Metropolitan Planning Organization
for the Miami Urbanized Area

Transportation Systems Performance Monitoring Study

November 2008

This report was funded in part through grant[s] from the Federal Highway Administration [and Federal Transit Administration], U.S. Department of Transportation. The views and opinions of the authors [or agency] expressed herein do not necessarily state or reflect those of the U.S. Department of Transportation.

Gannett Fleming

CONTENTS

1. Introduction

1.1 Background

The Miami-Dade MPO through this report has set up a methodology to obtain and maintain data about the transportation system by developing specifications for the utilization and collection of data. This document provides the background to support the development of transportation system performance monitoring measures.

This work provides consistent guidelines for data collection and performance monitoring that can be maintained for future use. The Transportation System Performance Monitoring project provides a concrete base for data collection that serves both technical and public consumption needs.

The Miami-Dade MPO completed the initial step of looking to the past for the data that has been used to define and measure system performance and improvements since the 1980s as documented in the *Miami-Dade County Historical LRTP Data Review, May 2007*. As mentioned in the 2007 *Miami-Dade County Historical LRTP Data Review,* the travel demand model is a tool constantly changing with technological advances. Consistency of data and the system improvement driven by policy decisions are not easily tracked if the tools and methods are constantly changing. As a result, the Miami-Dade MPO is now moving to the next step of defining performance measures that can be monitored using data from sources other than the travel demand model, utilizing model generated data only as a last resort.

1.2 Study Objective

The Miami-Dade MPO works to improve the travel demand model so reliable forecasts can guide policy decisions on transportation funding. Government agencies, elected officials and the general public are asking for more accountability and real-time information to stretch transportation dollars. The data derived from the travel demand model will continue to play a role in monitoring the performance of the transportation system, but the model should no longer be used as the primary source.

The purpose of this study is to define a series of performance measures that can be collected on a regular basis to provide planners and decision makers with a method of tracking changes in the quality and level of service of the transportation system. The study will look at available system performance measures over the last 10 years to track system improvements, demand on the system, and system performance.

Monitoring the performance of any transportation system can be a complicated and ambiguous task. The appropriate performance measures that can be readily collected to streamline and create consistency and be used to evaluate the Miami-Dade transportation system over time must be identified. These performance measures should provide more accountability and real-time

information to government agencies, elected officials and the general public. The ability to track the system's performance over time will also enable more effective planning of future transportation improvements.

1.3 Previous Work

The purpose of the *Miami-Dade County Historical LRTP Data Review, May 2007* research was to document the historical trends and forecasting methodologies used for Miami-Dade LRTPs and to identify the types of measures that can be driven by modeling data to standardize the reporting process for performance monitoring. Base year data (1980 through 2000) from the model was presented for population and employment and compared to the Bureau of Business and Economic Research figures. Historical, current and projected year demand and supply data were presented, as well as system characteristics data such as average peak period speed, trip length, volume to capacity ratios, vehicle miles traveled, and transit mode split.

1.4 About This Report

This report includes a summary of the process to develop performance measures as well as a State of the County Report, summarizing the Miami-Dade County transportation system performance over the past 10 years. Section 2 includes a summary of the performance measure literature reviewed and referenced for the Miami-Dade performance measures. Subsequent sections include a discussion of the proposed performance measures and how they were developed; a summary of data by those measures for the last 10 years; and recommended data collection efforts, including types, frequencies, and methodologies. It is the intent of this report that it be utilized as a basis for future measurement of the transportation system performance. As such, it provides a set of specifications for tracking and assessing the system.

2. Literature Review

2.1 Review of Literature

An extensive literature review of performance measures was conducted so that lessons learned in other areas could be incorporated into this study. Some of the key issues that were prevalent in the literature, in terms of the process to develop and track transportation system performance measures, include the definition of measures and the associated data collection methodologies. One approach is to review available data and define performance measures on a data availability basis. Another approach is to define the performance measures and then develop/implement methodologies to collect data that may not be readily available to track them.

In order to determine the appropriate methodology for this study, a review of how other agencies track the performance of their transportation systems was conducted. Based on the information that was collected, the best methodology includes neither of the aforementioned options. Rather, the most prudent first step in the process is to identify the audience, or consumer of the performance measure tracking system. Timothy Lomax, author of *Measuring Performance in*

Difficult-to-Measure Areas: Congestion and Reliability Performance Measures, Texas Transportation Institute, stresses the importance of understanding the audience you are trying to serve. Successful agencies consider these three points before moving into the actual development of measures.

- **Define your audience,**
- **Decide what you want to tell them, and**
- **Identify the types of data that can communicate your successes.**

It seems logical, but so often agencies start with available data and work backwards. Performance measures are created that can be measured, but the information does not necessarily help the MPO communicate with the intended audience.

The important aspect of this project will be identifying a common goal for data collection so consistency and continuity can be maintained. Performance measures and the supporting database will need to be structured to communicate the results with decision makers, technical agencies and the public. The literature research summarized on the following pages provides relevant guidance for this project.

Possible Performance Measures for Consideration

The National Transportation Operations Coalition (NTOC) Action Team on Performance Measurement (2005) defined ten measures for transportation agencies to use in measuring and documenting performance. The initiative was guided by an oversight team from MPOs, local transportation planning agencies, and state and federal agencies. A short list of selected measures were prepared and defined as the basis for a national set of performance measures that can be used for internal management, external communication, and comparative measurement. In May 2007, a Pilot Study to collect the data for these measures was developed and volunteer agencies will be tracking their progress of the monitoring.

Data Collected through Travel Demand Model and Other Methods

The *2007 Transportation Atlanta Performance MAP Report* identifies baselines and targets for use in tracking the overall performance of the transportation system: mobility, transit accessibility, air quality, safety, and transportation system performance. The indices are listed below.

1. Planning time index (new for 2007)
2. Freeway buffer time index (new for 2007)
3. Freeway travel time index
4. Arterial congestion
5. Daily vehicle miles traveled (VMT) per person
6. Pavement condition rating
7. Transit passenger miles traveled

8. Annual transit passenger boardings

Performance data is calculated using the regional model, GDOT's NaviGAtor video detection cameras on select freeways and arterial segments, and level of service with aerial photography.

Performance Monitoring with Travel Demand Model Data

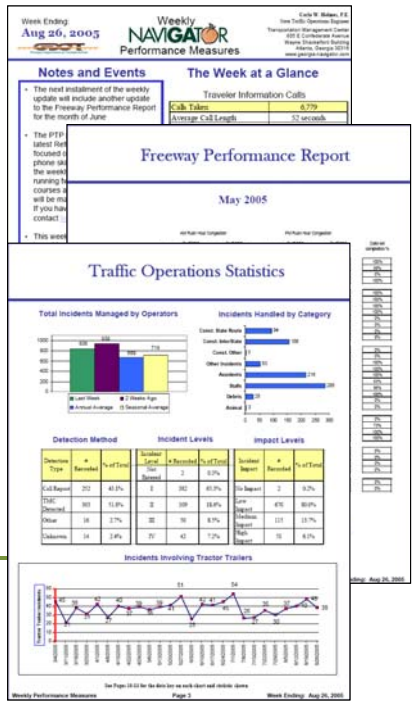
The *Texas Congestion Index: Concept and Methodology Report* details the Texas Department of Transportation's (TxDot) and area MPOs' development of travel demand model measures of mobility that can be standardized throughout the State. The Metropolitan Mobility Program includes the development of the Texas Congestion Index or Buffer Index, which is both a performance measure and procedures to develop a set of comparable values for the eight largest areas in Texas. The measures are based on travel time information and comparisons with freeflow travel speeds. In concept, the Index is the time it takes to travel in the peak period to the time it would take to travel the same distance at freeflow speeds. A value of 1.0 is freeflow conditions and 1.30 represents 30% longer in the peak.

Estimating Congestion and Mobility in Urban Areas (Including Miami, FL)

The *2005 Urban Mobility Report* (2007 release in late-September) uses data from federal, state and local agencies to estimate levels of congestion in urban areas and is useful for comparing trends for individual cities over time and ranking their congestion levels. Trends for Miami are listed and include annual delay per traveler, travel time index, congestion cost, effect of mobility improvements, and long-term changes from 1982 to 2003. The report identifies causes for congestion, why congestion is outpacing improvements, and suggested solutions and realistic expectations.

Data Collection Efforts

Challenges of Data for Performance Measures was the topic for a TRB Workshop in 2006. This workshop included on-point presentations directly applicable to the process the Miami-Dade MPO is conducting. Challenges and guidance for creating a Data Committee, selecting common goals for reporting, collecting useful data, and experiences of other agencies is provided. Methods for reaching a consensus on data collection and use are particularly helpful.



Communication with the Public

The Weekly NAVIGATOR Performance Measures Newsletter www.georgia-navigator.com is produced by the GDOT to inform the public on system performance.

Navigating the Gray Notebook – the Washington State Department of Transportation (WSDOT) uses a special style of reporting to convey transportation system performance to the legislature and public.

Colorful graphs and charts are used to depict successes in relieving congestion both on the highway and through transit. The style and methods of communication may provide ideas for the Miami-Dade MPO to review and use for developing materials.

The Performance Measurement Exchange Federal Highway Administration Web site was recently created as a place to ask questions and seek guidance on developing and monitoring performance measures: http://knowledge.fhwa.dot.gov/cops/pm.nsf/home.

Measuring Performance in Difficult-to-Measure Areas

Congestion and Reliability Performance Measures was a topic addressed by Timothy Lomax at a TRB Conference in 2005; key comments from the presentation have been summarized.

It is first important to examine what an agency is trying to measure and why? Congestion performance measures are of interest to a wide range of groups, including the public, travelers and shippers, the business community, elected and appointed officials, agency leaders, and agency staff. **An agency needs to look at the potential actions or end results such as influencing changes in travel behavior or action by agency staff to address problem areas identified through the use of specific measures**. Lower travel times and less congested time are two approaches that have been used to measure improvements. Consideration needs to be given to what the MPO should measure such as trip and segment travel times, as well as link, section and route speed. The value of travel and delay allows us to place a monetary value on congestion. **Measures that appear to resonate with the public and policy makers include travel time, travel time variation, and delay**.

2.2 American Community Survey and Census

The American Community Survey (ACS) is a survey conducted by the U.S. Census Bureau that provides economic, social, demographic, and housing information every year. The ACS was first conducted in 1996 in selected counties across the country. Since 2005 the ACS has been conducted in all United States counties.

The questionnaire for the ACS is substantially the same as the decennial census survey, in terms of content. The ACS is designed to collect data necessary for evaluation and/or management of government programs. By design, the ACS is meant to replace the decennial U.S. Census long form. The ACS will collect and update population and housing information annually, rather than decennially. It is estimated that approximately three million households will be surveyed each year. Like the Census 2000 long form, information such as income and employment, commute time to work, type of housing, and household composition will be collected by the ACS.

By its sample design, the ACS collects independent monthly sample data throughout the calendar year, allowing for the release of estimates for smaller geographic areas once enough sample data has been collected. **Table 1** explains the ACS release strategy, as it will occur over the next five years.

Table 1. American Community Survey Schedule

Data	Population Threshold	Year of Data Release	Year(s) of Data Collection
1-Year Estimates	65,000+	2006	2005
		2007	2006
		2008	2007
		2009	2008
		2010	2009
		2011	2010
		2012	2011
		2013	2012
3-Year Estimates	20,000+	2008	2005-2007
		2009	2006-2008
		2010	2007-2009
		2011	2008-2010
		2012	2009-2011
		2013	2010-2012
5-Year Estimates	All Areas	2010	2005-2009
		2011	2006-2010
		2012	2007-2011
		2013	2008-2012

A subsample of the ACS is selected annually to construct the Public Use Microdata (PUMS). This data set is available online to all researchers. The full sample of ACS data is not available, but is used to develop the published population estimates from the ACS.

3. Performance Measures

Transportation system performance measures are useful for many different purposes, including the analysis of facility performance resulting from proposed development; analysis of specific transportation improvements considered for inclusion in the LRTP; and holistic analysis of the transportation system performance. Performance measures can also be used to communicate with the public and various stakeholder groups. It was determined through consultation with the Data Development Committee that the intended audience, or consumer, for this performance measures development effort includes planners and decision-makers.

Two primary sets of criteria were utilized to identify performance measures. The first involved a dimensional analysis that identified a set of nine dimensions, each with its own set of categories. The second criteria includes a set of guidelines, by which each potential performance measure could be analyzed.

3.1 Dimensions of Transportation Performance Measures

Nine dimensions were identified to ensure coverage of all applicable measures for this study. Each dimension has its own set of categories, each of which includes all applicable types of data that falls under the respective dimension. For example, one of the dimensions is Level of Responsibility, or Jurisdiction. This dimension includes three categories: State, Regional, and Local. The purpose of the dimensional analysis is to first identify the broad levels of required data and then to ensure comprehensive coverage within each dimension. The dimensions and categories, as illustrated in **Table 2**, are all accounted for in the proposed performance measures, in terms of the form and function of the measures.

Table 2. Performance Measure Dimensions

Dimension	Categories	Variables
Sector	Passengers	All variables
Mode	Highway	Highway Miles, Trips by Auto, VMT, Highway LOS
	Bus	Revenue Miles, Metrobus Trips, Transit LOS
	Rail	Revenue Miles, Metrorail Trips, Transit LOS
Perspective	User and Supplier	Supply and Demand variables
	Performance	Performance variables
Concern	Efficiency	VMT
	Mobility	Highway LOS
Application	Policy	All variables
	Regulatory	All variables
Spatial Concern	County	All variables
	Subarea/Corridor	Transit LOS
Level of Responsibility	State	Highway Miles
	Regional	Tri-rail Track Miles
	Local	MDT variables, Highway Miles
Use of Information	Management Decision Making	All variables
	Tracking and Monitoring	All variables
	Resource Allocation	All variables
	Information Systems	All variables
Timeframe	Present	All variables
	Point in Time Versus Trend	All variables

3.2 Guidelines for Transportation Performance Measures

In addition to the dimensions considered in the development of the performance measures, a set of nine guidelines was developed as general criteria. These guidelines represent logistical issues with respect to the relevance of the potential variables. All of the variables in the proposed performance measures meet the guidelines, as listed in **Table 3**.

Table 3. Performance Measure Guidelines

Guidelines	
1	Measurability
2	Collectability
3	Multimodality
4	Clarity
5	Usefulness
6	Temporal Issues
7	Geographic Scale
8	Control
9	Relevance

3.3 Data Development Committee

A Data Development Committee was established to guide the development of the performance measures and to facilitate the collection of available data. The committee was comprised of representatives of six Miami-Dade County agencies, as listed in **Table 4**. These are the agencies that both have a stake in the performance measures from a user standpoint and have the resources and data to support their development.

Table 4. Data Development Committee Representatives

Agency
Miami-Dade Department of Planning and Zoning
Florida Department of Transportation
Miami-Dade Expressway Authority
Miami-Dade MPO
Miami-Dade Transit
Miami-Dade Department of Public Works

The purpose of the Data Development Committee can be summarized in the following three primary functions:

- **Help identify available data**
- **Recommend data needs**
- **Identify methods for collecting data**

The Data Development Committee served as a data resource as well as an intellectual resource. The committee provided invaluable guidance on the data availability from the respective agencies and helped the team to interpret certain data elements that were not clearly defined. In most cases, the agencies represented on the committee are the same agencies responsible for data collection and maintenance. Their involvement in some form should remain active in future performance measure updates.

3.4 Identify Performance Measures

Three categories of metrics were identified for the performance measures. The first two include the inputs that determine the actual performance of the system and the third consists of the actual measures of performance. The first category can be characterized by demand on the transportation system, and includes population, employment and auto ownership, to name a few. The second category includes variables that define the supply of transportation infrastructure, including miles of highway and transit service. Finally, the third category consists of variables that measure the performance of the system, all of which are a function of the first two categories.

This approach offers users of the performance measures the flexibility to customize measures they wish to examine. Simple computations can be made utilizing variables from the three categories.

The variables themselves were developed and refined through the coordination process with the Data Development Committee and are defined in the subsequent section. **Table 5** displays a list of the variables grouped by the three categories.

Table 5. Performance Measures

Variable Type	Variable
Demand Variables	Land Area
	Population
	Households
	Workers
	Auto Ownership
	Employment
	Work Trips
	Total Trips
Supply Variables	Highway Center-Line Miles
	Highway Lane Miles (SHS only)
	Bi-Directional Metrobus Route Miles
	Bi-Directional Metrorail Route Miles
	Bi-Directional Metromover Route Miles
	Bi-Directional Tri-Rail Route Miles
	Metrobus Annual Revenue Vehicle Miles
	Metrorail Annual Revenue Vehicle Miles
	Metromover Annual Revenue Vehicle Miles
	Tri-Rail Annual Revenue Vehicle Miles
	Metrobus Station Parking Capacity
	Metrorail Station Parking Capacity
	Tri-rail Station Parking Capacity
Performance Variables	Trip Length (minutes)
	HBW Trip Length (minutes)
	Trips by Auto
	HBW Trips by Auto
	Auto Occupancy
	HBW Auto Occupancy
	Trips by Metrobus
	Trips by Metrorail
	Trips by Metromover
	Trips by Tri-Rail
	HBW Trips by Transit
	Transit Mode Split
	HBW Transit Mode Split
	Metrobus Percent of Transfers
	Metrorail Percent of Transfers
	Tri-rail Percent of Transfers
	Vehicle Miles of Travel
	Vehicle Hours of Travel
	Volume-to-Capacity (V/C) ratio
	Highway Level of Service (LOS)
	Transit Reliability LOS
	Transit Revenue Vehicle Miles per Acre
	Peak-Period Speed
	Delay Time Due to Congestion

4. Existing Data Summary

All available data necessary to compute the identified performance measures were compiled for the previous ten years, resulting in a series of trends that track the demand on the transportation system; the development of the system; and the system performance. Each variable was developed and analyzed with respect to five primary attributes, including:

1. Definition
2. Value for Previous Ten Years (when available)
3. Existing Source of Data (when available)
4. Recommended Methodology of Data Collection
5. Recommended Frequency of Data Collection

An encyclopedic summary of the variables, including the five basic pieces of information listed above, is presented below. Values for each variable in the previous ten years are not available for every year, nor are they available for every variable. In some cases, the data simply are not collected every year and in others, the data components of the variable are not available. It is for this reason that the last two data attributes are critically important to the future tracking of the recommended variables.

Land Area

Definition:

The area (in square miles) of land that is part of Miami-Dade County.

Results/Analysis:

1,946 square miles (1,245,000 acres)

Source:

United States Census

Methodology:

Data collected from the United States Census

Frequency of Data Collection:

Decennial

Data Table:

Demand Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Land Area (square miles)	N/A	N/A	N/A	1,946	N/A	N/A	N/A	N/A	N/A	N/A	N/A

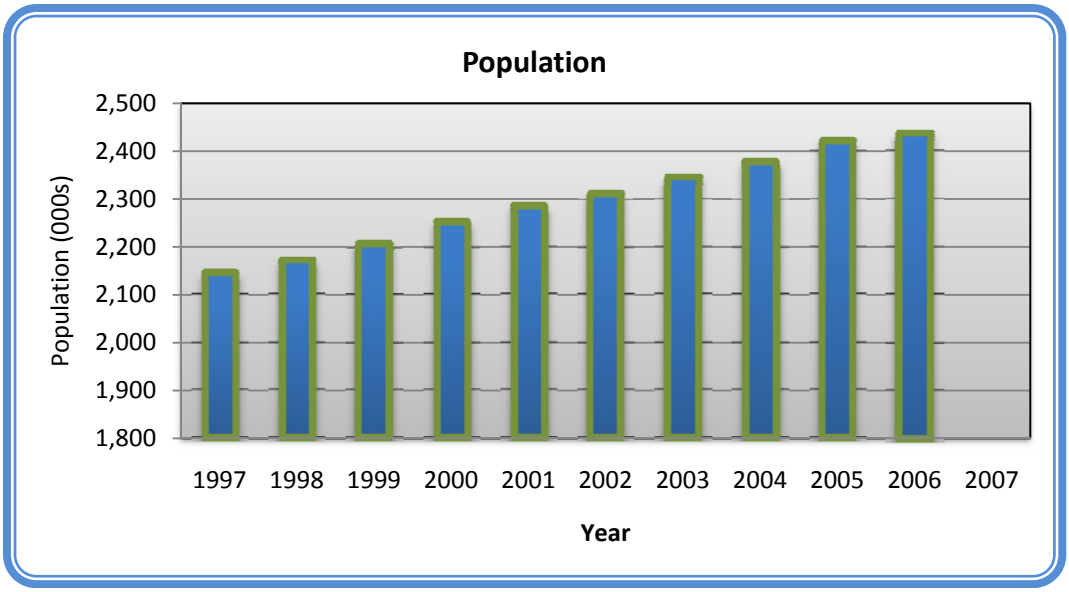
(In terms of acres, the 2000 land area of Miami-Dade County is approximately 1,245,400 acres.)

Population

Definition:

The total number of people who are permanent residents of Miami-Dade County.

Results/Analysis:



Source:

Bureau of Economic and Business Research (BEBR)

Methodology:

Data collected from BEBR

Frequency of Data Collection:

Annual

Data Table:

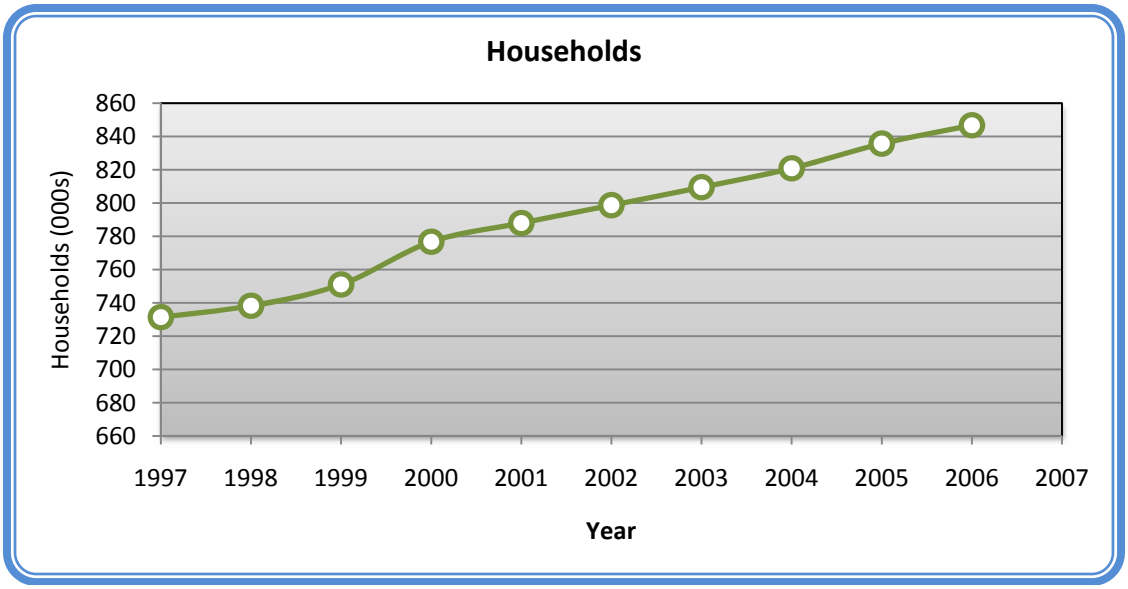
Demand Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Population (000s)	2,146	2,172	2,208	2,253	2,286	2,312	2,346	2,380	2,422	2,437	N/A

Households

Definition:

The total number of occupied housing units used as a place of permanent residence in Miami-Dade County.

Results/Analysis:



Source:

Bureau of Economic and Business Research (BEBR)

Methodology:

Data collected from BEBR

Frequency of Data Collection:

Annual

Data Table:

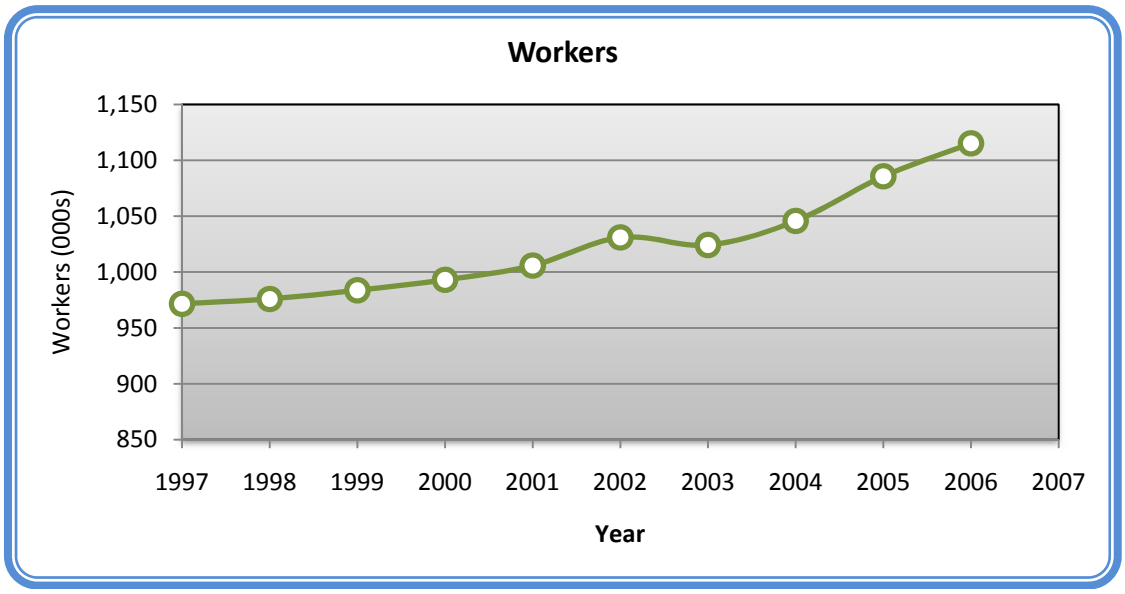
Demand Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Households (000s)	731	738	751	777	788	N/A	810	821	N/A	847	N/A

Workers

Definition:

Residents of Miami-Dade County, 16 years and over who work either full time or part time. Excluded from the employed are people whose only activity consisted of work around the house or unpaid volunteer work for religious, charitable, and similar organizations; also excluded are people on active duty in the United States Armed Forces.

Results/Analysis:



Source:

Bureau of Economic and Business Research (BEBR)

Methodology:

Data collected from BEBR

Frequency of Data Collection:

Annual

Data Table:

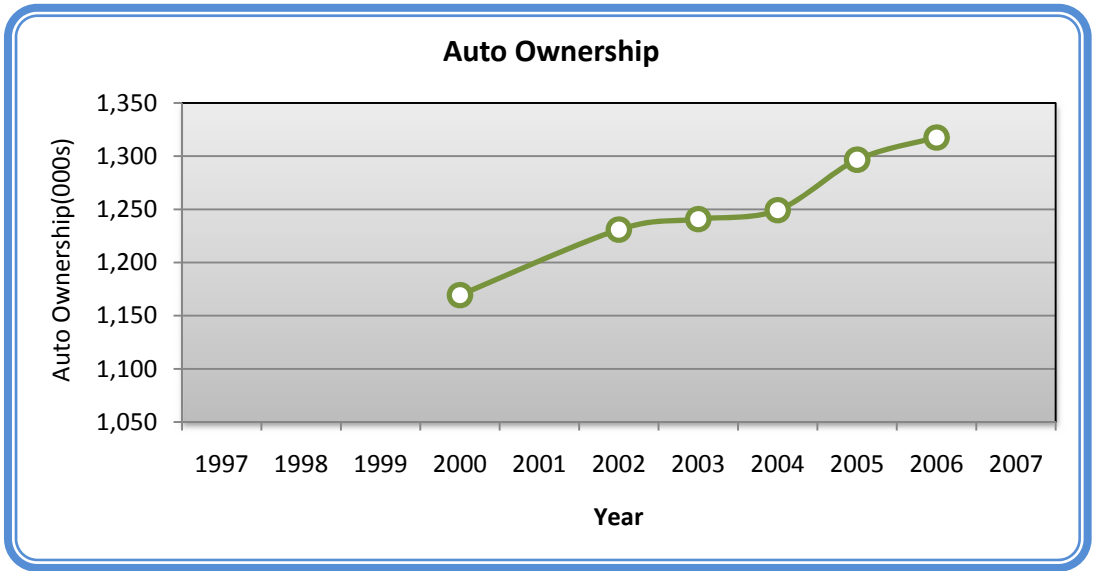
Demand Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Workers (000s)	972	976	984	993	1,006	1,031	1,024	1,046	1,086	1,115	N/A

Auto Ownership

Definition:

The number of passenger cars, vans, and pickup or panel trucks of 1-ton capacity or less kept at home and available for the use of household members in Miami-Dade County. Vehicles rented or leased for 1 month or more, company vehicles, and police and government vehicles are included if kept at home and used for non-business purposes. Dismantled or immobile vehicles are excluded. Vehicles kept at home but used only for business purposes also are excluded.

Results/Analysis:



Source:

American Community Survey (ACS)
(The value for 2000 was obtained from the 2000 U.S. Census Transportation Planning Package.)

Methodology:

Data collected from ACS

Frequency of Data Collection:

Annual since 2002

Data Table:

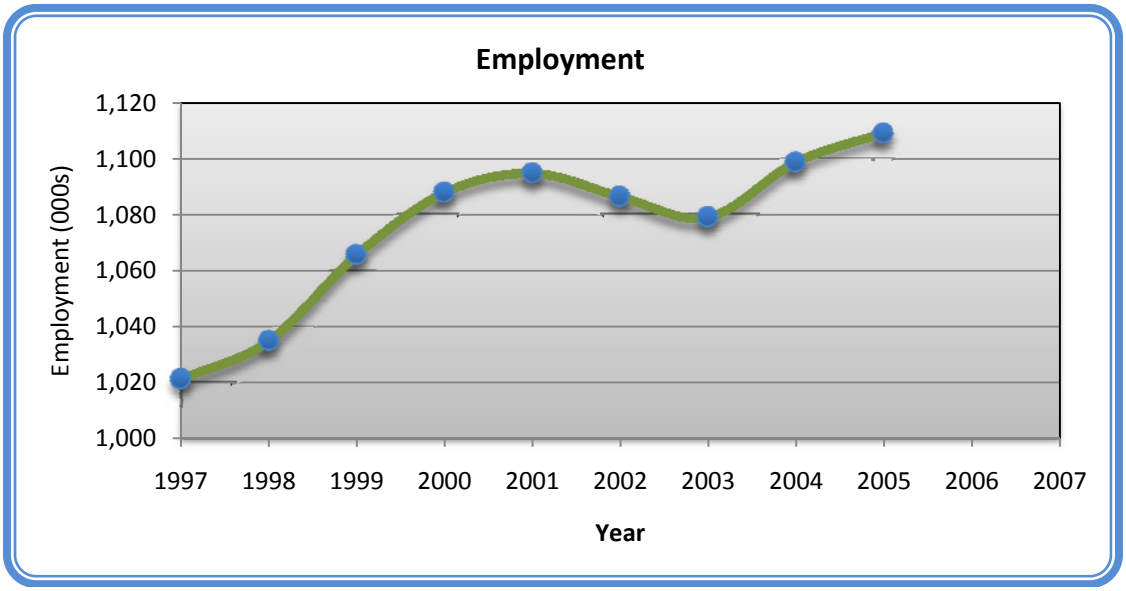
Demand Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Auto Ownership (000s)	N/A	N/A	N/A	1,169	N/A	1,231	1,241	1,249	1,297	1,317	N/A

Employment

Definition:

Employment refers to the total number of employees, 16 years and over, who work either full time or part time in Miami-Dade County.

Results/Analysis:



Source:

Bureau of Economic and Business Research (BEBR)

Methodology:

Data collected from BEBR

Frequency of Data Collection:

Annual

Data Table:

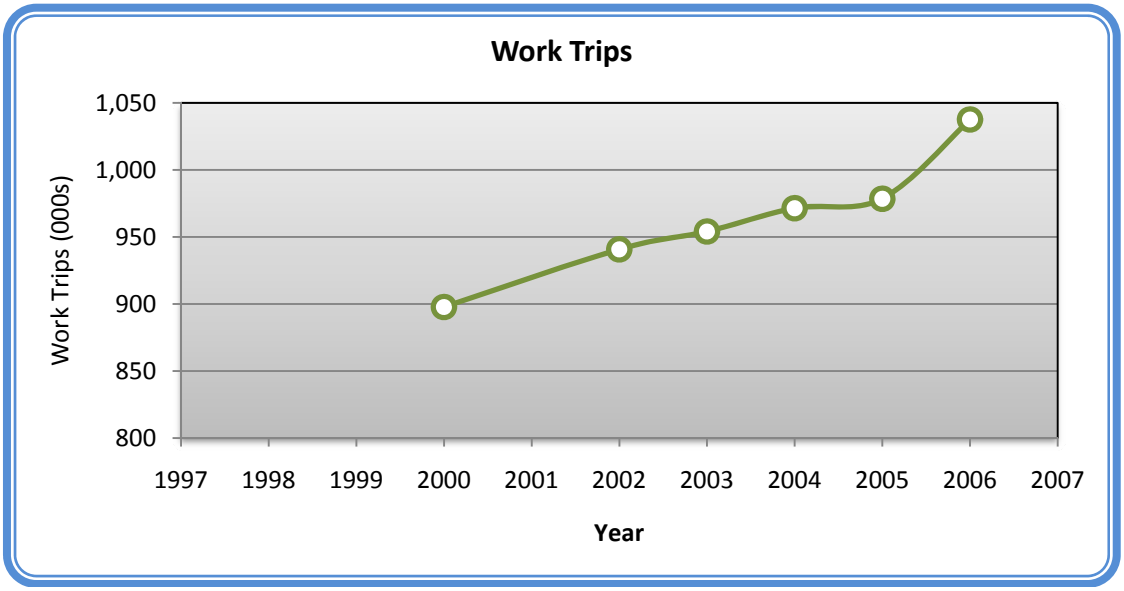
Demand	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Employment (000s)	1,021	1,035	1,065	1,088	1,095	1,086	1,079	1,099	1,109	N/A	N/A

Work Trips

Definition:

The total one-way person trips originating in Miami-Dade County and destined for work.

Results/Analysis:



Source:

American Community Survey (ACS)
(The value for 2000 was obtained from the 2000 U.S. Census Transportation Planning Package.)

Methodology:

Data collected from ACS

Frequency of Data Collection:

Annual since 2002

Data Table:

Demand Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Work Trips (000s)	N/A	N/A	N/A	898	N/A	941	954	971	979	1,038	N/A

Total Trips

Definition:

The total number of two-way person trips originating in Miami-Dade County.

Results/Analysis:

8,787,000 trips

Source:

Household survey, Bureau of Economic and Business Research (BEBR)

Methodology:

Daily Trip rates (daily trips/ household) are estimated from Household Survey. The number of households is collected from BEBR. The product of household and daily trip rates gives the total trips.

Frequency of Data Collection:

Household Survey (Decennial) (The last Household Survey was conducted in 1999)
BEBR (Annual)

Data Table:

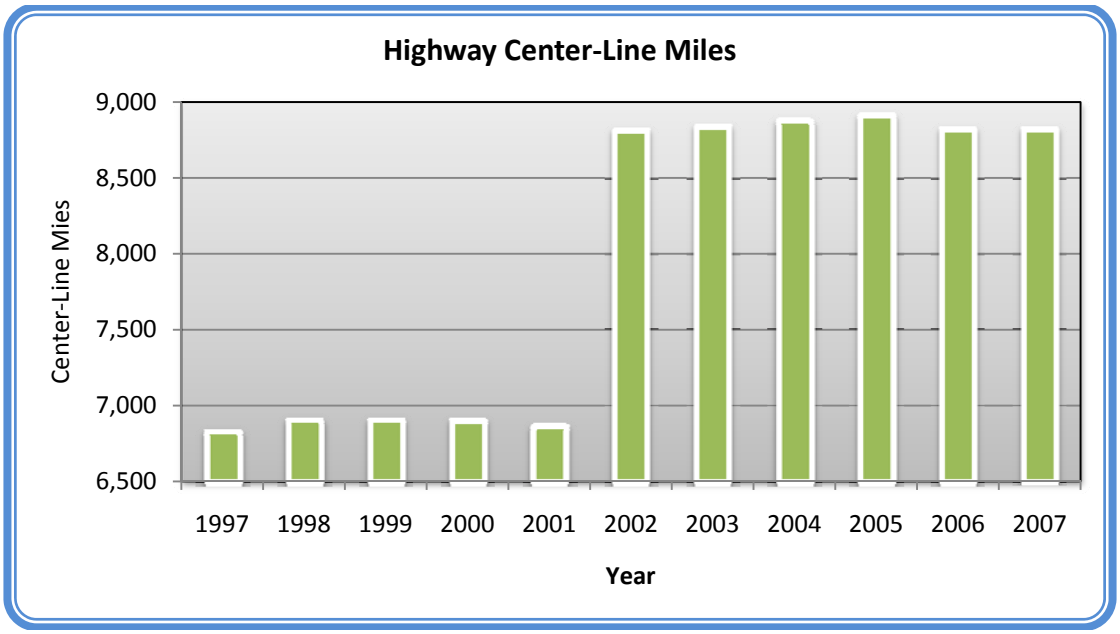
Demand Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total Trips (000s)	N/A	N/A	8,787	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Highway Center-Line Miles

Definition:

The length of all public roadways in Miami-Dade County. Public roads refer to all roads under the State Highway System, the County Road System, and the City Road System, plus public roads administered by various branches of the U.S. government. It does not include private subdivision roads or roads within shopping centers or other large private areas.

Results/Analysis:



Source:

FDOT Public Mileage Report

Methodology:

Data collected from FDOT Public Mileage Report

Frequency of Data Collection:

Annual

Data Table:

Supply Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Highway Center-Line Miles	6,829	6,905	6,905	6,902	6,864	8,818	8,843	8,880	8,916	8,826	8,826

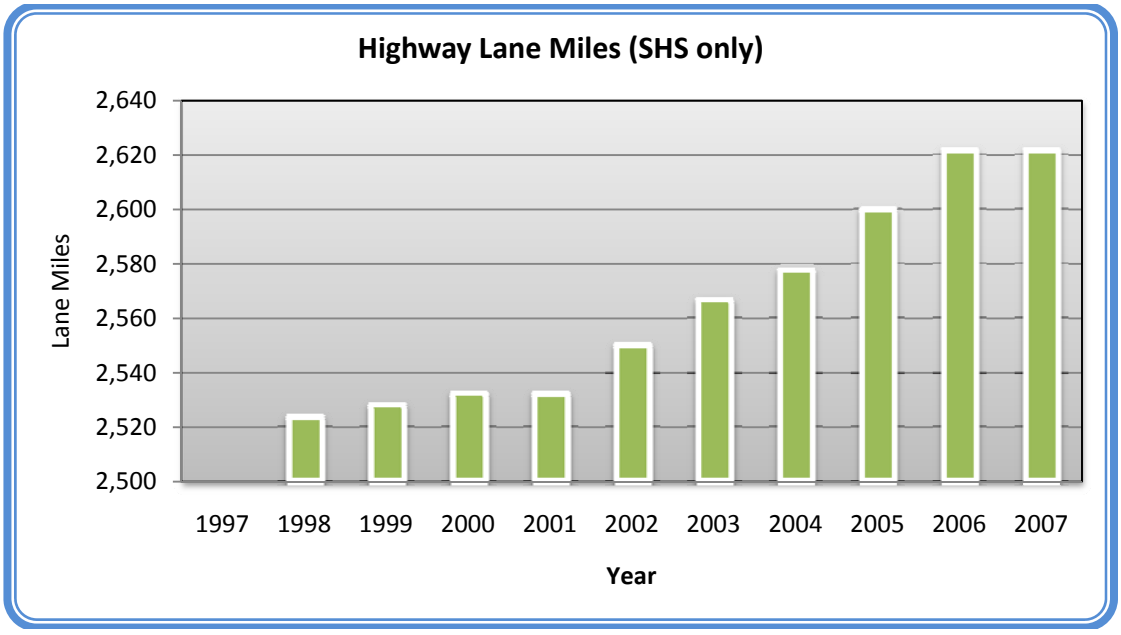
(Increase in 2002 and decline from 2005 onward are unexplained anomalies in FDOT Public Mileage Report.)

Highway Lane Miles

Definition:

The product of centerline miles and the number of lanes for all roads under the State Highway System in Miami-Dade County.

Results/Analysis:



Source:

FDOT State Highway System Report

Methodology:

Data collected from FDOT State Highway System Report

Frequency of Data Collection:

Annual

Data Table:

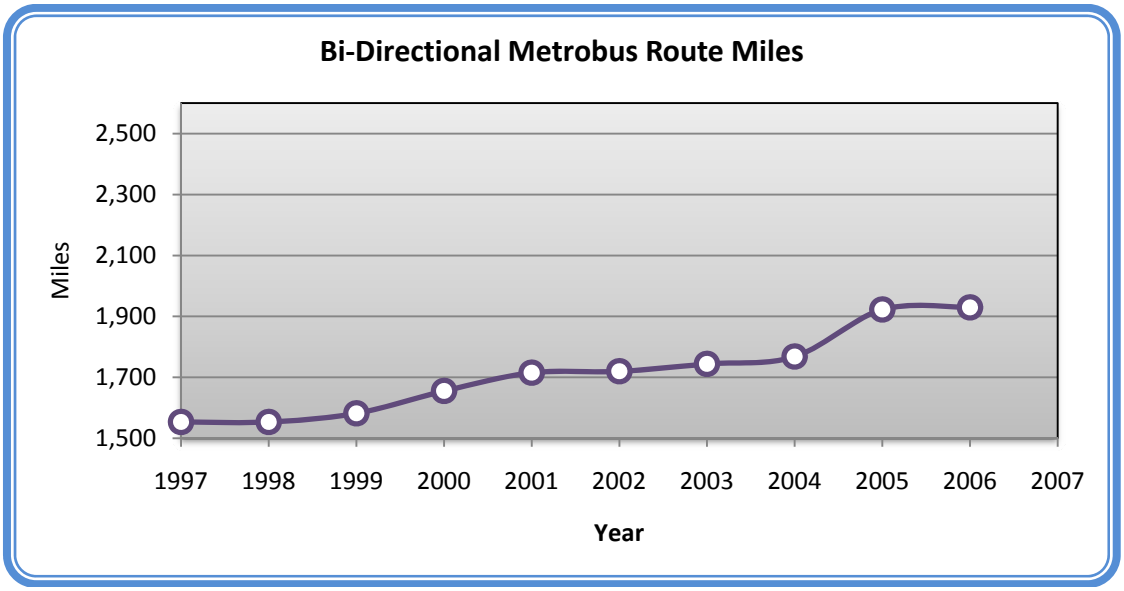
Supply Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Highway Lane Miles (SHS only)	N/A	2,524	2,528	2,532	2,532	2,550	2,567	2,578	2,600	2,622	2,622

Bi-Directional Metrobus Route Miles

Definition:

The mileage in each direction of all the routes over which public transportation buses, operating in Miami-Dade County, travel while in revenue service.

Results/Analysis:



Source:

National Transit Database (NTD)

Methodology:

Data collected from NTD.

Frequency of Data Collection:

Annual

Data Table:

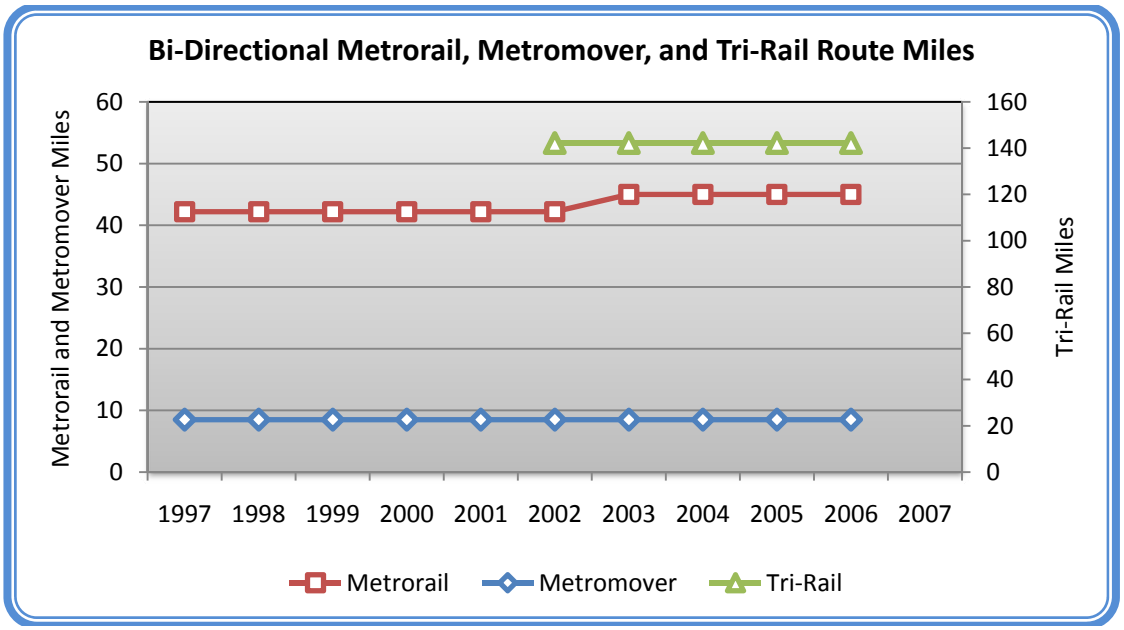
Supply Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bi-Directional Metrobus Route Miles	1,554	1,554	1,582	1,655	1,715	1,720	1,744	1,768	1,923	1,930	N/A

Bi-Directional Train Route Miles

Definition:

The mileage in each direction of all the routes over which public transportation trains, operating in Miami-Dade County, travel while in revenue service. Train route miles are computed separately for Tri-Rail[1], Metromover, and Metrorail.

Results/Analysis:



Source:

National Transit Database (NTD)

Methodology:

Data collected from NTD.

Frequency of Data Collection:

Annual

[1] Tri-Rail extends beyond Miami-Dade County. The statistics reported here are for the entire system and not just Miami-Dade County.

Data Table:

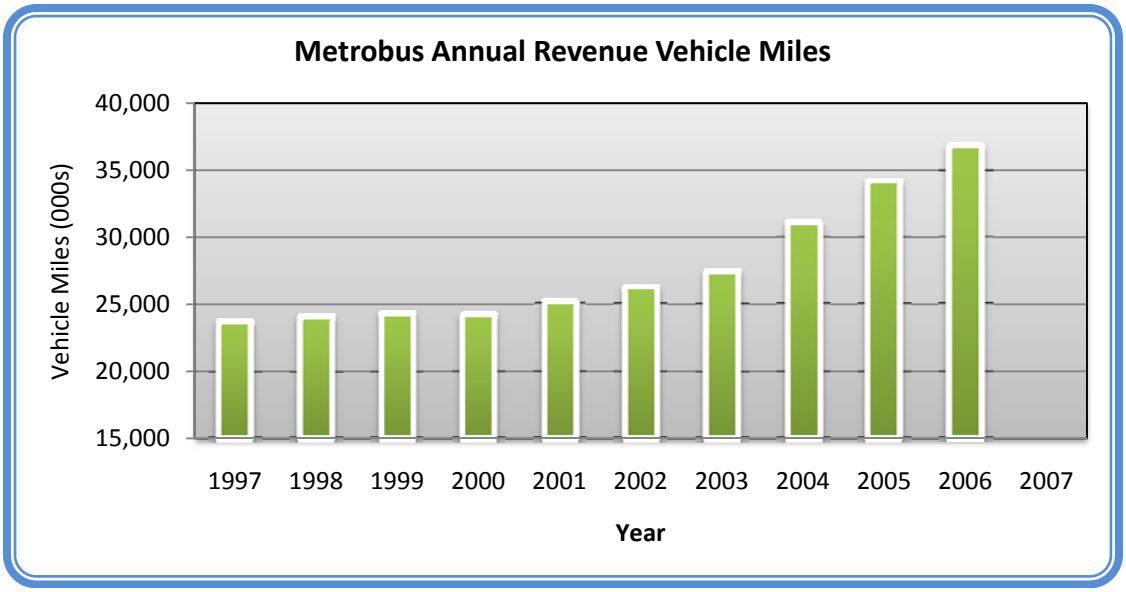
Supply Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bi-Directional Metrorail Route Miles	42	42	42	42	42	42	45	45	45	45	N/A
Supply Variable	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Bi-Directional Metromover Route Miles	9	9	9	9	9	9	9	9	9	9	N/A
Supply Variable	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Bi-Directional Tri-Rail Route Miles	N/A	N/A	N/A	N/A	N/A	142	142	142	142	142	N/A

Metrobus Annual Revenue Vehicle Miles

Definition:

The average total miles that all public transportation buses, operating in Miami-Dade County, travel each year while in revenue service.

Results/Analysis:



Source:

National Transit Database (NTD)

Methodology:

The average daily data for an average weekday schedule, an average Saturday schedule, and an average Sunday schedule is estimated. The annual total revenue miles are computed by multiplying the reported average day schedules by the corresponding number of days the schedules were operated and then the summing the three products- weekday, Saturday, and Sunday to estimate annual totals.

Frequency of Data Collection:

Annual

Data Table:

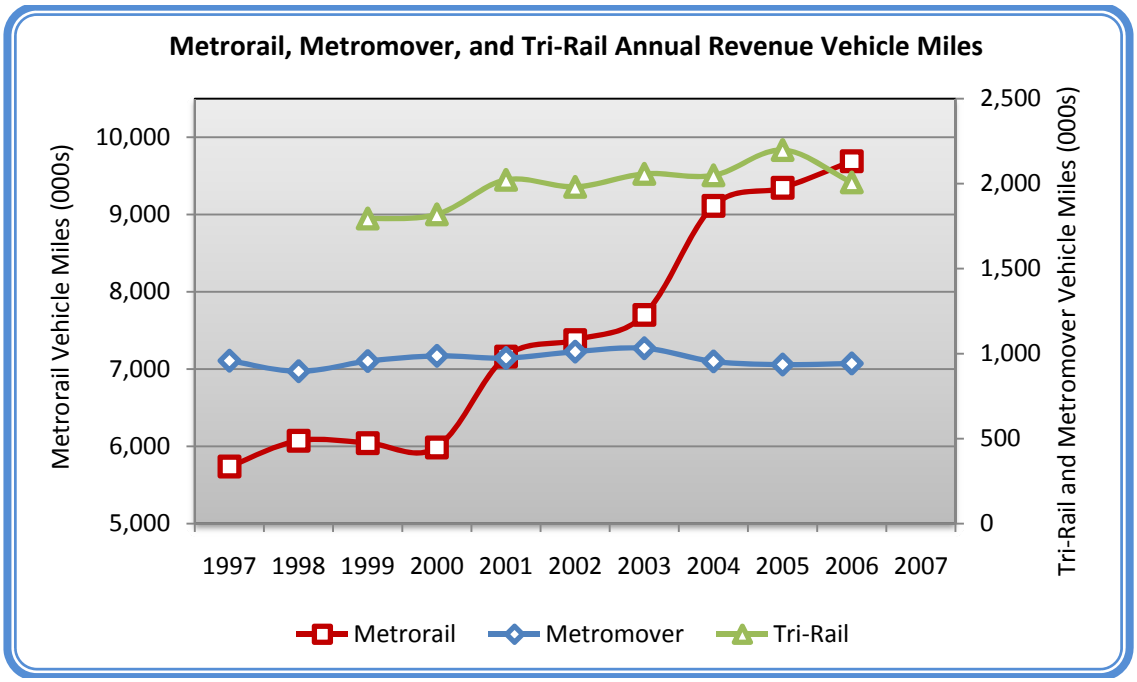
Supply Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Metrobus Annual Revenue Vehicle Miles (000s)	23,765	24,176	24,367	24,215	25,176	26,294	27,506	31,101	34,223	36,825	N/A

Rail Annual Revenue Vehicle Miles

Definition:

The average total car miles for all public transportation trains, operating in Miami-Dade County, travel each year while in revenue service. Annual revenue car miles are computed separately for Tri-Rail, Metromover, and Metrorail.

Results/Analysis:



Source:

National Transit Database (NTD)

Methodology:

The average daily data for an average weekday schedule, an average Saturday schedule, and an average Sunday schedule is estimated. The annual total revenue car miles are computed by multiplying the reported average day schedules by the corresponding number of days the schedules were operated and then the summing the three products- weekday, Saturday, and Sunday to estimate annual totals.

Frequency of Data Collection:

Annual

Data Table:

Supply Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Metrorail Annual Revenue Vehicle Miles (000s)	5,739	6,072	6,042	5,986	7,162	7,376	7,701	9,112	9,346	9,690	N/A
Metromover Annual Revenue Vehicle Miles (000s)	958	896	956	987	974	1,011	1,031	954	935	942	N/A
Tri-Rail Annual Revenue Vehicle Miles (000s)	N/A	N/A	1,795	1,819	2,022	1,981	2,058	2,049	2,198	2,007	N/A

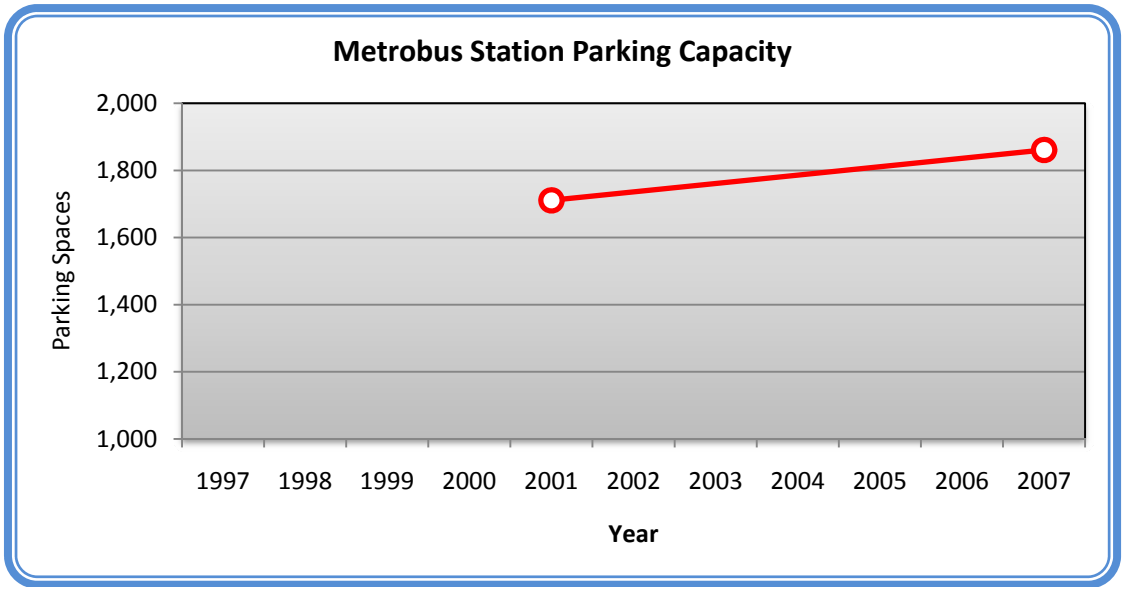
(Metromover service miles after 2002 are not truly revenue miles because Metromover service became free with the implementation of the People's Transportation Plan. The National Transit Database, however, still reports Metromover service miles as revenue miles.)

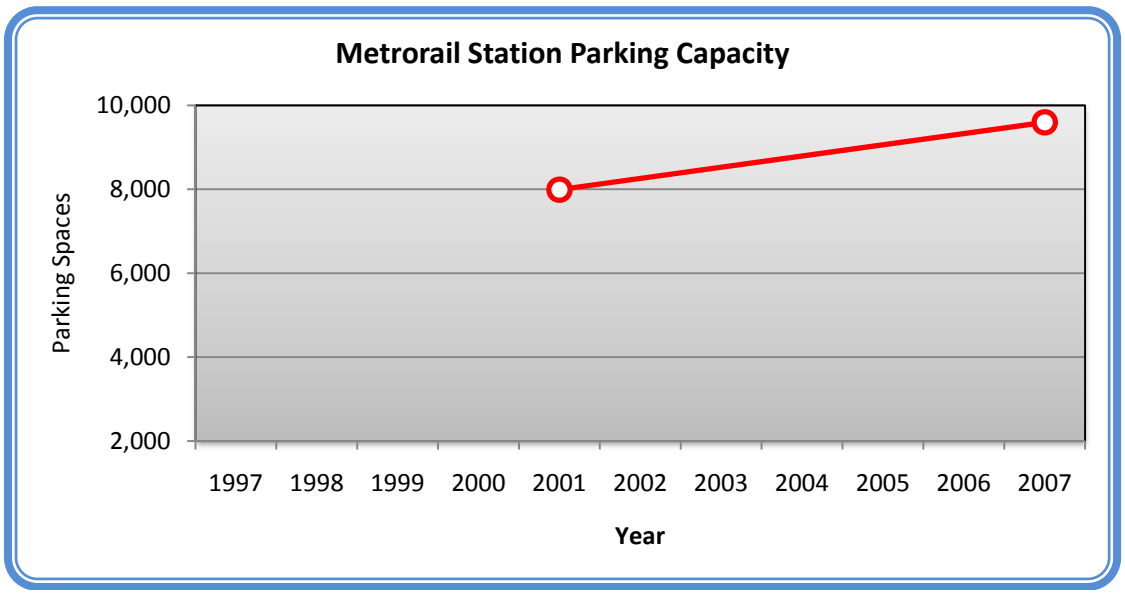
Parking Capacity

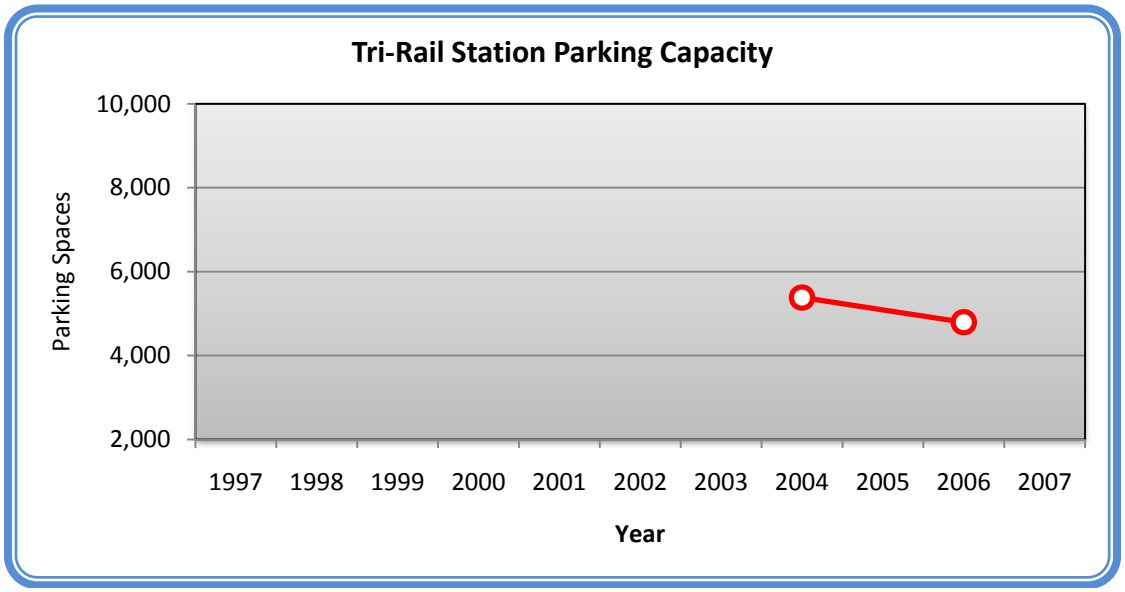
Definition:

The total number of parking spaces available at all Park and Ride stops of the public transportation system in Miami-Dade County. Parking Capacity is computed separately for Metrobus, Metrorail, and Tri-rail.

Results/Analysis:







Source:

Miami-Dade Transit (MDT), South Florida Regional Transportation Authority (SFRTA)

Methodology:

Metrobus and Metrorail parking capacity obtained from MDT. Tri-rail station parking capacity obtained from SFRTA.

Frequency of Data Collection:

Annual

Data Table:

Supply Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Metrobus Station Parking Capacity	N/A	N/A	N/A	N/A	1,711	N/A	N/A	N/A	N/A	N/A	1,861
Metrorail Station Parking Capacity	N/A	N/A	N/A	N/A	7,991	N/A	N/A	N/A	N/A	N/A	9,595
Tri-Rail Station Parking Capacity	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5,383	N/A	4,794	N/A

Trip Length

Definition:

The average travel time that it takes to make a trip (one way) originating in Miami-Dade County.

Results/Analysis:

22 minutes

Source:

Household Surveys

Methodology:

Data estimated from Household Surveys.

Frequency of Data Collection:

Decennial (The last Household Survey was conducted in 1999)

Data Table:

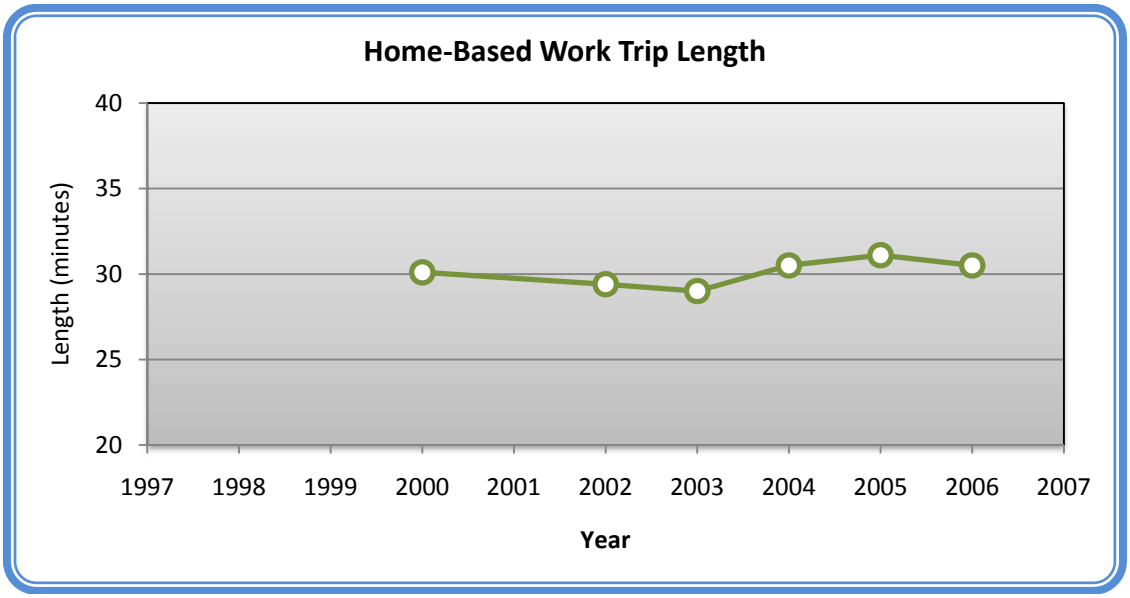
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Trip Length (minutes)	N/A	N/A	22	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Home-Based Work Trip Length

Definition:

The average travel time that it takes workers, residing in Miami-Dade County, to get from home to work (one way).

Results/Analysis:



Source:

American Community Survey (ACS)
(The value for 2000 was obtained from the 2000 U.S. Census Transportation Planning Package. The value for 1999 was obtained from the Household Survey.)

Methodology:

Data collected from ACS.

Frequency of Data Collection:

Annual since 2002

Data Table:

Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
HBW Trip Length (minutes)	N/A	N/A	31	30	N/A	29	29	31	31	31	N/A

Trips by Auto

Definition:

The total number of person trips originating in Miami-Dade County, for which autos are the principal mode of travel. Principal mode is the most frequently used mode or the mode used for longest distance while making a trip.

Results/Analysis:

7,926,000 total person trips by auto

Source:

Household Survey

Methodology:

Data estimated from Household Survey.

Frequency of Data Collection:

Decennial (The last Household Survey was conducted in 1999)

Data Table:

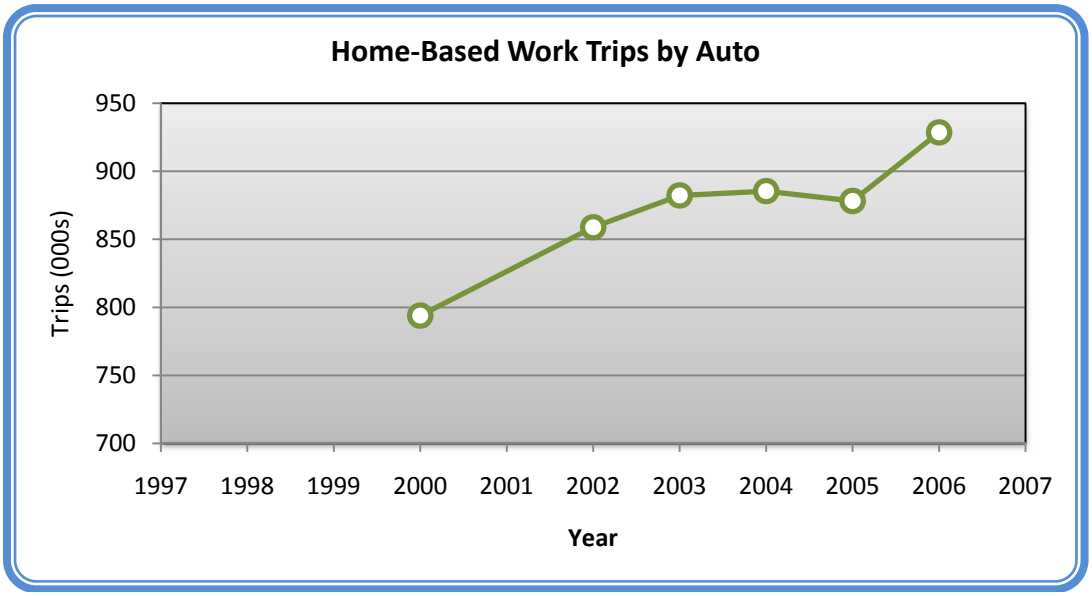
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Trips by Auto (Daily) (000s)	N/A	N/A	7,926	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Home-Based Work Trips by Auto

Definition:

The total number of trips made by workers (includes drivers and passengers) in Miami-Dade County who use autos as the principal mode of travel to get to work. Principal mode is the most frequently used mode or the mode used for longest distance while making a trip.

Results/Analysis:



Source:

American Community Survey (ACS)
The value for 2000 was obtained from the 2000 U.S. Census Transportation Planning Package.

Methodology:

Data collected from ACS.

Frequency of Data Collection:

Annual since 2002

Data Table:

Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
HBW Trips by Auto (000s)	N/A	N/A	N/A	794	N/A	859	882	885	878	929	N/A

Auto Occupancy

Definition:

The average number of persons, including driver and passenger(s), who drive together in a vehicle to make trips originating in Miami-Dade County.

Results/Analysis:

1.34 persons per vehicle

Source:

Household Surveys

Methodology:

Data estimated from Household Surveys.

Frequency of Data Collection:

Decennial (The last Household Survey was conducted in 1999)

Data Table:

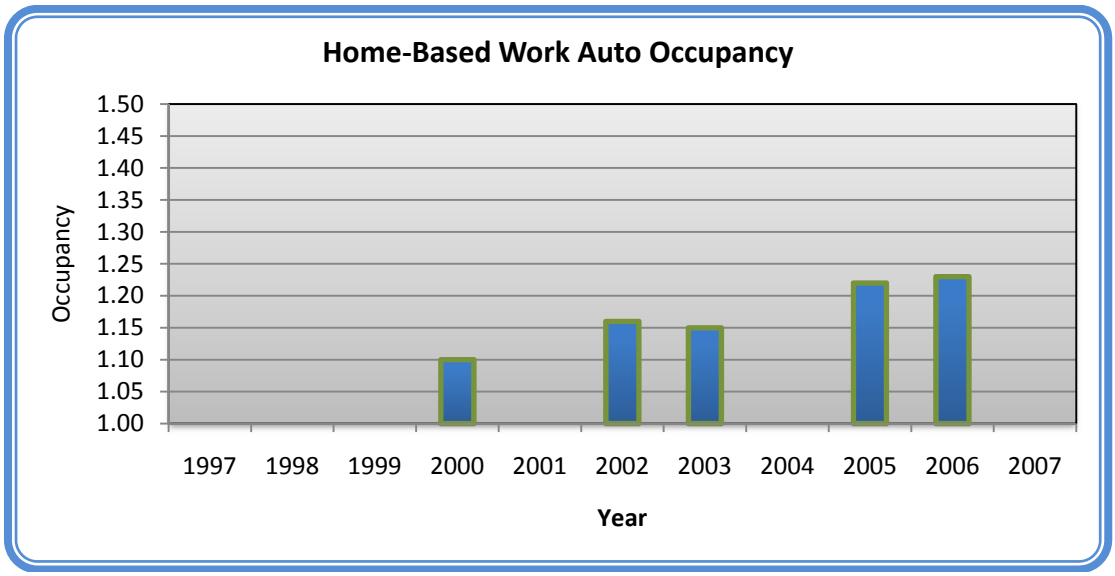
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Auto Occupancy	N/A	N/A	1.34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Home-Based Work Auto Occupancy

Definition:

The average number of persons, including driver and passenger(s), who live in Miami-Dade County and drive together in a vehicle to go to work.

Results/Analysis:



Source:

American Community Survey (ACS)
(The value for 2000 was obtained from the 2000 U.S. Census Transportation Planning Package. 2004 ACS data does not publish HBW-Auto Occupancy data)

Methodology:

Data collected from ACS.

Frequency of Data Collection:

Annual since 2002

Data Table:

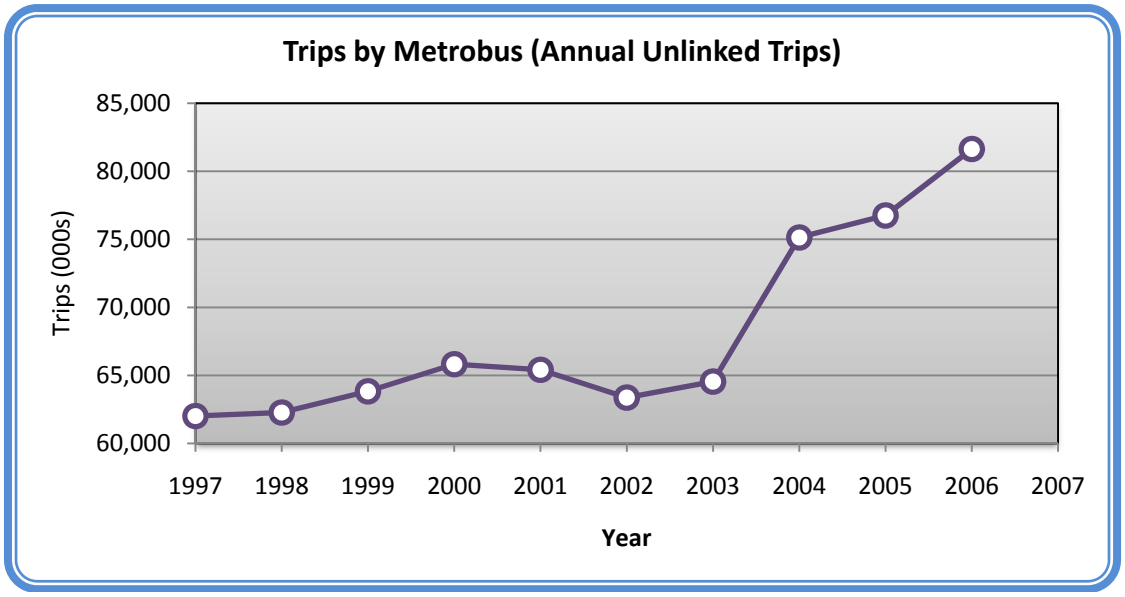
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
HBW Auto Occupancy	N/A	N/A	N/A	1.10	N/A	1.16	1.15	N/A	1.22	1.23	N/A

Annual Unlinked Trips by Metrobus

Definition:

The number of passengers who board Metrobus every year. Passengers are counted each time they board Metrobus no matter how many vehicles they use to travel from their origin to their destination.

Results/Analysis:



Source:

National Transit Database (NTD)

Methodology:

The estimation of trips by Metrobus involves a sampling plan in which a minimum of 549 one-way trips are sampled each year. The sample is drawn from the entire universe of scheduled trips operated during one fiscal year. The sample is randomly drawn and staff is sent out to collect the data. The sample provides an average of unlinked passenger trips per trip, and passenger miles per trip. This information is then expanded to system totals by multiplying by total number of bus trips.

Frequency of Data Collection:

Annual

Data Table:

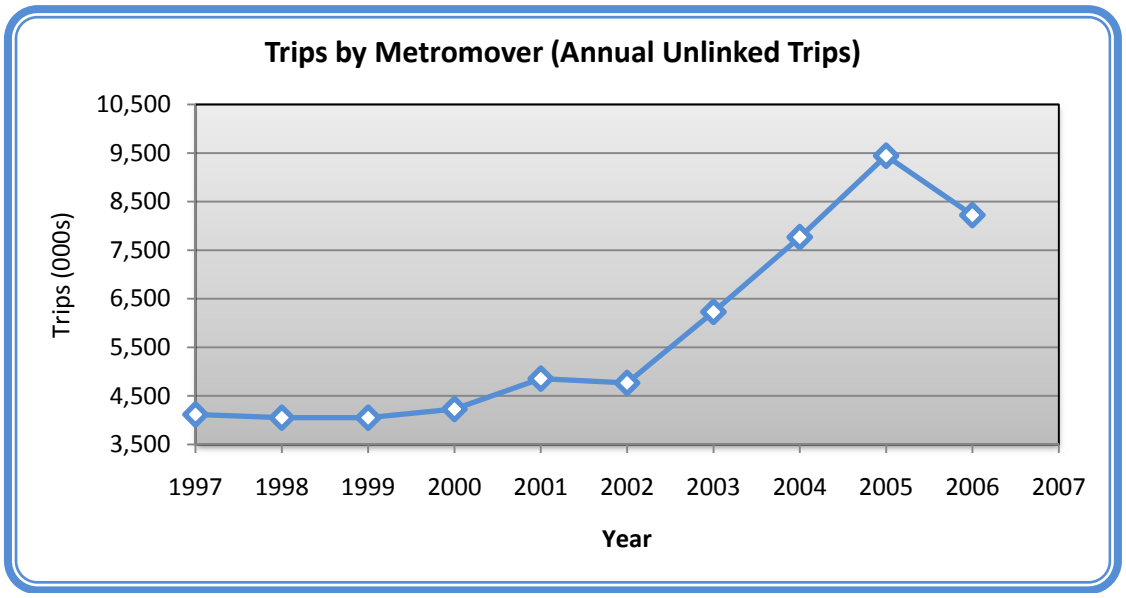
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Annual Unlinked Trips by Metrobus (000s)	62,014	62,270	63,827	65,821	65,414	63,369	64,547	75,137	76,753	81,637	N/A

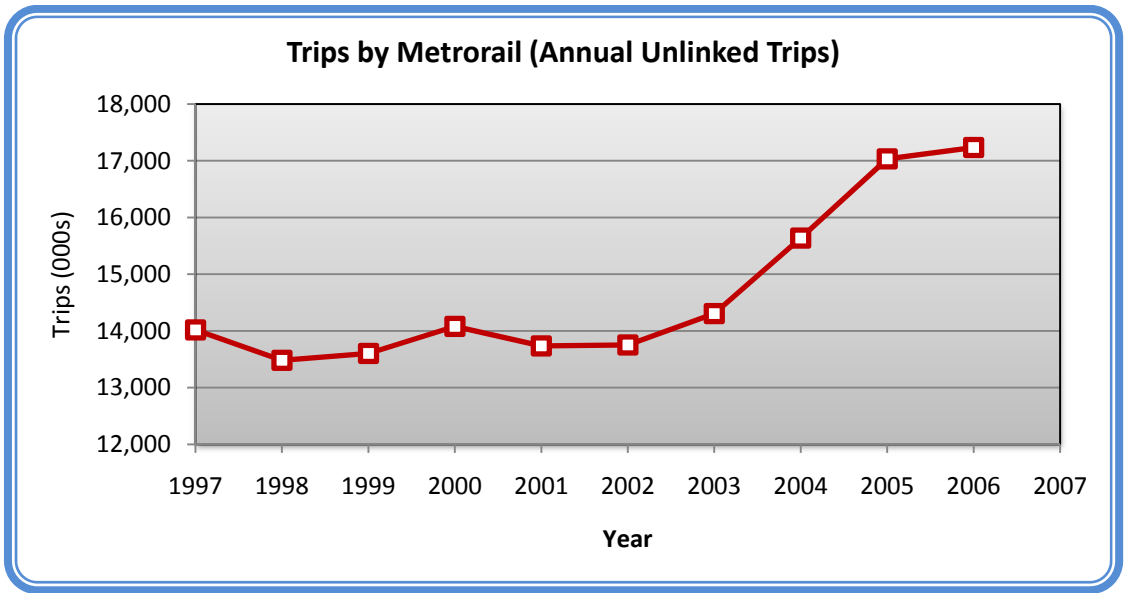
Annual Unlinked Trips by Fixed Guideway Transit

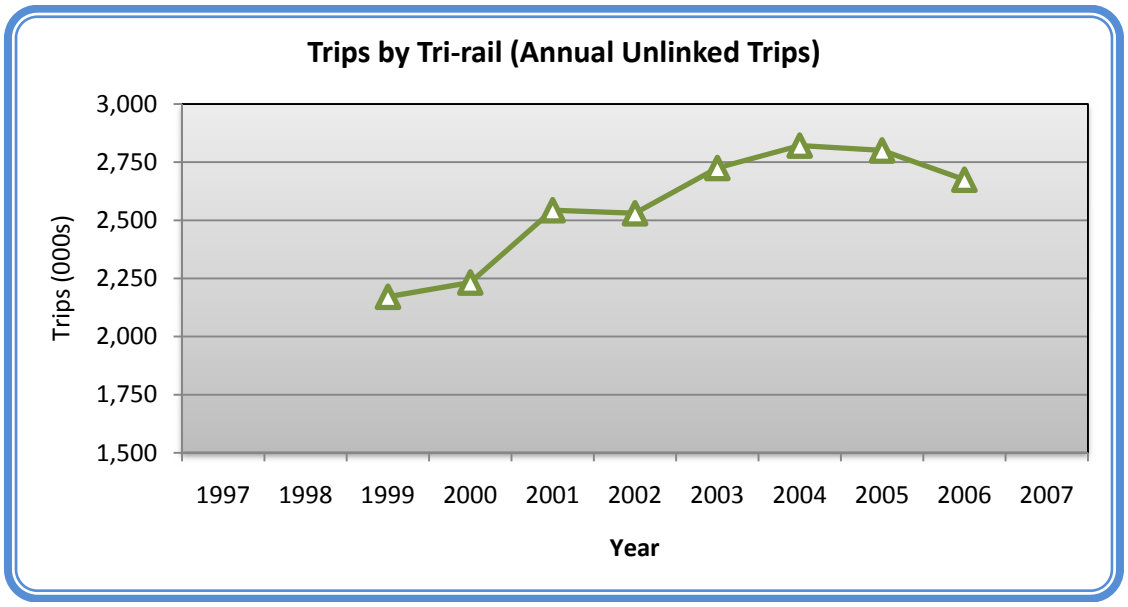
Definition:

The number of passengers who board public transportation trains. Passengers are counted each time they board trains no matter how many trains they use to travel from their origin to their destination. The Annual Unlinked Trips by Train are computed separately for Metromover, Metrorail, and Tri-rail.

Results/Analysis:







Source:

National Transit Database (NTD)

Methodology:

Data collected from NTD.

Frequency of Data Collection:

Annual

Data Table:

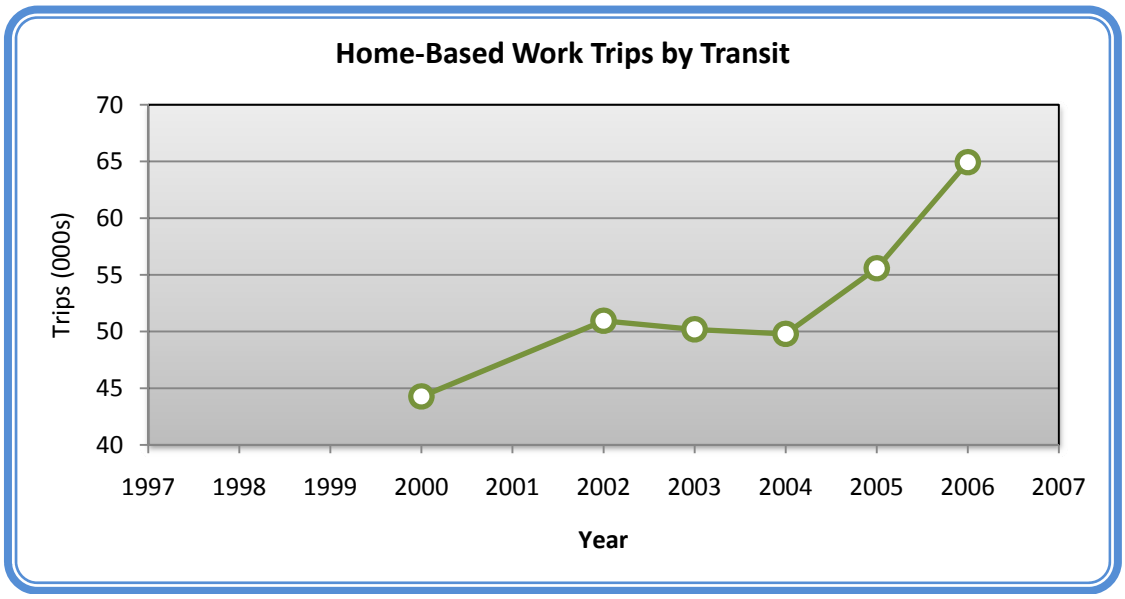
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Annual Unlinked Trips by Metrorail (000s)	14,020	13,483	13,605	14,080	13,735	13,754	14,306	15,638	17,035	17,235	N/A
Annual Unlinked Trips by Metromover (000s)	4,119	4,053	4,052	4,230	4,856	4,768	6,229	7,769	9,445	8,222	N/A
Annual Unlinked Trips by Tri-Rail (000s)	N/A	N/A	2,171	2,233	2,544	2,530	2,725	2,821	2,800	2,675	N/A

Home-Based Work Trips by Transit

Definition:

The total number of work trips made by workers in Miami-Dade County who use public transportation as the principal mode of travel to get to work. Principal mode is the most frequently used mode or the mode used for longest distance while making a trip.

Results/Analysis:



Source:

American Community Survey (ACS)
(The value for 2000 was obtained from the 2000 U.S. Census Transportation Planning Package.)

Methodology:

Data collected from ACS.

Frequency of Data Collection:

Annual since 2002

Data Table:

Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
HBW Trips by Transit (000s)	N/A	N/A	N/A	44	N/A	51	50	50	56	65	N/A

Transit Mode Split

Definition:

The ratio of person trips originating in Miami-Dade County for which public transport was the principal mode of travel to the total person trips originating in Miami-Dade County. Principal mode is the most frequently used mode or the mode used for longest distance while making a trip.

Results/Analysis:

4.4% of person trips by transit

Source:

Household Survey

Methodology:

Data estimated from Household Survey.

Frequency of Data Collection:

Decennial (The last Household Survey was conducted in 1999)

Data Table:

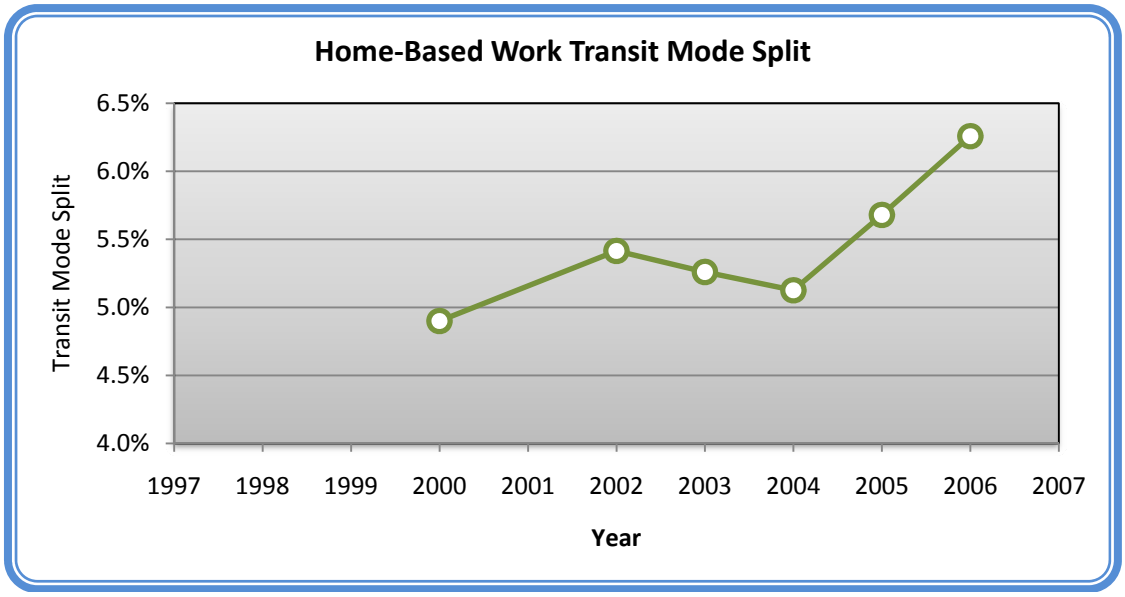
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Transit Mode Split	N/A	N/A	4.4%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Home-Based Work Transit Mode Split

Definition:

The ratio of workers in Miami-Dade County who used public transport as principal mode of travel to get to work to the total workers who commute to get to work in Miami-Dade County. Principal mode is the most frequently used mode or the mode used for longest distance while making a trip.

Results/Analysis:



Source:

American Community Survey (ACS)
(The value for 2000 was obtained from the 2000 U.S. Census Transportation Planning Package.)

Methodology:

Data collected from ACS.

Frequency of Data Collection:

Annual since 2002

Data Table:

Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
HBW Transit Mode Split	N/A	N/A	N/A	4.9%	N/A	5.4%	5.3%	5.1%	5.7%	6.3%	N/A

Percent of Transfers

Definition:

The percentage of transit users in Miami-Dade County that must make transfers within the transit system. Percent transfers are computed separately for Metrobus, Metrorail, Metromover, and Tri-rail users.

Results/Analysis:

51% transfer rate for Metrobus riders
62% transfer rate for Metrorail riders
53% transfer rate for Tri-Rail riders

Source:

Transit On-Board Survey

Methodology:

Data estimated from Transit On-Board Survey.

Frequency of Data Collection:

5 years

Data Table:

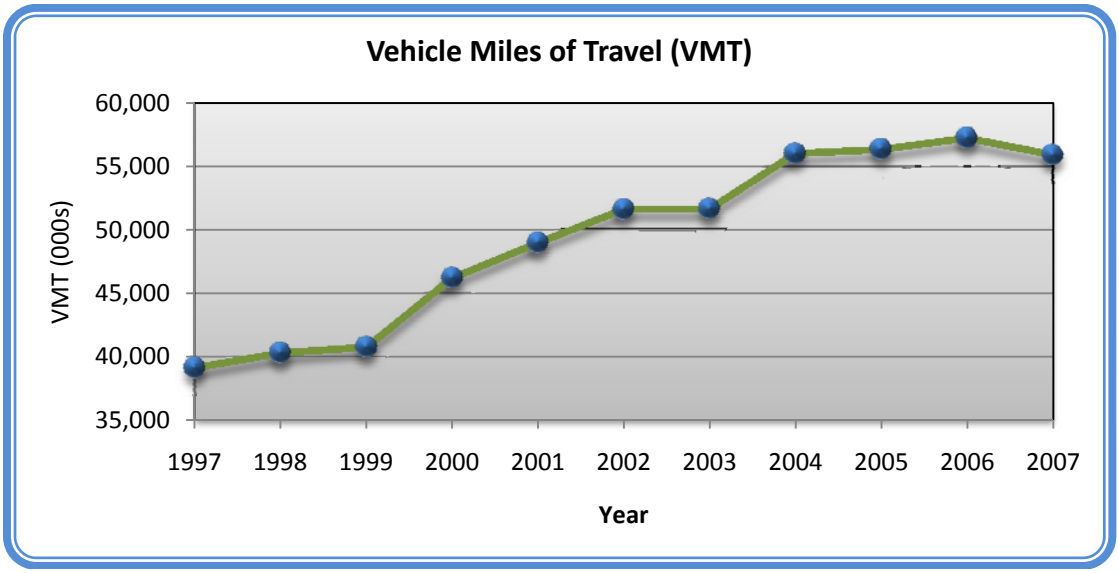
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Metrobus Percent Transfers	N/A	N/A	51%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metrorail Percent Transfers	N/A	N/A	62%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tri-Rail Percent Transfers	N/A	N/A	53%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Vehicle Miles of Travel

Definition:

The measurement of the average daily miles traveled by all vehicles on all public roadways in Miami-Dade County.

Results/Analysis:



Source:

FDOT Public Mileage Report

Methodology:

Data collected from FDOT Public Mileage Report.

Frequency of Data Collection:

Annual

Data Table:

Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Vehicle Miles of Travel (VMT) (000s)	39,101	40,276	40,742	46,200	48,963	51,610	51,639	55,999	56,327	57,229	55,903

Vehicle Hours of Travel

Definition:

The measurement of the average daily hours traveled by all vehicles on all public roadways in Miami-Dade County.

Results/Analysis:

N/A

Source:

Speed Survey (Currently, a speed survey is not available. Future speed survey(s) will be utilized.)
FDOT Public Mileage Report

Methodology:

The FDOT Public Mileage Report publishes Vehicle Miles of Travel (VMT) by area types and facility types. Average speed data will be estimated from Speed Survey for the same area types and facility types that are reported in the FDOT Public Mileage Report. Vehicle Hours of Travel (VHT) can be estimated in the following way:

$$VHT = \sum_{i=1}^{\#AT} \sum_{j=1}^{\#FT} VMT_i^j / s_i^j$$

Where:

VHT is the total vehicle hours of travel
i=1…#AT denotes the different area types classification for which VMT and Speed data is available
j=1…#FT denotes the different facility types classification for which VMT and Speed data is available
VMT_i^j is the VMT on all roadway links that are categorized as facility type i and located in area type j
s_i^j is the average speed on all roadway links that are categorized as facility type i and located in area type j.

Frequency of Data Collection:

Speed Survey (5 years)
FDOT Public Mileage Report (Annual)

Data Table:

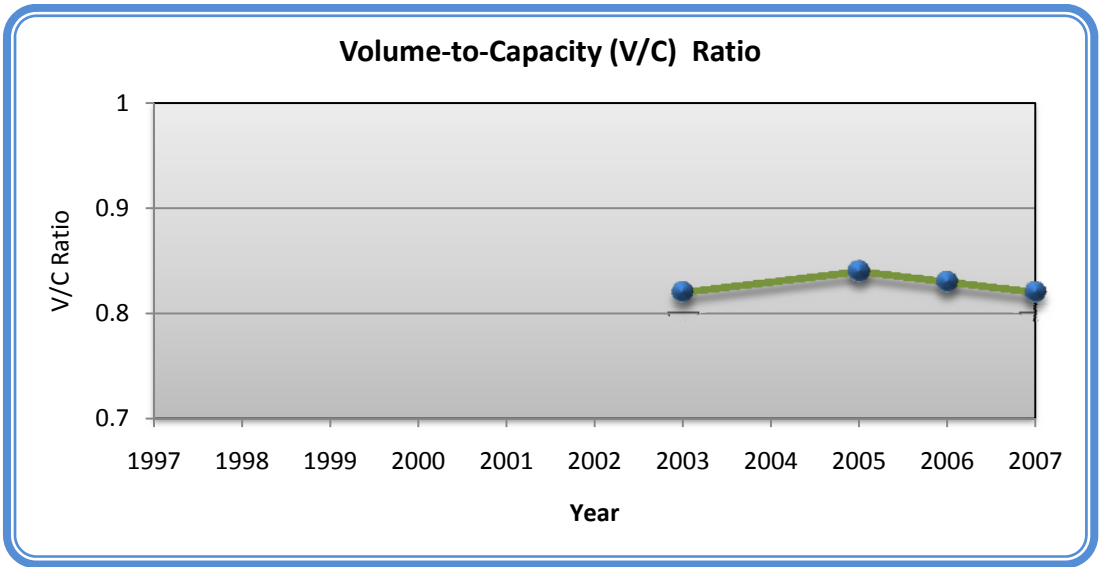
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Vehicle Hours of Travel (VHT) (000s)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Volume-to-Capacity (v/c) Ratio

Definition:

The ratio of peak hour volume to peak hour LOS E capacity (from LOS Handbook) for all roads with traffic counts that are part of the State Highway System.

Results/Analysis:



Source:

Florida Highway Data
LOS Handbook

Methodology:

v/c ratio can be computed as follows:

$$\frac{v}{c} = \sum_{i=1}^{\#links} \text{PkHrVolume}^i / \sum_{i=1}^{\#links} \text{LOS E Cap}^i$$

$$PkHrVolume^i = AADT^i * K - fac^i$$

Where:

Pk Hr Volume ^{i} is the peak hour volume on link i
AADT^i is the Average Annual Daily Traffic on link i,
K-fac^i is the K-factor for link i,

LOSE Cap^{i} is the LOS E capacity based on LOS Handbook for link i.
i=1…# links denotes roadway links in Miami Dade county that are part of Florida's State Highway Sytem,

Traffic counts for roadway links that are part of Florida's State Highway System were obtained from Florida Department of Transportation (FDOT). The count data is in the form of a shapefile which contains Annual Average Daily Traffic (AADT) and K-factor. K-factor was used to convert AADT into peak hour volume. FDOT also publishes data on the number of lanes, functional classification (Interstates, Principal Arterials etc), road type (Divided, Undivided, One-way), and signal location data for every roadway link. The signal location data was used to compute signal densities (signal/mile) for all roadways. The number of lanes, functional classification, road type, and signal densities were used as variables to look up LOS E capacities from LOS Handbook. Thus every roadway link had a peak hour volume and capacity associated with it. The ratio of the sum of peak hour volumes and capacities was computed.

Frequency of Data Collection:

Annual

Data Table:

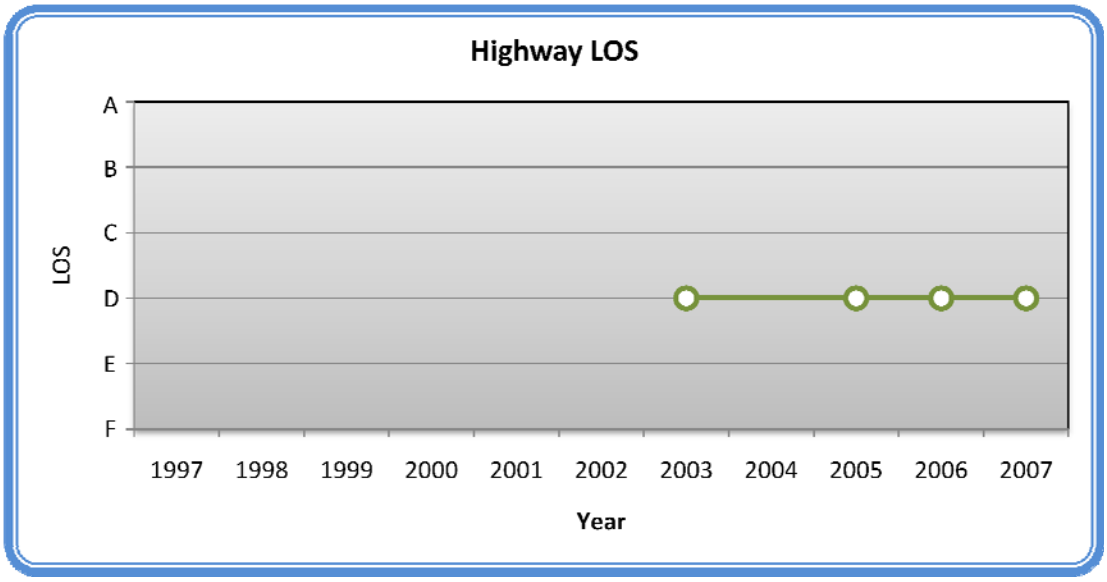
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Volume to Capacity Ratio (V/C)	N/A	N/A	N/A	N/A	N/A	N/A	0.82	N/A	0.84	0.83	0.82

Highway Level of Service (LOS)

Definition:

Refers to a letter grade, A through F, assigned to the State Highway System roadways based on volume–to-capacity ratio.

Results/Analysis:



Source:

Florida Highway Data

Methodology:

Data estimated from v/c ratio as follows:

v/c <=0.5 LOS A
0.5< v/c <=0.7 LOS B
0.7< v/c <=0.8 LOS C
0.8< v/c <=0.9 LOS D
0.9< v/c <=1.0 LOS E
v/c > 1.0 LOS F

Frequency of Data Collection:

Annual

Data Table:

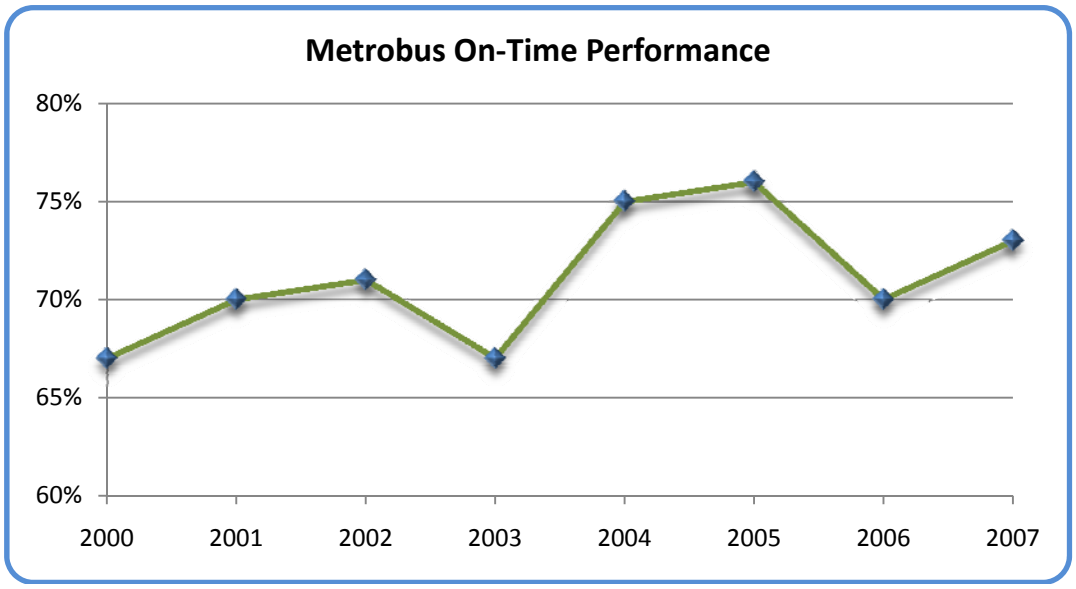
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Highway LOS	N/A	N/A	N/A	N/A	N/A	N/A	D	N/A	D	D	D

Transit Reliability Level of Service (LOS)

Definition:

The letter grade, A through F, assigned to Metrobus, Metrorail, and Metromover reliability of service. The reliability of service is measured as on-time performance.

Results/Analysis:



Source:

Miami-Dade Transit (MDT)

Methodology:

On time performance is obtained from MDT. Transit reliability is a function of OTP defined in TCQSM as follows:

OTP>=95.0 %	*LOS A*
90.0%<= OTP<=94.9 %	*LOS B*
85.0%<= OTP<=89.9 %	*LOS C*
80.0%<= OTP<=84.9 %	*LOS D*
75.0%<= OTP<=79.9 %	*LOS E*
OTP < 75.0 %	*LOS F*

Frequency of Data Collection:

Annual

Data Table:

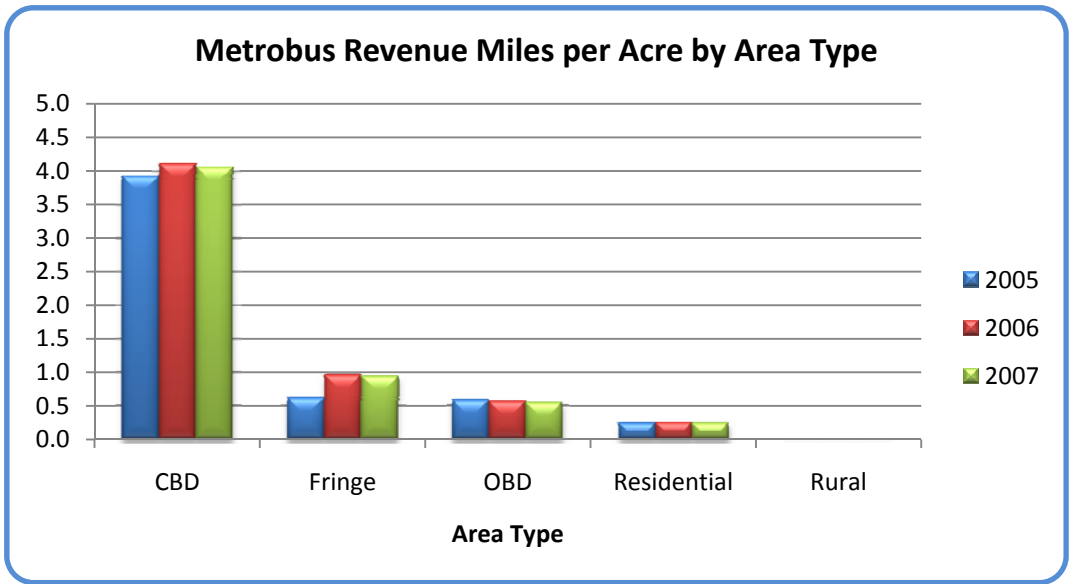
Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Transit Reliability LOS	N/A	N/A	N/A	67%	70%	71%	67%	75%	76%	70%	73%

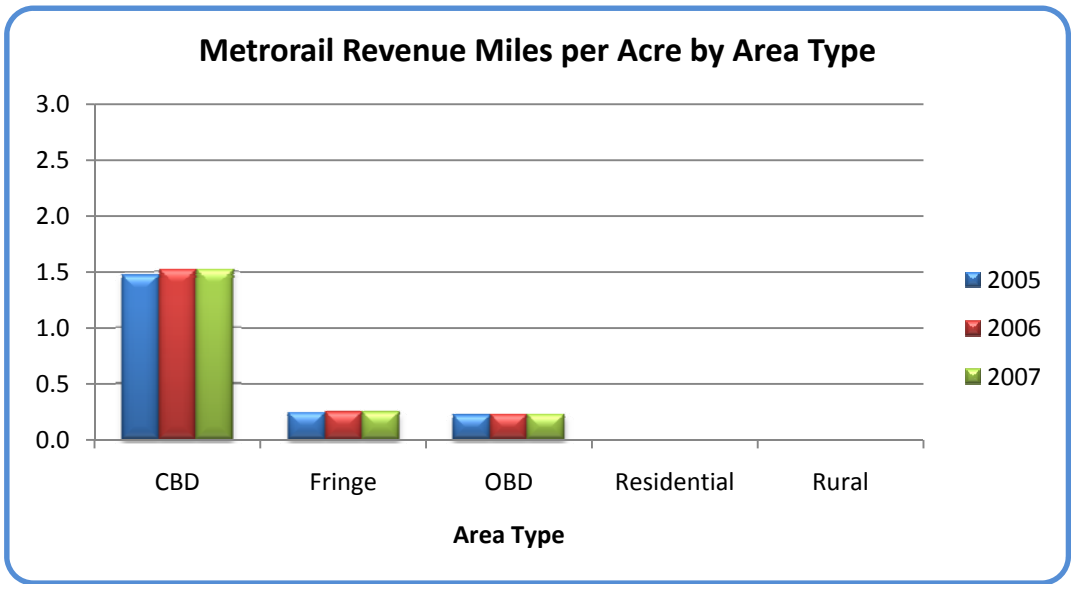
Transit Revenue Vehicle Miles per Acre

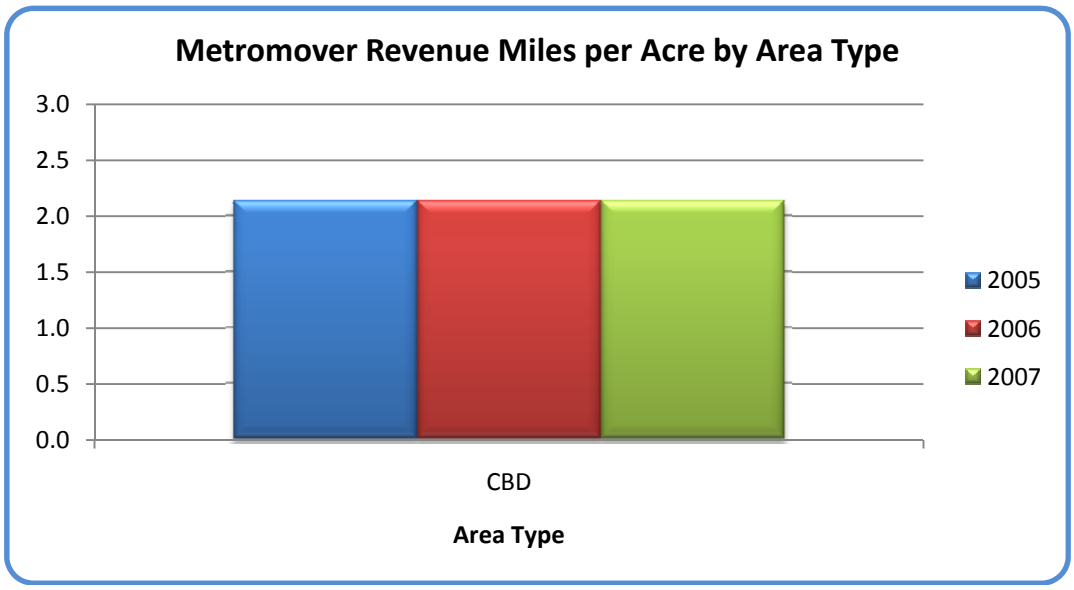
Definition:

The ratio of transit vehicle miles to land area (in acres), by area type. Miami-Dade County is divided into five area types, namely Central Building District (CBD), Fringe, Outlying Building District (OBD), Residential and Rural. The transit vehicle miles per acre are computed separately for Metrobus, Metrorail, and Metromover.

Results/Analysis:







Source:

National Transit Database (NTD)

Methodology:

Metrobus, Metromover, and Metrorail network shapefiles obtained from MDT were utilized to compute transit revenue miles. Headways were added to the database for peak and off-peak periods.

The transit revenue miles were computed for each route using headways, route length and service hour assumptions. It was assumed the transit operates at AM and PM peak hour headways for 3 hrs each and at midday headway for 10 hrs (16 hrs daily operation). The following formula was used to compute the daily revenue miles by route:

$$DTVM=\left(\frac{180}{AMPKHdwy}+\frac{600}{MiddayHdwy}+\frac{180}{PMPKHdwy}\right)*Rt\ Length$$

Where:

DTVM is daily transit revenue vehicle miles

AMPK Hdwy is AM peak hour headway in minutes,

MiddayHdwy is midday headway in minutes,

PMPK Hdwy is PM peak hour headway in minutes, and

RtLength is the route length in miles.

The countywide transit networks were split into area types using the SERPM area type classification. The total transit revenue miles were computed for each area type by summing the revenue miles across all the bus routes that fell in the area type category. For the transit routes that fell into two or more area type categories, the revenue miles were split using the respective route

length in the given area type sectors. The population density (persons/acre) was computed for each area type.

Frequency of Data Collection:

Annual

Peak Period Speed

Definition:

The average speed, on public roadways with speed study data, in Miami-Dade County during morning peak hour and evening peak hour. The roadway peak period speeds are computed for 7 facility types (Interstates, Turnpike/ Freeway, Principal Arterial, Minor Arterial, Major Collector, Minor Collector, and Local Roads) 2 area types (Urbanized and Rural).

Results/Analysis:

N/A

Source:

Speed Survey (Currently, a speed survey is not available. Future speed survey(s) will be utilized.)

Methodology:

Data estimated from Speed Surveys.

Frequency of Data Collection:

5 years

Data Table:

Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Peak Period Speed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Delay Time Due to Congestion

Definition:

The total extra time (in hours) spent by commuters on public roadways in Miami-Dade County, due to congestion.

Results/Analysis:

N/A

Source:

Speed Survey (Currently, a speed survey is not available. Future speed survey(s) will be utilized.)

Methodology:

The delay time due to congestion (DT) can be estimated by taking the difference between actual VHT (defined earlier) and VHT under free flow conditions as follows:

$DT = VHT - VHT^{FF}$

$$VHT^{FF} = \sum_{i=1}^{\#AT} \sum_{j=1}^{\#FT} VMT_i^j / sf_i^j$$

Where:
VHT is the total vehicle hours of travel
VHT^{FF} is the total vehicle hours of travel under free flow conditions
i=1…#AT denotes the different area types classification for which VMT and Speed data is available
j=1…#FT denotes the different facility types classification for which VMT and Speed data is available
VMT_i^j is the VMT on all roadway links that are categorized as facility type i and located in area type j
sf_i^j is the free flow speed on all roadway links that are categorized as facility type i and located in area type j.

Frequency of Data Collection:

Speed Survey (5 years)
FDOT Public Mileage Report (Annual)

Data Table:

Performance Measure	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Delay Time Due to Congestion (Hours) (000s)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

A summary of the available data for each of the aforementioned variables since 1997 is presented in **Table 6**. The values in this table are the same values that are graphed individually for each variable above.

Table 6. Performance Measure Variables

Variable	1990	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Demand Variables												
Area Land (Sq miles)					1,946 [1]							
Population (000s)	1,937 [1]	2,146 [2]	2,172 [2]	2,208 [2]	2,253 [1]	2,286 [2]	2,312 [2]	2,346 [2]	2,380 [2]	2,422 [2]	2,437 [2]	
Households (000s)	692 [1]	731 [2]	738 [2]	751 [2]	777 [1]	788 [2]		810 [2]	821 [2]		847 [2]	
Workers (000s)	902 [1]	972 [2]	976 [2]	984 [2]	993 [2]	1,006 [2]	1,031 [2]	1,024 [2]	1,046 [2]	1,086 [2]	1,115 [2]	
Auto Ownership (000s)					1,169 [7]		1,231 [5]	1,241 [5]	1,249 [5]	1,297 [5]	1,317 [5]	
Employment (000s)		1,021 [2]	1,035 [2]	1,065 [2]	1,088 [2]	1,095 [2]	1,086 [2]	1,079 [2]	1,099 [2]	1,109 [2]		
Work Trips * (000s)					898 [7]		941 [5]	954 [5]	971 [5]	979 [5]	1,038 [5]	
Total Trips				8,787 [10]								
Supply Variables												
Highway Center-Line Miles		6,829 [3]	6,905 [3]	6,905 [3]	6,902 [3]	6,864 [3]	8,818 [3]	8,843 [3]	8,880 [3]	8,916 [3]	8,826 [3]	8,826 [3]
Highway Lane Miles (SHS only)			2,524 [4]	2,528 [4]	2,532 [4]	2,532 [4]	2,550 [4]	2,567 [4]	2,578 [4]	2,600 [4]	2,622 [4]	2,622 [4]
Bi-Directional Metrobus Route Miles		1,554 [6]	1,554 [6]	1,582 [6]	1,655 [6]	1,715 [6]	1,720 [6]	1,744 [6]	1,768 [6]	1,923 [6]	1,930 [6]	
Bi-Directional Metrorail Track Miles		42 [6]	42 [6]	42 [6]	42 [6]	42 [6]	42 [6]	45 [6]	45 [6]	45 [6]	45 [6]	
Bi-Directional Metromover Track Miles		9 [6]	9 [6]	9 [6]	9 [6]	9 [6]	9 [6]	9 [6]	9 [6]	9 [6]	9 [6]	
Bi-Directional Tri-rail Track Miles**							142 [6]	142 [6]	142 [6]	142 [6]	142 [6]	
Metrobus Annual Revenue Vehicle Miles (000s)		23,765 [6]	24,176 [6]	24,367 [6]	24,215 [6]	25,176 [6]	26,294 [6]	27,506 [6]	31,101 [6]	34,223 [6]	36,825 [6]	
Metrorail Annual Revenue Vehicle Miles (000s)		5,739 [6]	6,072 [6]	6,042 [6]	5,986 [6]	7,162 [6]	7,376 [6]	7,701 [6]	9,112 [6]	9,346 [6]	9,690 [6]	
Metromover Annual Revenue Vehicle Miles (000s)		958 [6]	896 [6]	956 [6]	987 [6]	974 [6]	1,011 [6]	1,031 [6]	954 [6]	935 [6]	942 [6]	
Tri-rail Annual Revenue Vehicle Miles (000s)**				1,795 [6]	1,819 [6]	2,022 [6]	1,981 [6]	2,058 [6]	2,049 [6]	2,198 [6]	2,007 [6]	
Metrobus Station Parking Capacity						1,711 [8]						1,861 [12]
Metrorail Station Parking Capacity						7,991 [8]						9,595 [12]
Tri-rail Station Parking Capacity									5,383 [9]		4,794 [9]	

* Journey to work. Relfects worker flows and not actual trips

** Tri-rail statistics are for Miami-Dade, Broward and Palm Beach counties

1: US Census 1990 and 2000
2: BEBR 1998-2007
3: Public Road Mileage 1997- 2006
4: SHS Report 1998- 2006
5: ACS 2002- 2006
6: NTD 1997- 2006
7: CTPP 2000
8: 2002 Miami Dade TDP
9: 2008 Tri-Rail Parking Needs and Opportunities Study
10: SEFTCS
11: Estimated from Florida Highway Data
12: Miami-Dade Transit

Table 6. Performance Measure Variables Cont'd

Variable	1990	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Performance Measures												
Trip Length (minutes)				22 [10]								
HBW Trip Length (minutes)	25 [1]			31 [10]	30 [1]		29 [5]	29 [5]	31 [5]	31 [5]	31 [5]	
Trips by Auto (Daily) (000s)				7,926 [10]								
HBW Trips by Auto * (000s)					794 [7]		859 [5]	882 [5]	885 [5]	878 [5]	929 [5]	
Auto Occupancy				1.34 [10]								
HBW Auto Occupancy					1.10 [7]		1.16 [5]	1.15 [5]		1.22 [5]	1.23 [5]	
Annual Unlinked Trips by Metrobus (000s)		62,014 [6]	62,270 [6]	63,827 [6]	65,821 [6]	65,414 [6]	63,369 [6]	64,547 [6]	75,137 [6]	76,753 [6]	81,637 [6]	
Annual Unlinked Trips by Metrorail (000s)		14,020 [6]	13,483 [6]	13,605 [6]	14,080 [6]	13,735 [6]	13,754 [6]	14,306 [6]	15,638 [6]	17,035 [6]	17,235 [6]	
Annual Unlinked Trips by Metromover (000s)		4,119 [6]	4,053 [6]	4,052 [6]	4,230 [6]	4,856 [6]	4,768 [6]	6,229 [6]	7,769 [6]	9,445 [6]	8,222 [6]	
Annual Unlinked Trips by Tri-Rail (000s)**				2,171 [6]	2,233 [6]	2,544 [6]	2,530 [6]	2,725 [6]	2,821 [6]	2,800 [6]	2,675 [6]	
HBW Trips by Transit * (000s)					44 [7]		51 [5]	50 [5]	50 [5]	56 [5]	65 [5]	
Transit Mode Split				4% [10]								
HBW Transit Mode Split					5% [7]		5% [5]	5% [5]	5% [5]	6% [5]	6% [5]	
Metrobus Percent of Transfers				51% [10]								
Metrorail Percent of Transfers				62% [10]								
Tri-rail Percent of Transfers				53% [10]								
Vehicle Miles Traveled (VMT) (000s)		39,101 [3]	40,276 [3]	40,742 [3]	46,200 [3]	48,963 [3]	51,610 [3]	51,639 [3]	55,999 [3]	56,327 [3]	57,229 [3]	55,903 [3]
Vehicle Hours Traveled (VHT) (000s)												
Volume-to-Capacity (V/C) ratio								0.82 [11]		0.84 [11]	0.83 [11]	0.82 [11]
Highway LOS								D		D	D	D
Transit Reliability LOS					67% [12]	70% [12]	71% [12]	67% [12]	75% [12]	76% [12]	70% [12]	73% [12]
Transit Vehicle Mile /Acre												
Peak-Period Speed												
Delay Time Due to Congestion (000s hr)												

* Journey to work. Relfects worker flows and not actual trips

** Tri-rail statistics are for Miami-Dade, Broward and Palm Beach counties

1: US Census 1990 and 2000
2: BEBR 1998-2007
3: Public Road Mileage 1997- 2006
4: SHS Report 1998- 2006
5: ACS 2002- 2006
6: NTD 1997- 2006
7: CTPP 2000
8: 2002 Miami Dade TDP
9: Tri-rail Parking and Circulation Study, Kimley-Horn and Associates, March 2007
10: SEFTCS
11: Estimated from Florida Highway Data
12: Miami-Dade Transit

5. Data Collection Methodology

5.1 Data Needs for Each Performance Measure

Given the relative lack of data for many of the variables in the identified performance measures, recommended data collection methodologies were developed for those variables. **Table 7** includes the identification of the data sources for each variable, including those variables without currently available data. The recommended data collection needs can be summarized in three distinct data collection efforts, in addition to the readily available data sources. All three of the recommended data collection efforts vary in terms of frequency and methodology, as discussed in subsequent sections.

- **Household Travel Characteristics Survey**
- **Transit On-Board Survey**
- **Highway Speed Survey**

Table 7. Data Availability and Sources

Variables	Variable Type	Availability	Existing Source	Recommended Source	Frequency of Data collection
Variables that require data collection (Model data can supplement observed data)					
Total Trips	Demand	1999	BEBR, HH Survey	BEBR, HH Survey	10 yrs
Trip Length	Perf. Measure	1999	SEFTCS	HH Survey	10 yrs
Trips by Auto	Perf. Measure	1999	SEFTCS	HH Survey	10 yrs
Auto Occupancy	Perf. Measure	1999	SEFTCS	HH Survey	10 yrs
Transit Mode Split	Perf. Measure	1999	SEFTCS	HH Survey	10 yrs
Percent of Transfers (Metobus, Metrorail, Tri-rail)	Perf. Measure	1999	SEFTCS	On Board Survey	5 yrs
Peak-Period Speed	Perf. Measure	None	None	Speed Survey	5 yrs
Delay Time Due to Congestion	Perf. Measure	None	None	Speed Survey	5 yrs
Vehicle Hours Traveled (VHT)	Perf. Measure	None	None	Speed Survey	5 yrs
Variables that can be computed with existing data					
Volume-to-Capacity (v/c) Ratio	Perf. Measure	2003, Annual since 2005	FDOT Highway Data, LOS Handbook	FDOT Highway Data, LOS Handbook	Annual
Highway LOS	Perf. Measure	2003, Annual since 2005	FDOT Highway Data, LOS Handbook	FDOT Highway Data, LOS Handbook	Annual
Transit Vehicle Mile / Area	Perf. Measure	Annual since 2005	NTD, SERPM	NTD, SERPM	Annual
Metrobus Reliability LOS	Perf. Measure	Annual since 2000	MDT	MDT	Annual
Variables with data					
Land Area	Demand	Decennial since 2000	Census	Census	Decennial
Population	Demand	Annual since 1997	BEBR	BEBR	Annual
Households	Demand	Annual since 1997	BEBR	BEBR	Annual
Workers	Demand	Annual since 1997	BEBR	BEBR	Annual
Auto Ownership	Demand	Annual since 2002	ACS	ACS	Annual
Employment	Demand	Annual since 1997	BEBR	BEBR	Annual
Work Trips	Demand	2000, Annual since 2002	CTPP, ACS	ACS	Annual
Highway Center-Line Miles (Public Roads)	Supply	Annual since 1997	FDOT Public Mileage Report	FDOT Public Mileage Report	Annual

Table 7. Data Availability and Sources Cont'd

Variables	Variable Type	Availability	Existing Source	Recommended Source	Frequency of Data collection
Highway Lane Miles (SHS only)	Supply	Annual since 1998	FDOT State Highway System Report	FDOT State Highway System Report	Annual
Bi-Directional Metrobus Route Miles	Supply	Annual since 1997	NTD	NTD	Annual
Bi-Directional Metrorail Track Miles	Supply	Annual since 1997	NTD	NTD	Annual
Bi-Directional Metromover Track Miles	Supply	Annual since 1997	NTD	NTD	Annual
Bi-Directional Tri-rail Track Miles (Entire System)	Supply	Annual since 2002	NTD	NTD	Annual
Metrobus Annual Revenue Vehicle Miles	Supply	Annual since 1997	NTD	NTD	Annual
Metrorail Annual Revenue Vehicle Miles	Supply	Annual since 1997	NTD	NTD	Annual
Metromover Annual Revenue Vehicle Miles	Supply	Annual since 1997	NTD	NTD	Annual
Tri-rail Annual Revenue Vehicle Miles (Entire System)	Supply	Annual since 1999	NTD	NTD	Annual
Metrobus Station Parking Capacity	Supply	2001, 2007	MDT	MDT	Annual
Metrorail Station Parking Capacity	Supply	2001, 2007	MDT	MDT	Annual
Tri-rail Station Parking Capacity	Supply	2006	Tri-rail parking and circulation study	SFRTA	Annual
HBW Trip Length	Perf. Measure	2000, Annual since 2002	CTPP, ACS	ACS	Annual
HBW Trips by Auto	Perf. Measure	2000, Annual since 2002	CTPP, ACS	ACS	Annual
HBW Auto Occupancy	Perf. Measure	Annual since 2005	ACS	ACS	Annual
Annual Unlinked Trips by Metrobus	Perf. Measure	Annual since 1997	NTD	NTD	Annual
Annual Unlinked Trips by Metrorail	Perf. Measure	Annual since 1997	NTD	NTD	Annual
Annual Unlinked Trips by Metromover	Perf. Measure	Annual since 1997	NTD	NTD	Annual
Annual Unlinked Trips by Tri-rail (Entire System)	Perf. Measure	Annual since 1999	NTD	NTD	Annual
HBW Trips by Transit	Perf. Measure	2000, Annual since 2002	CTPP,ACS	ACS	Annual
HBW Transit Mode Split	Perf. Measure	2000, Annual since 2002	CTPP, ACS	ACS	Annual
Vehicle Miles Traveled (Public Roads)	Perf. Measure	Annual since 1997	FDOT Public Mileage Report	FDOT Public Mileage Report	Annual

5.2 Frequency of Data Collection

The frequency of data collection for the different data elements varies depending on the nature of the data and the effort required to collect it. Data elements that have been and will be obtained from the various sources, not including the recommended surveys, generally become available between six months and two years after data collection. For example, the U.S. Census will begin releasing 2010 data no sooner than 2012. This requires the assumption of lead time for tracking purposes in future performance measurement efforts.

In terms of recommended survey efforts, widely accepted practices were considered in developing the recommended frequencies, including Federal Transit Administration (FTA) guidelines and industry standards. Another consideration that must be accounted for in the planned frequency of survey data collection is the cost and extent of the respective survey. The U.S. Census, for example, historically conducts one survey every ten years, given its complexity and sheer size. Scaled down to the county level, the U.S. Census effort is roughly equivalent to a household survey, the last of which was conducted in Miami-Dade County in 1999. Transit surveys, on the other hand, should be conducted at a minimum every five years. Recently, the FTA has determined a different guideline, dependant on service characteristics. The new guideline dictates that major service changes require new transit surveys. An example of this is the Tri-Rail double-tracking that occurred in 2007. An on-board survey was conducted prior to the completion of the double-tracking in 2007. A subsequent survey was completed in October 2008 to comply with FTA guidance.

5.3 Survey Methodology

Each of the three data collection methodologies described below provides an efficient and accurate means of collecting the required information for nine performance variables outlined within this report. (1) The Household Travel Characteristics Survey collects information regarding trip rates, trip lengths, trips by auto, auto occupancy, and transit mode split; (2) Speed Surveys provide data for peak-period speed, delay time due to congestion, and vehicle hours traveled; and, (3)Transit On-Board Surveys supply the percentage of transfers for Metrobus, Metrorail, and Tri-Rail service.

Household Survey Methodology

Variables to be populated by household survey data include both demand and performance measure variables as identified in **Table 7**. Due to the cost and infrequency associated with this type of effort, the household survey should be designed to also capture necessary information to validate the travel demand model, including: trip rates, modal preferences, trip lengths, trip purposes and other travel characteristics of households.

To fulfill the survey objective and to maximize both the number and accuracy of survey results, it is recommended that the primary vehicle for finding satisfactory and volunteer participants for the survey is through an initial focus group presentation. The focus group method serves as the most

efficient means to maximize the number of completed and accurate surveys and to ensure coverage of all relevant demographic categories.

Focus group meetings should be conducted at designated locations throughout the region, selected to ensure they represent the major demographics of the region. As with any survey, the sample must be proportional to the survey universe in order that the results can be generalized to the region. The primary variables by which the focus groups should be categorized include the following:

- **Working versus non-working households**
- **Households with children versus households without children**
- **Distinct auto ownership categories (0, 1, 2, 3+ autos)**
- **Distinct people per household categories**

The reason for the disaggregation of households by these particular variables is that travel characteristics have been documented to depend on these independent variables. These are the variables by which travel is generated in South Florida travel demand model applications.

One of the key purposes of the focus group sessions is to educate participants about the survey purpose and the process associated with completing the survey. Household surveys typically include a large number of questions, some of which can be confusing to some people. The focus group sessions represent an opportunity to communicate and assist people with the documentation of their travel characteristics. The result of the focus groups is a commitment of participants to document their travel behaviors on a designated day and an appointment with a surveyor the following day to complete the questionnaire via telephone.

The primary advantage of the focus group survey methodology as opposed to the mail-out methodology, which typically facilitates distribution across a much wider population, lies in the relative quality of the data. With focus groups, the educational process facilitates a better response, in terms of data quality. The sample size can still be significant, but depends primarily on the resources committed to the effort. The selected sample size must be large enough so that all household survey cells contain enough points to conduct statistical analysis.

Speed Survey Methodology

Speed Surveys should be designed to collect travel time and location information along highway corridors between various facility/area type (FT/AT) combinations. An important component of any highway speed study is to determine the study area. Miami-Dade County includes over 8,800 miles of roadway segmented by 7 facility type or functional classification categories, in accordance with the FDOT Public Mileage Report. The area also can be broken down into five different area types, including Central Business District (CBD), CBD Fringe, Outlying Business District (OBD), Residential, and Rural.

An inventory of the roadway network must be conducted in order to determine the number of links, segments and miles within Miami-Dade County in each area and facility type category. From this inventory, a proportional sample must be selected for speed data collection. It is critical that the 7 categories in the FDOT Public Mileage Report are represented appropriately, so that the data collected in the speed survey is consistent with other data elements that will be computed against speed data.

A minimum number of segments in each facility/area type category should be present for consideration in the data collection effort. For statistical analysis, a sample of each facility/area type combination that contains the minimum number of segments will be used to achieve a 90 percent confidence interval. The sample size for each FT/AT combination shall be calculated by the following standard sample calculation:

$$n = \frac{n_o}{1 + \frac{n_o}{N}}$$

where

n	=	finite population size
n_o	=	sample size, infinite population
N	=	population size, e.g. number of segments in inventory

The calculation will determine which segments are required for surveying in order to achieve a 90 percent confidence interval. To estimate the total number of miles to be surveyed, each facility / area type combination will be divided by the total number of segments in each combination for an average length in miles per segment.

Transit On-Board Survey Methodology

It is recommended that transit on-board surveys be self-conducted and distributed to every passenger boarding Miami-Dade County transit vehicles in the survey period. In order to increase the participation rate, all surveys should be collected prior to the passenger departing the bus; a mail back option may be provided, but not encouraged. Based on the survey objective, to obtain information in order to monitor the performance of the system, it is best that only passengers that have not transferred from a previous bus complete the survey.

The five-year transit on-board survey program for the MPO should involve a phased approach that prioritizes the various parts of the Miami-Dade County transit system. Sampling methodologies should be designed to maximize the data collection effort with the allocated resources. A hybrid survey administration methodology that involves the short form/long form concept used by the U.S. Census can be utilized to maximize data accuracy. For questions that typically are difficult to get accurate answers, like origin/destination and other selected questions, a short-form intercept/interview methodology can be used for a limited sample. For other questions, a self-administered longer questionnaire can be distributed to a larger sample.

The design of the survey instrument(s) for the transit on-board surveys should include all relevant travel demand model validation data needs and should be designed in consultation with various stakeholder groups, including FDOT, MPO, MDT, and their modeling consultants. The goal of the survey should be to satisfy as many needs as possible relative to transit data. Aside from collecting information on variables not represented in other data sources, the transit survey data can be utilized to cross-reference the other data sources. The transit on-board surveys should be administered in accordance with FTA survey design guidelines and guidelines developed in consultation with the survey data users.

The transit on-board survey sampling plan should be guided by available resources, but should be maximized to the extent feasible. Bus surveys should consist of local and express weekday bus runs. Each collection period should consist of multiple bus runs which are a designated series of bus trips made by a single operator. A run may consist of one route or parts of two or more interlined routes. For the purposes of developing the sample, split runs should be counted as two runs.

Sample selection for local bus routes can be random, using a computer program. Randomly selected runs should be analyzed in terms of general route coverage, AM and PM inbound and outbound peak coverage, and ridership information to ensure a representative sample of all routes surveyed. Weekday peak coverage is defined as 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM for both inbound and outbound routes. Runs shall be added as necessary to provide AM and PM inbound and outbound peak coverage for each route.

6. State of the County Report

Changes over the last 10 years in the performance of the Miami-Dade County transportation system can be summarized and analyzed in terms of three categories of variables. The first, demand variables, are characterized by the demand on the transportation system and include population, employment, and other subsets of those two primary variables. The second category consists of supply variables, which are defined by the supply of transportation infrastructure and services. Supply variables include highway lane miles and transit revenue miles. The third and final category of variables can be characterized by performance measures that are a function of the supply and demand variables. The concept is similar to that of the economic principles of supply and demand and their combined impact on the performance of financial systems. Two examples of transportation system performance measures are highway vehicle miles traveled and transit ridership (boardings).

The following analysis provides an assessment of the trends over the last ten years in some of Miami-Dade County's supply, demand, and performance variables.

6.1 Demand Variables

Demand on the transportation system is typically defined by socioeconomic variables such as population and employment, and also travel behavior variables such as number of trips and mode of travel. **Table 1** includes these variables and their trends in Miami-Dade County over the last 10 years. Miami-Dade County's population grew at an annualized rate of 1.4% from 1997 to 2006, while employment grew by a rate of 1.0% from 1997 to 2005. Conversely, the daily vehicle miles traveled on Miami-Dade County state highways (VMT) increased by 3.6% annually over the same period. **Figures 1** and **2** depict those population, employment and VMT growth trends. The contrast in the growth of the demand on the highway system (represented by VMT) relative to the population growth indicates an upward trend in the magnitude of travel on a per capita basis. This is evident in the 2.6% annual growth in work trips made by automobile by Miami-Dade County residents, which is almost double the annual growth in population. The impact of the growth in the number of work trips is reduced somewhat by an annual increase of 1.9% in the average auto occupancy for work trips made by automobile and an annual increase of 4.2% in the transit mode share for work trips. **Figure 3** depicts the work trips by auto and auto occupancy trends and **Figure 4** depicts the work trips by auto and transit mode share trends.

Table 1: Annualized Growth Rates for Demand Variables

Variable	Time period	Annualized Growth Rate
Population	1997 - 2006	1.4%
Employment	1997 - 2005	1.0%
Vehicle Miles of Travel	1997 - 2007	3.6%
Work Trips by Auto	2000 - 2006	2.6%
Work Trip Auto Occupancy	2000 - 2006	1.9%
Work Trip Transit Mode Share	2000 - 2006	4.2%

Figure 1: Population and Daily Vehicle Miles Traveled (VMT) 1997-2007

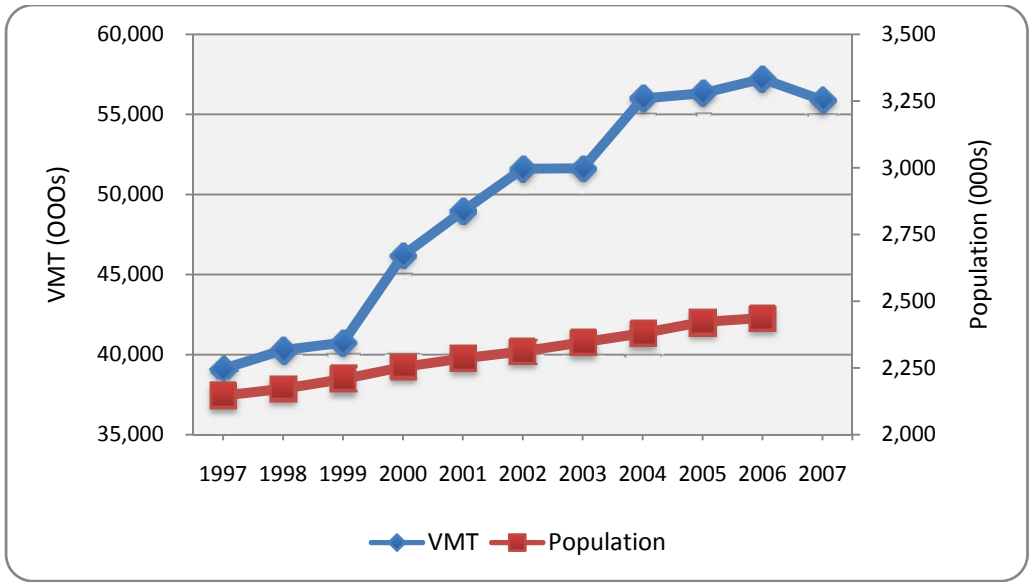


Figure 2: Employment and Daily Vehicle Miles Traveled (VMT) 1997-2007

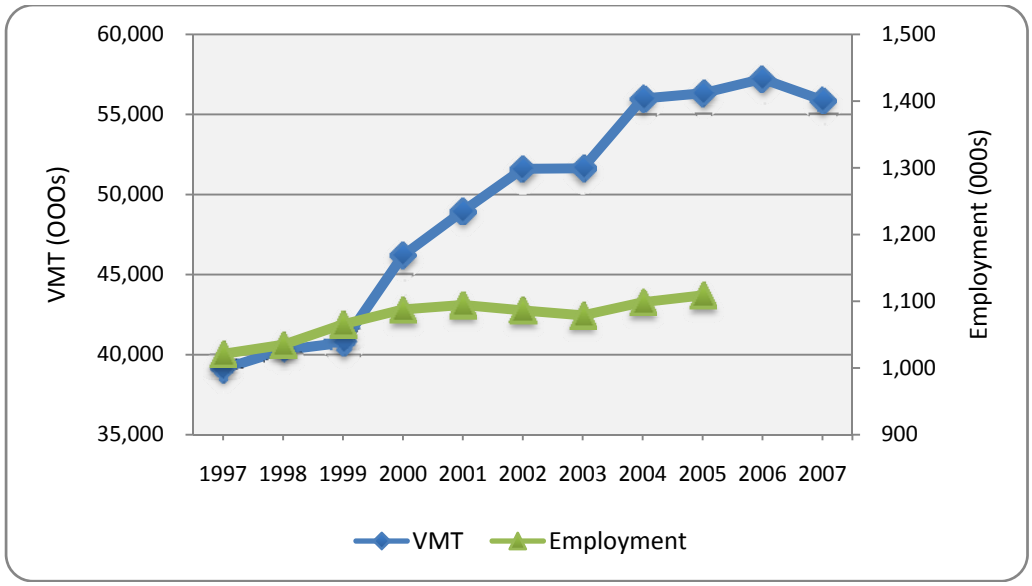


Figure 3: Work Trips by Auto and Work Trip Auto Occupancy

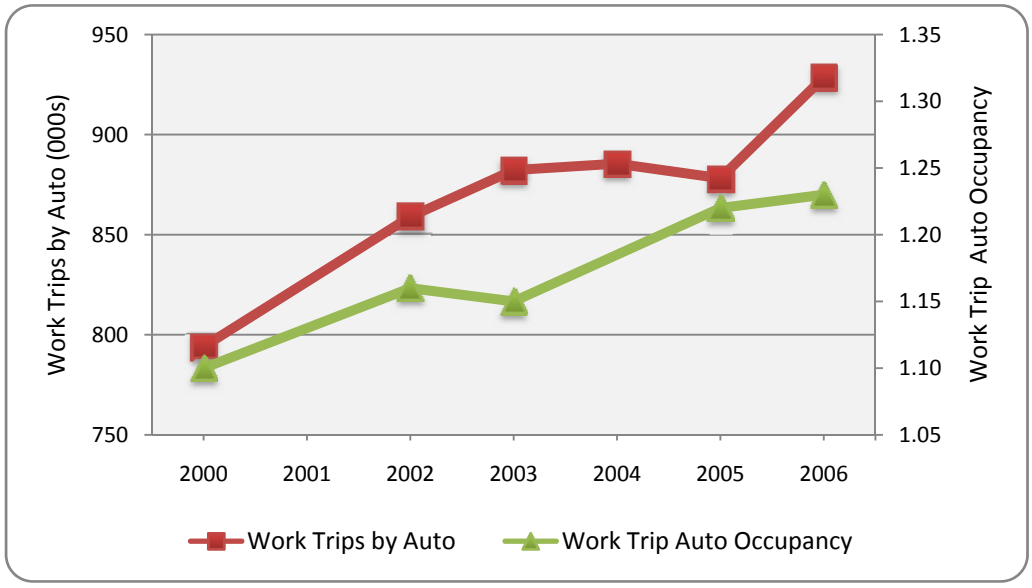
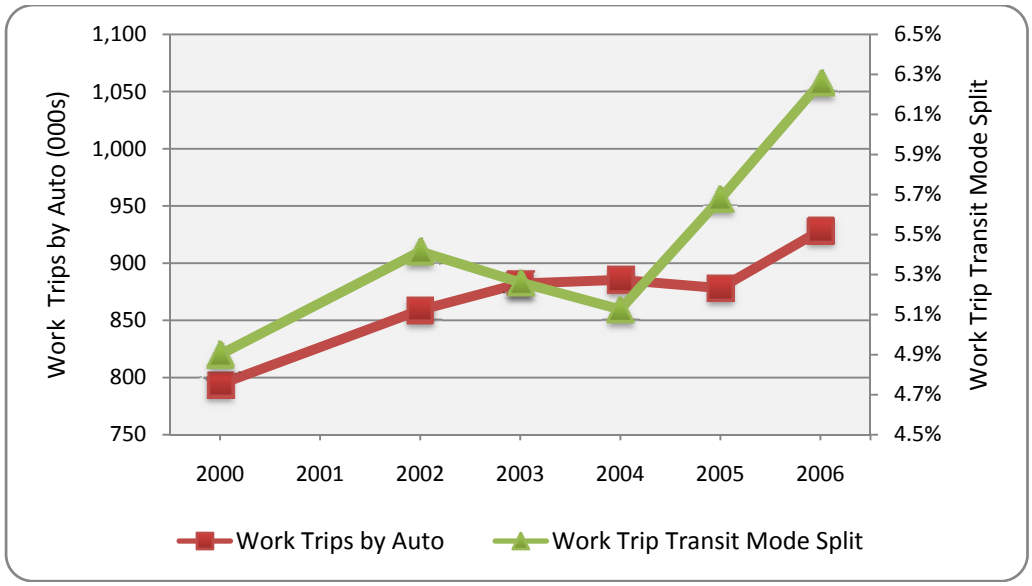


Figure 4: Work Trips by Auto and Work Trip Transit Mode Share



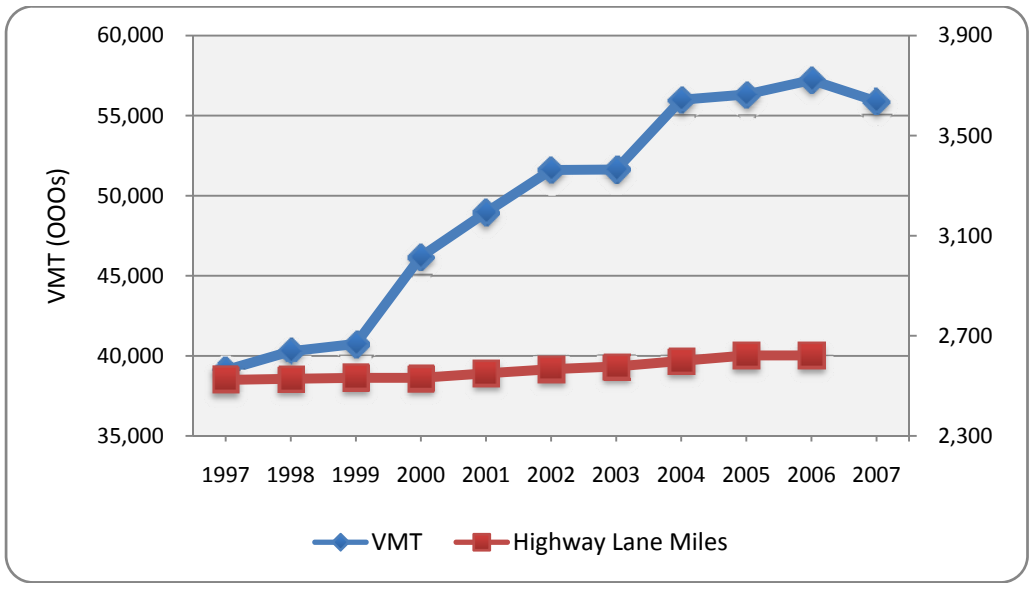
6.2 *Supply and Performance Variables*

The Miami-Dade County transportation system consists of highway and transit infrastructure and service, representing the supply of transportation services. The highway infrastructure grew at a much slower pace than the demand from 1997-2007. **Table 2** includes data on the trends in highway lane miles (State Highways only) and VMT during this period. The annual growth in VMT is nine times greater than the growth in the highway system, indicating a shortage in the supply of highway infrastructure, relative to the demand. **Figure 5** depicts the State Highway Lane miles and VMT growth trends, showing a gross imbalance between the two over the ten year time period. The consequently high level of congestion on the State Highway System in Miami-Dade County has consistently hovered at a level of service "D", on a scale from "A" to "F".

Table 2: Annualized Growth Rates for Highway Supply and Performance Variables

Variable	Time period	Annualized Growth Rate
State Highway Lane Miles	1997 - 2006	0.4%
Vehicle Miles of Travel	1997 - 2007	3.6%

Figure 5: State Highway Lane Miles and Daily Vehicle Miles of Travel (VMT) 1997-2007



The supply of transit service has, depending on the transit mode, in some cases outpaced the demand on the transit system. Transit services can be measured in terms of vehicle revenue miles, defined as the total miles traveled each year by transit vehicles while in revenue service. In the case of Metromover, revenue service after 2002 does not truly generate revenue, but is still referred to as revenue service. The performance of the transit system can be measured in terms of efficiency by relating the supply of transit services to the demand on the system. The Metrorail, Metromover, Metrobus, and Tri-rail systems in Miami-Dade County are discussed individually below, with analysis of the supply, demand, and efficiency of each system.

Metrorail's annual vehicle revenue miles grew at a rate of 6.0% per year between 1997 and 2006, while Metrorail ridership grew at a relatively low rate of 2.3% annually. **Figure 6** depicts the Metrorail vehicle revenue miles and ridership trends, indicating the unbalanced growth in demand at roughly one third of the growth in supply. **Figure 7** depicts a graph of the relative efficiency of Metrorail service, which fell from 2.4 passengers per revenue mile in 1997 to 1.8 in 2006. Metrorail's efficiency declined by 3.5% annually over the 10-year period.

Table 3: Annualized Growth Rates for Metrorail Supply and Performance Variables

Variable	Time period	Annualized Growth Rate
Metrorail Annual Rev. Miles	1997 - 2006	6.0%
Metrorail Annual Boardings	1997 - 2006	2.3%
Metrorail Boardings per Rev. Mile	1997 - 2006	-3.5%

Figure 6: Metrorail Annual Vehicle Revenue Miles and Boardings 1997-2006

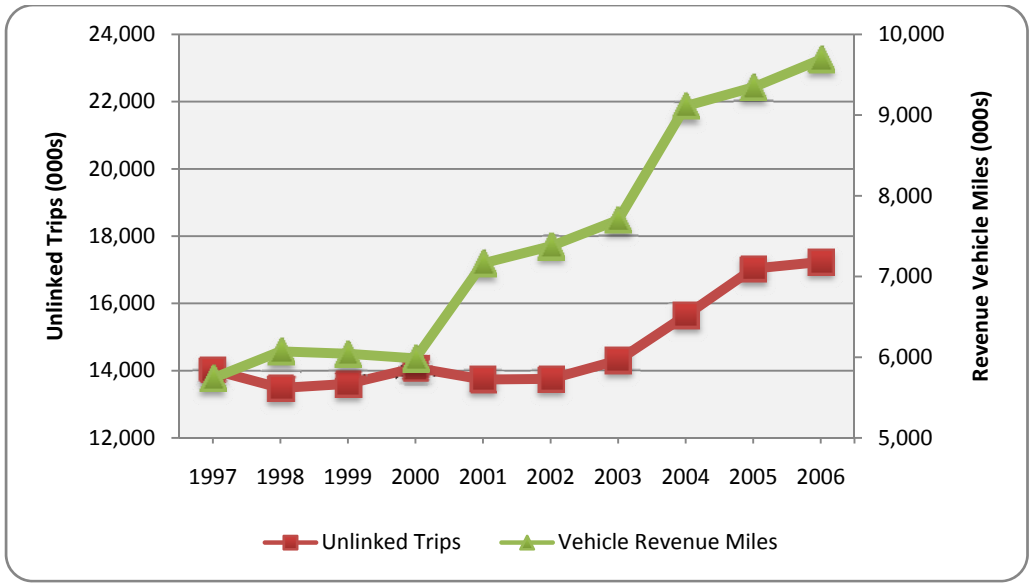
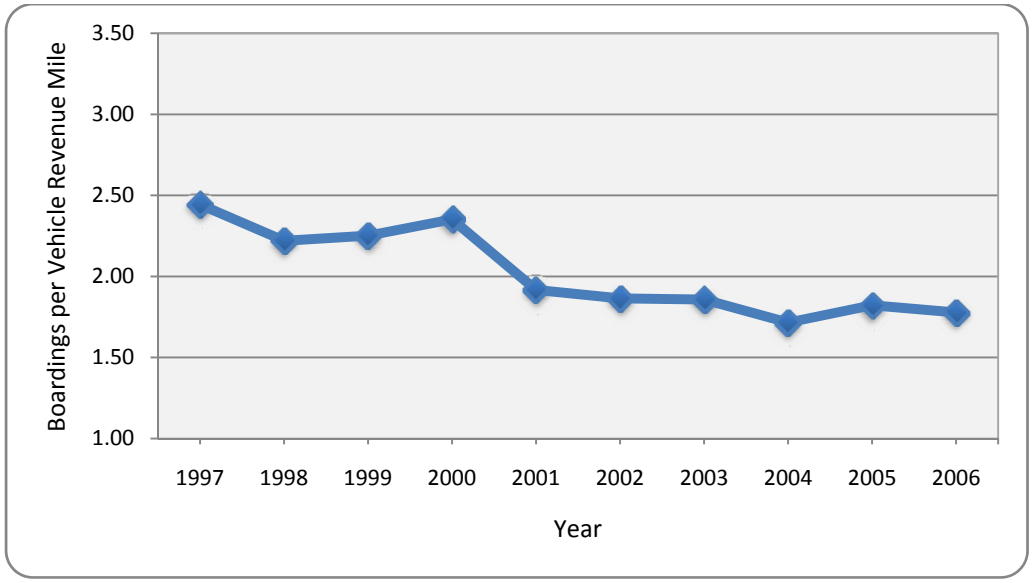


Figure 7: Metrorail Boardings per Vehicle Revenue Mile 1997-2006



Metromover's annual vehicle revenue miles declined at a rate of 0.2% per year between 1997 and 2006, while Metromover ridership grew at an annual rate of 8.0%. **Figure 8** depicts the Metromover vehicle revenue miles and ridership trends, indicating a spike in demand after 2002. This trend can be attributed, in part, to the establishment of free Metromover service at that time. **Figure 9** depicts a graph of the relative efficiency of Metromover service, which increased from 4.3 passengers per revenue mile in 1997 to 8.7 in 2006. Metromover's efficiency rose 8.2% annually over the 10-year period.

Table 4: Annualized Growth Rates for Metromover Supply and Performance Variables

Variable	Time period	Annualized Growth Rate
Metromover Annual Rev. Miles	1997 - 2006	-0.2%
Metromover Annual Boardings	1997 - 2006	8.0%
Metromover Boardings per Rev. Mile	1997 - 2006	8.2%

Figure 8: Metromover Annual Vehicle Revenue Miles and Boardings 1997-2006

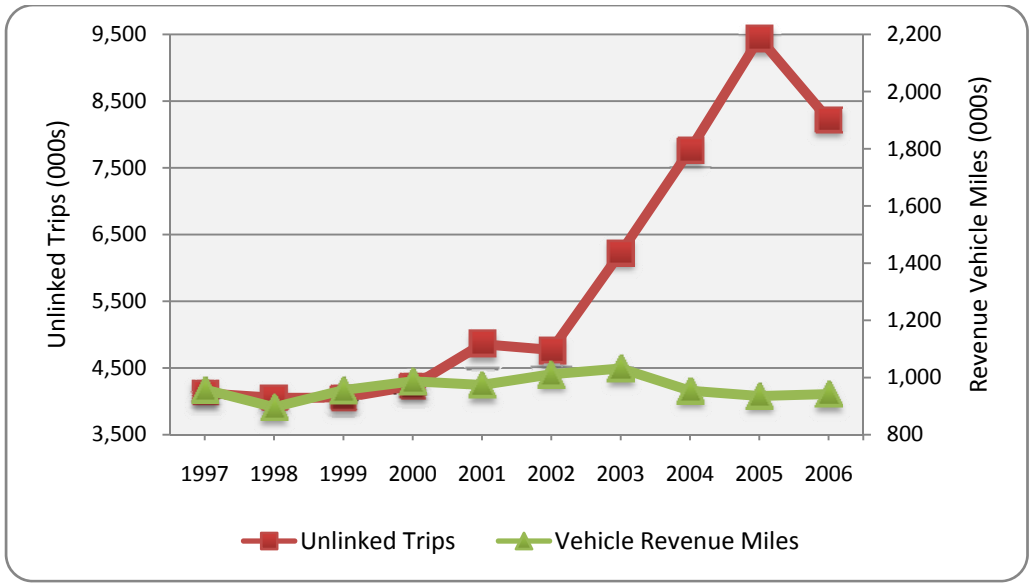
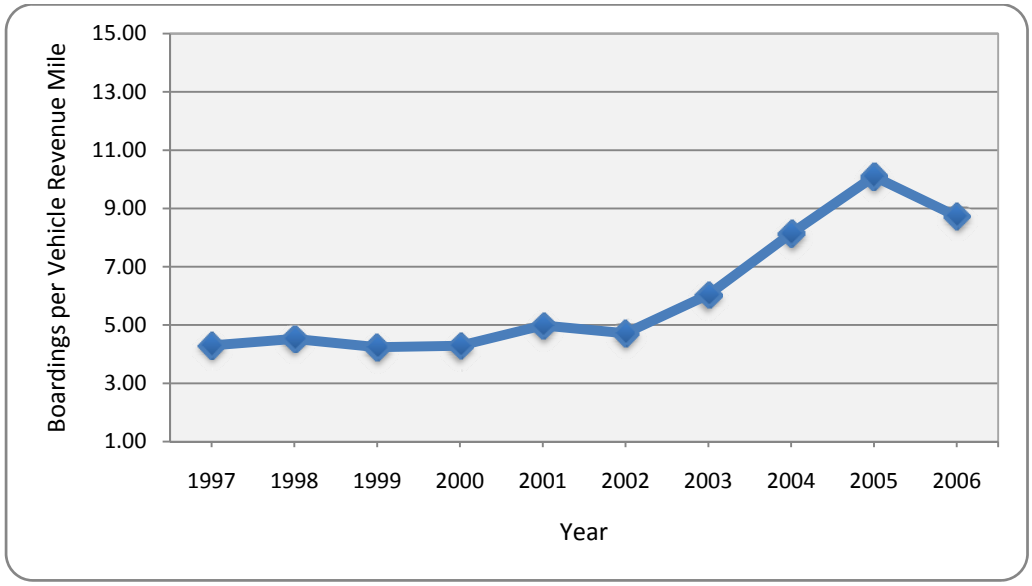


Figure 9: Metromover Boardings per Vehicle Revenue Mile 1997-2006



Metrobus' annual vehicle revenue miles grew at a rate of 5.0% per year between 1997 and 2006, while Metrobus ridership grew at a rate of 3.1%. **Figure 10** depicts the Metrobus vehicle revenue miles and ridership trends, indicating a surge in bus service after 2003, a direct result of the adoption of the People's Transportation Plan and related bus route improvements. The ridership also began rising rather sharply at that time, albeit not quite at the pace of the bus service growth. This imbalance is depicted in **Figure 11**, which shows the relative efficiency of Metrobus service, which fell from 2.6 passengers per revenue mile in 1997 to 2.35 in 2003. Efficiency rose in the subsequent year, but ultimately fell to 2.2 in 2006. The efficiency over the entire period dropped by 1.8% annually.

Table 5: Annualized Growth Rates for Metrobus Supply and Performance Variables

Variable	Time period	Annualized Growth Rate
Metrobus Annual Rev. Miles	1997 - 2006	5.0%
Metrobus Annual Boardings	1997 - 2006	3.1%
Metrobus Boardings per Rev. Mile	1997 - 2006	-1.8%

Figure 10: Metrobus Annual Vehicle Revenue Miles and Boardings 1997-2006

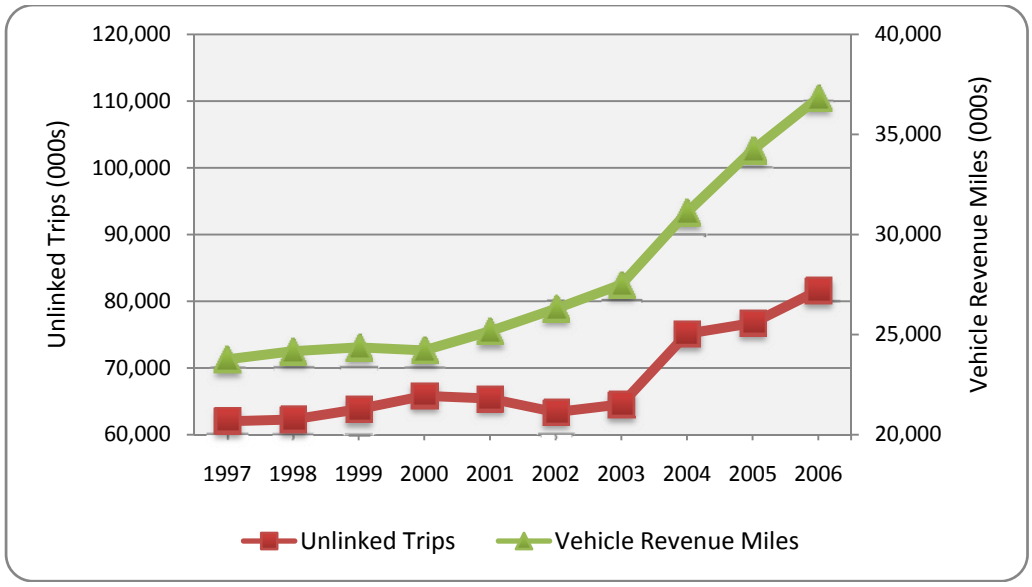
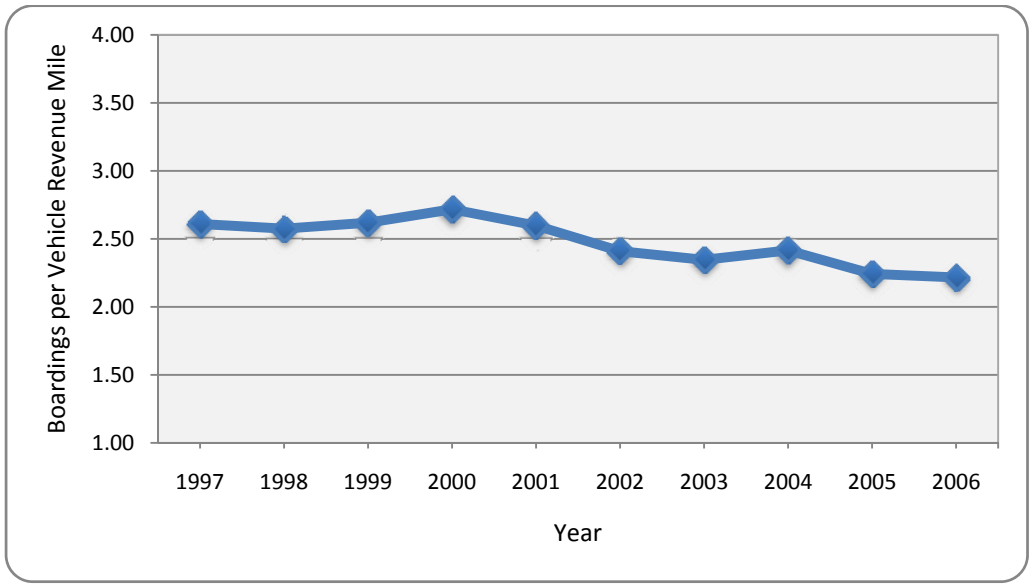


Figure 11: Metrobus Boardings per Vehicle Revenue Mile 1997-2006



Tri-rail's annual vehicle revenue miles grew at a of 1.6% per year between 1999 and 2006, while boardings grew by 3.0% annually over the same period. **Figure 12** depicts the Tri-rail vehicle revenue miles and riderhip trends, indicating a relatively higher growth in the demand, at twice the annual growth of increased service. These data do not reflect the completion of the double-tracking project, which dramatically increased service and ridership in 2008. **Figure 13** depicts a graph of the relative efficiency of Tri-rail service, which rose from 1.2 passengers per revenue mile in 1999 to 1.3 in 2006. Tri-rail's efficiency increased by 1.1% annually over the seven year period.

Table 6: Annualized Growth Rates for Tri-rail Supply and Performance Variables

Variable	Time period	Annualized Growth Rate
Tri-rail Annual Rev. Miles	1999 - 2006	1.6%
Tri-rail Annual Boardings	1999 - 2006	3.0%
Tri-rail Boardings per Rev. Mile	1999 - 2006	1.1%

Figure 12: Tri-rail Annual Vehicle Revenue Miles and Boardings 1997-2006

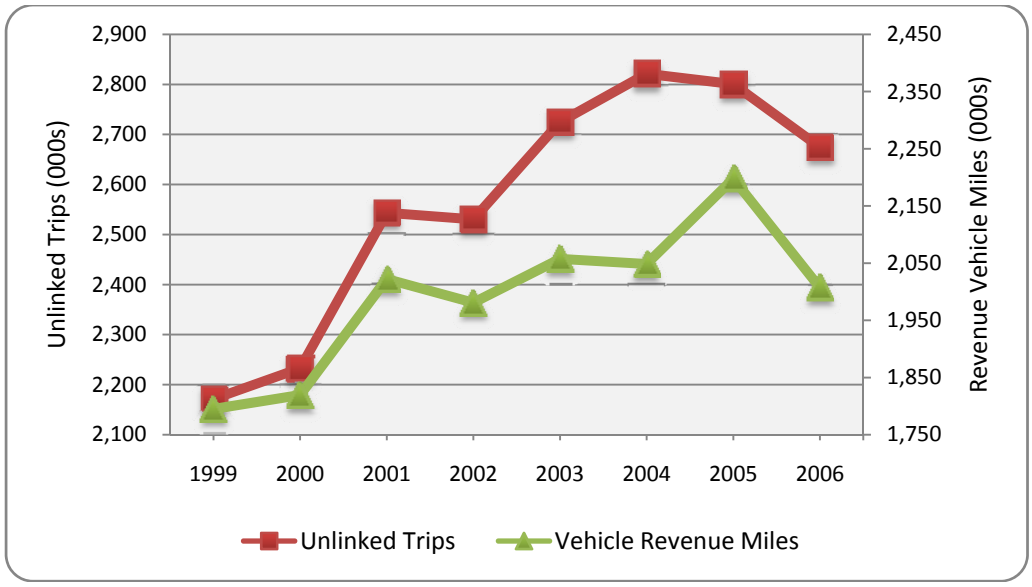
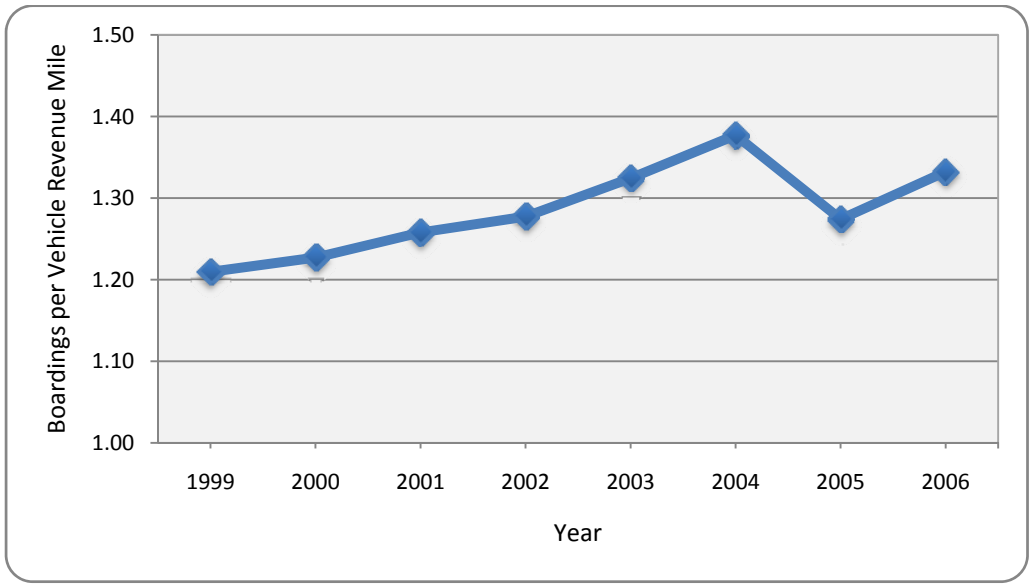


Figure 13: Tri-rail Boardings per Vehicle Revenue Mile 1997-2006



6.3 Summary

The data on supply, demand, and performance measure variables for Miami-Dade was collected from various sources. The trends in the growth rates of the variables were summarized and analyzed. The average growth in demand on the system from 1997 to 2007, defined by population and employment growth, is about 1.2% annually. The growth in the supply of transportation infrastructure has been much slower, ranging from 0.4% on the highway system to 6.0% on the transit system. The performance of the highway system has consistently registered at a level of service "D", while the performance of the transit system, measured as a ratio of ridership to revenue miles, has varied by mode. The efficiency of Metrorail and Metrobus has declined overall since 1997, while Metromover and Tri-rail have experienced overall gains in efficiency. **Table 7** summarizes the demand, supply and performance variables analyzed in this report.

Table 7: Annualized Growth Rates for Performance Measure Variables

Variable		Time period	Annualized Growth Rate
Demand	Population	1997- 2006	1.4%
	Employment	1997- 2005	1.0%
	Vehicle Miles of Travel	1997- 2007	3.6%
	Work Trips by Auto	2000- 2006	2.6%
	Work Trip Auto Occupancy	2000- 2006	1.9%
	Work Trip Transit Mode Share	2000- 2006	4.2%
	Metrorail Annual Boardings	1997- 2006	2.3%
	Metromover Annual Boardings	1997- 2006	8.0%
	Metrobus Annual Boardings	1997- 2006	3.1%
	Tri-rail Annual Boardings	1999- 2006	3.0%
Supply	State Highway Lane Miles	1997- 2006	0.4%
	Metrorail Annual Rev. Miles	1997- 2006	6.0%
	Metromover Annual Rev. Miles	1997- 2006	-0.2%
	Metrobus Annual Rev. Miles	1997- 2006	5.0%
	Tri-rail Annual Rev. Miles	1999- 2006	1.6%
Perf. Measure	Highway Level of Service	1997- 2006	"D"
	Metrorail Boardings per Rev. Mile	1997- 2006	-3.5%
	Metromover Boardings per Rev. Mile	1997- 2006	8.2%
	Metrobus Boardings per Rev. Mile	1997- 2006	-1.8%
	Tri-rail Boardings per Rev. Mile	1999- 2006	1.1%

REFERENCES

Florida Department of Transportation 2004-2005 Short-Range Component & Annual Performance Report, Florida Department of Transportation, March 2005.

Georgia Regional Transportation Authority (GRTA). *2007 Transportation Metropolitan Atlanta Performance Report*. GRTA, 245 Peachtree Center Avenue, NE, Atlanta, GA 30303, 404-463-3000: www.grta.org.

NCHRP Report 446: A Guidebook for Performance-Based Transportation Planning, 2000. Transportation Research Board, National Research Council, Washington, D.C. 2000.

National Cooperative Highway Research Program in association with National Transportation Operations Coalition (NTOC). *Instructions for Pilot Study Participants in support of Guide to Benchmarking Operations Performance Measures NCHRP 20-7, Rev. 1.0 May 2007.* U.S Department of Transportation Federal Highway Administration

National Transportation Operations Coalition (NTOC). *Performance Measurement Initiative: Final Report, July 2005.* U.S Department of Transportation Federal Highway Administration (FHWA).

Performance Measurement Exchange Federal Highway Administration Website. http://knowledge.fhwa.dot.gov/cops/pm.nsf/home. Transportation Research Board, Performance Measurement Committee ABC 30.

Timothy Lomax and David Schrank. *The 2005 Urban Mobility Report, May 2005*. Texas Transportation Institute, the Texas A&M University System, http://mobility.tamu.edu.

Timothy Lomax, et. al. *The Texas Congestion Index: Concept and Methodology. September 2005.* Texas Transportation Institute, the Texas A&M University System, College Station, Texas 77843-3135. Available through the National Technical Information Service: http://www.ntis.gov

Timothy Lomax, et. al. *Measuring Performance in Difficult-to-Measure Areas: Congestion and Reliability Performance Measures.* Transportation Research Board Conference Proceedings 36: Performance Measures to Improve Transportation Systems (August 2004). Transportation Research Board, Washington, D.C. 2005

Transportation Research Circular Number E-C115, April 2007. *Challenges of Data for Performance Measures, a Workshop, July 8, 2006 San Deigo, California*, Transportation Research Board of the National Academies: www.TRB.org.

Washington State Department of Transportation. *Measures, Markers and Mileposts, The Gray Notebook*. WSDOT's Strategic Assessment Office.
www.wsdot.wa.gov/accountability/graynotebook.pdf.

Weekly NAVIGATOR Performance Measures Newsletter, Georgia Department of Transportation, Atlanta, GA30316: www.georgia-navigator.com

Miami-Dade
Metropolitan Planning Organization

Gannett Fleming