Trip-Oriented Mobility Monitoring Framework Development

Final Report

prepared for

Florida Department of Transportation

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Executive Summary

Our ability to monitor mobility (i.e., congestion, reliability and accessibility) with field measurements of travel time is currently limited to the facility perspective. That is, measurement occurs on specific portions of a user's trip, but not the actual trip itself. It is important – and will continue to be important – to understand how facilities operate because agencies manage facilities. As more advanced operations strategies become more prevalent, it is clear that agencies will manage not only facilities but the entire trip as well. Further, because performance measurement should account for how users experience the system, changes in trip performance will account for this. This task creates both a conceptual and an empirical framework for studying trip-based mobility.

Of interest was analyzing the travel time from a major hub to the state line. Ports and railyards designated as Strategic Intermodal Systems (SIS) and Interstates were initially targeted. Working with FDOT, the project team identified 62 long-distance corridors that represent major truck freight movements in Florida. These facilities were selected because of their economic significance to the State of Florida. The corridors, along with their connecting roadways, are on the SIS. The starting point explored here is for ***long-distance travel in freight significant corridors***, but the concept and procedures can be adapted to monitor intra-urban trips as well.

This project undertook a study of trip-based performance analysis. The project team reviewed current efforts in Florida and elsewhere to undertake trip-based analysis and found that the ability to measure trips from origin to destination is lacking with currently available data. Therefore, a procedure to synthesize trips from current facility-based travel time data was developed. INRIX vehicle probe data was used but the method would also work with any other facility-based travel time data as well. The project team applied the new trip-based procedure to one year of INRIX travel time data to produce performance measures for trips within the identified corridors. It was discovered that using traditional performance measures that have been applied at the facility level (travel time indices for various moments of the travel time distribution), little distinction exists. However, when the delay per truck is computed over the entire distance, a more complete picture of performance emerges. Table 1.1 captures the 10 worst performing trips based on the 99^{th} percentile travel time index. The measures reported within the table 1.1 are consistent with traditional reliability facility measures.

Table 1.1 Ten Worst Performing Trips Based on Planning Time Index

				Travel Time Indices				
Corridor Name	**Path**	**Distance (Miles)**	**Speed Mean (mph)**	**Travel Time Mean (Min)**	**Mean**	**80^{th} %ile**	**95^{th} %ile**	**99^{th} %ile**
Tampa International Airport to Georgia via I-75	SR 60 southbound to I-275 eastbound to I-75 northbound to Georgia	221.9	65.6	203.2	1.049	1.065	1.099	1.166
Port of Tampa to Georgia via I-75	S. 50^{th} Street northbound to 22^{nd} St Causeway westbound to Selman Expressway eastbound to I-75 northbound to Georgia	229.3	64.6	213.2	1.056	1.071	1.104	1.186
Baldwin Railyard to Georgia via I-95	US 301 northbound to I-10 eastbound to I-95 northbound to Georgia	48.6	62.6	46.7	1.070	1.088	1.132	1.256
Winter Haven ILC to Georgia via I-75	SR 60 westbound to I-75 northbound to Georgia	253.7	61.5	247.7	1.081	1.102	1.138	1.208
Tampa International Airport to Georgia via I-95	SR 60 southbound to I-275 eastbound to I-4 eastbound to I-95 northbound to Georgia	262.3	64.7	243.7	1.081	1.100	1.152	1.226
Port of Tampa to Georgia via I-95	S. 50^{th} Street northbound to 22^{nd} St Causeway westbound to Selman Expressway eastbound to I-75 northbound to I-4 eastbound to I-95 northbound to Georgia	266.1	63.7	251.0	1.086	1.105	1.153	1.223
Port of Tampa to I-10 via US 301	S. 50th St northbound to 22nd St Causeway westbound to Selman Expressway eastbound to I-75 northbound to US 27 eastbound to US 301 northbound to I-10	109.8	62.6	105.4	1.085	1.102	1.157	1.341
Jacksonville FEC to Georgia via I-95	Phillips Hwy southbound to Butler Boulevard eastbound to I-95 northbound to Georgia	41.0	59.6	41.3	1.090	1.114	1.170	1.292
Winter Haven ILC to Georgia via I-95	SR 60 eastbound to US 27 northbound to I-4 eastbound to I-95 northbound to Georgia	394.2	57.1	414.4	1.127	1.156	1.194	1.235
Ft. Lauderdale FEC to Florida Turnpike (north) via US 27	Andrews Ave northbound to SR 84 westbound to I-595 westbound to US 27 northbound to FL Turnpike northbound	235.7	49.5	286.1	1.187	1.235	1.279	1.315

This process will likely be ongoing and it is expected that annual trends will be produced for FDOT based on these corridors. As the Source Book evolves a separate corridor analysis is planned for inclusion. Mobility performance measures reported on a corridor bases will be similar to the travel time reliability measures included in this report. There are many overlaps between the long distance corridors identified here and the corridors for Source Book reporting.

1.0 Introduction

The Florida Department of Transportation has been engaged in the analysis and reporting of multimodal performance measures on the extent and usage of Florida's transportation system for several years. These activities assist the Transportation Statistics Office (TranStat) in analyzing and producing systemwide mobility performance measures - ways of describing the performance of transportation systems related to the mobility of people and goods. However no FDOT office has yet to report on the performance of a trip or multiple trips.

1.1 Background to the Problem

MAP-21 legislation has elevated the concept of performance management as the basis for making transportation investment decisions. It specifies that performance measures and management be performed for a variety of functional areas, including congestion and reliability on the Nation's highways. While a narrow interpretation of the legislation would indicate that the highways should be the focal point for measuring performance, a broader view would encompass how travelers experience the system from the perspective of their entire trips.

Freight system performance is top-of-mind for manufacturers, shippers, carriers, and network managers and it underlies the fundamental competiveness of our economy. Shippers and logistics' operators place monetary value on time thus they have a strong self interest in achieving on time arrival. Freight fluidity captures the entire trip, across multiple modes, and accounts for break bulk points. The concept of fluidity is to monitor and report on the total travel time including dwell time at a port. To report on freight fluidity and combination-truck mobility, FDOT should analyze entire trips from origin to destination. Freight movement occurs within more clearly defined trips as opposed to automobile travelers. Automobiles are more likely than semi-trucks to change routes or even change destinations. Freight movement should have more predictable travel times from end-to-end. FDOT established trip based mobility performance for sixty-two relevant freight routes accounting for travel times, speeds, and travel time reliability.

1.2 Project Purpose

Our ability to monitor mobility (i.e., congestion, reliability and accessibility) with field measurements of travel time is currently limited to the facility perspective. That is, measurement occurs on specific portions of a user's trip, but the entire trip itself is not measured. It is important – and will continue to be important – to understand how facilities operate because agencies manage facilities. As additional advanced operations strategies become more prevalent, it is clear that agencies will manage not only facilities but the entire trip as well. Further, because performance measurement should account for how users experience the system, new trip based performance measures will evaluate this. This task creates both a conceptual and an empirical framework for studying trip-based mobility. The starting point explored here is for ***long-distance travel in freight significant corridors***, but the concept and procedures can be adapted to monitor intra-urban trips as well.

A comprehensive mobility measurement program involves using both trip- and facility-based measures because they both inform analysts about the nature of mobility in a state or a region:

- Many transportation investments are focused on improving and managing facilities, so facility-based measures are highly useful to planners and engineers. This is particularly true for operations and capacity improvements as well as some types of demand management.

- Other transportation investments – as well as land use and development policies – are more oriented to the entire trip-making process, so having an understanding of trip performance tells us about how our customers (i.e., travelers) are experiencing the transportation system. Emerging operations strategies – such as Active Transportation and Demand Management (ATDM) and Integrated Corridor Management (ICM) – also need to consider the entire trip-making process.

However, the data to track trips at the same level of detail as facilities is lacking. For example, planning agencies frequently conduct surveys of travelers and trip performance can be extracted from them, but they are hardly as rich and accurate as the continuously-collected data now available at the facility level. A major drawback of survey-based trip measures, related to their infrequency and small samples, is their inability to measure ***travel time reliability.***

When new data sources become available measuring the travel times between the origin and destination of a trip, it will be much easier to do both facility and trip-based analyses. Bluetooth devices currently capture the travel times between instruments based on unique identification numbers associated with an individual's bluetooth device. This data is typically aggregated and reported along a facility; it is not reported as a travel time between an origin and destination occurring on two different roadways. Further, even though many of the same mobility metrics can be applied to the performance of both facilities and trips, the nature of the measurements are different, and additional measures may be warranted for trip-based performance. Facility measurement describes the nature of traffic conditions to which travelers are exposed. Trip measurement includes factors in addition to traffic exposure – how users interact with entire landscape. With regard to trips, travelers are generally free to change departure times and routes, and in some cases, destinations and modes as well.

For the present and near future, however, facility-based data will need to be the basis for monitoring mobility performance. These data include vehicle probe data from private vendors. Although the ultimate source of these data is GPS "reads" on individual vehicles, the data are so heavily processed for consumption that they are essentially facility-based data, i.e., travel times for individual roadway segments. These data are used in this study and will continue to be used by FDOT for the foreseeable future.

When true origin-destination (O/D) travel time data becomes available it can be incorporated into analyses to address a broader range of concerns. Additional effort will have to be expended to account for the richness of the data and the complexities of travelers' patterns. Over time, trip purposes and destinations change. What will result are multiple definitions of what a "trip" is, even though it may be measured with the same metric. For example, a work trip could start at the same time every day, use auto only, and use the same route every day. Alternately, these factors can vary to different degrees. Measuring a true trip from the traveler's perspective ends up measuring a variety of factors, many of which are beyond the control of transportation agencies. Finally, measuring trip performance can be viewed how participants (travelers and businesses) ***adapt*** to the landscape. This adaptation no doubt includes avoiding traffic crowding (e.g., selecting origins and destinations to minimize traffic crowding exposure) and associated costs, which are not captured in trip-based measures.

2.0 Data Market Assessment

Current technology can track vehicle movements from one area to another. The instruments report if a vehicle is in the area through bluetooth technology. Cars traveling with bluetooth devices are identified by a MAC address when the vehicle comes within 300 feet of the instrument. Bluetooth instruments installed on a freeway may also gather travel data from a neighboring arterial roadway. To get around the void of precision, bluetooth data is primarily used to account for travel times along linear routes on the same facility. The technology in Florida cannot track vehicles precisely from one location to another. Further evaluation is needed to determine how to disaggregate the individual trips to determine specific paths.

2.1 Jacksonville

In 2012 an origin destination study was conducted in Jacksonville to determine the traffic patterns through the downtown Interstate system. The study occurred over 7 days using BlueTOAD Bluetooth instruments provided by TrafficCast. There were 29 Blue TOAD detectors that identified MAC addresses and MAC address movement was tracked between each site. Roughly 369,000 bluetooth device hits from vehicles traveling the network were recorded. The detectors accounted for travel times and speeds between sites.

Preliminary analysis was performed to identify the paths taken between sites to see if the vehicles followed the expected routes. The most common trip types can be observed through evaluating the percent of MAC addresses distributed to sites downstream. The instrumentation allows an analyst to observe the percent of original vehicle volume from the place of origin moving to instrumented destination points. These efforts should continue to be monitored by District 2 and the North Florida Transportation Planning Organization (TPO) to evaluate the trip analysis capabilities of their bluetooth system.

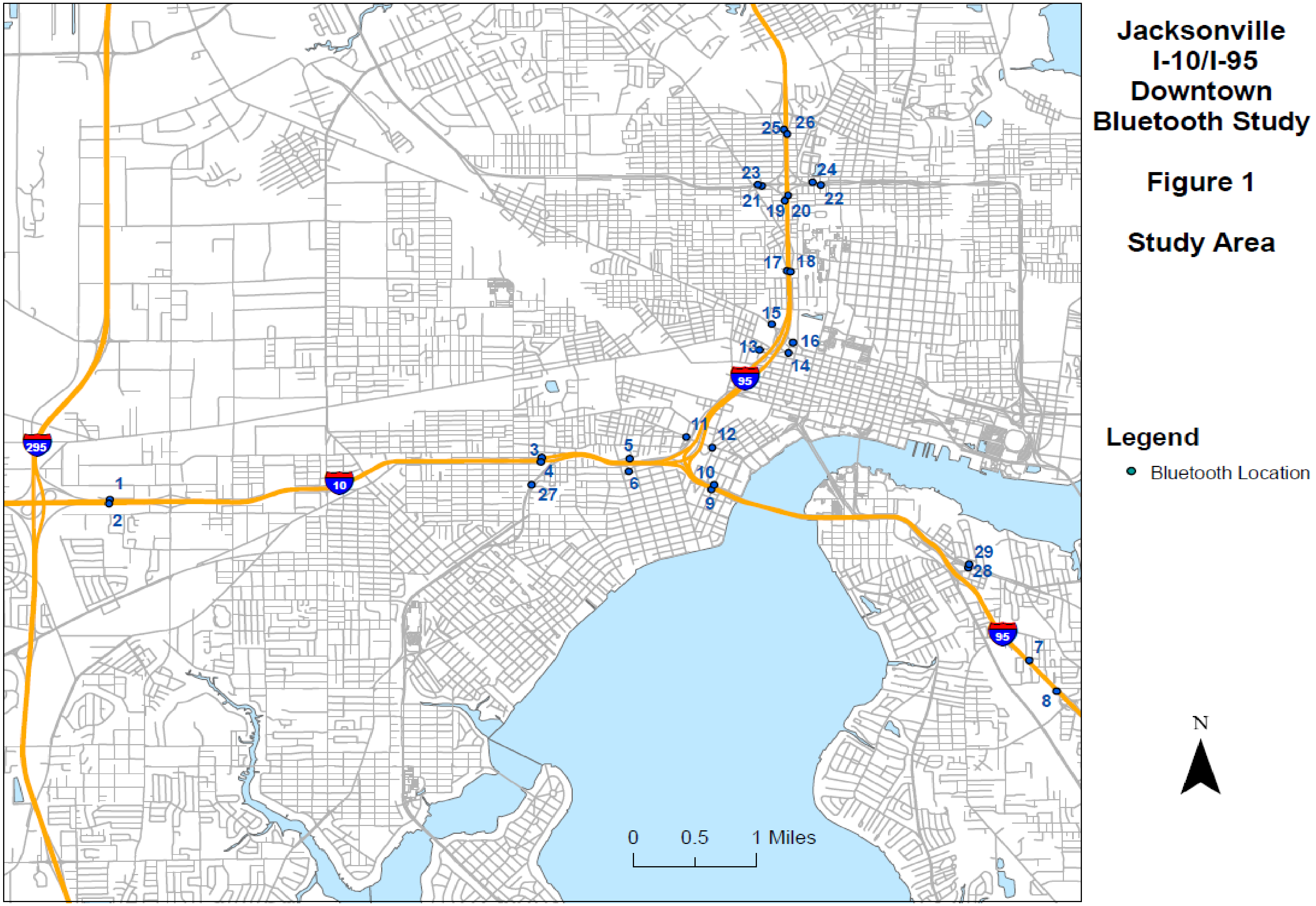
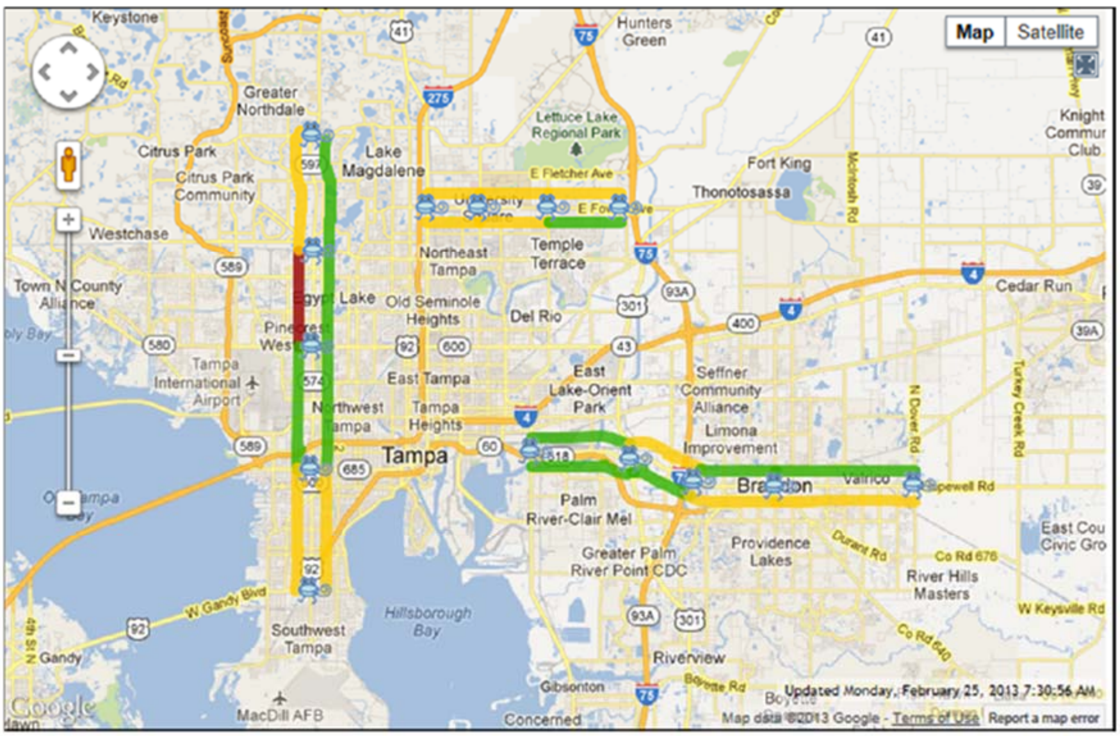


Figure 2.1 Bluetooth Locations in Jacksonville

2.2 Tampa Bay

Both Hillsborough and Pinellas Counties have used TrafficCast instrumentation primarily BlueTOAD for the past three years. The instruments have a sensitivity range of up to 300 ft and are used on arterials as well as freeways. The robustness of the data allows for various types of reporting. In addition to real time reporting, speeds can be reported by day of the week or time of the month. District 7 can monitor real time travel speeds and display the results on an automated thematic map.

Figure 2.2 Bluetooth Locations in Tampa



BlueTOAD Automated Speed Map

BlueTOAD instruments read and time stamp MAC addresses, relaying travel times and speeds to a computer. The analyst then can use the data to report on many mobility performance measures including delay by time of day. TrafficCast is developing real time alarms for atypical conditions. This will allow traffic monitoring center personnel to use active traffic demand management (ATDM) strategies to combat abnormally extreme traffic crowding. The research team plans to meet with District 7 and the Hillsborough MPO to gather information on trip based travel times.

2.3 FRATIS

Freight Advanced Traveler Information System (FRATIS) This application enhances traveler information systems to address specific freight needs for long and short-haul goods movement. The application provides traveler information to freight operators and drivers such as real-time travel estimates with route guidance to freight facilities, and basic incident alert, road closure and work zone information. The application uses archived information for performance monitoring. This application determines, in real-time and potentially while a truck is already on a route, the best route (or re-routing if applicable) between freight facilities for each carrier that subscribes to the service. Routes will be calculated on current and predicted conditions, with traffic crowding avoidance and incident avoidance being the predominate goals. As road conditions change, alternate routing is be provided to avoid the problem or to minimize the impact of the delay.

FRATIS tracks truck travel from origin to destination and includes queue times going into and leaving terminals. The travel speed data is captured through cell phone bluetooth detection. Tracking truck travel times from origin to destination will be applicable to long- and short-haul freight movement. For long-haul freight movement, this information may be useful in maneuvering through a metropolitan area while en route to the final destination.

2.4 SHRP 2 IDEA PROJECT L15

The SHRP 2 L15 project set out to develop an application that provides travelers with a fundamentally different way to planning trips or daily commute. Giving the traveler an expected delay prediction based on probabilistic incident occurring rate was a primary goal of L15. The SHRP 2 L15 project used ITS instruments to gather travel times between points on a freeway. By obtaining multiple periods of travel time data, the SHRP 2 L15 team successfully assessed reliability from freeway exit to freeway exit. The initial project excluded travel time on arterials however future research efforts plan to include arterials.

Commercial traffic information service providers process reports from traffic management centers and repackage the data into two types of information 1) speed and flow from sensors 2) text data on traffic incidents and special events. Initially the incoming information is processed through a data manager program. The data manager component continuously downloads real time data and converts the data into latitudinal and longitudinal information. Lastly the data manager component sends processed data forward to the prediction engine. Through freeway instrumentation, initial data is converted into information used for statistical predictions of nonrecurring events.

The IDEA prototype tool provides travel time predictions under both recurring and nonrecurring traffic conditions. A prediction engine provides up-to-date travel time reliability forecasts. The IDEA prototype tool predicts reliability along a freeway facility up to one week in advance of departure, 30 minutes before departure, or any time period in-between. A CPU user interface that remembers users trips based on log-on was developed by the L15 research team. The user can create and save trips including trip preferences like desired arrival time.

Prior to any advancement, the IDEA methodology underwent testing. The methodology was tested in metropolitan Washington D.C. along the I-66 corridor. Criteria in corridor selection included heavy traffic crowding and the likelihood of nonrecurring events such as incidents. Two different models were used, one for recurring traffic and another for nonrecurring traffic. The researcher team planned to do two forecasts, one with a 75% probability and one with a 95% probability. Ideally real world observations would statistically validated the L15 prediction models. The researchers' modeled travel times were validated by comparing the times to Bluetooth data gathered from BlueTOAD devices. Initial success was achieved, the 95th percentile travel times predicted correctly 95% of the time.

Vehicle probe data obtained by INRIX provides travel times and speeds between points along a facility. Currently, INRIX is a primary provider of travel time data to public agencies and even to individual travelers. Software engineers at INRIX developed an arrival time cell phone application that is distributed to the general public, both the Google and the iPhone app stores provide the free INRIX application. Personalized traffic and travel times to a given destination based on current and forecasted traffic conditions are delivered directly to a user's cell phone. The INRIX Arrival Time app lets a user share expected time of arrival with friends, provides departure alerts, and updates the user of changes to travel time.

2.5 Emerging Technology

Into the future state DOTs will access travel time data through third party purchases, vehicle detection instruments, and traffic monitoring sites embedded within the roadway. Nokia/Navteq (HERE), Air Sage, Tom Tom, TrafficCast, and INRIX continue to collect data and make it available for purchase; Florida DOT has recently purchased the HERE data; it is in real time and covers Florida's vast roadway network from principal arterials to local roads. HERE gathers the data from personal handheld devices and in-car bluetooth systems. Questions remain on how data is gathered on local roads where there is no instrumentation. How is sampling performed and data imputed? Answers to these questions are on the immediate horizon, in the meantime the HERE data is a promising data source for future use.

The Federal Highway Administration (FHWA) will make NPMRDS data from HERE available for the next 3 years. Through this effort travel time data is distributed for the entire National Highway System (NHS) every month. The data consists of travel times along TMC segments which analyst can use to produce trip travel times, from origin to destination. All state DOTs and MPOs can access this data free of charge.

Many agencies have begun installing bluetooth or similar instrumentation to gather vehicle performance data along arterial and freeway facilities. This practice will likely continue in areas where there is minimal vehicle probe data coverage. State DOT's future ITS plans include deploying transponder based data collection, toll tag readers, and radar detection devices. Some of these plans may change now that third party data is becoming readily available. Over the next 3 years states will continue to rely on point sensors like loop detectors and video image detectors for travel speeds and volume counts until the new sources of data can be validated.

3.0 Methodology

Indicators of traffic crowding for facilities do not provide adequate indication of trip traffic. The length of a trip is substantially longer than the length of a facility. To produce a trip many facilities are pieced together, facilities experiencing traffic crowding are combined with uncongested facilities to produce an entire trip. There are more uncongested facilities than there are facilities experiencing traffic crowding. When reporting on trip mobility the portions of the trip experiencing positive mobility dilute the congested segments. As a result consideration is given to selecting performance measures that show variation between trips.

3.1 Step 1: Define Trip-Based Performance Measures

The considerations for performance measures for monitoring trips are:

- Measures should be appropriate for documenting regional, statewide, or national performance.
- Measures should be "scalable" to high levels of temporal and spatial aggregation in the same way that facility-based measures are.
- To the extent possible, trip-based measures should be consistent with facility-based measures.

The project team decided that performance metrics commonly used for facility analysis be used for trip analysis, as they meet the above criteria. These include the distributions for the travel time index (TTI), the travel speed and the unit delay (delay per vehicle). The TTI is the ratio of an actual travel time to the ideal or free flow travel time.

For reliability, the distribution of travel times is used to compute the commonly used performance metrics: the mean TTI plus the, 80th, 95th, and 99th percentile TTIs. The TTI and delay metrics are all measured relative to the or free flow travel times that would occur for the trips. This value is computed directly from the INRIX data by taking the 85th percentile travel time from the overnight hours, 1:00 to 4:00 AM, for each segment that comprises the trip. Free flow speed captured in this manner will vary depending on the travel speeds along the analysis segment. An ongoing discussion on free flow speed may lead to free flow speed being calculated in a different manner. Other alternatives for free flow speed are the 85th percentile travel time of vehicles Sunday from 6 to 7 AM or 5 mph over the posted speed limit.

There is a major difference in applying these measures to trip-based performance. For facility analysis, measures are usually categorized by time slices throughout the day, e.g., peak period, mid-day, overnight. Because the trips analyzed here maybe hundreds of miles long, this concept is no longer relevant – a trip may span both peak and off peak times along its route. What becomes important is the ***start time of the trip*** as this influences where and when a trip may encounter traffic crowding.

3.2 STEP 2: TRIP DEFINITION

A trip can be thought of as a complete movement through the transportation system, from an origin to a desired destination. (Sometimes this is referred to as a "trip end".) A trip can be made using different routes (if made by private vehicle), different modes (if available) and at different times. It is important to note that when trips are tracked over time, additional factors beyond facility traffic are included, namely, how users interact with their environment in terms of:

- The choice of origin (where people choose to live) and destination (opportunities), so the effect of land use policies is detected; and
- Choice of modes, so the effect of transit investments is also imbedded in the measures.

3.3 Step 3: Data Assessment

The data source used in the analysis was provided by INRIX. In theory, data from GPS-equipped vehicle probes can be used to measure a trip (from origin to destination) but the private vendors who control these data do not currently process the data in this way – the data are parsed and assigned to links in the roadway network, so they represent the facility view. However, the project team anticipates that advances in data collection technology in the next few years will provide the O/D data needed to monitor the trip. Whether this comes to pass is not known with certainty, but FDOT should position itself to take advantage of the data if and when the data becomes available on a widespread enough basis to be useable for performance measures.

Therefore, a market and technology assessment was performed to determine the state of travel time data in the next 1-3 years, with an emphasis on the ability to provide O/D data. To do this the project team talked with developers of data collection technologies as well as private vendors of travel time data.

3.4 Step 4: Develop Conceptual Framework for Trip-Based Mobility

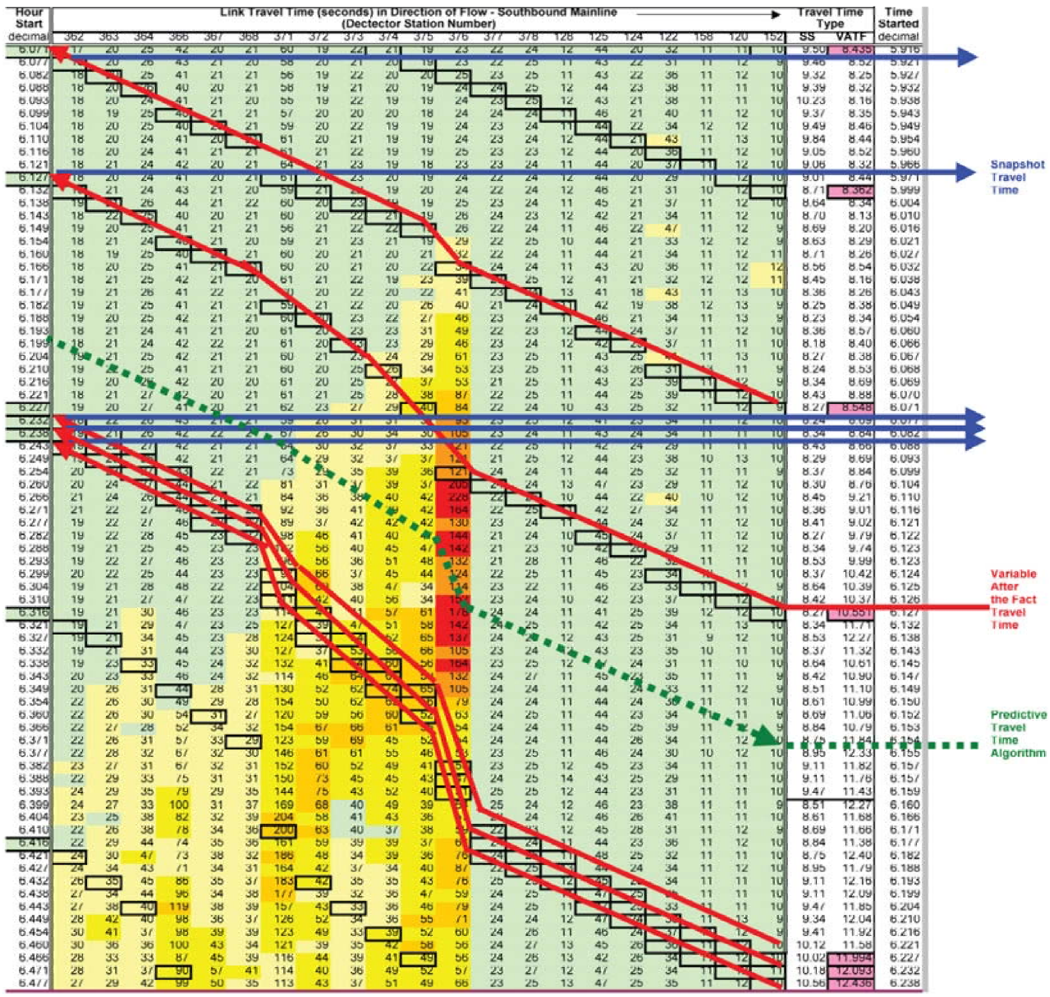
This step designed a test bed using Florida to study trip-based performance. The test bed is based on synthesizing trips from a fixed number of origins and destinations in the state. The process proceeds as follows:

- Select long distance trips that are representative of truck freight trips in Florida. In conjunction with FDOT personnel, a list of trips was compiled (Table 4.2). The trips include not only the origin and destination but the "path" of the trips (routes taken) as well.
- Obtain INRIX travel time data for the major roadways in the network. The period from July 1, 2010 to June 30, 2011 was used for the testing.
- Create link sequences for the trips in the vendor data.
- Adapt algorithm developed by CS for the I-95 Corridor Coalition to create trip times by simulating the passage of a vehicle onto the network at 5-minute intervals.

Two methods are available to estimate corridor or trip travel times from link travel times: The "snapshot" method and the vehicle trajectory method. Figure 2.1 illustrates these two basic methods of travel time estimation: the blue arrows represent a snapshot travel time; whereas, the red arrows represent a travel time based on vehicle trajectory.

The snapshot method sums all link travel times for the same time period, regardless of whether vehicles traversing the freeway section will actually be in that link during the snapshot time period. This method (or a derivation of this method) is often used in real-time systems, in which the computer system simply adds all link travel times between a defined origin and destination.

Figure 3.1 The Snapshot and Vehicle Trajectory Methods of Estimating Travel Times from Spot Speeds



Source: Cambridge Systematics, Inc., et al., *Guide to Effective Freeway Performance Measurement*, Web-Only Document 97, Transportation Research Board, August 2006, http://www.trb.org/TRBNet/ProjectDisplay.asp?ProjectID=822.

The vehicle trajectory method "traces" the vehicle trip in time and applies the link travel time corresponding to the precise time in which a vehicle is expected to traverse the link. For example, a section travel time that begins at 7:00 a.m. will use a link travel time for 7:00 to 7:05 at the trip origin, but could use a link travel time from 7:05 to 7:10, or 7:10 to 7:15 at the trip destination. The vehicle trajectory method attempts to more closely model the actual link travel times experienced by motorists as they traverse the freeway system.

3.5 Conduct Trip-Based Mobility Tests

A series of tests can be made with the framework developed in Subtask 2. For example:

- Conduct tests comparing trip-based versus facility-based data for determining areawide performance – the degree to which they are different is unknown; and

- Establish procedures for using trip-based performance data in the event that O/D travel time data does not become available.

- Compute a second set of areawide performance measures based on the traditional facility-based approach and compare to the trip-based metrics. Do this for a single year and for a two-year trend.

- Study the effect of taking alternate routes, modes, and departure times. For simplicity, the above testing is based on establishing the "most likely" path from origin to destination for a fixed departure time every day. It uses a single path between origins and destinations and therefore does not allow for route diversion due to unusually congested segments. However, travelers adjust their trip to respond to system conditions and personal circumstances. To address the issue of route diversion, paths can be built every day between origins and destinations, but this increases computational requirements.

4.0 Analysis Results

This section of the report includes an assessment of current and future data for use in trip reliability analysis. Also included within this section are the results of the trip-based mobility analyses. Even though the entire trip may not experience significant traffic crowding overall, there are short segments of many trips that do. Table 4.1 displays these highway segments**.**

Table 4.1 Most Congested Highway Segments of Long Distance Trips

		Travel Time Indices			
Highway Section	**Length**	**Mean**	**80th %ile**	**95th %ile**	**99th %ile**
SR112 from Miami Airport to I-95	4.8	1.299	1.394	1.554	1.772
NW 74th from Miami FEC to SR826	0.6	1.324	1.509	1.987	2.654
Port of Miami to I-395	0.7	1.359	1.546	1.779	2.022
I-395 from NE 1st Ave to I-95	0.5	1.285	1.386	1.596	2.236
I-395 from I-95 to SR826	8.5	1.396	1.392	2.840	3.790
SR826 from SR836 to 25th	0.7	1.301	1.347	2.084	3.542
Andrew Avenue through SR84 to I-95	2.5	1.247	1.363	1.499	1.637
Old Dixie from Port of Palm Beach to 45th St	0.7	1.269	1.333	1.600	2.237
45th st from Dixie Hwy to I-95	2.2	1.281	1.403	1.603	1.825
Prichard Rd from Sportsman Club to I-295	0.2	1.465	1.650	2.357	3.078
Butler Blvd from Phillips HWY to I-95	1.0	1.499	1.764	2.337	2.946
Soutel Dr from Old Kings Rd to I-295	0.9	1.158	1.248	1.430	1.675
Heckscher from I-295 to Berlin	0.2	1.602	1.947	2.467	3.083
Ramp from SR826 to TPK	1.3	1.498	1.696	2.205	2.920
TPK to I-95 at SR826	0.8	1.630	1.977	2.976	3.886
Ramp from I-95 to TPK	0.7	1.269	1.311	2.08	2.864

4.1 Long-Distance Travel Time Performance in Florida

The travel time performance of the selected corridors is shown in Table 3.2, ranked by the mean travel time index (lowest to highest). As stated above, the TTI and delay metrics are all measured relative to the "ideal" or "free flow" travel times that would occur for the trips. Rural Interstates have a much higher ideal travel time than local roads.

Compared to the analysis of urban facilities, the mobility metrics are quite a bit lower for Florida's long distance travel. Florida's long distance truck travel – at least the great majority of it that occurs on major roadways – experiences very low congestion levels and is relatively reliable as well. The effect of small pockets of traffic crowding – mainly peak period recurring traffic crowding – is diluted by the high travel speeds for the majority of the trip. Considering that the major routes identified avoid major urban areas on the line-haul portion of the trips, these results are not surprising.

Still, the effect of traffic crowding is showing up in the metrics and lead to high annual costs of delay, even if the metrics such as the TTI are small compared to those developed for much shorter urban facilities. For example, a mean TTI of 1.1 for a trip that takes five hours means there is an extra 30 minutes of delay for each truck that makes the trip. So, while the TTI is low, it is deceptive to compare it to a similar TTI value for a facility that might be five miles long.

This result also indicates that traditional urban-based congestion and reliability measures are not the most revealing for long distance travel. Delay is the most useful tested here, but because truck volumes were not available, it is expressed as a unit delay – delay per truck.

These results may not include traffic problems that occur at port and terminal access points; queuing occurring at port entry and exit points may not be captured in the data. Access to the ports via entry point along with the arterial connection represent the so called "last (or first) mile" of the truck trip. Florida DOT has elevated the importance of arterials connecting key hubs to the Interstate; these connecting pieces are designated as Strategic Intermodal System (SIS) facilities and receive prioritized funding. In 2013 all National Highway System (NHS) and SIS connectors were analyzed using preliminary engineering software to evaluate their level of service. This effort was intended to indicate the accessibility of the SIS and NHS hubs.

The "last mile" of a connector can function as a choke point for an entire route and significantly impact mobility. Unfortunately, the INRIX vehicle probe data does not cover many lower order highways. An alternate source, the National Performance Management Research Data Set (NPMRDS), does not include roadways not designated as NHS routes. The project team is currently reviewing options for obtaining data on these lower order roadways including the purchase of additional vehicle probe data through the American Transportation Research Institute.

Table 4.3 shows the influence of start time of the trips for the corridors with the highest mean TTIs. Only slight variation exists in the performance of trips throughout the day as measured by the travel time indices, with start times during daylight hours showing slightly higher values. However, when these values are transposed into unit delay (minutes of delay per vehicle), the differences are quite striking. As with the data shown in Table 4.2, relying solely on the travel time indices masks significant differences that occur over the full length of these long trips.

Moving forward, the project team envisions that these same corridors will be monitored annually and trends will be produced for inclusion into the *Source Book* and other FDOT performance documents. Travel time data for highways that provide port and terminal access will also be used, if available, in future trends analyses.

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
49	Baldwin Railyard to Alabama via I-10	US 301 northbound to I-10 westbound to Alabama	356.5	66.0	324.1	1.026	1.042	1.058	1.082	8.6
36	Jacksonville CSX to Alabama via I-10	Sportsman Club Road southbound to Pritchard Road eastbound to I-295 southbound to I-10 westbound to Alabama	374.2	65.8	341.3	1.029	1.044	1.060	1.084	9.8
42	Jacksonville NS to Alabama via I-10	Edgewood Drive southbound to Edgewood Avenue southbound to Old Kings Highway westbound to Soutel Drive westbound to I-295 southbound to I-10 westbound to Alabama	376.3	65.5	344.9	1.030	1.044	1.060	1.084	10.1
7	Orlando International Airport to Alabama via I-10	SR 528 westbound to FL Turnpike northbound to I-75 northbound to I-10 westbound to Alabama	477.4	65.8	435.7	1.032	1.046	1.064	1.092	13.8
56	Port of Jacksonville Talleyrand to Alabama via I-10	Talleyrand Avenue northbound to 21st Stree westbound to Phoenix Avenue southbound to MLK Jr. Parkway westbound to I-95 southbound to I-10 westbound to Alabama	387.1	65.5	354.9	1.033	1.047	1.064	1.088	11.4

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
52	Port of Jacksonville Dames Point to Alabama via I-10	New Berlin Road northbound to Hecksher Drive westbound to I-95 southbound to I-10 westbound to Alabama	391.3	64.8	362.5	1.033	1.047	1.064	1.088	11.7
22	Port of Jacksonville Blount Island to Alabama via I-10	Dave Rawls Boulevard northbound to Blount Island Road northbound to Hecksher Drive westbound to I-95 southbound to I-10 westbound to Alabama	393.1	64.6	365.5	1.034	1.048	1.065	1.089	12.2
39	Jacksonville FEC to Alabama via I-10	Phillips Highway southbound to Butler Boulevard eastbound to I-95 northbound to I-10 westbound to Alabama	385.9	65.2	355.5	1.035	1.050	1.067	1.092	12.1
50	Baldwin Railyard to Georgia via I-10	US 301 northbound to I-10 westbound to I-75 northbound to Georgia	84.3	65.9	76.9	1.031	1.050	1.068	1.100	2.4
9	Fort Lauderdale International Airport to Alabama via Tpk.	I-595 westbound to FL Turnpike northbound to I-75 northbound to I-10 westbound to Alabama	673.8	66.3	610.2	1.038	1.051	1.069	1.093	22.5
21	Port Everglades to Alabama via Tpk.	Eller Drive westbound to I-595 westbound to FL Turnpike northbound to I-75 northbound to I-10 westbound to Alabama	673.8	66.3	610.2	1.038	1.051	1.069	1.093	22.5

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
14	Tampa International Airport to Alabama via I-10	SR 60 southbound to I-275 eastbound to I-75 northbound to I-10 westbound to Alabama	494.0	65.8	450.4	1.036	1.050	1.070	1.100	15.6
31	Port of Palm Beach to Alabama via Tpk.	Old Dixie Hwy northbound to SR 710 westbound to FL Turnpike northbound to I-75 northbound to I-10 westbound to Alabama	620.4	65.7	567.1	1.039	1.053	1.071	1.097	21.6
48	Ft. Lauderdale FEC to Alabama via Tpk.	Andrews Avenue northbound to SR 84 westbound to I-595 westbound to FL Turnpike northbound to I-75 northbound to I-10 westbound to Alabama	674.3	65.8	614.6	1.040	1.053	1.071	1.095	23.8
17	Port of Tampa to Alabama via I-10	S. 50th Street northbound to 22nd Street Causeway westbound to Selman Expressway eastbound to I-75 northbound to I-10 westbound to Alabama	501.4	65.4	460.4	1.039	1.053	1.073	1.106	17.3
33	Miami FEC Intermodal terminal to Alabama via Tpk.	NW 69th Avenue northbound to NW 74th Street westbound to NW 72nd Street southbound to NW 74th Street Connector westbound to SR 826	694.8	65.9	632.9	1.042	1.056	1.075	1.098	25.8

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
		northbound to FL Turnpike northbound to I-75 northbound to I-10 westbound to Alabama								
28	Port of Miami to Alabama via Tpk.	Port Boulevard westbound to NE 1st Avenue northbound to I-395 westbound to I-95 northbound to FL Turnpike northbound to I-75 northbound to I-10 westbound to Alabama	690.8	65.9	629.2	1.043	1.056	1.076	1.098	25.7
2	Miami International Airport to Alabama via Tpk.	SR 112 eastbound to I-95 northbound to FL Turnpike northbound to I-75 northbound to I-10 westbound to Alabama	692.2	65.9	630.5	1.043	1.057	1.076	1.098	26.0
38	Jacksonville CSX to Georgia via I-10	Sportsman Club Road southbound to Pritchard Road eastbound to I-295 southbound to I-10 westbound to I-75 northbound to Georgia	102.1	65.1	94.1	1.040	1.057	1.077	1.112	3.7

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
43	Jacksonville NS to Georgia via I-10	Edgewood Drive southbound to Edgewood Avenue southbound to Old Kings Highway westbound to Soutel Drive westbound to I-295 southbound to I-10 westbound to I-75 northbound to Georgia	104.1	64.0	97.7	1.042	1.058	1.078	1.112	4.0
6	Orlando International Airport to Georgia via I-75	SR 528 westbound to FL Turnpike northbound to I-75 northbound to Georgia	205.3	65.4	188.5	1.042	1.059	1.082	1.135	7.7
11	Fort Lauderdale International Airport to Georgia via Tpk.	I-595 westbound to FL Turnpike northbound to I-75 northbound to Georgia	401.7	66.4	363.0	1.048	1.063	1.086	1.123	16.5
18	Port Everglades to Georgia via Tpk.	Eller Drive westbound to I-595 westbound to FL Turnpike northbound to I-75 northbound to Georgia	401.7	66.4	363.0	1.048	1.063	1.086	1.123	16.5
54	Port of Jacksonville Dames Point to Georgia via I-10	New Berlin Road northbound to Hecksher Drive westbound to I-95 southbound to I-10 westbound to I-75 northbound to Georgia	119.1	62.0	115.3	1.051	1.067	1.089	1.123	5.6

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
45	Ft. Lauderdale FEC to Georgia via Tpk.	Andrews Avenue northbound to SR 84 westbound to I-595 westbound to FL Turnpike northbound to I-75 northbound to Georgia	402.2	65.7	367.4	1.051	1.067	1.089	1.126	17.8
57	Port of Jacksonville Talleyrand to Georgia via I-10	Tallyrand Avenue northbound to 21st Stree westbound to Phoenix Avenue southbound to MLK Jr. Parkway westbound to I-95 southbound to I-10 westbound to I-75 northbound to Georgia	115.0	64.1	107.7	1.052	1.068	1.090	1.127	5.3
60	Winter Haven Intermodal Logistics Center to Alabama via I-10	SR 60 (west of Alturas Road) westbound to I-75 northbound to I-10 westbound to Alabama	525.8	63.8	495.0	1.052	1.068	1.090	1.120	24.6
30	Port of Palm Beach to Georgia via I-75	Old Dixie Hwy northbound to SR 710 westbound to FL Turnpike northbound to I-75 northbound to Georgia	348.3	65.4	319.9	1.051	1.067	1.091	1.132	15.6
37	Jacksonville CSX and Georgia via I-95	Sportsman Club Road southbound to Pritchard Road eastbound to I-295 northbound to I-95 northbound to Georgia	31.4	64.2	29.4	1.047	1.067	1.092	1.137	1.3

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
41	Jacksonville FEC to Georgia via I-10	Phillips Highway southbound to Butler Boulevard eastbound to I-95 northbound to I-10 westbound to I-75 northbound to Georgia	105.7	63.5	100.0	1.053	1.070	1.092	1.125	5.0
24	Port of Jacksonville Blount Island to Georgia via I-10	Dave Rawls Boulevard northbound to Blount Island Road northbound to Hecksher Drive westbound to I-95 southbound to I-10 westbound to I-75 northbound to Georgia	120.9	61.4	118.2	1.054	1.070	1.094	1.126	6.1
34	Miami FEC Intermodal terminal to Georgia via I-Tpk.	NW 69th Avenue northbound to NW 74th Street westbound to NW 72nd Street southbound to NW 74th Street Connector westbound to SR 826 northbound to FL Turnpike northbound to I-75 northbound to Georgia	422.7	65.8	385.6	1.054	1.070	1.095	1.133	19.8
8	Fort Lauderdale International Airport to Georgia via I-75	I-595 westbound to I-75 northbound to Georgia	463.3	66.9	415.9	1.056	1.070	1.095	1.142	22.0

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
19	Port Everglades to Georgia via I-75	Eller Drive westbound to I-595 westbound to I-75 northbound to Georgia	463.3	66.9	415.9	1.056	1.070	1.095	1.142	22.0
29	Port of Palm Beach to Georgia via I-95	Old Dixie Hwy southbound to 45th Street westbound to I-95 northbound to Georgia	311.0	65.6	284.6	1.058	1.074	1.095	1.124	15.5
26	Port of Miami to Georgia via I-Tpk.	Port Boulevard westbound to NE 1st Avenue northbound to I-395 westbound to I-95 northbound to FL Turnpike northbound to I-75 northbound to Georgia	418.7	65.8	382.0	1.054	1.071	1.096	1.135	19.7
4	Miami International Airport to Georgia via Tpk.	SR 112 eastbound to I-95 northbound to FL Turnpike northbound to I-75 northbound to Georgia	420.1	65.8	383.2	1.055	1.072	1.097	1.134	20.0
44	Jacksonville NS to Georgia via I-95	Edgewood Drive southbound to Edgewood Avenue southbound to Old Kings Highway westbound to Soutel Drive westbound to I-295 northbound to I-95 northbound to Georgia	33.5	61.0	32.9	1.052	1.072	1.097	1.138	1.7

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	**Corridor Name**	**Path**	**Distance (Miles)**	**Speed Mean (mph)**	**Travel Time Mean (Min)**	**Mean**	**80th %ile**	**95th %ile**	**99th %ile**	**Delay per Truck (Min)**
32	Miami FEC Intermodal terminal to Georgia via I-75	NW 69th Avenue northbound to NW 74th Street westbound to NW 72nd Street southbound to NW 74th Street Connector westbound to SR 826 northbound to I-75 northbound to Georgia	475.2	66.8	427.0	1.057	1.071	1.097	1.142	22.9
47	Ft. Lauderdale FEC to Georgia via I-75	Andrews Avenue northbound to SR 84 westbound to I-595 westbound to I-75 northbound to Georgia	463.8	66.2	420.3	1.059	1.073	1.098	1.144	23.3
12	Tampa International Airport to Georgia via I-75	SR 60 southbound to I-275 eastbound to I-75 northbound to Georgia	221.9	65.6	203.2	1.049	1.065	1.099	1.166	9.6
1	Miami International Airport to Georgia via I-75	NW 25th Street westbound to SR 826 northbound to I-75 northbound to Georgia	478.1	66.8	429.5	1.057	1.072	1.100	1.145	23.2
10	Fort Lauderdale International Airport to Georgia via I-95	I-595 westbound to I-95 northbound to Georgia	359.6	66.1	326.8	1.060	1.076	1.100	1.132	18.5
20	Port Everglades to Georgia via I-95	Eller Drive westbound to I-595 westbound to I-95 northbound to Georgia	359.6	66.1	326.8	1.060	1.076	1.100	1.132	18.5

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
46	Ft. Lauderdale FEC to Georgia via I-95	Andrews Avenue northbound to SR 84 westbound to I-95 northbound to Georgia	356.1	65.6	326.1	1.062	1.078	1.102	1.134	19.0
15	Port of Tampa to Georgia via I-75	S. 50th Street northbound to 22nd Street Causeway westbound to Selman Expressway eastbound to I-75 northbound to Georgia	229.3	64.6	213.2	1.056	1.071	1.104	1.186	11.3
23	Port of Jacksonville Blount Island to Georgia via I-95	Dave Rawls Boulevard northbound to Blount Island Road northbound to Hecksher Drive westbound to I-295 northbound to I-95 northbound to Georgia	28.5	63.0	27.2	1.057	1.078	1.104	1.151	1.5
5	Orlando International Airport to Georgia via I-95	SR 528 eastbound to SR 417 northbound to I-4 eastbound to I-95 northbound to Georgia	197.5	65.4	181.3	1.065	1.082	1.105	1.146	11.1
55	Port of Jacksonville Talleyrand to Georgia via I-95	Talleyrand Avenue northbound to 21st Stree westbound to Phoenix Avenue southbound to MLK Jr. Parkway westbound to I-95 northbound to Georgia	29.7	63.5	28.0	1.058	1.081	1.107	1.149	1.6

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
53	Port of Jacksonville Dames Point to Georgia via I-95	New Berlin Road northbound to Hecksher Drive westbound to I-95 northbound to Georgia	29.7	56.4	31.6	1.049	1.073	1.107	1.155	1.5
35	Miami FEC Intermodal terminal to Georgia via I-95	NW 69th Avenue northbound to NW 74th Street westbound to NW 72nd Street southbound to NW 74th Street Connector westbound to SR 826 northbound to I-95 northbound to Georgia	382.9	65.4	351.7	1.069	1.086	1.118	1.158	22.6
25	Port of Miami to Georgia via I-95	Port Boulevard westbound to NE 1st Avenue northbound to I-395 westbound to I-95 northbound to Georgia	378.7	65.4	347.6	1.069	1.086	1.118	1.158	22.4
3	Miami International Airport to Georgia via I-95	SR 112 eastbound to I-95 northbound to Georgia	380.1	65.4	348.8	1.070	1.087	1.118	1.157	22.7
27	Port of Miami to Georgia via I-75	Port Boulevard westbound to NE 1st Avenue northbound to I-395 westbound to SR	488.6	65.9	444.8	1.066	1.082	1.122	1.165	27.4

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
		826 northbound to I-75 northbound to Georgia								
51	Baldwin Railyard to Georgia via I-95	US 301 northbound to I-10 eastbound to I-95 northbound to Georgia	48.6	62.6	46.7	1.070	1.088	1.132	1.256	3.1
58	Winter Haven Intermodal Logistics Center to Georgia via I-75	SR 60 (west of Alturas Road) westbound to I-75 northbound to Georgia	253.7	61.5	247.7	1.081	1.102	1.138	1.208	18.6
13	Tampa International Airport to Georgia via I-95	SR 60 southbound to I-275 eastbound to I-4 eastbound to I-95 northbound to Georgia	262.3	64.7	243.7	1.081	1.100	1.152	1.226	18.3
16	Port of Tampa to Georgia via I-95	S. 50th Street northbound to 22nd Street Causeway westbound to Selman Expressway eastbound to I-75 northbound to I-4 eastbound to I-95 northbound to Georgia	266.1	63.7	251.0	1.086	1.105	1.153	1.223	20.0
62	Port of Tampa to I-10 via US 301	S. 50th Street northbound to 22nd Street Causeway westbound to Selman Expressway eastbound to I-75 northbound to US 27 eastbound to US 301 northbound to I-10	109.8	62.6	105.4	1.085	1.102	1.157	1.341	8.3

Table 4.2 Travel Time Performance for Long Distance Corridors in Florida, June 2010 to July 2011

						Travel Time Indices				
Corridor Number	Corridor Name	Path	Distance (Miles)	Speed Mean (mph)	Travel Time Mean (Min)	Mean	80th %ile	95th %ile	99th %ile	Delay per Truck (Min)
40	Jacksonville FEC to Georgia via I-95	Phillips Highway southbound to Butler Boulevard eastbound to I-95 northbound to Georgia	41.0	59.6	41.3	1.090	1.114	1.170	1.292	3.4
59	Winter Haven Intermodal Logistics Center to Georgia via I-95	SR 60 (west of Alturas Road) eastbound to US 27 northbound to I-4 eastbound to I-95 northbound to Georgia	394.2	57.1	414.4	1.127	1.156	1.194	1.235	46.7
61	Ft. Lauderdale FEC to Florida Turnpike (north) via US 27	Andrews Avenue northbound to SR 84 westbound to I-595 westbound to US 27 northbound to FL Turnpike northbound	235.7	49.5	286.1	1.187	1.235	1.279	1.315	45.1

Table 4.3 Effect of Trip Start Times on Trip Performance

					Travel Time Indices				
Corridor	**Time Range**	**Length**	**Travel Time**	**Speed**	**Mean**	**80th %ile**	**95th %ile**	**99th %ile**	**Delay per Truck**
Port of Tampa to Georgia	0:00 to 4:00	266.1	249.5	64.0	1.079	1.095	1.113	1.136	18.4
	4:00 to 8:00	266.1	248.0	64.4	1.073	1.090	1.118	1.168	16.9
	8:00 to 12:00	266.1	250.7	63.8	1.085	1.107	1.156	1.212	19.7
	12:00 to 16:00	266.1	254.0	63.0	1.099	1.129	1.197	1.273	23.0
	16:00 to 20:00	266.1	253.4	63.1	1.096	1.122	1.182	1.250	22.3
	20:00 to 24:00	266.1	250.6	63.7	1.085	1.101	1.124	1.153	19.5
Jacksonville FEC to Georgia	0:00 to 4:00	41.0	41.1	59.8	1.086	1.107	1.140	1.197	3.3
	4:00 to 8:00	41.0	40.8	60.3	1.077	1.101	1.142	1.204	2.9
	8:00 to 12:00	41.0	41.0	60.0	1.083	1.108	1.151	1.244	3.2
	12:00 to 16:00	41.0	41.2	59.8	1.087	1.113	1.156	1.253	3.3
	16:00 to 20:00	41.0	42.4	58.3	1.118	1.156	1.278	1.460	4.5
	20:00 to 24:00	41.0	41.3	59.6	1.091	1.115	1.152	1.217	3.4
Winter Haven Intermodal Logistics Center to Georgia	0:00 to 4:00	394.2	405.3	58.4	1.102	1.125	1.151	1.172	37.6
	4:00 to 8:00	394.2	415.6	56.9	1.131	1.155	1.185	1.221	48.0
	8:00 to	394.2	422.3	56.1	1.149	1.176	1.211	1.253	54.7

Table 4.3 Effect of Trip Start Times on Trip Performance

Corridor	Time Range	Length	Travel Time	Speed	Travel Time Indices Mean	80th %ile	95th %ile	99th %ile	Delay per Truck
	12:00								
	12:00 to 16:00	394.2	423.6	55.9	1.152	1.183	1.223	1.268	55.9
	16:00 to 20:00	394.2	413.1	57.3	1.124	1.145	1.171	1.198	45.4
	20:00 to 24:00	394.2	406.2	58.3	1.105	1.126	1.150	1.174	38.6
Ft. Lauderdale FEC to Florida Turnpike (north) via US 27	0:00 to 4:00	235.7	278.3	50.9	1.154	1.194	1.237	1.263	37.2
	4:00 to 8:00	235.7	290.5	48.7	1.205	1.244	1.282	1.312	49.4
	8:00 to 12:00	235.7	295.7	47.9	1.226	1.265	1.301	1.330	54.6
	12:00 to 16:00	235.7	292.1	48.5	1.212	1.250	1.289	1.326	51.1
	16:00 to 20:00	235.7	285.9	49.5	1.186	1.228	1.272	1.313	44.8
	20:00 to 24:00	235.7	274.3	51.6	1.138	1.178	1.217	1.248	33.3
Port of Tampa to I-10 via US 301	0:00 to 4:00	109.8	105.0	62.8	1.081	1.100	1.124	1.147	7.9
	4:00 to 8:00	109.8	103.8	63.5	1.069	1.089	1.120	1.180	6.7
	8:00 to 12:00	109.8	105.4	62.7	1.085	1.099	1.158	1.407	8.2
	12:00 to 16:00	109.8	105.3	62.8	1.084	1.096	1.165	1.409	8.2
	16:00 to 20:00	109.8	107.6	61.5	1.108	1.137	1.260	1.425	10.5

Table 4.3 Effect of Trip Start Times on Trip Performance

					Travel Time Indices				
Corridor	**Time Range**	**Length**	**Travel Time**	**Speed**	**Mean**	**80th %ile**	**95th %ile**	**99th %ile**	**Delay per Truck**
	20:00 to 24:00	109.8	105.3	62.6	1.084	1.103	1.136	1.193	8.2

5.0 Recommendations

This project established a framework for monitoring long distance trips in Florida. The trips were selected to be representative major truck freight flows in the state, although the they are also relevant for long distance passenger travel because significant passenger flows also occur along these routes. The following recommendations are made to continue the work developed here.

1. ***Long distance travel monitoring should be done on an annual basis to establish trends.*** The trips presented here should have the same performance measures developed every year using vehicle probe data, and the results should be compared with previous years. This trend analysis should be presented in the *Source Book*. Based on the findings of this study, delay should be metric on which the trends are compared. As a starting point, horizontal bar charts showing annual delay by trip (and total for all trips) for five successive years should be used.

2. ***Define a procedure for obtaining travel time data for the "last mile of the trip".*** The "last mile" is meant to cover the relatively short distance of highway leading up to the property of a port or terminal. A limitation of the INRIX data – as well as the vehicle probe data from several other vendors – is that many lower-order highways are not covered, most likely due to low sample sizes. While any congestion on this short distance will have a negligible effect on the overall long-distance trip, it is nonetheless a concern for carriers and shippers. Therefore, monitoring port and terminal access could be conducted as a separate activity for FDOT and investigation into potential data sources should be undertaken. This investigation would include probe data from vendors who do not have coverage limitations as well as original data collection y FDOT with technologies such as Blue Tooth.

3. ***Estimate origin-destination (O/D) truck demand and combine with congestion metrics to derive total delay by trip.*** Obtaining O/D data (truck flows) for individual trips using existing data sources is difficult. However, it is possible that such data will become available in the near future, most likely from private vendors. If and when it does, a more complete picture of long distance travel performance can be obtained.

4. ***Drill-down analysis should be conducted to examine where and when delay is occurring.*** This is essentially bottleneck analysis. Since many trips share common routes, a single bottleneck may be affecting multiple trips. The analysis may also reveal the presence of work zones or days when severe weather are affecting the outcomes and thus would be a way of explaining differences in observed delay trends.

5. ***Adapt methodology to intra-urban trips.*** The method for developing performance measures developed here representatives a major departure from the state of the practice. Traditionally, performance is developed from the perspective of short sections on individual facilities. The method developed here is a trip-based perspective, which is also relevant for trips that occur within an urban area (e.g.,

weekday commuter trips, trips to the airport). The value of trip rather than facility monitoring within urban areas is that it accounts for not only congestion but how users interact with the system in a realistic way.

6. ***Extend the analysis to include supply chains important to Florida.*** The current defined trips occur wholly within Florida, but key supply chains will include travel outside the state as well. This information may be important to FDOT in developing partnerships with other states to ensure that that the entire supply chain is operating efficiently, thereby aiding all involved states. The logical place to start would be with other states already part of the I-95 Corridor Coalition.

6.0 References

Florida Department of Transportation "Jacksonville I-95/I-10 Downtown Bluetooth Stud" June 2013

Peter J. Yauch "Applying Arterial Performance Measures to Operational Needs" July 2013

Ed Hutchinson "Development of Revised Methodology for Collecting Origin-Destination Data" February 2006

Zongwei Tao, Jeffrey Spots, Bin Lu, Xuesong Zhou, and Tao Xing "Forecasting and Delivery of Highway Travel Time Reliability Information" November 2012

APPENDIX

Locations of Long Distance Corridors

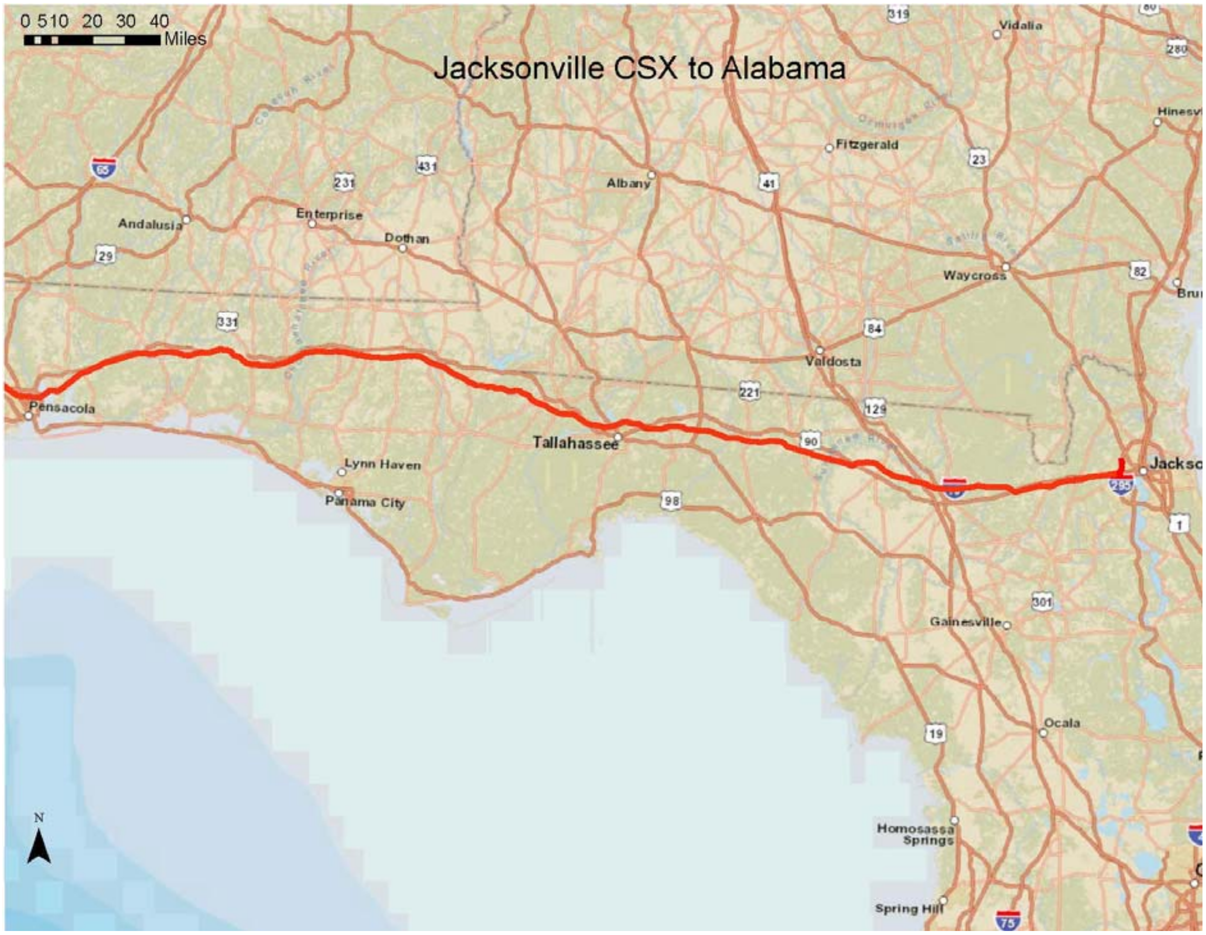


Figure A.1 Jacksonville CSX to Alabama

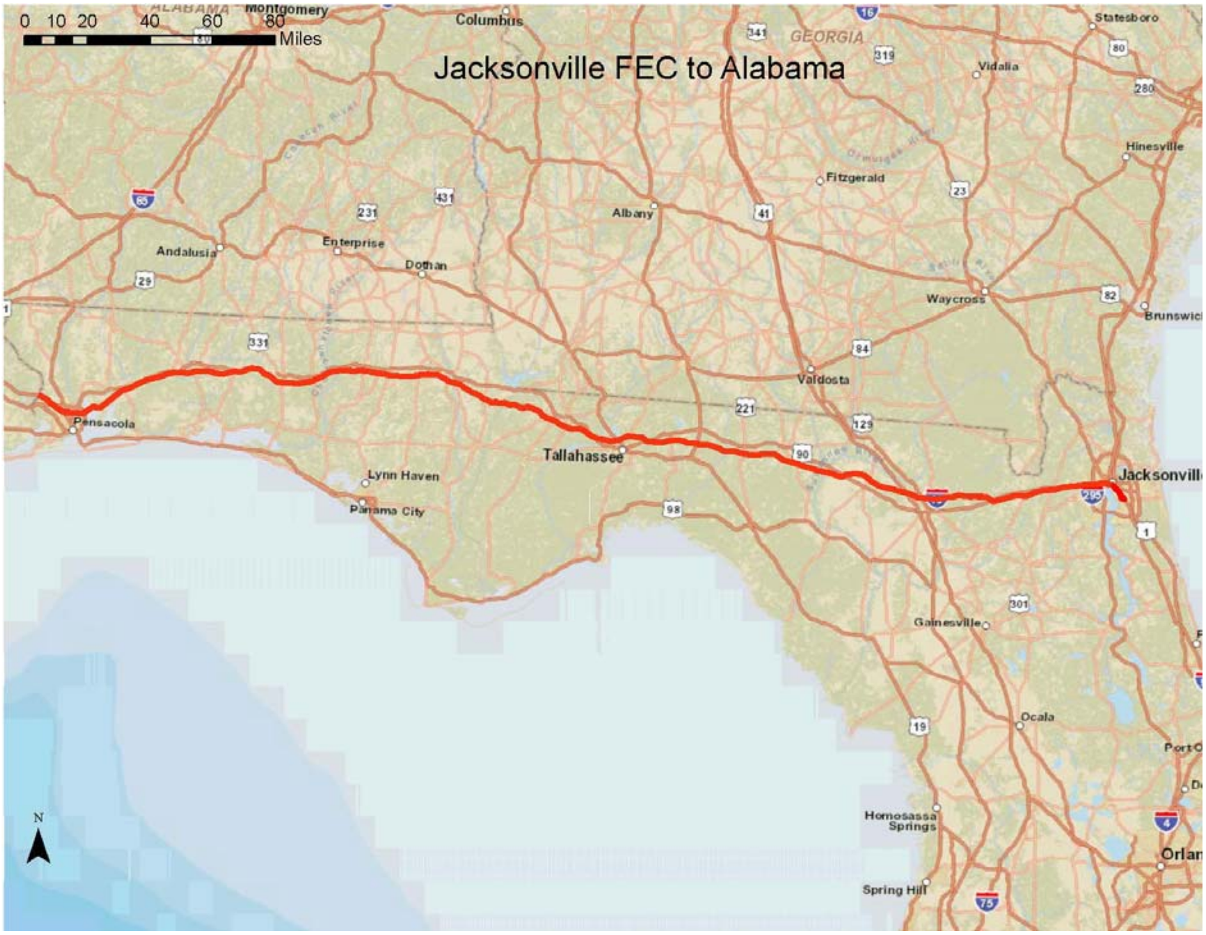


Figure A.2 Jacksonville FEC to Alabama

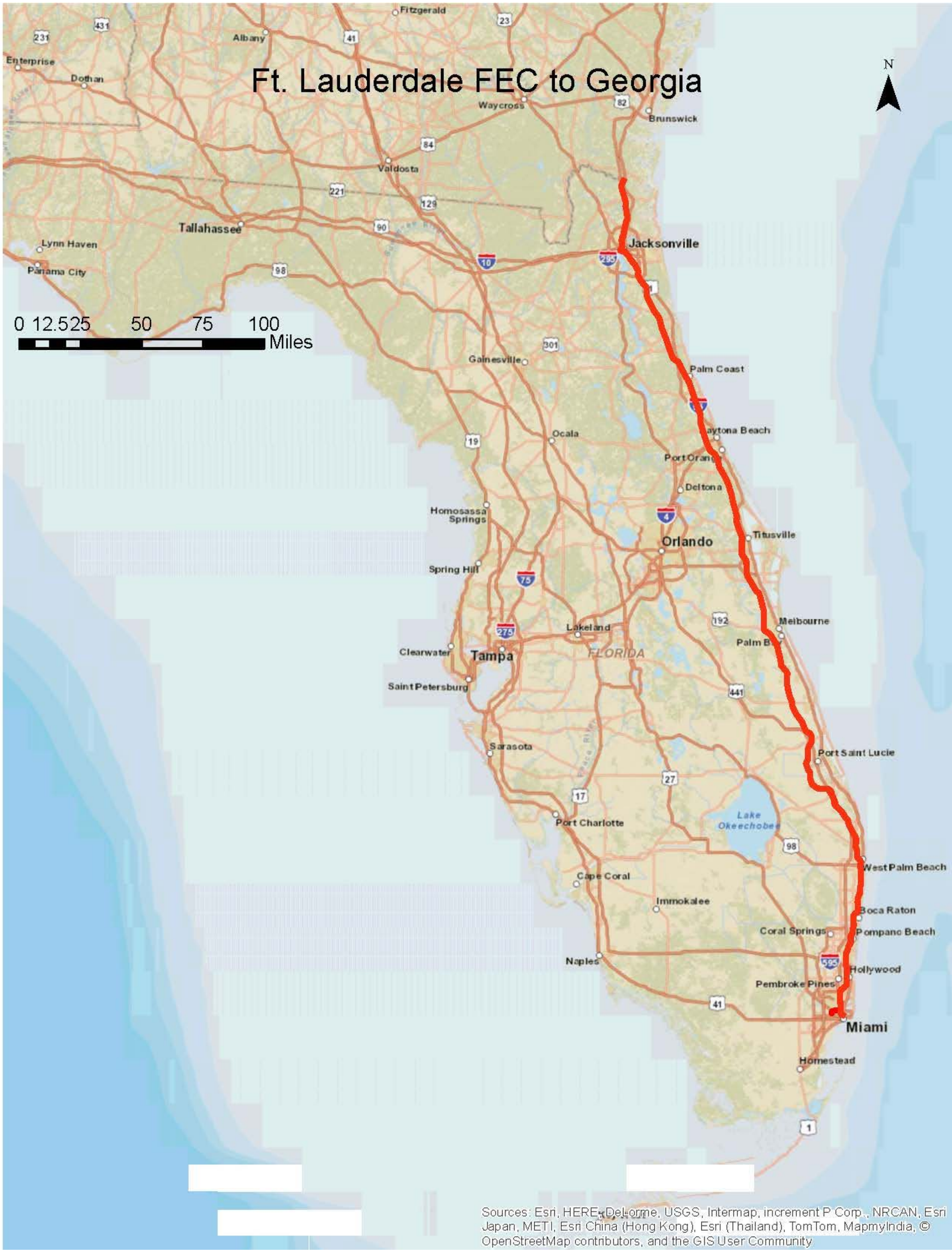


Figure A.3 Ft. Lauderdale FEC to Georgia

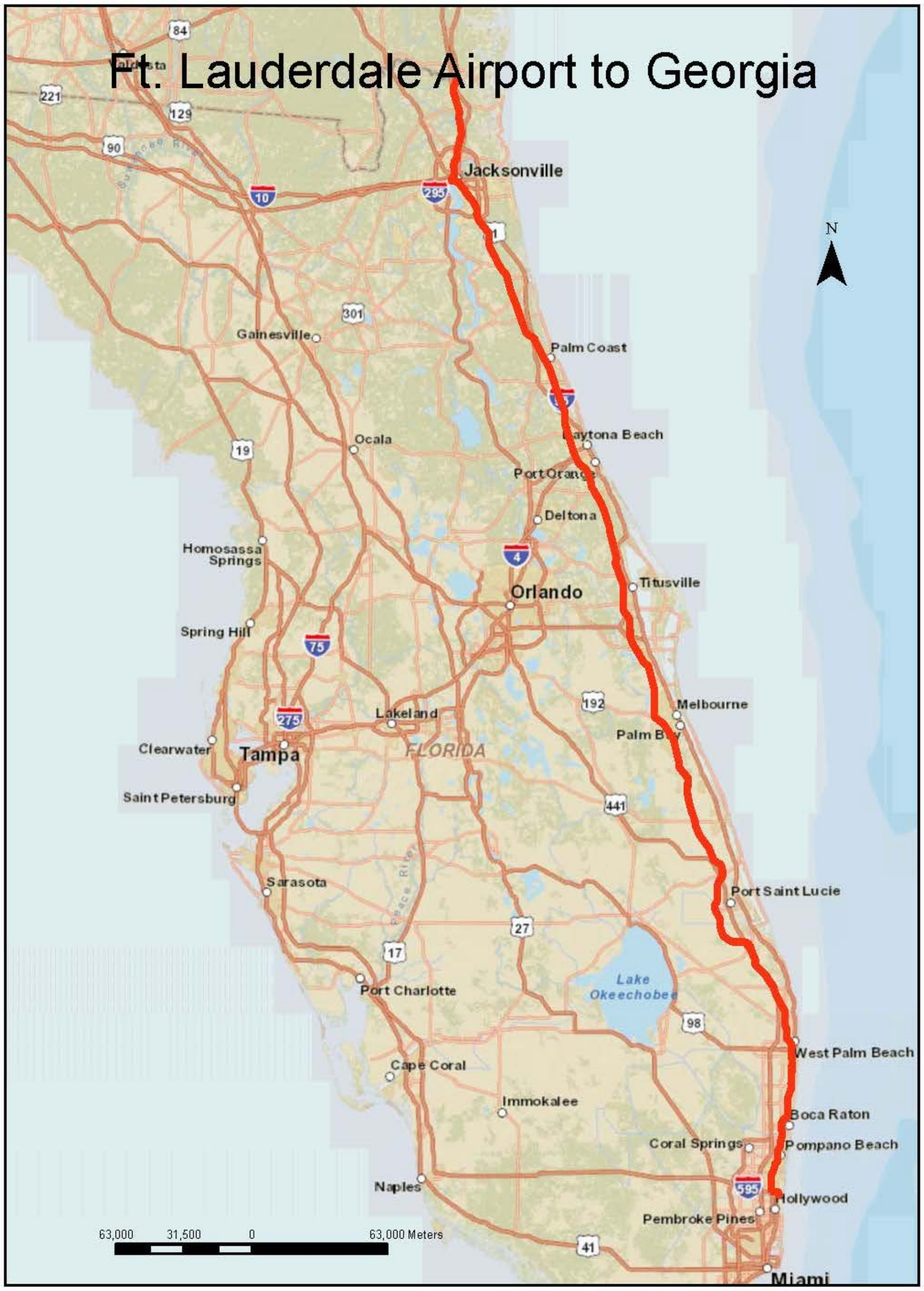


Figure A.4 Ft. Lauderdale Airport to Georgia

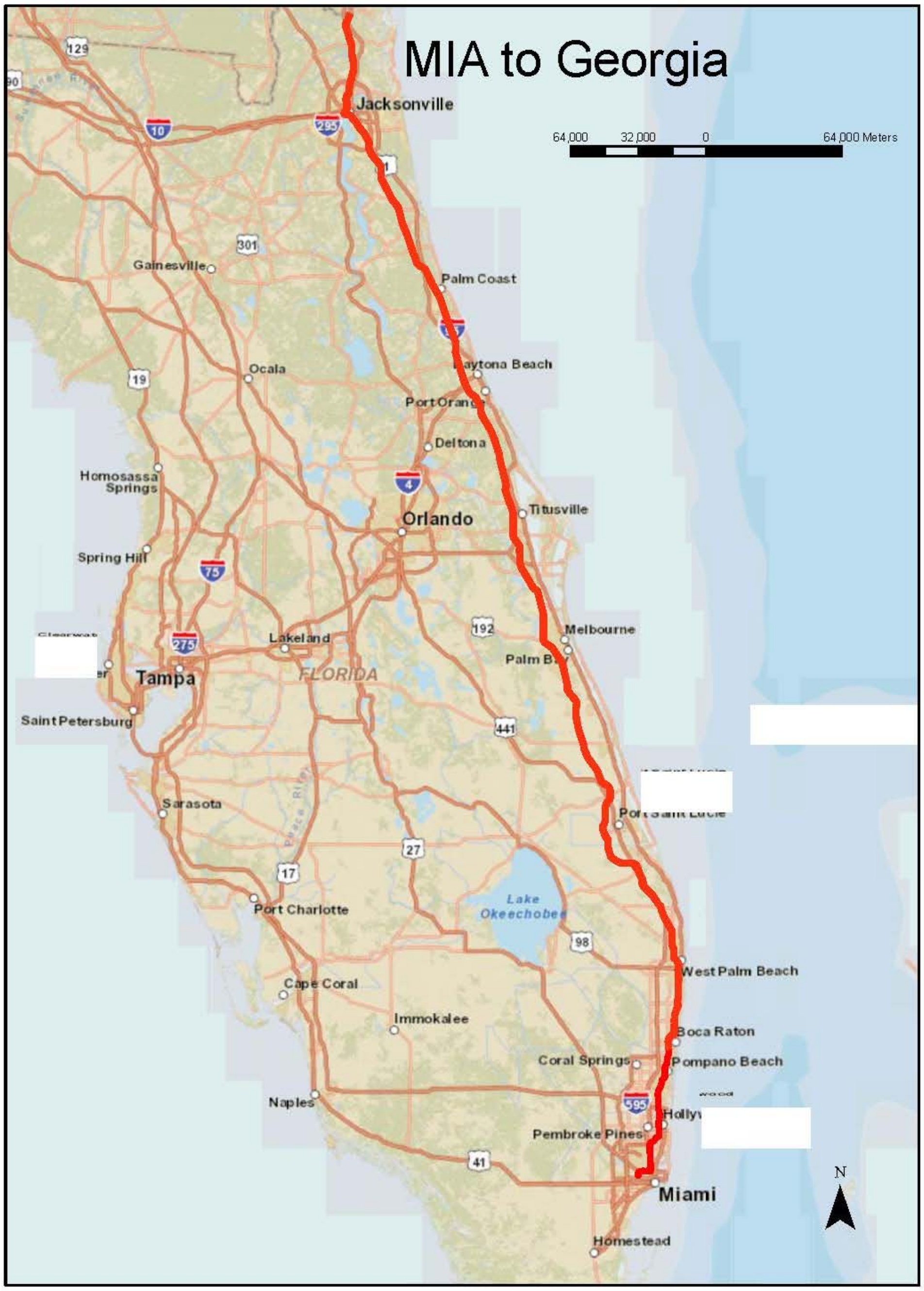


Figure A.5 MIA to Georgia

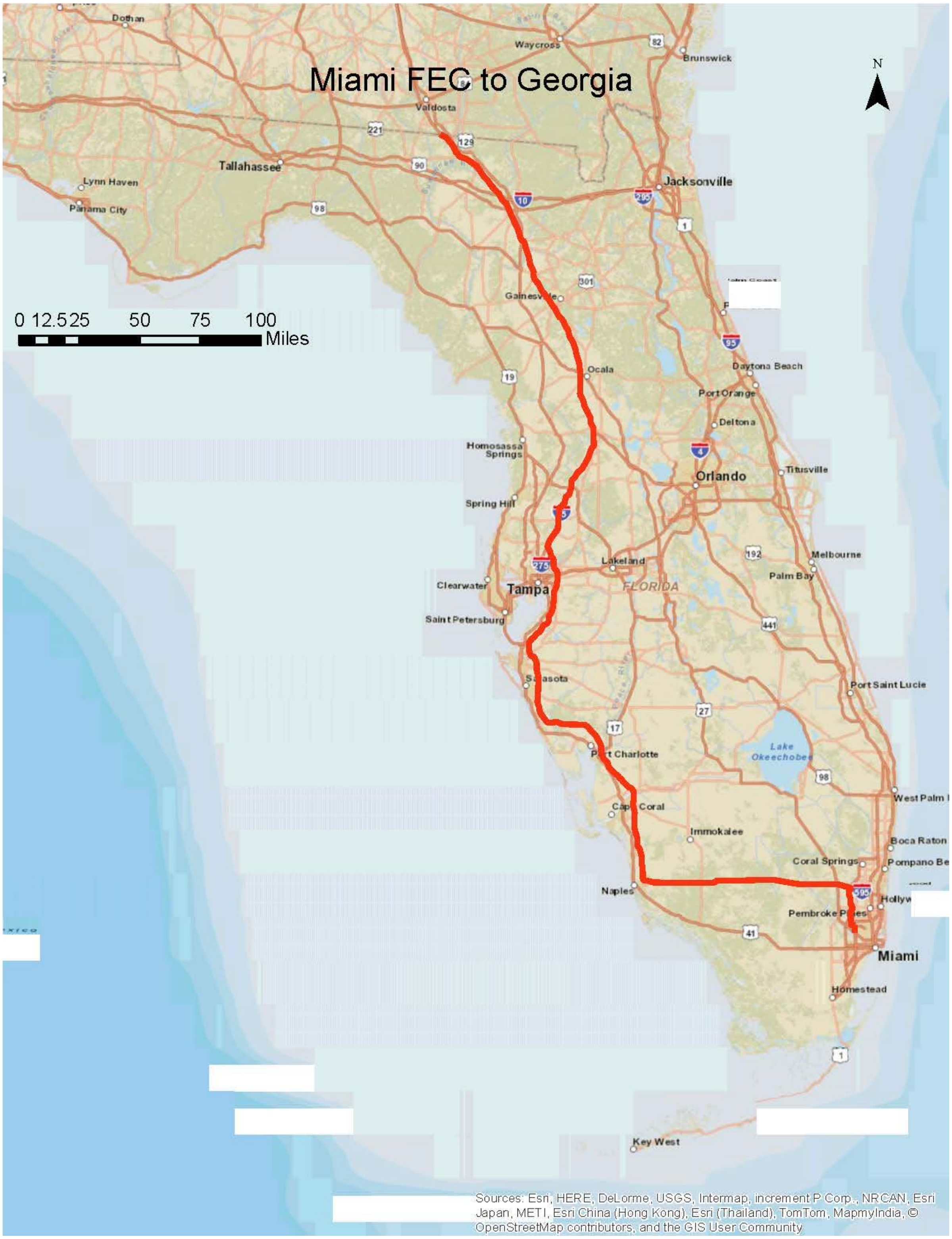


Figure A.6 Miami FEC to Georgia

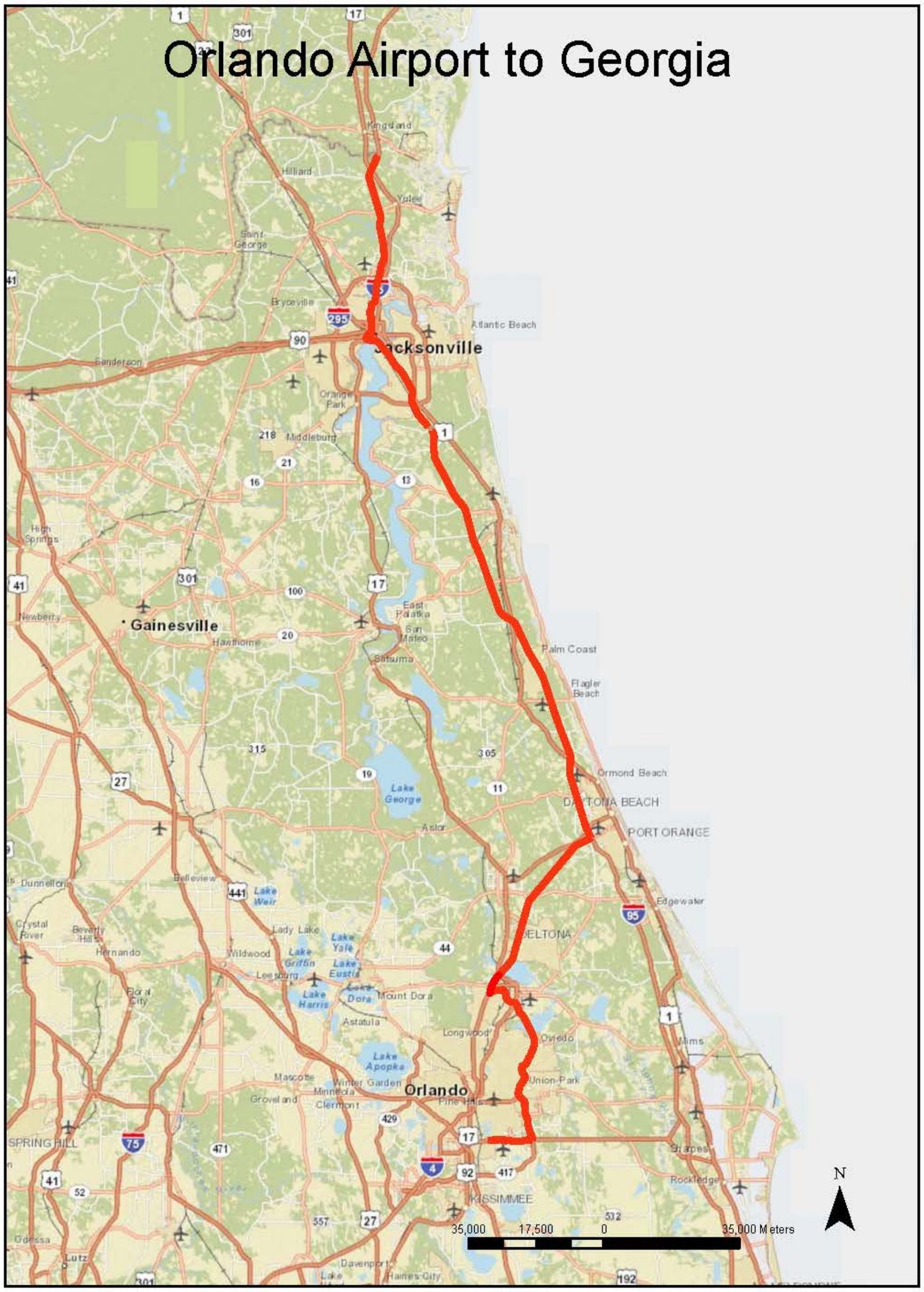


Figure A.7 Orlando Airport to Georgia

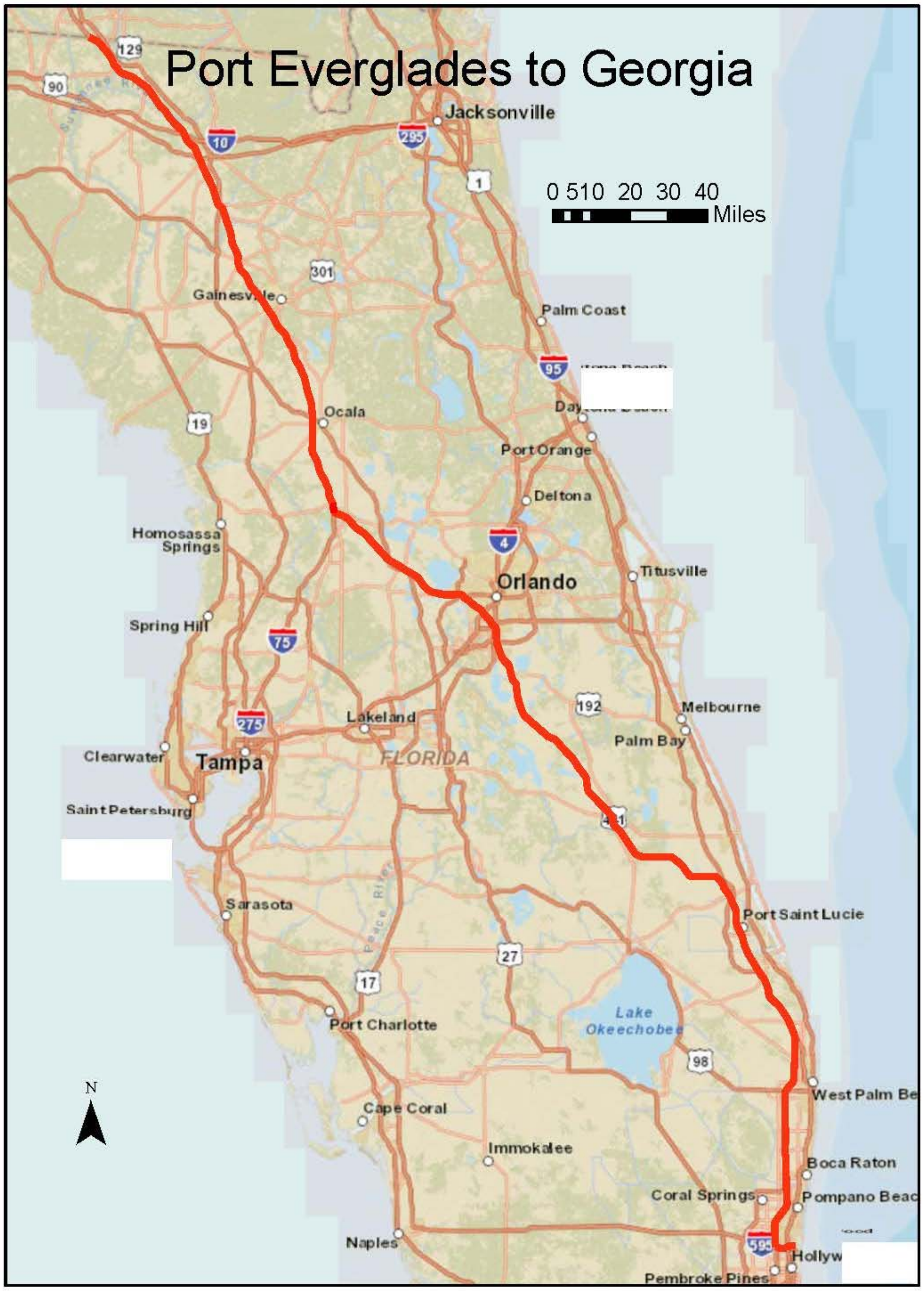


Figure A.8 Port Everglades to Georgia

Figure A.9 Port of Jacksonville to Alabama

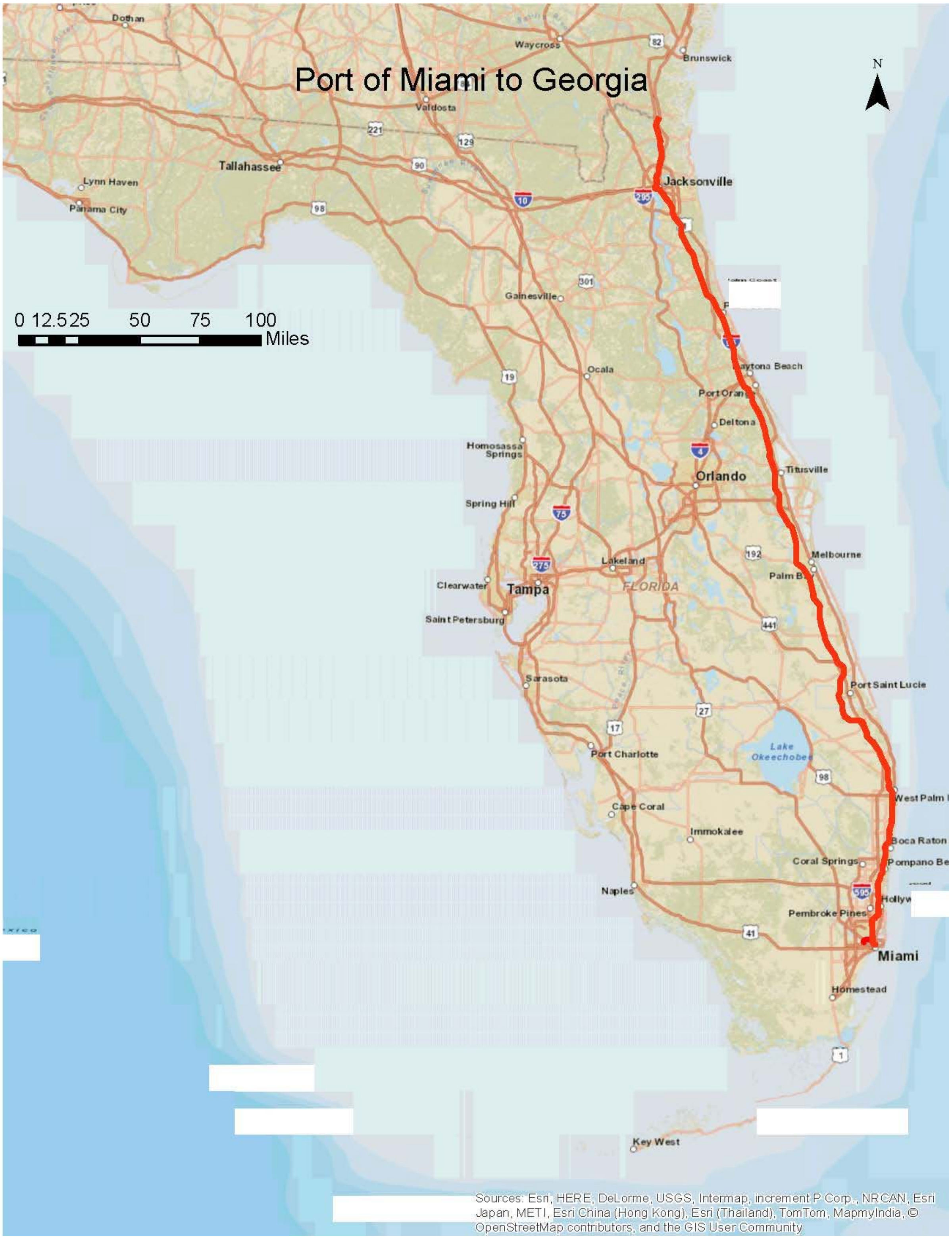


Figure A.10 Port of Miami to Georgia

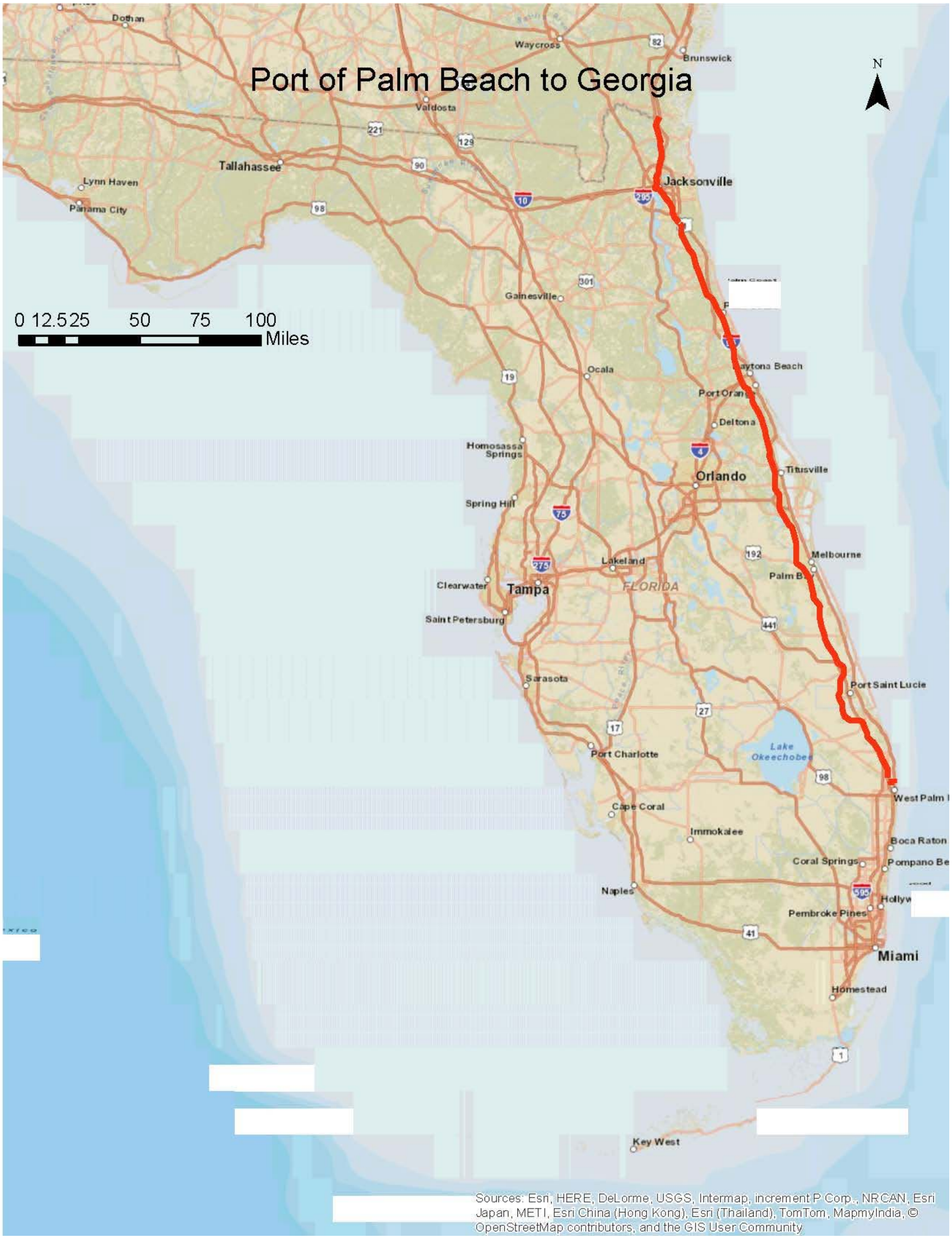


Figure A.11 Port of Palm Beach to Georgia

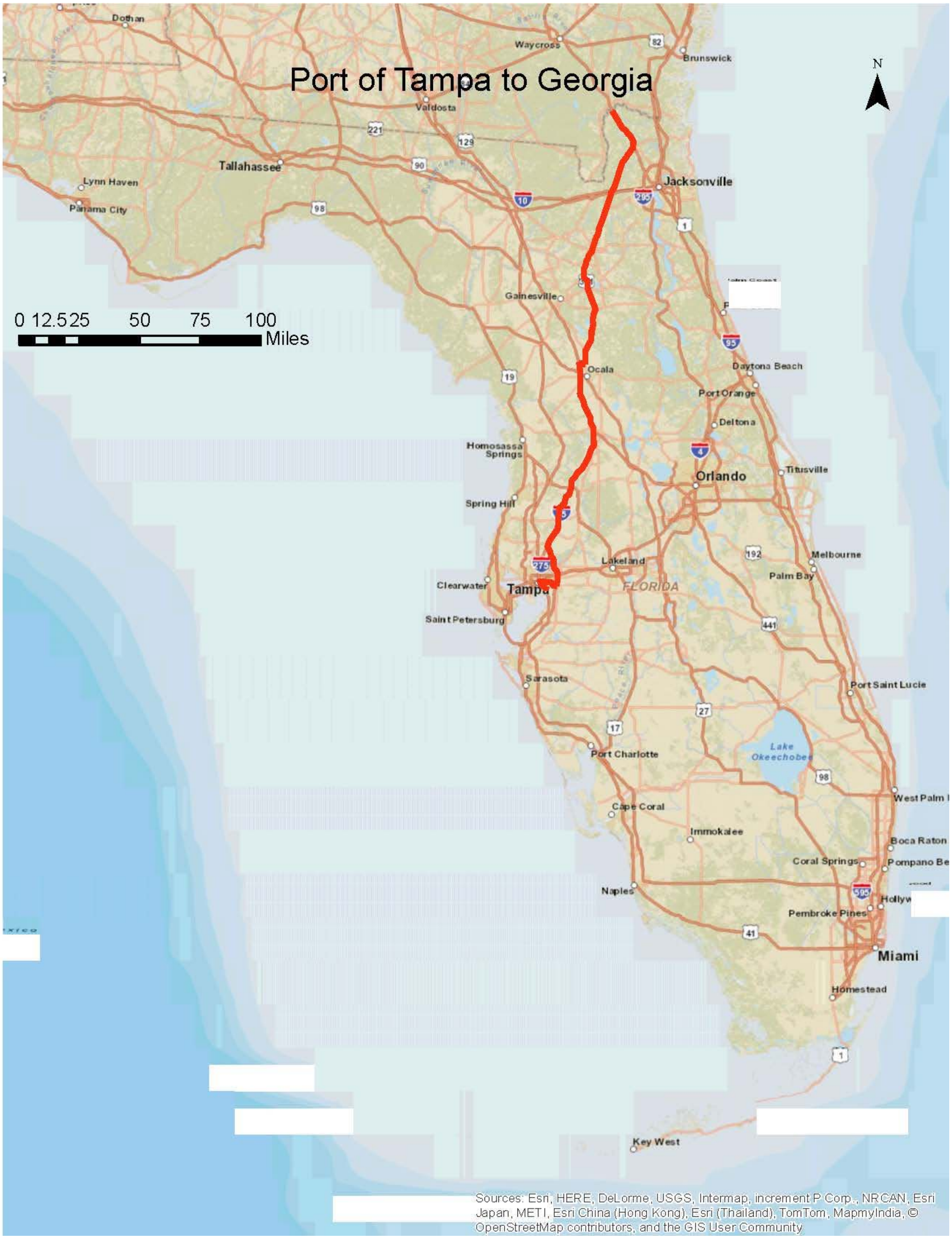


Figure A.12 Port of Tampa to Georgia

Figure A.13 Tampa Airport to Georgia