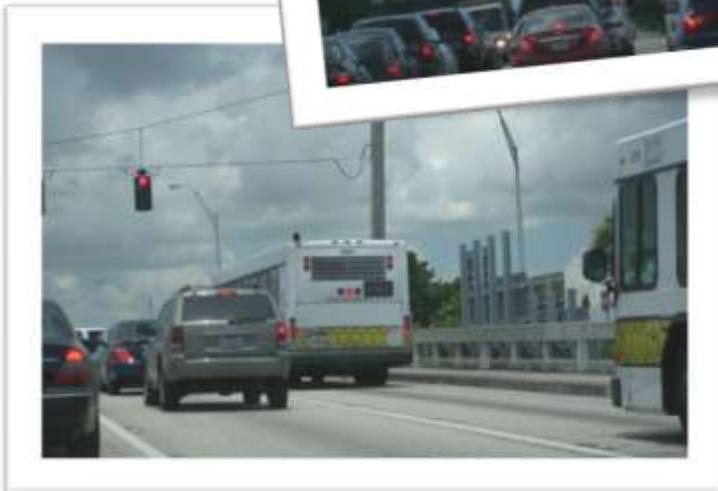
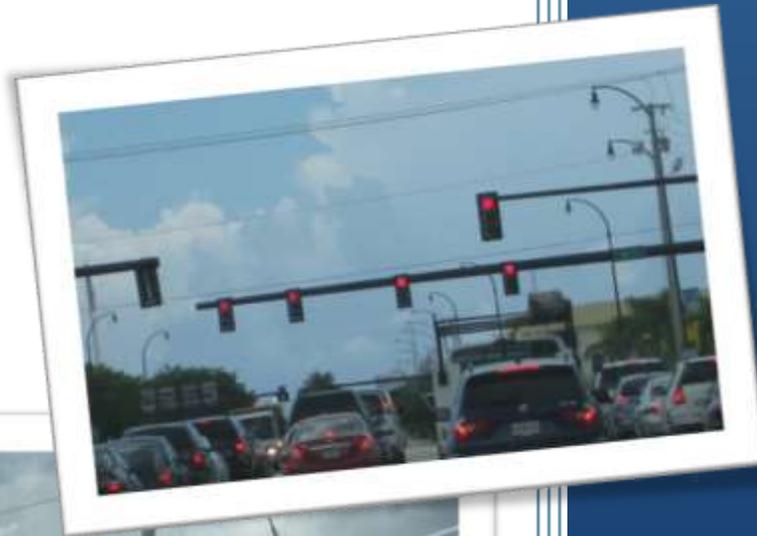


Quarterly TSM&O Performance Measurement Report



Broward County
January 2010



Florida DOT District 4
Transportation System
Management & Operations
Program



Table of Contents

- Table of Contents 2
- Introduction 4
 - TSM&O Performance Measures 4
 - TSM&O Network 5
- Travel Time Index 8
 - Definition 8
 - Purpose 8
 - Objective 8
 - Methodology 8
 - Results & Trends 8
- Arterial Travel Time Delay 14
 - Definition 14
 - Purpose 14
 - Objective 14
 - Methodology 14
 - Results & Trends 14
- Throughput (Vehicle) 20
 - Definition 20
 - Purpose 20
 - Objective 20
 - Methodology 20
 - Results & Trends 20
- Throughput (Person) 27
 - Definition 27
 - Purpose 27
 - Objective 27
 - Methodology 27
 - Results & Trends 27
- Transit Schedule Adherence 30
 - Definition 30
 - Purpose 30
 - Objective 30
 - Methodology 30
 - Results & Trends 31
- Number of Incidents and Incident Duration 32
 - Definition 32
 - Purpose 32
 - Objective 32
 - Methodology 32
 - Results & Trends 32
- Signal System Health 35
 - Definition 35
 - Purpose 35

Objective	35
Methodology.....	35
Results & Trends	36
Work Zone Characteristics	41
Definition	41
Purpose	41
Objective	41
Methodology.....	41
Results & Trends	41
Air Quality	42
Definition	42
Purpose	42
Objective	42
Methodology.....	42
Results & Trends	42
Resources Spent.....	45
Definition	45
Purpose	45
Objective	45
Methodology.....	45
Results & Trends	45

Introduction

As congestion continues to increase disproportionately to funding resources, the current practice of roadway expansion is becoming obsolete. It is clear that a paradigm shift is needed, and the Florida Department of Transportation (FDOT) is responding by developing a statewide Transportation System Management and Operations (TSM&O) program that is expected to address the growing congestion problem within the state. TSM&O will shift the focus of FDOT's strategies to ones that provide mobility outcomes, such as travel time reliability, that maximize the efficiency of the transportation system. TSM&O improves mobility for all users through an emphasis on real-time active management and operations of the existing transportation system. TSM&O is a performance driven program that requires inter-agency coordination and collaboration among the agencies that currently manage and/or operate the transportation system.

The Broward County TSM&O program began with the formation of the Broward County TSM&O Task Team. The Task Team is comprised of the agencies that manage and/or operate the Broward County transportation system, which include Broward County Traffic Engineering Division (BCTED), Broward County Transit (BCT), Broward County Metropolitan Planning Organization (MPO), FDOT Planning, FDOT Traffic Operations, and FDOT Modal Development. The Team has been meeting regularly since its formation in January 2009. Activities to date include defining the Broward County TSM&O Initial Deployment Network and targeted user groups; defining performance measures to begin tracking; and establishing a quarterly performance reporting schedule.

This report represents the third quarterly report on TSM&O performance measurement for Broward County. For purposes of comparison, this report references the results of the second quarterly report for Broward County, published in December 2009.

The quarterly performance measurement reports will be used to identify trends and assist FDOT and Broward County in understanding the causal relationship between resources allocated to specific TSM&O activities and the resulting outcomes. It is expected that TSM&O program activities in Broward County will continue to be refined based in part on what is learned through the performance measurement process.

TSM&O PERFORMANCE MEASURES

The TSM&O performance measures addressed in this report include the following:

- Mobility Performance Measures
 - Travel Time Index
 - Arterial Travel Time Delay
 - Throughput (Vehicle)
 - Throughput (Person)

- Transit Performance Measures
 - Transit Schedule Adherence
- Safety Performance Measures
 - Number of Incidents
 - Incident Duration
- Other Performance Measures
 - Signal System Health
 - Work Zone Characteristics
 - Air Quality
 - Resources Spent

TSM&O NETWORK

Arterial roadways included in the Broward County TSM&O Initial Deployment Network include the following:

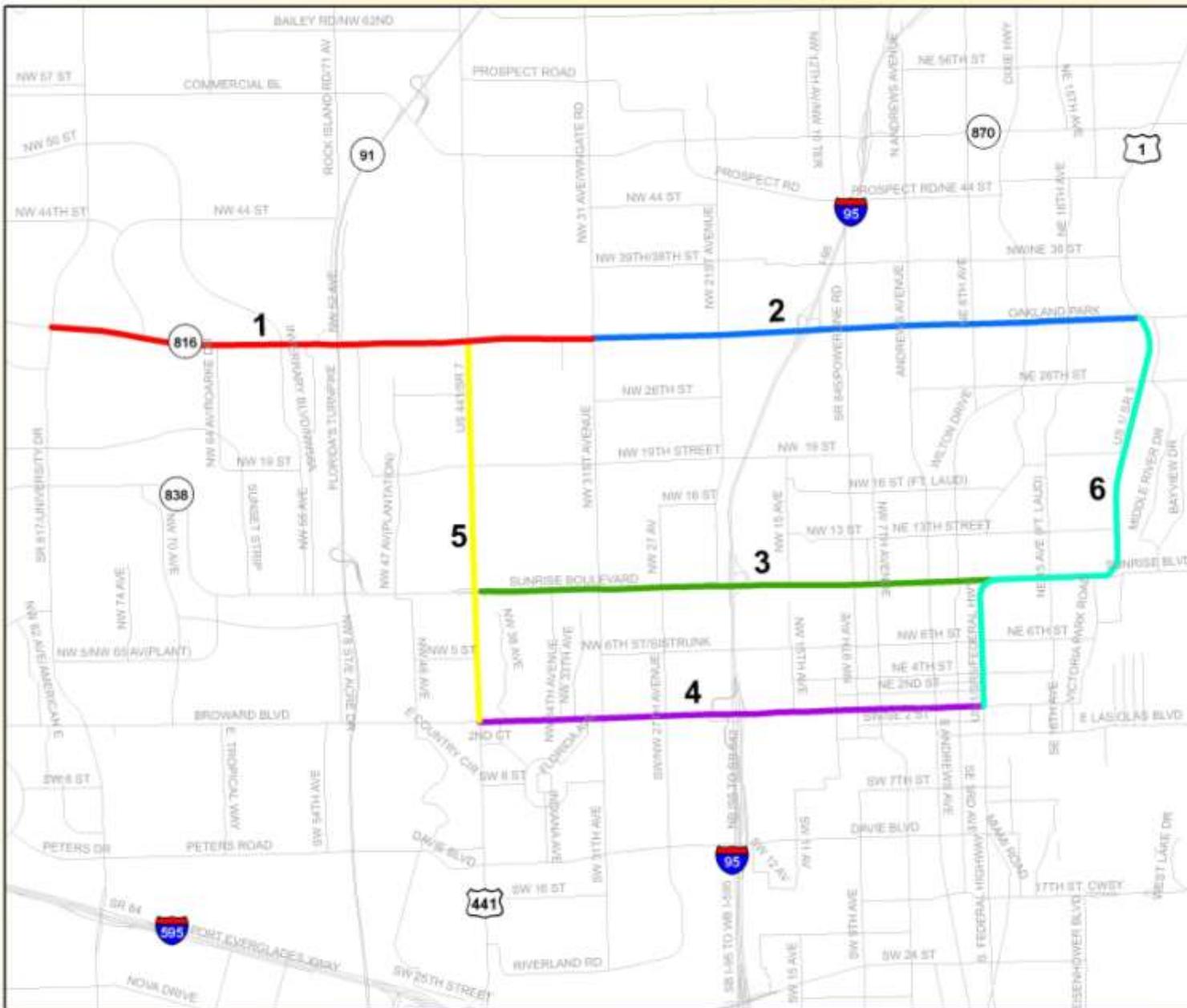
1. Oakland Park Boulevard (West) from SR 817/ University Drive to NW 31st Avenue (3.7 mi)
2. Oakland Park Boulevard (East) from NW 31st Avenue to US 1/SR 5 (3.7 mi)
3. Sunrise Boulevard from SR 7/US 441 to US 1/SR 5 (4.1 mi)
4. Broward Boulevard from SR 7/US 441 to US 1/SR 5/Federal Highway (4.0 mi)
5. SR 7/US 441 from Broward Boulevard to Oakland Park Boulevard (3.1 mi)
6. US 1/SR 5 from Broward Boulevard to Oakland Park Boulevard (4.1 mi)

School zones are located along portions of Sunrise Boulevard and Broward Boulevard.

Maps depicting the Broward County TSM&O arterial network and locations of school zones are shown on the following two pages.

TSM&O Performance Measurement Report

Broward County TSM&O Network



Legend

- TSM&O Arterial Corridors**
- 1 - Oakland Park Blvd. (West)
 - 2 - Oakland Park Blvd. (East)
 - 3 - Sunrise Blvd.
 - 4 - Broward Blvd.
 - 5 - SR-7
 - 6 - US-1
 - Major Roads

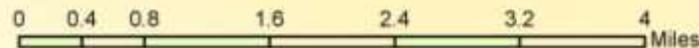
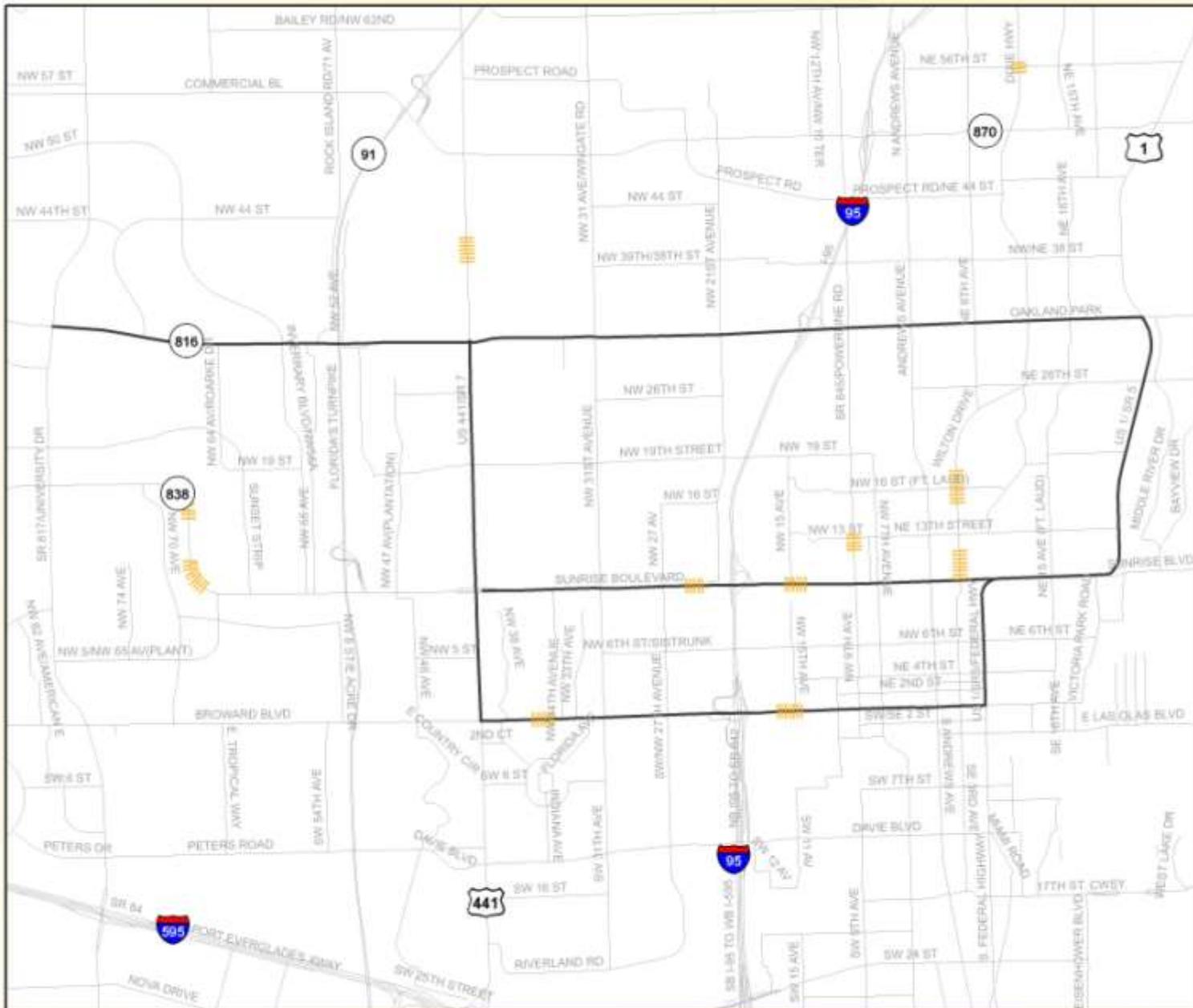


TSM&O Performance Measurement Report

Broward County School Zones

Legend

-  School Zones
-  TSM&O Arterials
-  Major Roads



Travel Time Index

DEFINITION

The Travel Time Index (TTI) is a measure of congestion that describes the average time it takes to travel during peak hours compared to free flow conditions.

PURPOSE

Report a qualitative measure of the variability or uncertainty in the performance of the TSM&O network over time.

OBJECTIVE

Achieve peak period travel time reliability on critical arterial segments in the TSM&O network.

METHODOLOGY

The TTI is calculated as the ratio of average peak travel time to an off-peak (free-flow) standard, as shown in the following equation:

$$\text{Travel Time Index} = \frac{\text{Average Travel Time}}{\text{Free Flow Travel Time}}$$

TTI is reported as an index value. For example, a TTI value of 1.20 means that average peak travel times are 20 percent longer than off-peak travel times. A TTI value equal to or slightly greater than 1 is desired, but may not be realistic for the traffic demands.

TTI is calculated based on travel time data, which are collected by probe vehicles equipped with QSTARZ GPS loggers that record travel time directly while conducting travel time runs along each arterial in the TSM&O network. Travel time runs were conducted on January 13-14, 2010 during the following time periods:

AM peak: from 7 a.m. to 9 a.m.

Midday peak: from 11:30 a.m. to 1:30 p.m.

PM peak: 4 p.m. to 6 p.m.

For purposes of TSM&O performance reporting, the free flow travel time is assumed to be equal to the lowest recorded travel time on the segment of interest (presumed to be the free flow travel time during the off peak period).

RESULTS & TRENDS

Table 1 summarizes the travel time and travel time index results for the Broward County TSM&O network. The table indicates the free flow travel time, average peak period travel time, travel time index, and change compared to previous quarter values. The TTI values highlighted in red indicate the worst congested arterials for each peak period, as well as the arterials

experiencing the greatest increase and decrease compared to last quarter. Figure 1 shows the average travel time for each peak period compared to the free flow travel time, while Figure 2 shows the change in travel time index compared to last quarter.

During the AM peak, the eastbound direction of Broward Boulevard experienced the most congestion, with a travel time index of 1.82. This is a four percent decrease compared to last quarter. For the AM peak period, the southbound direction of SR 7 experienced the greatest increase (21 percent) compared to last quarter, while the eastbound direction of Oakland Park Boulevard (West) experienced the greatest decrease (28 percent). During the midday peak, the eastbound direction of Oakland Park Boulevard (East) experienced the most congestion, with a travel time index of 1.75. The greatest increase of TTI from the last quarter occurred at southbound SR 7 (24 percent) whereas the greatest decrease occurred at eastbound Broward Boulevard (16 percent). During the PM peak, the northbound direction of SR 7 experienced the most congestion, with a travel time index of 2.29. Southbound SR 7 experienced the greatest increase in TTI from the previous quarter (32 percent) whereas westbound Oakland Park Boulevard (East) experienced the greatest decrease (38 percent).

Table 1. Travel Time Index for the TSM&O Network

ID	Arterial Corridor	Dir	Free Flow TT	AM Peak Period			Midday Peak Period			PM Peak Period		
				Average TT	TTI	Change from Last Quarter	Average TT	TTI	Change from Last Quarter	Average TT	TTI	Change from Last Quarter
1	Oakland Park Blvd (West)	EB	6:12	8.46	1.36	-28%	8.98	1.45	5%	11.39	1.84	-6%
		WB	7:00	8.56	1.22	-10%	8.89	1.27	-2%	10.06	1.44	3%
2	Oakland Park Blvd (East)	EB	7:10	10.07	1.40	14%	12.56	1.75	20%	13.14	1.83	19%
		WB	8:07	10.09	1.24	2%	11.46	1.41	8%	12.88	1.58	-38%
3	Sunrise Blvd	EB	8:45	14.39	1.64	14%	12.31	1.41	18%	11.92	1.36	6%
		WB	8:45	10.25	1.17	-9%	11.24	1.28	10%	12.82	1.47	11%
4	Broward Blvd	EB	7:12	13.11	1.82	-4%	9.14	1.27	-16%	10.71	1.49	-8%
		WB	8:11	10	1.22	-8%	10.26	1.25	0%	16.55	2.02	13%
5	SR 7	NB	4:48	7.12	1.48	8%	7.27	1.51	19%	11	2.29	28%
		SB	4:48	6.22	1.30	21%	7.34	1.53	24%	9.25	1.93	32%
6	US 1	NB	6:35	8.89	1.35	2%	9.9	1.50	-32%	10.52	1.60	-3%
		SB	6:40	8.44	1.27	4%	8.82	1.32	3%	10.73	1.61	9%

Figure 1. Average Travel Time on the TSM&O Network

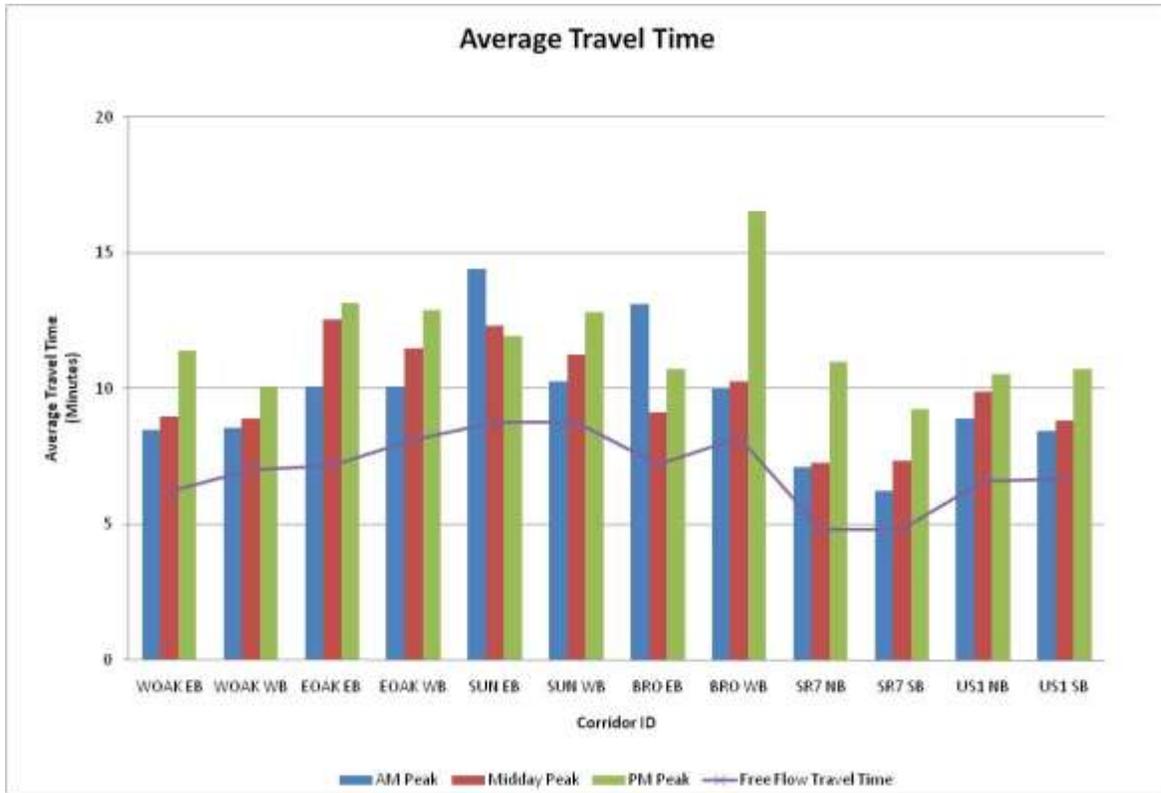
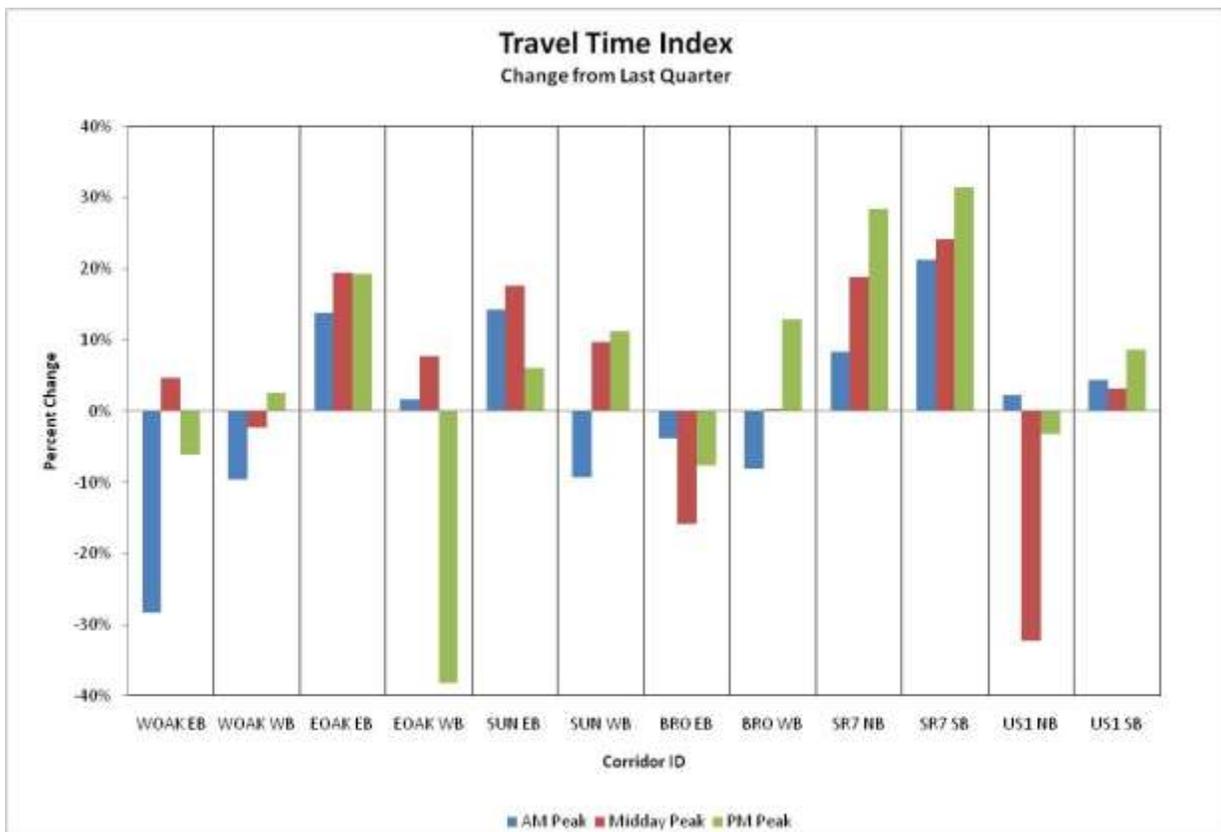


Figure 2. Travel Time Index - Change from Last Quarter



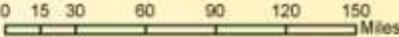
TSM&O Performance Measurement Report

Broward County Travel Time Index AM Peak

Legend

Travel Time Index AM Peak

- 1.09 - 1.25
- 1.26 - 1.50
- 1.51 - 1.75
- > 1.75
- TSM&O Arterials
- Major Roads



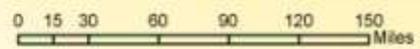
TSM&O Performance Measurement Report

Broward County Travel Time Index Middy Peak

Legend

Travel Time Index Middy Peak

- 1.10 - 1.25
- 1.26 - 1.50
- 1.51 - 1.75
- > 1.75
- TSM&O Arterials
- Major Roads



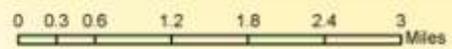
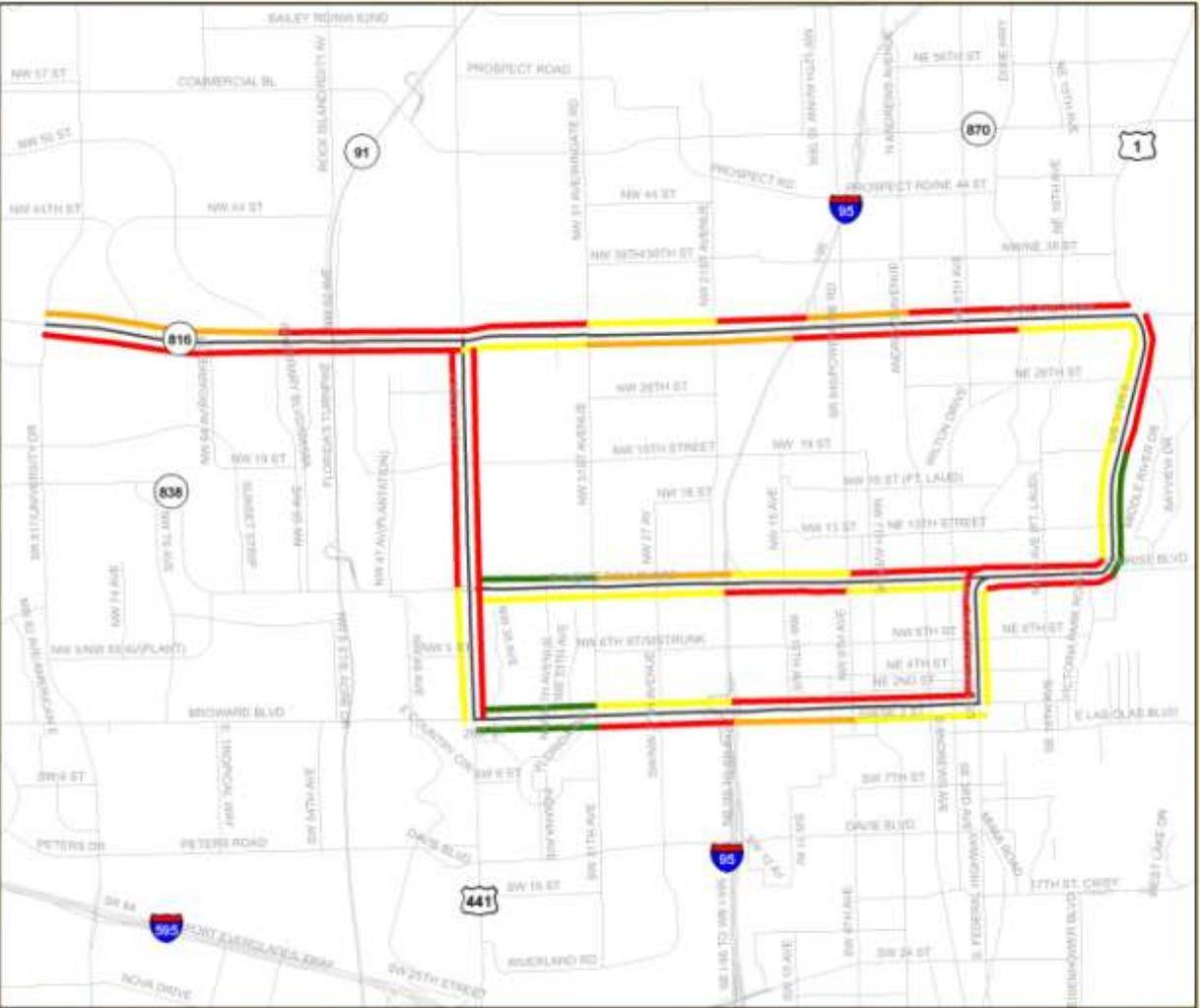
TSM&O Performance Measurement Report

Broward County Travel Time Index PM Peak

Legend

Travel Time Index PM Peak

- 1.17 - 1.25
- 1.26 - 1.50
- 1.51 - 1.75
- > 1.75
- TSM&O Arterials
- Major Roads



Arterial Travel Time Delay

DEFINITION

Arterial travel time delay is the additional travel time beyond the “ideal” (or free flow) travel time experienced by a driver along a corridor. Stopped and control delay are inherently included as part of this measure, since its calculation is based on cumulative travel time runs conducted between the begin and end points of the corridor.

PURPOSE

Report a qualitative measure of arterial travel time delay on the TSM&O network over time.

OBJECTIVE

Reduce delay on critical arterial segments in the TSM&O network.

METHODOLOGY

Average travel time delay is calculated as the difference between the average travel time measured during the peak period, and the free flow travel time, as shown in the following equation:

$$\text{Average Arterial Travel Time Delay} = \text{Average Travel Time} - \text{Free Flow Travel Time}$$

Average travel time delay is calculated based on travel time data obtained from the travel time runs conducted along each arterial in the TSM&O network, as described in the previous section. The average travel time was computed by direction for each corridor and peak period. For purposes of TSM&O performance reporting, the free flow travel time is equal to the lowest recorded travel time for each direction of the corridor across all peak periods (presumed to be the free flow travel time during the off peak period).

RESULTS & TRENDS

Table 2 summarizes the arterial travel time delay results for each arterial in the Broward County TSM&O network. The values highlighted in red indicate the arterial with the highest average arterial travel time delay for each time period, as well as the arterials experiencing the greatest increase and decrease compared to last quarter. Figure 3 shows the average arterial travel time delay for each peak period, while Figure 4 shows the change in arterial travel time delay compared to last quarter.

During the AM peak, the eastbound direction of Broward Boulevard experiences the highest delay, with an average of 5 minutes 55 seconds. The greatest increase in travel time delay occurred at SR 7 southbound (88 percent), whereas the greatest decrease for the AM peak period occurred at eastbound Oakland Park Boulevard (West) (133 percent). The eastbound direction of Oakland Park Boulevard (East) experiences the highest delay during the midday peak, with an average delay of 5 minutes 23 seconds. The greatest increase during the midday

peak occurred at southbound SR 7 (53 percent) and the greatest decrease occurred at northbound US 1 (112 percent). For the PM peak period, Broward Boulevard westbound experienced the greatest delay at 8 minutes 22 second. The greatest increase in delay occurred at southbound SR 7 (46 percent) and the greatest decrease occurred at westbound Oakland Park Boulevard (East).

Table 2. Arterial Travel Time Delay for the TSM&O Network

ID	Arterial Corridor	Dir	AM Peak Period		Midday Peak Period		PM Peak Period	
			Average Delay	Change from Last Quarter	Average Delay	Change from Last Quarter	Average Delay	Change from Last Quarter
1	Oakland Park Blvd (West)	EB	2:16	-133%	2:46	5%	5:11	-28%
		WB	1:34	-53%	1:53	-10%	3:04	8%
2	Oakland Park Blvd (East)	EB	2:54	34%	5:23	31%	5:58	27%
		WB	1:58	-1%	3:20	21%	4:45	-123%
3	Sunrise Blvd	EB	5:38	20%	3:34	51%	3:10	1%
		WB	1:30	-99%	2:29	32%	4:04	23%
4	Broward Blvd	EB	5:55	-8%	1:56	-89%	3:31	-22%
		WB	1:49	-42%	2:05	1%	8:22	26%
5	SR 7	NB	2:19	8%	2:28	45%	6:12	38%
		SB	1:25	88%	2:32	53%	4:27	46%
6	US 1	NB	2:19	1%	3:19	-112%	3:56	-18%
		SB	1:46	11%	2:09	4%	4:04	15%

Figure 3. Arterial Travel Time Delay for the TSM&O Network

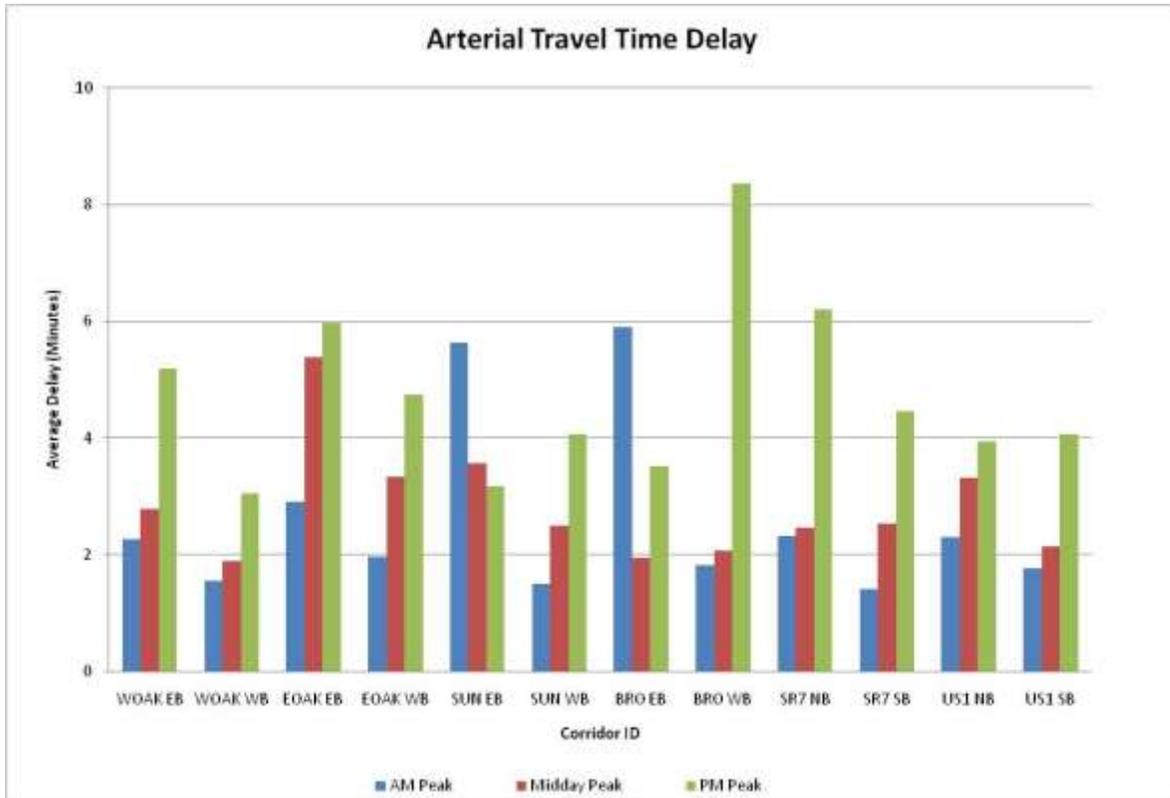
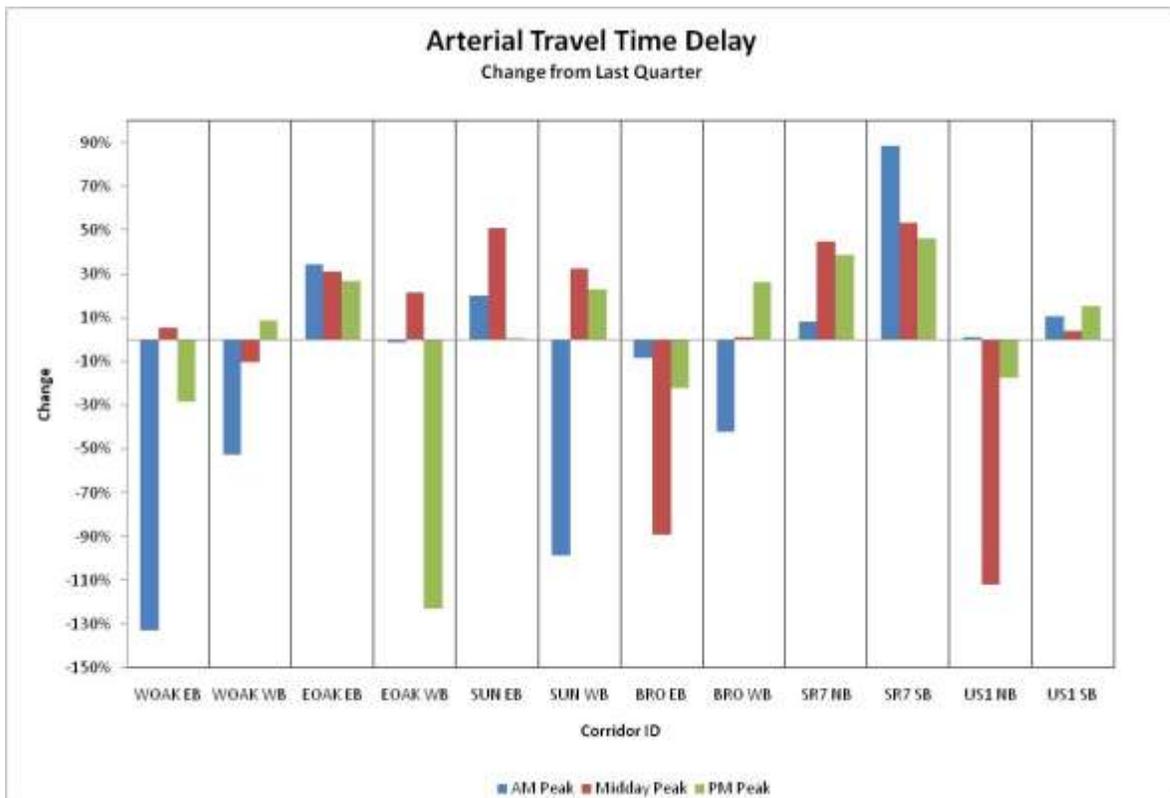


Figure 4. Arterial Travel Time Delay - Change from Last Quarter



TSM&O Performance Measurement Report

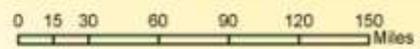
Broward County Arterial Travel Time Delay AM Peak



Legend

Number of Stops AM Peak

- 0.0 - 2.0
- 2.1 - 4.0
- > 4.0
- TSM&O Arterials
- Major Roads



TSM&O Performance Measurement Report

Broward County Arterial Travel Time Delay Middy Peak

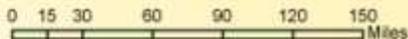


Legend

Number of Stops Middy Peak

- 0.0 - 2.0
- 2.1 - 4.0
- > 4.0

- TSM&O Arterials
- Major Roads



TSM&O Performance Measurement Report

Broward County Arterial Travel Time Delay PM Peak

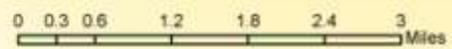


Legend

Number of Stops PM Peak

- 0.0 - 2.0
- 2.1 - 4.0
- > 4.0

- TSM&O Arterials
- Major Roads



Throughput (Vehicle)

DEFINITION

Vehicle throughput is defined as the number of vehicles traversing an arterial during a given peak period.

PURPOSE

Vehicle throughput provides information on how effective the TSM&O network is in moving people and goods through the network.

OBJECTIVE

Increase vehicle volume throughput on the TSM&O network.

METHODOLOGY

Vehicle throughput is calculated based on 24-hour traffic volume counts conducted at 20 Portable Traffic Monitoring Sites (PTMS) located within the TSM&O network, as shown on the map on the following page. The locations in blue depict sites that are maintained by Florida DOT, while the locations in green depict those maintained by the local jurisdiction. Each PTMS location is equipped with in-pavement sensors (loops and/or piezoelectric traffic sensors) and a traffic cabinet. A traffic counter is placed in the cabinet and attached to the in-pavement sensors to collect vehicle volume data for the duration of the data collection period.

Traffic volume data were collected at each PTMS location in 15-minute increments by lane for the period from January 13-14, 2010. The volumes across all lanes was computed for each hour of each day of data collection. An average hourly volume was then computed for each peak period, defined as follows:

AM peak: from 7 a.m. to 9 a.m.

Midday peak: from 11:30 a.m. to 1:30 p.m.

PM peak: 4 p.m. to 6 p.m.

The average hourly volume was then computed across all PTMS locations for each arterial corridor.

RESULTS & TRENDS

Table 3 summarizes the vehicle throughput results for the Broward County TSM&O network. The values highlighted in red indicate the arterial corridors with the greatest change in vehicle throughput compared to the previous quarter for each time period. Figure 5 shows the average hourly vehicle throughput for each peak period, while Figure 6 shows the change in vehicle throughput compared to last quarter.

TSM&O Performance Measurement Report

Broward County Traffic Volume Data Collection Locations

Legend

Traffic Volume Collection Sites

PTMS Locations

- Broward County Managed
- FDOT Managed
- TSM&O Arterial Corridors
- Major Roads



During the AM peak, the eastbound direction of Oakland Park Boulevard (West) had the greatest average vehicle throughput at 2,040 vehicles per hour, and the northbound direction of US 1 had the least at 1,033 vehicles per hour. Sunrise Boulevard westbound had the greatest increase of vehicle throughput from the previous quarter at 3.7 percent, while SR 7 southbound had the greatest decrease at 21.6 percent. During the midday peak, US 1 southbound experienced the greatest vehicle throughput at 1,775 vehicles per hour, and this also marked the greatest quarterly increase during this peak period at 5.9 percent. Broward Boulevard westbound had the least vehicle throughput during the midday peak, at 1,465 vehicles per hour. The greatest decrease in throughput during the midday peak occurred on SR 7 southbound, at 4.5 percent. For the PM peak period, westbound Oakland Park Boulevard (West) experienced the greatest vehicle throughput at 2,092 vehicles per hour, while the eastbound direction of Broward Boulevard had the least at 1,573 vehicles per hour. The greatest quarterly decrease for this time period was on SR 7 southbound at 3.4 percent, and the greatest decrease was on Oakland Park Boulevard (East) westbound at 9.6 percent.

Table 3. Vehicle Throughput for the TSM&O Network

ID	Arterial Corridor	Dir	AM Peak Period		Midday Peak Period		PM Peak Period	
			Average Hourly Volume	Change from Last Quarter	Average Hourly Volume	Change from Last Quarter	Average Hourly Volume	Change from Last Quarter
1	Oakland Park Blvd (West)	EB	2040	-4.0%	1638	4.8%	1824	1.0%
		WB	1426	-4.4%	1643	5.1%	2092	2.2%
2	Oakland Park Blvd (East)	EB	1824	1.1%	1692	0.3%	1754	4.0%
		WB	1413	0.5%	1725	1.0%	2080	9.6%
3	Sunrise Blvd	EB	1905	-1.1%	1589	4.3%	1718	1.7%
		WB	1214	3.7%	1594	-1.9%	2006	1.4%
4	Broward Blvd	EB	1819	-10.7%	1603	-0.9%	1573	1.3%
		WB	1068	-9.1%	1465	-1.9%	2067	-2.7%
5	SR 7	NB	1236	-16.9%	1475	1.5%	1782	0.8%
		SB	1204	-21.6%	1506	-4.5%	1758	-3.4%
6	US 1	NB	1033	-4.5%	1765	4.7%	2027	3.5%
		SB	1478	-3.7%	1775	5.9%	1785	4.3%

Figure 5. Vehicle Throughput for the TSM&O Network

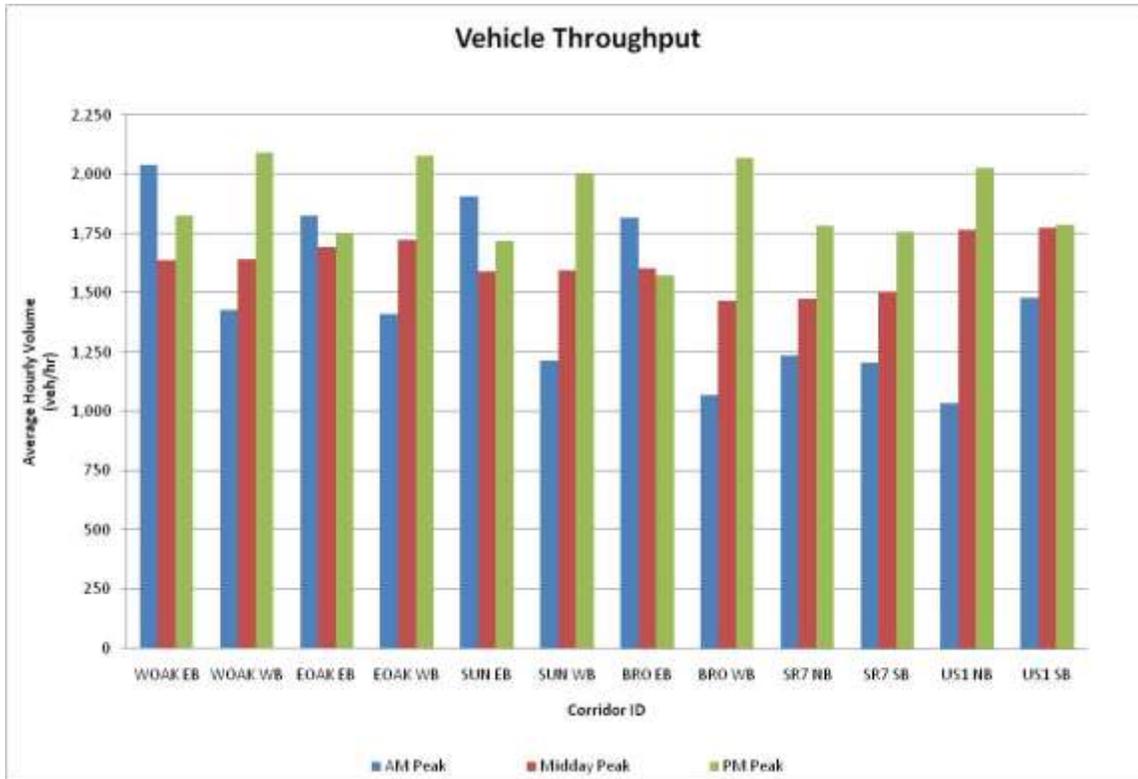
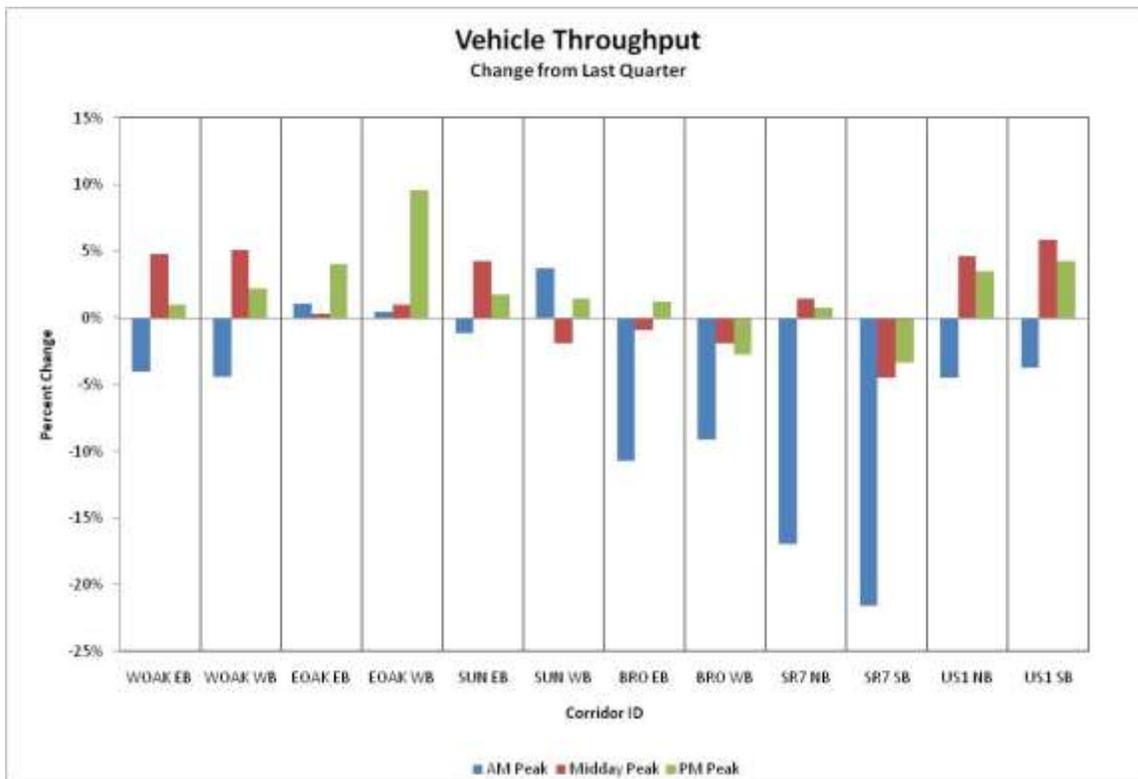


Figure 6. Vehicle Throughput - Change from Last Quarter



TSM&O Performance Measurement Report

Broward County Vehicle Throughput AM Peak

January 2009

Legend

PTMS Volume AM Peak
Hourly Average Volume (vph)

- < 1,800
- 1,801 - 2,199
- 2,200 - 2,599
- > 2,600
- Major Roads
- TSM&O Arterials



TSM&O Performance Measurement Report

Broward County Vehicle Throughput Middy Peak

January 2009

Legend

PTMS Volume MD Peak Hourly Average Volume (vph)

- < 1,800
- 1,801 - 2,199
- 2,200 - 2,599
- > 2,600
- TSM&O Arterials
- Major Roads



0 0.4 0.8 1.6 2.4 3.2 4 Miles

TSM&O Performance Measurement Report

Broward County Vehicle Throughput PM Peak

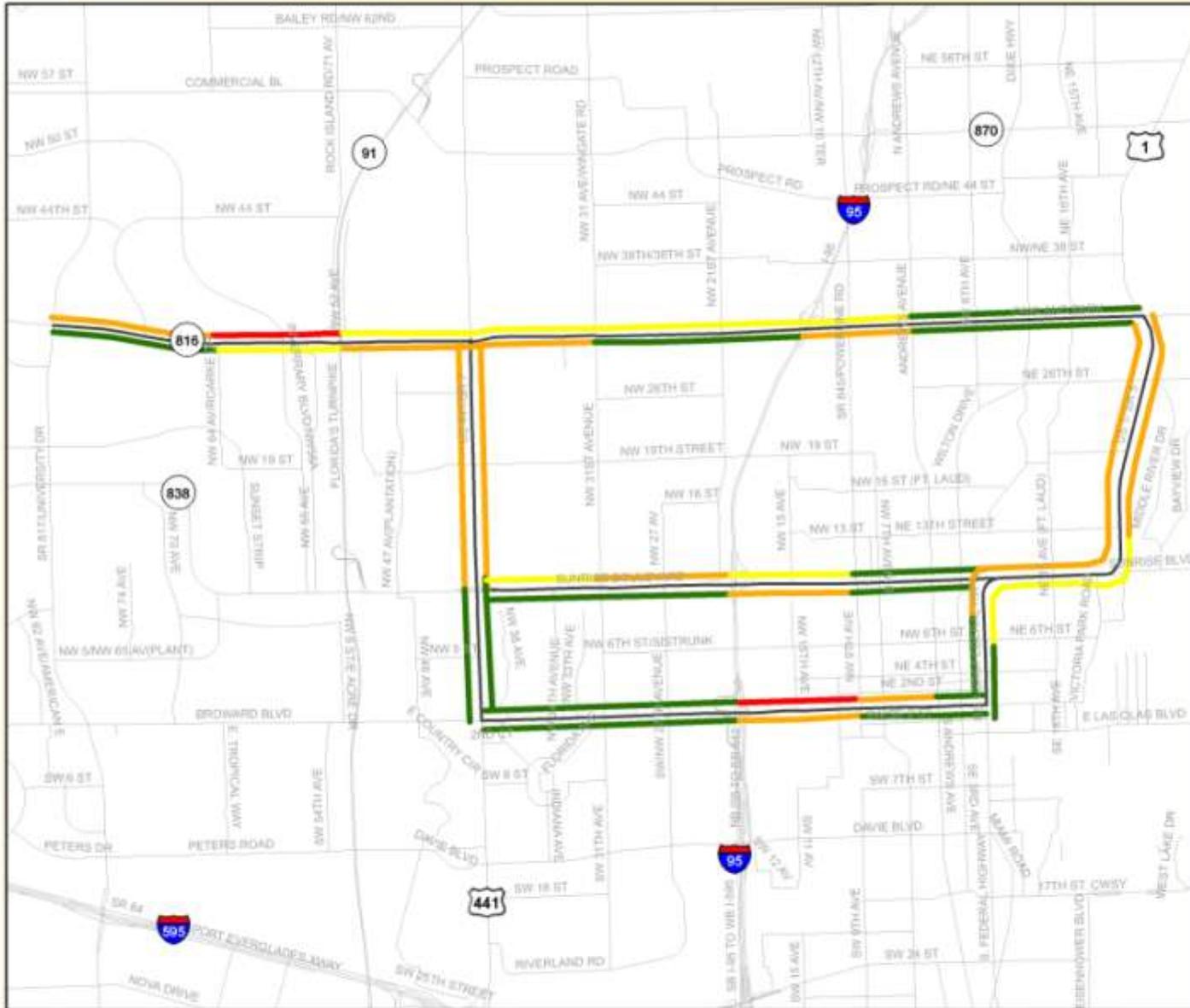
January 2009

Legend

**PTMS Volume PM Peak
Hourly Average Volume (vph)**

- █ < 1,800
- █ 1,801 - 2,199
- █ 2,200 - 2,599
- █ > 2,600

- Major Roads
- TSM&O Arterials



0 0.4 0.8 1.6 2.4 3.2 4 Miles



Throughput (Person)

DEFINITION

Person throughput is defined as the average number of persons traversing an arterial during a given peak period.

PURPOSE

Person throughput provides information on how effective the TSM&O network is in moving people and goods through the network.

OBJECTIVE

Increase person throughput on the TSM&O network.

METHODOLOGY

Person throughput data is based on two data sources: 1) Transit passenger counts provided by Broward County Transit (BCT) on routes within the TSM&O network; and 2) average vehicle occupancy rates provided by the Broward County MPO. Transit passenger counts were not available for this quarter; therefore, person throughput was computed by applying an average vehicle occupancy rate of 1.3773 persons per vehicle to the vehicle throughput results reported in the previous section.

RESULTS & TRENDS

Table 4 summarizes the person throughput results for the Broward County TSM&O network. The values highlighted in red indicate the arterial corridors with the lowest volumes and decrease in person throughput compared to the previous quarter, while the values in green highlight the highest volumes and increase in person throughput. Figure 7 shows the average hourly person throughput for each peak period, while Figure 8 shows the change in person throughput compared to last quarter.

The results follow those for vehicle throughput, with eastbound Oakland Park Boulevard (West) experiencing the highest person throughput and US 1 northbound experiencing the lowest during the AM peak. Southbound US 1 experiences the highest throughput and Broward Boulevard westbound experiences the lowest during the midday peak. Westbound Oakland Park Boulevard (West) experiences the highest throughput and eastbound Broward Boulevard experiences the lowest during the PM peak period.

Table 4. Person Throughput for the TSM&O Network

ID	Arterial Corridor	Dir	AM Peak Period		Midday Peak Period		PM Peak Period	
			Average Hourly Throughput	Change from Last Quarter	Average Hourly Throughput	Change from Last Quarter	Average Hourly Throughput	Change from Last Quarter
1	Oakland Park Blvd (West)	EB	2809	-4.0%	2256	4.8%	2512	1.0%
		WB	1965	-4.4%	2264	5.1%	2882	2.2%
2	Oakland Park Blvd (East)	EB	2513	1.1%	2330	0.3%	2416	4.0%
		WB	1946	0.5%	2375	1.0%	2864	9.6%
3	Sunrise Blvd	EB	2624	-1.1%	2188	4.3%	2367	1.7%
		WB	1672	3.7%	2196	-1.9%	2763	1.4%
4	Broward Blvd	EB	2505	-10.7%	2207	-0.9%	2167	1.3%
		WB	1471	-9.1%	2017	-1.9%	2847	-2.7%
5	SR 7	NB	1703	-16.9%	2031	1.5%	2454	0.8%
		SB	1658	-21.6%	2075	-4.5%	2422	-3.4%
6	US 1	NB	1423	-4.5%	2431	4.7%	2792	3.5%
		SB	2036	-3.7%	2444	5.9%	2459	4.3%

Figure 7. Person Throughput for the TSM&O Network

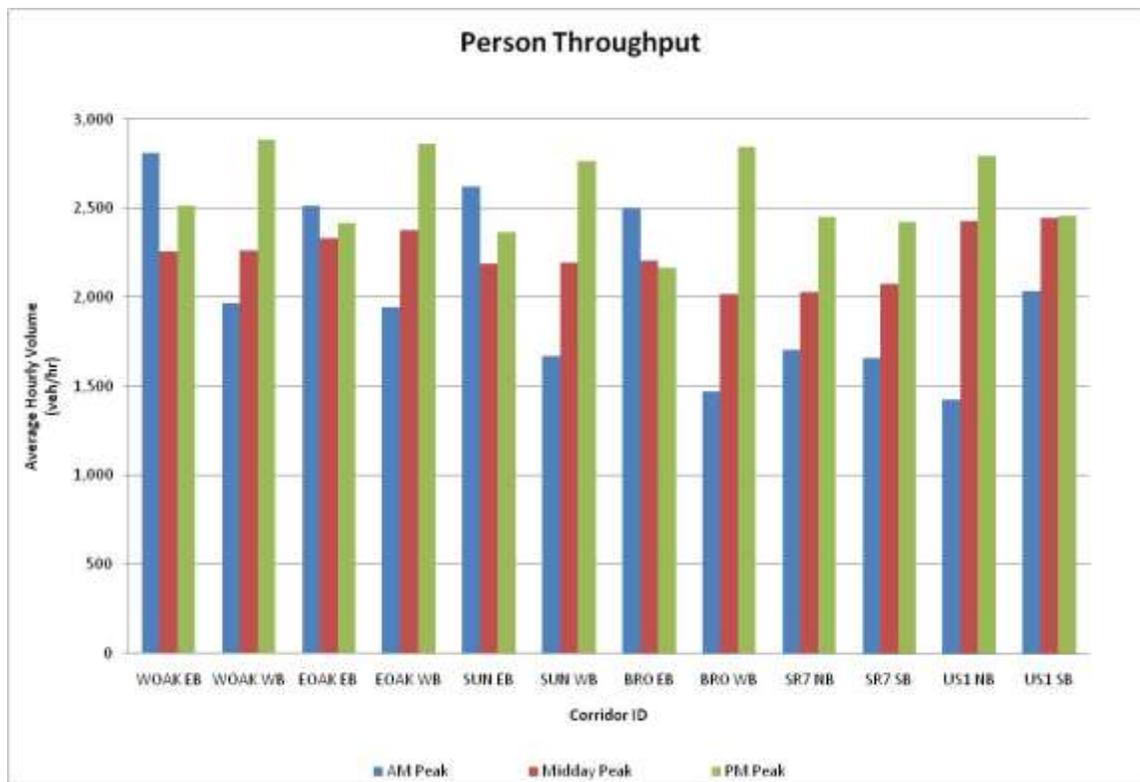
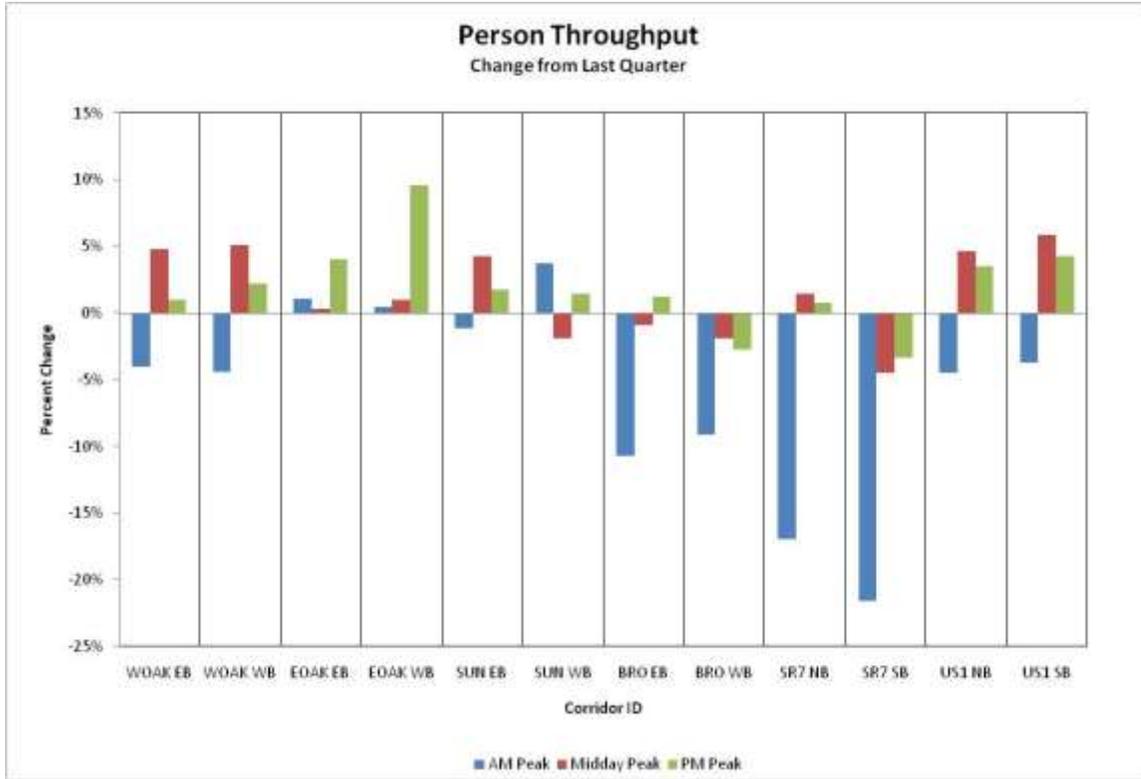


Figure 8. Person Throughput - Change from Last Quarter



Transit Schedule Adherence

DEFINITION

Transit schedule adherence (or on-time performance) is a measure of a bus' ability to adhere to a published schedule. A transit vehicle operating along a fixed route is considered "on-time" if it departs from its scheduled location no more than five (5) minutes early or late.

PURPOSE

Report a qualitative measure of the impact that the TSM&O network has on transit schedule adherence over time.

OBJECTIVE

To track the extent to which fixed route transit vehicles adhere to their pre-determined schedules.

METHODOLOGY

Broward County Transit operates the following local bus routes along the arterials included in the Broward County TSM&O network:

- Route 10 serving US 1
- Route 18 serving SR 7/US 441
- Route 22 serving Broward Boulevard
- Route 36 serving Sunrise Boulevard
- Route 72 serving Oakland Park Boulevard
- Route 441 Breeze serving SR 7/US 441

Transit schedule adherence data for these routes is collected by Broward County Transit (BCT), who runs the report through their Automated Passenger Count (APC) system. BCT is in process of installing an Automatic Vehicle Location (AVL) system, which will be used to report transit schedule adherence when it is operational. FDOT coordinated with BCT to ensure that buses equipped with APC were assigned to the routes within the TSM&O network for the duration of the data collection period.

Data collected includes the number and percent of Very Early Departures (more than 5 minutes early), Early Departures (0 to 5 minutes early), On-time Departures (0 to 5 minutes late), Late Departures (5 to 10 minutes late), and Very Late Departures (more than 10 minutes late). Transit schedule adherence is calculated based on the percent of early and on-time departures (i.e., no more than five minutes early or late). Currently, Broward County Transit has targets aimed at eliminating *all* early departures. A target for eliminating late departures should be established by the TSM&O Task Team.

RESULTS & TRENDS

No transit schedule adherence data could be obtained for the data collection period.

Number of Incidents and Incident Duration

DEFINITION

Incident duration is defined as the period of time from when the agency is first notified or observes an incident to the time when the incident is resolved and the arterial travel lanes are cleared of obstructions.

PURPOSE

Incident duration is included as a performance measure to help identify possible causes of delay on arterials.

OBJECTIVE

Reduce the number and duration of incidents on critical arterial segments in the TSM&O network.

METHODOLOGY

Incident duration data were obtained from the Broward County Sheriff's Office and the City of Fort Lauderdale, as well as from the volunteers who conducted the travel time runs. Data were also obtained from the SMART SunGuide Transportation Management Center incident logs, as Road Ranger Service Patrol provides service on a portion of Oakland Park Boulevard from University Drive to US 1. This area is monitored during the peak hours of 6 a.m. to 9 a.m. and 4 p.m. to 7 p.m., Monday through Friday.

As part of the travel time data collection effort, volunteers keep a log of incidents observed while they are conducting travel time runs. The start time is recorded as the time they pass by the incident, while the clearance time is recorded as the time they observe the incident has been cleared from the roadway. Incident duration is calculated as the difference between the incident start time and the time the incident is cleared, as shown in the following equation:

$$\text{Incident Duration} = \text{Incident Clearance Time} - \text{Incident Start Time}$$

RESULTS & TRENDS

Table 6 summarizes the incident duration results for the Broward County TSM&O network. The values highlighted in red indicate the arterial corridors with the highest incident duration. The location and type of incident are also depicted on the map on the following page.

There were 13 incidents that occurred on the Broward County TSM&O network, with an average incident duration of 29 minutes 45 seconds. This is a significant increase compared to last quarter's average incident duration of 13 minutes. The incident with the highest duration occurred during the midday peak period at 3001 N SR-7 just south of Oakland Park Boulevard. The incident lasted for 2 hours 12 minutes and involved a vehicle crash.

Table 5. Incident Duration for the TSM&O Network

ID	Corridor	Location	Date	Type of Incident	Start Time (hr:min)	Clearance Time (hr:min)	Incident Duration (hr:min)	No. of Incidents	Average Incident Duration (min:sec)	Change from Last Quarter (min:sec)
1	Oakland Park Blvd (West)	At SR-7	13-Jan	Crash	16:07	16:08	0:01	3	0:18:20	0:11:50
		At SR-7	13-Jan	Crash	16:35	17:08	0:33			
		At 5591 W Oak Pk Blvd	13-Jan	Police Assist	13:05	13:26	0:21			
2	Oakland Park Blvd (East)	EB at NE 6th Ave	13-Jan	Disabled vehicle	7:54	8:00	0:06	2	0:33:00	0:15:36
		EB at NE 17th Ave	14-Jan	Police blocking traffic at St. Mark's Church	7:15	8:15	1:00			
3	Sunrise Blvd	At 3295 W Sunrise Blvd	13-Jan	Crash	16:02	16:54	0:52	3	0:56:00	0:37:00
		At 5th NW Terrace	14-Jan	Repair truck	16:00	17:00	1:00			
		WB at Powerline Road	14-Jan	Disabled vehicle	17:55	unk.	unk.			
4	Broward Blvd	WB at SW 17 th Ave	14-Jan	Disabled vehicle	16:20	16:25	0:05	1	0:05:00	0:05:00
5	SR 7/US 441	At NW 21st Street	13-Jan	Crash	16:44	17:49	1:05	5	1:02:12	N/A
		At 2928 N SR-7	13-Jan	Crash	17:07	17:51	0:44			
		At 1190 N SR-7	14-Jan	Medical	16:36	17:00	0:24			
		At 2400 N SR-7	14-Jan	Police assist	12:45	13:31	0:46			
		At 3001 N SR-7	14-Jan	Crash	13:24	15:36	2:12			
Total Number of Incidents / Average Incident Duration								13	0:29:45	0:16:45

TSM&O Performance Measurement Report

Broward County Incident Locations

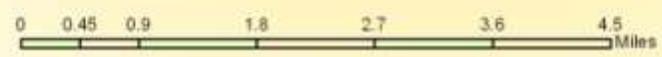


Legend

Incident Locations

Type of Incident

- Crash
- Disabled Vehicle
- Other
- TSM&O Aerial Corridor
- Major Roads
- Roads



Signal System Health

DEFINITION

Signal system health is defined as the number of signals that went offline or lost communication with the central computer located in the Broward County Traffic Management Center. When a signal falls offline, it essentially loses coordination with adjacent signals on the arterial network, which causes user delay.

PURPOSE

Signal system health provides information on the effectiveness of active signal system operation/management strategies.

OBJECTIVE

Reduce the impact of signal system failures on traffic operations on critical arterial segments in the TSM&O network.

METHODOLOGY

Signal system health is based on traffic signal failure data collected by Broward County Traffic Engineering. This data is routinely collected for all signalized intersections in the county, and includes the date and time of the failure, as well as the type of failure (see Table 7). For all Failure IDs except 0, 10 and 15, it is assumed that communications is lost. For Failure IDs 0, 10 and 15, if the failure is chronic, it could lead to communications failure.

Traffic signal failure data were obtained from Broward County for signalized intersections located along the Broward County TSM&O network. The data were obtained for the period from January 13-14, 2010, then parsed to isolate those signal failures occurring during the peak periods for the network, defined as follows:

AM peak: from 7 a.m. to 9 a.m.

Midday peak: from 11:30 a.m. to 1:30 p.m.

PM peak: 4 p.m. to 6 p.m.

The total number of signal system failures was then computed by peak period for each arterial corridor. These include all signal system failures (failure IDs 0, 1, 10, 13, 15, 18, 50 and 51). Controller preemption failures (failure ID 60 and 61) are reported separately.

Table 6. Signal System Failure Codes

Failure ID	Description/Cause	Description/Cause
0	Automatic Repair	Every 15 minutes the central computer checks to see if the signals are online and if they are not, it automatically brings them back online.
1	No Communication Response	Central computer sent a command to the signal and the signal did not respond.
10	Controller Stuck	
13	Offset Synchronization Failure	Signal was unable to reach the predefined offset in the allotted amount of time. This can happen when the signal is transitioning between timing patterns.
15	Excessive Clearance Time	
18	Flash	Signal is flashing yellow. Signals are sensitive to changes in voltage, making them vulnerable to lightning and power surges.
50	Maintenance Preemption Finished	Police officer may be manually operating the signal or a technician may be working on the signal.
51	Maintenance Preemption in Progress	
60	Controller Preemption Finished	An emergency vehicle or a train is passing through an intersection causing the signal to turn red for the opposing movements.
61	Controller Preemption In Progress	An emergency vehicle or a train is passing through an intersection causing the signal to turn red for the opposing movements.

RESULTS & TRENDS

Table 8 summarizes the signal system health performance for the Broward County TSM&O Network. The values highlighted in red indicate the arterial corridors with the highest number of signal failures during each peak period. The location and number of signal system failures are also shown on maps for each peak period.

There were five signal failures during the AM peak period on Sunrise Boulevard, and four on Broward Boulevard. During the midday peak, there were 14 total signal failures, all on Broward Boulevard. During the PM peak, there were 44 total signal failures, with Sunrise Boulevard experiencing the majority of the failures with 25 occurrences, and Broward Boulevard again second with 17 failures. There were a total of 67 traffic signal failures for the entire duration of the data collection period.

Table 7. Signal System Health for the TSM&O Network

ID	Corridor	AM Peak			Midday Peak			PM Peak		
		Number of Pre-emptions	Number of Failures	Change in Failures from Last Quarter	Number of Pre-emptions	Number of Failures	Change in Failures from Last Quarter	Number of Pre-emptions	Number of Failures	Change in Failures from Last Quarter
1	Oakland Park Blvd (West)	0	0	-8	32	0	-9	19	0	-10
2	Oakland Park Blvd (East)	38	0	0	37	0	0	38	2	2
3	Sunrise Blvd	14	5	-4	20	0	-18	10	25	5
4	Broward Blvd	2	4	0	18	14	-7	22	17	17
5	SR-7	8	0	0	24	0	0	34	0	0
6	US-1	0	0	-18	0	0	0	0	0	0
Total		62	9	N/A	131	14	N/A	123	44	N/A

TSM&O Performance Measurement Report

Broward County AM Peak Signal System Health



Legend

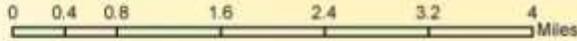
Signal Health Fail Rate

- 2-3
- 4

TSM&O Aerial Corridor

Major Roads

Roads



TSM&O Performance Measurement Report

Broward County Midday Peak Signal System Health



Legend

Signal Health

- 1
- 13

— TSM&O Arterial Corridors

— Major Roads

— Roads



TSM&O Performance Measurement Report

Broward County PM Peak Signal System Health

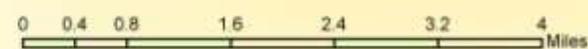


Legend

Signal Health Fail Rate

- 2
- 3 - 6
- 7 - 15

— TSM&O Arterial Corridor
 — Major Roads
 — Roads



Work Zone Characteristics

DEFINITION

Work zone characteristics describe the planned construction projects and other maintenance activities occurring on the TSM&O network during the data collection time period.

PURPOSE

Work zone characteristics is included as a performance measure to help identify possible causes of delay on arterials.

OBJECTIVE

Reduce the impact of work zones on traffic operations on critical arterial segments in the TSM&O network.

METHODOLOGY

FDOT is aware of major construction projects, and travel time volunteers also observe maintenance activities while they are conducting travel time runs.

RESULTS & TRENDS

There were no construction or work zone activities observed or reported during the data collection periods of this study on the corridors of interest.

Air Quality

DEFINITION

This measure describes the quality of the air at a given location on the TSM&O network.

PURPOSE

Air quality is a measure of the effectiveness of TSM&O strategies in reducing greenhouse gas emissions.

OBJECTIVE

Reduce greenhouse gas emissions on critical arterial segments in the TSM&O network.

METHODOLOGY

Air quality data is obtained from Broward County's Pollution Prevention, Remediation and Air Quality Division, which manages several air quality measurement stations throughout the county, as shown in Figure 1 on the following page. For purposes of TSM&O performance reporting, air quality data is obtained for Station 28, which is located on Sunrise Boulevard within the limits of the Broward County TSM&O network. This station collects Carbon Monoxide (CO), Sulfur Dioxide (SO₂), and Particulate Matter (PM-10). Broward County currently measures air quality every 6 days at Station 28, but will eventually implement continuous data collection.

RESULTS & TRENDS

Table 8 summarizes air quality results for the TSM&O network during the data collection period, along with the change compared to last quarter. The maximum allowable guidelines for emissions are as follows:

- CO Max Allowed: 9 ppm
- SO₂ Max Allowed: 0.14.ppm
- PM-10 Max Allowed: 150 µg/m³

CO, SO₂, and PM-10 emissions for the Broward County TSM&O network were all within the maximum allowable guidelines. Average observed levels of CO and PM-10 emissions increased compared to last quarter, while SO₂ decreased considerably.

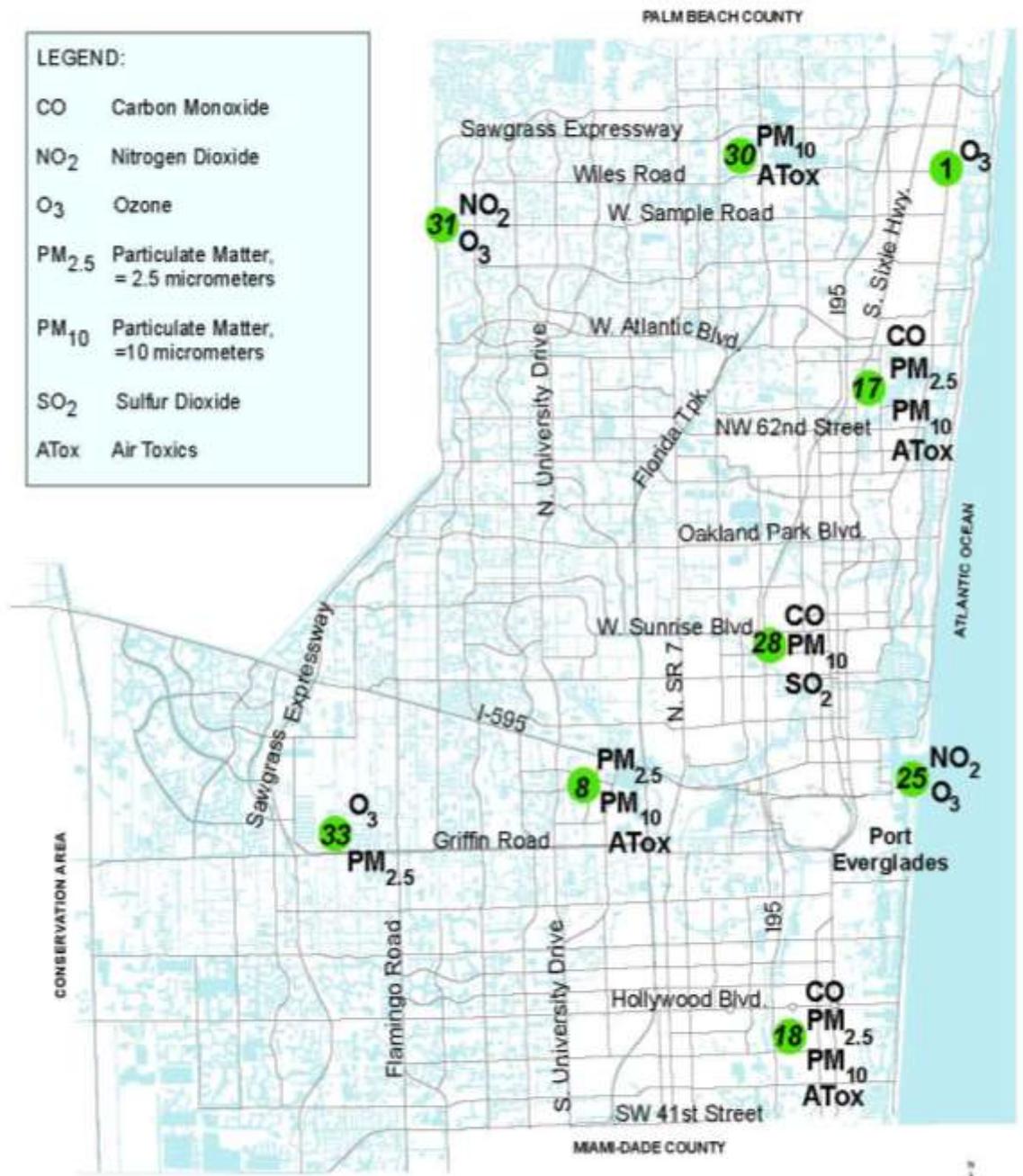
Table 8. Air Quality for the TSM&O Network

	Carbon Monoxide (CO) Ppm		Sulfur Dioxide (SO ₂) ppm		Particulate Matter (PM-10) µg/m ³	
	This Quarter	Change from Last Quarter	This Quarter	Change from Last Quarter	This Quarter	Change from Last Quarter
Minimum Observed	0.3	0%	0	0%	8.6	-9.3%
Mean Observed	0.5	9.5%	0.0003	-717%	14.2	18.3%
Maximum Observed	0.9	-11.1%	0.002	-1500%	17	17.6%
Maximum Allowed	9		0.14		150	

Broward County Air Quality Monitoring Network

LEGEND:

CO	Carbon Monoxide
NO ₂	Nitrogen Dioxide
O ₃	Ozone
PM _{2.5}	Particulate Matter, = 2.5 micrometers
PM ₁₀	Particulate Matter, =10 micrometers
SO ₂	Sulfur Dioxide
ATox	Air Toxics



Updated: May 2008



Environmental Protection & Growth Management Department

Figure 9. Broward County Air Quality Monitoring Site Locations

Resources Spent

DEFINITION

This measure describes the additional funding required to support data collection for quarterly TSM&O performance measure reporting for Broward County, including labor, equipment, annual expenditures, etc. This measure excludes data that is currently collected/reported by other agencies (e.g., transit schedule adherence, transit passenger count data for person throughput, traffic signal system health, air quality, and work zone characteristics), or that is collected by travel time run volunteers (e.g., travel time index, arterial travel time delay, number of incidents, and incident duration).

PURPOSE

Resources spent tracks the additional funding required to support data collection for quarterly TSM&O performance reporting.

OBJECTIVE

Minimize resources spent to support data collection for quarterly TSM&O performance reporting.

METHODOLOGY

For this data collection period, the Department reported on the additional funding required to collect traffic volume data at 20 PTMS locations for purposes of calculating vehicle throughput. Resources spent is calculated as the average cost for data collection per site multiplied by the number of sites, as shown in the following equation:

$$\text{Resources Spent} = \text{Average Cost per Site for Data Collection} \times \text{Number of PTMS Locations}$$

RESULTS & TRENDS

Table 9 summarizes the Resources Spent to collect the data for Vehicle Throughput. The total cost was \$7,119.87. This amount is unchanged compared to last quarter.

Table 9. Resources Spent for the TSM&O Program

	Average Cost per Site for Data Collection	Number of PTMS Locations	Total Cost
Broward County	\$355.99	20	\$7,119.87