6	Enforced Monday through Friday from 7:00 a.m. to 9:00 a.m. in the southbound direction and 4:00 p.m. to 6:00 p.m. in the northbound direction.
Broward	4	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.
Palm Beach	4	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.

In Miami-Dade County, trucks with three or more axles are prohibited in the HOV lane. In Broward and Palm Beach Counties, trucks with three or more axles are prohibited in the two leftmost lanes (the HOV lane and adjacent general-purpose lane.)

## ■ 1.3 Report Organization

The report is organized as follows:

- **Section 1.0, Introduction** - This section defines the purpose of the study and describes the organization of the report.
- **Section 2.0, Traffic** - This section summarizes the traffic volume and level of service analyses.
- **Section 3.0, Travel Time and Delay Analysis** - This section summarizes the travel speed and time data, and documents the time savings associated with the HOV lanes.
- **Section 4.0, Vehicle Occupancy** - This section summarizes the average vehicle occupancy data.
- **Section 5.0, Person Throughput** - This section presents the average person throughput, based on traffic volumes and vehicle occupancy, for HOV and general-purpose lanes. It includes the impact of the I-95 HOV Express Bus Services.
- **Section 6.0, Enforcement** - This section summarizes the enforcement activities, including violation rates and citation trends.
- **Section 7.0, Findings, Conclusions, and Recommendations** - This section summarizes the study findings and provides recommendations for FDOT.

## 2.0 Traffic

### ■ 2.1 Methodology – Data Collection

Consistent data is critical when analyzing trends. For this reason, the data collection points and analysis sections used in the 2002 I-95 HOV Lane Monitoring Report were carefully reviewed prior to collecting new data for the 2004 report. To improve the efficiency of the data collection process, only sites necessary to support analysis of specific sections were identified for collection.

Composite traffic data is used to monitor value trends. Figure 2.1 shows where data was collected in 2002 and where volume comparisons and profiles were analyzed. The 2004 data collection points were thus selected to ensure data coverage for those same locations. Seven final sites used were:

1. South of NW 79<sup>th</sup> Street;
2. South of Golden Glades;
3. South of Hollywood Boulevard;
4. South of Sunrise Boulevard;
5. South of Atlantic Boulevard;
6. South of Hillsboro Road; and
7. North of Glades Road.

Traffic volume data was collected to evaluate the current operating conditions of the I-95 HOV facility. To evaluate typical weekday conditions, 24-hour counts were collected at various locations along the corridor, consistent with previous studies. The counts in Miami-Dade County were collected on Tuesday, March 30, 2004 and the counts in Broward and Palm Beach counties were collected on Wednesday, March 31, 2004. The northbound and southbound count locations are shown in Figures 2.2 and 2.3, respectively.

For the three counties, individual lane traffic counts also were obtained using Florida Department of Transportation (FDOT) count stations. These count stations recorded volume in the HOV lane, in the general-purpose lane adjacent to the HOV lane, and in the other general-purpose lanes. Speed data were obtained from the Travel Time and Delay runs. The methodology is described in Section 3.0 (page 3-1). A resurfacing project underway on Hallandale Beach Boulevard prevented the collection of data from that count station, necessitating the use of data from the Hollywood Boulevard Station in its place.

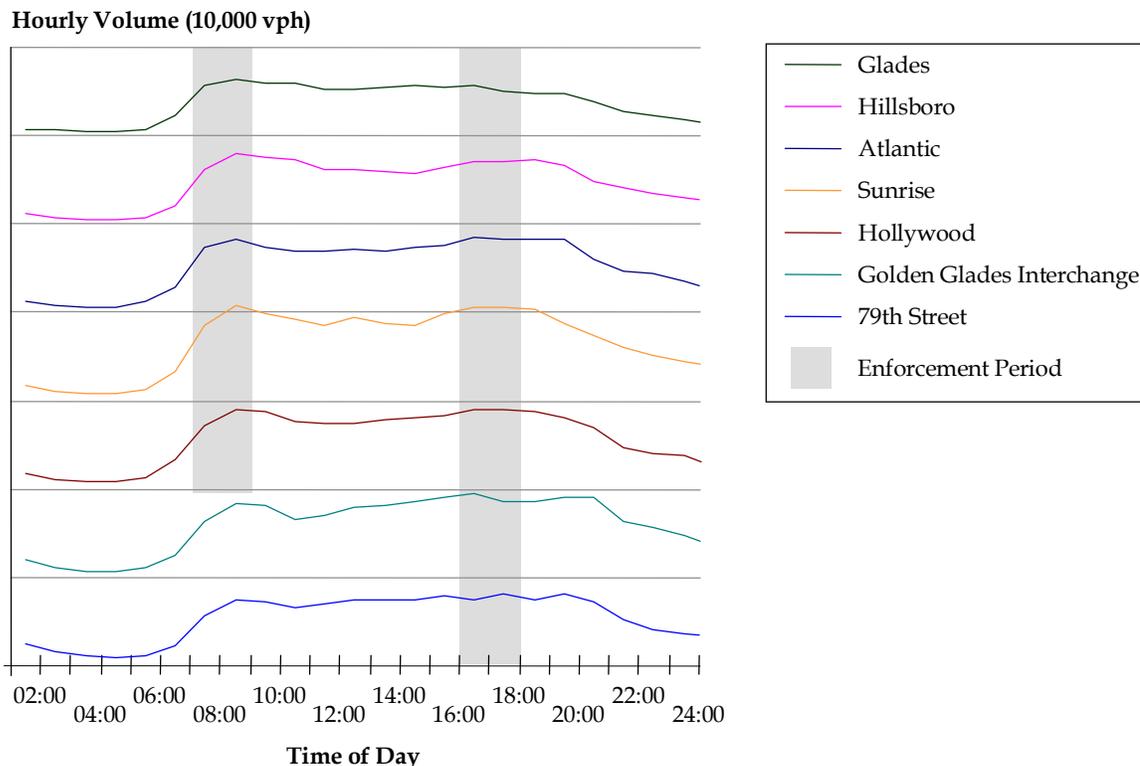


## 2.2 2004 Results – Traffic Volume Profiles

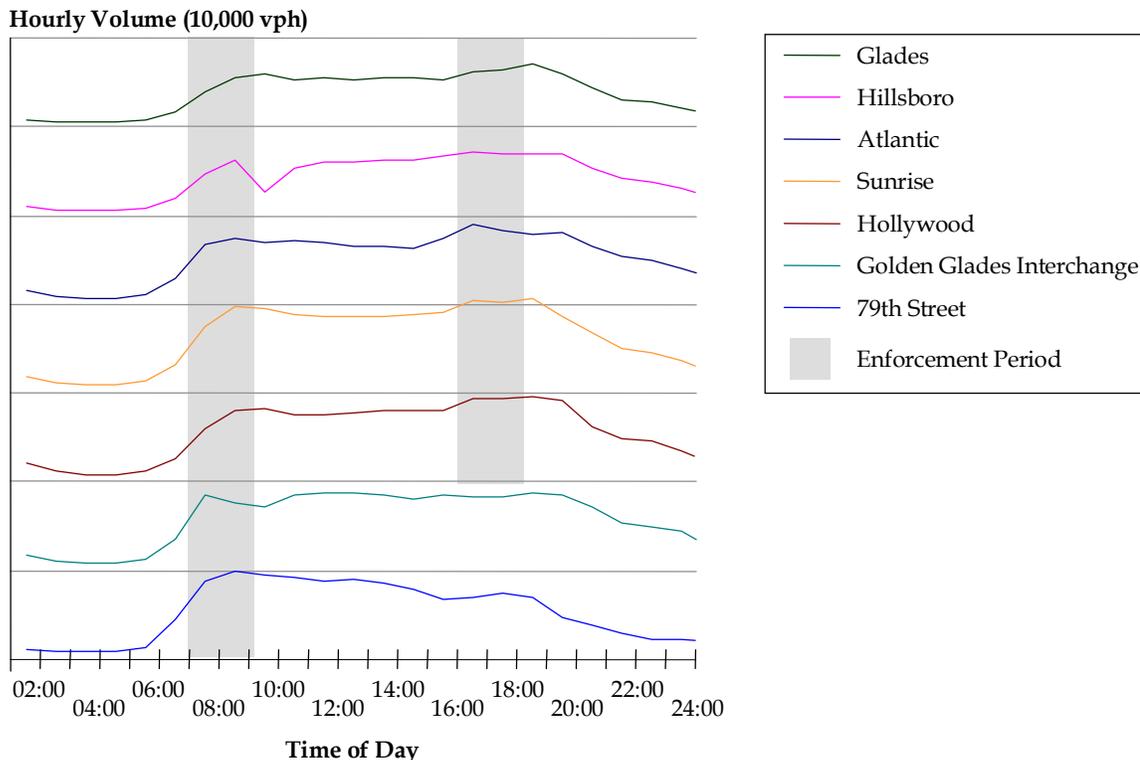
The observed 24-hour traffic counts were adjusted to reflect annual average daily traffic (AADT) conditions by applying weekly and axle adjustment factors provided by FDOT. The factors used are included in Appendix 2. Figure 2.4 depicts traffic volume profiles for the recorded locations. The volume profiles are averaged hourly for the 24-hour period. Appendix 2 includes data presented in daily format for 15-minute intervals.

Traffic volume in the I-95 corridor in Miami-Dade County begins to increase between 6:30 and 7:00 a.m. and remains heavy until 7:30 to 8:00 p.m. The southbound p.m. traffic is the heaviest, with traffic counts approaching 11,000 vehicles per hour. The peak spread occurs only in Miami-Dade County. In Broward and Palm Beach counties, traffic volume begins to increase between 6:30 and 7:00 a.m. Although it declines slightly by 11:00 a.m., volume remains heavy throughout the early afternoon and rises again between 3:00 and 4:00 p.m. before tapering off by 7:00 to 8:00 p.m. Figure 2.2 and 2.3 show the actual peak hours at each of the identified locations in the northbound and southbound directions, respectively.

**Figure 2.2 Year 2004 I-95 Volume Profile**  
*Northbound*



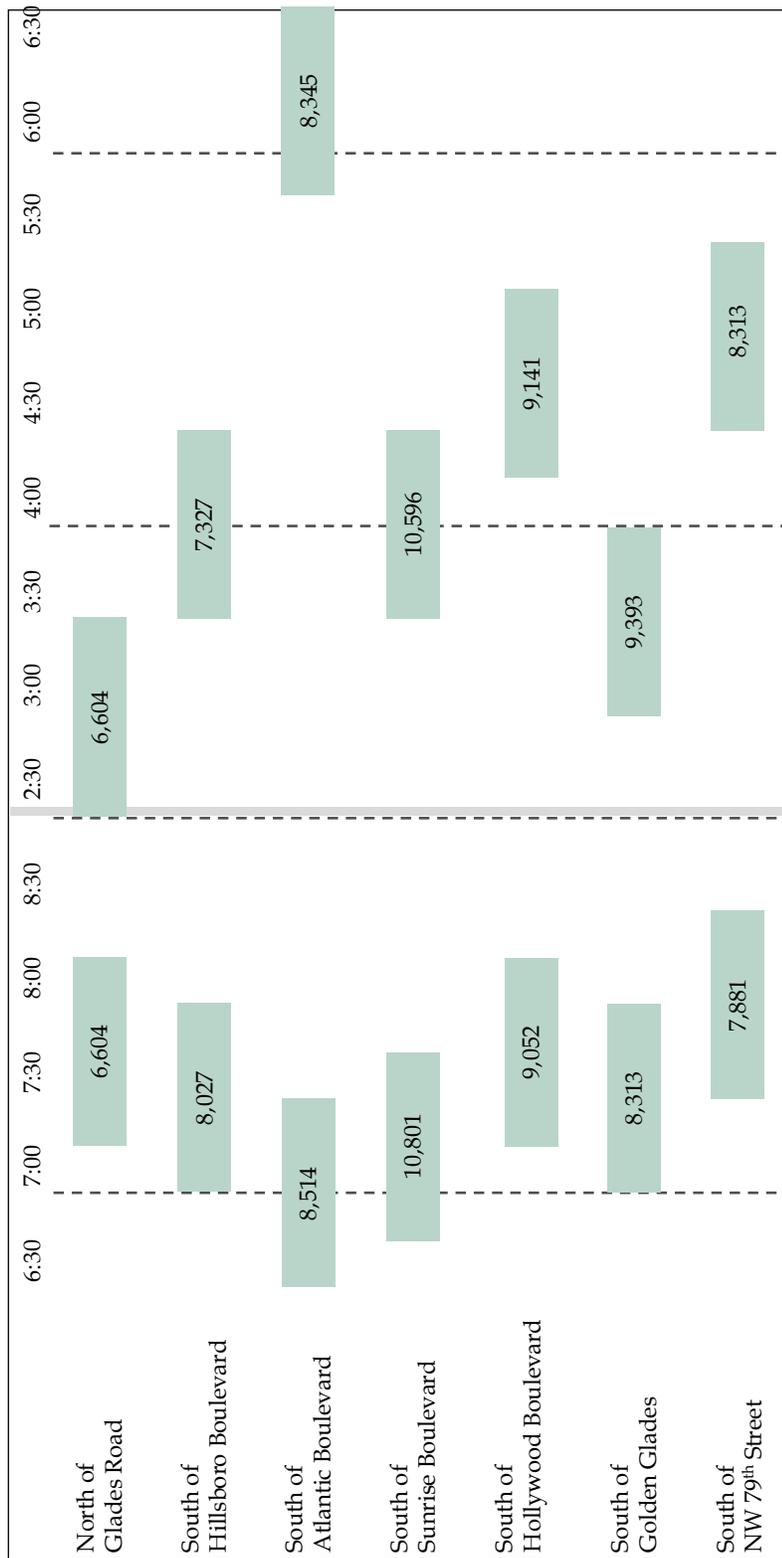
**Figure 2.3 Year 2004 I-95 Volume Profile**  
Southbound



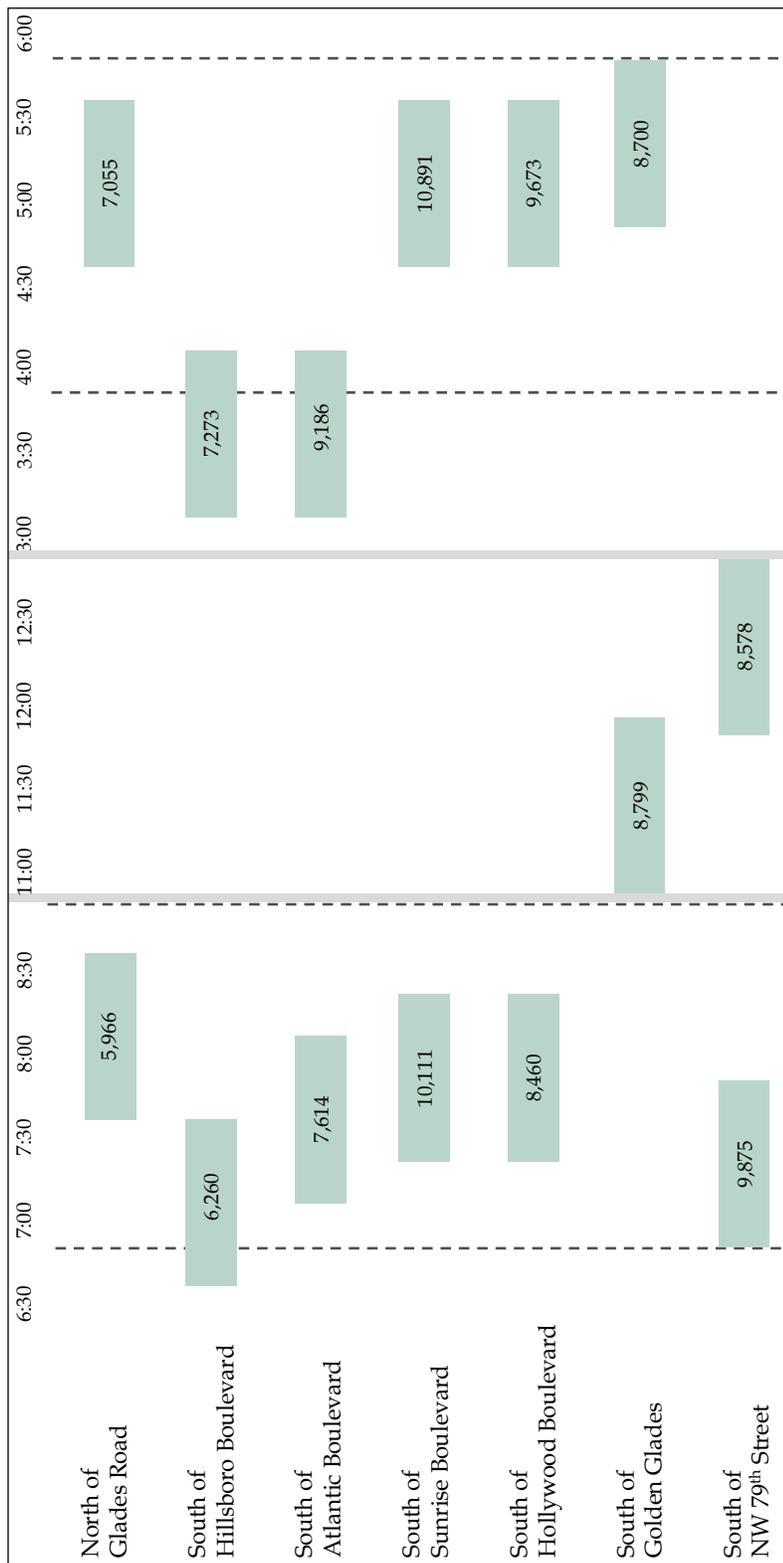
**Table 2.1 I-95 Actual Observed Peak Hours**

I-95 Location		Direction	A.M. Peak Hour	A.M. Peak Volume	P.M. Peak Hour	P.M. Peak Volume
Miami- Dade County	South of NW 79 <sup>th</sup> Street	NB	7:30-8:30	7,881	4:30-5:30	8,313
		SB	7:00-8:00	9,875	12:00-1:00	8,578
	South of Golden Glades	NB	7:00-8:00	8,313	3:00-4:00	9,393
		SB	11:00-12:00	8,799	5:00-6:00	8,700
Broward County	South of Hollywood Boulevard	NB	7:15-8:15	9,052	4:15-5:15	9,141
		SB	7:30-8:30	8,460	4:45-5:45	9,673
	South of Sunrise Boulevard	NB	6:45-7:45	10,801	3:30-4:30	10,596
		SB	7:30-8:30	10,111	4:45-5:45	10,891
	South of Atlantic Boulevard	NB	6:30-7:30	8,514	5:45-6:45	8,345
		SB	7:15-8:15	7,614	3:15-4:15	9,186
South of Hillsboro Boulevard	NB	7:00-8:00	8,027	3:30-4:30	7,327	
	SB	6:45-7:45	6,260	3:15-4:15	7,273	
Palm Beach County	North of Glades Road	NB	7:15-8:15	6,604	2:30-3:30	6,604
		SB	7:45-8:45	5,966	4:45-5:45	7,055

**Figure 2.4 Actual Observed Peak Hours**  
*Northbound*



**Figure 2.5 Actual Observed Peak Hours**  
*Southbound*



## ■ 2.3 Trends and Comparison with Previous Years

### *Peak-Hour Traffic Volumes*

Peak hours during current HOV enforcement periods were identified from traffic count data. Tables 2.2 and 2.3 compare 2004 and 2002 a.m. and p.m. traffic volumes during current enforcement periods, showing both northbound and southbound travel in general-purpose and HOV lanes.

**Table 2.2 Volume Comparison – For Years 2002 and 2004**  
*A.M. Peak Hour*

I-95 Location	Direction	2002				2004				Difference		
		Volume		Volume		Volume		Volume		Year 2004 and 2002		
		A.M. Peak Volume	General-Purpose Lanes	HOV Lane	HOV Lane	A.M. Peak Volume	General-Purpose Lanes	HOV Lane	HOV Lane	A.M. Peak	HOV	
Miami Dade County	NB	*	*	*	*	*	*	*	*	*	*	*
	SB	7,709	5,576	2,133	2,133	9,875	7,737	2,138	2,166	2,166	5	
	NB	*	*	*	*	*	*	*	*	*	*	
	SB	6,742	5,147	1,595	1,595	7,671	6,310	1,361	929	929	-234	
Broward County	NB	9,267	6,032	1,028	1,028	9,052	8,094	958	-215	-215	-70	
	SB	8,203	5,437	726	726	8,460	7,897	563	257	257	-163	
	NB	9,775	8,491	1,284	1,284	10,790	8,873	1,917	1,015	1,015	633	
	SB	9,351	8,463	888	888	10,111	9,284	827	760	760	-61	
Palm Beach County	NB	7,948	6,678	1,270	1,270	8,297	7,182	1,115	349	349	-155	
	SB	8,349	7,396	953	953	7,614	6,424	1,190	-735	-735	237	
	NB	7,794	6,435	1,359	1,359	8,027	6,723	1,304	233	233	-55	
	SB	5,873	5,295	578	578	6,183	4,373	1,810	310	310	1,232	
Palm Beach County	NB	6,812	5,699	1,113	1,113	6,604	4,878	1,726	-208	-208	613	
	SB	5,783	5,261	522	522	5,966	3,937	2,029	183	183	1,507	

Notes: \* Direction not enforced.

2002 Peak volumes for Hollywood are imputed from actual 2002 Sheridan Street volumes.

**Table 2.3 Volume Comparison – For Years 2002 and 2004**  
*P.M. Peak Hour*

I-95 Location	Direction	2002				2004				Difference Year 2004 and 2002
		P.M. Peak		Volume		P.M. Peak		Volume		
		Volume	Lanes	HOV Lane	General-Purpose Lanes	Volume	Lanes	HOV Lane	General-Purpose Lanes	
Miami Dade County	NB	7,356	5,491	1,865	6,878	8,313	6,878	1,435	957	-430
	SB	*	*	*	*	*	*	*	*	*
South of Golden Glades	NB	7,862	6,051	1,811	7,046	8,531	7,046	1,485	669	-326
	SB	*	*	*	*	*	*	*	*	*
Broward County	NB	8,610	5,903	789	8,111	9,141	8,111	1,030	531	241
	SB	9,706	6,377	1,202	8,576	9,673	8,576	1,097	-33	-105
South of Sunrise Boulevard	NB	9,314	8,156	1,158	8,805	10,596	8,805	1,791	1,282	633
	SB	10,222	8,797	1,425	9,324	10,891	9,324	1,567	669	142
South of Atlantic Boulevard	NB	7,989	6,779	1,210	6,849	8,345	6,849	1,496	356	286
	SB	8,457	7,094	1,367	6,850	8,300	6,850	1,450	-157	83
South of Hillsboro Boulevard	NB	6,790	5,661	1,129	6,205	7,327	6,205	1,122	537	-7
	SB	7,329	5,708	1,621	5,129	6,980	5,129	1,851	-349	230
Palm Beach County	NB	5,823	5,027	776	3,719	4,928	3,719	1,209	-895	433
	SB	6,349	5,141	1,208	5,013	7,055	5,013	2,042	706	834

Notes: \* Direction not enforced.

2002 Peak volumes for Hollywood are imputed from actual 2002 Sheridan Street volumes.

In the a.m. peak period, HOV volumes in all three counties show little or no increase between 2002 and 2004. In Miami-Dade County, southbound traffic volumes declined slightly south of Golden Glades and increased by only five vehicles per hour south of 79th Street, a marginal increase. Travel Speeds (19.7 mph) indicate the freeway is operating at capacity-constrained conditions. The HOV lane is not enforced in the northbound direction during the a.m. period.

In Broward County, between 2002 and 2004, HOV traffic volumes increased in three locations: northbound south of Sunrise Boulevard, southbound south of Atlantic Boulevard, and southbound south of Hillsboro Boulevard (where the number of vehicles per hour rose by over 1,300). HOV traffic volumes declined at all other locations in the County, even as volumes in the general-purpose lanes at all but one of these same locations increased. (Northbound on Hollywood Boulevard was the exception.)

In Palm Beach County, HOV volumes increased in both directions north of Glades Road, while general-purpose lane volumes decreased in the northbound direction. This trend is somewhat consistent with the general reduction in a.m. peak traffic in 2002 compared to 2000.

In the p.m. peak period, HOV volumes have generally increased over 2002 volumes. In Broward County, HOV volumes have increased, with the exception of the southbound HOV lane south of Hallandale Beach Boulevard and the northbound lane south of Hillsboro Boulevard (whose decrease of seven vehicles per hour is marginal). In Palm Beach County, north of Golden Glades, HOV volumes have increased and general-purpose lane volumes have decreased. The 1,615-vehicle decrease in the general-purpose lane is significant in the northbound direction. Only in Miami-Dade County have the HOV volumes in the northbound direction decreased, even as general-purpose lane volumes have increased. (The HOV lane is not enforced in the southbound direction during the p.m. period.)

### ***Annual Average Daily Traffic Volumes (AADT)***

Table 2.4 compares the annual average daily traffic volumes for 2004, 2002, and 2000. With the exception of south of NW 79<sup>th</sup> Street and south of Hollywood Boulevard, total AADT volume (both directions aggregated) has increased. Again, this is consistent with the general trend.

**Table 2.4 Volume Comparison – For Years 2002 and 2004**  
*Annual Average Daily Traffic (AADT)*

	I-95 Location	By Direction	2000	2002	2004	Volume Increase for 2002-2004	Percentage Change
Miami Dade County	South of NW 79 <sup>th</sup> Street	NB	108,464	128,248	122,611	-5,637	-4%
		SB	115,450	154,275	120,832	-33,443	-22%
	South of Golden Glades	NB	134,328	133,419	135,997	2,578	2%
		SB	133,898	133,762	135,400	1,638	1%
Broward County	South of Hollywood Boulevard	NB	-	161,086	127,858	-33,228	-21%
		SB	-	147,680	127,686	-19,994	-14%
	South of Sunrise Boulevard	NB	135,562	139,037	147,783	8,746	6%
		SB	136,044	141,748	140,505	-1,243	-1%
	South of Atlantic Boulevard	NB	117,381	115,270	118,489	3,219	3%
		SB	109,663	120,214	117,923	-2,291	-2%
	South of Hillsboro Boulevard	NB	102,274	101,504	103,821	2,317	2%
		SB	101,155	100,317	94,760	-5,557	-6%
Palm Beach County	North of Glades Road	NB	90,907	84,696	81,198	-3,498	-4%
		SB	90,044	82,403	83,066	663	1%

In Miami-Dade County, AADT increased over 2002 levels, except in the southbound direction south of NW 79<sup>th</sup> Street, where the number of vehicles fell by a significant -33,433 AADT. In Broward County AADT significantly decreased at the highest volume location while at all others it increased. The decrease was measured south of Hollywood Boulevard, and was a significant -33,228 in the northbound direction and -19,994 in the southbound direction. In Palm Beach County, AADT increased north of Glades Road in the southbound direction.

## ■ 2.4 Level of Service Analysis

The level of service (LOS) analysis was performed based on the methodology described in Chapter 3 of the *Highway Capacity Manual*, “Basic Freeway Segments.”

The three measures of speed, density, and flow or volume are interrelated. Knowing the values of two of these measures, the third can be determined. From the travel time runs, an average speed (expressed in mi/hr) was calculated for each of the analysis segments.<sup>1</sup> During the same peak time periods, the volumes were measured and converted to passenger car equivalent volumes (expressed in pc/ln/hr). The density was then determined using the following equation:

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

The LOS thresholds for a basic freeway segment are shown below:

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

The Level of Service is summarized in Table 2.5. Along most segments of I-95, for a given direction and enforced timeframe, the HOV lane performed better than or equivalent to the general-purpose lane. There were two exceptions, however: Sample Road to Palmetto Park Road and Palmetto Park Road to Linton Boulevard.

<sup>1</sup> See Section 3.0 of this report for more details on the calculation procedure.

Table 2.5 Level of Service

Average Speed (Miles/Hour)	A.M.				P.M.			
	Southbound		Northbound		Southbound		Northbound	
	GP	HOV	HOV	GP	GP	HOV	HOV	GP
	Average Speed							
Linton Boulevard-Palmetto Park Road	67.1	67.9	65.2	66.4	63.1	61.2	56.0	69.9
Palmetto Park Road-Sample Road	57.5	63.1	66.6	58.8	43.7	49.5	69.4	57.7
Sample Road-Commercial Boulevard	52.0	57.5	63.1	58.6	55.6	46.5	64.6	53.5
Commercial Boulevard-Broward Boulevard	65.4	69.4	56.5	58.1	55.4	61.0	54.8	46.5
Broward Boulevard-Griffin Road	66.9	69.4	67.2	61.4	31.3	51.0	59.6	60.0
Griffin Road-Ives Dairy Road	67.3	76.8	67.9	62.2	52.2	56.5	65.8	64.8
Ives Dairy Road-Golden Glades	65.3	74.5	67.4 <sup>a</sup>	67.2	59.1	61.0 <sup>a</sup>	61.1	59.5
Golden Glades-125 <sup>th</sup> Street	19.7	44.6	64.9 <sup>a</sup>	61.9	54.4	54.5 <sup>a</sup>	38.9	31.0
125 <sup>th</sup> Street-SR 112	19.7	35.5	68.4 <sup>a</sup>	64.2	59.3	63.1 <sup>a</sup>	36.6	32.0
	Volume (pc/hr/ln)							
Linton Boulevard-Palmetto Park Road	1,312	2,029	1,726	1,626	1,671	2,042	1,209	1,240
Palmetto Park Road-Sample Road	1,458	1,810	1,304	2,241	1,710	1,851	1,122	2,068
Sample Road-Commercial Boulevard	1,606	1,190	1,115	1,796	1,713	1,450	1,496	1,712
Commercial Boulevard-Broward Boulevard	1,857	827	1,917	1,775	1,865	1,567	1,791	1,761
Broward Boulevard-Griffin Road <sup>b</sup>	1,718	695	1,438	1,697	1,790	1,332	1,411	1,692
Griffin Road-Ives Dairy Road	1,579	563	958	1,619	1,715	1,097	1,030	1,622
Ives Dairy Road-Golden Glades <sup>b</sup>	1,421	962	1,173	1,507	1,556	1,405	1,258	1,516
Golden Glades-125 <sup>th</sup> Street	1,262	1,361	1,388	1,395	1,398	1,712	1,485	1,409
125 <sup>th</sup> Street-SR 112	1,934	2,138	1,476	1,601	1,638	918	1,435	1,720

<sup>a</sup> HOV restrictions are not currently enforced for this direction or timeframe.<sup>b</sup> Estimated by averaging volumes at upstream and downstream stations.

Table 2.5 Level of Service (continued)

Density (pc/mi/ln)	A.M.				P.M.			
	Southbound		Northbound		Southbound		Northbound	
	GP	HOV	HOV	GP	GP	HOV	HOV	GP
	Density pc/mi/ln							
Linton Boulevard-Palmetto Park Road	19.5	29.9	26.5	24.5	26.5	33.4	21.6	17.7
Palmetto Park Road-Sample Road	25.4	28.7	19.6	38.1	39.2	37.4	16.2	35.9
Sample Road-Commercial Boulevard	30.9	20.7	17.7	30.7	30.8	31.2	23.1	32.0
Commercial Boulevard-Broward Boulevard	28.4	11.9	33.9	30.6	33.7	25.7	32.7	37.9
Broward Boulevard-Griffin Road	25.7	10.0	21.4	27.6	57.2	26.1	23.7	28.2
Griffin Road-Ives Dairy Road	23.5	7.3	14.1	26.0	32.9	19.4	15.7	25.0
Ives Dairy Road-Golden Glades	21.8	12.9	17.4	22.4	26.4	23.0	20.6	25.5
Golden Glades-125 <sup>th</sup> Street	64.0	30.5	21.4	22.5	25.7	31.4	38.2	45.5
125 <sup>th</sup> Street-SR 112	98.0	60.2	21.6	24.9	27.6	14.5	39.2	53.8
<b>Level of Service</b>	<b>Level of Service</b>	<b>Level of Service</b>	<b>Level of Service</b>	<b>Level of Service</b>	<b>Level of Service</b>	<b>Level of Service</b>	<b>Level of Service</b>	<b>Level of Service</b>
Linton Boulevard-Palmetto Park Road	C	D	D	C	D	D	C	B
Palmetto Park Road-Sample Road	C	D	C	E	E	E	B	E
Sample Road-Commercial Boulevard	D	C	B	D	D	D	C	D
Commercial Boulevard-Broward Boulevard	D	B	D	D	D	C	D	E
Broward Boulevard-Griffin Road	C	A	C	D	F	D	C	D
Griffin Road-Ives Dairy Road	C	A	B	D	D	C	B	C
Ives Dairy Road-Golden Glades	C	B	B	C	D	C	C	C
Golden Glades-125 <sup>th</sup> Street	F	D	C	C	C	D	E	F
125 <sup>th</sup> Street-SR 112	F	F	C	C	D	B	E	F

<sup>a</sup> HOV restrictions are not currently enforced for this direction or timeframe.

<sup>b</sup> Estimated by averaging volumes at upstream and downstream stations.

In the southern segment from Sample Road to Palmetto Park Road, the southbound a.m. peak-hour volume was almost 20 percent higher in the HOV lane than in the general-purpose lane (1,810 vehicles versus 1,460 vehicles). With a slightly higher speed, the HOV lane still had a higher overall density, hence a lower LOS.

In the northern segment from Palmetto Park Road to Linton Boulevard, LOS in the HOV lane also was lower than in the general-purpose lane. In this instance, an ongoing construction project appears to have been the reason. A narrow travel lane and even narrower left shoulder caused motorists to reduce their speed and maintain greater following distances.

## 3.0 Travel Time and Delay Analysis

The objective of this part of the evaluation was to determine the benefit in terms travel time (if any) experienced by vehicles that are able to use the HOV lanes during enforced times.

### ■ 3.1 Methodology – Travel Time Runs

Travel time runs were performed for the entire length of the HOV lanes on I-95 from SR 112 (Miami-Dade County) to Linton Boulevard (Palm Beach County). The runs were performed using the floating car method, as defined in the *Manual on Uniform Traffic Studies* (MUTS). The 2004 data are presented and analyzed in four segments as follows:

1. SR 112 to Golden Glades Interchange;
2. Golden Glades Interchange to Broward Boulevard;
3. Broward Boulevard to Sample Road; and
4. Sample Road to Linton Boulevard.

The previously studied section between SR 112 and the Miami-Dade County Line has been changed to Golden Glades Interchange due to the very different operating characteristics north and south of the interchange.

The travel time runs were conducted on March 30 and 31 and April 1, 2004. Initially, six 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 (the HOV lane and the general-purpose lanes). The travel time reported between each waypoint was reviewed to determine that it was reasonable. Based on this review, a few of the runs were excluded from analysis, if proved to be significant outliers caused by crashes and/or construction work which resulted in some non-representative travel speeds.

As shown in Figure 3.1, travel time between a total of 10 locations was recorded, including the terminal ends of the runs. In addition to the travel speed data, a notation was made to represent any delay to the test vehicle. The summaries for each of the runs are contained in Appendix 3. The summaries identify average travel speeds and travel times.

**Figure 3.1 Segments of Travel Time Runs for the 2002 and 2004 I-95 HOV Lane Monitoring Studies**



## ■ 3.2 2004 Results

The average travel speeds resulting from the travel time runs are summarized in Table 3.1. The table shows the average travel speeds for each peak period for each direction in the general-purpose (GP) lanes and the HOV lane.

### Travel Speeds

Table 3.1 presents the average travel speeds and speed difference between the two lane types. The arrows indicate whether the speeds in the HOV lane are higher (↑) or lower (↓) than the speeds in the general-purpose lanes. In most cases, the speeds are higher in the HOV lanes than in the GP lanes. The only exception is for the northbound and southbound segment from Sample Road to Linton Boulevard during the p.m. peak periods. This is explained by ongoing construction in the area.

Southbound in the a.m. peak, the overall difference in travel speed is significant, ranging from 3.9 mph (Linton Boulevard to Sample Road) to 18.3 mph (Golden Glades to SR 112). Northbound in the a.m. peak, the overall difference in travel speed is less significant, ranging from 1.4 mph (Broward Boulevard to Sample Road) to 4.5 mph (Golden Glades to Broward Boulevard).

Southbound in the p.m. peak, the overall difference in travel speed also is relatively minor. The HOV speed for the segment from Linton Boulevard to Sample Road is approximately 1.2 mph lower than the GP lane speed. The greatest difference in the HOV speed is 6.5 mph higher in the segment from Broward Boulevard to the Golden Glades.

Northbound in the p.m. peak, the overall difference in travel speeds is small but significant. The HOV speed for the segment from Sample Road to Linton Boulevard is approximately 3.2 mph lower than the GP lane speed. The greatest difference is found in the segment from Broward Boulevard to Sample Road, where the HOV lane speed is 14.4 mph higher than the GP lane speed.

### Travel Time

Table 3.1 also presents the travel time savings provided by the HOV lane. The National Cooperative Highway Research Program *HOV Systems Manual* states that HOV facilities should provide one minute per mile in travel time savings and an overall travel time savings of at least five minutes per trip.<sup>2</sup>

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<sup>2</sup> National Cooperative Highway Research Program, *HOV Systems Manual*, Report 414, Transportation Research Board, National Research Council, Washington, D.C., February 1998.

**Table 3.1 HOV Lane and General-Purpose Lane Travel Speeds**

Section	A.M. <sup>a</sup>				P.M. <sup>b</sup>			
	Southbound		Northbound		Southbound		Northbound	
	General-Purpose Lanes (mph)	HOV Lane (mph)	General-Purpose Lanes (mph)	HOV Lane (mph)	General-Purpose Lanes (mph)	HOV Lane (mph)	General-Purpose Lanes (mph)	HOV Lane (mph)
<i>Average Travel Speeds</i>								
Sample Road-Linton Boulevard	61.2	65.1 ↑	62.1	64.9 ↑	55.9	54.7 ↓	59.2 ↓	62.3
Broward Boulevard-Sample Road	55.5	60.2 ↑	57.6	59.0 ↑	54.8	59.1 ↑	59.5 ↑	45.2
Golden Glades-Broward Boulevard	66.4	73.4 ↑	62.8	67.3 ↑	48.7	55.2 ↑	61.4 ↑	61.4
SR 112-Golden Glades	18.4	36.8 ↑	63.1	67.1 <sup>c</sup> ↑	58.0	59.8 <sup>c</sup> ↑	35.1 ↑	26.5
<i>HOV-GP Lane Speed Difference and HOV Lane Travel Time Savings</i>								
Sample Road-Linton Boulevard	3.9	0:12	0:08	2.7	-1.2	-0:05	-3.2	-0:10
Broward Boulevard-Sample Road	4.7	1:00	0:05	1.4	4.2	0:15	14.4	3:10
Golden Glades-Broward Boulevard	7.0	1:05	0:15	4.5	6.5	2:02	0.0	0:00
SR 112-Golden Glades	18.3	13:00	0:08 <sup>c</sup>	4.0	1.8	0:03 <sup>c</sup>	8.6	4:07
<b>Total Times (minutes:seconds)</b>		15:17	0:36			2:15		7:07

Note: The arrows indicate whether the speeds in the HOV lane are higher (↑) or lower (↓) than the speeds in the general-purpose lanes.

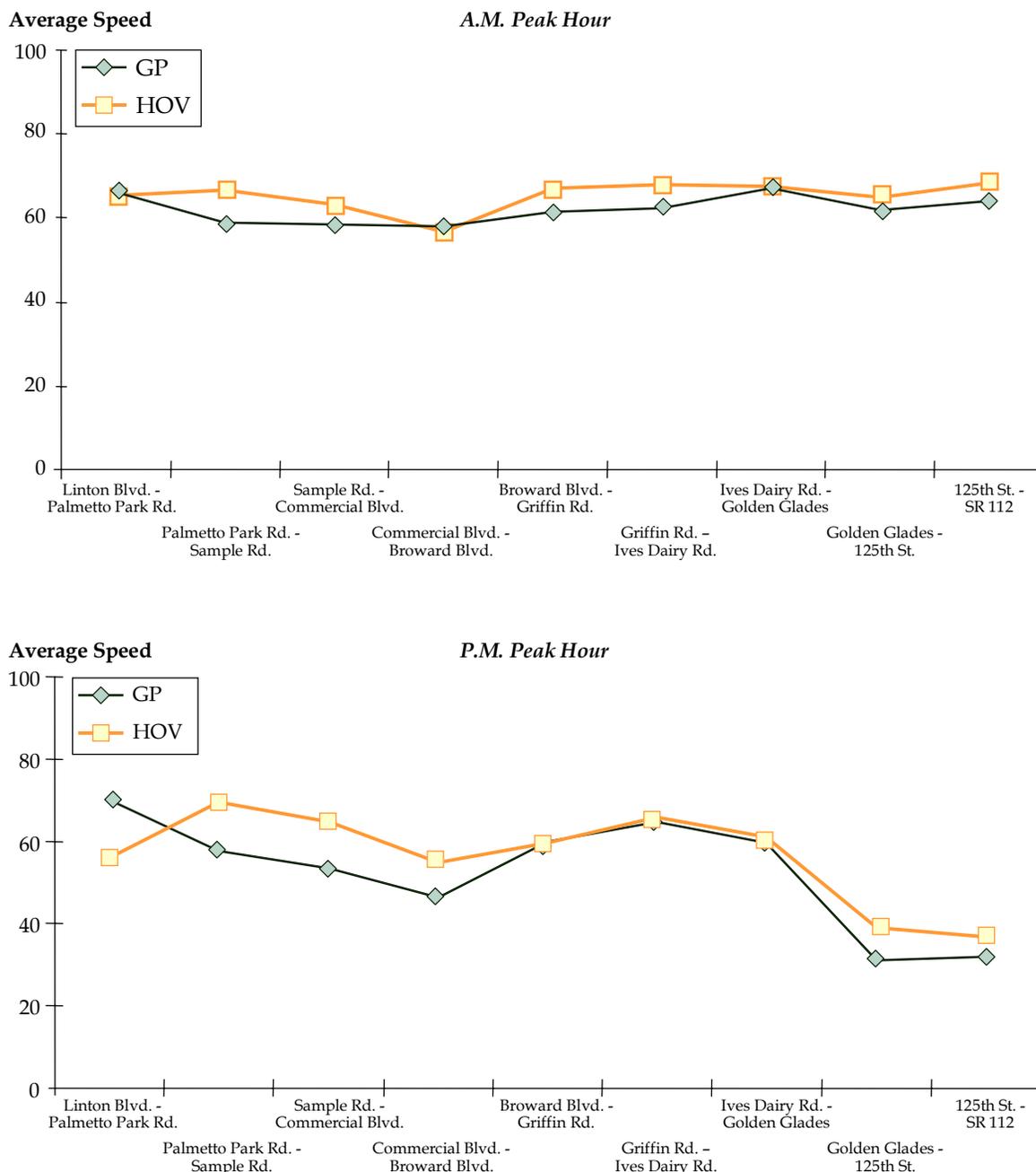
<sup>a</sup> a.m. = 7:00 a.m. to 9:00 a.m.

<sup>b</sup> p.m. = 4:00 p.m. to 6:00 p.m.

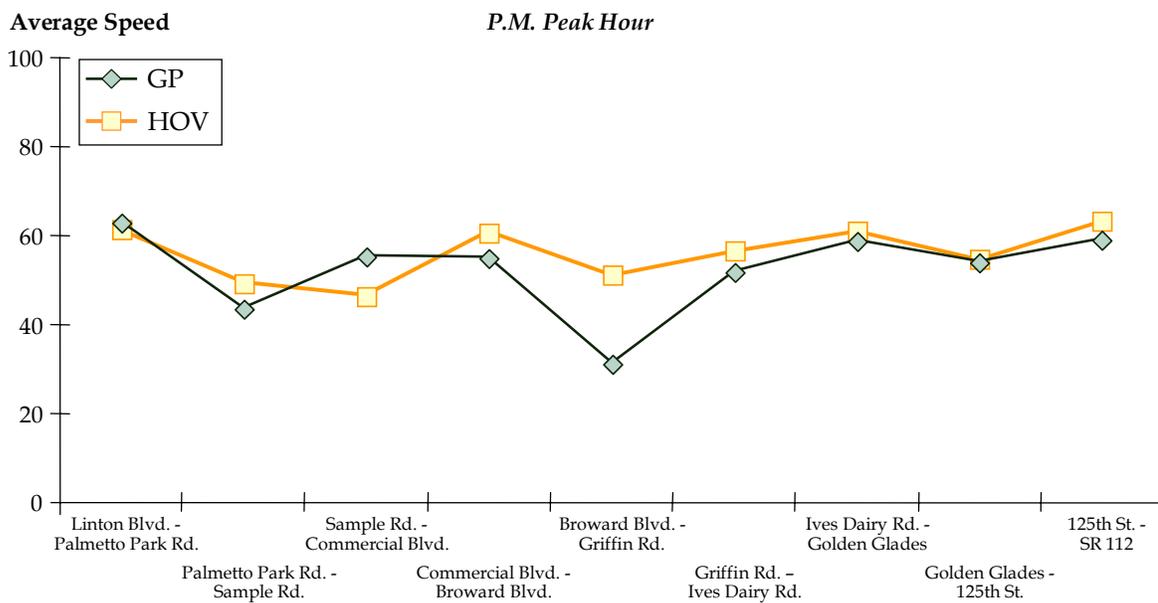
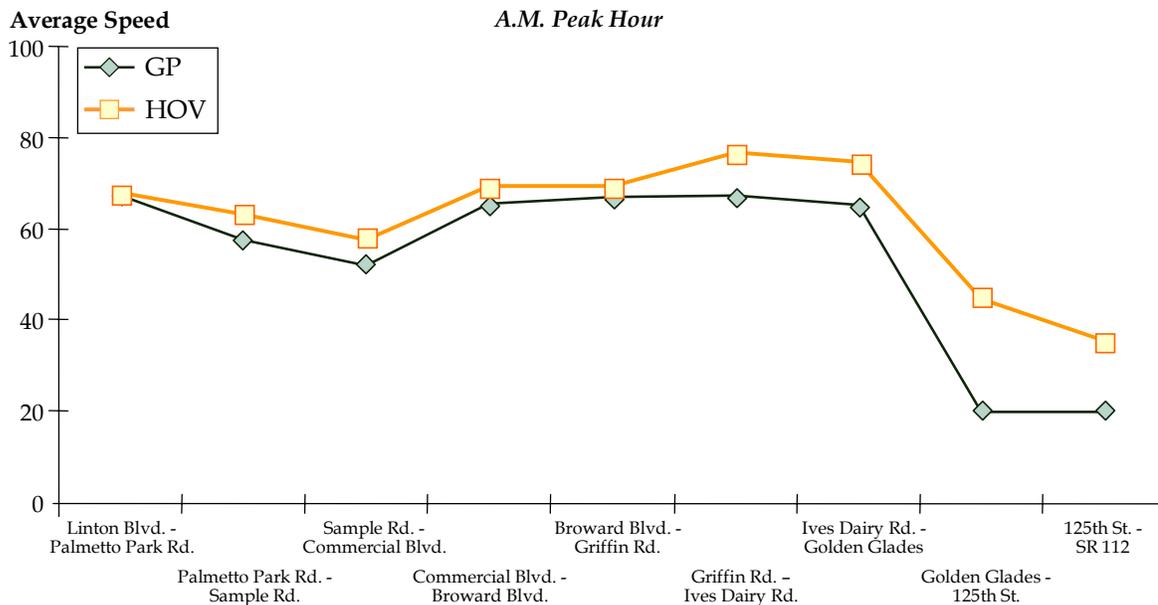
<sup>c</sup> HOV restrictions are not currently enforced for this direction or timeframe.

The 2004 study shows an overall travel time savings of 15 minutes and 17 seconds in the southbound direction during the a.m. peak, and of seven minutes and seven seconds in the northbound direction during the p.m. peak. The travel time savings per mile is highest between SR 112 and Golden Glades: one minute 37 seconds per mile southbound during the a.m. peak, and 31 seconds per mile northbound during the p.m. peak.

**Figure 3.2 Average Travel Speeds**  
*Northbound*



**Figure 3.3 Average Travel Speeds**  
*Southbound*



## ■ 3.3 Trends and Comparison with Previous Years

### Travel Speeds

Tables 3.2 and 3.3 show the changes in travel times in both the GP and HOV lanes over a seven-year period. The information is taken from I-95 HOV lane monitoring studies conducted in 1997, 1998, 2000, 2002, and 2004. The arrows indicate whether the 2004 speeds are higher (↑) or lower (↓) than the 2002 speeds.

For peak periods in both directions, 2004 speeds are noticeably different than 2002 speeds. The most southern segment of the corridor was modified from the Miami-Dade County Line to the Golden Glades Interchange for the 2004 analysis. For comparative purposes, it was assumed that the average speeds were representative throughout the entire segment.

The speeds increased more significantly in the general-purpose lanes than in the HOV lanes in six segments:

1. Northbound from SR 112 to Golden Glades Interchange (GGI) during the a.m. peak (13.1 mph higher in 2004);
2. Northbound from GGI to Broward Boulevard during the a.m. peak (16.2 mph higher in 2004);
3. Southbound from Broward Boulevard to the GGI during the a.m. peak (12.7 mph higher in 2004);
4. Northbound from SR 112 to GGI during the p.m. peak (25.7 mph higher in 2004);
5. Southbound from Broward Boulevard to GGI during the p.m. peak (16.3 mph higher in 2004); and
6. Southbound from Linton Boulevard to Broward Boulevard during the p.m. peak (14.3 mph higher in 2004).

The most significant increase in speed in the HOV lane was found in the northbound segment from SR 112 to GGI during the p.m. peak period (22.7 mph higher in 2004 than in 2002).

**Table 3.2 Travel Speed Comparisons, 1997-2004**  
*A.M. Peak Period*

Section	Northbound											
	Percent Change 1997-2004			Fall 2004			Fall 2002			Spring 1997		
	GP	HOV	(mph)	GP	HOV	(mph)	GP	HOV	(mph)	GP	HOV	(mph)
SR 112-Golden Glades Interchange	-0.47%	5.84%	63.1 ↑	67.1 <sup>a</sup> ↑	50.0	65.8 <sup>i</sup>	43.0	62.4 <sup>a</sup>	59.2	62.7 <sup>a</sup>	63.4	67.2 <sup>a</sup>
Golden Glades Interchange-Broward Boulevard	-4.56%	2.28%	62.8 ↑	67.3 ↑	46.6	61.4	55.6	65.6	62.6	60.6	65.8	73.4
Broward Boulevard-Sample Road	2.13%	4.61%	57.6 ↑	59.0 ↓	56.0	61.1	35.4	49.9	50.7	61.6	56.4	70.8
Sample Road-Linton Boulevard	1.97%	6.57%	62.1 ↓	64.9 ↑	62.5	64.5	39.3	52.2	54.6	60.9	60.9	72.2

Section	Southbound											
	Percent Change 1997-2004			Fall 2004			Fall 2002			Spring 1997		
	GP	HOV	(mph)	GP	HOV	(mph)	GP	HOV	(mph)	GP	HOV	(mph)
SR 112-Golden Glades Interchange	-32.10%	35.79%	18.4 ↓	36.8 ↓	33.8	41.4	26.0	38.1	25.4	44.2	27.1	48.8
Golden Glades Interchange-Broward Boulevard	-2.64%	7.62%	66.4 ↑	73.4 ↑	53.7	64.3	64.3	70.1	64.5	67.6	68.2	73.5
Broward Boulevard-Sample Road	7.35%	16.44%	55.5 ↓	60.2 ↓	56.0	63.6	63.0	69.0	53.5	65.1	51.7	68.7
Sample Road-Linton Boulevard	-4.52%	1.56%	61.2 ↓	65.1 ↔	66.5	65.1	52.1	68.1	63.3	67.5	64.1	69.9

Note: The arrows indicate whether the 2004 values are higher (↑) or lower (↓) than the 2002 speeds.  
<sup>a</sup> HOV restrictions are not currently enforced for this direction and timeframe.

**Table 3.3 Travel Speed Comparisons, 1997-2004**  
*P.M. Peak Period*

Section	Percent Change 1997-2004		Northbound														
	GP	HOV	Fall 2004			Fall 2002			Fall 2000			Spring 1998			Spring 1997		
			GP (mph)	HOV (mph)	HOV (mph)	GP (mph)	HOV (mph)	HOV (mph)	GP (mph)	HOV (mph)	HOV (mph)	GP (mph)	HOV (mph)	HOV (mph)	GP (mph)	HOV (mph)	HOV (mph)
SR 112-Golden Glades Interchange	24.46%	28.33%	58.0	59.8 <sup>a</sup>	32.3	37.1	32.8	43.5	38.8	41.9	37.9	46.6					
Golden Glades Interchange-Broward Boulevard	-29.11%	-19.65%	48.7	55.2	49.4	64.9	62.0	58.6	63.9	63.5	63.0	68.7					
Broward Boulevard-Sample Road	-18.33%	-11.92%	54.8	59.1	49.8	57.8	53.0	63.2	50.5	61.0	51.8	67.1					
Sample Road-Linton Boulevard	-17.19%	-18.96%	55.9	54.7	57.8	66.7	58.6	64.4	64.2	67.4	64.5	67.5					
Section	Percent Change 1997-2004		Southbound														
	GP	HOV	Fall 2004			Fall 2002			Fall 2000			Spring 1998			Spring 1997		
			GP (mph)	HOV (mph)	HOV (mph)	GP (mph)	HOV (mph)	HOV (mph)	GP (mph)	HOV (mph)	HOV (mph)	GP (mph)	HOV (mph)	HOV (mph)	GP (mph)	HOV (mph)	HOV (mph)
SR 112-Golden Glades Interchange	-57.80%	-44.11%	26.5	35.1 <sup>a</sup>	49.3	57.5 <sup>a</sup>	51.0	56.9 <sup>a</sup>	58.9	61.1 <sup>a</sup>	62.4	62.8 <sup>a</sup>					
Golden Glades Interchange-Broward Boulevard	-8.36%	-8.21%	61.4	61.5	45.1	55.7	50.9	56.6	56.4	56.3	62.0	67.0					
Broward Boulevard-Sample Road	-31.10%	-9.30%	45.2	59.5	48.6	51.7	49.4	48.1	54.5	60.2	56.2	65.6					
Sample Road-Linton Boulevard	-9.97%	-14.45%	62.3	59.2	48.0	60.7	40.7	58.1	56.5	63.7	63.9	69.2					

Note: The arrows indicate whether the 2004 values are higher (↑) or lower (↓) than the 2002 speeds.

<sup>a</sup> HOV restrictions are not currently enforced for this direction and timeframe.

## Travel Times

Tables 3.4 and 3.5 show travel time savings in the HOV lane compared to the previous reports. Figures 3.4 and 3.5 depict the same.

Overall travel time savings in 2004 were much lower than in 2002, with one exception: Traveling southbound during the a.m. peak period, the savings were 15 minutes and 17 seconds in 2004, compared with eight minutes and 40 seconds in 2002.

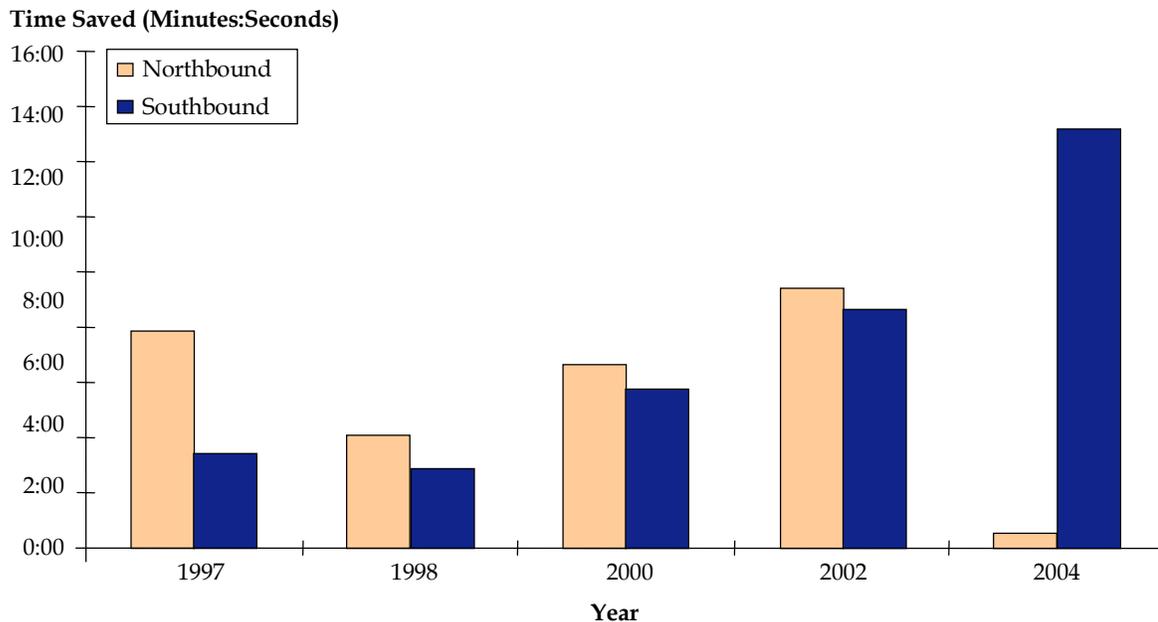
**Table 3.4 Year-on-Year Time Savings, 1997-2004**  
*A.M. Peak Period*

Total Corridor Savings (Minutes:Seconds)	2004	2002	2000	1998	1997
Northbound	0:36	8:05	16:10	4:47	5:56
Southbound	15:17	7:13	12:10	15:40	16:52

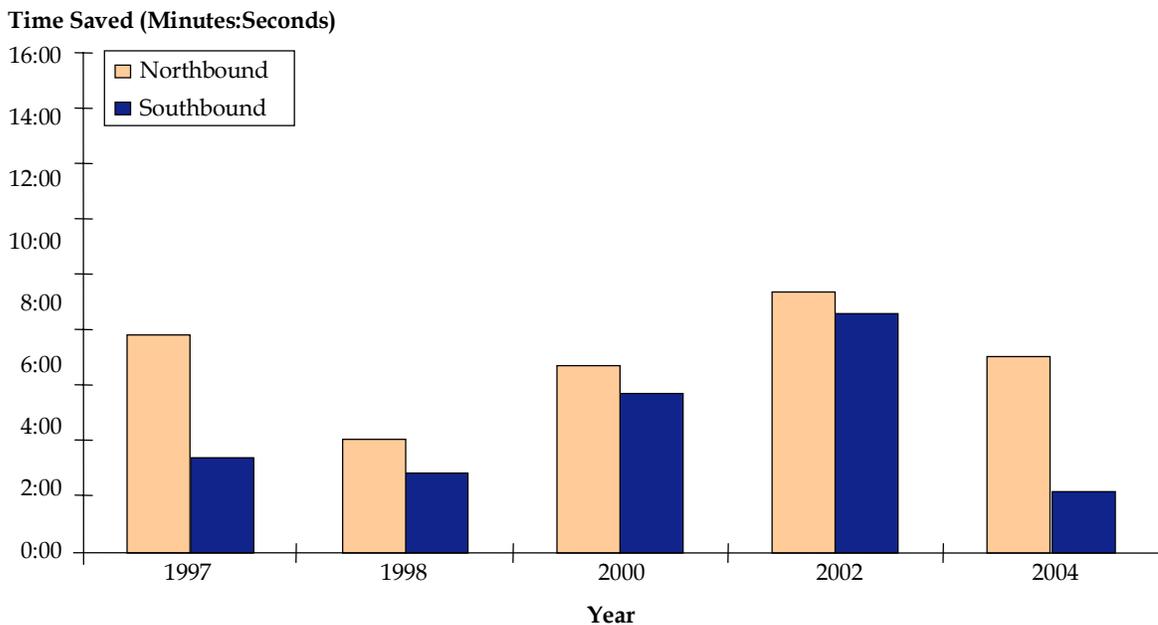
**Table 3.5 Year-on-Year Time Savings, 1997-2004**  
*P.M. Peak Period*

Total Corridor Savings (Minutes:Seconds)	2004	2002	2000	1998	1997
Northbound	7:07	9:27	6:51	4:10	7:55
Southbound	2:15	8:40	5:46	2:52	3:26

**Figure 3.4 Year-on-Year Time Savings, 1997-2004**  
*A.M. Peak Period*



**Figure 3.5 Year-on-Year Time Savings, 1997-2004**  
*P.M. Peak Period*



## 4.0 Vehicle Occupancy

### ■ 4.1 Methodology

#### Vehicle Occupancy Surveys

Vehicle occupancy surveys were conducted at seven locations along the Interstate 95 corridor in South Florida on March 30, 2004. Locations include:

County	Location
Miami-Dade	NW 79 <sup>th</sup> Street Pedestrian Overpass
	NW 151 <sup>st</sup> Street Pedestrian Overpass
	Ives Dairy Road Overpass
Broward	Sunrise Boulevard Overpass
	Pompano Parkway Overpass
	SW 10 <sup>th</sup> Street Overpass
Palm Beach	Glades Road Overpass

As shown in Figure 4.1, these locations were chosen because they were consistent with previous monitoring efforts and because they provided favorable locations for visual observations (in terms of both ease of data collection and safety). The 24-hour manual observations were conducted on March 30 and 31, 2004. Data were collected for the HOV lane and the general-purpose (GP) lane adjacent to the HOV lane for each direction during each time period, regardless of enforcement hours. Vehicle occupancy was reported as a percent of single-occupant vehicles, two-person vehicles, and vehicles containing three or more persons within the traffic stream. Transit buses were included in the calculation for those segments in Miami-Dade County. Other vehicle types - including motorcycles, buses, and trucks with three or more axles - were noted but not included in the calculation. The data reported in this section summarize vehicle occupancy during the hours of HOV enforcement. The complete data summary worksheets are provided in Appendix 4.

**Figure 4.1 Vehicle Occupancy Locations for the 2002 and 2004 HOV Lane Monitoring Study**



### *Average Vehicle Occupancy*

The vehicle occupancy data were used to calculate the average vehicle occupancy (AVO) rate for each of the seven locations. The AVO reflected 1.0 person per each single-occupant vehicle; 2.0 persons per each two-person vehicle; and 3.2 persons per each vehicle containing three or more passengers.

The transit bus ridership data were provided separately by the Miami-Dade Transit Authority (MDTA) for Metrobus Route 95X. The transit data were collected at Golden Glades by MDTA staff on July 21<sup>st</sup>. The original data collection effort of April 5<sup>th</sup> and 6<sup>th</sup> provided insufficient data for this analysis. The July data were used to calculate average bus ridership for the a.m. and p.m. enforcement periods and then applied to the data collected at NW 79<sup>th</sup> Street and NW 151<sup>st</sup> Street.

## ■ 4.2 2004 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. The following summarizes the results by county:

- In Miami-Dade County, the enforcement periods differ by direction, with southbound enforcement in the morning and northbound enforcement in the evening. In addition, transit bus data are included in the Miami-Dade summary, as MDTA express buses are allowed to use the HOV lanes.
  - A.M. enforcement, HOV southbound: AVO ranged from 1.76 (versus 1.08 for the general-purpose lane) at Ives Dairy Road to 2.33 (versus 1.06 GP) at NW 151<sup>st</sup> Street with the Metrobus Route 95X ridership data reflected in the calculation. Without the transit data, the AVO ranged from 1.76 at Ives Dairy Road to 2.01 at NW 151<sup>st</sup> Street. With the transit data, the AVO was 2.22 at NW 79<sup>th</sup> Street (versus 1.10 GP). Without the transit data, the AVO was 1.96 at NW 79<sup>th</sup> Street (versus 1.10 GP).
  - P.M. enforcement, HOV northbound: AVO ranged from 1.69 (versus 1.20 GP) at Ives Dairy Road and 1.50 (versus 1.20 GP) at NW 151<sup>st</sup> Street with the transit data included. Without the transit data, the AVO ranged from 1.69 at Ives Dairy Road to 1.28 at NW 151<sup>st</sup> Street. With the transit data, the AVO was 2.24 at NW 79<sup>th</sup> Street (versus 1.17 GP). Without the transit data, the AVO was 1.99 at NW 79<sup>th</sup> Street (versus 1.17 GP).
- In Broward and Palm Beach Counties, no express bus routes travel the HOV lane. The a.m. and p.m. enforcement periods apply to both northbound and southbound traffic.
  - In Broward County, the AVO for the HOV lane ranged from a minimum of 1.36 (versus 1.16 GP) at Sunrise Boulevard (southbound in the p.m. period) to a maximum of 1.85 (versus 1.09 GP) at Pompano Parkway (northbound in the p.m. period).

- In Palm Beach County, at Glades road, the AVO for the HOV lane ranged from a minimum of 1.38 (northbound in the a.m. period) to a maximum of 1.77 (southbound in the p.m. period).

**Table 4.1 Average Vehicle Occupancy (AVO)**  
*Current Enforcement Period (Persons per Vehicle)*

		Northbound					
		A.M. Enforcement Period			P.M. Enforcement Period		
		HOV	General	Overall	HOV	General	Overall
Miami-Dade County	NW 79 <sup>th</sup> Street	*	*	*	2.24	1.17	1.67
	Without MDTA 95X Ridership	*	*	*	1.99	1.17	1.55
	NW 151 <sup>st</sup> Street	*	*	*	1.50	1.20	1.33
	Without MDTA 95X Ridership	*	*	*	1.28	1.20	1.23
	Ives Dairy Road	*	*	*	1.69	1.20	1.39
Broward County	Sunrise Boulevard	1.54	1.11	1.29	1.60	1.58	1.59
	Pompano Parkway	1.79	1.05	1.30	1.85	1.09	1.38
	SW 10 <sup>th</sup> Street	1.70	1.05	1.29	1.63	1.09	1.31
Palm Beach County	Glades Road	1.38	1.06	1.19	1.47	1.12	1.25
		Southbound					
		A.M. Enforcement Period			P.M. Enforcement Period		
		HOV	General	Overall	HOV	General	Overall
Miami-Dade County	NW 79 <sup>th</sup> Street	2.22	1.10	1.66	*	*	*
	Without MDTA 95X Ridership	1.96	1.10	1.53	*	*	*
	NW 151 <sup>st</sup> Street	2.33	1.06	1.71	*	*	*
	Without MDTA 95X Ridership	2.01	1.06	1.54	*	*	*
	Ives Dairy Road	1.76	1.08	1.25	*	*	*
Broward County	Sunrise Boulevard	1.67	1.05	1.24	1.36	1.16	1.27
	Pompano Parkway	1.82	1.05	1.29	1.80	1.13	1.41
	SW 10 <sup>th</sup> Street	1.56	1.07	1.24	1.68	1.09	1.35
Palm Beach County	Glades Road	1.67	1.14	1.29	1.77	1.18	1.44

\* Indicates direction currently not enforced during specified time and direction.

The following provides data comparisons for the highest AVO for each county for both a.m. and p.m. enforcement periods.

- In Miami-Dade, NW 151<sup>st</sup> Street had the highest AVO (1.71) in the southbound a.m. period and 79<sup>th</sup> Street had the highest AVO (1.67) in the northbound p.m. period.
- In Broward County, Pompano Parkway had the highest AVO (1.30) in the northbound a.m. period (southbound) and Sunrise Boulevard had the highest AVO (1.59) in the northbound p.m. period.
- In Palm Beach County, Glades Road AVO had the highest AVO (1.29) in the southbound a.m. period and also the highest (1.44) southbound in the p.m. period.

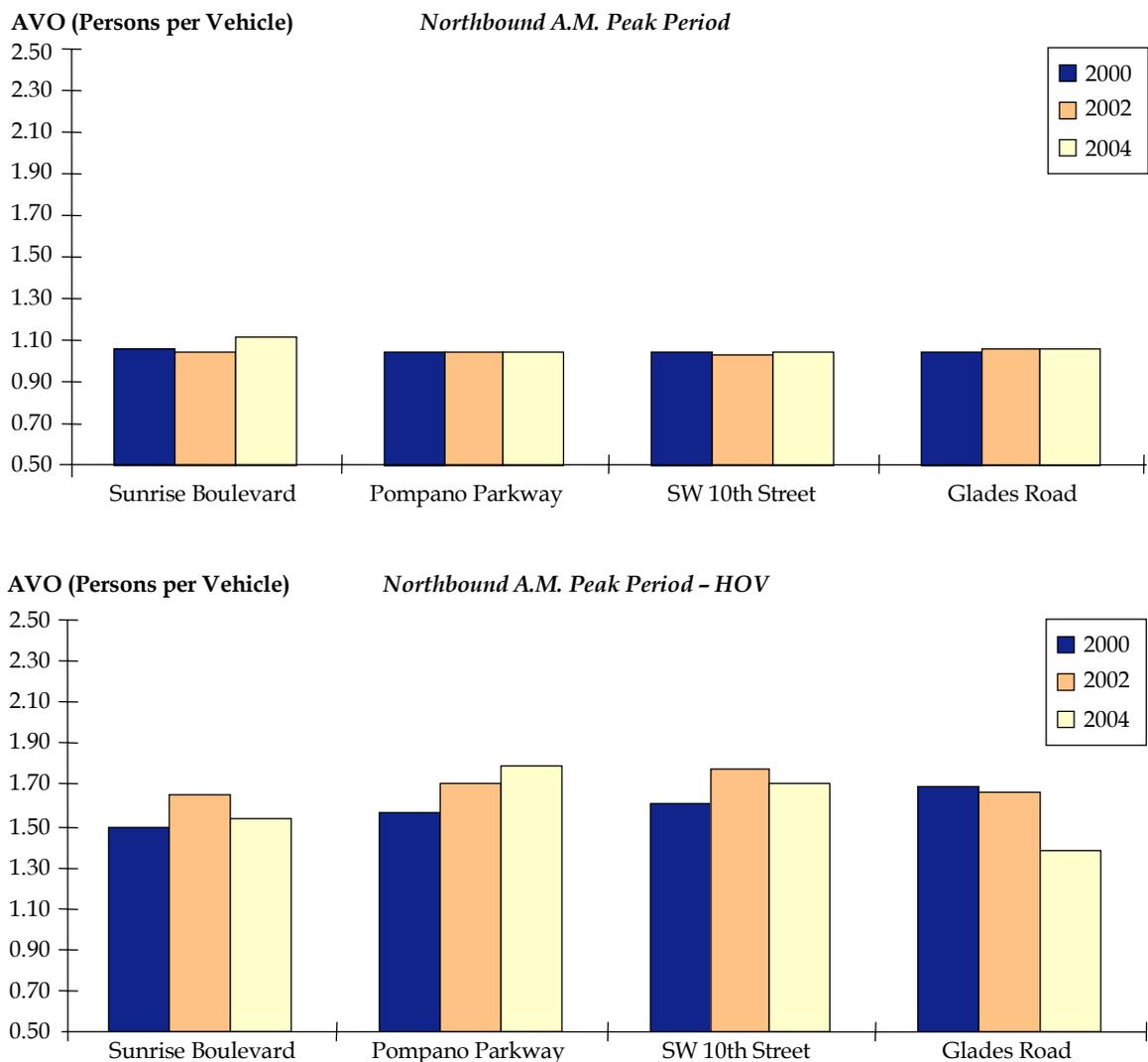
## ■ 4.3 Trends and Comparison with Previous Years

Tables 4.2 and 4.3 provide the I-95 HOV and general-purpose lane data for each site for each year, as data are available. The comparative analysis of the performance data shows average vehicle occupancy in the HOV lanes increasing between 1995 and 2002, but decreasing thereafter. Specifically, between 2002 and 2004:

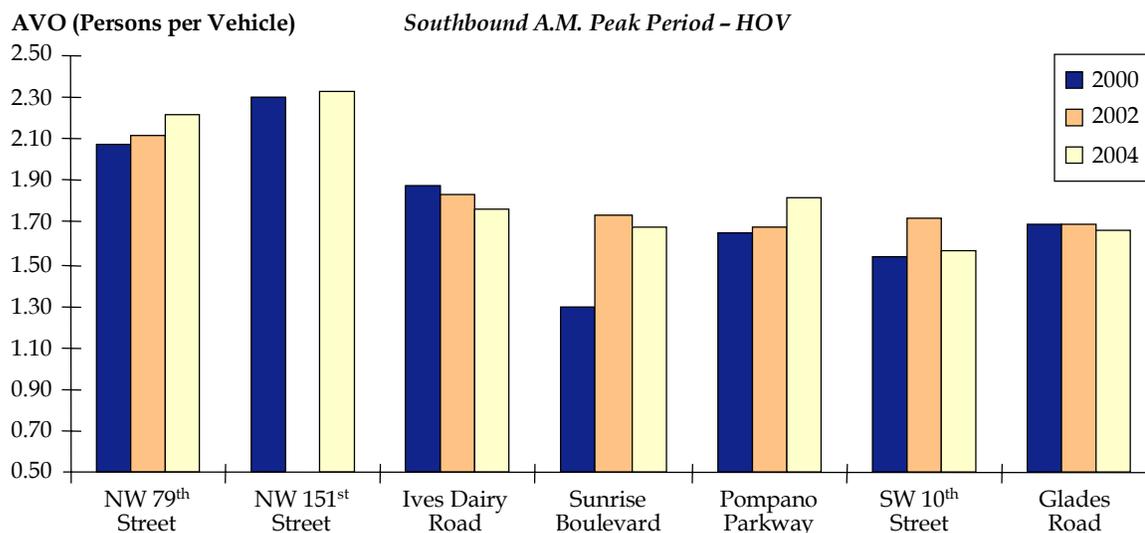
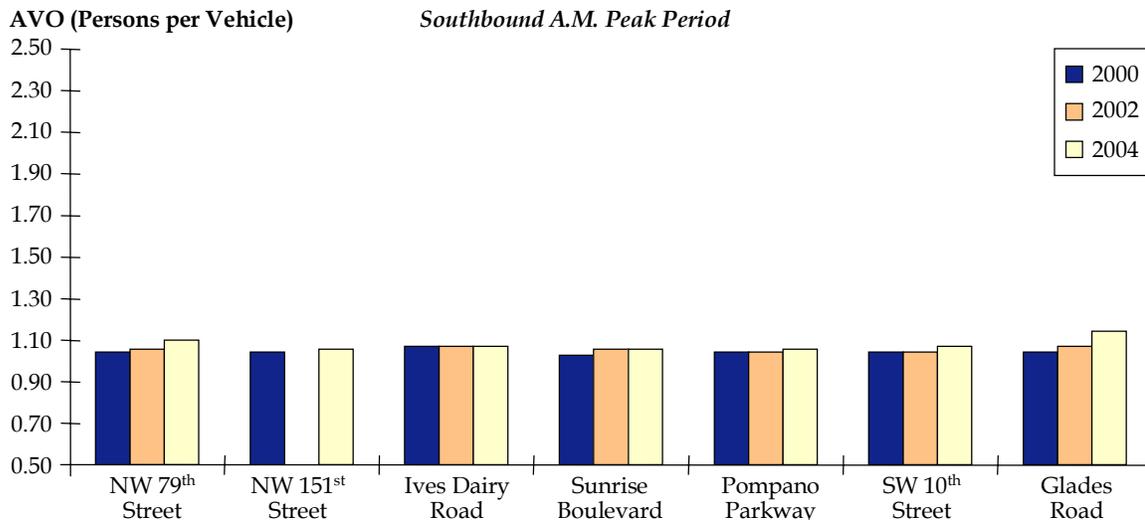
- In the a.m. HOV AVO decreased for all points except Pompano Parkway, where it increased both northbound and southbound. As shown in Figure 4.2, with the exception of Sunrise Boulevard (southbound), general-purpose lane AVO is either comparable to or higher than it was in 2002.
- In the p.m. HOV AVO decreased for all points except Pompano Parkway, where it increased southbound. As shown in Figure 4.3, with the exception of Glades Road (southbound), general-purpose lane AVO is higher than it was in 2002.

One possible explanation for the decreases in AVO at certain locations may be a lack of sufficient HOV enforcement.

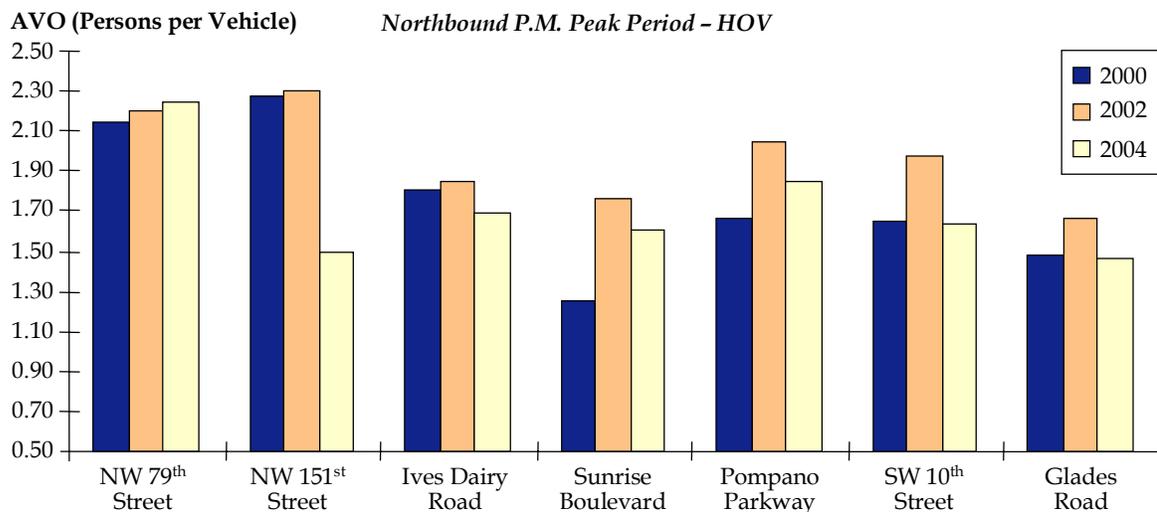
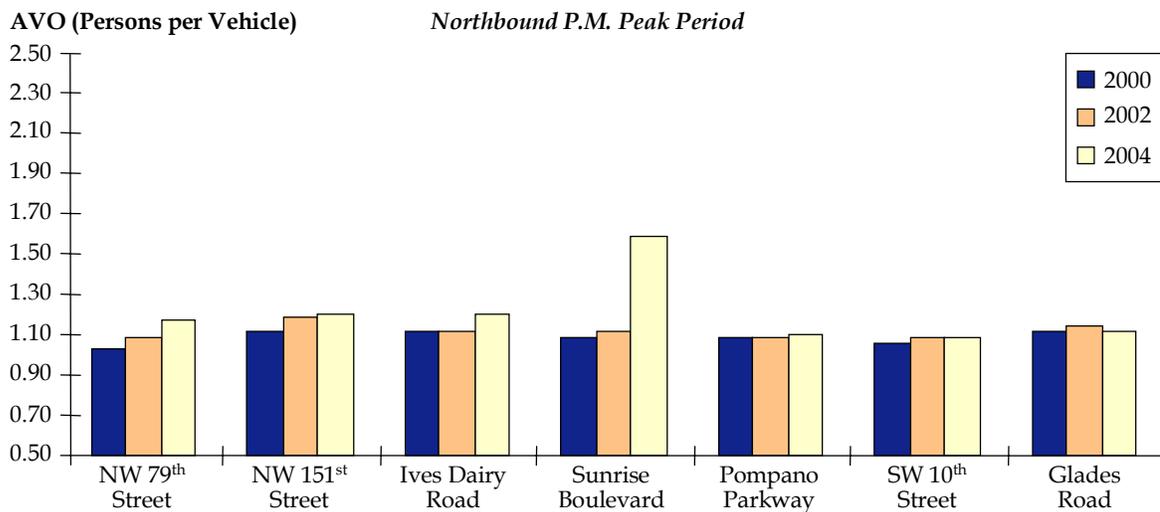
**Figure 4.2 Comparison of Average Vehicle Occupancy (AVO) for A.M. Period**



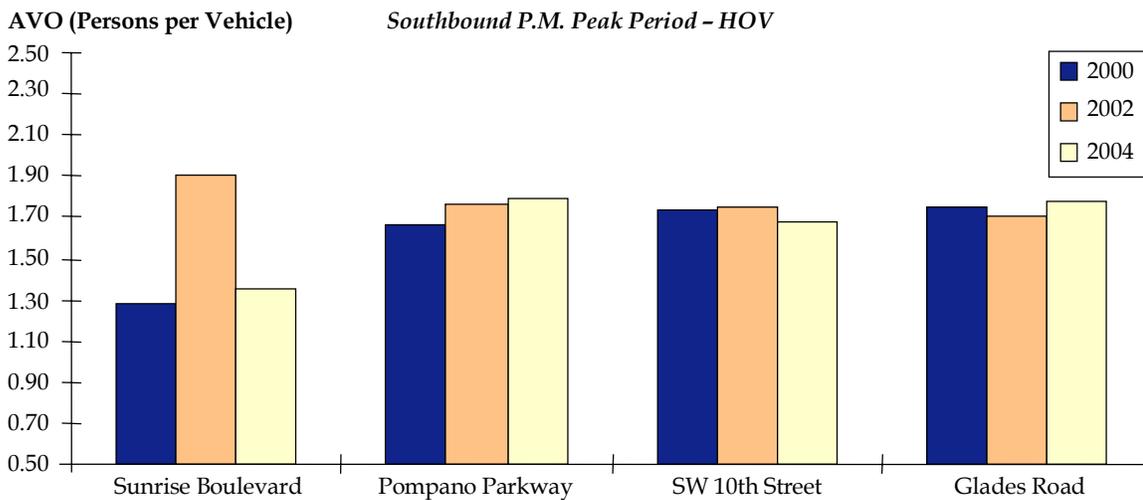
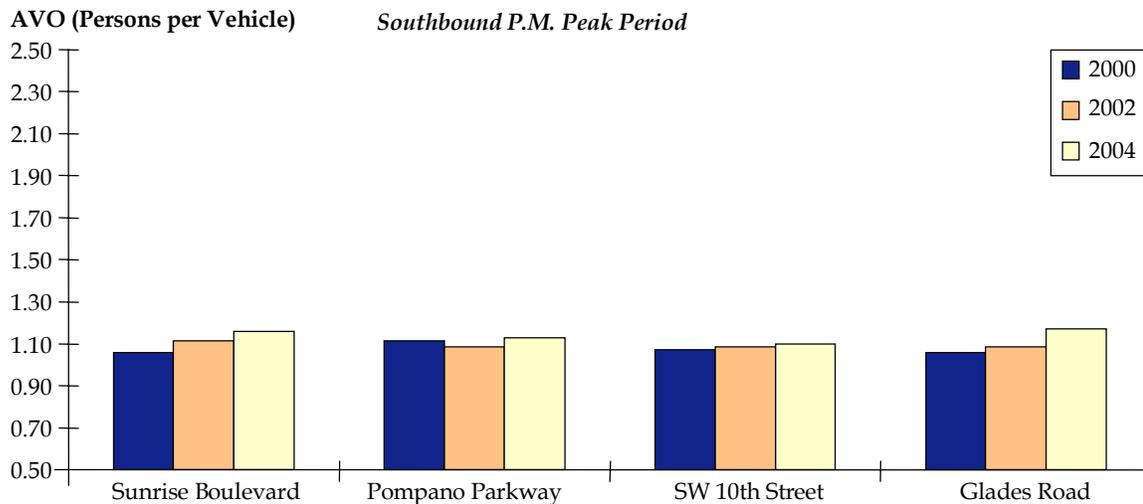
**Figure 4.2 Comparison of Average Vehicle Occupancy (AVO) for A.M. Period**  
(continued)



**Figure 4.3 Comparison of Average Vehicle Occupancy (AVO) for P.M. Period**



**Figure 4.3 Comparison of Average Vehicle Occupancy (AVO) for P.M. Period**  
*(continued)*



**Table 4.2 AVO Comparison**  
*A.M. Enforcement Period*

Location	2004		2002		2000		1998		1997		1995	
	GP	HOV										
<b>Northbound</b>												
NW 79 <sup>th</sup> Street	*	*	*	*	*	*	-	-	-	-	*	*
NW 151 <sup>st</sup> Street	*	*	*	*	*	*	-	-	-	-	*	*
Ives Dairy Road	*	*	*	*	*	*	-	-	-	-	*	*
Sunrise Boulevard	1.11	1.54	1.05	1.65	1.06	1.50	-	-	-	-	1.08	1.47
Pompano Parkway	1.05	1.79	1.05	1.70	1.05	1.57	-	-	-	-	1.10	1.59
SW 10 <sup>th</sup> Street	1.70	1.05	1.03	1.78	1.04	1.61	-	-	-	-	1.32	1.51
Glades Road	1.06	1.38	1.06	1.66	1.05	1.69	-	-	-	-	1.10	1.52
<b>Southbound</b>												
NW 79 <sup>th</sup> Street	1.06	1.38	1.06	2.11	1.05	2.07	-	-	-	-	1.17	1.57
NW 151 <sup>st</sup> Street	1.06	2.01	-	-	1.04	2.30	-	-	-	-	1.16	1.63
Ives Dairy Road	1.76	1.08	1.07	1.84	1.07	1.88	1.16	1.77	1.20	1.80	1.11	1.84
Sunrise Boulevard	1.05	1.67	1.06	1.74	1.03	1.30	-	-	-	-	1.08	1.47
Pompano Parkway	1.05	1.82	1.05	1.68	1.04	1.65	-	-	-	-	1.10	1.59
SW 10 <sup>th</sup> Street	1.07	1.56	1.05	1.72	1.04	1.54	-	-	-	-	1.32	1.51
Glades Road	1.67	1.14	1.07	1.69	1.04	1.69	-	-	-	-	1.10	1.52

\* Direction not currently enforced during specified time period.

**Table 4.3 AVO Comparison**  
*P.M. Enforcement Period*

Location	2004		2002		2000		1999		1997		1995	
	GP	HOV										
<b>Northbound</b>												
NW 79th Street	1.17	1.99	1.09	2.20	1.03	2.15	-	-	-	-	1.14	2.06
NW 151st Street	1.20	1.28	1.18	2.30	1.12	2.27	1.24	2.24	1.21	2.27	1.10	1.91
Ives Dairy Road	1.20	1.69	1.12	1.85	1.11	1.80	1.21	2.01	1.20	1.92	1.14	1.67
Sunrise Boulevard	1.58	1.60	1.12	1.76	1.08	1.25	-	-	-	-	1.18	1.55
Pompano Parkway	1.09	1.85	1.08	2.04	1.08	1.66	-	-	-	-	1.11	1.53
SW 10th Street	1.63	1.09	1.09	1.97	1.06	1.65	-	-	-	-	1.17	1.57
Glades Road	1.12	1.47	1.15	1.67	1.11	1.48	-	-	-	-	1.22	1.72
<b>Southbound</b>												
NW 79th Street	*	*	*	*	*	*	-	-	-	-	*	*
NW 151st Street	*	*	*	*	*	*	-	-	-	-	*	*
Ives Dairy Road	*	*	*	*	*	*	-	-	-	-	*	*
Sunrise Boulevard	1.16	1.36	1.11	1.90	1.06	1.28	-	-	-	-	1.17	1.67
Pompano Parkway	1.13	1.80	1.09	1.76	1.11	1.67	-	-	-	-	1.07	1.55
SW 10th Street	1.09	1.68	1.08	1.75	1.07	1.73	-	-	-	-	1.12	1.57
Glades Road	1.77	1.18	1.09	1.70	1.06	1.75	-	-	-	-	1.18	1.50

\* Direction not currently enforced during specified time period.

# 5.0 Person Throughput

HOV 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 general-purpose (GP) lanes 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 or 900 to 1,800 persons per hour per lane during the peak hours.<sup>3</sup>

## ■ 5.1 Methodology

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

Tables 5.1 and 5.2 show the 2004 results for peak-period volume and person throughput for the general-purpose and HOV lanes.

Each table summarizes the following data:

- Peak hour (the actual peak hour within the enforced times);
- General-purpose lane volumes;
- General-purpose lane AVO (from Section 4.0);
- General-purpose lane person throughput (calculated by multiplying the GP lane volume by the AVO and dividing by the number of lanes [from Table 1.1]);
- HOV lane volumes;
- HOV lane AVO;
- HOV person throughput (determined by multiplying the HOV volume by HOV AVO); and

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

- Additional person throughput ( $\Delta$  Person Throughput) for the HOV lane compared to the average for the GP lanes. For example, a number of 500 means that at peak period 500 more people travel in the HOV lane per hour than travel in an average GP lane at the same location. A negative value in the last column shows a negative net difference in person throughput; the general-purpose lane is actually carrying more people than the HOV lane at that location.

**Table 5.1 Person Throughput**  
*Miami-Dade County – 2004*

I-95 Location	Direction	Peak Hour	General-Purpose Lanes		Number of GP Lanes	GP Person Throughput (Lane Average)	HOV Lane		HOV Person Throughput	Δ Person Throughput (Per Hour) <sup>a</sup>
			Volume	AVO			Volume	AVO		
<i>A.M. Peak Hour</i>										
South of NW 79 <sup>th</sup> Street	SB	07:00-08:00	7,737	1.10	4	2,126	2,138	2.22	4,744	2,618
South of Golden Glades	SB	07:00-08:00	6,310	1.06	5	1,337	1,361	2.33	3,178	1,841
<i>P.M. Peak Hour</i>										
South of NW 79 <sup>th</sup> Street	NB	16:30-17:30	6,878	1.17	4	2,020	1,435	2.24	3,220	1,201
South of Golden Glades	NB	17:00-18:00	7,046	1.20	5	1,684	1,485	1.50	2,223	539

<sup>a</sup> Negative value reflects a higher person throughput for the general-purpose lanes compared to HOV lane.

**Table 5.2 Person Throughput**  
*Broward and Palm Beach County – 2004*

I-95 Location	Direction	Peak Hour	General-Purpose Lanes		Number of GP Lanes	GP Person Throughput (Lane Average)		HOV Lane		HOV Person Throughput	Δ Person Throughput (Per Hour) <sup>a</sup>
			Volume	AVO		Throughput	Volume	AVO			
<b>A.M. Peak Hour</b>											
South of Hollywood Boulevard	NB	07:15-08:15	8,094	1.10	5	1,773	958	1.32	1,262	-511	
	SB	07:30-08:30	7,897	1.08	5	1,702	563	1.76	990	-712	
South of Sunrise Boulevard	NB	07:00-08:00	8,873	1.11	5	1,967	1,917	1.54	2,952	985	
	SB	07:30-08:30	9,284	1.05	5	1,955	827	1.67	1,384	-570	
South of Atlantic Boulevard	NB	07:00-08:00	7,182	1.05	4	1,880	1,115	1.79	1,992	112	
	SB	07:15-08:15	6,424	1.05	4	1,694	1,190	1.82	2,163	468	
South of Hillsboro Boulevard	NB	07:00-08:00	6,723	1.05	3	2,343	1,304	1.70	2,217	-126	
	SB	07:00-08:00	4,373	1.07	3	1,557	1,810	1.56	2,821	1,264	
North of Glades Road	NB	07:15-08:15	4,878	1.06	3	1,718	1,726	1.38	2,383	665	
	SB	07:45-08:45	3,937	1.14	3	1,491	2,029	1.67	3,388	1,897	
<b>P.M. Peak Hour</b>											
South of Hollywood Boulevard	NB	16:15-17:15	8,111	1.20	5	1,950	1,030	1.69	1,744	-206	
	SB	16:45-17:45	8,576	1.17	5	2,002	1,097	1.53	1,679	-324	
South of Sunrise Boulevard	NB	16:45-17:45	8,805	1.58	5	2,784	1,791	1.60	2,865	81	
	SB	16:45-17:45	9,324	1.16	5	2,161	1,567	1.36	2,128	-33	
South of Atlantic Boulevard	NB	17:00-18:00	6,849	1.09	4	1,872	1,496	1.85	2,771	899	
	SB	16:00-17:00	6,850	1.13	4	1,937	1,450	1.80	2,604	666	
South of Hillsboro Boulevard	NB	17:00-18:00	6,205	1.09	3	2,252	1,122	1.63	1,831	-421	
	SB	16:30-17:30	5,129	1.09	3	1,872	1,851	1.68	3,104	1,232	
North of Glades Road	NB	16:00-17:00	3,719	1.12	3	1,385	1,209	1.47	1,776	392	
	SB	16:45-17:45	5,013	1.18	3	1,963	2,042	1.77	3,616	1,653	

<sup>a</sup> Negative value reflects a higher person throughput for the general-purpose lanes compared to HOV lane.

## ■ 5.2 2004 Results

The I-95 HOV lanes in South Florida are heavily utilized and meet the goal of carrying more than the national average of vehicles and persons. For all data collection points along the corridor, the number of vehicles per hour per lane meets or exceeds the recommended threshold of 400 to 800. At all but one point, the number of persons per hour per lane well exceeds the recommended threshold of 900 to 1,800. The exception is south of Hollywood Boulevard southbound in the a.m. period, where throughput falls to 607 persons per hour per HOV lane.

The location with the highest person throughput in the HOV lane is NW 79<sup>th</sup> Street southbound in the a.m. peak period. The location with the greatest difference between GP and HOV lane throughputs is again NW 79<sup>th</sup> Street southbound in the a.m. peak period.

In Miami-Dade County, the greatest difference between GP and HOV lane throughputs was recorded south of NW 79<sup>th</sup> Street during the a.m. peak period. In all cases, the HOV person throughput exceeds that of the average general-purpose lanes. In all cases, the difference between carrying capacity on the HOV lane compared to the average GP lanes is significant.

In Broward County, with the exception of Atlantic Boulevard, observed locations show negative change in average person throughput, meaning that throughput is actually higher in the GP lanes. This suggests stricter HOV lane enforcement may be needed; the low AVO in the HOV lanes at these locations is due to a large number of single-occupant vehicles using the HOV lanes illegally during enforcement hours.

In Palm Beach County, at Glades Road, the difference is positive, indicating higher person throughput in HOV at all times and highest southbound both in the a.m. and p.m.

## ■ 5.3 Trends and Comparison to Previous Years

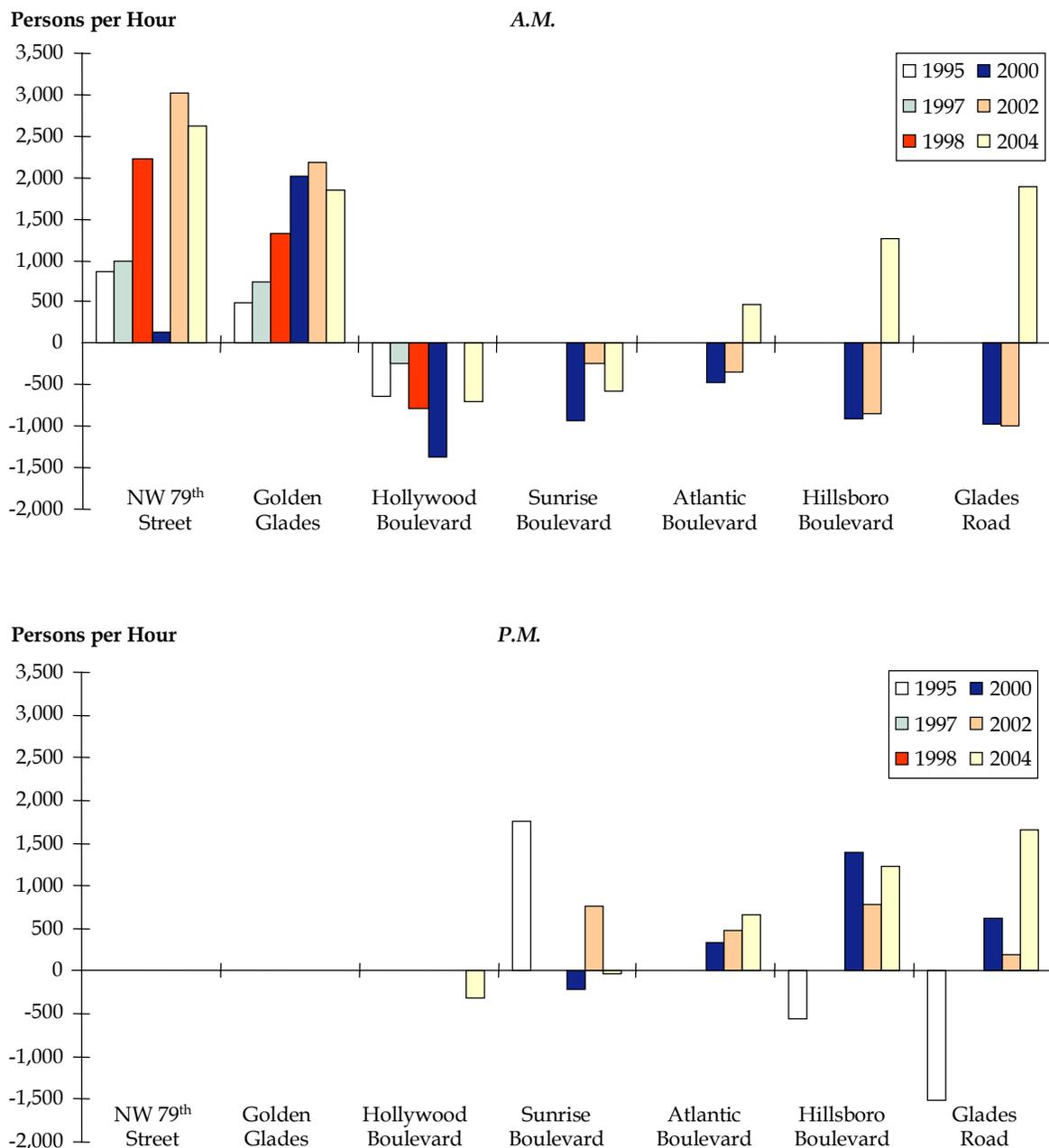
Figures 5.1 and 5.2 compare person throughput in 2004 to previous years. The figures show the difference in HOV lane person throughput and general-purpose lane throughput. A positive value indicates higher person throughput in the HOV lane and a negative value indicates lower person throughput in the HOV lane when compared to the average GP lane.

In Miami-Dade, person throughput in the HOV lane at NW 79<sup>th</sup> Street southbound in the a.m. peak period increased significantly compared to 2002, while throughput in HOV lanes at other locations declined.

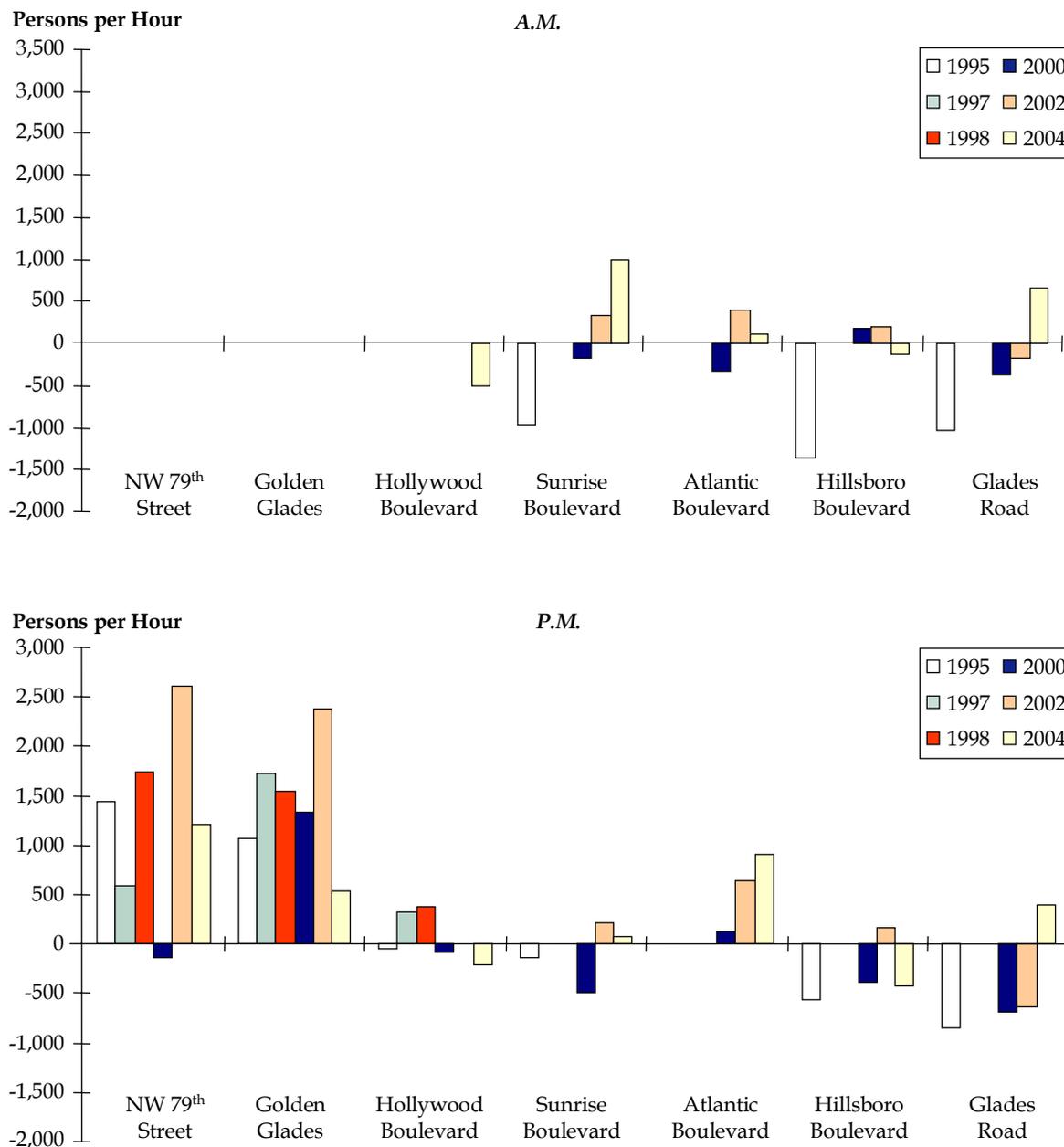
In Broward County, HOV person throughput in the HOV lane first exceeded average throughput in the GP lanes in 2002. This trend continues in 2004. Person throughput in the HOV lane increased at Atlantic Boulevard as well as Hillsboro Boulevard.

In Palm Beach County, person throughput in the HOV lane at Glades Road showed a significant increase over 2002.

**Figure 5.1 Person Throughput Comparisons Southbound Direction**



**Figure 5.2 Person Throughput Comparisons Northbound Direction**



## ■ 5.4 Change in Person Throughput Due to Express Bus Service

In Miami-Dade County the express bus service contributes significantly to the person throughput in the HOV lane. Just south of NW 79<sup>th</sup> Street northbound in the p.m. peak, the express bus service is contributing 28 percent of the total person throughput in the HOV lane (see Table 5.3).

**Table 5.3 Change in Person Throughput Due to Express Bus Service**

I-95 Location	Direction	Peak Period	Average Number of Persons per Bus	HOV Lane AVO with Express Bus	HOV Lane AVO without Express Bus	Difference in Person Throughput (Person Per Hour Per Lane)	Percentage of Total Person Throughput
South of NW 79 <sup>th</sup> Street	SB	a.m.	30.00	1.66	1.53	986	7%
	NB	p.m.	25.85	1.67	1.23	3,203	32%
South of Golden Glades	SB	a.m.	30.00	1.71	1.54	1,112	10%
	NB	p.m.	25.85	1.33	1.23	748	7%

## 6.0 Enforcement

Florida Highway Patrol (FPH) 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 reduction in violation in the HOV lane by single-occupant vehicles.

### ■ 6.1 Methodology

#### Violation Rates

The I-95 HOV lane enforcement periods and limits in South Florida are shown in Table 1.2 in Section 1.0.

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.

### ■ 6.2 2004 Results

#### Violation Rates

The recorded violation rates for the I-95 corridor in 2004 are summarized in Table 6.1. Violation rate profile for 2002 and 2004 is show in Figure 6.1. The violation rate is defined as the percentage of the total HOV lane volume comprised of single-occupant vehicles. For example, Sunrise Boulevard has a 43 percent violation rate northbound in the p.m. peak period. This indicates that 43 percent of vehicles in the HOV lane were single-occupant vehicles and only 57 percent were in the HOV lane legally.

The highest violation rates in 2004 were found in Broward and Palm Beach Counties, with a maximum rate of 64 and 54 percent at Glades Road northbound in the a.m. and p.m. peak periods, respectively. Violation rates were significantly lower in the southbound direction at this location, at 40 and 27 percent in the a.m. and p.m. periods, respectively. In Miami-Dade County, the highest violation rate was recorded at NW 151<sup>st</sup> Street in the northbound p.m. peak periods (44 percent). The lowest violation rate, 14 percent, occurred at NW 79<sup>th</sup> Street in Miami-Dade County.

**Table 6.1 HOV Violation Rates**

Location	Northbound		Southbound	
	A.M. Peak	P.M. Peak	A.M. Peak	P.M. Peak
NW 79 <sup>th</sup> Street	Not Enforced	14%	24%	Not Enforced
NW 151 <sup>st</sup> Street	Not Enforced	44%	15%	Not Enforced
Ives Dairy Road	Not Enforced	32%	28%	Not Enforced
Sunrise Boulevard	50%	43%	34%	64%
Pompano Parkway	26%	21%	28%	24%
SW 10 <sup>th</sup> Street	35%	38%	48%	35%
Glades Road	64%	54%	40%	27%

Note: Data collected on March 30 and 31, 2004.

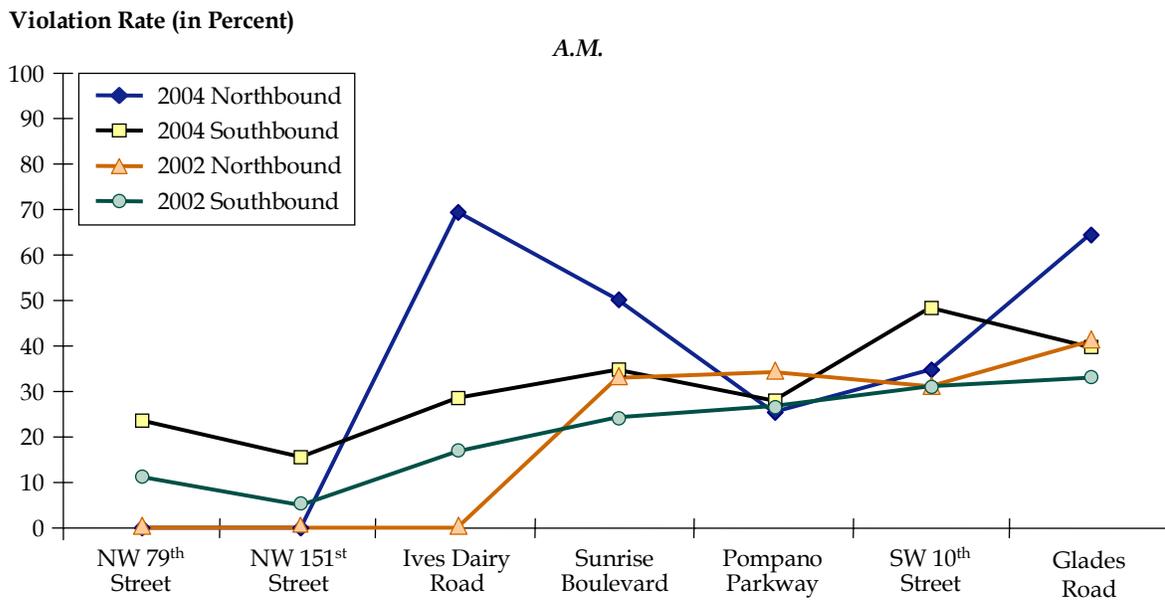
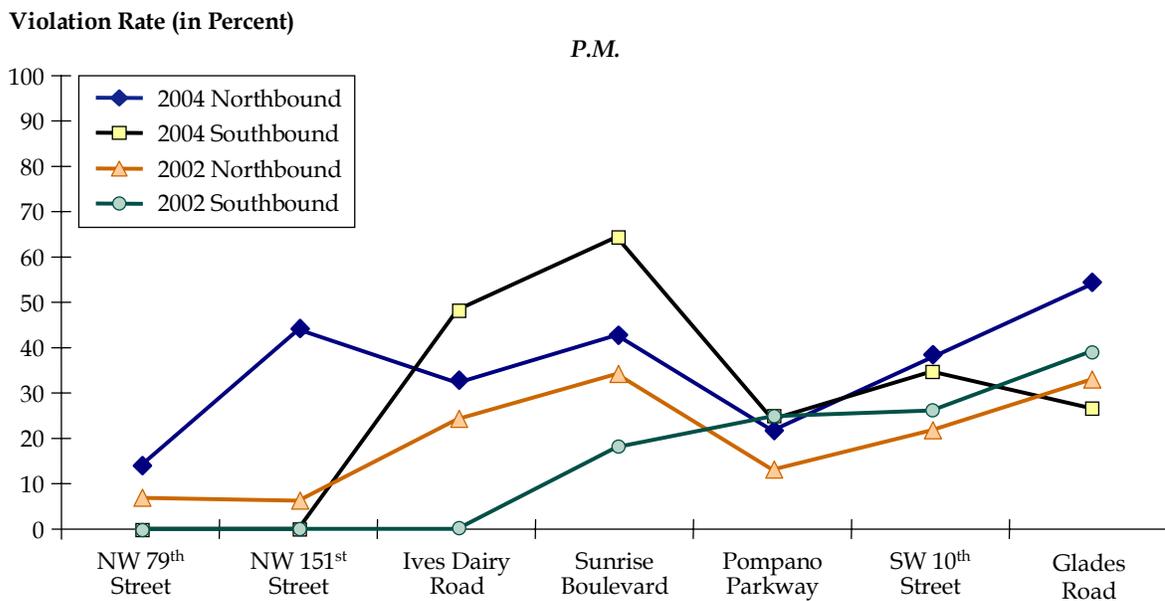
## Citations

Fines for drivers who violate the HOV lane restrictions are outlined in Table 6.2. Currently, no points are assessed to the driver. The fines have risen \$3.00 per violation in all three counties since the 2000 report.

**Table 6.2 Current HOV Violation Fines**

County	Current Fine
Miami-Dade County	\$86.00
Broward County	\$81.00
Palm Beach County	\$81.00

Figure 6.1 HOV Violation Rate Comparison



## ■ 6.3 Trends and Comparison with Previous Reports

Table 6.3 shows the number of HOV citations issued between 1999 and 2004.

**Table 6.3 HOV Citations**

Time Period	Miami-Dade		Broward		Palm Beach	
	Citations	Percent Change	Citations	Percent Change	Citations	Percent Change
1999	7,692	-	3,534	-	2,382	-
2000	6,948	10%	7,240	-105%	6,513	-173%
2001	6,441	7%	3,897	46%	5,338	18%
2002	5,299	18%	1,205	69%	2,302	57%
2003	5,379	-2%	5,292	-339%	2,369 <sup>a</sup>	-3%
2004 <sup>b</sup>	6,520	-21%	7,710	-46%	2,436	-3%

<sup>a</sup> 2004 data was only available for January through March for Broward and January through February for Broward and Palm Beach. The data was interpolated to generate an annual value for each county.

<sup>b</sup> Data was suspect, hence this value is interpolated from 2002 and 2004 citations.

Between 2000 and 2002, violation rates decreased in Broward and Miami-Dade counties. However, violation rates increased thereafter, and in 2004 were in fact higher than the 2000 rates. In Miami-Dade County, violation rates increased an average of 21 percent between 1999 and 2004. In Broward County violation rates increased by almost 46 percent over the same period, and in Palm Beach County by almost three percent. As more data are collected in the future, better trends can be established.

# 7.0 Conclusions and Recommendations

## ■ 7.1 Conclusions

This 2004 Monitoring report indicates that the I-95 HOV system in south Florida continues to operate well as indicated by the positive impacts on driver travel time savings and system person throughput. Trends in data over the past 10 years since monitoring began show increases in these important indicators of the benefits of HOV operation, with the exception of average vehicle occupancy (AVO) in certain segments of the corridor. In some segments of the HOV system there are indications that the HOV may be too successful as the HOV lane volumes are approaching lane capacity. The near capacity situation suggests two possible recommendations: 1) increase the number of hours of HOV operations to spread the peak volumes over a longer time period; and 2) provide stricter enforcement in segments nearing capacity that should reduce the number of single-occupant vehicles using the HOV lanes.

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

### Traffic Characteristics

- In the a.m. peak period, 2004 HOV volumes do not show a significant increase from the 2002 volumes in all three counties. In Miami-Dade County, there was a decrease in the southbound direction south of Golden Glades. In Broward County, with the exception of northbound south of Sunrise Boulevard, south bound south of Atlantic as well as Hillsboro Boulevard, there has been a small decrease in HOV volumes at all stations. In Palm Beach County, there has been an increase in HOV volumes in both directions north of Glades Road.
- In the p.m. peak period, HOV volumes have generally increased compared to the data from the 2002 report. In Miami Dade County, the volumes in the northbound direction have decreased. In Broward County, the HOV volumes have increased with the exception of south of Hallandale Beach Boulevard in the southbound direction. In Palm Beach County, north Glades Road, the HOV volumes increased.
- With the exception of south of NW 79<sup>th</sup> Street in Dade County and south of Hollywood Boulevard in Broward County, there has been an increase in total AADT

volume (both directions aggregated). This is consistent with the general trend of increase of AADT in 2002.

- LOS is generally worse in the general-purpose lane adjacent to the HOV lane. In most cases, the HOV lane performed better than or equivalent to the general-purpose lane, for the same direction and enforced timeframe. The two segments, from Sample Road to Palmetto Park Road (Broward and Palm Beach Counties) and Palmetto Park Road to Linton Boulevard (Palm Beach County), are exceptions.
- HOV lane volumes were found to be over 1,800 vehicles per hour in several segments of the HOV system in both the a.m. and p.m. peak hours (see Table 2.8). These near capacity volumes (theoretical lane capacity is approximately 2,200 vehicles per hour under ideal conditions) coupled with low LOS in the HOV lane discourages eligible HOV drivers from using the HOV lane since there is little time savings advantage to be gained.

## Travel Speeds

- In most cases, the speeds in the HOV lanes are higher than the GP lanes. The only exception is for the segment from Sample Road to Linton Boulevard for both the northbound and southbound during the p.m. peak periods. This is explained by the ongoing construction in the area.
- Southbound in the a.m. peak, the overall difference in travel speed is significant. Northbound in the a.m. peak, the overall difference in travel speed is less significant.
- Southbound in the p.m. peak, the overall difference in travel speed also is relatively insignificant. Northbound in the p.m. peak, the overall difference in travel speeds is small but significant.

## Time Savings

- The 2004 evaluation shows an overall travel time savings in the southbound direction during the a.m. peak is 15 minutes and 17 seconds.
- The overall travel time savings in the northbound direction during the p.m. peak is seven minutes and seven seconds, approximately the same time saving as in 2002.
- The overall travel time saving is less compared with 2002 evaluation, with the exception of the southbound during the a.m. peak period of 15 minutes and 17 seconds, compared with eight minutes and 40 seconds.
- As found in the 2002 report, it is noted that while travel speeds have increased, time savings have decreased. This is due to the fact that the differences between the GP

and HOV speeds have continued to decrease since 2000. In essence vehicles traveling in the HOV lane in 2004 are only slightly faster than those in the GP lanes.

## Vehicle Occupancy

- The comparative analysis of the multi-year performance data across data collection sites illustrates a positive trend in AVO for the HOV lane between 1995 and 2002 but a general decrease from 2002 to 2004. The following provides comparison of 2004 AVO with the 2002 AVO.
- In the a.m. HOV AVO decreased for all points except Pompano Parkway, where it increased both northbound and southbound. With the exception of Sunrise Boulevard (southbound), general-purpose lane AVO is either comparable or increased when compared with the 2002 AVO values.
- In the p.m. HOV AVO decreased for all points except Pompano Parkway, where it increased southbound. With the exception of Glades Road (southbound), general-purpose lane AVO increased when compared with the 2002 AVO values.
- There are several locations where AVO of 1.3 to 1.8 were observed during enforcement hours (see Table 4.1). This indicates that as many or more single-occupant vehicles are using the HOV lane than two or more occupant vehicles. One possible explanation for the low AVO at certain locations may be a lack of sufficient HOV enforcement.

## Person Throughput

- In Miami-Dade, the data show that there are significant increases in person throughput in the HOV lane NW 79<sup>th</sup> Street southbound in the a.m. peak period. Compared to 2002, the persons throughput in HOV lane for other locations declined.
- In Broward County, it was noted in 2002 that the HOV person throughput difference finally changed to a positive value, indicating that for the first time since monitoring began, the HOV lane carried more people than the average general-purpose lane. This trend continues in 2004. Person throughput in the HOV increased at Atlantic Boulevard as well as Hillsboro Boulevard.
- In Palm Beach County, person throughput in the HOV at Glades Road showed a significant increase from year 2002.
- In Miami-Dade County the express bus service contributes significantly to the person throughput in the HOV lane. Just south of NW 79<sup>th</sup> Street northbound in the p.m. peak, the express bus service is contributing 28 percent of the total person throughput in the HOV lane.

## Enforcement

- Violation rates are much greater in Broward and Palm Beach Counties with a maximum rate of 64 and 54 percent at Glades Road northbound in the a.m. and p.m. peak periods, respectively and are significantly lower at 40 and 27 percent in the southbound direction. Therefore, at Glades Road this indicates that 64 percent of vehicles in the HOV lane are single-occupant vehicles. Conversely, only 36 percent of the vehicles are in the HOV lane legally.
- In Miami-Dade County, the highest violation rate was recorded NW 151<sup>st</sup> Street in the northbound p.m. peak periods (44 percent). The lowest rate of 14 percent occurred at NW 79<sup>th</sup> Street in Miami-Dade County.
- Violation rates in 2002 decreased significantly in Broward and Miami-Dade counties when compared to 2000 data. However, violation rates again increased significantly by 2004, and are in fact higher than the 2000 rates. In Miami-Dade, the average increase in violation from year 2003 is about 21 percent. In Broward violation rates increased by almost 46 percent, and in Palm Beach County violation rates increased by almost three percent.

## ■ 7.2 Recommendations

Operation of the HOV lanes should continue and specific recommendations made in the I-95 HOV Systems Plan, Phase II Systemwide Operations Study recently completed for the Department should be referenced for specific recommendations regarding hours and direction of HOV operations.

Enforcement should be enhanced to ensure reduction in violation of the HOV lane. The nationally accepted violation rate of approximately 20 percent has not yet been achieved for entire corridor.

The following recommendations are organized in two sets: those specific to the operation of the HOV lanes and others regarding the conduct of future monitoring studies.

### Recommendations Regarding HOV Operation

- Demand supports extension of HOV enforcement in both directions in Miami-Dade and GP LOS would not be degraded;
- Demand supports extension of hours and GP LOS would not degraded if HOV hours expanded to 6:00 to 10:00 a.m. and 3:00 to 7:00 p.m. for the corridor north of Golden Glades and extension of 24-hour operations south of Golden Glades. This expansion

of HOV Operations hours should allow for spreading the HOV demand over a longer time period and improvement in the HOV lane LOS;

- Continue operation of HOV lanes as all measures show favorable performance of HOV lane in carrying more people at higher travel speeds, even with the high violation rates;
- Keep vehicle occupancy restriction to two persons but continue to monitor potential to change restrictions in vehicle occupancy; and
- Continue to fund and invest funding for increased enforcement activity.

### **Recommendations Regarding Conduct of Future Monitoring Studies**

An overall methodology review needs to be undertaken to define a state-of-the-art analysis scheme based on all lessons learned in since 1995, as well as other HOV systems around the country. Many of the recommendations carryover from the 2002 report.

Specific recommendations are described below.

#### ***Data Collection***

- A data collection manual is needed to ensure consistency between different years. Changes to the prior approach are suggested in the following points.
- Data collection should be handled by one firm as much as practical to ensure the same dates, locations, and methodologies are used.
- Floating car speeds used in 2004 are more meaningful and should continue to be used in place of spot speeds at count stations.
- Methodology for floating car speeds should be clearly provided to data collection firm and GPS data loggers should be considered as they are becoming more affordable.
- Transit occupancy data cannot be collected by observation as with other vehicle occupancy. This should be continued to be collected by/with the local transit agency and it should be collected for the same time period (and same days) as the vehicle occupancy data.
- A uniform and consistent methodology is needed for summarizing data for analysis. This was achieved in the 2004 HOV Monitoring Study. Measures included with the data summaries are:

- Individual and system peak-hour;
  - Peak-hour factor; and
  - Consistent lane identification.
- By the time of the next HOV Monitoring update, speed and volume sensors that are part of Intelligent Transportation Systems (ITS) deployments in all three counties may be operational through the entire corridor. The sensors where available should be used to collect traffic volumes and as a reference point for the floating car vehicle speeds collected.
  - Continued improvements to several tables and graphs, including consolidation of the number of graphs, would make results more easily understood compared with those in prior reports.