Freight Mobility and Trade Plan

Technical Memorandum 3

Performance and Conditions

April 2020

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Introduction

This technical memorandum evaluates and documents the condition and performance of the state's freight transportation systems and assets described in the "Systems and Assets Technical Memorandum." The performance measures included in this document are consistent with FDOT's Source Book, FDOT Transportation Asset Management Plan (TAMP), Transportation Performance Management (TPM) federal performance measures, Florida Transportation Plan (FTP) goals, Freight and Mobility Trade Plan (FMTP) objectives and the Highway Performance Monitoring System (HPMS). These measures indicate whether Florida's transportation system is achieving the objectives outlined in this plan and also show whether progress is being made towards federal and organizational goals. Measures included in this document are categorized by mode: highway, rail, seaport and aviation. Additionally, performance measures required by FHWA, such as bridge and pavement conditions are also summarized. All performance measures included in this technical memorandum are described according to the following dimensions:

- **Quantity** - How much freight is moved;
- **Quality** – How good or bad the travel experience is; and
- **Utilization** – How much of the transportation system is used/available.

A summary of each performance measure and condition is provided along with the definition, data source, supporting FDOT program or project, and outcomes. Additionally, some of the performance measures and conditions quantified here are recommended for applicability to freight project prioritization. Finally, modal issues and trends are identified through the assessment of performance measures and conditions. The issues and trends listed here are limited to those identified through analysis of the system.

Freight and Freight Related Measures Appraisal

This document is a critical objective component of the FMTP as it outlines the existing performance measures and conditions based on available data and information. The measures and outcomes included in this document have been derived from existing measures and datasets produced by multiple offices within FDOT and federal programs. Table 1 summarizes the different appraised resources.

Table 1 | Freight and Freight Related Measures Appraisal

Programs or Projects	Summary of Goals and Objectives
Highway Performance Monitoring System (HPMS)[1]	• Contains system information on all public roads, and information on characteristics of arterial and collector functional systems. Limited information on travel and paved miles for the lowest functional systems is also provided in the data. • The data are used extensively in the assessment of highway system condition, performance, and investment needs.
Transportation Asset Management Plan (TAMP)[2]	The principal objectives of the Department's Transportation Asset Management Plan (TAMP) are: 1. Ensure the safety and security of transportation customers; 2. Minimize damage to infrastructure from vehicles; 3. Achieve and maintain a state of good repair for transportation assets; and 4. Reduce the vulnerability and increase the resilience of critical infrastructure to the impacts of extreme weather and events. These objectives are the foundation for performance measures related to asset management for Florida Department of Transportation (FDOT).
Florida Transportation Plan (FTP)[3]	Florida Transportation Plan Vision element outlines following seven goals. FMTP goals align with these goals and the targeted performance measures in this technical memorandum are useful to satisfy these goals. 1. Efficient and reliable mobility for people and freight 2. Safety and Security and for residents, visitors, and businesses; 3. Transportation solutions that support Florida's global Economic Competitiveness; 4. Transportation solutions that support Florida's Environment and Conserve Energy; 5. Agile, Resilient, Quality Transportation Infrastructure; 6. More Transportation Choices for people and freight; and 7. Transportation solutions that support Quality Places to live, learn, work, and play.
Transportation Performance Management (TPM)[4]	FHWA defines Transportation Performance Management as a strategic approach that uses system information to make investment and policy decisions to achieve national performance goals. TPM aligns with important national goals. The national goals relevant to this document are as follows: 1. National goals for Federal-Aid Highway Program. 2. National freight policy goals. 3. Consideration of the Federal-aid highway national goals and public transportation general purposes in the scope of the performance-based planning process. 4. Consideration of Federal-aid highway national goals in State Asset Management Plans.
FDOT Source Book[5]	The FDOT Source Book 2018 (Source Book) describes the mobility performance of Florida's transportation system using decades of research and historic data from multiple sources including vehicle probe data, volumes, and roadway geometry. Through the Source Book, a comprehensive report is provided for all major modes of travel in Florida. Although the Source Book measures are not facility specific, they are the aggregation of measures calculated at the facility level. Some of these mobility measures are leveraged for making funding decisions when used at the segment level. The Source Book provides mobility performance measures for every segment of the State Highway System (SHS).

[1] *Highway Performance Monitoring System (HPMS), 2018*
[2] *Transportation Asset Management Plan (TAMP), 2019*
[3] *Florida Transportation Plan (FTP), 2018*
[4] *Transportation Performance Management (TPM), 2018*
[5] *FDOT Source Book, 2018*

Highway Performance

The different highway performance measures outlined in this technical memorandum are listed in Table 2 below.

Table 2 | Highway Performance Measures

Quantity	Quality	Utilization
• Truck Miles Traveled • Combination Truck Miles Traveled • Combination Truck Ton Miles	• Combination Truck On-Time Arrival • Combination Truck Planning Time Index • Combination Truck Hours of Delay • Truck Bottlenecks • Percent of travel meeting Level of Service • Highway Pavement Conditions • Bridge Conditions • Highway (Truck) Safety	• Truck Empty Backhaul • Truck Parking Utilization

Truck Miles Traveled (TMT)

Definition: Truck Miles Traveled (TMT) is computed by multiplying daily Vehicle Miles Traveled (VMT) by a truck factor, also known as the heavy vehicle percentage or T Factor. The truck factor for each roadway segment is provided in the Traffic Characteristics Inventory (TCI) database.

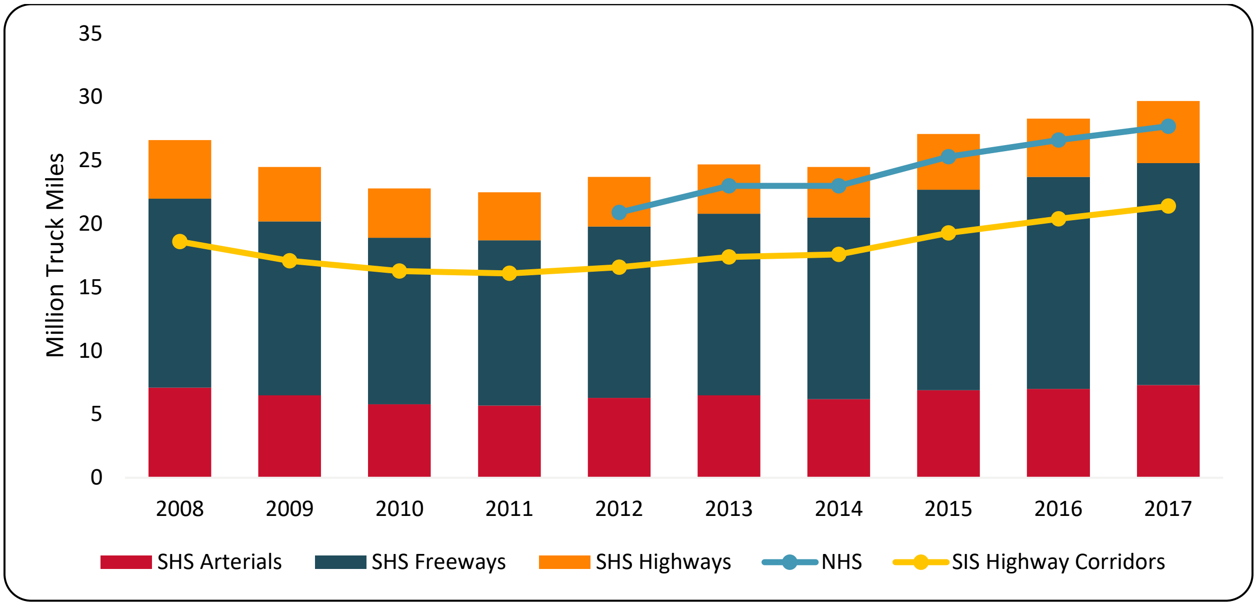
$$Truck\ Miles\ Traveled = \sum Segment\ Length\ \times\ Volume\ \times\ \%\ of\ Trucks$$

Data Source: FDOT Traffic Characteristics Inventory and FDOT Roadway Characteristics Inventory

Data Coverage: State Highway System (SHS), National Highway System (NHS), Strategic Intermodal Systems (SIS) Highways

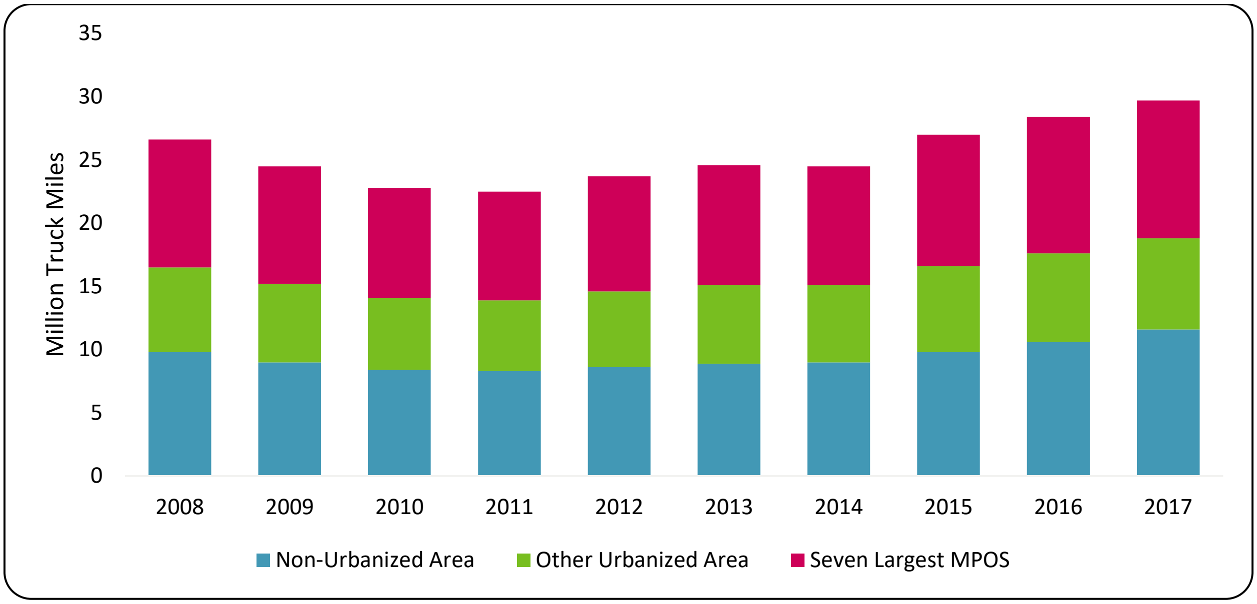
Major observations: Figure 1 and Figure 2 provide the annual trends of TMT for different facility types as well as MPOs[6] and other areas in the state. In 2017, there were 29.6 million daily truck miles traveled on State Highway System, which is a 4% increase from 2016.

[6] *Seven (7) Largest MPOs: Broward County, Hillsborough, MetroPlan Orlando, Miami-Dade, North Florida, Palm Beach, and Forward Pinellas.*



Source: FDOT Source Book, 2018

Figure 1 | Daily Truck Miles Traveled by Facility Type



Source: FDOT Source Book, 2018

Figure 2 | Daily Truck Miles Traveled on SHS by Area

Combination Truck Miles Traveled (CTMT)

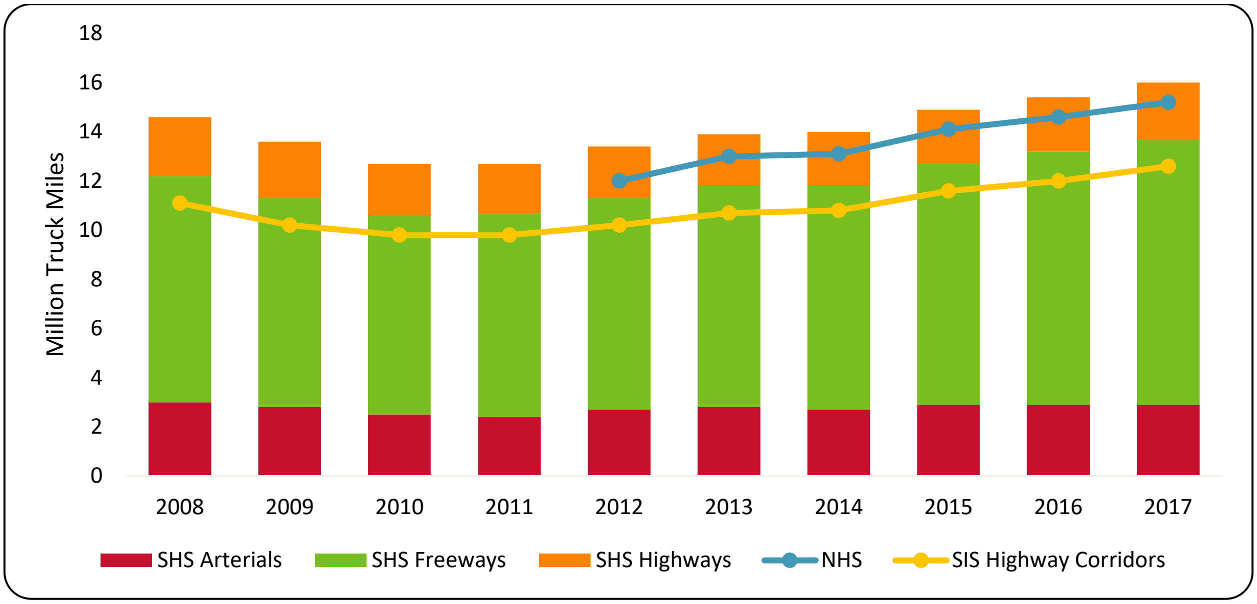
Definition: A combination truck is a truck consisting of a tractor and trailer (FHWA Vehicle Category Classification 8-13).[7] Combination Truck Miles Traveled (CTMT) is computed by multiplying VMT by the combination truck factor. The combination truck factor is provided on a county-by-county basis and represents the proportion of heavy vehicles that are combination trucks.

$$Combination\ Truck\ Miles\ Traveled = \sum Segment\ Length \times Volume \times Combination\ Truck\ Factor$$

Data Source: FDOT Traffic Characteristics Inventory and FDOT Roadway Characteristics Inventory

Data Coverage: State Highway System (SHS), National Highway System (NHS)

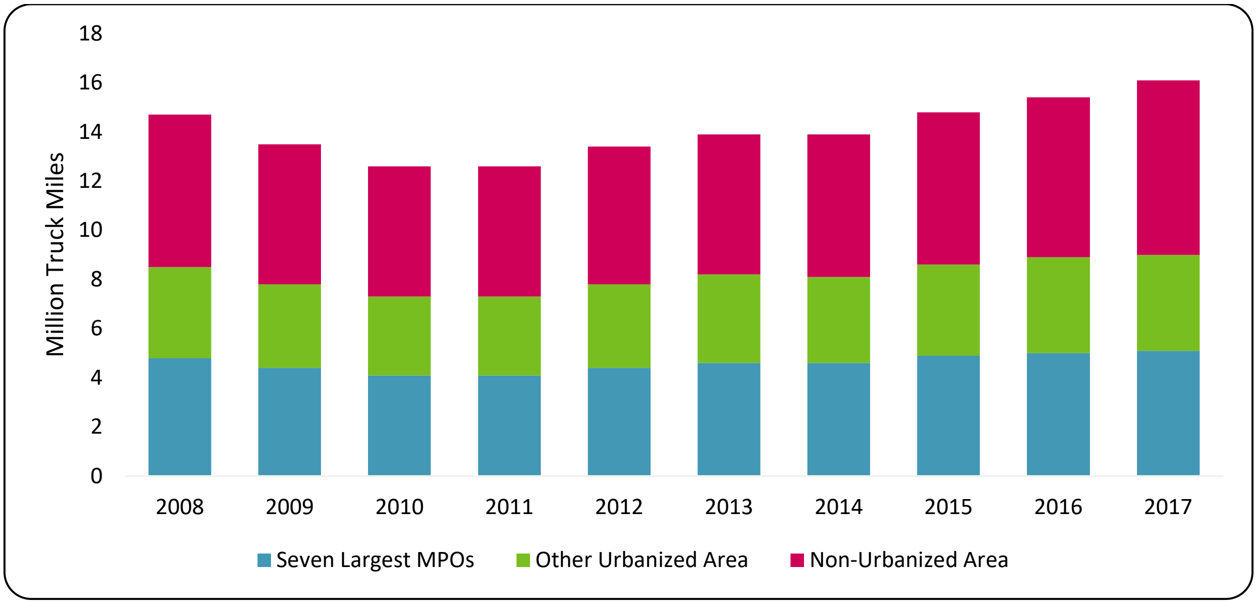
Major observations: Figure 3 and Figure 4 provide the annual trends of CTMT for different areas as well as different facility types in the state. Statewide, 16 million daily combination truck miles were traveled in 2017, which was the highest observed in the last ten years.



Source: FDOT Source Book, 2018

Figure 3 | Combination Daily Truck Miles Traveled by Facility Type (2008-2017)

[7] *Florida Department of Transportation Traffic Monitoring Handbook (2018)*



Source: FDOT Source Book, 2018

Figure 4 | Combination Daily Truck Miles Traveled on SHS by Area (2008-2017)

Annual TMT and annual CTMT trends for different facility types indicate a growing truck traffic demand which necessitates identifying solutions to alleviate the increasing volume of trucks on Florida's roadways. Figure 5 and Figure 6 depict the truck AADT (2018) and % change in truck AADT (from 2013 to 2018) on the SHS respectively. The roadway segments identified with high truck traffic movement and significant percent growth in truck traffic are the potential roadway segments to be prioritized for freight and freight related projects.

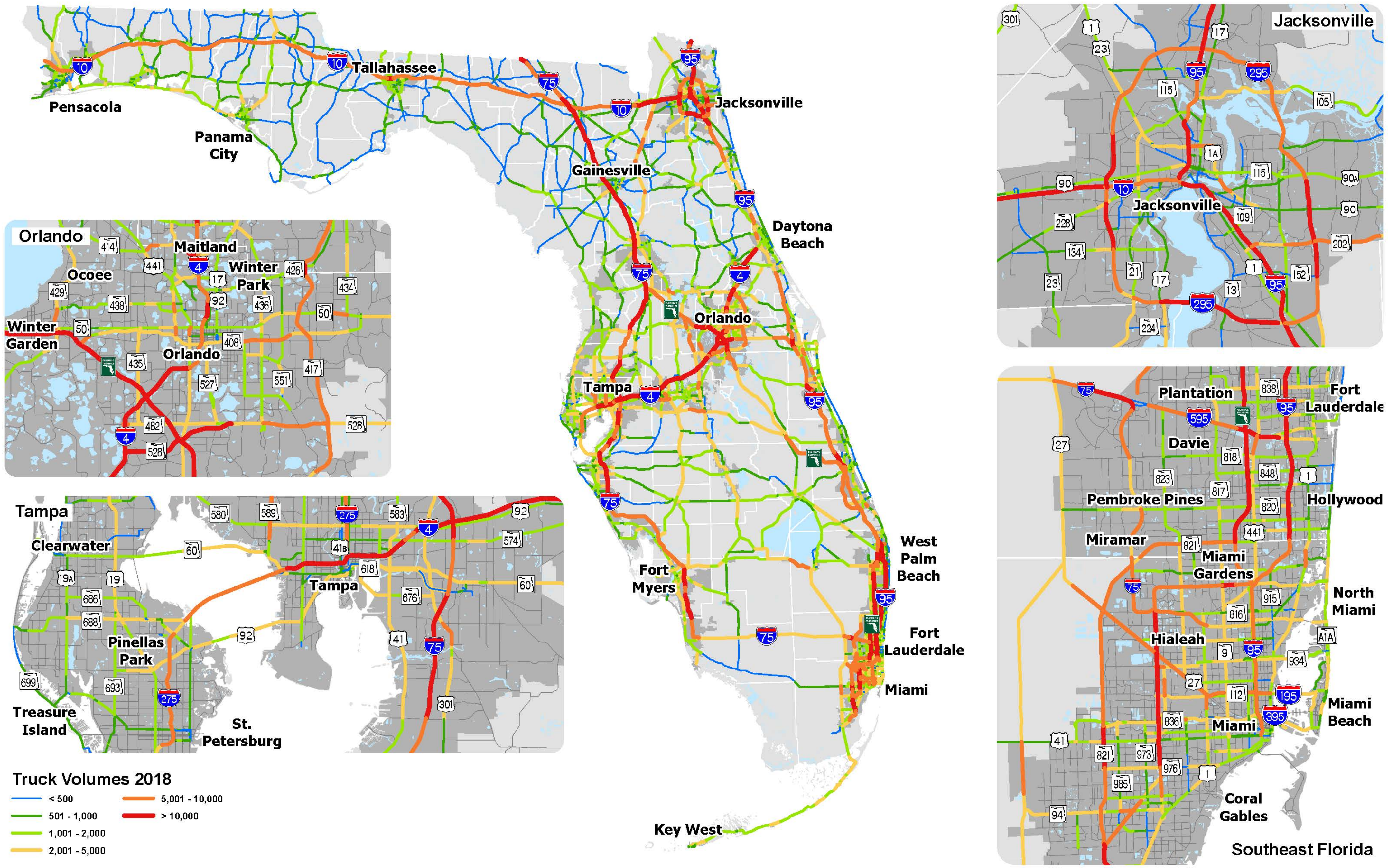


Figure 5 | Annual Average Daily Truck Traffic (2018)

Source: FDOT Transportation Data and Analytics, 2018

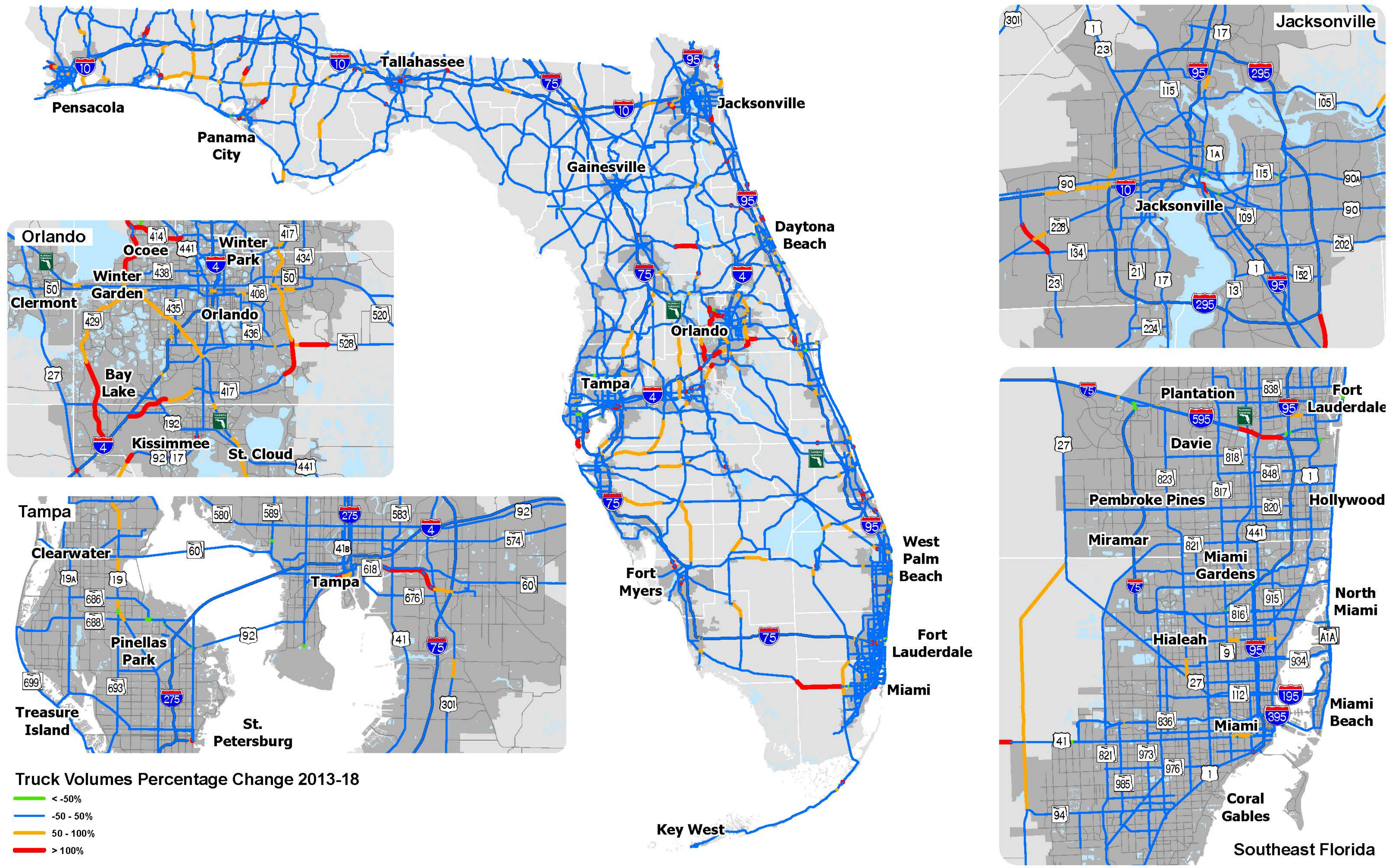


Figure 6 | Percent Change in Annual Average Daily Truck Traffic (2013-2018)

Source: FDOT Transportation Data and Analytics, 2018

Combination Truck Ton Miles (CTTMT)

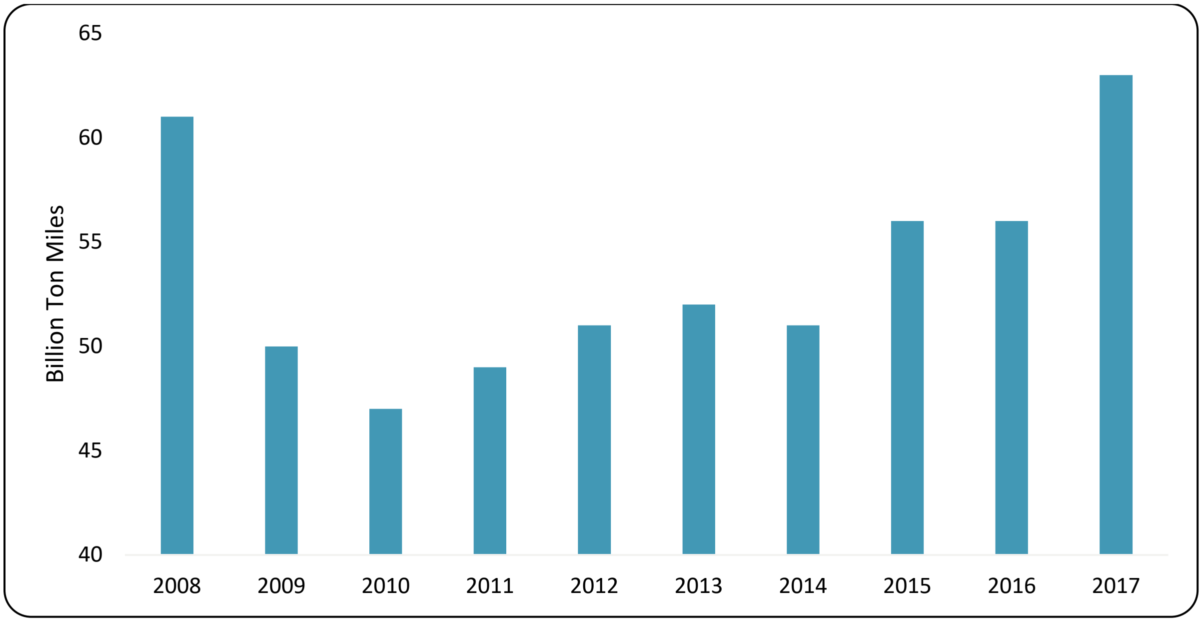
Definition: Combination truck ton miles traveled (CTTMT) is determined using combination truck miles traveled and average load of all combination trucks. This is the product of combination truck tonnage and the combination truck miles traveled.

$$Combination\,Truck\,Ton\,Miles\,Traveled = \sum AvgLoadofAllCombTR \times CTMT \times \frac{365}{1000}$$

Data Source: FDOT Weigh in Motion, FDOT Traffic Characteristics Inventory, FDOT Roadway Characteristics Inventory and Freight Analysis Framework

Data Coverage: State Highway System (SHS), National Highway System (NHS)

Major observations: Figure 7 provides the annual trends of CTTMT in the state. The CTTMT increased 12% between 2016 and 2017.



Source: FDOT Source Book, 2018

Figure 7 | Annual Combination Truck Ton Mile (2008-2017)

Figure 8 and 9 depict estimated tonnage movement on different roadways for years 2012 and 2045 respectively (Source: Freight Analysis Framework (FAF)). The roadways identified with high 2012 truck tonnage movements and 2045 (forecast) truck tonnage movements are the roadway segments that should be potentially prioritized for freight and freight related projects.

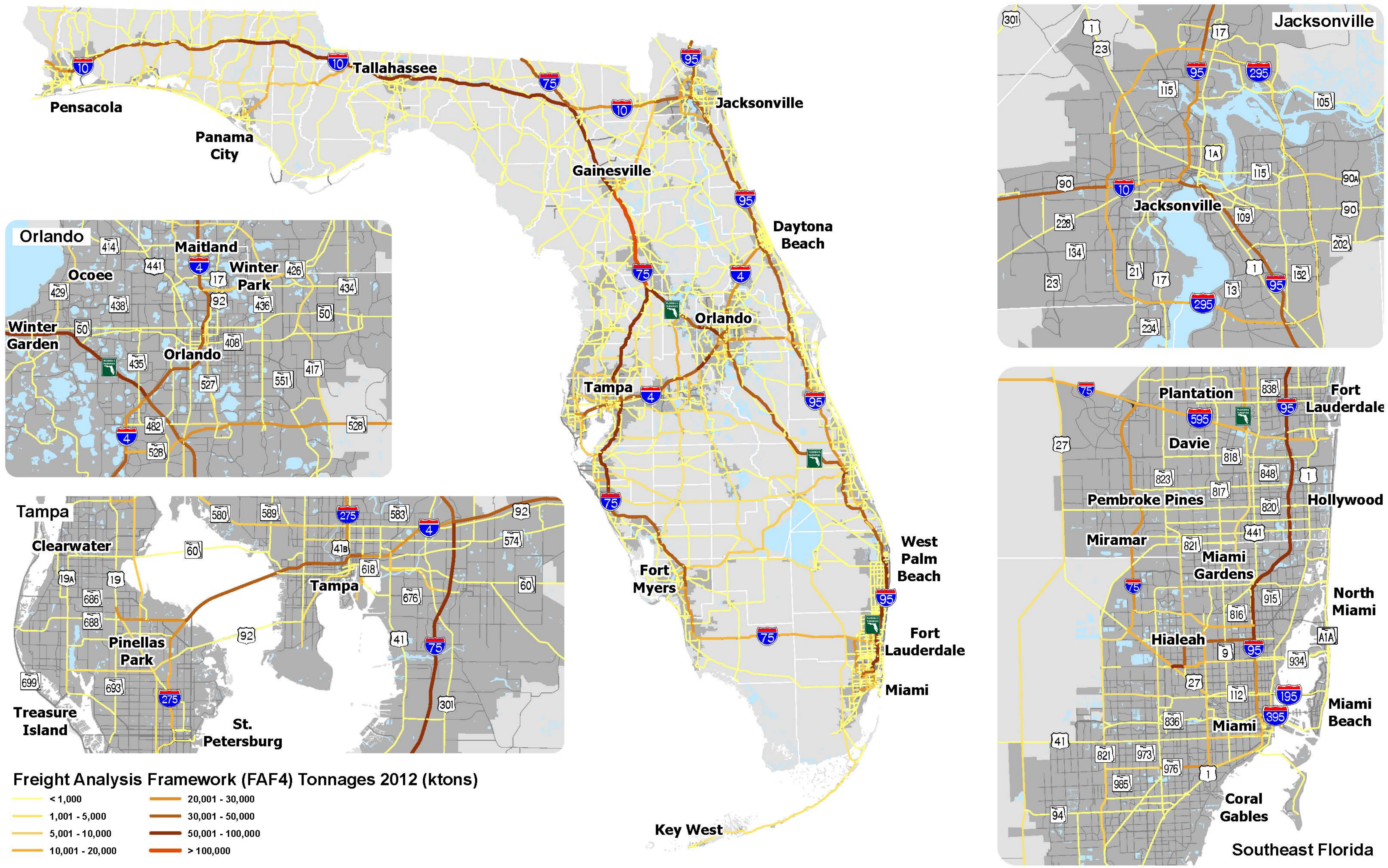


Figure 8 | Freight Analysis Framework (FAF4) Tonnage 2012 (KTons)

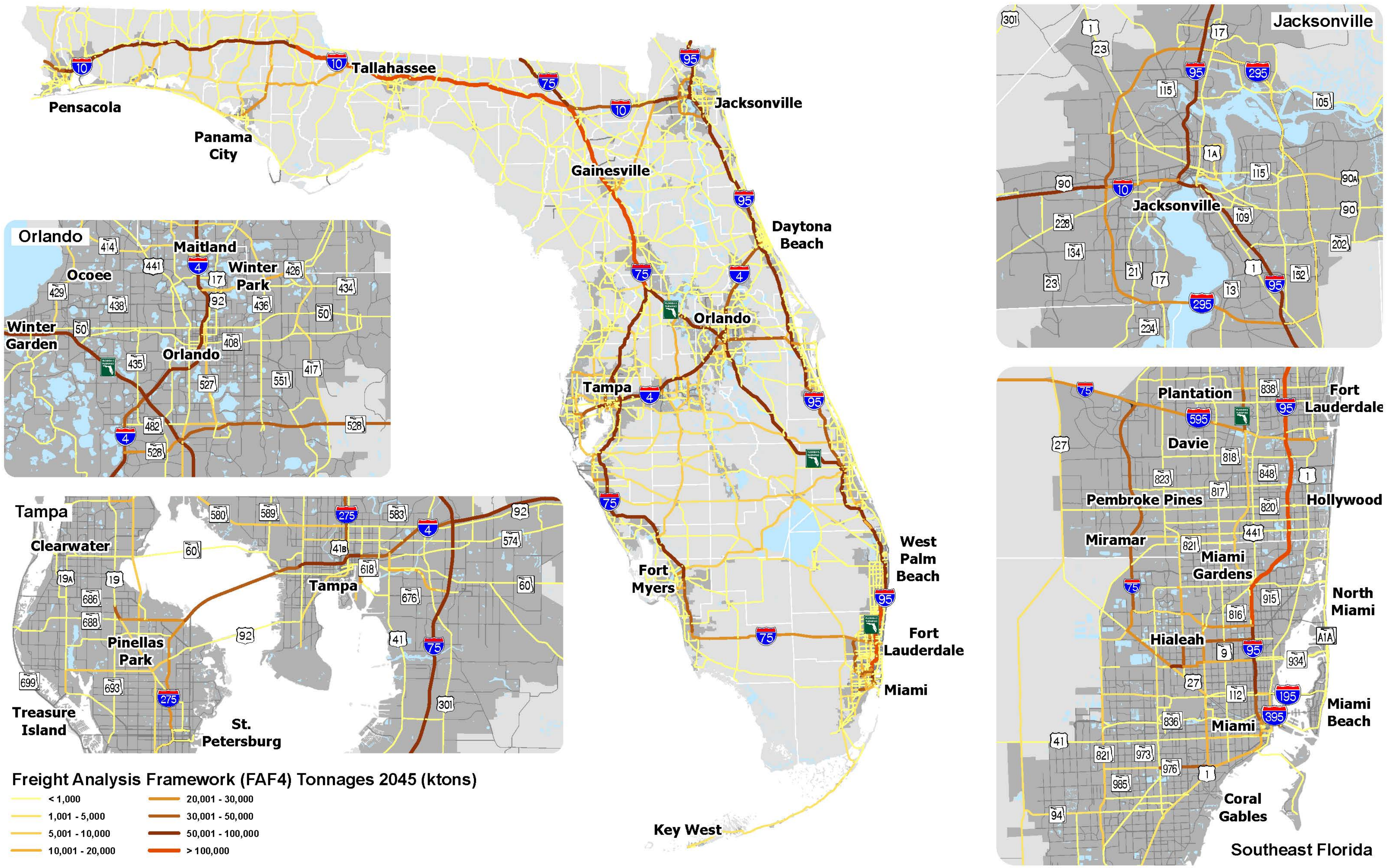


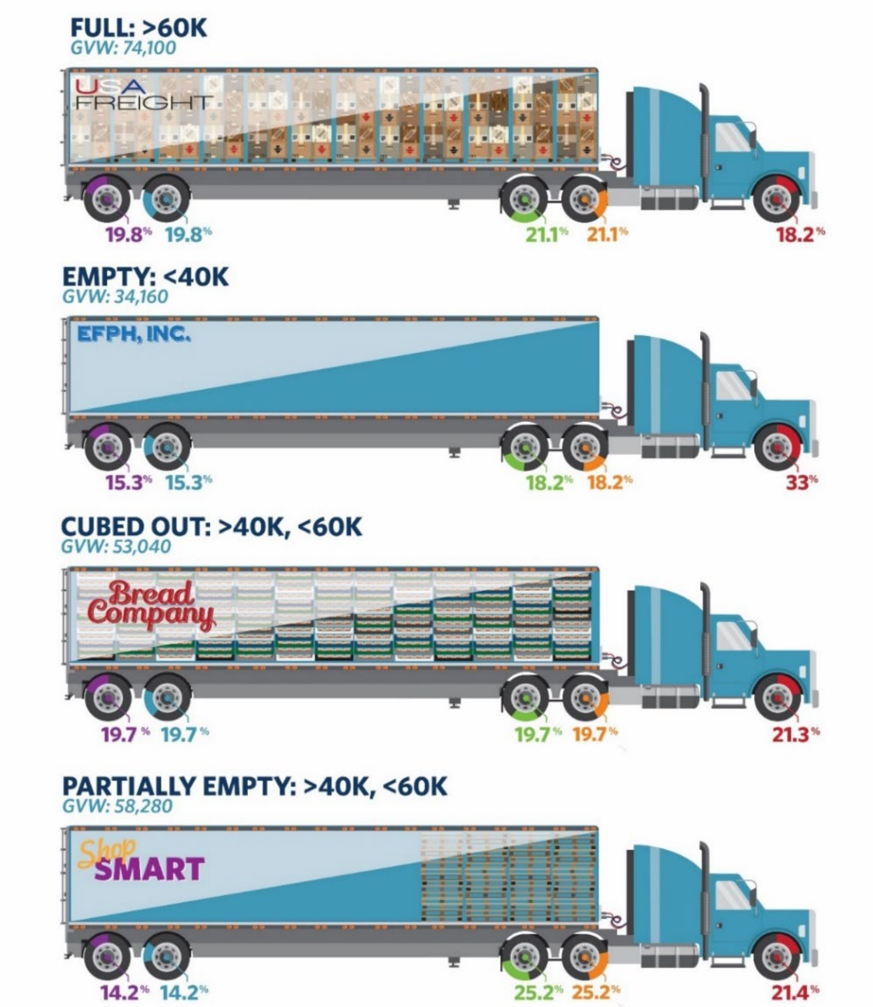
Figure 9 | Freight Analysis Framework (FAF4) Tonnage 2045 (KTons)

Truck Empty Backhaul

Definition: Truck empty backhaul is the return movement of a truck from its original destination to its point of origin when the truck is not hauling cargo. An imbalance of trade flows is the fundamental reason behind empty backhaul; Florida is a consumer state with a relatively small manufacturing sector and a relatively large distance from other major U.S. consumer markets.

Empty backhaul tends to increase supply chain costs, as carriers need to pass along the cost of empty backhaul to shippers and customers. It also reduces both productivity and profitability of the motor carrier industry. While it is largely an economic issue outside of FDOT's purview, addressing empty backhaul could reduce congestion/bottleneck issues, truck parking issues, costs and environmental impacts for the commercial motor vehicle industry.

The definitions of empty backhaul are illustrated in Figure 10 below.



Note: all truck weight units are in pounds.
Source: Transportation Data and Analytics Office, 2018

Figure 10 | Class 9 Truck Axle Weight Load Distribution

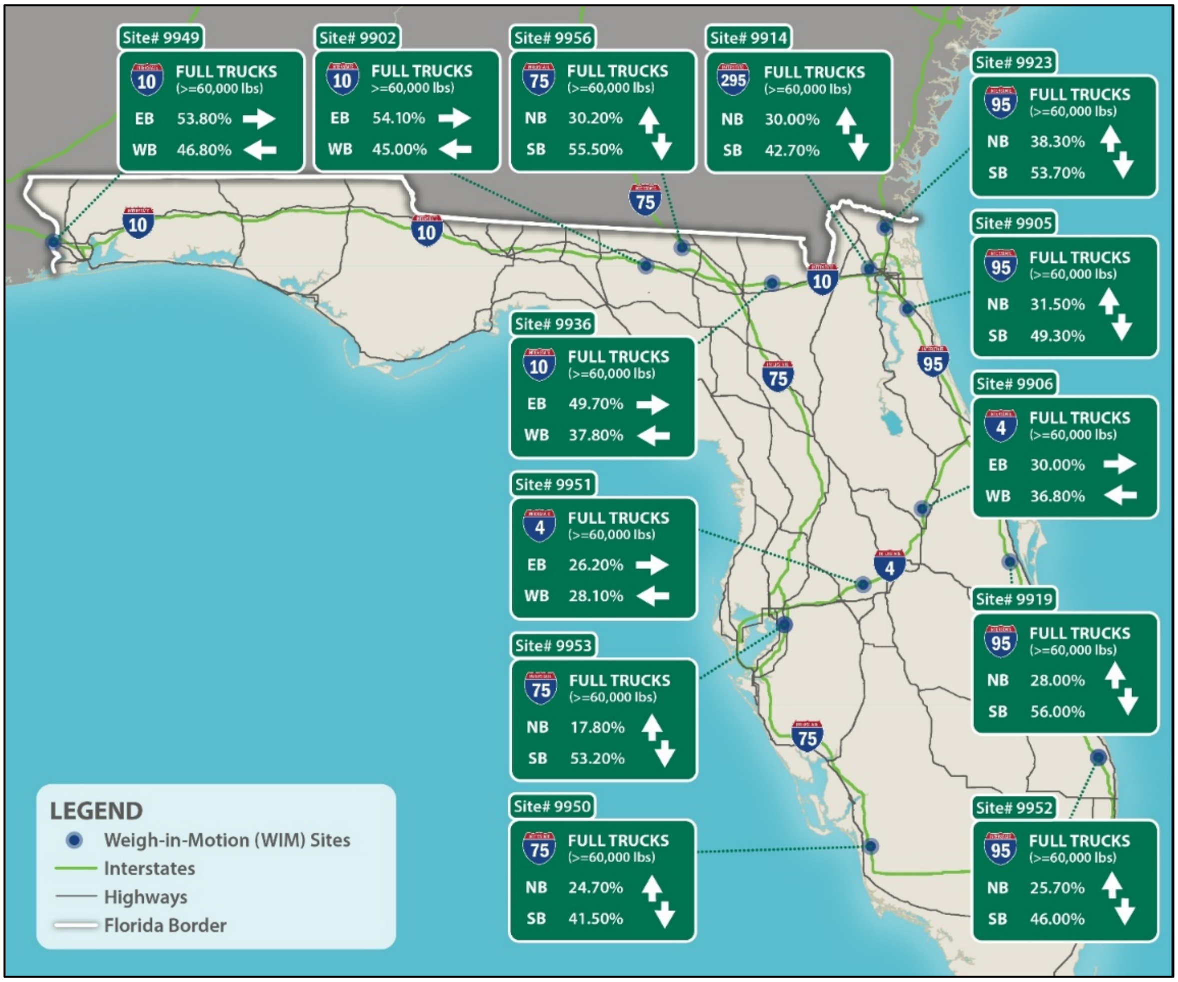
Definitions are explained below:

- Full Truck = Gross vehicle weight > 60,000 lbs.
- Empty Truck = Gross vehicle weight < 40,000 lbs.
- Partially Empty = Unequal Trailer Weight Distribution = If > 5% difference (between axles 3 & 4, of 5 axle vehicle) = Available capacity for additional cargo
- Cubed Out (Full) = Equal Trailer Weight Distribution = If < 5% difference (between axles 3 & 4, of 5 axle vehicle) = No available capacity

Data Source: FDOT Weigh In Motion (WIM)

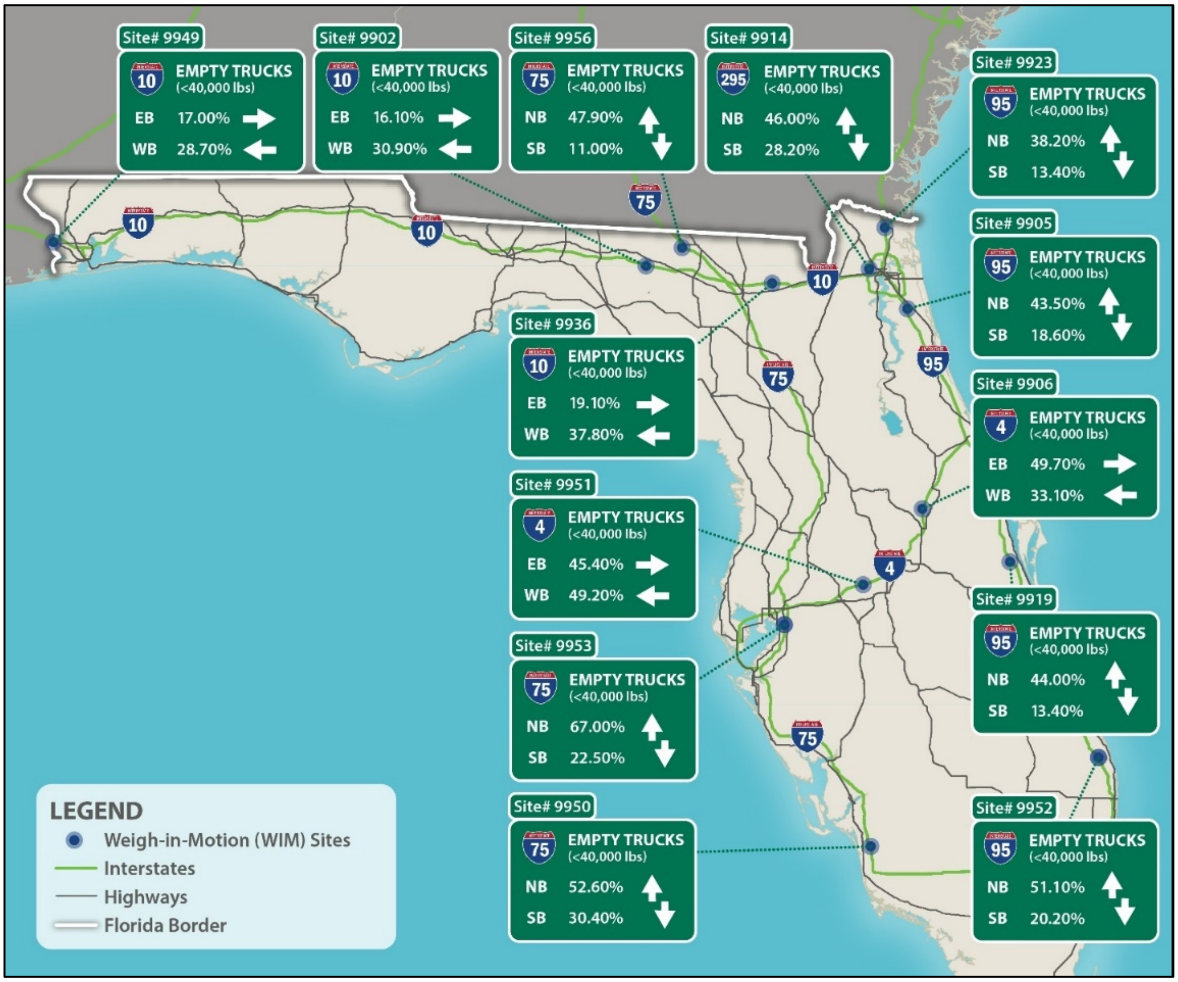
Data Coverage: TDA Weigh In Motion locations

Key Observations:
Figure 11 shows that for the three sites near the state border (I-10, I-95 and I-75) there is a larger percentage of full trucks traveling into the state compared to trucks leaving the state. Similarly, Figure 12 shows the percentage of empty trucks entering and leaving. More than half of the trucks coming into the state between the years of 2015 and 2017 are full trucks in comparison to nearly 38% that left the state during the same time period. This shows the domestic trade imbalance between freight coming in and going out of the state in terms of weight.



Source: Transportation Data and Analytics Office, 2018

Figure 11 | Percentage of Full Class 9 Trucks by Direction of Travel



Source: Transportation Data and Analytics Office, 2018

Figure 12 | Percentage of Empty Class 9 Trucks by Direction of Travel

Combination Truck Travel Time Reliability

Definition: Truck Travel Time Reliability is the percent of truck miles traveled for which the travel speed is greater than or equal to 45 mph for freeways within the seven largest MPO urbanized areas and greater than or equal to five mph below the posted speed limit for freeways in all other areas.

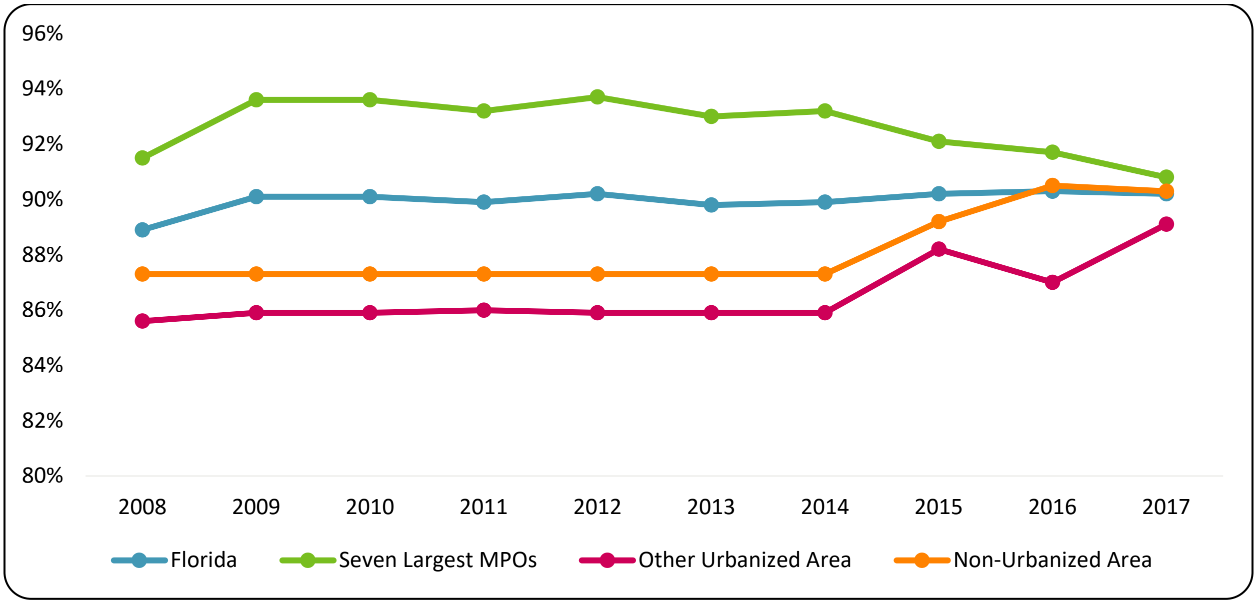
$$Travel\ Time\ Reliability\ On\ Time\ Arrival\ (urbanized\ areas - Seven\ largest\ MPOs) = \frac{\sum VMT \mid Travel\ speed \geq 45\ mph}{\sum VMT} \times 100$$

$$Travel\ Time\ Reliability\ On\ Time\ Arrival\ (All\ others) = \frac{\sum VMT \mid (Travel\ speed \geq Speed\ Limit - 5mph)}{\sum VMT} \times 100$$

Data Source: FDOT Traffic Characteristics Inventory and HERE Technologies – Travel Time Data

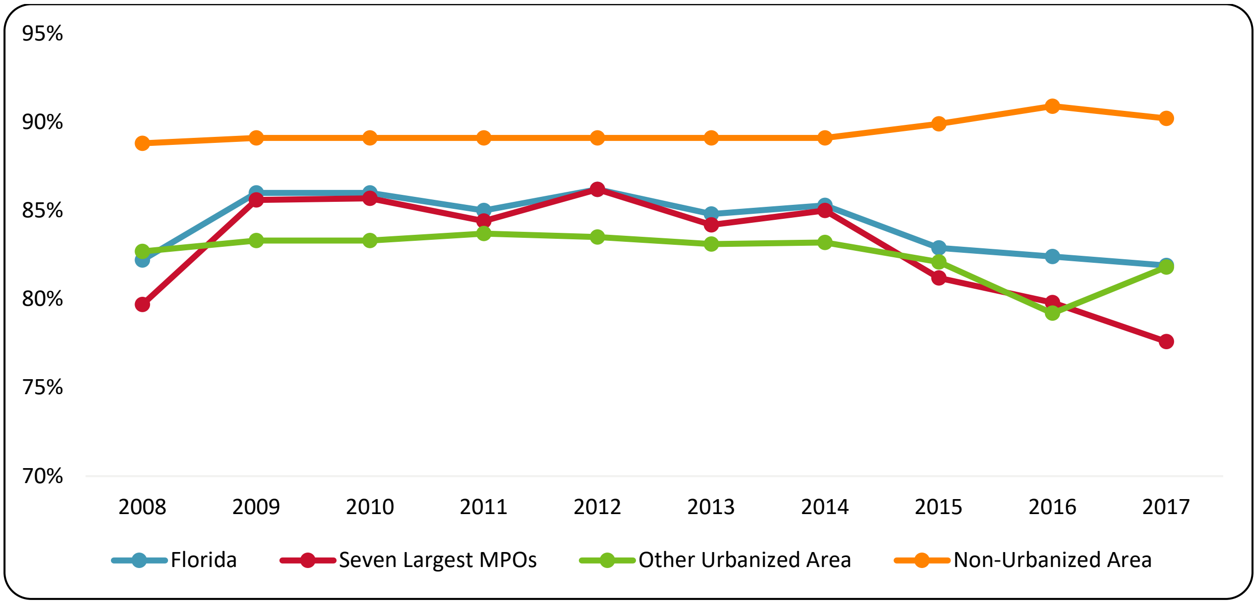
Data Coverage: National Highway System (NHS) and other major roadways

Major observations: Figure 13 and Figure 14 provide the annual trends of Combination Truck Travel Time Reliability for different areas in the state. The daily truck travel time reliability remained consistent statewide from 2013 through 2017 whereas the peak-period on-time arrival for the urbanized areas of the 7 largest metro areas saw a 3% decrease from 2016 to 2017. The drop was even larger (10%) from the best performing year of 2012 to 2017. Peak period truck travel time reliability is considerably lower when compared to daily truck travel time reliability with the seven largest metro areas contributing to the biggest drops in comparison to other areas in the state.



Source: FDOT Sourcebook, 2018

Figure 13 | Daily Percent of Combination Truck Travel Time Reliability (2008-2017)



Source: FDOT Sourcebook, 2018

Figure 14 | Peak Period Percent of Combination Truck On-Time Arrival (2008-2017)

Combination Truck Planning Time Index

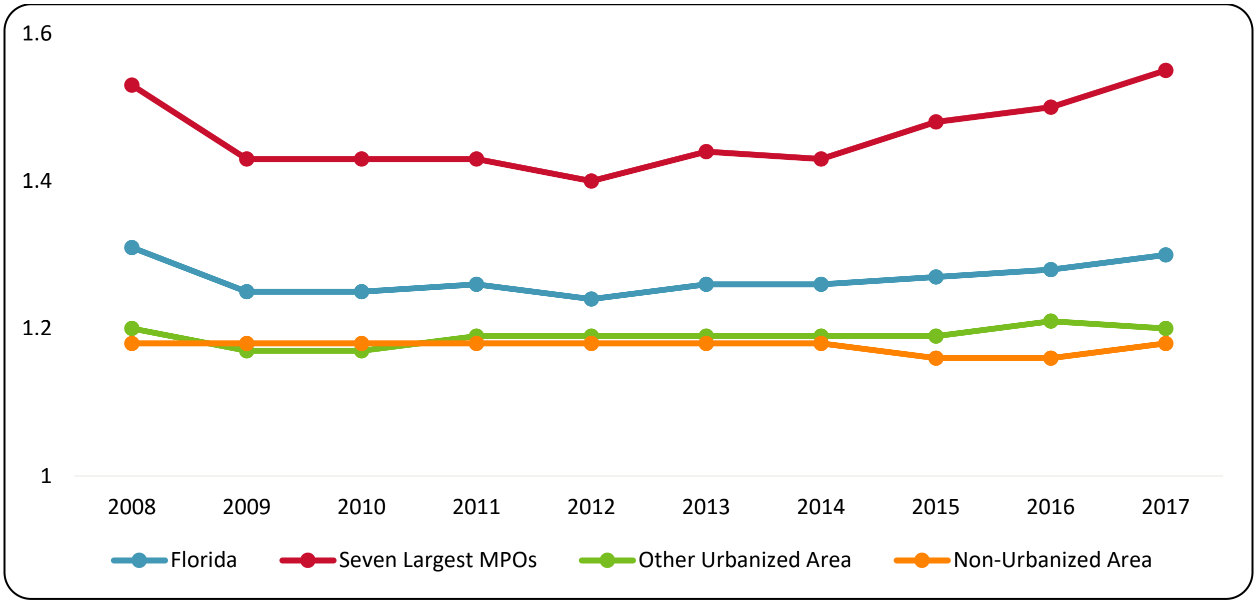
Definition: Combination Truck Planning Time Index (PTI) is defined as the ratio of the 95th percent peak period or peak hour travel time to the free flow travel time. This measure represents the additional time that a shipper should budget to ensure on-time arrival 95% of the time. The reporting period is the peak period (4:00 p.m. to 6:00 p.m.) for the urbanized areas of the seven largest metro areas and the peak hour in other urbanized areas and elsewhere.

$$PTI = \frac{Travel\ Time_{95th\ percentile}}{Travel\ Time_{free-flow}}$$

Data Source: FDOT Traffic Characteristics Inventory and HERE Technologies-Travel Time Data

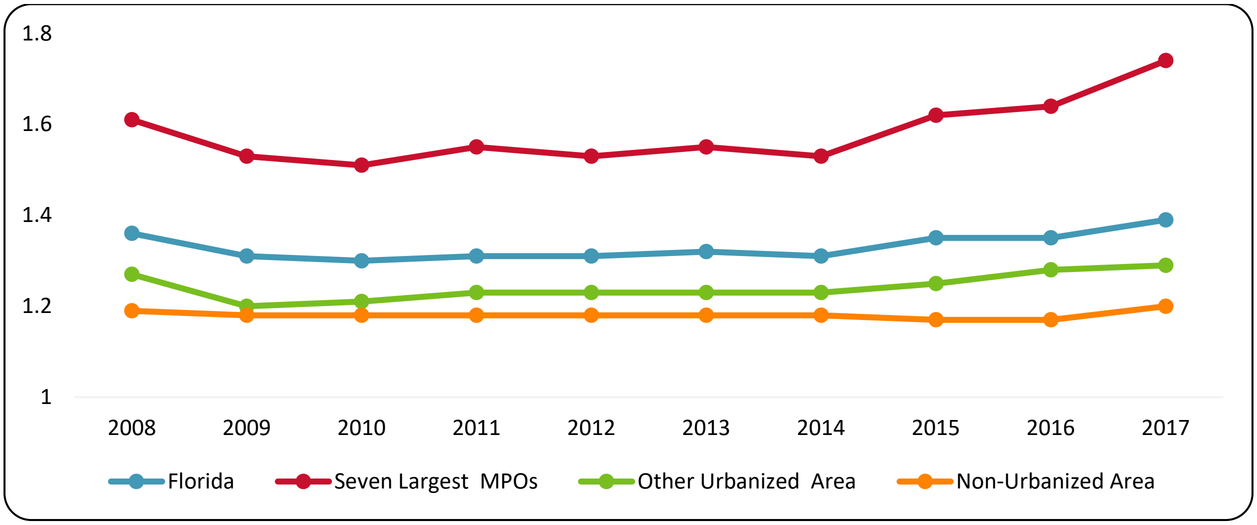
Data Coverage: National Highway System (NHS) and other major roadways

Major observations: Figure 15 and Figure 16 provide the annual trends of Combination Truck Planning Time Index for different areas in the state. Between 2016 and 2017, combination truck PTI slightly increased statewide from 1.35 in 2016 to 1.39 in 2017 for peak period conditions. For a trip that would take 10 minutes in free-flow conditions, the 95th percentile travel time is 14 minutes with a 1.39 PTI. But, in the top seven metro areas the same 10 minute trip in free-flow conditions will take 18 minutes.



Source: FDOT Sourcebook, 2018

Figure 15 | Daily Combination Truck Planning Time Index (2008-2017)



Source: FDOT Sourcebook, 2018

Figure 16 | Peak Period Combination Truck Planning Time Index (2008-2017)

Combination Truck Hours of Delay

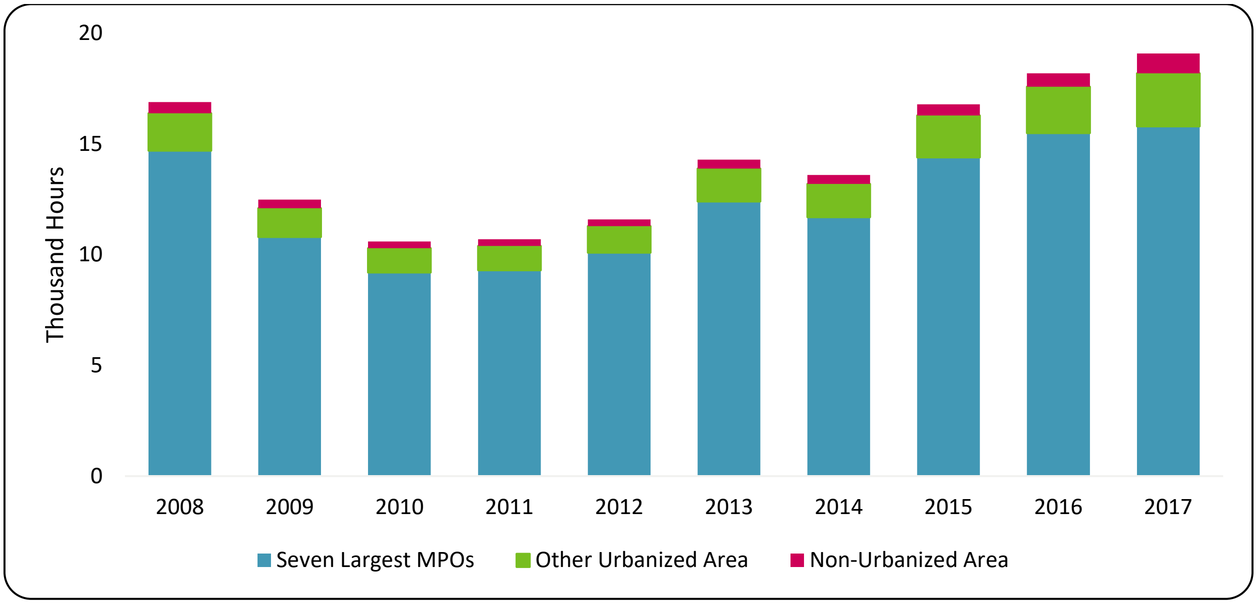
Definition: Combination Truck Hours of Delay were estimated on an hourly basis by determining the difference between delay threshold travel time and an actual travel time along a facility. Delay threshold travel time/speed is considered the additional travel time experienced by a motorist beyond what would be experienced under uncongested conditions. The definition of uncongested conditions was defined as Level of Service "B."

$$\sum Combination\ Truck\ Volume\ \times (Daily\ Combination\ Truck\ Travel\ Time - Travel\ Time\ at\ LOS\ B)$$

Data Source: FDOT Traffic Characteristics Inventory and HERE Technologies – Travel Time Data

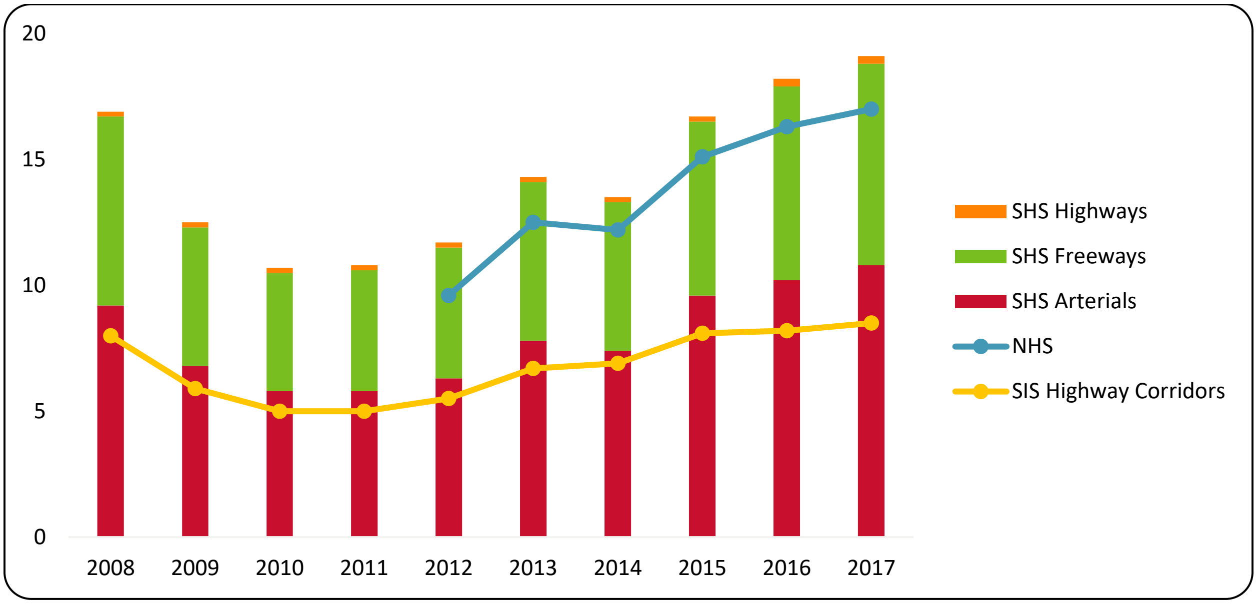
Data Coverage: National Highway System (NHS) and other major roadways

Major observations: Figure 17 and Figure 18 provide the annual trends of Combination Truck Hours of Delay for different areas and facility types in the state respectively. Between 2016 and 2017 the combination truck hours of delay increased by 4% to 19,100 daily hours of delay for combination trucks. The seven largest metro areas contribute to the majority of the hours of delay, which further emphasizes the congestion issues in major metro areas. The increase in hours of delay across different facility types is concerning and highlights the importance of exploring different solutions to alleviate the truck congestion in Florida, especially in major metro areas.



Source: FDOT Sourcebook, 2018

Figure 17 | Combination Truck Hours of Delay on SHS by Area (2008-2017)



Source: FDOT Sourcebook, 2018

Figure 18 | Combination Truck Hours of Delay by Facility Type (2008-2017)

Truck Bottlenecks

Definition: The roadway segments which rank highest in recurring congestion or in non-recurring congestion are defined as truck bottlenecks in the state of Florida.

Data Source: FHWA National Performance Measurement Research Data Set, 2018

Data Coverage: National Highway System (NHS)

Appendix A explains the methodology for identifying truck bottlenecks. The objective of the analysis was to describe the recurring and non-recurring congestion during a regular weekday. It is important to distinguish these two measures because research shows that freight users are more concerned with non-recurring congestion than recurring congestion. Motor carriers can easily schedule deliveries to consider recurring congestion, however non-recurring congestion is difficult to predict which could lead to delays and later deliveries. This not only causes disruptions for the motor carrier, but also for the receiver. One of the most important factors in modern-day supply-chains is being on-time, which becomes much more difficult with high levels of non-recurring congestion.

Major observations: Figure 19 depicts the top 10 truck bottlenecks (for recurring or non-recurring congestion) as well the top 100 truck bottlenecks (for recurring or non-recurring congestion) in the state. Table 3 provides the top 10 truck bottlenecks for recurring and non-recurring congestion.

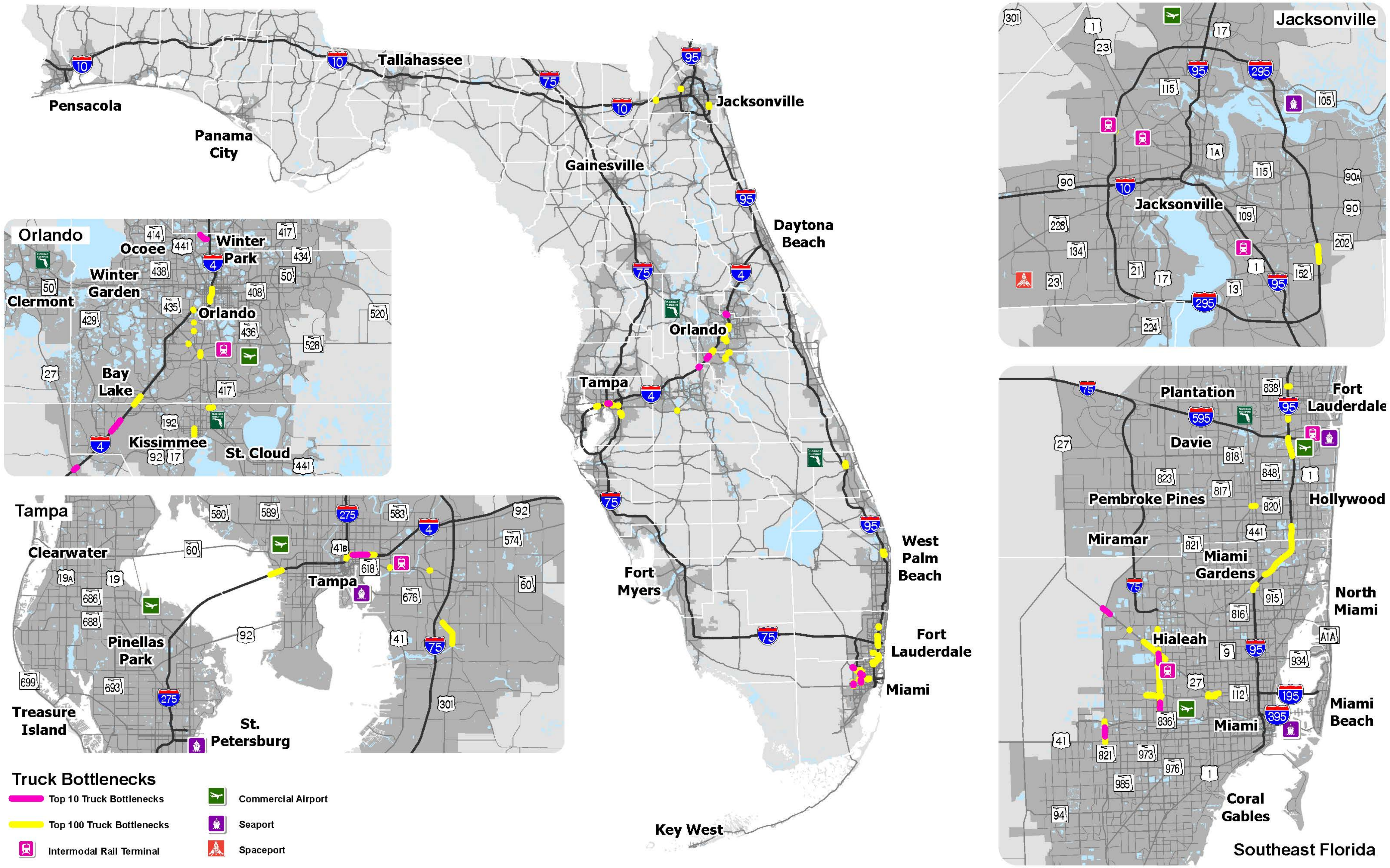


Figure 19 | Major Truck Bottlenecks (2018)

Table 3 | Top 10 Truck Bottlenecks for Recurring and Non-Recurring Congestion (2018)

Rank	Recurring Congestion		Non-Recurring Congestion	
	Road	County	Road	County
1	FL-414 eastbound between Seminole/Orange County border and I-4	Orange	FL-414 eastbound between Seminole/Orange County border and I-4	Orange
2	I-4 westbound close to Lee Roy Selmon Expressway	Hillsborough	I-4 westbound close to Lee Roy Selmon Expressway	Hillsborough
3	I-4 westbound approaching I-275	Hillsborough	I-4 eastbound approaching US 27	Polk
4	Palmetto Expressway Northbound corridor between the ramps entering and exiting NW 25th Street	Miami-Dade	US-27 Northbound approaching FL Turnpike	Miami-Dade
5	I-4 Westbound between Daniel Webster Western Beltway and SR 417-Toll S	Osceola	US-27 Northbound between West 12th Avenue and close to Hialeah Expressway	Miami-Dade
6	Florida Turnpike Southbound between Dolphin Expressway and US 41	Miami-Dade	Palmetto Expressway Northbound close to Miami Airport approaching Dolphin Expressway	Miami-Dade
7	Palmetto Expressway Northbound and south of Okeechobee Road	Miami-Dade	US-27 Northbound between West 12th Avenue and south of Hialeah Expressway	Miami-Dade
8	Palmetto Expressway Northbound close to NW 74th Street	Miami-Dade	US-27 Northbound between the ramps entering and exiting FL Turnpike	Miami-Dade
9	Palmetto Expressway Northbound and north of Okeechobee Road	Miami-Dade	Palmetto Expressway Northbound corridor between the ramps entering and exiting NW 25th Street	Miami-Dade
10	US-27 Northbound approaching FL Turnpike	Miami-Dade	Palmetto Expressway Southbound and south of Okeechobee Road	Miami-Dade

The top bottleneck in the state (FL-414 approaching I-4) is the same for recurring as well as non-recurring congestion. The I-4, Central Florida, and major highways in Miami-Dade County are also among the top 10 truck bottlenecks. It is important to note that the American Transportation Research Institute (ATRI)[8] publishes a list of the top 100 bottlenecks in the country every year. In 2019, the ATRI study identified one top 100 truck bottleneck in Florida. It is located in Tampa along I-4 and I-275. The same truck bottleneck is ranked #2 in the state as per the analysis conducted for the statewide truck bottleneck study. It should be noted that the methodology and data sources used to assess truck bottlenecks by ATRI differs from the study described here. As such, the results of each study vary. Future work should determine the causes of each truck bottleneck identified by this study.

Percent of Travel Meeting Level of Service (LOS)

Definition: The Percent of Travel Meeting LOS is determined by summing the VMT on roadways operating acceptably and then dividing by the total system VMT. "Acceptably" was defined as LOS D (two-hour peak and daily) for the 7 largest MPO urbanized areas, LOS D (one hour peak and daily) for other urbanized areas, and LOS C (one-hour peak and daily) everywhere else. The Percent of Travel Meeting LOS criteria is reported on daily and peak period basis for the 7 largest MPO urbanized areas, and on a daily and peak hour basis for all others. Peak period refers to 4:00 p.m. to 6:00 p.m. in the 7 largest MPO urbanized areas, and peak hour is defined as the hour with the highest hourly factor in other urbanized areas and elsewhere.

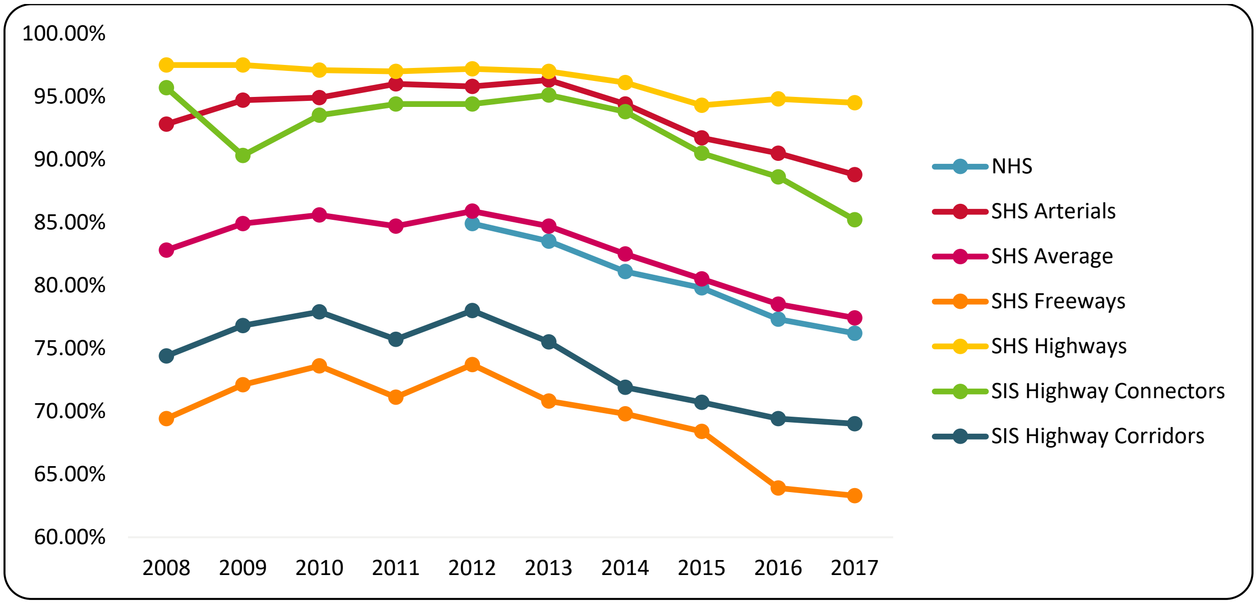
$$\frac{\sum(VMT\ during\ Peak\ Performance\ \geq Acceptable\ LOS\ Criteria\ Threshold) \times 100}{\sum VMT}$$

Data Source: FDOT – Traffic Characteristics Inventory, FDOT – Roadway Characteristics Inventory and HERE Technologies – Travel Time Data

Data Coverage: State Highway System (SHS); National Highway System (NHS)

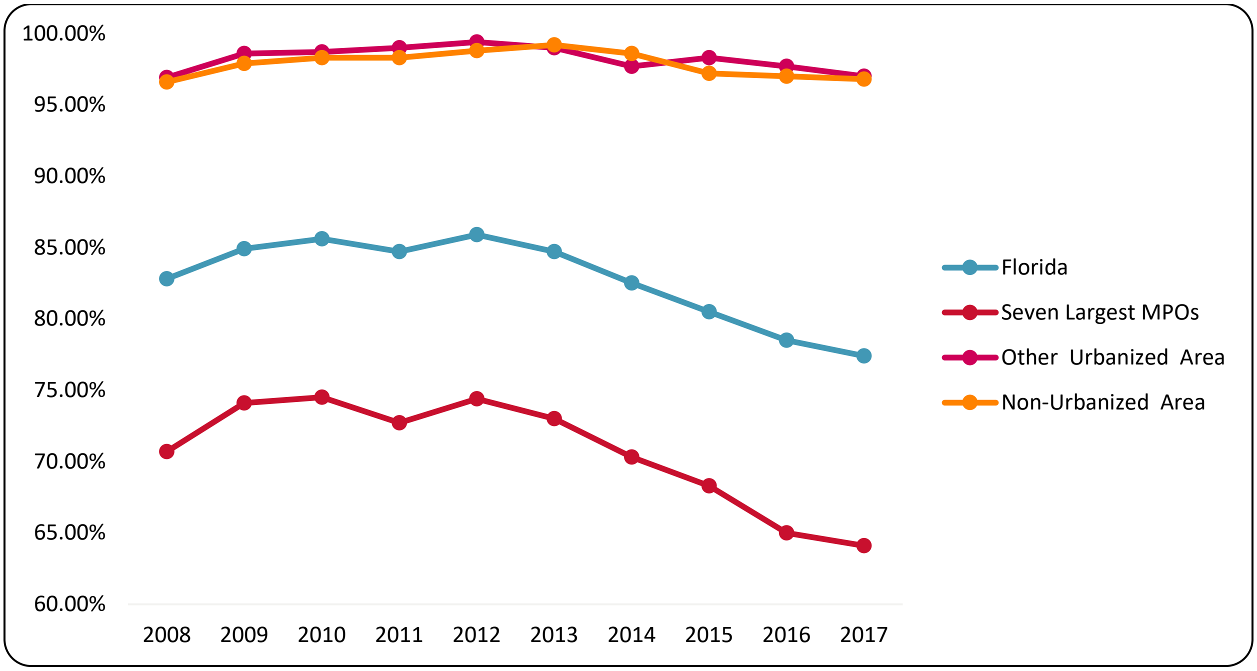
Major observations: Figures 20 through 23 provide the annual trends of Percent of Travel Meeting LOS criteria for different areas and facility types in the state. As travel on Florida's roadways has increased, the percent of travel meeting the acceptable LOS criteria during peak hour/peak period has decreased. From 2016 to 2017, it went from 78.5% to 77.4% on Florida's SHS during peak hour/peak period.

[8] American Transportation Research Institute –Top 100 Bottlenecks, 2019



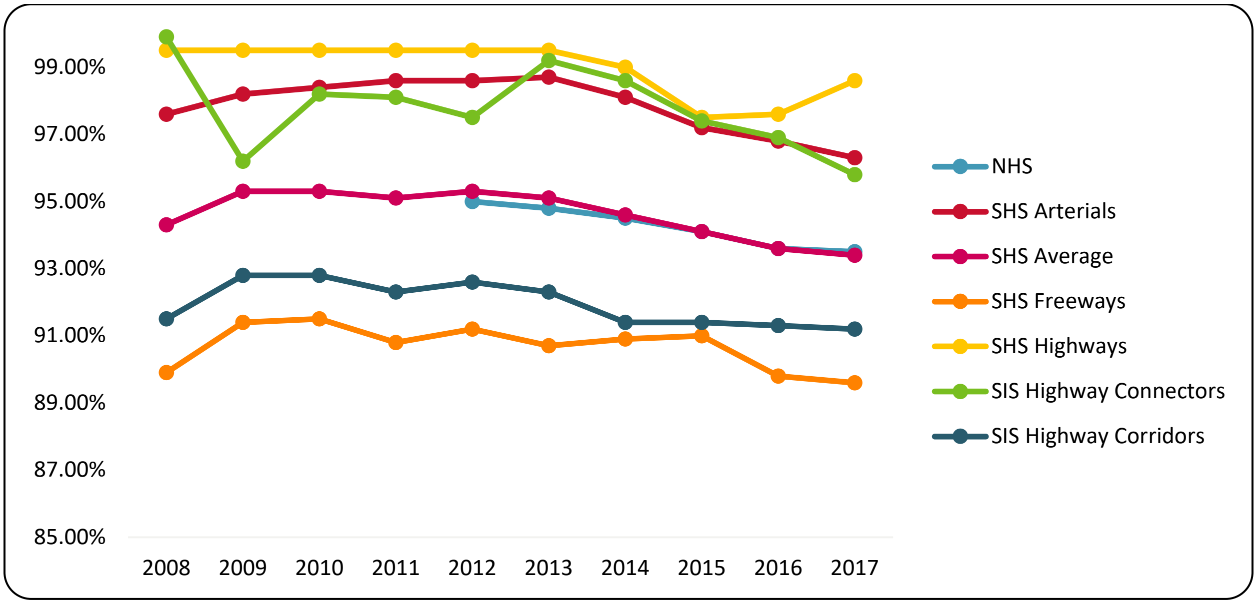
Source: FDOT Sourcebook, 2018

Figure 20 | % Travel Meeting LOS Criteria - Facility Type during Peak Period (2008-2017)



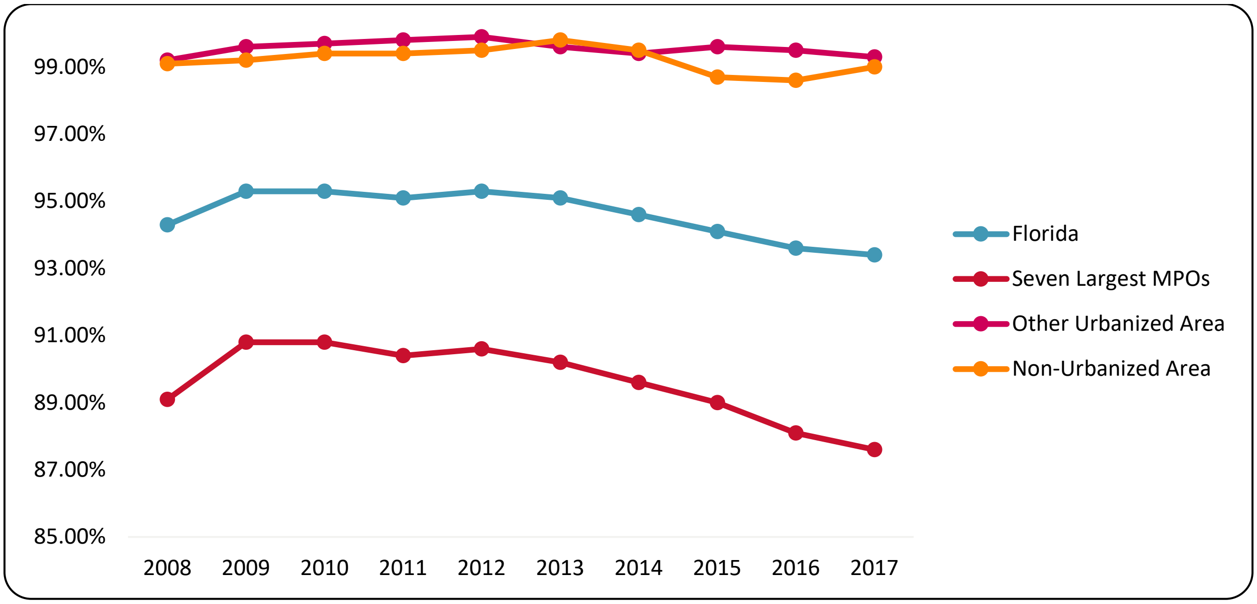
Source: FDOT Sourcebook, 2018

Figure 21 | % Travel Meeting LOS Criteria on SHS-Peak Period (2008-2017)



Source: FDOT Sourcebook, 2018

Figure 22 | % Travel Meeting LOS Criteria - Facility Type - Daily Time Period (2008-2017)



Source: FDOT Sourcebook, 2018

Figure 23 | Percent Travel Meeting LOS Criteria on SHS-Daily Period (2008-2017)

Figure 24 and Figure 25 depict existing (2016) and future (2040) Levels of Service for SHS roadways in the state. The LOS for the forecasted year indicates the worsening of travel conditions.

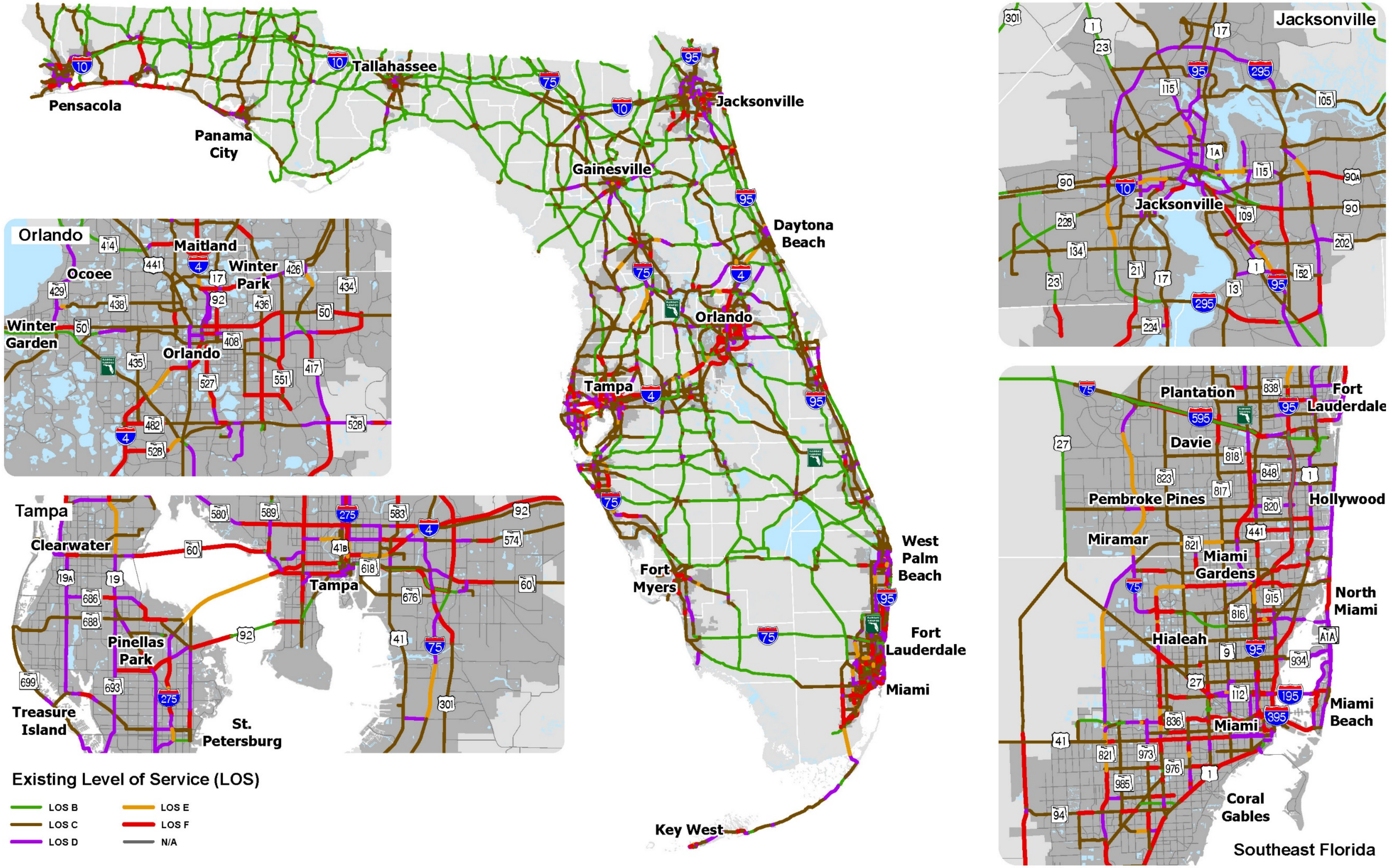


Figure 24 | Existing Level of Service (2016)

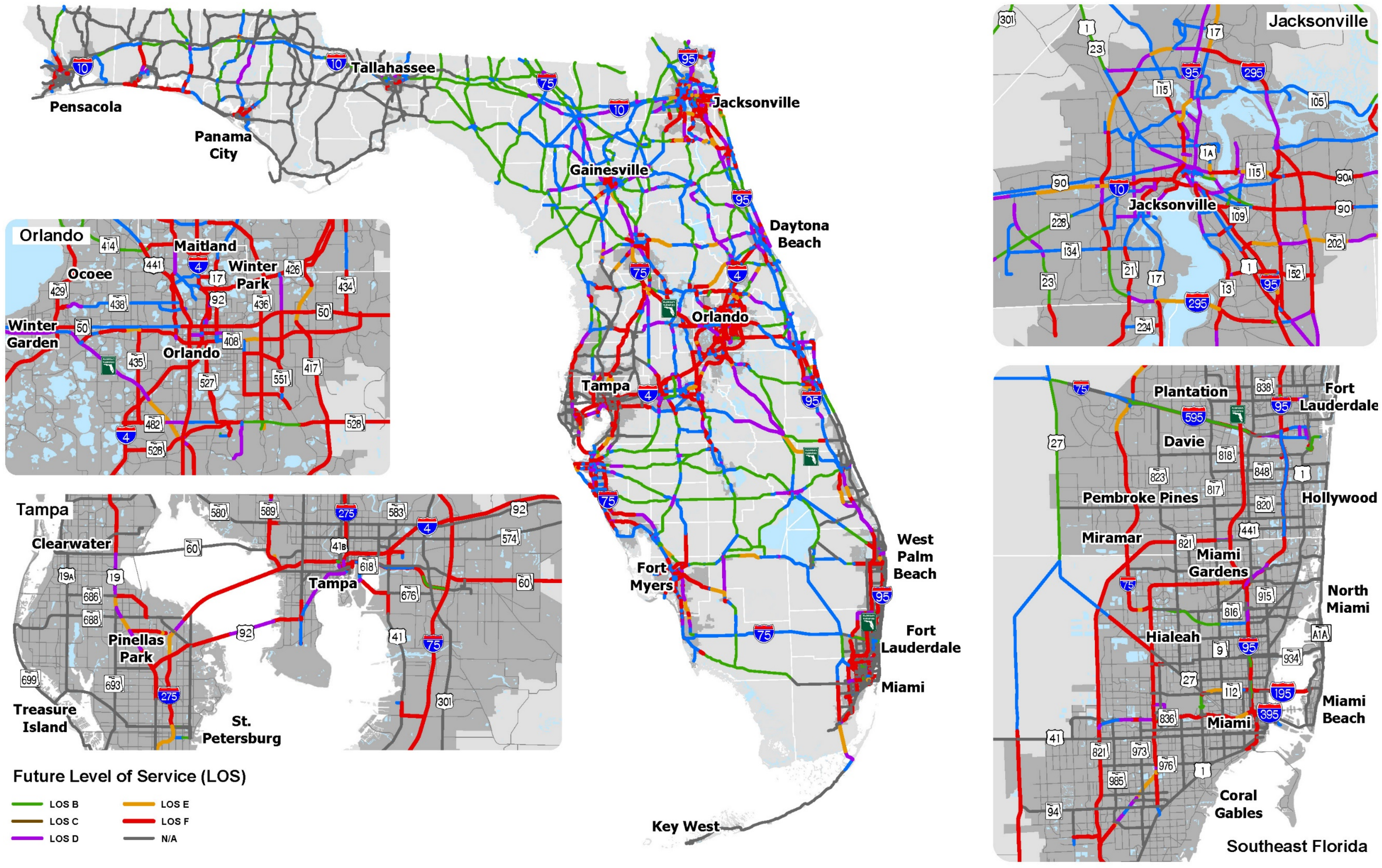


Figure 25 | Future Level of Service (2040)

Highway Pavement Conditions

Definition: Pavement conditions are rated by the FDOT and FHWA criteria as outlined below:

Data Coverage: State Highway System (SHS), National Highway System (NHS)

FDOT criteria: Ensure at least 80% of the pavement on the SHS meets the Department standard

Table 4 shows the Department's criteria for assessing pavement condition.

Table 4 | Pavement Condition Criteria (FDOT)

Rating Factors	Non-Deficient	Deficient
Ride Rating	>=6.5 (IRI<=125 in/mile)	<6.5 (IRI>125)
Crack Rating	>=6.5	<6.5
Rut Rating	>=6.5 (Rut <3/8 in)	<6.5 (Rut > 3/8 in)

Note: Pavement ratings are averaged along the entire segment which varies in length. The segment is considered "Deficient" if any one of the three ratings are deficient. Crack rating is a combination of lengths and severities and is not comparable to the FHWA Cracking Percent. International Roughness Index (IRI) is defined as a mathematical transform (a property) of a true profile describing surface roughness that causes vehicle vibration. A rut is a continuous longitudinal depression deviating from a surface plane defined by transverse cross slope and longitudinal profile. This depression normally occurs in the wheel paths.
Source: Transportation Asset Management Plan (TAMP), 2019

FHWA criteria: For the FHWA performance measurement reporting for pavements on the entire NHS, the Department has to ensure:

- Percentage of Interstate pavements in Good condition: ≥ 60.0%
- Percentage of Interstate pavements in Poor condition: ≤ 5.0%
- Percentage of non-Interstate NHS pavements in Good condition: ≥ 40.0%
- Percentage of non-Interstate NHS pavements in Poor condition: ≤ 5.0%

Per the FHWA Rule (23 CFR 490.315), the minimum condition for interstate pavements is that no more than 5% should be in poor condition. There are no minimum condition requirements for the non-interstate NHS pavements. Table 5 shows the FHWA's criteria for assessing pavement condition.

Table 5 | Pavement Condition Criteria (FHWA)

Rating Factors	Good	Fair	Poor
IRI (in/mile)	< 95	95-170	>170
Cracking Percent	<5	5-15 (Jointed plain concrete pavement: JPCP) 5-20 (Asphalt)	>15 (JPCP) >20 (Asphalt)
Rutting	<0.2	0.2-0.4	>0.4

Note: Pavement metrics are measured in 0.1-mile intervals. All three metrics must be rated "Good" for the 0.1-mile segment to be considered "Good". Two of the three metrics must be rated as Poor for the interval to be considered "Poor". *Note: 5.9% of interstate and 3.2% of non-interstate lane miles not rated due to construction.*
Source: Transportation Asset Management Plan (TAMP), 2019

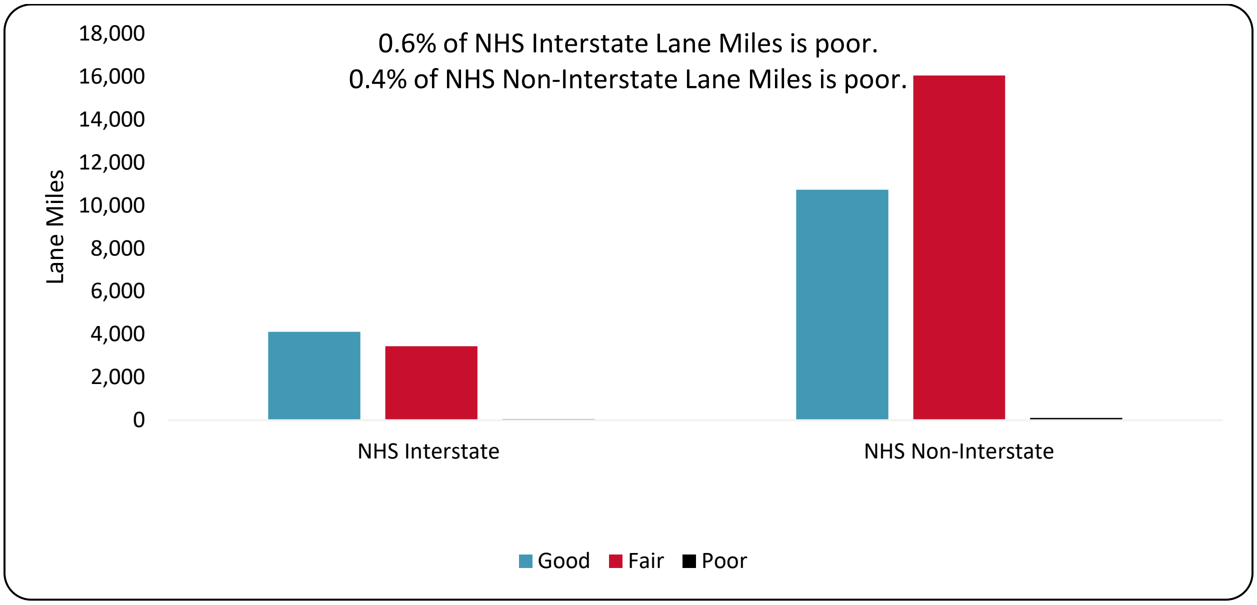
Data Source: Roadway Characteristics Inventory and State Materials Office

Data Coverage: State Highway System (SHS); National Highway System (NHS)

Major Observations:

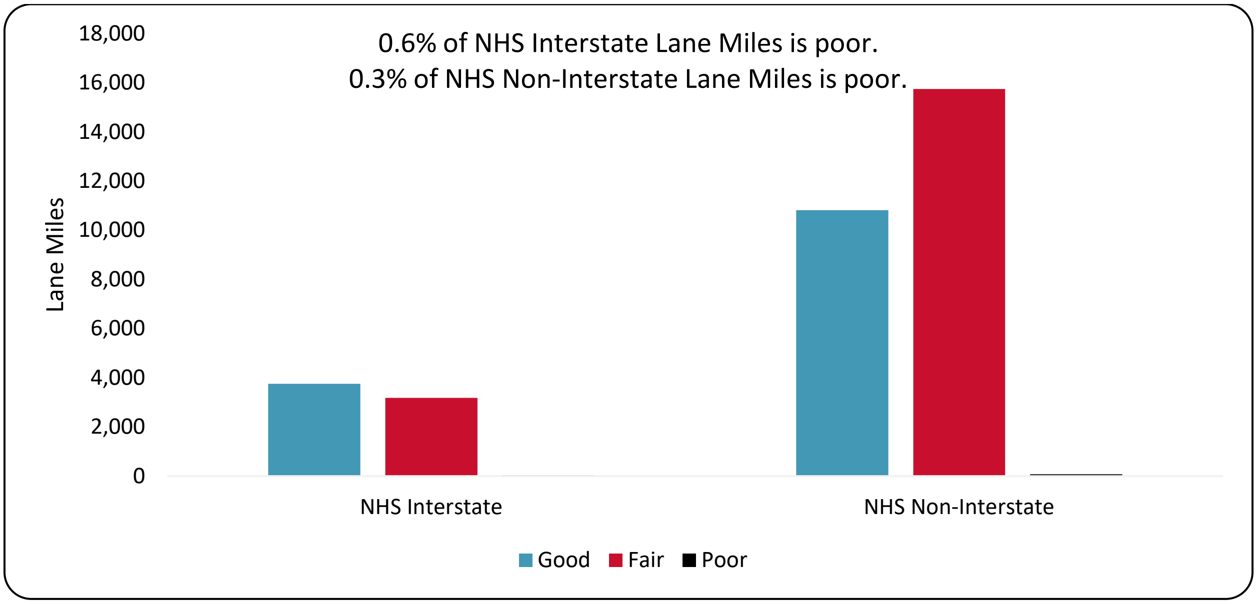
FDOT Criteria: Pavement on the SHS is in good condition. In calendar year 2018, 91.3% of the SHS pavements met Department standards which is well above FDOT target (80%). Over the past ten years, performance has improved dramatically.

FHWA Performance Measures: Figures 26 through 28 present the condition of the entire NHS pavements based on the FHWA performance measures. Overall, the pavement on the NHS is in good and fair condition with relatively few lane miles in poor condition. Figure 29 depicts a statewide map of pavement conditions for the NHS per FHWA ratings. The statistics indicate that the state is performing very well for pavement conditions with a few issue areas highlighted in the Figure 29.



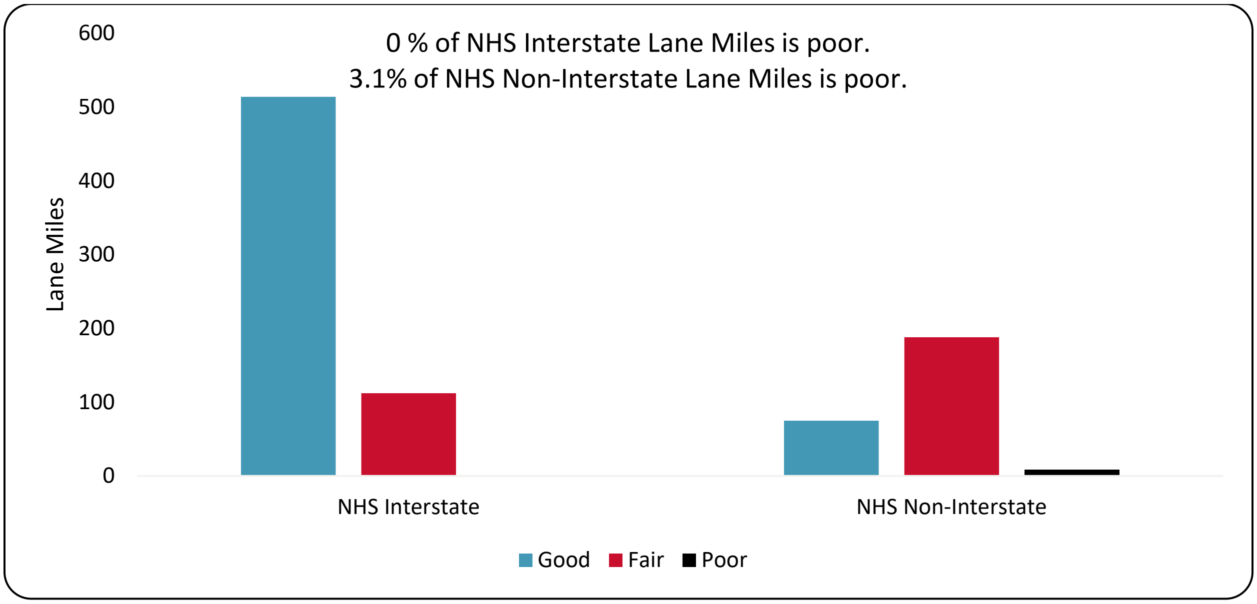
Source: Transportation Asset Management Plan (TAMP), 2019

Figure 26 | 2018 NHS Pavement Condition Based on FHWA Performance Measures (All Pavement Types)



Source: Transportation Asset Management Plan (TAMP), 2019

Figure 27 | 2018 NHS Pavement Condition Based on FHWA Performance Measures (Asphalt Pavement)



Source: Transportation Asset Management Plan (TAMP), 2019

Figure 28 | 2018 NHS Pavement Condition Based on FHWA Performance Measures (Concrete Pavement)

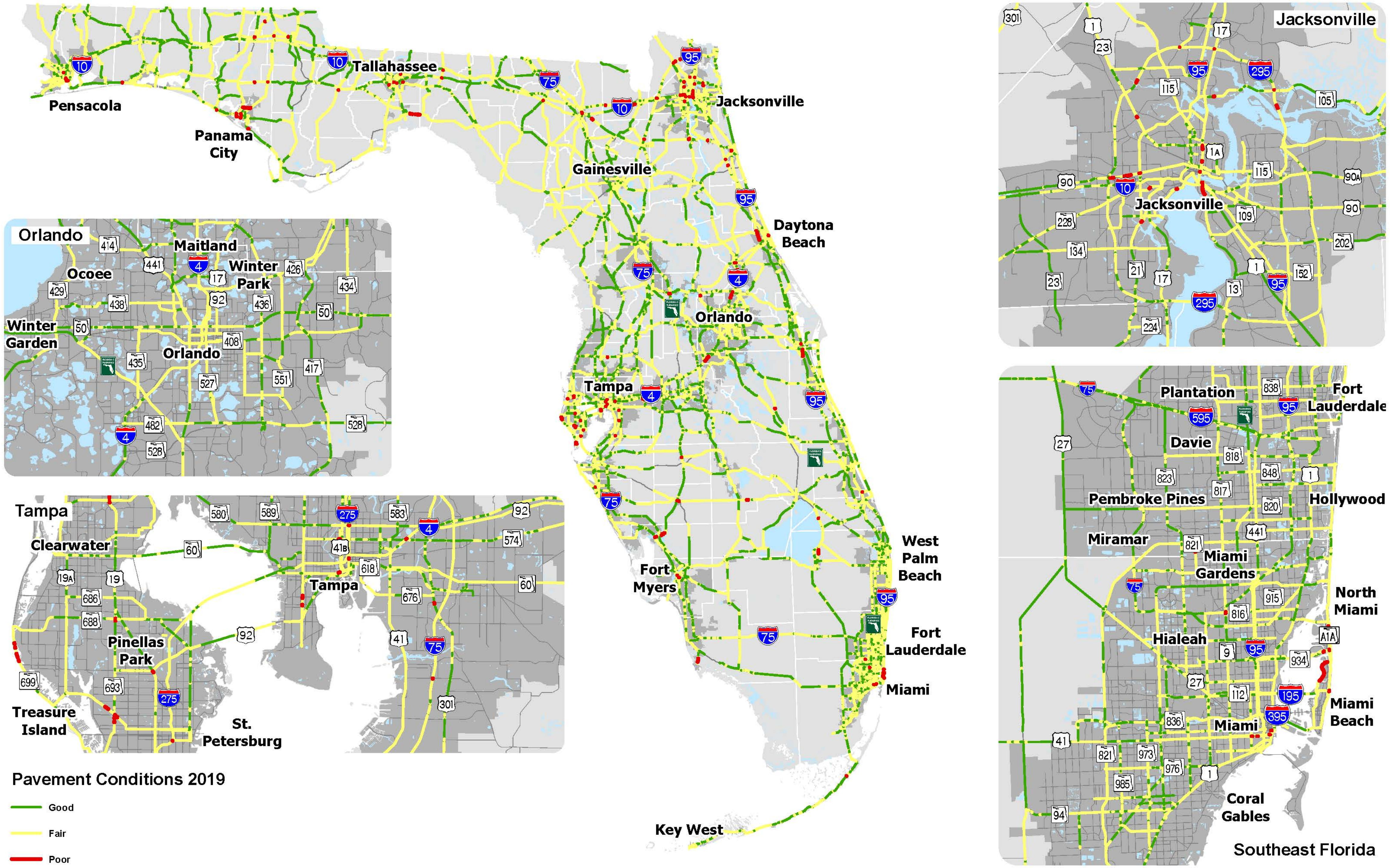


Figure 29 | Pavement Conditions (2018)

Bridge Conditions

Definition: The definitions of bridge conditions are defined below:

Functionally obsolete means that the bridge design is outdated. For example, narrow shoulders, narrow lanes, or older traffic barriers can induce the functionally obsolete classification. Functionally obsolete bridges are scheduled for replacement or rehabilitation as budgets permit.

Structurally deficient means that a National Bridge Inspection (NBI) structural condition state is poor, or worse. NBI structural condition states are described within the FDOT Bridge Management System (BMS) Coding Guide, at keywords "DECK (58)," "SUPERSTUCTURE (59)," "SUBSTRUCTURE (60)," and "CULVERT (62)." Structurally deficient bridges are recommended for repair, or scheduled for replacement; meanwhile, they are posted as necessary for load, or closed.

Data Source: FDOT office – Office of Maintenance

Data Coverage: All bridges in Florida

Reference studies or projects: FDOT Transportation Asset Management Plan, 2019 (TAMP), Florida Bridge Information 2019, Quarter 3[9] and FDOT Bridge Inventory 2019 Annual Report.[10]

Major observations: For the past decade over 90% of the state's bridges have met the Department's performance measures and targets. This demonstrates the state's bridges are in a state of good repair and do not exhibit signs of structural deterioration. Table 6 shows the percentage of NHS bridge deck area in good and poor condition as defined by the FHWA scale. For state owned NHS bridges, 66% of the total NHS deck area is in good condition and less than 2% is in poor condition. For locally owned bridges, 69% of the total NHS deck area is in good condition and none are in poor condition.

Table 6 | Percentage of NHS Bridge Deck Area in Good and Poor Condition

	Deck Area (square feet)	Good Area (square feet)	Percentage of Area in Good Condition	Poor Area (square feet)	Percentage of Area in Poor Condition
State Owned NHS	127,238,250	84,142,970	66.1%	1,579,416	1.2%
Locally Owned NHS	4,450,844	3,081,681	69.2%	0	0%
NHS Total	**131,689,094**	**87,224,651**	**66.2%**	**1,579,416**	**1.2%**

Source: Transportation Asset Management Plan (TAMP), 2019

Figure 30 depicts all structurally deficient and functionally obsolete bridges in the state of Florida. As per the 2019 Bridge Inventory annual report, there are 376 structurally deficient bridges. FDOT maintaining 55 of those bridges, counties maintain 246 of those structurally deficient bridges, and cities/towns maintain 45 of those structurally deficient bridges.

[9] *Florida Bridge Information 2019, Quarter 3*

[10] *FDOT Bridge Inventory Report, 2019*

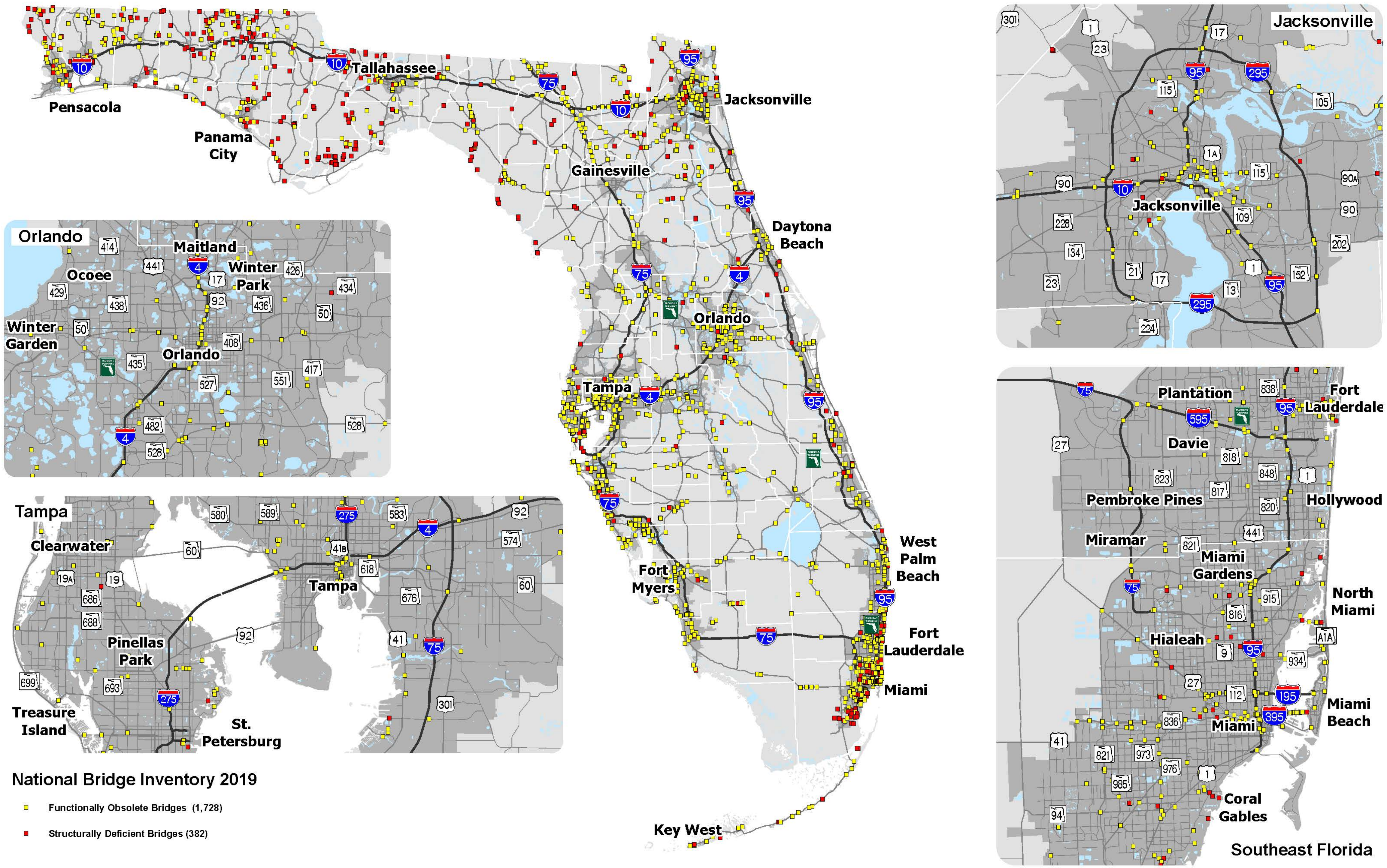


Figure 30 | Functionally Obsolete and Structurally Deficient Bridges (2019)

Highway (Truck) Safety

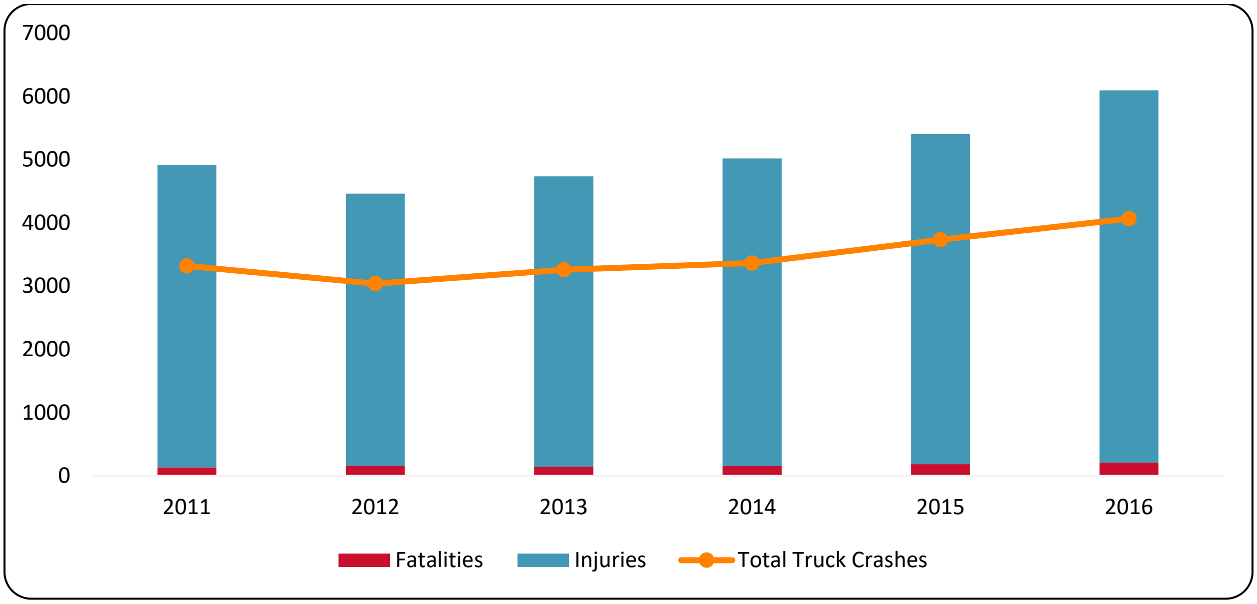
Definitions:

Number of Truck Fatalities: The total number of fatalities on Florida's roadways as a direct result of a traffic crash involving a truck within thirty days of the crash occurrence.

Number of Truck Injuries: The total number of injuries from traffic crashes involving a truck that occur on Florida's roadways.

Data Source: Truck crash data was acquired from the FDOT Safety Office for years 2011-2016. The data includes truck crashes that resulted in a fatality or injury and were locatable on the statewide road network.

Data Coverage: All truck crashes that resulted in an injury or fatality in Florida



Source: Safety Office, 2019

Figure 31 | Truck Fatalities, Injuries and Crashes (2011-2016)

From 2011 to 2016, approximately 20,794 truck crashes occurred on Florida's roadways resulting in 995 fatalities (see Figure 31). Since 2012, there has been a steady increase in the amount of traffic crashes involving a truck on Florida's roadways. In 2016, the number of truck crashes increased by 1.6%, or 332 accidents, from 2015. Truck crashes involving a fatality or injury have also increased over time with an increase of 1.3% in truck accident deaths (27 fatalities) from 2015 to 2016, and an increase of 11.2% (660) in truck accident related injuries from 2015 to 2016.

District 5 had the most truck crashes (3,930) and saw an 11.8% increase in total truck crashes from 2015 to 2016. District 3 had the fewest total truck crashes (1,540). Figure 32 showcases the areas in Florida with the highest concentration of truck crashes. Major metropolitan areas such as Tampa, Orlando, Jacksonville, and Miami have higher occurrences of truck crashes. Urban areas have more occurrences of truck crashes than rural areas. Miami-Dade had the highest share of truck crashes statewide. Orange, Duval, and Hillsborough Counties have all seen an increase of approximately 5% of their overall truck crashes from 2011 to 2016. On the contrary, Pinellas and Broward counties have seen a decrease of approximately 7% of their overall truck crashes from 2011 to 2016.

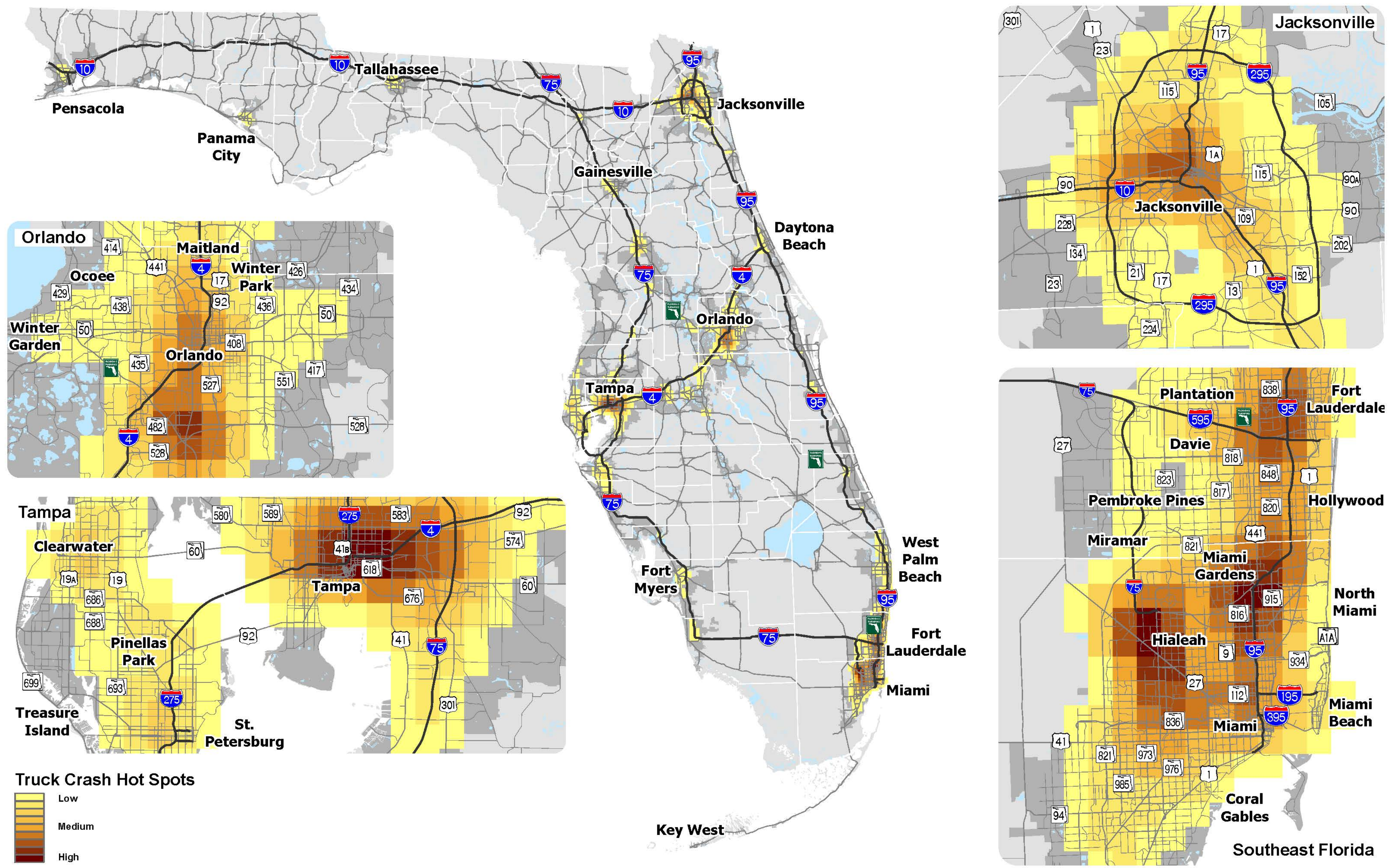


Figure 32 | Truck Crash Hot Spots (2011-2016)

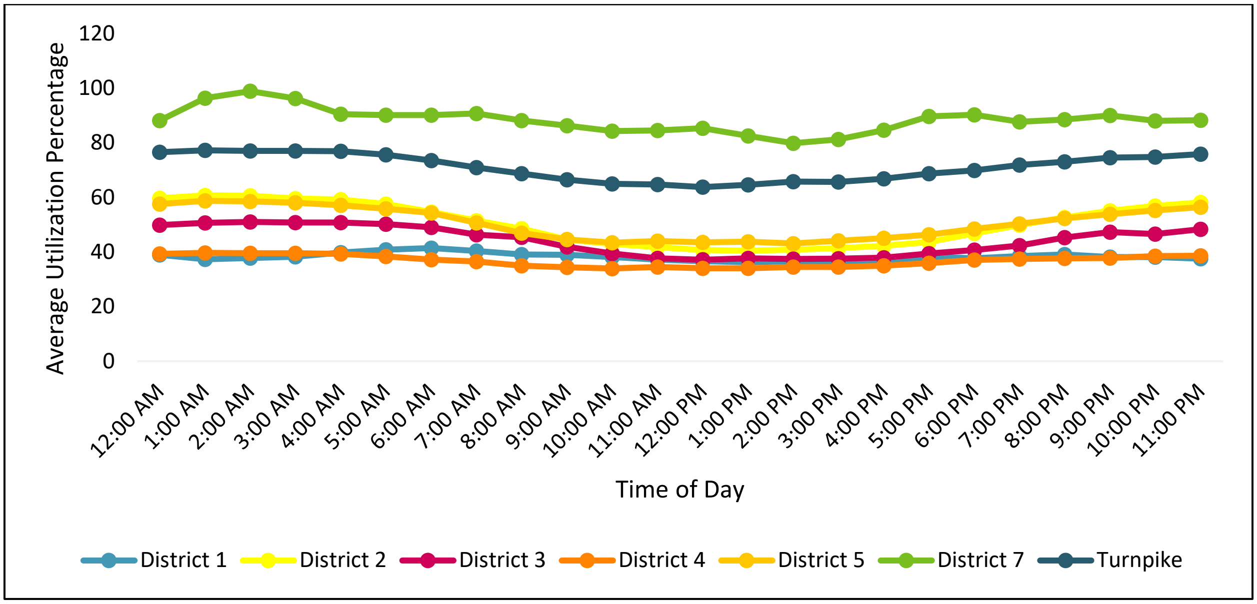
Source: Safety Office, 2019

Truck Parking Utilization

Definition: Truck Parking Utilization is defined as the percent of total parked trucks at a given hour of the day to the total truck parking spaces at a given truck parking location. This will provide an indication of how truck parking activity changes by time of day for different facility types and geographic areas. Hourly utilization datasets and supply information are used to compute this measure.

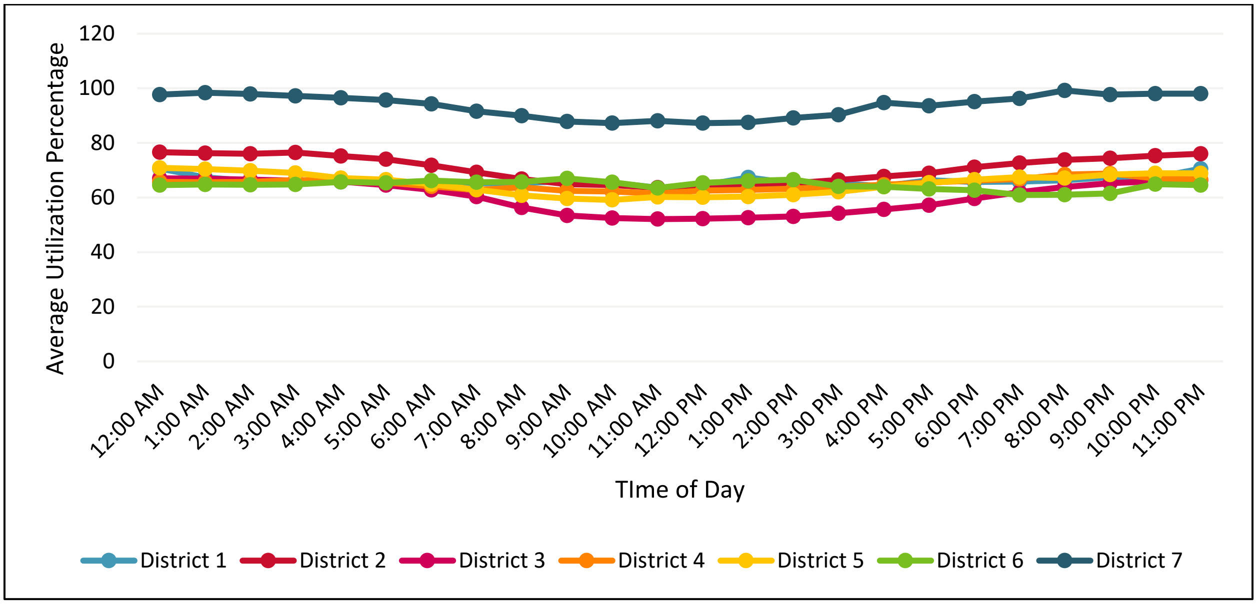
Data Coverage: All identified authorized truck parking locations in Florida

Major observations: Figure 33 and Figure 34 depict the truck parking utilization for public and private locations for different Districts. The analysis excludes locations with less than 5 parking spaces. The results clearly indicate that the private locations have higher utilization across the day when compared to public locations. Figure 35 provides the truck parking utilization for individual locations across the state. Figure 36 depicts the major areas of concern by weighing the highly utilized truck parking locations and locations with high density of unauthorized truck stops. The different figures indicate that truck parking is a major issue in the state of Florida and that there is a need for both traditional and innovative solutions to alleviate this problem.



Source: Transportation Data and Analytics, 2019

Figure 33 | Average Hourly Utilization of Public Truck Parking Locations in the State



Source: Transportation Data and Analytics, 2019

Figure 34 | Average Hourly Utilization of Private Truck Parking Locations in the State

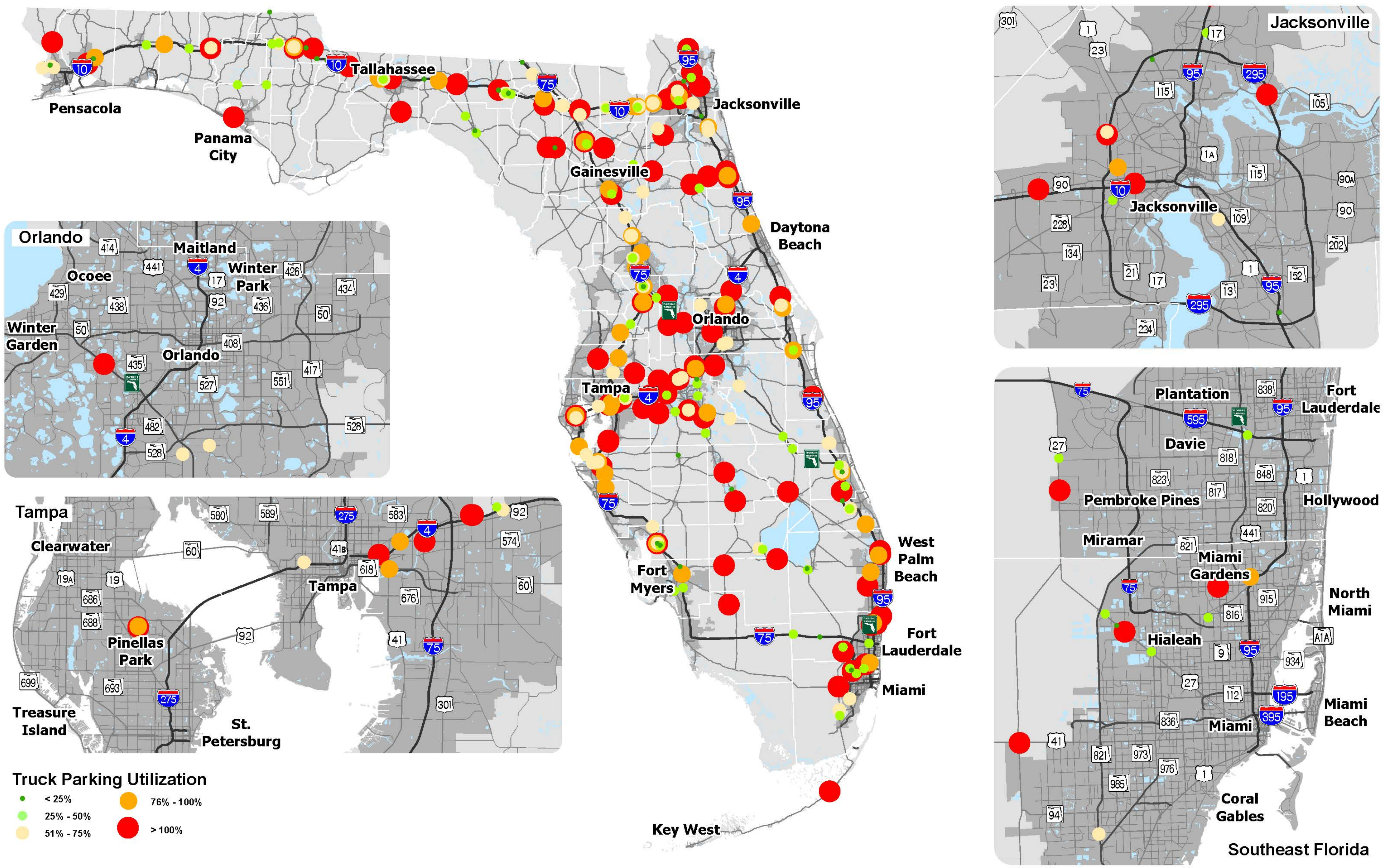


Figure 35 | Truck Parking Utilization (2017-2018)

Source: FDOT Transportation Data and Analytics, 2019

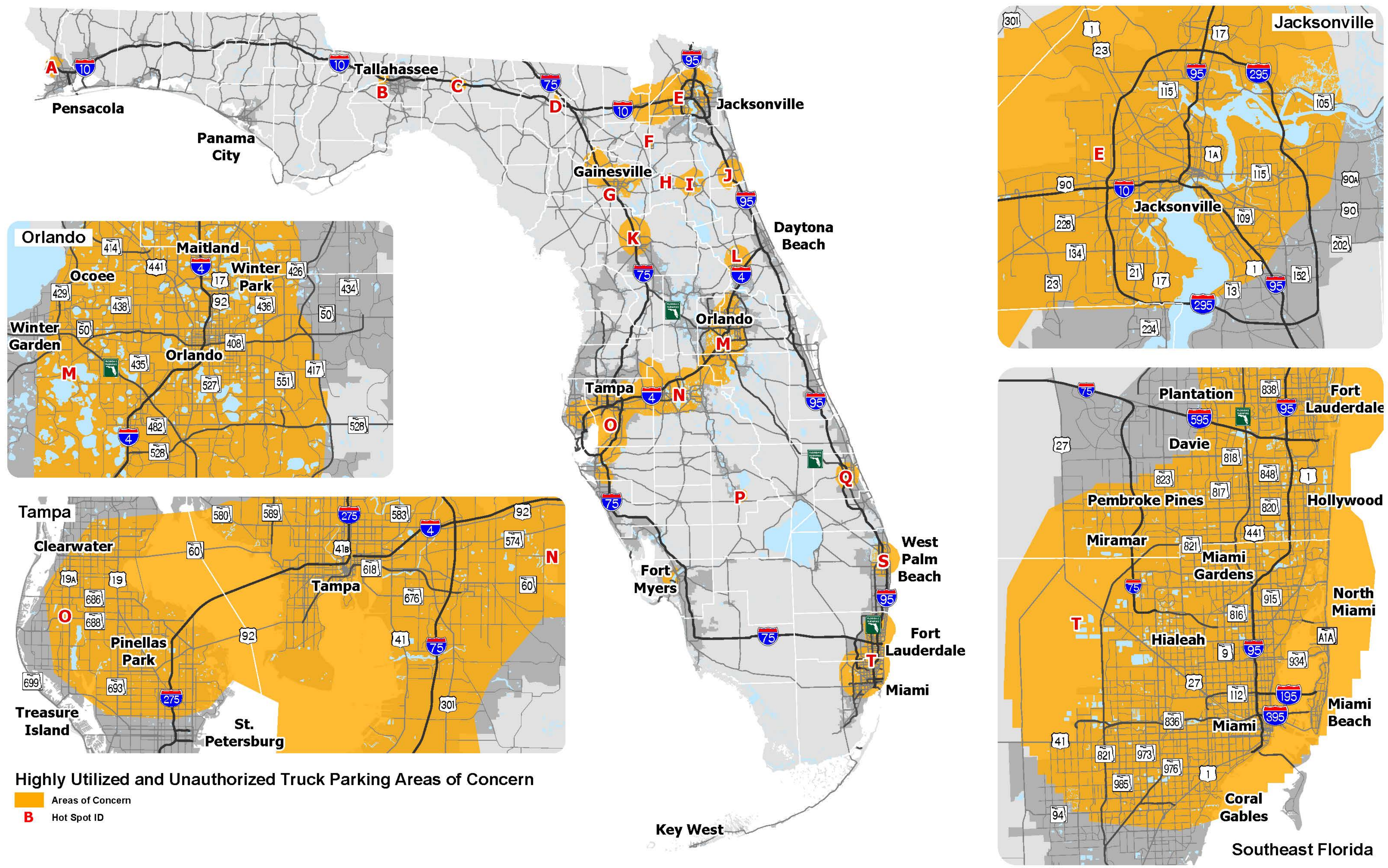


Figure 36 | Truck Parking Areas of Concern

Source: FDOT Transportation Data and Analytics, 2019

Rail Performance

Rail Tonnage

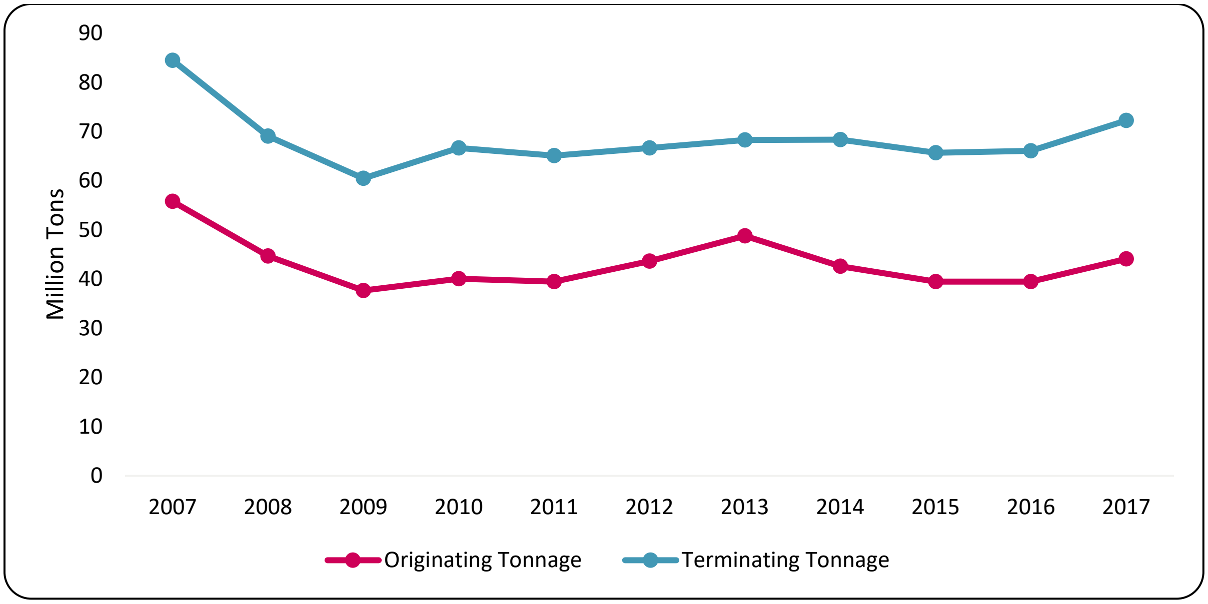
Definition: The tons of freight carried by rail originated or terminated in Florida.

$$Rail\ Tonnage = \sum Rail\ Tonnage$$

Data Source: Association of American Railroads, 2017.[11]

Data Coverage: Statewide statistics

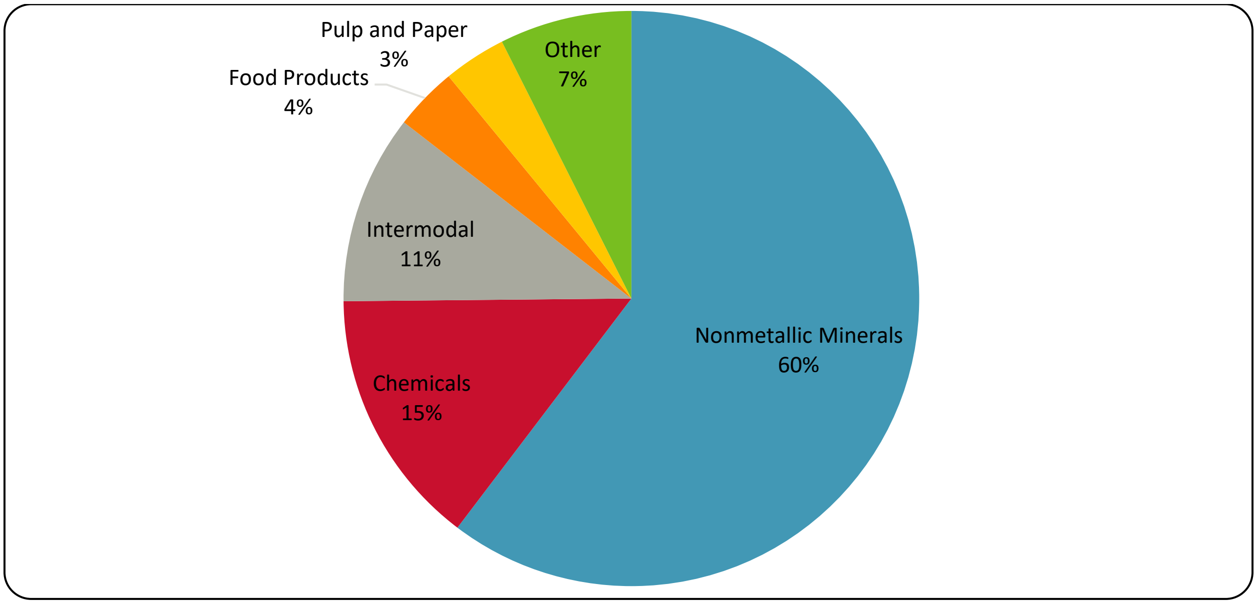
Major Observations: In 2017, Florida ranked 11th in the country with 44.1 million originated rail tons and 4th with 72.3 million terminated rail tons. Due to Florida's geography, the majority of rail traffic will either originate or terminate in the state, as opposed to pass-through rail traffic. Florida ranks 32nd in the total rail tons and rail carloads as the state carries 85.5 million tons and 1,737,200 rail carloads. The statistics emphasize the state being a consumer state (Figure 37). Figures 38 and 39 provide a breakdown of commodity shares for rail traffic originating and terminating in Florida respectively.



Source: Association of American Railroads

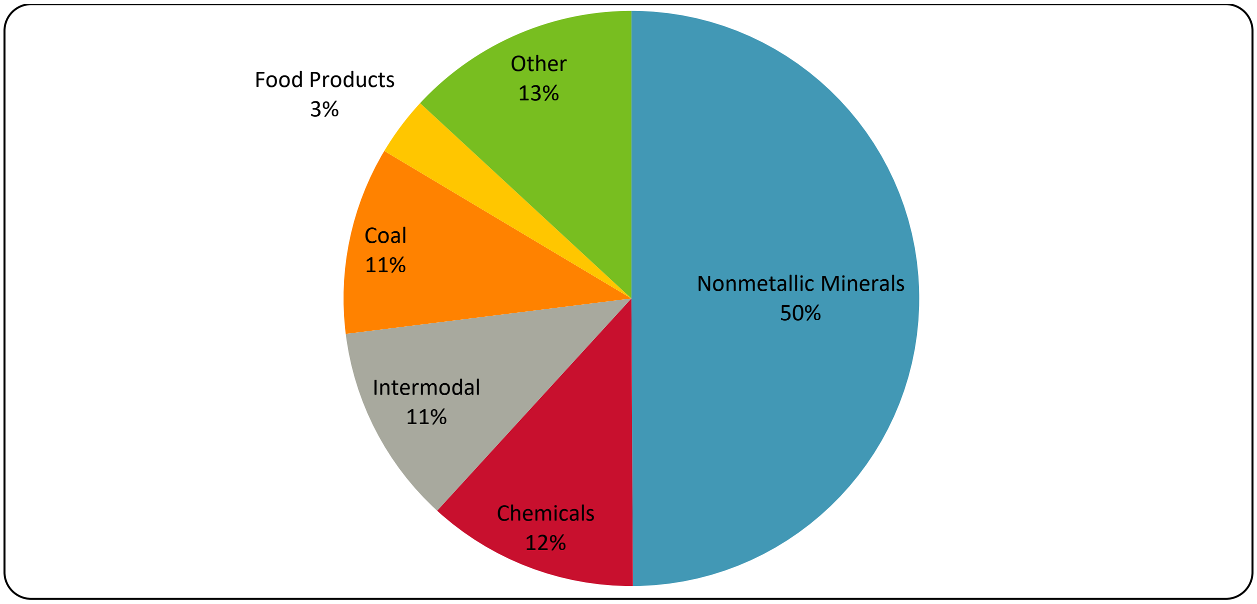
Figure 37 | Rail Tonnage Trends

[11] Association of American Railroads, 2017



Source: Association of American Railroads, 2017

Figure 38 | Rail Traffic Originating in Florida (Based on Tons)



Source: Association of American Railroads, 2017

Figure 39 | Rail Traffic Terminating in Florida (Based on Tons)

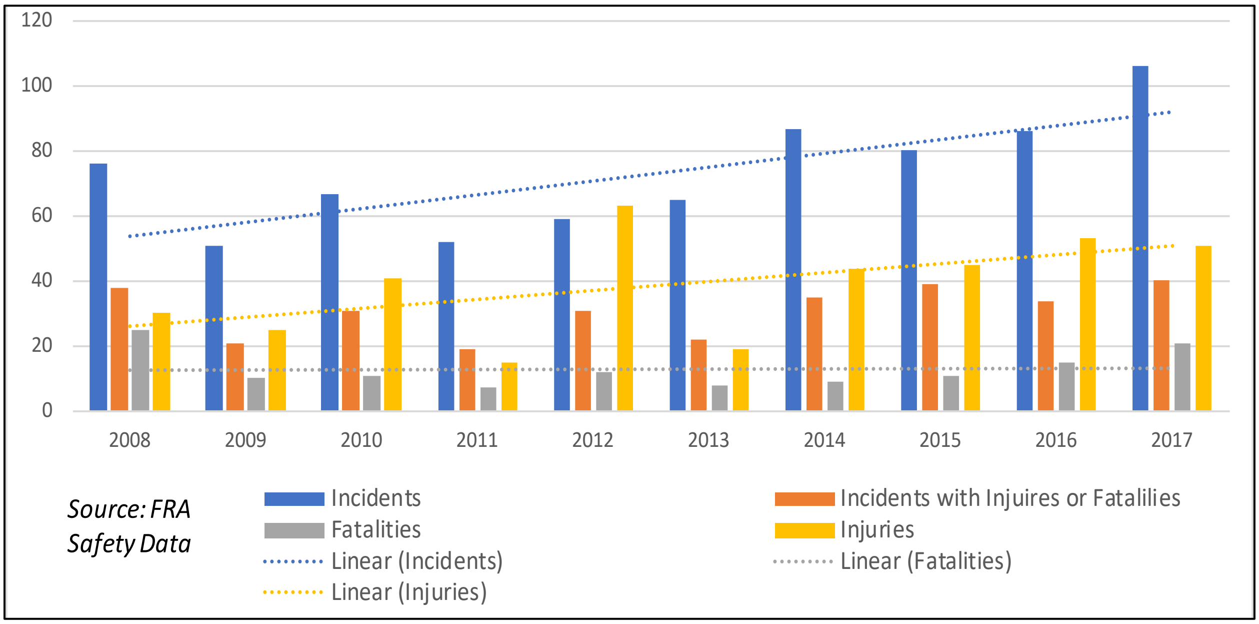
Rail Safety

Definition: The number of rail crashes or incidents in Florida.

$$Rail\ Crashes\ or\ Incidents = \sum Rail\ Crashes\ or\ Incidents$$

Data Coverage: All rail related crashes that resulted in an injury or fatality in Florida

In 2016 there were 343 total rail crashes/incidents in Florida, which is the sum of train crashes, highway-rail incidents (86 out of the total), and other incidents (Figure 40). There were a total of 2,119 highway railroad incidents in 2017 for the United States that resulted in 272 fatalities. 5% of those total incidents and 7.4% of those fatalities were in Florida. In addition, the rate of highway-railroad incidents in Florida have been increasing over the past decade. Florida experienced an upward trend of highway-railroad incidents totaling 729 occurrences from 2008 to 2017. The same ten-year period shows similar trends with 310 incidents resulting in 386 injuries and 129 fatalities.



Source: Federal Rail Administration (FRA)

Figure 40 | Rail Safety Trends (2008-2017)

Seaport Performance

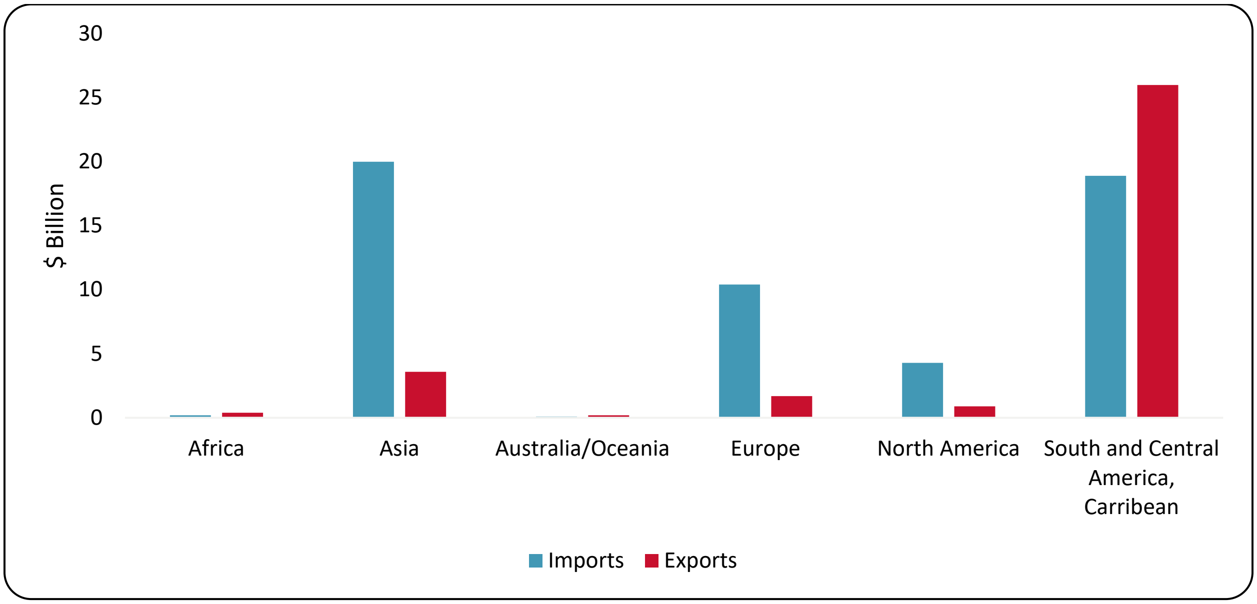
Seaport Tonnage and Value

Definition: The tons, value and TEUs of freight carried by seaport mode originated or terminated in Florida.

Data Source: Florida Ports Council

Data Coverage: All major Florida ports

Major observations: In 2018, Florida seaports handled $87.3 billion of international trade and 4.1 million TEUs. This $87.3 billion represented 55.6% of Florida's total international trade. Figure 41 clearly indicates that Florida's major export partners are South and Central America and the Caribbean region. On the other hand, Florida's major import partners are Asian countries. Brazil and China are the top export and import partners for Florida ports respectively. Tables 7 and 8 depict the top 10 countries for imports and exports by commodity value.



Source: U.S. Census Bureau

Figure 41 | Florida International Waterborne Trade by Region (By Value) 2018 (US$ Billions)

Table 7 | Top Ten Trading Import Partners for Waterborne Cargo, by Value (2016-2018)

Country	2016	2017	2018	Percent Change 2018 over 2017
China	$6,141,798,998	$6,441,885,051	$7,133,750,876	10.70%
Japan	$6,167,890,898	$6,624,047,167	$6,629,076,002	0.10%
Mexico	$2,475,459,736	$3,422,021,969	$3,791,381,004	10.80%
Dominican Republic	$2,661,076,914	$2,656,952,146	$2,977,571,897	12.10%
Honduras	$2,456,892,181	$2,391,894,727	$2,594,241,862	8.50%
Chile	$1,721,376,443	$2,457,536,542	$2,429,851,020	-1.10%
Germany	$2,573,594,363	$2,406,630,924	$2,130,072,256	-11.50%
Italy	$1,678,913,369	$1,711,704,280	$1,942,296,829	13.50%
Brazil	$1,289,134,399	$1,425,438,985	$1,710,594,348	20.00%
Nicaragua	$932,101,976	$1,442,958,228	$1,535,494,391	6.40%
All Countries	$47,793,985,026	$51,309,067,432	$54,198,051,876	5.60%

Source: U.S. Census Bureau

Table 8 | Florida Top Ten Trading Export Partners for Waterborne Cargo, by Value (2016-2018)

Country	2016	2017	2018	Percent Change 2018 over 2017
Brazil	$2,720,531,730	$2,962,359,300	$3,522,489,335	18.90%
Dominican Republic	$2,577,378,910	$2,506,872,061	$2,729,582,417	8.90%
Honduras	$1,667,800,215	$1,643,226,136	$1,654,773,020	0.70%
Colombia	$1,427,787,978	$1,549,554,579	$1,610,238,674	3.90%
Chile	$1,237,809,927	$1,336,594,785	$1,475,081,091	10.40%
Costa Rica	$1,409,840,190	$1,393,416,246	$1,410,685,577	1.20%
Panama	$1,378,854,963	$1,303,330,945	$1,291,268,770	-0.90%
Bahamas	$1,118,143,111	$1,243,926,513	$1,252,371,757	0.70%
Peru	$1,075,794,403	$1,055,760,181	$1,221,582,832	15.70%
Argentina	$1,094,538,374	$1,276,020,951	$1,100,050,400	-13.80%
All Countries	$31,494,869,596	$31,869,527,760	$33,148,125,407	4.00%

Source: U.S. Census Bureau

Tables 9 and 10 provide a list of top ten trading import and export commodities for waterborne cargo by value. There are more than 12 commodities with a value of more than $1 billion for exports or imports.

Table 9 | Florida Top Ten Trading Import Commodities for Waterborne Cargo, by Value (2016-2018)

Imports	2016	2017	2018	Percent Change 2018 over 2017
Vehicles, Except Railway or Tramway, and Parts	$11,900,439,363	$13,175,511,693	$12,738,160,490	-3.30%
Apparel Articles and Accessories, Knit or Crochet	$4,411,718,247	$4,691,688,266	$5,026,434,698	7.10%
Electric Machinery, Including Sound and TV Equipment	$2,517,996,693	$2,845,157,414	$3,247,733,742	14.10%
Mineral Fuel, Oil, Bituminous Substances, Mineral Wax	$2,411,876,819	$2,290,300,251	$2,937,959,165	28.30%
Nuclear Reactors, Boilers, Machinery and Parts Thereof	$2,129,516,017	$2,063,843,149	$2,442,001,545	18.30%
Copper and Articles Thereof	$1,220,285,610	$1,933,399,325	$1,989,241,966	2.90%
Furniture, Bedding, Lamps, Prefabricated Buildings	$1,425,479,076	$1,540,445,091	$1,723,721,808	11.90%
Beverages, Spirits and Vinegar	$1,540,788,842	$1,537,809,114	$1,611,132,505	4.80%
Apparel Articles and Accessories, not Knit	$1,589,764,191	$1,527,017,219	$1,607,325,063	5.30%
Fish, Crustaceans and Aquatic Invertebrates	$1,360,904,836	$1,565,361,052	$1,565,887,578	0.00%
All Commodities	$47,793,985,026	$51,309,067,432	$54,198,051,876	5.60%

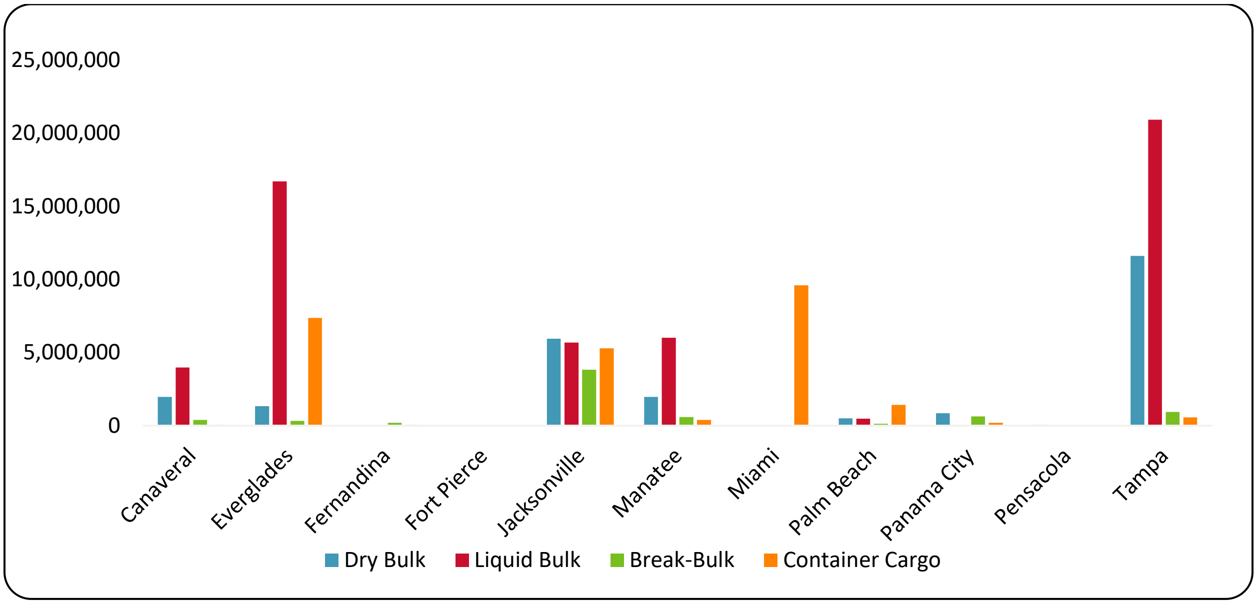
Source: U.S. Census Bureau

Table 10 | Florida Top Ten Trading Export Commodities for Waterborne Cargo, by Value (2016-2018)

Exports	2016	2017	2018	Percent Change 2018 over 2017
Nuclear Reactors, Boilers, Machinery and Parts Thereof	$5,773,229,061	$5,835,923,665	$6,135,106,223	5.10%
Vehicles, Except Railway or Tramway, and Parts Equipment	$5,058,953,402	$4,809,423,418	$5,166,001,164	7.40%
Electric Machinery, Including Sound and TV	$2,691,482,853	$2,848,377,067	$2,833,277,696	-0.50%
Fertilizers	$1,542,738,620	$1,523,497,595	$1,437,247,272	-5.70%
Plastics and Articles Thereof	$1,126,751,076	$1,110,555,624	$1,169,615,392	5.30%
Essential Oils, Perfumery, and Cosmetic Preparations	$893,570,427	$990,756,623	$995,182,639	0.40%
Cotton, including Yarn and Woven Fabric Thereof	$778,963,991	$839,056,770	$881,871,755	5.10%
Optical, Photo, Medical or Surgical Instruments	$792,342,557	$768,332,015	$823,914,889	7.20%
Meat and Edible Meat Offal	$648,913,591	$709,551,580	$697,901,977	-1.60%
Ships, Boats and Floating Structures	$485,172,158	$548,648,669	$648,855,753	18.30%
All Commodities	$31,494,869,596	$31,869,527,760	$33,148,125,407	4.00%

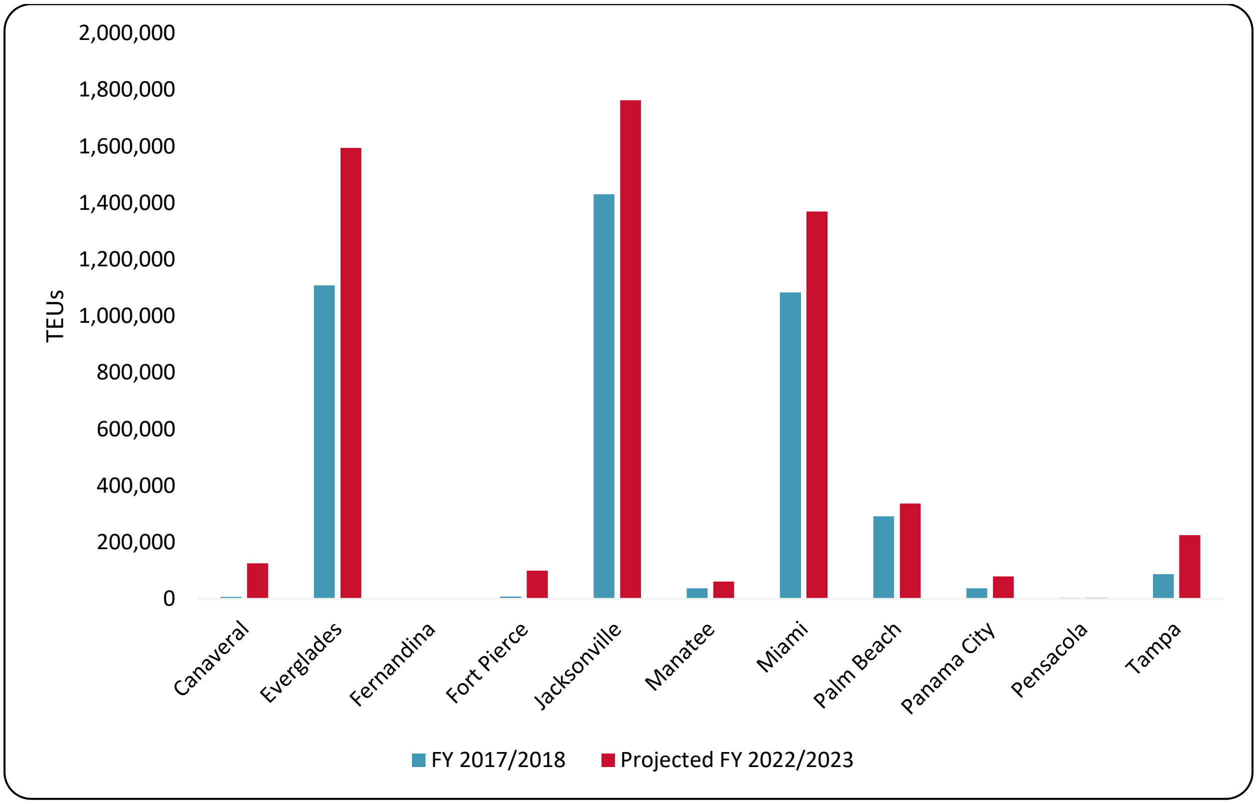
Source: U.S. Census Bureau

Figure 42 highlights the waterborne cargo types handled by Florida seaports (by total tonnage). Port Tampa Bay has the highest liquid bulk and dry bulk movement, whereas Port Jacksonville shows the highest break-bulk movement. Port Miami dominates in container cargo movement. Per Figure 43, Port Jacksonville has the highest TEU volume among all Florida ports.



Source: Five Year Florida Seaport Master Plan (FY-2017/2018)

Figure 42 | Waterborne Cargo Types Handled by Florida Seaports (by Tonnage)



Source: Five Year Florida Seaport Master Plan

Figure 43 | TEUs Handled by Florida Seaports

Aviation Performance

Aviation Tonnage

Definition: The weight of all air cargo handled at Florida airports.

$$Aviation\ CargoLanded\ Weight = \sum Cargo\ Landed\ Weight\ handled\ at\ all\ Florida\ Airports$$

$$Aviation\ Tonnage = \sum Tons\ handled\ at\ all\ Florida\ Airports$$

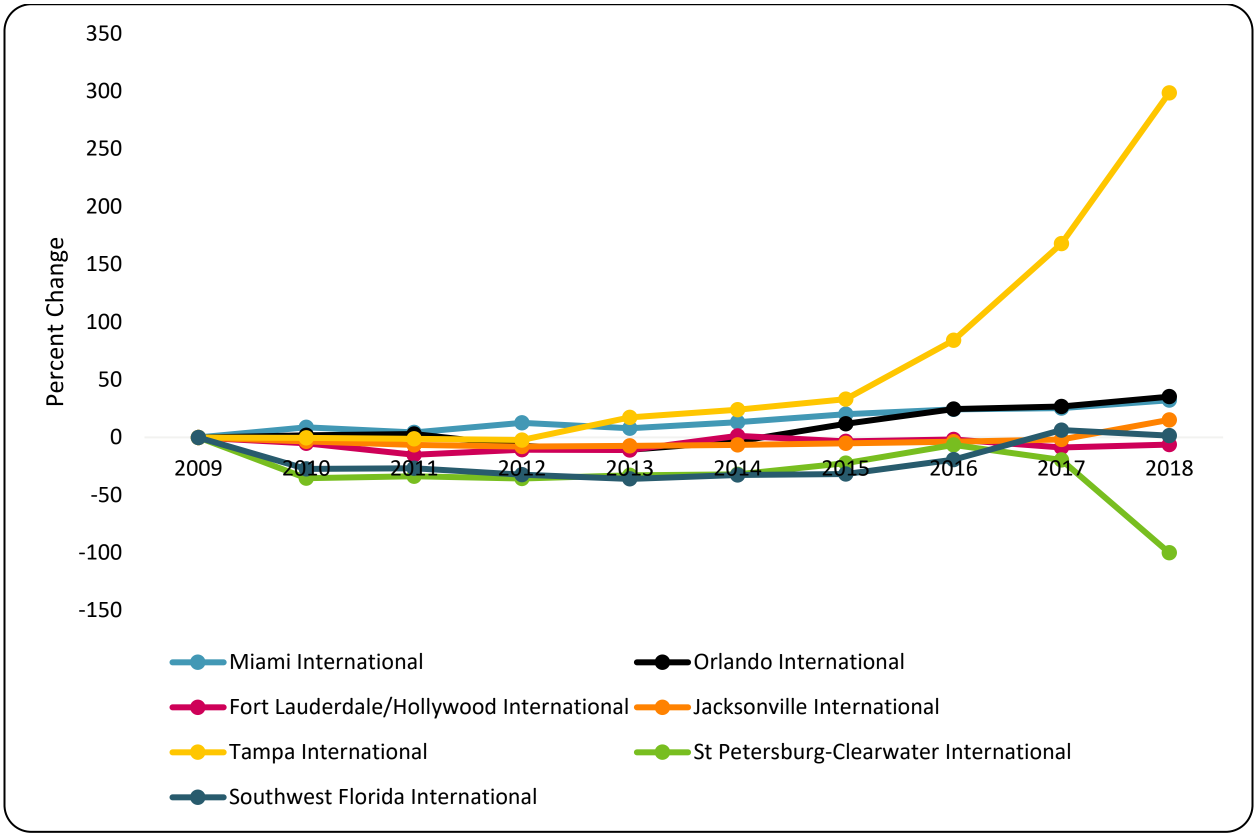
Data Source: U.S. Bureau of Transportation Statistics and Federal Aviation Administration

Data Coverage: All major airports

Major observations:

As per the Florida Aviation System Plan, Florida ranks #1 in air cargo with Latin American countries. Miami International Airport (MIA) features heavily in north-south cargo flows in the Western Hemisphere. 7 of the top 10 trade lanes are from MIA to markets located in Latin America and the Caribbean. MIA is a leading airport in the U.S. for international freight and ranks 10th globally. Figure 44 illustrates the percent change from 2009 to 2018 in "all cargo landed weight" at major Florida airports. "Landed weight" means the weight of aircraft transporting only cargo in intrastate, interstate, and foreign air transportation.[12] As per preliminary numbers for 2018, MIA ranks 4th in the nation with 8.4 million lbs. landed weight. Tampa International Airport (TPA) has seen significant growth in last decade. Since 2015, air cargo at TPA has more than doubled. Both Amazon and UPS shifted services and relocated portions of their air cargo operations from St. Petersburg to Tampa. TPA is now ranked 23rd nationally with 1.3 million lbs. landed weight. It has overtaken Orlando International Airport (MCO) which is ranked 29th in the nation now, with 1.06 million landed weight.

[12] Federal Aviation Administration, 2020



Source: Federal Aviation Administration

Figure 44 | Percent Change in Final All-Cargo Landed Weights (Base Year - 2009)

Tables 11, 12, 13 and 14 provide the top 5 origin and destination airports for freight and mail by tonnage. MIA is the leader in air freight and mail for the state of Florida. But, the growth of air freight at MCO and TPA should be noted. These growth rates need to be considered to ensure that sufficient capacity is available for intermodal truck movements as trucks are expected to be the primary transfer mode. It is a potential issue which needs to be considered for regional and state freight plans.

Table 11 | Top 5 Freight Destination Airports (pounds)

Airports	2013	2014	2015	2016	2017	2018
MIA	2,121,225,706	2,281,999,052	2,318,028,252	2,366,191,222	2,288,447,178	2,357,232,048
MCO	183,955,063	190,955,443	205,477,148	224,496,252	264,706,145	274,610,964
TPA	93,933,775	95,686,454	104,940,093	129,712,467	166,159,832	221,236,796
FLL	90,026,887	101,219,126	108,674,367	112,390,334	126,622,041	138,814,585
JAX	74,829,820	75,278,136	76,204,560	81,034,245	86,744,127	90,356,200

Source: Bureau of Transportation Statistics

Table 12 | Top 5 Freight Origin Airports (pounds)

Airports	2013	2014	2015	2016	2017	2018
MIA	1,684,011,990	1,807,110,506	1,659,785,198	1,594,325,598	1,615,742,555	1,674,663,569
MCO	157,856,912	160,213,328	178,685,325	193,550,635	207,274,585	218,074,614
TPA	85,761,264	89,437,335	97,784,484	120,522,980	148,724,314	202,468,201
FLL	95,030,996	95,423,804	108,552,194	102,748,097	109,250,628	116,910,185
JAX	73,289,678	75,794,736	76,256,127	75,472,133	78,413,332	81,512,647

Source: Bureau of Transportation Statistics

Table 13 | Top 5 Mail Destination Airports (pounds)

Airports	2013	2014	2015	2016	2017	2018
MIA	23,301,869	19,767,826	30,860,672	31,869,119	33,690,084	34,990,883
MCO	9,360,612	8,436,973	18,261,267	15,002,368	14,717,377	17,435,885
TPA	5,587,004	5,756,636	10,876,090	9,927,243	12,132,181	18,367,784
PIE	1,052,513	1,517,460	2,541,568	4,273,854	6,459,875	0
JAX	1,875,050	1,830,745	2,274,259	2,153,755	3,089,977	2,486,289

Source: Bureau of Transportation Statistics

Table 14 | Top 5 Mail Origin Airports (pounds)

Airports	2013	2014	2015	2016	2017	2018
MIA	36,630,039	27,647,764	33,050,575	33,478,127	34,940,193	35,110,159
MCO	2,213,684	2,728,816	11,126,356	10,850,443	9,835,684	10,487,704
TPA	3,802,130	4,484,522	5,572,549	4,513,385	4,588,410	8,322,083
JAX	3,912,594	4,879,246	4,580,032	4,063,191	5,421,882	4,984,167
FLL	5,709,933	6,353,773	1,792,271	615,663	512,183	781,398

Source: Bureau of Transportation Statistics

***MIA**: Miami International Airport | **MCO**: Orlando International Airport | **TPA**: Tampa International Airport | **FLL**: Fort Lauderdale-Hollywood International Airport | **JAX**: Jacksonville International Airport | **PIE**: St. Pete–Clearwater International Airport*

Aviation Departure Reliability

Definition: Departure is deemed reliable if the flight departs within 15 minutes after the scheduled time shown in the carrier's Computerized Reservations Systems (CRS). In the aviation industry, this is commonly known as on-time departure. Departure reliability is based on departure from the gate and can be influenced by various factors such as heavy traffic volume, weather, and mechanical reasons.

Data Source: Bureau of Transportation Statistics

Data Coverage: Statewide Statistics

Major observations: As per statewide statistics, aviation departure reliability has been between approximately 75%-85% in the last decade. The highest reliability was in 2008 with 85.3% reliability, whereas the lowest reliability was in 2013 with 75.4%. In 2017, aviation departure reliability was 81.5%. These statistics are related to all air traffic movement.

Identification of Issues and Trends

Table 15 summarizes the issues and trends relevant to the different performance measures and conditions evaluated in this technical memorandum.

Table 15 | Identified Issues and Trends

Modes	Issues	Trends
Highway/Truck	• Major truck bottlenecks • High rates of unauthorized truck parking across the state • High truck parking utilization in areas of concern • High truck empty back haul out of the state • Truck travel time reliability is worse in the largest seven metropolitan areas	• Increasing trend in truck crashes across the state • High growth rate of truck miles traveled and truck ton miles traveled during peak period in largest seven metropolitan areas
Aviation and Spaceports		• Significant growth at Tampa, Orlando and Miami airports
Rail		• Number of rail crashes increasing over the years
Pipeline	• Florida's lack of connectivity to major domestic bulk liquid fuel pipelines and refining regions leads to an over reliance on waterborne and highway transportation for Florida's liquid fuel	

Heavy Truck Tonnage

It is important to note that high truck AADT and heavy truck tonnage in rural areas, as per Figures 5 and 8, are expected to substantially deteriorate the condition of roadways. Figure 26 indicates that the Florida National Highway System is performing very well. 0.6% of NHS interstate lane miles are poor. 0.4% of NHS non-interstate lane miles are poor. 91.3% of pavement on the SHS exceeds FDOT standards. The pavement conditions are not identified as an issue in this technical memorandum.

Appendix A. Truck Bottleneck Analysis Methodology

National Performance Management Research Data Set (NPMRDS)

Federal guidance published January 18, 2017 (23 CFR Part 490 – Subpart F) established, for the first time, a freight-specific performance measure – Truck Travel Time Reliability (TTTR). TTTR scores must be calculated annually for interstate highways (other NHS and non-NHS facilities are excluded), and reported to the U.S. Department of Transportation (USDOT) along with other required Highway Performance Monitoring System (HPMS) information on an annual basis. USDOT requires that this measure be calculated annually starting in 2018, reporting values for the previous calendar year.

This measure is calculated using the National Performance Management Research Data Set (NPMRDS), which was developed by the Federal Highway Administration (FHWA) to provide a comprehensive picture of travel times throughout the National Highway Network, for both passenger vehicles and trucks. NPMRDS is a probe dataset commissioned by the Federal Highway Administration (FHWA), available for free to DOTs and MPOs.

The NPMRDS data was obtained for Florida for calendar year 2018. This consisted of 309.2 million truck travel time records and 662.4 million passenger vehicle travel time records, throughout the National Highway System (NHS). NPMRDS divides the NHS in Florida into 14,212 segments identified by a TMC code. The travel time records are provided throughout the day at a time resolution of 5-minute intervals.

Because NPMRDS provides truck travel time data at the link level, for each roadway segment in the National Highway System, users are not limited to calculation of the Federal TTTR. Importantly, NPMRDS allows for the calculation of travel time-based performance metrics at the link level for most of the state's critical highway freight infrastructure, and for the identification of primary bottlenecks or chokepoints on the NPMRDS network based on truck travel time data.

Performance Measurement Methodology

For the FMTP Update, the methodology used for this analysis follows the recommendations provided in the soon to be published report of National Highway Cooperative Research Project 07-24: *Estimating the Value of Truck Travel Time Reliability*. This study recommends methodologies for estimating recurring and non-recurring congestion from NPMRDS data, and interpreting the results from an economics perspective.

The objective of the analysis was to describe the recurring and non-recurring congestion during a regular weekday. This is important because research shows that freight users care much more about non-recurring congestion than recurring congestion. Motor carriers can easily schedule deliveries to consider recurring congestion, however non-recurring congestion could lead deliveries to be late, which not only causes disruptions for the motor carrier, but also for the receiver. Being on-time, which is one the most important factors in modern-day supply-chains, becomes much more difficult with high levels of non-recurring congestion.

First, the NPMRDS data was filtered to exclude weekends and federal holidays (1st of January, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas). Truck operations in these days are likely to be considerably different than during regular weekdays.

Then, several travel time metrics were calculated for each segment for each hour of the day:

- $\bar{\tau}_h$ - The average travel time during hour h.
- $10\%\tau$ - The 10th percentile travel time across all hours of the day. This was assumed to represent the free flow travel time.
- $95\%\tau_h$ - The 95th percentile travel time during hour h. This represents how slow travel times could get 5 percent of the time. The 95th percentile threshold has been used in many congestion studies to represent unreliability, including in the calculation of the Federal Reliability measure.

For each roadway segment, the Vehicle Miles of truck Travel (VMT) was calculated as

$$VMT = \sum_{\forall h} l\, T_h \tag{1}$$

where l represents the length of the segment and T_h represents the hourly truck volume. This was obtained by dividing the truck Average Annualized Daily Traffic (AADT) reported by NPMRDS by 2 (because traffic is reported combined for both directions of travel), and multiplying by the assumed share of volume during that time of the day (approximated from the 2018 FHWA Truck Freight Bottleneck Reporting Guidebook).

Similarly, the Vehicle Hours of truck Travel (VHT) was calculated as

$$VHT = \sum_{\forall h} \bar{\tau}_h\, T_h. \tag{2}$$

The average speeds of trucks in each segment were then calculated as VMT/VHT.

Recurring congestion was quantified as the number of hours of travel above free flow conditions, which was defined as the Vehicle Hours of Delay (VHD). This was estimated by comparing average travel times to the free flow travel time, and then summing according to

$$VHD = \sum_{\forall h} (\bar{\tau}_h - 10\%\tau_h) T_h \,. \quad (3)$$

Non-recurring congestion was quantified as the number of Vehicle Hours of Unreliability (VHU) accumulated in each segment, which was calculated as the difference between the 95th percentile travel time and the average travel time. This measure, first introduced in project NCHRP 07-24, sums the hours of uncertainty that trucks face while traveling throughout the day. This is a superior way of measuring unreliability than the often-used travel time indices or buffer indices, because it is additive and captures only non-recurring congestion.

$$VHU = \sum_{\forall h} (95\%\tau_h - \bar{\tau}_h) T_h \quad (4)$$

To compare the VHD and VHU measures between different segments, the metrics were normalized by segment mileage. This way, segments are not more likely to be identified as bottlenecks just because they are long. (Note that the extraction process for the NPMRDS travel times provides average, 10th percentile and 95th percentile metrics by segment, regardless of the number of travel lanes in that segment; with these metrics in hand it is not necessary to make further adjustments to normalize for the number of travel lanes.)

Using NPMRDS to Identify Leading Truck Bottlenecks

As described above, the two key performance measures calculated for this analysis are:

- Vehicle (Truck) Hours of Delay per Segment Mile (VHD/M)
- Vehicle (Truck) Hours of Unreliability per Segment Mile (VHU/M)

These measures are continuous, ranging from near zero in the best cases to high values (over 260 VHD/M and over 420 VHU/M) for the highest delay and unreliability segment. There is no specific cutoff point at which the metrics indicate that delay or unreliability are acceptable or unacceptable. Therefore, the metrics are best used in several ways:

1. To identify the segments of Florida's NHS which experience the highest VHD/M and VHU/M, as leading candidates for attention;
2. To identify the concentrations of the highest VHD/M and VHU/M segments by county and by route/road number; and
3. To examine the relative performance of Florida's NHS in each region, identifying segments that are performing better or worse than average, to highlight the most significant challenges and opportunities at the regional level.

Highest VHD/M and VHU/M Segments

The VHD/M and VHU/M metrics were calculated for 12,900 NPMRDS segments in Florida, and this document reports the 100 highest VHD/M and 100 highest VHU/M values. The top 100 VHD/M segments can be considered leading Recurring Congestion Bottlenecks, and have significant truck volumes along with the largest differences between average travel times and free flow speeds (see Tables 1 and 2 following). The top 100 VHU/M segments can be considered leading Non-Recurring Congestion Bottlenecks, and have significant truck volumes along with congested travel times that be much worse than average travel times, causing unreliability for system users (see Tables 3 and 4 following).

Table 1. Leading Recurring Truck Congestion Bottlenecks (1-50)

Rank	Road	Direction	County	VHD/mi
1	FL-414	EASTBOUND	ORANGE	265.0
2	I-4	WESTBOUND	HILLSBOROUGH	240.5
3	I-4	WESTBOUND	HILLSBOROUGH	237.6
4	FL-826	NORTHBOUND	MIAMI-DADE	223.9
5	I-4	WESTBOUND	OSCEOLA	219.0
6	FL-821	SOUTHBOUND	MIAMI-DADE	218.2
7	FL-826	NORTHBOUND	MIAMI-DADE	212.3
8	FL-826	NORTHBOUND	MIAMI-DADE	209.9
9	FL-826	NORTHBOUND	MIAMI-DADE	209.7
10	US-27	NORTHBOUND	MIAMI-DADE	194.3
11	FL-826	NORTHBOUND	MIAMI-DADE	192.7
12	FL-826	NORTHBOUND	MIAMI-DADE	188.3
13	I-4	WESTBOUND	HILLSBOROUGH	186.0
14	FL-826	NORTHBOUND	MIAMI-DADE	183.9
15	FL-826	NORTHBOUND	MIAMI-DADE	180.3
16	FL-826	NORTHBOUND	MIAMI-DADE	179.5
17	US-27	NORTHBOUND	MIAMI-DADE	178.5
18	I-95	SOUTHBOUND	MIAMI-DADE	174.1
19	PRITCHARD RD	WESTBOUND	DUVAL	174.0
20	FL-826	NORTHBOUND	MIAMI-DADE	173.8
21	US-27	NORTHBOUND	MIAMI-DADE	168.8
22	FL-948	WESTBOUND	MIAMI-DADE	166.9
23	FL-826	NORTHBOUND	MIAMI-DADE	165.9

Rank	Road	Direction	County	VHD/mi
24	FL-821	SOUTHBOUND	MIAMI-DADE	158.7
25	FL-821	SOUTHBOUND	MIAMI-DADE	157.6
26	FL-934	WESTBOUND	MIAMI-DADE	152.9
27	US-27	NORTHBOUND	MIAMI-DADE	150.0
28	US-27	NORTHBOUND	MIAMI-DADE	149.6
29	US-17	NORTHBOUND	ORANGE	148.4
30	FL-826	SOUTHBOUND	MIAMI-DADE	147.7
31	I-4	EASTBOUND	ORANGE	144.2
32	I-4	WESTBOUND	HILLSBOROUGH	143.1
33	I-95	SOUTHBOUND	BROWARD	141.4
34	45TH ST	EASTBOUND	PALM BEACH	140.0
35	FL-826	SOUTHBOUND	MIAMI-DADE	139.4
36	FL-826	SOUTHBOUND	MIAMI-DADE	138.3
37	45TH ST	WESTBOUND	PALM BEACH	137.8
38	US-17	NORTHBOUND	ORANGE	135.1
39	I-95	SOUTHBOUND	BROWARD	134.7
40	FL-934	EASTBOUND	MIAMI-DADE	134.2
41	FL-826	SOUTHBOUND	MIAMI-DADE	134.0
42	I-4	EASTBOUND	ORANGE	133.2
43	US-27	SOUTHBOUND	MIAMI-DADE	132.3
44	45TH ST	WESTBOUND	PALM BEACH	131.5
45	I-4	EASTBOUND	ORANGE	130.6
46	FL-826	SOUTHBOUND	MIAMI-DADE	130.6
47	US-27	NORTHBOUND	MIAMI-DADE	129.6
48	US-27	SOUTHBOUND	MIAMI-DADE	128.2
49	I-4	EASTBOUND	ORANGE	128.1
50	US-27	NORTHBOUND	MIAMI-DADE	127.9

Table 2. Leading Recurring Truck Congestion Bottlenecks (51-100)

Rank	Road	Direction	County	VHD/mi
51	E OSCEOLA PKWY	EASTBOUND	OSCEOLA	127.8
52	N JOHN YOUNG PKWY	NORTHBOUND	OSCEOLA	127.7
53	FL-826	SOUTHBOUND	MIAMI-DADE	127.4
54	NW 36TH ST	EASTBOUND	MIAMI-DADE	126.6
55	NW 36TH ST	EASTBOUND	MIAMI-DADE	125.9
56	I-95	NORTHBOUND	BROWARD	125.5
57	FL-826	SOUTHBOUND	MIAMI-DADE	125.5
58	US-27	NORTHBOUND	MIAMI-DADE	125.4
59	FL-934	EASTBOUND	MIAMI-DADE	124.8
60	FL-713	NORTHBOUND	ST. LUCIE	123.6
61	FL-826	SOUTHBOUND	MIAMI-DADE	123.3
62	I-95	SOUTHBOUND	BROWARD	123.1
63	US-27	NORTHBOUND	MIAMI-DADE	122.7
64	FL-932	EASTBOUND	MIAMI-DADE	121.7
65	US-301	NORTHBOUND	HILLSBOROUGH	120.6
66	FL-826	SOUTHBOUND	MIAMI-DADE	120.4
67	I-95	SOUTHBOUND	BROWARD	119.1
68	FL-826	SOUTHBOUND	MIAMI-DADE	118.9
69	I-4	EASTBOUND	ORANGE	117.8
70	US-27	NORTHBOUND	MIAMI-DADE	117.6
71	I-95 S	SOUTHBOUND	MIAMI-DADE	117.3
72	FL-826	NORTHBOUND	MIAMI-DADE	117.2
73	N JOHN YOUNG PKWY	NORTHBOUND	OSCEOLA	117.2
74	FL-948	WESTBOUND	MIAMI-DADE	117.1
75	I-4	EASTBOUND	POLK	116.5
76	FL-826	NORTHBOUND	MIAMI-DADE	116.4
77	I-95	SOUTHBOUND	BROWARD	114.6
78	FL-826	SOUTHBOUND	MIAMI-DADE	114.3
79	FL-826	SOUTHBOUND	MIAMI-DADE	113.1
80	PRITCHARD RD	EASTBOUND	DUVAL	112.6
81	NW 36TH ST	EASTBOUND	MIAMI-DADE	112.6
82	FL-948	EASTBOUND	MIAMI-DADE	112.2

Rank	Road	Direction	County	VHD/mi
83	FL-838	WESTBOUND	BROWARD	111.6
84	FL-932	EASTBOUND	MIAMI-DADE	110.8
85	FL-820	WESTBOUND	BROWARD	110.6
86	I-275	NORTHBOUND	HILLSBOROUGH	109.8
87	I-95	SOUTHBOUND	MIAMI-DADE	109.7
88	I-275	NORTHBOUND	HILLSBOROUGH	109.3
89	I-295	SOUTHBOUND	DUVAL	109.1
90	I-295	SOUTHBOUND	DUVAL	108.4
91	FL-112	WESTBOUND	MIAMI-DADE	108.4
92	NW 36TH ST	WESTBOUND	MIAMI-DADE	107.9
93	I-4	EASTBOUND	ORANGE	107.9
94	ORANGE AVE	WESTBOUND	ST. LUCIE	107.6
95	I-4	EASTBOUND	ORANGE	107.1
96	US-27	SOUTHBOUND	MIAMI-DADE	106.4
97	I-4	EASTBOUND	ORANGE	105.7
98	US-27	SOUTHBOUND	MIAMI-DADE	105.6
99	S 50TH ST	SOUTHBOUND	HILLSBOROUGH	105.6
100	45TH ST	EASTBOUND	PALM BEACH	104.7

Table 3. Leading Non-Recurring Truck Congestion Bottlenecks (1-50)

Rank	Road	Direction	County	VHU/mi
1	FL-414	EASTBOUND	ORANGE	420.1
2	I-4	WESTBOUND	HILLSBOROUGH	395.9
3	I-4	EASTBOUND	POLK	389.4
4	US-27	NORTHBOUND	MIAMI-DADE	380.2
5	US-27	NORTHBOUND	MIAMI-DADE	370.6
6	FL-826	NORTHBOUND	MIAMI-DADE	361.5
7	US-27	NORTHBOUND	MIAMI-DADE	349.8
8	US-27	NORTHBOUND	MIAMI-DADE	347.8
9	FL-826	NORTHBOUND	MIAMI-DADE	346.2
10	FL-826	SOUTHBOUND	MIAMI-DADE	340.6
11	PRITCHARD RD	WESTBOUND	DUVAL	340.3
12	I-4	WESTBOUND	HILLSBOROUGH	336.1

Rank	Road	Direction	County	VHU/mi
13	US-27	NORTHBOUND	MIAMI-DADE	318.4
14	I-4	WESTBOUND	HILLSBOROUGH	313.4
15	US-301	NORTHBOUND	HILLSBOROUGH	302.0
16	FL-934	WESTBOUND	MIAMI-DADE	301.2
17	I-95	NORTHBOUND	BROWARD	300.8
18	FL-934	EASTBOUND	MIAMI-DADE	299.4
19	US-27	SOUTHBOUND	MIAMI-DADE	297.0
20	N JOHN YOUNG PKWY	NORTHBOUND	OSCEOLA	291.7
21	FL-826	SOUTHBOUND	MIAMI-DADE	291.5
22	FL-826	NORTHBOUND	MIAMI-DADE	286.2
23	NW 36TH ST	EASTBOUND	MIAMI-DADE	286.1
24	I-95	SOUTHBOUND	BROWARD	278.3
25	FL-91 S	SOUTHBOUND	MIAMI-DADE	275.8
26	US-27	SOUTHBOUND	MIAMI-DADE	274.4
27	45TH ST	EASTBOUND	PALM BEACH	273.6
28	45TH ST	WESTBOUND	PALM BEACH	271.4
29	US-27	SOUTHBOUND	MIAMI-DADE	267.3
30	FL-713	NORTHBOUND	ST. LUCIE	264.4
31	US-301	NORTHBOUND	HILLSBOROUGH	264.0
32	FL-845	SOUTHBOUND	BROWARD	263.3
33	PRITCHARD RD	EASTBOUND	DUVAL	263.0
34	US-27	NORTHBOUND	MIAMI-DADE	261.1
35	US-301	SOUTHBOUND	HILLSBOROUGH	261.1
36	US-27	NORTHBOUND	MIAMI-DADE	259.8
37	E OSCEOLA PKWY	EASTBOUND	OSCEOLA	258.1
38	FL-821	SOUTHBOUND	MIAMI-DADE	257.6
39	FL-826	NORTHBOUND	MIAMI-DADE	257.3
40	NW 36TH ST	WESTBOUND	MIAMI-DADE	257.0
41	FL-948	WESTBOUND	MIAMI-DADE	254.5
42	S JOHN YOUNG PKWY	SOUTHBOUND	ORANGE	254.0
43	FL-845	NORTHBOUND	BROWARD	254.0
44	FL-826	SOUTHBOUND	MIAMI-DADE	252.5
45	S JOHN YOUNG PKWY	SOUTHBOUND	ORANGE	251.3

Rank	Road	Direction	County	VHU/mi
46	S JOHN YOUNG PKWY	NORTHBOUND	ORANGE	249.2
47	FL-826	NORTHBOUND	MIAMI-DADE	247.4
48	FL-845	SOUTHBOUND	BROWARD	246.9
49	I-95 S	SOUTHBOUND	MIAMI-DADE	246.2
50	US-27	NORTHBOUND	MIAMI-DADE	245.5

Table 4. Leading Non-Recurring Truck Congestion Bottlenecks (51-100)

Rank	Road	Direction	County	VHU/mi
51	NW 36TH ST	EASTBOUND	MIAMI-DADE	245.5
52	NW 36TH ST	WESTBOUND	MIAMI-DADE	245.3
53	I-95	SOUTHBOUND	BROWARD	245.1
54	US-27	SOUTHBOUND	MIAMI-DADE	245.0
55	N JOHN YOUNG PKWY	NORTHBOUND	OSCEOLA	244.9
56	E OSCEOLA PKWY	EASTBOUND	OSCEOLA	244.8
57	45TH ST	EASTBOUND	PALM BEACH	244.2
58	S 50TH ST	SOUTHBOUND	HILLSBOROUGH	244.1
59	FL-826	NORTHBOUND	MIAMI-DADE	243.5
60	I-4	EASTBOUND	ORANGE	242.4
61	I-4	EASTBOUND	ORANGE	241.4
62	I-4	EASTBOUND	ORANGE	241.3
63	I-4	EASTBOUND	ORANGE	241.1
64	FL-713	SOUTHBOUND	ST. LUCIE	240.8
65	FL-948	WESTBOUND	MIAMI-DADE	240.7
66	S JOHN YOUNG PKWY	SOUTHBOUND	ORANGE	240.3
67	FL-708	WESTBOUND	PALM BEACH	240.2
68	I-95	SOUTHBOUND	BROWARD	240.1
69	FL-826	SOUTHBOUND	MIAMI-DADE	240.1
70	FL-838	WESTBOUND	BROWARD	239.7
71	I-4	EASTBOUND	ORANGE	239.6
72	FL-948	EASTBOUND	MIAMI-DADE	238.4
73	FL-826	NORTHBOUND	MIAMI-DADE	235.4
74	FL-948	EASTBOUND	MIAMI-DADE	234.1
75	US-27	SOUTHBOUND	MIAMI-DADE	233.5

Rank	Road	Direction	County	VHU/mi
76	NW 36TH ST	EASTBOUND	MIAMI-DADE	229.3
77	I-4	EASTBOUND	ORANGE	228.5
78	I-4	EASTBOUND	ORANGE	227.5
79	I-4	WESTBOUND	HILLSBOROUGH	227.2
80	I-4	WESTBOUND	OSCEOLA	226.8
81	FL-934	EASTBOUND	MIAMI-DADE	225.4
82	S JOHN YOUNG PKWY	NORTHBOUND	ORANGE	225.3
83	FL-60	EASTBOUND	HILLSBOROUGH	225.2
84	FL-826	NORTHBOUND	MIAMI-DADE	225.0
85	FL-826	SOUTHBOUND	MIAMI-DADE	225.0
86	S JOHN YOUNG PKWY	NORTHBOUND	ORANGE	222.7
87	US-301	NORTHBOUND	DUVAL	222.4
88	US-98	EASTBOUND	POLK	222.1
89	FL-713	SOUTHBOUND	ST. LUCIE	221.1
90	N JOHN YOUNG PKWY	SOUTHBOUND	OSCEOLA	220.7
91	FL-821	SOUTHBOUND	MIAMI-DADE	219.0
92	I-4	EASTBOUND	OSCEOLA	218.6
93	FL-826	SOUTHBOUND	MIAMI-DADE	218.6
94	FL-826	NORTHBOUND	MIAMI-DADE	218.4
95	FL-948	WESTBOUND	MIAMI-DADE	217.5
96	I-4	EASTBOUND	ORANGE	217.3
97	FL-948	EASTBOUND	MIAMI-DADE	216.8
98	E OSCEOLA PKWY	EASTBOUND	OSCEOLA	216.0
99	FL-713	NORTHBOUND	ST. LUCIE	214.6
100	FL-60	WESTBOUND	HILLSBOROUGH	214.0
100	45TH ST	EASTBOUND	PALM BEACH	104.7

Concentration of Highest VHD/M and VHU/M Segments

The top 100 VHD/M and VHU/M segments show a strong tendency to cluster in a limited number of counties. As shown in Figures 1 and 2 following:

- Miami-Dade has 58% of the Top 100 Recurring and 46% of the Top 100 Non-Recurring bottlenecks
- Orange has 11% of the Top 100 Recurring and 15% of the Top 100 Non-Recurring bottlenecks
- Hillsborough and Broward each have 8% of the Top 100 Recurring and 8 of the Top 100 Non-Recurring bottlenecks
- Palm Beach, Osceola, Duval, St. Lucie, and Polk counties also have Top 100 bottlenecks

Figure 1: Share of Top 100 Recurring Truck Congestion Bottlenecks by County

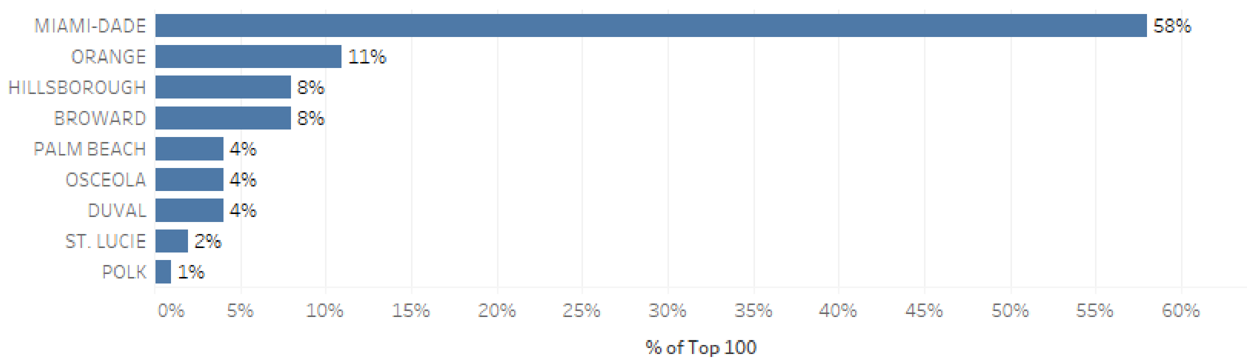
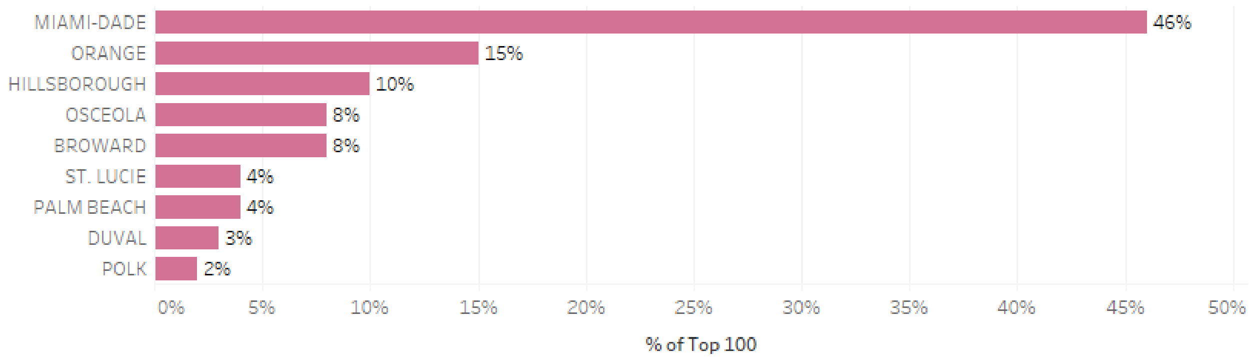


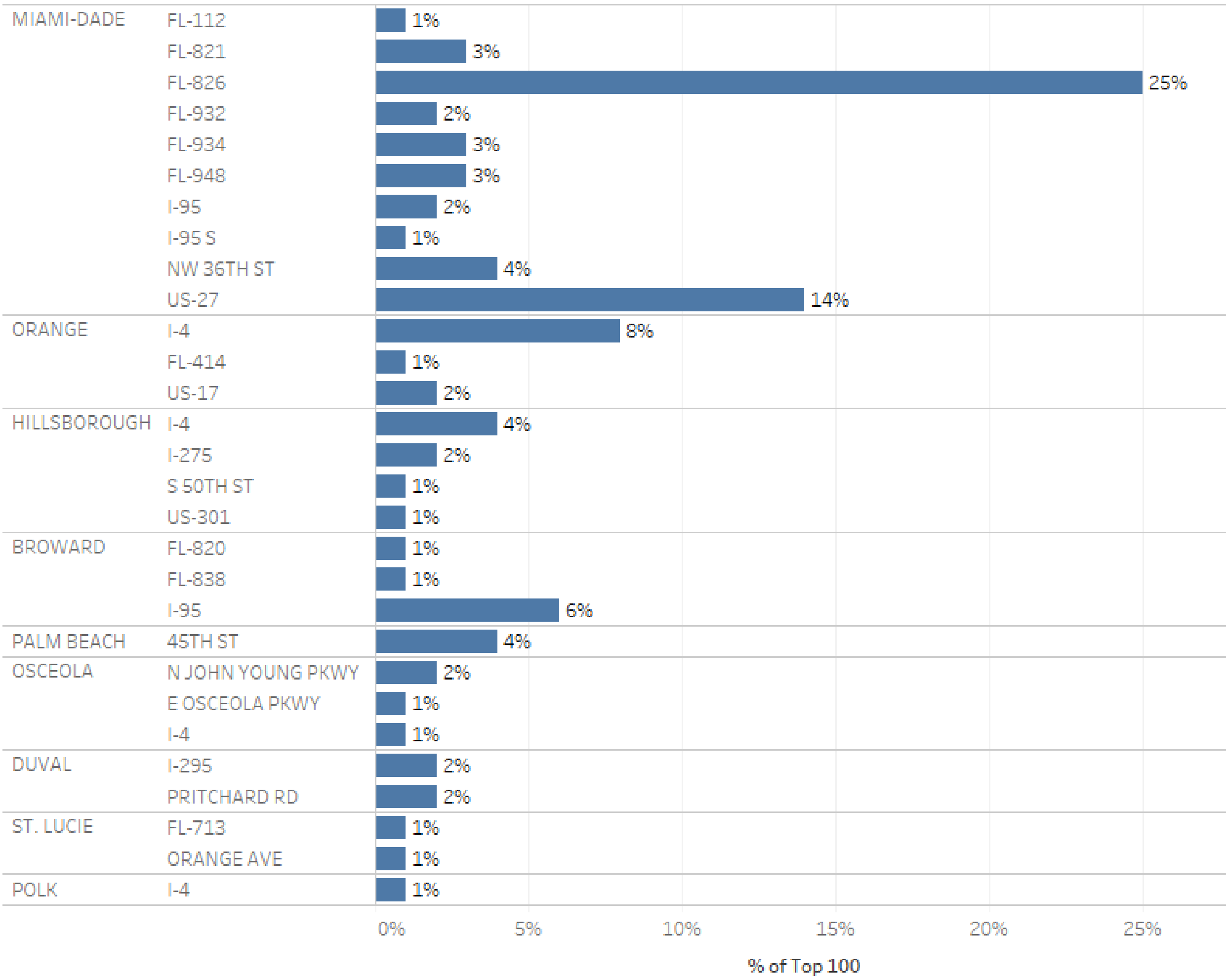
Figure 2: Share of Top 100 Non-Recurring Truck Congestion Bottlenecks by County



As shown in Figure 3 following, the highest shares of Top 100 Recurring bottleneck locations are located on:

- FL-826 in Miami-Dade (25%)
- US-27 in Miami-Dade (14%)
- I-4 in Orange (8%)
- I-95 in Broward (6%)
- NW 36th St. in Miami-Dade, I-4 in Hillsborough, 45th St. in Palm Beach (4% each)

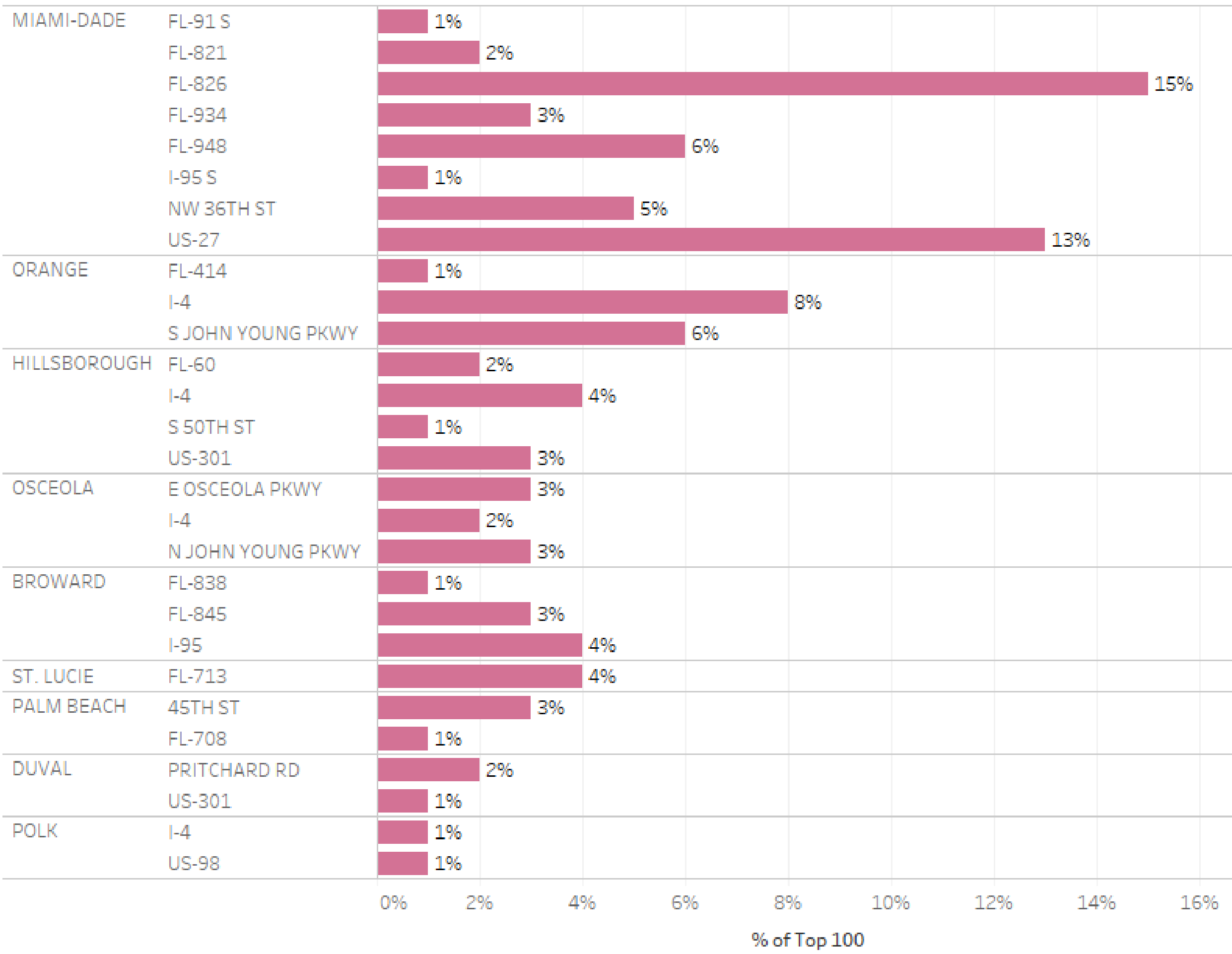
Figure 3: Share of Top 100 Recurring Truck Congestion Bottlenecks by County and Road



As shown in Figure 4 following, the highest shares of Top 100 Non-Recurring bottleneck locations are located on:

- FL-826 in Miami-Dade (15%)
- US-27 in Miami-Dade (13%)
- I-4 in Orange (8%)
- FL-948 in Miami-Dade and S. John Young Pkwy in Orange (6% each)
- NW 36th St. in Miami-Dade (5%)
- I-4 in Hillsborough, I-95 in Broward, and FL-713 in St. Lucie (4% each)

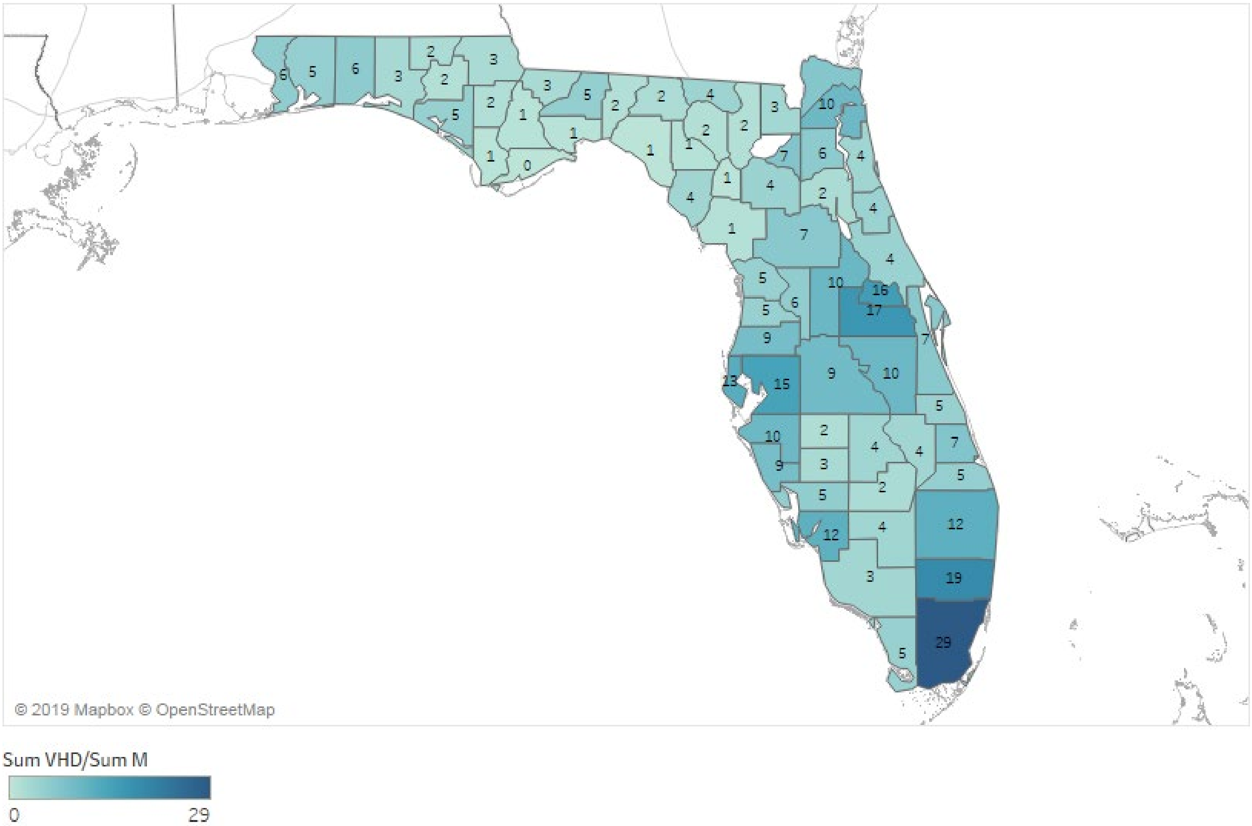
Figure 4: Share of Top 100 Non-Recurring Truck Congestion Bottlenecks by County and Road



Regional Performance

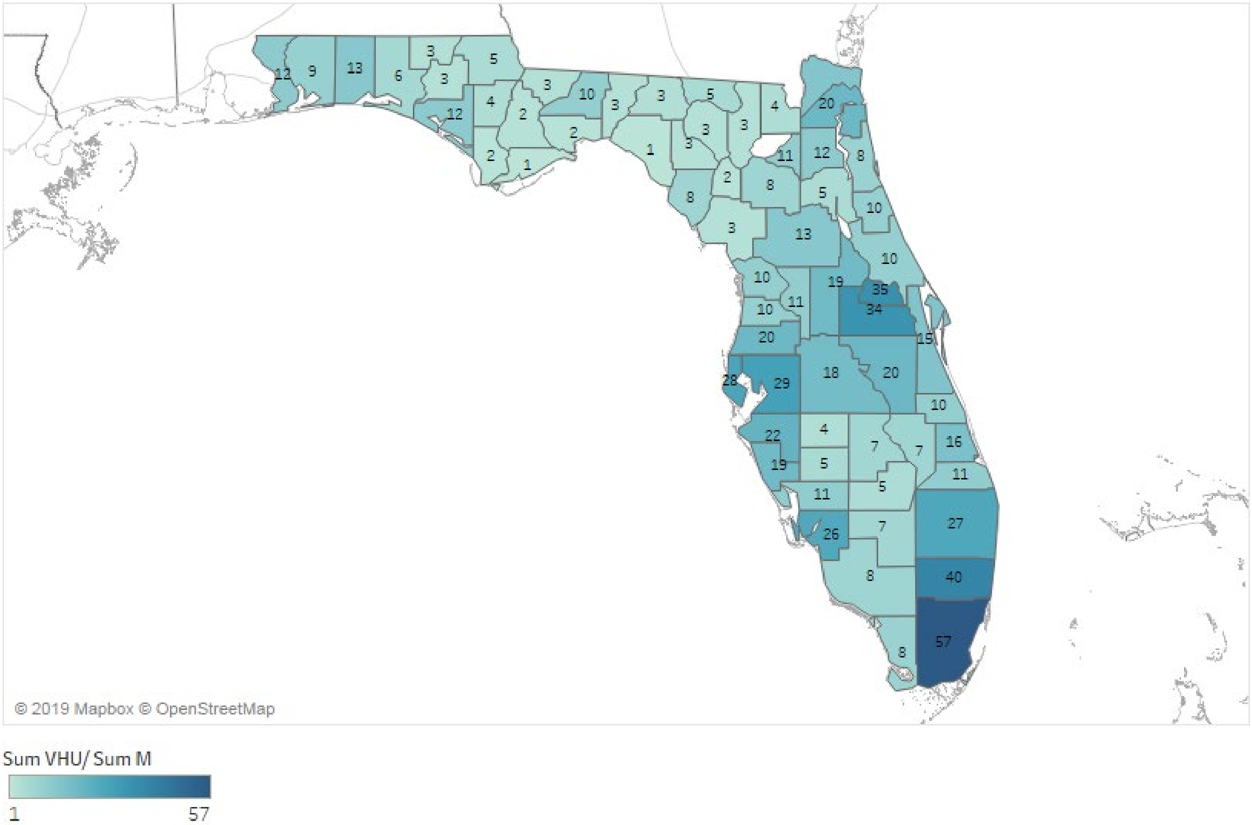
Figure 5 following illustrates the sum of all VHD divided by the sum of all segment miles in each of Florida's counties, providing a general measure of how recurring bottlenecks are distributed throughout the state. The highest average VHD/M, by far, is in Miami-Dade (29), followed by Broward, Hillsborough, Orange, and Lake counties.

Figure 5: County-Wide Average VHD/M (Intensity of Recurring Congestion)



Similarly, Figure 6 following illustrates the sum of all VHU divided by the sum of all segment miles in each of Florida's counties, providing a general measure of how non-recurring bottlenecks are distributed throughout the state. The highest average VHD/U, by far, is again in Miami-Dade (57), followed by Broward, Lake, Orange, and Hillsborough counties.

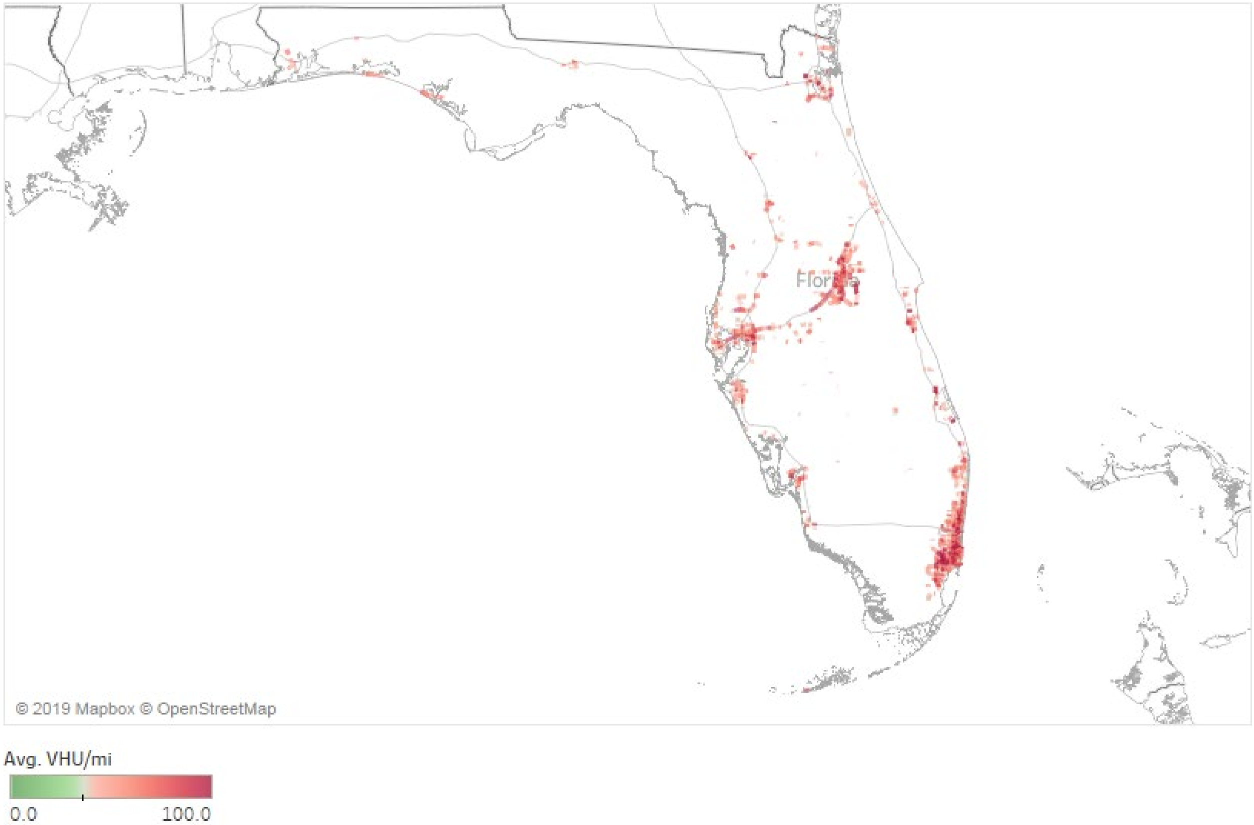
Figure 6: County-Wide Average VHU/M (Intensity of Non-Recurring Congestion)



Interestingly, the distribution of non-recurring congestion indicates more significant challenges in certain counties – Palm Beach, Pinellas, Lee, Manatee, Duval, etc. – than the distribution of recurring congestion. To examine this effect at a link level, each Florida segment with a VHU/M of 36 or more was mapped. (The statewide average of all links is 18 VHU/M, and 36 was chosen as a display threshold value representing twice the average level of non-recurring congestion.) As shown in Figure 7 below, these bottlenecks are:

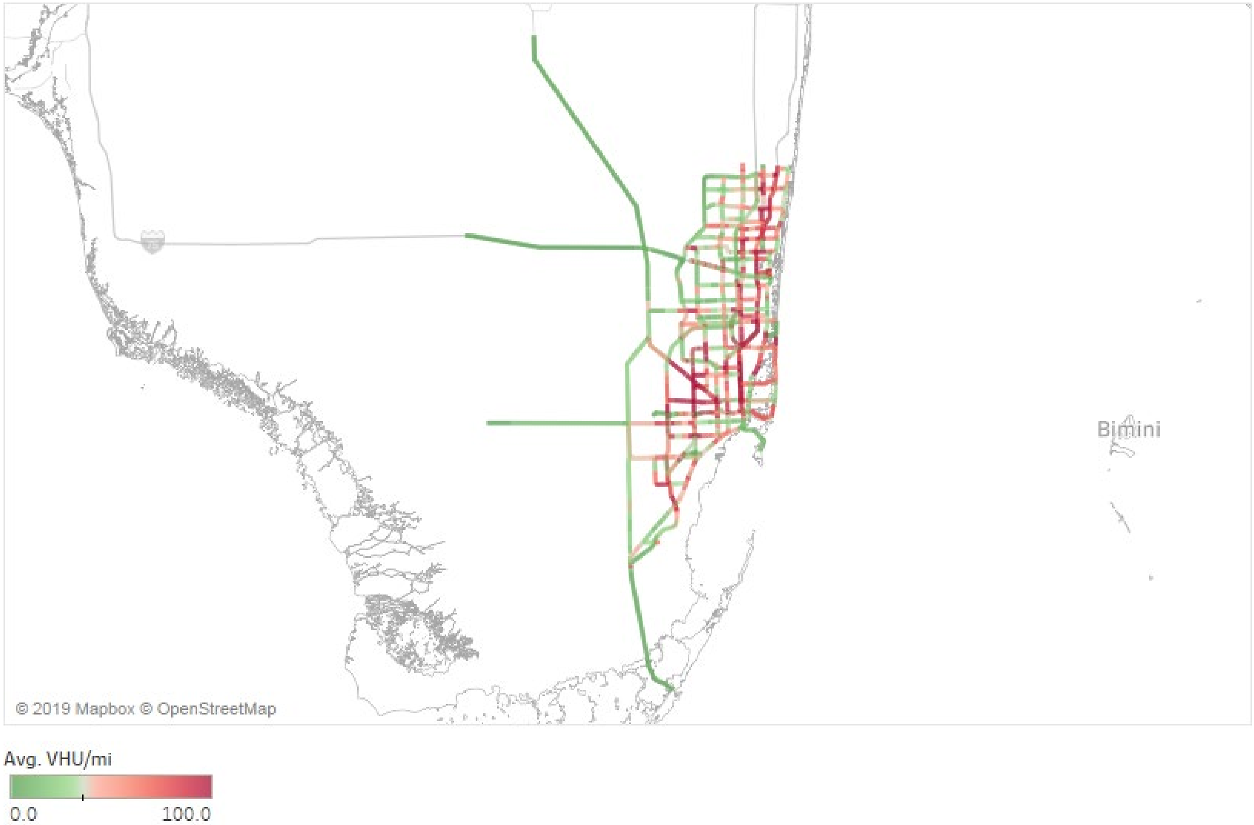
- Clustered (in the metropolitan areas of Miami-Ft. Lauderdale-West Palm Beach, Tampa, Orlando, Jacksonville, and Ft. Myers);
- Distributed (along the I-95, I-75, and I-4 corridors); or
- Showing as localized hot spots or mini-clusters in other locations throughout Florida.

Figure 7: Link Locations with >= 36 VHU/M (Non-Recurring Congestion)



For ease of illustration, Figure 7 is scaled with a midpoint of 36, and all values over 100 are assigned the highest intensity color on a green-white-red scale. Using this same display method, Figures 8 illustrates link-level non-recurrent congestion for the most impacted sub-areas and regions of the state like Miami-Dade/Broward. In Miami-Dade/Broward, high non-recurrent congestion is seen not only on major controlled access interstate and state highways, but also on much of the local street grid. In other regions, like Duval/Nassau, high non-recurrent congestion occurs primarily on major controlled access highways and their connectors, and in areas with very limited NHS route choices.

Figure 8: VHU/M (Non-Recurring Congestion), Miami-Dade/Broward



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