Introduction

• FreightSIM Overview
• Applications and Policy Sensitivity
• Model Structure
• FreightSIM Results
• Next Steps
Overview Of The Florida Freight Supply-chain Intermodal Model (FreightSIM)
Florida Statewide Freight Model

Inputs: business locations, transportation infrastructure, and commodity flows

Firm Synthesis

Supplier Selection

Goods Demand

Distribution Channel

Shipment Size

Mode and Transfers

Network Assignment

Model: simulates shipments and vehicle movements. Sensitive to policy, economic, and infrastructure changes

Vehicle volumes on the transportation network

Freight demand by commodity group

Outputs: freight demand and vehicle flows to support policy development and project evaluation.
Freight Model Integration

Step 1 - Firm Synthesis

Step 2 - Supplier Selection

Step 3 - Business Location Assignment

Step 4 - Distribution Channel

Step 5 - Distribution Channel

Step 6 - Business Location Assignment

Step 7 - Mode Path Selection

Step 8 - Prepare Trip Tables
Domestic Geography

Combination of FAF zones and Counties

Allocation to TAZs in FL, AL, and GA
Model uses the 8 international FAF zones (801-808) for International firm locations and commodity flows origins and destinations.
Gasoline imports arrive at ports and are mainly distributed in the region close to the port, with relatively small amounts trucked to other regions.
FreightSIM Model Components and Calibration for 2010
Model Structure Overview

- **Passenger Model**
- **FreightSIM Model** (Firms, Shipments, Modes)
  - Conversion to modal trip tables
  - National/Statewide Networks
- **Regional Model**
  - **Regional Truck Touring Model**
  - **Regional Networks**
FreightSIM Components

- **Firm Synthesis**: Synthesizes a list of businesses in Florida, the rest of the US, and an international sample.
- **Supplier Selection**: Connects suppliers to buyers based on the commodities produced by the supplier and consumed by the buyer.
- **Goods Demand**: Distributes commodity flows amongst the paired suppliers and buyers.
- **Distribution Channel**: For each buyer/supplier pair, selects whether shipments are direct or involve intermediate handling (intermodal, distribution center).
- **Shipment Size**: For each buyer/supplier pair, converts an annual commodity flow to shipments by size and frequency.
- **Mode and Transfers**: Identifies the mode for each leg of the trip from supplier to buyer and the transfer locations.
- **Network Assignment**: Assigns the trips to the multi-modal networks based on the mode(s) and transfer locations.
FreightSIM is a simulation model and produces very detailed results – individual shipment records and a trip list for trucks. In addition, more aggregate results are produced.

**Types of output from FreightSIM**

- **Shipment records** – similar to the commodity flow survey or other shipment surveys, with details of origin, destination, commodity, mode, etc.
- **Modal trip lists** – shipment movements by mode, with truck based shipments also converted to truck trips.
- **Trip table list** – aggregation of truck trips to zone to zone totals, ready for passing to CUBE, conversion to matrices, and assignment.
- **Summary outputs** – tabular summaries output by each model component, primarily used so far for validation purposes so far, but could be used for scenario comparison.
- **Assignment results** – loaded networks, and measures derived from loaded networks, e.g. VMT by functional class and area type.
Firm Synthesis in Florida

- Synthesis in Florida is based on InfoGroup data
- Largest numbers of business establishment points are in the metropolitan counties

Top 20 Florida County Synthesized Firms

<table>
<thead>
<tr>
<th>County</th>
<th>Number of Establishments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miami-Dade, FL</td>
<td>120,000</td>
</tr>
<tr>
<td>Broward County, FL</td>
<td>100,000</td>
</tr>
<tr>
<td>Palm Beach County, FL</td>
<td>90,000</td>
</tr>
<tr>
<td>Orange County, FL</td>
<td>80,000</td>
</tr>
<tr>
<td>Hillsborough County, FL</td>
<td>70,000</td>
</tr>
<tr>
<td>Pinellas County, FL</td>
<td>60,000</td>
</tr>
<tr>
<td>Duval County, FL</td>
<td>50,000</td>
</tr>
<tr>
<td>Lee County, FL</td>
<td>40,000</td>
</tr>
<tr>
<td>Sarasota County, FL</td>
<td>30,000</td>
</tr>
<tr>
<td>Brevard County, FL</td>
<td>20,000</td>
</tr>
<tr>
<td>Volusia County, FL</td>
<td>15,000</td>
</tr>
<tr>
<td>Polk County, FL</td>
<td>10,000</td>
</tr>
<tr>
<td>Seminole County, FL</td>
<td>7,000</td>
</tr>
<tr>
<td>Collier County, FL</td>
<td>5,000</td>
</tr>
<tr>
<td>Pasco County, FL</td>
<td>4,000</td>
</tr>
<tr>
<td>Lake County, FL</td>
<td>3,000</td>
</tr>
<tr>
<td>Marion County, FL</td>
<td>2,000</td>
</tr>
<tr>
<td>Escambia County, FL</td>
<td>1,000</td>
</tr>
<tr>
<td>Leon County, FL</td>
<td>1,000</td>
</tr>
<tr>
<td>Manatee County, FL</td>
<td>1,000</td>
</tr>
</tbody>
</table>
The model build firms pairs, with significant detail within Florida itself to capture details of the within-state movements.

**Business Connections between Metro Areas in Florida**

<table>
<thead>
<tr>
<th></th>
<th>Jacks.</th>
<th>Miami</th>
<th>Orlando</th>
<th>Tampa</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacksonville</td>
<td>25,593</td>
<td>24,018</td>
<td>40,156</td>
<td>12,864</td>
<td>102,631</td>
</tr>
<tr>
<td>Miami</td>
<td>6,852</td>
<td>261,276</td>
<td>14,147</td>
<td>12,625</td>
<td>294,900</td>
</tr>
<tr>
<td>Orlando</td>
<td>36,159</td>
<td>42,270</td>
<td>78,379</td>
<td>67,728</td>
<td>224,536</td>
</tr>
<tr>
<td>Tampa</td>
<td>10,296</td>
<td>35,089</td>
<td>59,529</td>
<td>69,518</td>
<td>174,432</td>
</tr>
<tr>
<td>Grand Total</td>
<td>78,900</td>
<td>362,653</td>
<td>192,211</td>
<td>162,735</td>
<td>796,499</td>
</tr>
</tbody>
</table>
• The within-Florida segment overall segment is the largest
• In terms of cross border flows, Florida is a net importer both domestically and internationally

2010 Commodity Tonnage by Segment
The model compares Florida demand for goods by type.

**Top 20 2010 Commodity Tonnage by Type**

- **Gravel**
- **Nonmetal min. prod.**
- **Coal**
- **Waste/scrap**
- **Gasoline**
- **Wood prod.**
- **Other foodstuffs**
- **Basic chemicals**
- **Natural sands**
- **Coal n.e.c.**
- **Cereal grains**
- **Nonmetallic minerals**
- **Fertilizers**
- **Other ag prod.**
- **Base metals**
- **Newsprint/paper**
- **Fuel oils**
- **Animal feed**
- **Articles-base metal**

- **Observed**
- **Model**
Distribution channel represents supply chains with number of transfers. These vary significantly by commodity group.

**Percent Transfers by Commodity Group**
Shipment Size Model

Model Compared to CFS Shipment Tonnage

Model Compared to CFS Shipment Value
Calibration to the mode choice model resulted in a relatively good match to the mode choice observed from in the Transearch data.

**Domestic Freight Mode Shares**

![Graphs showing mode choice by mode type: Tons and Value.](image-url)
FreightSIM Networks and Validation for 2010
FreightSIM includes multimodal networks for rail, waterways, airports, and ports, and highways, as well as distribution center locations, for the US, with more detail in Florida.
2010 Average Daily Truck Volumes by Facility Type

- Arterial
- Freeway
- Toll
- Total

2010 Average Daily Truck Volumes by District

- Model Total
- Count Total

Facility Type

- Model Total
- Count Total

District

- Model Total
- Count Total
Truck Speed Validation

- Observed truck speeds from ATRI
- Congested truck speeds from FreightSIM
Future Year Truck Trip Estimates

Total truck trip growth (number of truck trip origins in FL) between 2010 and 2040 is closely aligned with forecasts of overall commodity flow growth.

<table>
<thead>
<tr>
<th>Year</th>
<th>FL Origin Trips/Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base – 2010</td>
<td>297,955</td>
</tr>
<tr>
<td>Future – 2040</td>
<td>433,105</td>
</tr>
<tr>
<td>Growth</td>
<td>45%</td>
</tr>
</tbody>
</table>
Network and Policy Applications of the Florida Statewide Freight Model
Network Model Applications

- **Infrastructure Investments in Strategic Intermodal System (SIS)**
  - Highway Capacity Projects – adding general purpose lanes
  - Managed Lane Projects – adding truck-only lanes or managed lanes prohibiting trucks
  - Rail Capacity projects – adding service or terminals/routes, improving access/egress to rail terminals
  - Airport capacity projects – adding terminals, improving access/egress to airports
  - Seaport capacity projects – adding terminals, improving access/egress to ports
  - Intermodal projects – adding terminals, improving access/egress to terminals

- **Congestion Management**
  - Corridor studies, alternative analysis
  - Congestion management studies
  - Accessibility to manufacturing and industrial centers
  - Operational studies, impact on speeds and travel times
Policy Model Applications

• Transportation Policies
  – Statewide transportation plans
  – Tolls, user fees, or pricing studies, traffic and revenue studies
  – Congestion pricing studies
  – Value of time/Value of Reliability studies

• Performance Metrics And Outreach
  – Evaluate MAP21 metrics
  – Evaluate FTP metrics
  – Freight infrastructure and commodity movement brochures

• Private Sector Decisions
  – Impact studies of logistics decisions e.g. just-in-time delivery or night delivery
  – Adding or moving warehouse and distribution centers

• Regional Projects
  – Regional transportation plans
  – Regional corridor, congestion, pricing studies
Next Steps

• Conduct **sensitivity tests** to evaluate the freight model’s response to various freight mobility policies.

• Develop baseline **forecasts** for interim years; every five years from 2015 to 2035.

• Add **reporting** capabilities to provide regional or corridor summaries.

• Provide **training** to FDOT staff that will be using the model.