

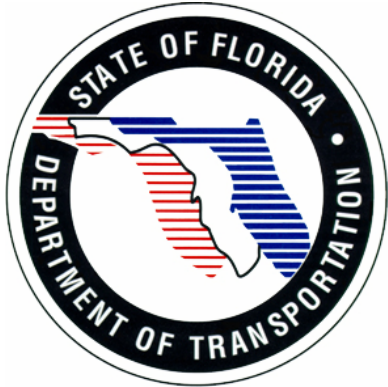
Technical Memorandum

**FDOT Project TWO 091003.51 and 091820.01
(Assignment 35)**

final

Refinement of Florida Statewide Operations Performance Measures and Data Collection Methodology

Version 2



Prepared for:

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June 2006

■ 1.0 Introduction

This report summarizes the activities to develop Statewide Performance Measures conducted in 2005 for the Florida DOT Central Office of Traffic Operations. Major activities included the planning and conduct of three performance measure workshops and research and development for the three statewide outcome measures, travel time reliability, incident duration, and customer satisfaction. The summary follows the outline of the task descriptions in the original 2005 scope of work.

The 2005 Statewide Performance Measures activities stem from the request by the Florida Transportation Commission (FTC) that the Florida Department of Transportation (DOT) report on outcome measures, not just output measures as originally presented to the FTC in 2004. The 2005 activities focus on obtaining data from the Districts to report on the three selected outcome measures: 1) travel time and reliability, 2) incident duration, and 3) customer satisfaction. The output measures will continue to be reported using the data collection process developed in 2004.

■ 2.0 Recommendations of 2005 Work Task

The 2005 FDOT Statewide Intelligent Transportation Systems (ITS) Program activities resulted in several recommendations for continuing work efforts. The recommendations are summarized below.

- **Continue data collection and reporting for the three selected Output Measures:** 1) Road Ranger Stops, 2) ITS Miles Managed, and 3) 511 calls.
- **Work continued for the three selected outcome performance measures:** 1) Incident Duration, 2) Travel Time Reliability and 3) Customer Satisfaction.
- For the **Incident Duration Outcome Performance Measure**, the manual data collection efforts have been suspended for 2006. It has been decided that the automated data collection systems and software will be provided through the implementation of District Transportation Management Centers (TMC) and the installation of SunGuide software. Southwest Research Institute (SWRI), the developers of the SunGuide software, has not yet completed the data archive module and the incident reporting interface. It is recommended that the development of the data archive module and the incident reporting interface be advanced in the SunGuide software development schedule. It is suggested that the reporting of incident duration be phased in as individual Districts are able to report. It is further recommended that the Traffic Operations Central Office staff and the performance measures consultants work closely with SWRI in the development of the data archive module and the incident reporting operator interface. This will ensure that the SunGuide software collects and

reports the data needed for reporting incident duration. **The incident duration measure will be reported for the July 1, 2006 to June 30, 2007 time period.**

- **Currently, there is not enough continuous real-time travel time data to adequately calculate the Reliability Outcome Performance Measure in Florida for 2006.** However, there is expected to be sufficient number of traffic sensors in several urban areas around the State to report to the FTC on reliability in 2007. The next steps are to define a process to obtain, archive, and conduct data quality checks; and analyze travel time data for each of those deployments. It was determined from a poll of all Districts that only one District has speed data that will be available prior June 30, 2006. Therefore, reliability will not be reported for this year. It is recommended that the performance measures consultant obtain the data available from District 2, and provide a travel time reliability analysis with that data. This will serve as a pilot study using real data and should help identify problems with transferring data, data quality, or data analysis. **It is further recommended that speed data be collected from other Districts (2, 4, 5, 6, and Turnpike) beginning as soon as each District has data available, so that travel time reliability can be reported for FY 2007.**
- **Approval of the Customer Satisfaction Outcome Performance Measure questionnaire was obtained in February 2006. The consultants initiated the survey calls in early March 2006. The analysis of the data began in early April and a draft report was produced in May.** For each District, a written report summarizing the telephone survey findings and displaying the appropriate graphic (chart or table) for each question was prepared. The reports also contain an analysis of each question by various demographic subgroups (i.e., geographic, age, type of freeway use). Finally, the reports contain an overall summary, and will identify key findings. A statewide summary report was also be produced. The results will be presented at an ITS Working Group meeting in July 2006. **This 2006 survey task will provide the baseline for future ITS customer satisfaction surveys. It is expected that statewide surveys will be conducted approximately two years apart.** The survey techniques used will be evaluated and may be modified for the next statewide survey. The survey data, however, should be collected so that a comparison to be 2006 baseline can be made. It is recommended that each District review the survey results for their District, and address any issues or problems in customer service delivery that are revealed.

■ 3.0 Summary of 2005 Activities

The 2005 activities are summarized below and described in detail in the following sections.

2005 Output Measure Results

Data was collected and the results of the three selected output measures were reported for the period of July 1, 2004 to June 30, 2005.

- **511 calls**
 - 4.7 Million calls for 3 systems (South Florida, Central Florida, and Tampa Bay);
 - 45 percent increase over previous year.
- **Road Ranger Stops**
 - All Districts have Road Rangers;
 - 1,064 miles of coverage; and
 - 359,000 annual stops.
- **Miles Managed by ITS**
 - 218 miles or 10 percent of limited-access Florida Intrastate Highway System (FIHS); and
 - Increase of 28 percent over previous year.

Incident Duration Outcome Measure Activities

The initial task for this measure was to define incident duration. The definition used for incident duration was confirmed at a Performance Measures Workshop held on July 20, 2005. **Lane Closure Incident Duration is defined as that time that begins with the arrival of the first responding officer and ends when all mainline travel lanes are cleared, in order to be compatible with and measurable against the Open Roads Policy.** The following levels of incidents were defined as:

- **Level 1** - Any lane blocked for less than 30 minutes;
- **Level 2** - Any lane blocked between 30 to 120 minutes;
- **Level 3** - ALL lanes blocked for any period of time, or individual lanes blocked more than 120 minutes.

After the July workshop, it was determined that two efforts would be conducted to obtain incident duration data: 1) a manual data collection task using Florida Highway Patrol (FHP) incident record in District 7; and 2) an automated data collection task using data from the System Management for Advanced Roadway Technologies (SMART) software system in District 4.

The manual process conducted in District 7 reviewed Road Ranger Activity Logs and FHP Call History Records for July and August 2005. The findings of the effort were that it took 20 hours to compile and analyze 124 incidents for the 2-month period. Of those incidents, 49 involved lane closures. Of those lane closure incidents, only 15 incidents had enough available data to determine the incident duration.

The automated data collection process in District 4 found that incident duration data can be successfully collected and reported. District 4 began collecting incident duration data in July 2005, and have been reporting and using that data since then. The SMART software developed by District 4 enables the reporting of all points of the incident timeline for all incidents with a Road Ranger response.

The results of these two data collection efforts were reported at an Incident Duration Workshop held on December 8, 2005. **Based on the results of the data collection tasks and the discussion at the workshop, it was determined that a manual data collection effort for all Districts would be too costly and time consuming, and would yield only partial results.** It was also determined that the automated data collection could be successful if appropriate systems and software were implemented in each District.

Congestion/Reliability Outcome Measure Activities

Reliability is a measure of the variability or uncertainty in the performance of the facility over time. Unreliable travel times are associated with variations in congestion levels caused either by higher than normal traffic demand or reduced available capacity. **The initial tasks in 2005 were to recommend a definition for reliability, and to determine if a travel time sampling method could be used to report reliability on a roadway segment.**

Definition of Reliability

Several coordination meetings were held with the Systems Planning Office to arrive at a recommended definition for reliability. It was decided that two definitions would be appropriate for use within the Department. They are described as follows.

1. **Travel Time Reliability (On-Time Arrival)** - This will be applied for **planning** purposes. The proposed measure to capture this concept is the percent of people and goods that arrive at their destination within an expected travel time.
2. **Travel Time Reliability (Variability)** - This will be used in **operations**. It is defined as the percentage of time that actual travel time exceeds the expected travel time. The measure would be the percent of time a corridor is reliable during a specified time of day. For example, if a driver expects a trip to take 20 minutes (this time includes a certain amount of normal congestion) and the trip actually takes 25 minutes, the trip is considered to be 80 percent reliable. If the actual travel time is equal to or less than the expected travel time, the trip would be considered to be 100 percent reliable. Appendix A contains a detailed description of the definition.

Reliability Data Needs

The travel time data collected through sampling surveys only represents the average travel time, not the variations in travel time. To capture the variability of travel times for various time-of-day periods, weather conditions, incidents, and special events, this travel time analysis would have to be repeated for different times of everyday over a number of

months. The required number of travel time samples to accurately calculate reliability would likely be in the hundreds of travel time runs. As the result, it was determined that a manual travel time sampling survey is not a practical method for reliability analysis, and only continuous data collection such as ITS systems can provide sufficient traffic data for reliability analysis.

Assessment of the status of collecting travel time data was conducted in a workshop conducted on January 12, 2006, in the District 6 TMC in Miami. The following freeway sections are expected to have traffic sensor data in summer 2006:

- **District 2** - I-95 between I-295 north and I-295 south in Jacksonville;
- **District 4** - I-95 in Broward County;
- **District 5** - Toll tag probe data on several freeways and major arterials, I-4 in Orange and Seminole Counties when Central Florida Data Warehouse is completed;
- **District 6** - I-95 in Dade County and I-195; and
- **Turnpike Enterprise** - Sawgrass Expressway in Broward County.

FDOT is in the process of testing the statewide SunGuide software for traffic data collection and archiving. The SunGuide software would collect traffic data from vehicle sensors, control CCTV (closed-circuit television) camera and Dynamic Message Signs (DMS), evaluate traffic conditions, manage incidents, provide information to general public and transportation agencies, and perform data logging and archiving. The software should meet the following functional requirements to be able to provide data for reliability analysis: 1) provide for the collection and storage of traffic data, incident data, DMS messages, detector/DMS inventory and maintenance activities, and 511/TMC web site activities; and 2) provide for traffic data processing functions, including data transformations, data imputation, quality control, and transmitting data to other units within FDOT. It should be noted that none of these Districts have data archiving software installed, and data archiving and reporting is not available within the SunGuide software at this time. Initially, the only way to access traffic data will be through a data stream stored at hardware's memory buffer. Unfortunately, the buffer only holds about a couple of hours' data, which is not adequate for reliability analysis. Once more sensors and archiving software are installed, the Districts could provide 15-second volume, speed, occupancy, and classification information for each traffic lane at sensor locations, which would be sufficient for reliability analysis.

Currently, there is not enough continuous real-time travel time data to adequately calculate reliability in Florida. However, there is expected to be sufficient number of traffic sensors in several urban areas around the State to report to the FDOT on reliability in 2007. The next steps are to define a process to obtain, archive, conduct data quality checks, and analyze travel time data for each of the deployments listed above.

Customer Satisfaction Outcome Measure Activities

Customer satisfaction was be measured by collecting statistically valid sample survey data from ITS users throughout the State. This task surveyed via telephone a random sample of 400 adults age 18 and over in each of the seven FDOT Districts. Respondents must drive at least 3 times per week on freeways to qualify. **The purpose of this survey is to gauge awareness and perceived value of the traffic management services offered by FDOT, including Road Ranger services, DMS, and 511.** The surveys provide a benchmark against which to measure changes in awareness and perceptions in the future. Each interview will last approximately 10 minutes.

A draft questionnaire was developed and submitted for review by the Districts at the December 8 Working Group meeting. Further review was conducted by the Central Office Traffic Operations staff. Several questions regarding the survey methodology and length of the questionnaire were received and addressed. **The telephone survey for all Districts was conducted in March 2006, and analysis of the survey was delivered in May 2006.**

■ 4.0 Task 1 - Performance Measures Workshop

A Performance Measures Workshop was held on July 20, 2005 at the Tradewinds Sandpiper Hotel in St. Petersburg Beach. The purpose of the meeting was to discuss the current status of data collection for the outcome and output measures, and to better describe data collection methods to District staff. There were approximately 100 attendees, including representatives from Traffic Operations from all Districts.

Discussion on Output Data Request

1. **Road Ranger Stops** - There was some discussion regarding assists versus stops, and it was determined that stops are to be reported. The consultants will coordinate with Paul Clark to ensure we are using the correct definitions of terms. **For 2005, Districts were not required to report on cost of Road Ranger programs.** All incident duration activities are to be coordinated with Mike Akridge and Paul Clarke.
2. **Miles Managed By ITS** - The definition was discussed and there were still several concerns. **It was agreed that Districts would report on the ITS miles for which they have responsibility.** Other facilities are to be reported with a note as to who manages the corridor (i.e., District 2 pays for ITS on certain corridors, but is not responsible for them). **The Districts will add caveats and notes to the mileage they report.**
3. **511 Calls** - The request asked Districts 5, 6 and 7 to report on what their vendor has recorded. The request also asked for 511 activities during hurricanes. **It was discovered**

that the information is available through hurricane studies and Districts do not need to provide it.

Each District was to transmit their data electronically by July 31, 2005.

Discussion of Outcome Measures

1. **Incident Duration** - The definitions were discussed and it was agreed that **all lane closures, no matter how long, were to be reported.**
2. **Customer Satisfaction** - It was agreed that one statewide survey managed by the Central Office should be pursued, and that a workshop needs to be held to brainstorm questions for the statewide survey. It was suggested that each District be allowed to add tailored questions for their District operations to the survey taken within that District.
3. **Reliability/Delay** - More work is needed in this area. A method to estimate congestion and reliability using traffic volumes and model data and determine results would be useful.

Appendix B includes a meeting summary and handout materials.

■ 5.0 Task 2 - Develop Short-Term Methodology to Estimate Outcome Measures

The purpose of this task was to evaluate the potential to estimate outcome measures in the near term in time for the July 2006 FTC report.

5.1 Reliability

Assessment of Reliability Sampling Methodologies

This section provides an assessment of travel time reliability data sampling techniques, analyzes these manual data collection methods for usefulness in calculating reliability, and provides a comparison of different reliability measures. As part of this Statewide Performance Measures project, a set of performance measures was initially identified that quantify the *output* of the ITS program. After review by the FTC, it was requested that more *outcome*-based measures be added to truly report on the benefits of Florida's ITS program from the perspective of the ultimate customer - the traveling public. Three key *outcome* measures were recommended, and they will be reported annually to the FTC in addition to output measures. These three outcome measures are: 1) incident duration, 2) congestion and travel time reliability, and 3) customer satisfaction. The purpose of this

section was to determine if manually collected sample travel time data is a viable alternative to collecting continuous real-time data for calculating travel time reliability.

Reliability is a measure of the variability or uncertainty in the performance of the facility over time. Unreliable travel times are associated with variations in congestion levels caused either by higher than normal traffic demand or reduced available capacity. Congestion is a measure of the typical usage of a transportation facility compared to the capacity that is provided. Recent national studies have estimated that of all congestion-related delay, approximately one-half is caused by congestion (recurring typical conditions) and one-half by temporary disruptions, such as traffic incidents (accident, disabled vehicles, etc); work zones; and weather (nonrecurring). It is important that both congestion and reliability be measured and reported to capture the impact of ITS on both types of congestion. This task focuses on reliability.

Sampling Survey for Travel Time Reliability

Various travel time studies, such as the Federal Highway Administration's (FHWA) *Travel Time Data Collection Handbook*¹ and the FDOT's *Guideline for Collecting and Analyzing of Travel Time Studies of Florida Roadways Using GPS Technology*,² have introduced cost-effective collection methods and their sampling requirements. Using an example of I-95 in Broward County and based on the guidelines presented in these studies, travel time data collection over the example study area would need 48 test runs on 6 5-mile long routes. According to past probe vehicle studies, it is reasonable to expect finishing 5 runs per vehicle in 3 hours for a 5-mile route. So 2 probe vehicles should be able to finish all 48 runs within 3 days. The approximate cost of vehicle and labor is \$500 per vehicle per day. Global positioning system (GPS) equipment retails for about \$200. A staff-month of effort, about \$10,000, should also be budgeted for planning, management, data reduction, and other overhead. The total cost would be $\$10,000$ (staffing) + $\$500$ (vehicle/labor cost per day per vehicle) \times 2 (vehicles) \times 3 (days) + $\$200$ (GPS equipment cost per vehicle) \times 2 (vehicles) = $\$19,000$.

Although the cost of conducting such a study covering a freeway system is under \$20,000, these kinds of surveys can only provide average travel time during a specific peak period, while a reliability study would need to take into account much wider spectrum. The following statistical box-plot shows the travel time variability based on a month's worth of ITS traffic data on a 10-mile freeway route in Portland. In this figure, the vertical lines extend to the minimum travel time and maximum travel time, the length of the box represents the interquartile range (the distance between the 25th and the 75th percentiles of travel time), the dot in the box interior represents the mean travel time, and the horizontal line in the box interior represents the median travel time.

¹ *Travel Time Data Collection Handbook*, Federal Highway Administration (FHWA), 1998.

² *Guideline for Collecting and Analyzing of Travel Time Studies of Florida Roadways Using GPS Technology*, FDOT, 2005.

As shown in Figure 1, travel time varies tremendously during peak hours, and reliability studies would need to incorporate these variations. In fact, the buffer index is based on 95 percentile of travel time samples. The travel time data collected through sampling surveys only represents the average travel time, not the variations in travel time. To capture the variability of travel times for various time-of-day periods, weather conditions, incidents, and special events, this travel time analysis would have to be repeated for different times of every day over a number of months. The required number of travel time samples to accurately calculate reliability is not known, but it would likely be in the hundreds of travel time runs. As the result, we suggest that a manual travel time sampling survey is not a practical method for reliability analysis, and only continuous data collection such as ITS systems can provide sufficient traffic data for reliability analysis.

ITS Traffic Data Availability Workshop

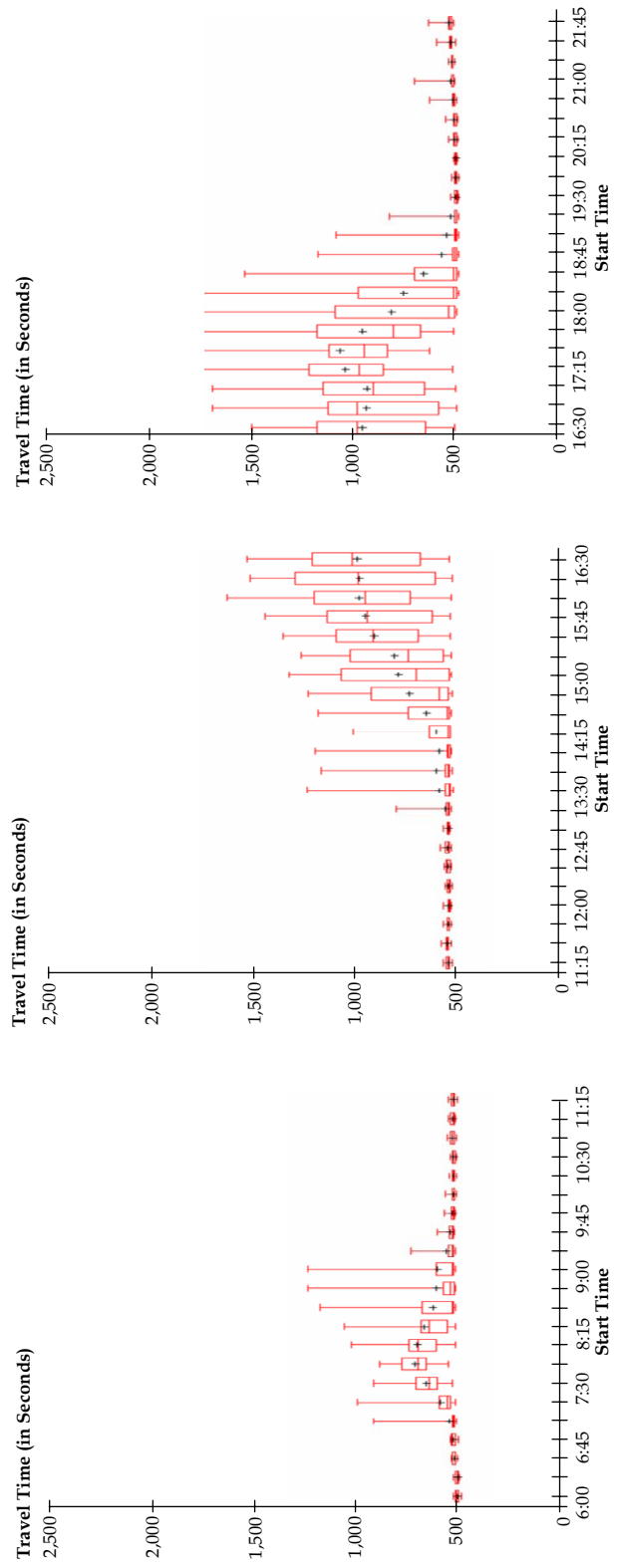
This section describes the availability of travel time data for the FDOT Districts. This information was developed in a workshop conducted on January 12, 2006 in the District 6 TMC in Miami. The workshop attendees included representatives of FDOT Traffic Operations staff from Districts 2, 4, 6, the Turnpike Enterprise, and FDOT Central Office staff. Additionally, Miami-Dade Expressway Authority (MDX) operations staff attended.

Currently, no District has continuous traffic speed data saved in an archive. However, several Districts will have sensors operating in the near future. The following freeway sections are expected to have traffic sensor data in 2006:

- **District 2** - I-95 between I-295 north and I-295 south in Jacksonville;
- **District 4** - I-95 in Broward County;
- **District 5** - Toll tag probe data on several freeways and major arterials and the reactivation of a 36 mile section of I-4 in Orange and Seminole Counties;
- **District 6** - I-95 in Dade County and I-195; and
- **Turnpike Enterprise** - Sawgrass Expressway in Broward County.

FDOT is in the process of testing the statewide SunGuide software for traffic data collection and archiving. The SunGuide software would collect traffic data from vehicle sensors, control CCTV camera and DMS signs, evaluate traffic conditions, manage incidents, provide information to general public and transportation agencies, and perform data logging and archiving. The software should meet the following functional requirements to be able to provide data for reliability analysis: 1) provide for the collection and storage of traffic data, incident data, DMS messages, detector/DMS inventory, and maintenance activities, and 511/TMC web site activities; and 2) provide for traffic data processing functions, including data transformations, data imputation, quality control, and transmitting data to other units within FDOT.

Figure 1. Box-Plot of Travel Time
Section 2 of Portland Freeways – July 2005



Note: Route Length 7.71 miles.

It should be noted that none of these Districts have data archiving software installed and data archiving, and reporting is not available within the SunGuide software at this time. Initially, the only way to access traffic data will be through a data stream stored at hardware's memory buffer. Unfortunately, the buffer only holds about a couple of hours' data, which is not adequate for reliability analysis. Once more sensors and archiving software are installed, the Districts could provide 15-second volume, speed, occupancy, and classification information for each traffic lane at sensor locations, which would be sufficient for reliability analysis.

Currently, there is not enough continuous real-time travel time data to adequately calculate reliability in Florida. However, there is expected to be sufficient number of traffic sensors in several urban areas around the State to report to the FDOT on reliability by July 2007. The next steps are to define a process to obtain, archive, conduct data quality checks, and analyze travel time data for each of the deployments listed above.

In mid-March, the Districts were asked again about the availability of detector data. It was determined that only District 2 will be able to provide detector data for any significant freeway segment by June 30, 2006. Appendix B includes a summary of the meeting in the form of a table showing the status of detector deployment for those Districts that may have speed data available in 2006.

Measuring Reliability: Buffer Index and the Florida Reliability Method

The Buffer Index is widely used in various national congestion studies, while the Florida Reliability Method has been developed by the Planning Office of FDOT.³ Since FDOT does not have continuous traffic data that is required in reliability analysis, ITS traffic data collected in Portland, Oregon was used as an example in this study to examine the differences between these two measures. The July 2005's Buffer Index and Florida Method values for the a.m. and p.m. peak hours of 19 freeway sections in Portland are shown in Table 1. Theoretically, a Buffer Index value could range from 0 to ∞ , while a Florida Method value could vary from 0 to 1. Since higher Buffer Index values indicate poorer reliability, while higher Florida Method values represent better reliability, either of Buffer Index or Florida Method values must be modified for any comparative analysis. A simple straightforward modification is "1 minus Florida Method." Figure 2 uses "1 minus Florida Method" values compared with Buffer Index values. Although more studies are needed to understand the correlations between Buffer Index and Florida Method, Figure 2 does show that these two measures basically follow the same pattern. When reliability gets worse, both of the Buffer Index and "1 - Florida Method" will increase.

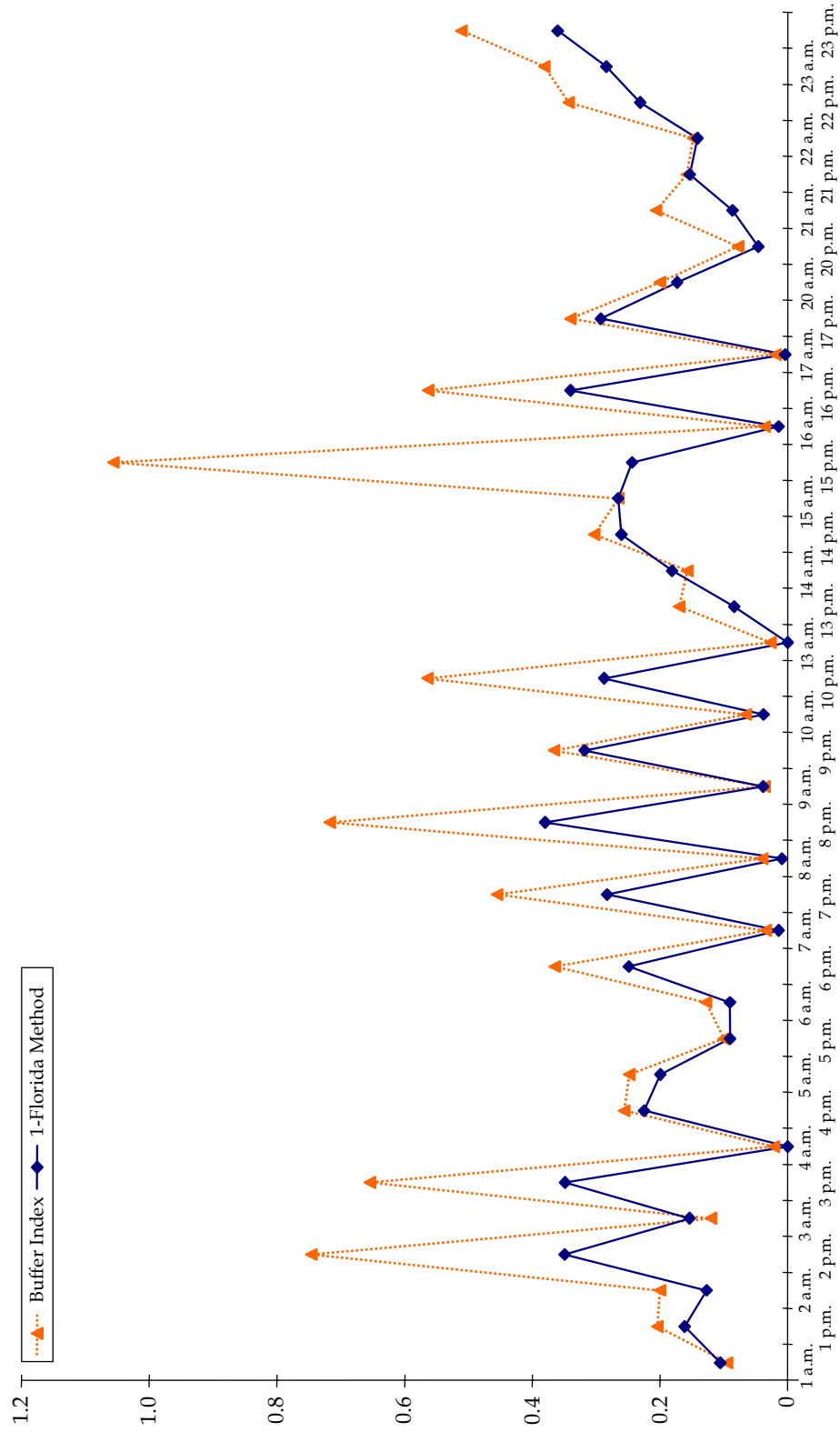
The simple mathematical transformation of "1 - Florida Method" demonstrates that Buffer Index and Florida Method are closely related, and both of them could be used to monitor reliability trends. Further studies on mathematical transformations could reveal more detailed correlations between these two measures.

³ The Florida Reliability Method in Florida's Mobility Performance Measuring Program, FDOT.

Table 1. Buffer Index versus Florida Method

Section ID	Peak Period	Florida Method	Buffer Index	Section ID	Peak Period	Florida Method	Buffer Index
1	AM	0.894363	0.095	13	AM	1.000000	0.027
1	PM	0.838846	0.204	13	PM	0.916098	0.170
2	AM	0.872893	0.200	14	AM	0.819137	0.157
2	PM	0.650697	0.746	14	PM	0.739530	0.303
3	AM	0.846459	0.120	15	AM	0.735030	0.265
3	PM	0.651619	0.654	15	PM	0.756387	1.056
4	AM	1.000000	0.022	16	AM	0.985638	0.036
4	PM	0.775265	0.256	16	PM	0.659624	0.563
5	AM	0.800545	0.248	17	AM	0.995866	0.019
5	PM	0.910000	0.100	17	PM	0.707297	0.340
6	AM	0.909656	0.128	20	AM	0.827118	0.200
6	PM	0.750958	0.365	20	PM	0.953878	0.078
7	AM	0.986180	0.034	21	AM	0.913792	0.206
7	PM	0.717279	0.455	21	PM	0.846820	0.158
8	AM	0.991159	0.040	22	AM	0.858605	0.148
8	PM	0.620222	0.717	22	PM	0.769169	0.343
9	AM	0.961683	0.036	23	AM	0.716342	0.381
9	PM	0.681989	0.366	23	PM	0.640142	0.511
10	AM	0.962276	0.066				
10	PM	0.712641	0.564				

Figure 2. Buffer Index versus 1-Florida Method for A.M. and P.M. Peaks at 19 Freeway Sections



Reliability is a measure of the variability or uncertainty in the performance of the facility over time. Unreliable travel times are associated with variations in congestion levels caused either by higher than normal traffic demand or reduced available capacity.

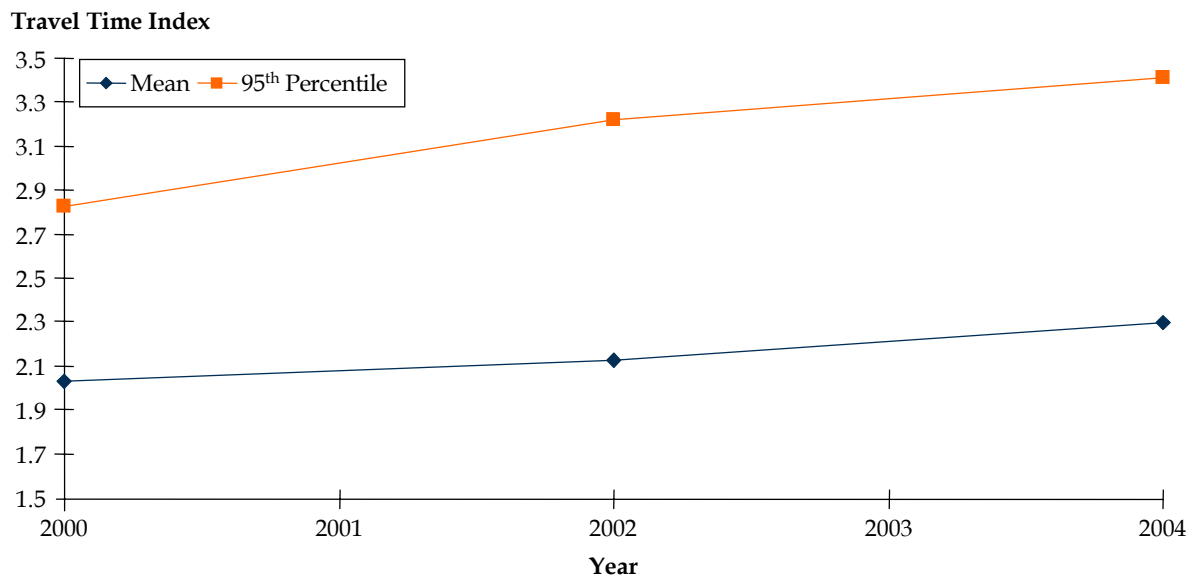
One of the guiding principles for performance measurement established in the National Cooperative Highway Research Program (NCHRP) 3-68 is that multiple metrics should be used to describe each aspect of performance, especially congestion/mobility. Examination of trends in congestion data for a section of I-75 in central Atlanta reveals why. This freeway section (4.05 miles in length) is one of the most heavily traveled (At one point, Average Annual Daily Traffic (AADT) is in excess of 330,000 vehicles per day.) and congested in the County. The p.m. peak-period data from 2000, 2002, and 2004 show that both the average congestion level (mean Travel Time Index) and congestion on “bad” travel days (95th percentile Travel Time Index) increased over the period (Figure 3). Note that a Travel Time Index of 2.0 indicates that it takes twice as long to travel this section during the peak than it does under free-flow conditions. The increasing 95th percentile provides a general indication that reliability decreased over the period.

Figure 4 shows what happens with several other reliability metrics over the period. The Buffer Index and the Florida Reliability Method (FL_10%: the percent of trips that take longer than the median plus 10 percent) both initially increase to 2002, and then decrease slightly to 2004. Why? Because they both are measured relative to the mean or median travel time, and those increased over the period. This tells us something valuable though, namely, that the extreme days are not increasing as quickly as the base level of congestion. In theory, this would indicate that the events that cause extreme travel times (e.g., incidents, bad weather, work zones) are being controlled better, but at the same time, increasing traffic volume is causing growth in the base congestion level. In fact, operations strategies did grow more aggressive over the period (based on subjective conversations with NaviGator personnel) and traffic did grow.

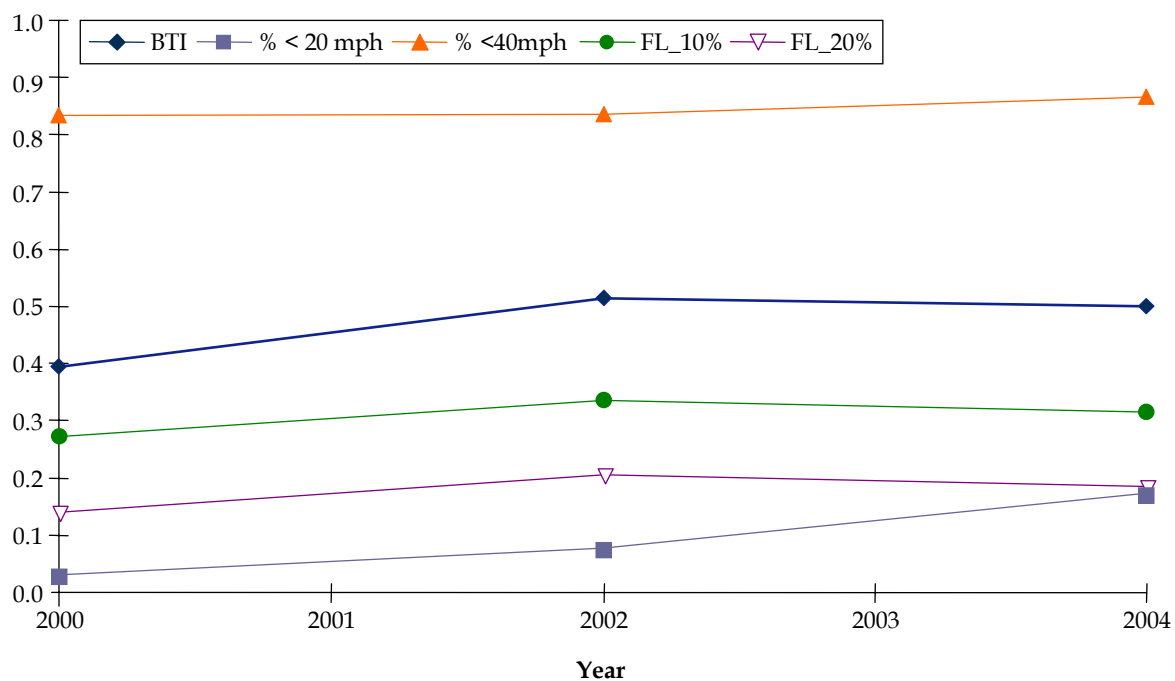
Two failure-based reliability measures are also shown: percentage of trips that occur at speeds less than 20 mph and 40 mph. Both grew over the period, especially the share of trips less than 20 mph. These metrics essentially tell us the same thing as the 95th percentile: that the extreme days are getting worse. Note that a problem with failure-based metrics is that they are binary: either a trip was reliable or it was not. They tell you how badly a trip failed. For example, trips at 19 mph and 3 mph both “fail,” but one is clearly a lot worse than the other.

So, did reliability improve or worsen over the period? The 95th percentile and failure-based metrics are “pure” (not normalized), and show that reliability from the traveler’s perspective did indeed worsen. The Buffer Index and Florida Reliability metrics indicate that part of this worsening reliability is due to the increase in base-level congestion, and this increase was more pronounced than the increase in the extremes. Given the need to understand reliability patterns in depth – and the fact that all of these metrics are computed from the same data – it is clear that multiple metrics for reliability are the desired path.

**Figure 3. I-75 Southbound
Central Atlanta**



**Figure 4. I-75 Southbound
Central Atlanta**



The proposed on-time performance by FDOT's System Planning Office could be used as one of the measurement metrics. Once the System Planning Office finalizes the on-time performance definitions, more detailed studies will be performed on the differences between on-time performance and other reliability indexes such as buffer index.

Several coordination meetings were held with the Systems Planning Office to arrive at a recommended definition for reliability. It was decided that two definitions would be appropriate for use within the Department. They are described as follows.

1. **Travel Time Reliability (On-Time Arrival)** - This will be applied for **planning** purposes. The proposed measure to capture this concept is the percentage of people and goods that arrive at their destination within an expected travel time.
2. **Travel Time Reliability (Variability)** - This will be used in **operations**. It is defined as the percentage of time that actual travel time exceeds the expected travel time. The measure would be the percentage of time a corridor is reliable during a specified time of day. For example, if a driver expects a trip to take 20 minutes (this time includes a certain amount of normal congestion) and the trip actually takes 25 minutes, the trip is considered to be 80 percent reliable. If the actual travel time is equal to or less than the expected travel time, the trip would be considered to be 100 percent reliable. The definition of reliability that will be used for future performance measure reporting is in Appendix A.

5.2 Incident Duration

Data Needs

For the period from July 1, 2005 through June 30, 2006, each District should provide the following for each incident. The data shown is an example (Table 2).

Table 2. Data Needs Example

District: _____

FHP Incident Number	Date	Time of Day	Facility	Nearest Cross-Street/ Mile Marker	Direction	Lane Closure Incident Duration (Minutes)
LWRC04CAD095105	6/28/2004	14:59:36	I-95	Forest Hill Boulevard	SB	72

The duration of an “incident” (or incident duration) begins at that instant an “incident” first occurs and ends when normal (immediately previous) traffic flow is restored. The specific type of “incident” (or traffic event), where performance will be monitored for this effort, will involve only those “incidents” that involve mainline travel lane closure(s). The intention of this particular outcome performance measure will be to formally document performance as directly related to the FHP-FDOT Open Roads Policy (ORP) established in 2002.

Ultimately, fully implemented SunGuide software will be capable of automatically capturing and recording these “incident” beginning and ending time stamps, as well as all the incremental “incident” events of significance between these two times (e.g., detection, notification, verification, dispatch, various responder arrivals, individual lane closures and openings, and various responder departures). This full-timeline of incremental “incident” events will constitute the long-term goal for this outcome measure.

Lane Closure Incident Duration is defined as that time that begins with the arrival of the first responding officer and ends when all mainline travel lanes are cleared, in order to be compatible with and measurable against the ORP. Additionally, data received from the Districts should be categorized as follows.

- **Level 1** - Any lane blocked for less than 30 minutes;
- **Level 2** - Any lane blocked between 30 to 120 minutes; and
- **Level 3** - *All* lanes blocked for any period of time, or individual lanes blocked more than 120 minutes.

Because the ORP is focused on “incident” clearance times, Central Office will initially only request data from each District or corresponding FHP Troop/Regional Communications Center that reflects this incremental “incident” characteristic. Therefore, for all “incidents” occurring from July 1, 2005 through June 30, 2006 that involve lane closure, where FDOT was a participant in on-site incident management, Lane Closure Incident Durations shall be provided.

For each Lane Closure Incident Duration provided, it is requested that the FHP Incident Number, date, time of day, facility, nearest cross-street or the nearest mainline mile marker, and direction of “incident” also be included. (The FHP Incident Number is a unique, 15-character, alphanumeric identifier for each “incident” that can be found in the far left column on the on-line FHP Live Traffic Crash and Road Condition Report, www.fhp.state.fl.us/traffic).

Incident Duration Workshop on December 8, 2005

An incident duration performance measure workshop was held in conjunction with the FDOT ITS Working Group meeting in Orlando on December 8. The agenda is in Appendix B. The workshop focused on data collection efforts for incident duration. A pilot study for manual data collection in District 7 was discussed; a summary of the study

is in the following section. A data collection process using automated procedures in District 4 was also described and is summarized below.

Manual Incident Data Collection Process

The data collection effort for this outcome measure will necessitate the establishment of a close working relationship between each FDOT District and corresponding FHP Troop. Until such time as SunGuide software is fully implemented or TMC/Incident Management database software is available for data extraction and compilation, it is expected that the required data collection will be a manual effort.

If the manual effort is all that can be conducted at this time in your District, the following basic steps are recommended:

1. On a monthly basis, identify all those “incidents” that involved lane closure(s) and FDOT assistance in on-site “incident” management.
2. For each of the “incidents” identified under Step 1 above, determine its unique FHP Incident Number, as well as the date and corresponding (dispatch) time this particular “incident” was created in the FHP database, which can be found in real-time on the FHP Live Traffic Crash and Road Condition Report.
3. Given the information identified under Step 2 above for each “incident,” prepare a written request (with this information clearly listed) to your FHP Troop Dispatch Supervisor requesting an FHP Call History Record for each “incident” noted. (It may be possible for the FHP Troop to automatically provide the needed Call History Records, once they are fully engaged into the data collection effort and understand its purpose. Given the need to regularly compile this information on a monthly basis, it is desirable to achieve strong partnering with your FHP Troop).
4. Within the FHP Call History Record, typically under the Unit/Call Times or detailed Call Notes, the arrival time and lane clearance time (for the last lane closure) can be found. From these two points in time, the Lane Closure Incident Duration can be calculated (i.e., last lane clearance time – arrival time).
5. As a cross-check, whenever available, the District’s TMC records, Road Ranger logs, or incident management database should be compared with the information calculated under Step 4 above.

The submittal of the required performance data for the previously noted reporting period is to be completed no later than August 8, 2006.

A case study of FDOT District 7 was performed to determine general level of effort (and any related issues or concerns) associated with the manual collection of Lane Closure Duration data.

The procedure used in this case study includes the following:

- District Road Ranger (RR) Activity Log sheets were compiled for July and August 2005 (all records were compiled because it was not always evident when lane closure was involved and for how long) – four hours to complete.
- District requested Call History Records (CHRs) only for the month of July 2005, given FHP Communications staffing levels for Troop C did not allow this type of request on a “priority” basis (FDOT had to provide labor for database retrieval and printing of requested CHRs) – 8 hours to complete following personal request made by FDOT District TIM Manager, which was approved by FHP within 24 hours.
- Given the short turnaround time requested, District was not able to provide compilation and determination of Lane Closure Duration. Consequently, the Transportation Safety Institute (TSI) provided the necessary assistance – eight hours to complete review and comparison of July 2005 CHRs and RR Activity Logs for documentation into spreadsheet.

The total time to complete this procedure is 20 hours and the major findings are the following:

- 124 total RR Activity Logs (incidents) for July 2005;
- 23 of 124 incidents involved assistance to non-FHP responders;
- 49 of 121 FHP-assisted incidents involved lane closure (48 percent);
- 15 incidents (30 percent) able to determine Lane Closure Duration, based on CHR call notes documentation;
- RR Activity Log sheets being revised and new RR contractor as of November 1, 2005 (current form indicates FHP case number, arrival and departure times, and number of lanes closed);
- 34 incidents (70 percent) did not include sufficient documentation to determine Lane Closure Duration;
- FHP was first to arrive on scene 57 percent of the time;
- Of 15 incidents with documentable Lane Closure Duration:
 - **Level 1** – 2,
 - **Level 2** – 9 (percent greater than 90 minutes = 4 out of 15 (27 percent), and
 - **Level 3** – 4.

Automated Process – Case Study in District 4

Florida District 4 has developed the SMART software for incident data collection and archiving. The SMART software replaces FDOT's Incident Database System and Incident Tracking Database System with a centralized system that provides real-time access to incident data and supports mobile data collection by Road Rangers and Severe Incident Response Vehicles. SMART's incident logs have event type, severity, and time stamps for FHP notified, FHP arrived, TMC notified, TMC confirmed, TMC arrived, lanes cleared, and case closed for all the TMC managed incidents. The incident logs also estimate TMC detection, TMC verification, TMC response, clearance, blockage duration, and event duration based these time stamps as shown in Table 3. These incident logs would supply sufficient data for both outcome and output ITS incident performance measures.

Figure 5 shows an example of the incident duration trends calculated by District 4 staff between July and November 2005. The effects of Hurricanes Katrina and Wilma are clearly seen in this graphic.

Incident Duration and Travel Time Reliability Data Collection – Final Progress

Based on comments received from District staff at the December 8 workshop and the length of time it took to manually collect 1 month of data in the District 7 pilot study, it was decided that manual collection of incident duration data would not be continued at this time. The Central Office and its consultants will pursue incident duration data collection through an automated processes within the FDOT Statewide SunGuide TMC Control Software is being developed under contract to SWRI. SWRI is tasked to provide an archived data module and has initiated that task. It is suggested that FDOT request that SWRI advance work on a data archive module as soon as the project schedule allows.

A memorandum describing those needed data elements for SunGuide is in Appendix C.

5.3 Florida DOT ITS Customer Satisfaction Survey

Florida DOT has undertaken a project to collect data and report on a series of statewide outcome and output performance measures. Among the three selected outcome performance measures is customer satisfaction. This task is proposed to collect statistically valid sample survey data from ITS users throughout the State. This 2006 survey task will provide the baseline for future ITS customer satisfaction surveys.

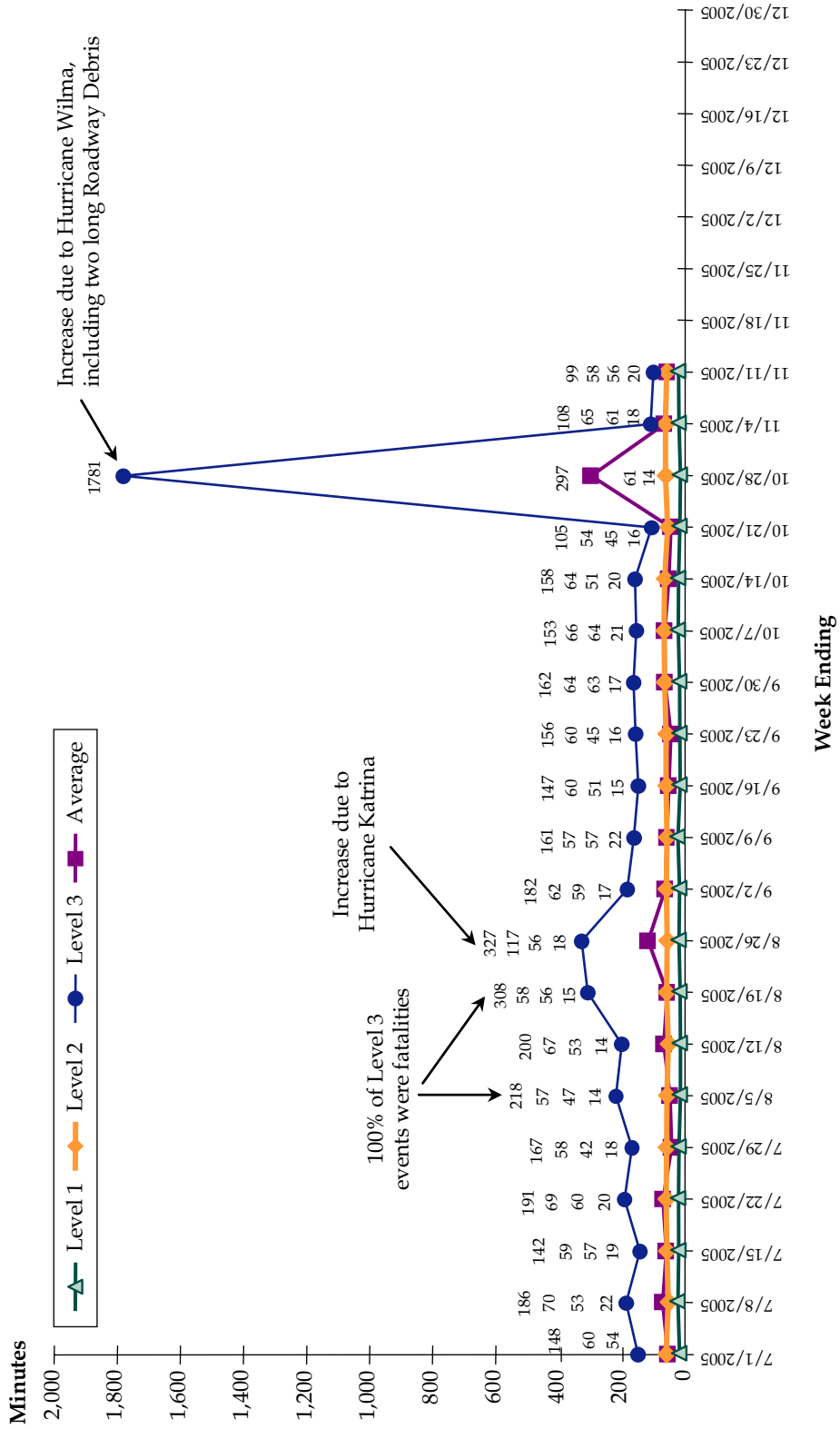
Table 3. FDOT District 4's Incident Logs

Event	Event Type	Severity	First Agency Notified	First Agency Arrival	Event Response	FHP Notified	FHP Arrived	TMC Notified	TMC Confirmed	TMC Arrived	TMC Detection	TMC Verification	TMC Response	Lanes Cleared	Clearance	Closed	Blockage Duration	Event Duration
151397	Accident	Level 2	8/1/2005 8:02	8/1/2005 9:11	70	8/1/2005 8:02	8/1/2005 9:12	8/1/2005 9:11	8/1/2005 9:11	8/1/2005 9:11	70	0	0	8/1/2005 9:17	5	8/1/2005 20:43	75	761
151416	Accident	Level 2	8/1/2005 10:53	8/1/2005 10:58	6	8/1/2005 10:53	8/1/2005 11:14	8/1/2005 10:58	8/1/2005 10:58	8/1/2005 10:58	5	0	0	8/1/2005 11:29	31	8/1/2005 17:26	37	394
151438	Disabled Vehicle	Level 1	8/1/2005 13:00	8/1/2005 13:00	1			8/1/2005 12:58	8/1/2005 13:00	8/1/2005 13:00	0	1	1	8/1/2005 13:07	8	8/1/2005 13:07	9	9
151439	Accident	Level 2	8/1/2005 11:36	8/1/2005 11:53	17	8/1/2005 11:36	8/1/2005 11:53	8/1/2005 12:59	8/1/2005 12:59	8/1/2005 12:59	83	0	0	8/1/2005 13:11	79	8/1/2005 13:35	96	120
151526	Accident	Level 2	8/1/2005 21:46	8/1/2005 22:15	29	8/1/2005 21:46	8/1/2005 22:15	8/1/2005 22:04	8/1/2005 22:24	8/1/2005 22:24	19	20	19	8/1/2005 23:14	60	8/1/2005 23:22	89	96
151597	Accident	Level 3	8/2/2005 10:50	8/2/2005 10:55	5	8/2/2005 10:50	8/2/2005 10:58	8/2/2005 10:56	8/2/2005 10:57	8/2/2005 10:57	7	1	1	8/2/2005 14:00	185	8/2/2005 14:16	190	207
151612	Disabled Vehicle	Level 2	8/2/2005 12:38	8/2/2005 12:52	14	8/2/2005 12:38	8/2/2005 12:52	8/2/2005 12:43	8/2/2005 12:53	8/2/2005 12:53	5	10	10	8/2/2005 13:27	35	8/2/2005 17:17	49	279
151641	Accident	Level 1	8/2/2005 15:37	8/2/2005 15:51	14	8/2/2005 15:37	8/2/2005 16:00	8/2/2005 15:49	8/2/2005 15:51	8/2/2005 15:51	12	2	2	8/2/2005 16:06	16	8/2/2005 16:39	30	62
151656	Accident	Level 1	8/2/2005 16:58	8/2/2005 16:58	1	8/2/2005 17:06	8/2/2005 17:08	8/2/2005 16:57	8/2/2005 16:58	8/2/2005 16:58	0	1	1	8/2/2005 17:01	3	8/2/2005 20:24	4	207
151734	Accident	Level 2	8/3/2005 7:48	8/3/2005 7:48	1	8/3/2005 7:48	8/3/2005 8:03	8/3/2005 7:48	8/3/2005 7:48	8/3/2005 7:48	0	0	0	8/3/2005 9:09	81	8/3/2005 9:25	81	97
151746	Accident	Level 1	8/3/2005 8:54	8/3/2005 8:55	2	8/3/2005 8:54	8/3/2005 9:28	8/3/2005 8:53	8/3/2005 8:55	8/3/2005 8:55	0	2	2	8/3/2005 9:11	15	8/3/2005 12:01	18	188
151755	Accident	Level 2	8/3/2005 9:46	8/3/2005 9:51	5	8/3/2005 9:46	8/3/2005 9:51	8/3/2005 9:56	8/3/2005 10:07	8/3/2005 10:07	10	11	11	8/3/2005 10:17	26	8/3/2005 10:30	31	45
151802	Disabled Vehicle	Level 2	8/3/2005 13:32	8/3/2005 13:32	0			8/3/2005 13:32	8/3/2005 13:33	8/3/2005 13:32	0	0	0	8/3/2005 14:03	30	8/3/2005 18:28	31	296
151815	Disabled Vehicle	Level 2	8/3/2005 14:58	8/3/2005 14:58	0			8/3/2005 14:58	8/3/2005 14:58	8/3/2005 14:58	0	0	0	8/3/2005 15:36	38	8/3/2005 15:39	38	41
151851	Accident	Level 2	8/3/2005 17:20	8/3/2005 17:24	4	8/3/2005 17:20	8/3/2005 17:45	8/3/2005 17:24	8/3/2005 17:24	8/3/2005 17:24	4	0	0	8/3/2005 18:06	42	8/3/2005 21:40	46	260
151907	Accident	Level 2	8/4/2005 5:12	8/4/2005 5:12	0	8/4/2005 5:12	8/4/2005 5:12	8/4/2005 5:16	8/4/2005 5:28	8/4/2005 5:28	5	12	12	8/4/2005 5:49	38	8/4/2005 5:52	38	41

Table 3. FDOT District 4's Incident Logs (continued)

Event	Event Type	Severity	First Agency Notified	First Agency Arrival	Event Response	FHP Notified	FHP Arrived	TMC Notified	TMC Confirmed	TMC Arrived	TMC Detection	TMC Verification	TMC Response	Lanes Cleared	Clearance	Closed	Blockage Duration	Event Duration
151920	Accident	Level 1	8/4/2005 7:44	8/4/2005 7:52	8	8/4/2005 7:44	8/4/2005 7:52	8/4/2005 7:47	8/4/2005 7:54	8/4/2005 7:54	3	7	7	8/4/2005 7:57	6	8/4/2005 10:05	14	141
151931	Accident	Level 1	8/4/2005 8:28	8/4/2005 8:28	0			8/4/2005 8:28	8/4/2005 8:29	8/4/2005 8:28	0	0	0	8/4/2005 8:37	8	8/4/2005 8:44	9	16
152014	Accident	Level 1	8/4/2005 14:09	8/4/2005 14:09	0	8/4/2005 14:12		8/4/2005 14:09	8/4/2005 14:10	8/4/2005 14:09	0	0	0	8/4/2005 14:17	8	8/4/2005 15:01	8	52
152039	Accident	Level 1	8/4/2005 16:51	8/4/2005 17:01	10	8/4/2005 16:51	8/4/2005 17:07	8/4/2005 16:54	8/4/2005 17:01	8/4/2005 17:01	4	7	7	8/4/2005 17:03	2	8/4/2005 21:03	13	253
152102	Accident	Level 2	8/5/2005 5:28	8/5/2005 5:56	28	8/5/2005 5:28	8/5/2005 5:56	8/5/2005 5:35	8/5/2005 6:01	8/5/2005 6:01	8	26	25	8/5/2005 6:02	7	8/5/2005 12:08	35	401
152123	Disabled Vehicle	Level 2	8/5/2005 8:11	8/5/2005 8:22	14			8/5/2005 8:08	8/5/2005 8:22	8/5/2005 8:22	0	15	14	8/5/2005 9:41	79	8/5/2005 9:48	93	100
152240	Accident	Level 1	8/5/2005 19:17	8/5/2005 19:38	21	8/5/2005 19:17	8/5/2005 20:04	8/5/2005 19:22	8/5/2005 19:38	8/5/2005 19:38	5	16	16	8/5/2005 19:43	5	8/5/2005 20:39	27	83
152241	Accident	Level 2	8/5/2005 19:23	8/5/2005 19:47	24	8/5/2005 19:23	8/5/2005 19:47	8/5/2005 19:23	8/5/2005 19:58	8/5/2005 19:58	0	35	35	8/5/2005 20:28	41	8/5/2005 20:29	65	66
152289	Accident	Level 2	8/6/2005 4:36	8/6/2005 4:40	4	8/6/2005 4:36	8/6/2005 4:40	8/6/2005 4:38	8/6/2005 4:56	8/6/2005 4:56	3	17	17	8/6/2005 5:18	39	8/6/2005 5:20	43	45
152402	Police Activity	Level 3	8/7/2005 3:27	8/7/2005 3:33	6			8/7/2005 3:26	8/7/2005 3:31	8/7/2005 3:47	0	4	20	8/7/2005 5:54	141	8/7/2005 5:57	147	150
152403	Police Activity	Level 3	8/7/2005 3:45	8/7/2005 3:45	4			8/7/2005 3:40	8/7/2005 3:41	8/7/2005 3:45	0	0	4	8/7/2005 8:03	259	8/7/2005 8:05	263	265
152404	Accident	Level 3	8/7/2005 3:37	8/7/2005 3:46	9	8/7/2005 3:37	8/7/2005 3:46	8/7/2005 3:47	8/7/2005 4:13	8/7/2005 4:13	10	26	26	8/7/2005 8:44	298	8/7/2005 23:05	307	1,169
152407	Accident	Level 2	8/7/2005 5:05	8/7/2005 5:35	31	8/7/2005 5:05	8/7/2005 6:18	8/7/2005 5:12	8/7/2005 5:35	8/7/2005 5:35	7	24	24	8/7/2005 6:16	40	8/8/2005 14:06	71	1,981

**Figure 5. Incident Duration
FDOT District 4**



This task will survey via telephone a random sample of 400 adults age 18 and over in each of the seven Florida Department of Transportation (FDOT) Districts. Respondents must drive at least 3 times per week on freeways to qualify. The purpose of this survey is to gauge awareness and perceived value of the traffic management services offered by FDOT, including Road Ranger services, DMS, and 511. The surveys will provide a benchmark against which to measure changes in awareness and perceptions in the future. Each interview will last approximately 10 minutes.

A draft questionnaire was developed and submitted for review at the December 8 Working Group meeting. Upon review and approval of the questionnaire, the consultants will conduct the surveys and analyze the data. Several questions regarding the survey methodology and length of the questionnaire were received and will be addressed.

For each District, a written report summarizing the telephone survey findings and displaying the appropriate graphic (chart or table) for each question will be prepared. The reports will also contain an analysis of each question by various demographic subgroups (i.e., geographic, age, type of freeway use). Finally, the reports will contain an overall summary and will identify key findings.

The survey questionnaire is in Appendix C.

Customer Satisfaction Final Progress

The survey is to be completed in March or April 2006, and reported in May 2006.

■ **6.0 Task 3 – Develop Short-Term Methodology to Estimate Output Measures**

Methodology

A methodology to utilize for reporting Output measures was prepared. The three output measures will be collected for each District for the period from July 1, 2005 to June 30, 2006. The results of the performance measures will be reported to the Florida Transportation Commission in time for the 2006 Florida DOT Performance and Production Review. The methodology is included in Appendix D.

Florida Transportation Commission Output Report

A report of output measures performance in 2005 was prepared and delivered to the FTC. Unfortunately, it was not published. A copy of the FTC report is in Appendix D.