The Florida Regional Supply Chain Optimization Model (FRSCOM)

FDOT Districts 2 and 3

Final Report

Prepared for the

Florida Department of Transportation

Prepared by

Quetica, LLC

3800 American Boulevard West, Suite 1500

Bloomington, MN 55431

July 2022

Table of Contents

Executive Summary **ES-1**

Introduction **1**

Applying Network Optimization to North Florida's Multimodal Freight Network **2**

Populating The Supply Module 5

Populating The Demand Module 7

Defining Benchmarks for Freight Services and Local Commodities/Products 10

North Florida Commodity Flow Profile **11**

Phase 2: FRSCOM Model Results **18**

Using FRSCOM to Explore Network Opportunities: Green Field Analysis **18**

Narrowing Candidates for Additional Analysis 26

What-If Scenario Runs Using FRSCOM **27**

Rail Transload 27

Rail Intermodal Scenario for Bay County 33

Freight Consolidation / Cross Dock Facility for Escambia County 39

Business Case Analysis **42**

Conclusions and recommendations **54**

Table of Exhibits

Exhibit ES-1: North Florida Optimization Study Process Flow Diagram ES-2
Exhibit ES-2: What-If Scenario Facility Locations in North Florida ES-4
Exhibit ES-3: Summary Table for North Florida FRSCOM Business Case Analysis ES-5
Exhibit 1: North Florida Region: FDOT Districts 2 and 3 2
Exhibit 2: FRSCOM Study Process Flow Diagram 3
Exhibit 3: Overview of the FRSCOM Conceptual Architecture 3
Exhibit 4: FRSCOM Multimodal Inventory 6
Exhibit 5: How Freight Demand Flows are Modeled in FRSCOM 7
Exhibit 6: Stakeholder Outreach List of Participating Organizations 10
Exhibit 7: Study Area Total Commodity Flows by Direction 11
Exhibit 8: Study Area Commodity Flows: Domestic, Import, Export 12
Exhibit 9: Study Area Modal Share 13
Exhibit 10: Truck Tonnage Imbalance by FDOT District 13
Exhibit 11: Study Area Commodity Flows by Commodity Group 14
Exhibit 12: Study Area Commodity Flow Volumes by Trading Partner 15
Exhibit 13: Study Area Commodity Flow Values By Trading Partner 15
Exhibit 14: Study Area Top International Trading Partners By Volume And Value 16
Exhibit 15: Study Area Top Non-Florida Gateways of International Flows 16
Exhibit 16: Study Area Domestic Modes Of International Flows Not Using A Florida Gateway 17
Exhibit 17: Study Area Commodity Share of International Flows Not Using a Florida Gateway 17
Exhibit 18: Generic Modal Service Attributes and Cost 19
Exhibit 19: Representation of Freight Consolidation Scenario 20
Exhibit 20: In-Scope Commodities for Greenfield Analysis of Cross-dock Consolidation Scenario 21
Exhibit 21: Top Locations from Greenfield Analysis of North Florida Cross-dock Scenario 21
Exhibit 22: Summary of End-To-End Truck To Rail Transload Process 22
Exhibit 23: In-Scope Commodities for Greenfield Analysis Of Truck/Rail Transload Scenario 23
Exhibit 24: Top Locations From Greenfield Analysis Of North Florida Truck/Rail Transload Scenario 23
Exhibit 25: Map of the M-95 Marine Highway Corridor 24
Exhibit 26: Examples of Rail Intermodal Services 25
Exhibit 27: In-Scope Commodities for Greenfield Analysis Of Rail Intermodal Service Scenario 26
Exhibit 28: Top Locations from Greenfield Analysis Of North Florida Intermodal Rail Scenario 26
Exhibit 29: Dry and Liquid Commodity Groups Included in Rail Transload Scenario 28
Exhibit 30: Dry and Liquid Commodity Tons And Savings By Site 29
Exhibit 31: Total Market Opportunity for Dry Commodities 29
Exhibit 32: Top Dry Origin to Destination Trade Lanes by Railcars 30
Exhibit 33: Dry Transload Commodity Savings and Tons by Location 31

Exhibit 34: Total Market Opportunity for Liquid Commodities ... 32
Exhibit 35: Liquid Commodity Tons and Savings by Location ... 33
Exhibit 36: Commodities in Intermodal Scenario ... 34
Exhibit 37: Intermodal Scenario Summary, Inbound and Outbound ... 34
Exhibit 38: Bay County Intermodal Tonnage by US Region ... 35
Exhibit 39: Top Intermodal Markets for Bay County By Container Volume ... 35
Exhibit 40: Top Intermodal Markets for Bay County by Total Savings In Transportation Costs ... 36
Exhibit 41: Top Intermodal Trade Lanes for Reducing Truck Ton-Miles (TTM) ... 37
Exhibit 42: Equipment Type Volume, Dry and Reefer ... 37
Exhibit 43: Dry Intermodal Commodity Volumes and Savings ... 38
Exhibit 44: Reefer Intermodal Commodity Volumes and Savings ... 38
Exhibit 45: Commodities Included in Truck Consolidation Scenario ... 39
Exhibit 46: Truck Consolidation Scenario Summary, Inbound and Outbound ... 40
Exhibit 47: Truck Consolidation Tonnage by Region ... 40
Exhibit 48: Total Market Opportunity By Region And Flow Type ... 41
Exhibit 49: Top Truck Consolidation Trade Regions ... 41
Exhibit 50: Truck Consolidation Commodities, Tonnage and Savings ... 41
Exhibit 51: Elements of the Business Case ... 43
Exhibit 52: Dry Commodity Total Market Opportunity ... 43
Exhibit 53: Annual Rail Transload Volumes and Savings – 10 & 15 Percent Capture Rate ... 44
Exhibit 54: Rail Transload Terminal Construction Sketch-level Costs Estimates ... 45
Exhibit 55: Business Case Payback Periods for Four Rail Transload Scenarios ... 45
Exhibit 56: Existing Truck Rail Transload Facilities and Proposed FRSCOM Nodes ... 46
Exhibit 57: The Disposition of Florida's Municipal Solid Waste In 2020 ... 47
Exhibit 58: Municipal Solid Waste Data for Counties in FDOT Districts 2 And 3 ... 48
Exhibit 59: Landfills in Florida by Status ... 49
Exhibit 60: Intermodal Scenario Summary with 10% and 15% Market Capture ... 50
Exhibit 61: Intermodal Ramp Construction Costs Estimate ... 51
Exhibit 62: Business Case Payback Periods for Intermodal Scenario ... 51
Exhibit 63: Truck Consolidation Scenario Summary, Inbound and Outbound ... 52
Exhibit 64: Business Case Payback Periods for Truck Consolidation Scenario ... 53
Exhibit 65: Summary Table for North Florida FRSCOM Business Case Analysis ... 54

EXECUTIVE SUMMARY

The transportation of goods, including transportation and warehousing, are significant activities that support Florida's tourism, agriculture, advanced manufacturing, and other traded sector businesses of the state's economy. According to data from U.S. Department of Transportation (USDOT), Florida's multimodal freight networks facilitated domestic trade of goods into, out of, and within Florida, valued at nearly $900 billion in 2020. Florida's international water and airport gateways handled an additional $186 billion of import and export trade in 2020.[1]

Safe and efficient freight transportation is critical to the state's future mobility and livability: In 2020 Florida was the 3rd most populous state in the Union with 21.5 million residents, and an average annual growth rate of about 1.5 percent per year.[2] In support of statewide freight planning efforts aimed at keeping the state competitive and resilient, the Florida Department of Transportation (FDOT) undertook an innovative supply chain modeling project that is described in this report. The Florida Supply Chain Optimization Model (FRSCOM) draws from a data-driven approach frequently used by private sector companies to identify opportunities for lowering shipping costs. Private firms use optimization models to make site location decisions and/or to evaluate the impact of a new warehouse or transportation terminal on their supply chain costs. Using this same approach, public sector agencies can evaluate how changes to a multimodal network, adding a truck-to-rail transload facility for example, impact shipping costs for goods that might otherwise use rail services.

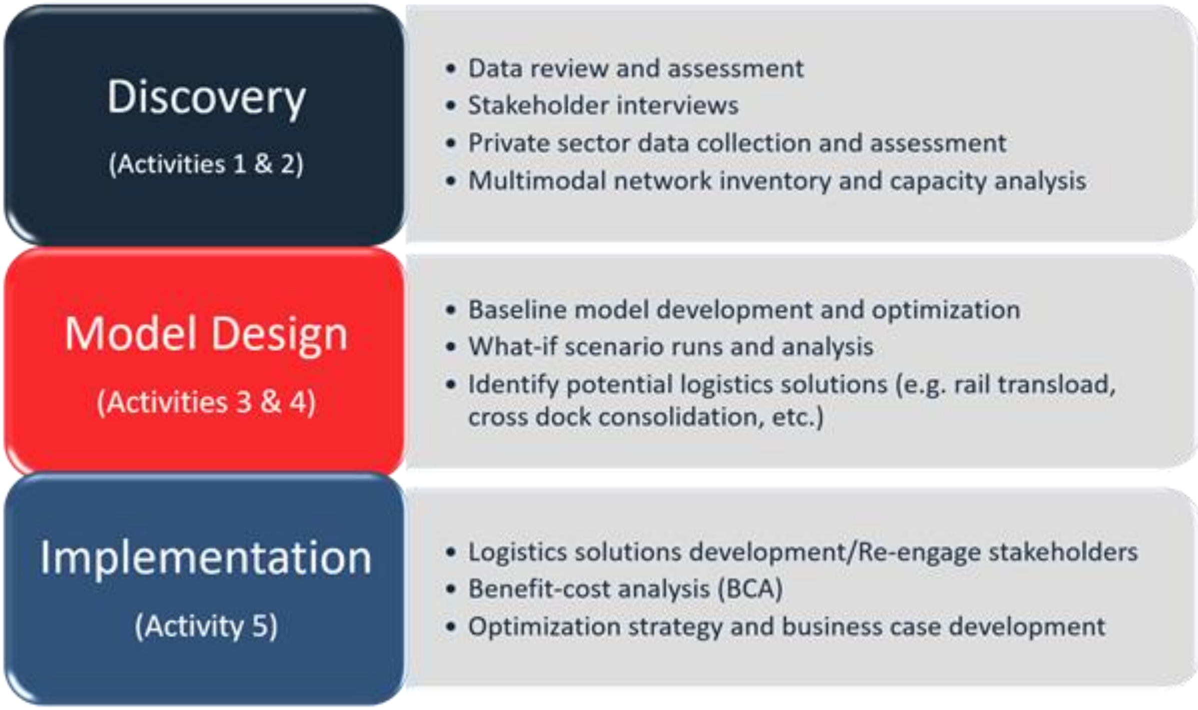
This report provides an overview of the model development process, as well as the results of several "what-if" scenarios that examine potential public/private investment opportunities in North Florida (i.e., FDOT Districts 2 and 3). The initial model build-out was completed for FDOT Districts 2 and 3 with headquarters in Lake City and Chipley. The model development process was undertaken in three phases as depicted in Exhibit ES-1

---

[1] USDOT, Bureau of Transportation Statistics, Summary Statistics: [Freight Analysis Framework (FAF) (ornl.gov)]

[2] US Census Bureau, *Florida Was Third-Largest State in 2020 With Population of 21.5 Million.* August 25, 2021 https://www.census.gov/library/stories/state-by-state/florida-population-change-between-census-decade

Exhibit ES-1: North Florida Optimization Study Process Flow Diagram



The Discovery Phase focuses on securing data necessary to populate the optimization model. The data collection goal is to assemble data that represents Florida's freight supply and demand conditions. Through the modeling process, data and algorithms are used to create a digital twin of how supply chains in North Florida currently operate. The necessary data can be summarized in three categories:

1. **Supply**: This data set captures the multimodal infrastructure, both links and nodes, available for moving goods. Links represent highways, railroads, and shipping lanes, while nodes represent terminals where freight is handled and/or transferred between modal links. Constraints on links and nodes represent the current capacity of these network elements.
2. **Demand:** This data category represents the freight demand currently being placed upon the infrastructure across surface transportation modes. The data represents the volume of goods moving into, out of, and within the North Florida study area. Demand data is expressed as:
    a. *Out of movements*: The tonnage of goods by commodity group moving between county level origins in the study area and all external destinations (domestic U.S. counties and 41 foreign countries/country groups);
    b. *Into movements:* The tonnage of goods by commodity group moving from all origins external to the study group (U.S. counties and 41 foreign countries) to all destination counties in the study area; and
    c. *Within or intra study area movements*: The tonnage of goods by commodity group moving between all study area counties.

3. **Modal and commodity benchmarks:** The benchmark dataset is developed from private shipping records, primarily bill of lading (BOL) records. Benchmark data provides information

on the price differentials between various service offerings across modes. Benchmarks are also used to develop metrics about specific products within commodity groups relevant to the study area. Most two-digit commodity classification categories in the Standard Classification of Transported Goods (SCTG) have dozens if not hundreds of specific products. For example, SCTG 07 *Other Prepared Foodstuffs, Fats and Oils* includes hundreds of specific products, including dry bulk goods like sugar, liquid bulk goods like corn oil, processed products such as potato chips or refrigerated products like milk or cheese. Each of the forementioned products require different types of equipment based on their handling characteristics. Shipping records from the study area provide insights into the specific equipment and facility needs required to transport local products within a commodity group.

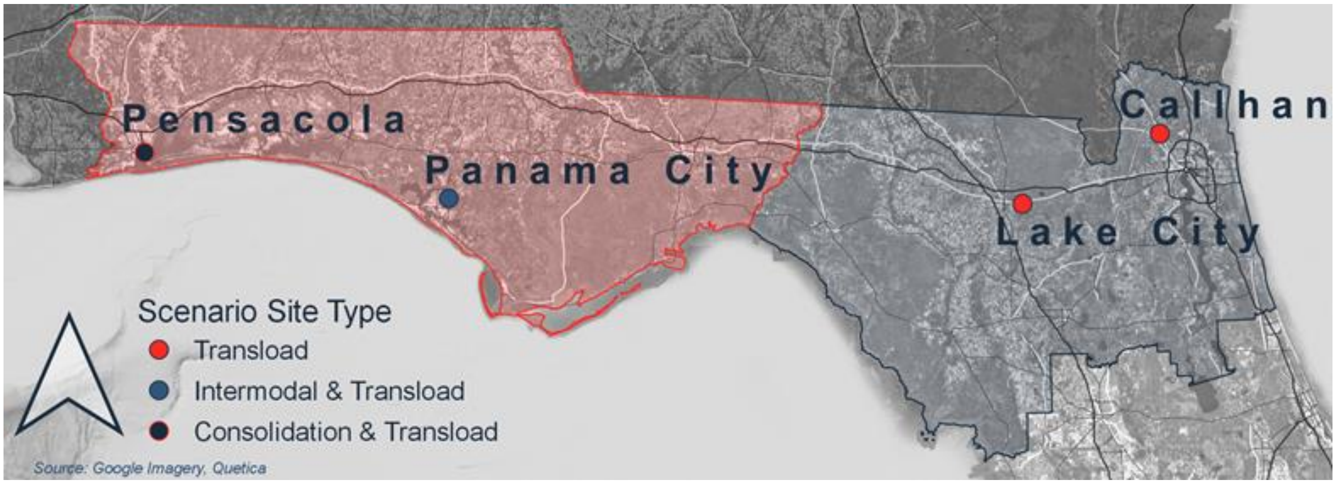
The collection of shipping records to populate the modal benchmarks category for Northern Florida was done through stakeholder outreach meetings. Normally, requesting data from private sectors shippers occurs through in-person meetings, but due to the COVID-19 pandemic, most stakeholder meetings were conducted virtually.

During the design phase, algorithms were modeled to mimic how goods travel into, out of, and within the North Florida study area across the multimodal freight network. Once the baseline model represented the existing trading environment of the North Florida economy, the optimization model was run to conduct "greenfield" analyses. Green field analyses examine the network as "unconstrained" under existing demand conditions. Greenfield scenarios explore how the addition of four different facility types/services would affect the cost of freight transportation for North Florida shippers. The four scenarios tested were:

- Intermodal rail container terminal
- Truck-to-rail transload terminal
- Truckload consolidation/deconsolidation (cross-dock terminal)
- Coastal barge service

The greenfield analysis is used to identify potential candidate locations worthy of a deeper examination, through *"what-if"* scenario analysis. The scope of work includes developing six what-if scenarios to examine impacts resulting from the introduction of additional nodes or services to the multimodal freight network in the study area. After reviewing results from the greenfield analysis, the six candidates were selected for further analysis. The six sites are displayed on the map in Exhibit ES-2. The follow-on modeling process introduces modal service assumptions and criteria related to modal choice decisions. Each what-if scenario is run using FRSCOM to produce an estimated Total Market Opportunity (TMO). The TMO represents the estimated commodity tonnage that the proposed logistics solution could serve if introduced into the existing multimodal network.

Exhibit ES-2: What-If Scenario Facility Locations in North Florida



In the third phase of the project business cases were developed for each of the six scenarios. The model results from each of the scenarios was also presented to key stakeholders in virtual meetings to discuss the results and receive additional feedback.

In the business case analysis presented for each scenario market capture rates are introduced as a more realistic portion of the TMO that a proposed solution is likely to secure if developed. For each scenario the estimated tonnage and cost savings are estimated using 10% and 15% market capture rates. Each scenario business case also includes sketch-level facility development costs, which are weighed against estimated project benefits from lower shipping costs to produce a return on investment (ROI) metric. The ROI is expressed as a ratio of the time required to payback the initial investment and is used to assess the potential for either private sector investment or more likely, Public-Private-Partnership (P3) opportunities.

The table in Exhibit 65 shows the combined ROI results for all six scenarios examined in greater detail as part of the FRSCOM initial effort. All the scenarios examined presented very strong ROI metrics based upon the initial facility investment costs assembled. The consolidation scenario in the Pensacola region shows the best ROI among the six facilities examined, based on initial facility costs, followed by the transload and the intermodal scenarios in the Panama City region.

While the case for an intermodal rail facility in the Bay County/Panama City Area appears strong, railroad officials were more restrained in their outlook for additional intermodal services in the North Florida market, with lane imbalance noted as a significant concern. In addition, Bay County is only served by a short line railroad, which would require an interchange agreement with a Class 1 to provide intermodal services in the area.

Among the four transload scenarios examined, Panama City had the strongest ROI, however follow-on interviews with railroads and developers suggest that some of the bulk commodities that the data suggest would be strong markets may have marketplace realities that diminish the TMO in some cases. However, some stakeholders also suggested that additional market competition in rail services might increase the margin between truckload and rail carload, expanding the market for transload facilities further.

Exhibit ES-3: Summary Table for North Florida FRSCOM Business Case Analysis

Scenario	Annual Carloads/ FTLs/Containers		Annual Savings		Investment		ROI Period	
Capture Rate	10%	15%	10%	15%	10%	15%	10%	15%
Callahan Transload	3,810	5,715	$13.12M	$19.97M	$17.4M	$23.4M	1.30	1.17
Lake City Transload	3,690	5,535	$15.19M	$22.79M	$17.4M	$23.4M	1.14	1.03
Panama City Transload	4,535	6,800	$19.03M	$28.54M	$17.4M	$23.4M	0.91	0.82
Panama City Intermodal	27,880	41,820	$35.50M	$53.30M	$35M	$50M	0.99	0.94
Pensacola Transload	2,925	4,385	$15.32M	$22.98M	$17.4M	$23.4M	1.13	1.02
Pensacola Consolidation	9,680	14,510	$19.90M	$29.80M	$9.5M	$13.3M	0.67	0.62

One commodity group that appears to make a strong case for further investigation is municipal solid waste (MSW). The current system for tracking MSW sent to landfills appears to lack specificity regarding whether the final disposition is to local landfills or whether significant volumes may be trucked long distances to landfills located out-of-state. With Florida's projected population increases finding additional in-state landfills is likely to be a challenge. Information from the US Environmental Protection Agency (EPA) shows that more than one-half of existing Florida landfill sites have closed. Florida Department of Environmental Protection data shows that of an estimated nearly 8 million tons of MSW produced in North Florida, approximately 80%, goes into landfills.

MSW is a commodity that could be moved out of Florida via rail through transload facilities seems to be a potential project for further examination. Population growth will continue to stress those landfills that remain open, and it is likely that in the future more waste will be moved to landfills outside of the state. Understanding the current life expectancy of existing sites could help determine where demand for MSW transportation services will be highest demand in the future.

In summary, it is important to note that the "What-if" scenarios tested only represent potential opportunities and were developed to present the application of the FRSCOM and its abilities. In other words, the FRSCOM represents an evaluation tool used to evaluate the private sector-based freight and supply chain business opportunities. These opportunities translate into economic development outcomes as well as positive impacts to the use, maintenance, and lifespan of public infrastructure.

It is this direct relationship between public infrastructure and private sector use of the infrastructure that offers Florida the opportunity to evaluate and growth the freight and logistics industry as well as the related manufacturing and support industries. Future use of the FRSCOM by economic development entities such as Enterprise Florida, Inc. as well as regional and local entities represents the on-going benefits for this tool.

By enhancing opportunities for commerce through strategic investment in transportation infrastructure that meet current and future user needs, the project also identifies economic development opportunities to encourage companies to establish operations and/or expand their supply chain networks in North Florida. The project provides a dynamic tool that can support Florida’s efforts toward creating a more efficient transportation system, supporting econoimc development, and providing better services for citizens.

INTRODUCTION

The transportation of goods, including transportation and warehousing, are significant activities that support Florida's tourism, agriculture, advanced manufacturing, and other traded sector businesses of the state's economy. The 2020 FDOT Freight Mobility and Trade Plan (FMTP) estimates that in 2017 commercial trucks travelled nearly 30 million miles each day on the state highway network, with over half (17 million) of those daily miles attributed to "big rig" tractor-semitrailer combinations.[3] The FMTP also notes that while over 50 percent of the commercial trucks entering the state were loaded with goods, only 38 percent of the trucks leaving the state were full. In addition to highway commerce, railroads originated over 44 million tons of freight in Florida, and railroads terminated over 72 million tons.

Florida is the fourth largest economy in the U.S. by gross domestic product. According to USDOT data, Florida's multimodal freight networks facilitated domestic trade of goods into, out of and within Florida valued at nearly $900 billion in 2020. Florida's international water and airport gateways handled an additional $186 billion of import and export trade in 2020.[4] Freight activity has at times been described as the economy in motion. Trade markets, supply chains, transportation technologies and service offerings are constantly evolving. Two objectives of the FMTP are to:

- Continue to forge partnerships between the public and private sectors to improve trade and logistics, and,
- Capitalize on emerging freight trends to promote economic development.

Network optimization is a data modeling technique that uses machine learning to identify solutions for complex problems. Following de-regulation of the U.S. railroad industry in 1980, many Class I railroads were early adopters of optimization modeling to rationalize mainline track assets. Since that time, the interest among private sector firms to use data analytics to reduce supply chain costs has grown. In 2021, the *25th Annual Third-Party Logistics Study* found that when asked what information technology services shippers seek from third party logistics providers, 45% responded *"network modeling and optimization."*[5]

The growth in the application of optimization as a business tool for addressing complex network problems has coincided with the acceleration in computing speed. However, the use of optimization modeling in the public sector has lagged. To date, the application of network optimization has been restricted mostly to federal agencies dealing with defense and emergency logistics. More recently some state and local transportation agencies have turned to optimization modeling to identify network enhancements that lower logistics costs and support economic growth and development. Many times, these enhancements are opportunities for public/private partnerships.

---

[3] *Freight Mobility and Trade Plan*, Florida Department of Transportation. Pg. 17. (2017 data).

[4] USDOT, Bureau of Transportation Statistics, Summary Statistics [Freight Analysis Framework (FAF) (ornl.gov)]

[5] Infosys Consulting, Penn State, Penske and CSCMP. *2021 Third-Party Logistics Study: The state of Logistics Outsourcing*.

Applying Network Optimization to North Florida's Multimodal Freight Network

> *The Florida economy is the 4th largest in the U.S. and 17th largest globally. Freight related industries - construction, manufacturing, trade, and logistics – support every facet of the state's economy. The trade sector has seen a tremendous growth with 40% increase in wholesale trade and 80% in retail trade industries from 2009 to 2019. Transportation and warehousing industries have seen a 60% growth since 2009. Because of tourism and population growth, as well as a large population of retirees, Florida is largely a consumer state. This factor contributes significantly to the domestic trade imbalance, which manifests into the high quantity of empty trailers and containers moving out of Florida.*[6]

As one response to the demands on Florida's freight transportation networks, FDOT's Freight & Multimodal Operations Office contracted to develop the FRSCOM, a multimodal freight network optimization model for northern Florida. The FRSCOM study area encompasses FDOT Districts 2 and 3 (see Exhibit 1). In its totality, the study area is referenced as North Florida throughout this report.

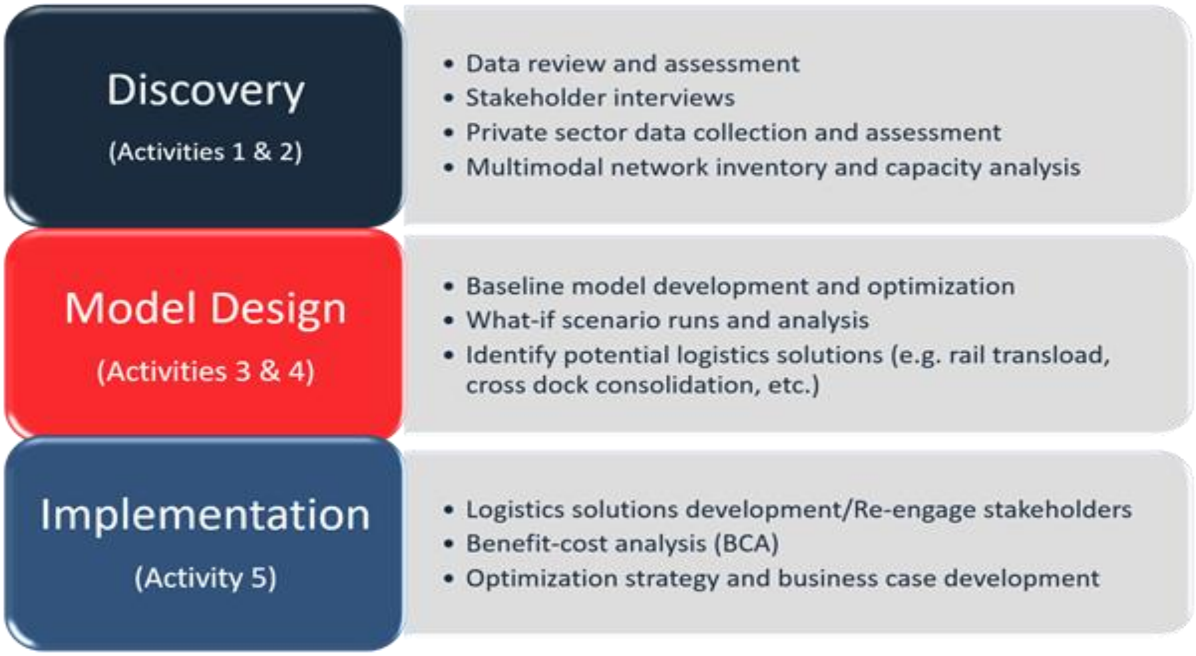
Exhibit 1: North Florida Region: FDOT Districts 2 and 3

Source: FDOT

The model development process was undertaken in three phases as depicted in Exhibit 2.

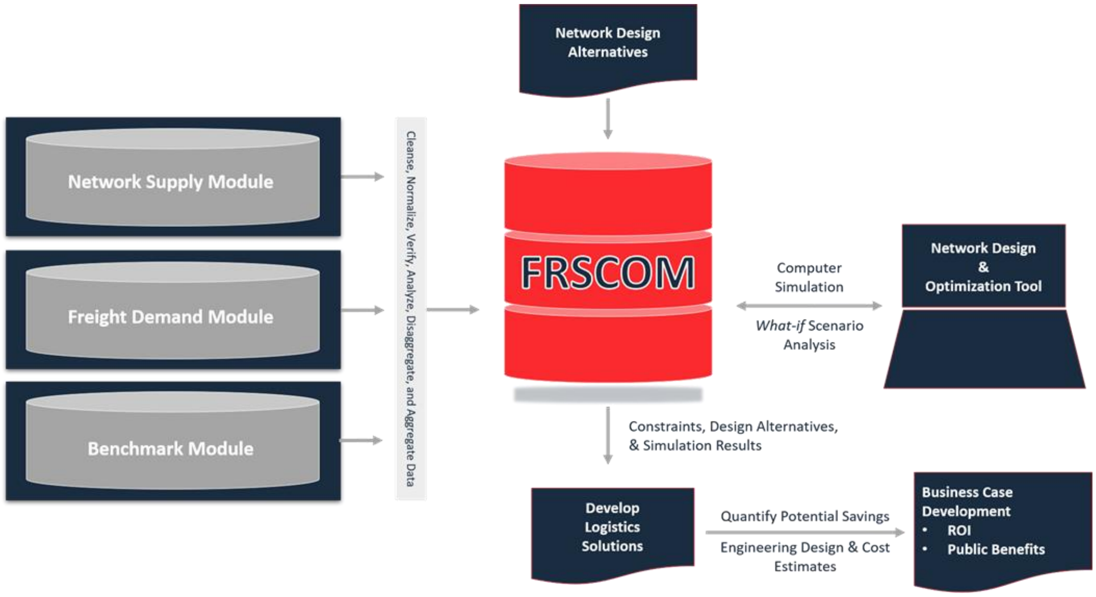
6 *Freight Mobility and Trade Plan: Technical Memorandum 4 – Trends.* April 2020. Pg.4.

Exhibit 2: FRSCOM Study Process Flow Diagram



The first phase of FRSCOM's development focused on securing the data necessary to represent Florida's freight supply and demand conditions. In addition, private sector data related to the cost of various transportation services, indications of equipment needs required for moving study area products, and other benchmarks and metrics are derived from shipping records. Through the modeling process, data and algorithms are used to create a digital representation of how supply chains in North Florida currently perform. Exhibit 3 shows the data bins and model architecture for the FRSCOM.

Exhibit 3: Overview of the FRSCOM Conceptual Architecture



The data bins represented on the left-hand side of Exhibit 3 can be summarized as:

1. **Multimodal Freight Infrastructure Supply**: This data set represents the surface transportation infrastructure, both links and nodes available for moving goods into, out of and within the study area. Network links include highways, railroads, and ocean shipping lanes. Network nodes represent terminals where freight is handled and/or transferred between modal links. Constraints on links and nodes represent the current capacity of these network elements.

2. **Commodity/Product Demand:** Demand data represents the current and future freight volumes using the surface transportation networks. Demand data is represented as commodity tonnages moving into, out of, and within the North Florida study area. Demand data is expressed as:
   a. *Out of movements*: The tonnage of goods by commodity group moving between county level origins in the study area and all external destinations (domestic US counties and 41 foreign countries/country groups);
   b. *Into movements:* The tonnage of goods by commodity group moving from all origins external to the study group (U.S. counties and 41 foreign countries) to all destination counties in the study area; and
   c. *Within or intra study area movements*: The tonnage of goods by commodity group moving between all study area counties.

3. **Modal and commodity benchmarks**: Benchmark data is developed from private shipping records, primarily bill of lading (BOL) records. Benchmark data provides information on the price differentials between various freight service offerings across modes. Benchmarks are also used to develop metrics about specific products within commodity groups relevant to the study area. Most two-digit commodity classification categories have dozens if not hundreds of specific products. For example, SCTG 07 *Other Prepared Foodstuffs, Fats and Oils* includes hundreds of specific products, including dry bulk goods like sugar, liquid bulk goods like corn oil, processed products such as potato chips, or refrigerated products like milk or cheese. Each of the forementioned products require different types of equipment based on their handling characteristics. Shipping records from the study area provide insights into the specific equipment and facility needs required to transport local products within a commodity group.

What is a Bill of Lading?

The bill of lading is a required document to move a freight shipment. The bill of lading (BOL) works as a receipt of freight services, a contract between a freight carrier and shipper and a document of title. The bill of lading is a legally binding document providing the driver and the carrier all the details needed to process the freight shipment and invoice it correctly.

A bill of lading is like a waybill, with the difference being that a bill of lading conveys title to the shipment, while a waybill merely serves as evidence that the consignee has contracted with the shipper to carry the goods to an identified destination.

Source; Freight Quote, Online at: https://www.freightquote.com/how-to-ship-freight/bill-of-lading

Populating The Supply Module

The FRSCOM supply module can be thought of as a multimodal inventory of surface transportation modes serving freight needs in the study area. FRSCOM's network includes the following components:

- **Domestic and foreign sites –** All 3,143 U.S. counties and 41 foreign ports representing the 41 countries/country groups in scope are geocoded[7] and modeled as sites that freight can be originated or terminated. All U.S. ports in the disaggregated import/export dataset is assigned to a U.S. county based on their geographic locations.
- **Road network –** The road network is modeled as records in a database table with the road distance between the origin and destination counties. If there is no road network connectivity between two counties, the corresponding record is not in the table, thereby constraining the optimization process from using the road network for freight transportation between those counties.
- **Rail network –** The rail network is modeled as records in a database table with the rail distance between the origin and destination counties. If there is no rail network connectivity between two counties, the corresponding record is not in the table, thereby constraining the optimization process from using the rail network for freight transportation between those counties.
- **Inland and intracoastal waterway network –** The network is modeled as records in a database table with the water distance between the origin and destination counties. If there is no water network connectivity between two counties, the corresponding record is not in the table, thereby constraining the optimization process from using the inland waterway network for freight transportation between those counties.
- **Intermodal network –** In the FRSCOM, intermodal refers to containerized cargo that moves using more than one mode. This move typically occurs between truck and rail in domestic freight movements. In international trade, this occurs between ships, trucks, and rail, with the emphasis on truck-rail intermodal movements. In general, intermodal facilities are required to transfer containers from one mode to another. There are approximately 200 intermodal facilities in the U.S. The intermodal network is modeled as records in a database table with the distance between two intermodal facilities in the U.S at the county level. If there is no intermodal network connectivity between two counties, the corresponding record is not in the table, thereby constraining the optimization process from using the
- **Ocean network –** The ocean network is modeled as port-to-port pairs between U.S. seaports and the representing seaports in the 41 countries/country groups in scope. This network includes all possible import and export ocean freight shipment options.

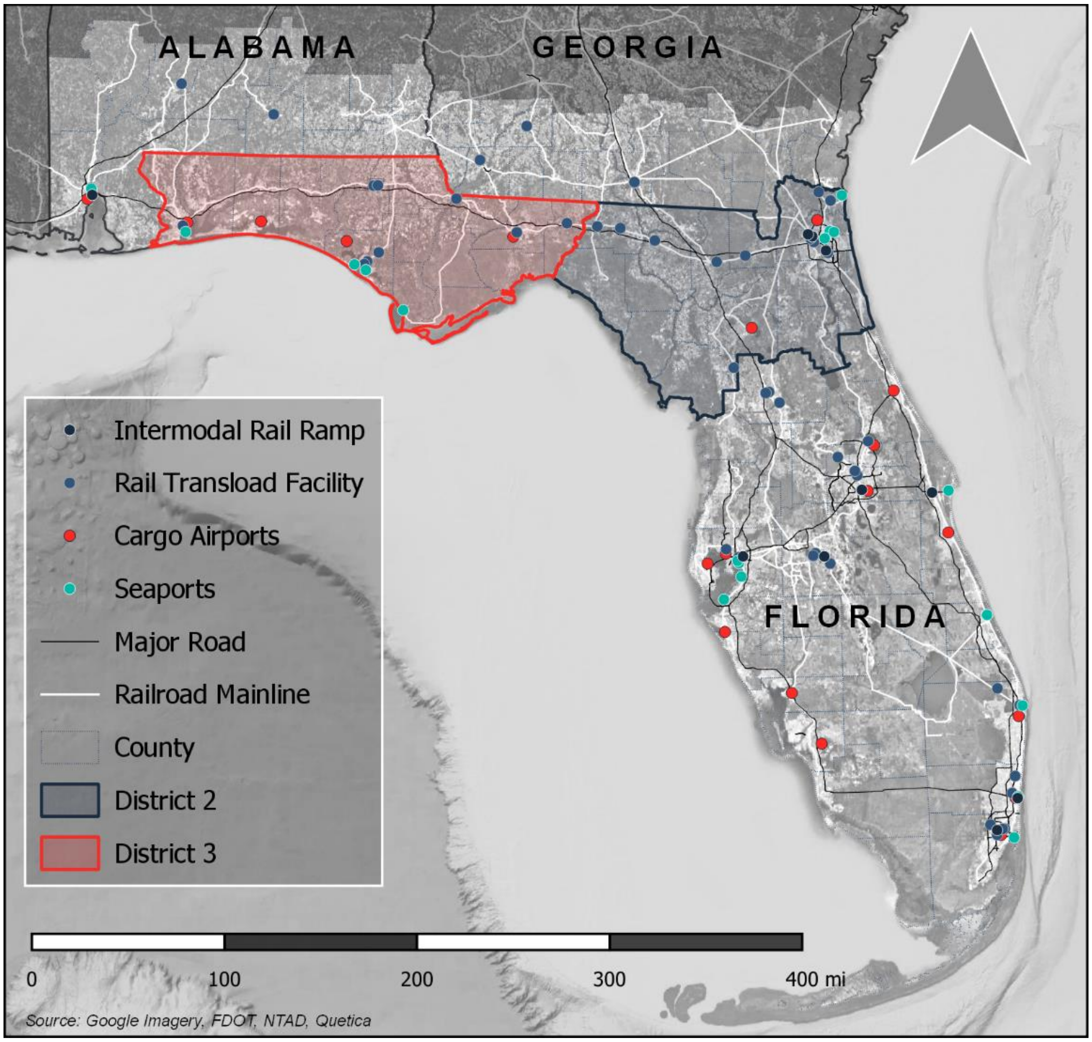
The movement of goods between an origin and a destination can be accomplished using a single mode such as those described above or a combination of two or more modes (multimodal). The FRSCOM treats a multimodal movement in multiple legs with each leg being completed using a single mode. For example, a multimodal shipment from Philadelphia, PA to Jacksonville, FL can be done by trucking the commodity to the nearest rail access point and then railing the freight to Jacksonville, or by trucking the commodity to the closest marine terminal and then using a vessel to move the freight to Jacksonville. In a multi-leg shipment, each leg of shipment will be constrained by the single modal networks described above to ensure that the optimization is done within the defined networks.

---

[7] A site is geocoded using its the geographical coordinates (latitude and longitude) corresponding to its centroid, if provided.

Additional effort was made to inform the FRSCOM's network module with a current inventory of the state's multimodal facilities where commodity hand-offs occur between the road, rail, water, and air networks (Exhibit 4). This effort captured multimodal assets in 15 neighboring Alabama counties and 22 neighboring Georgia counties as well.

Exhibit 4: FRSCOM Multimodal Inventory



Source: Quetica, LLC, FDOT, NTAD, Google Imagery

The rail facility inventory is from FDOT's Strategic Intermodal System (SIS), public websites of rail operators, and Google Imagery. The inventory includes information related to the facility such as its name, location (latitude and longitude coordinates and county), the type (such as truck-to-rail, rail served warehouse, etc.), the railroad owner, any Class 1 interchanges if the owner is not a Class 1, the number of railcar spots, and the types of products serviced by the facility. The marine facility inventory uses data from FDOT's SIS, FDOT's Seaports Office, port websites, individual terminal operator's websites, and Google Imagery. In addition to the attributes related to name, location, and products, the marine inventory also captured information about on-site rail access, if applicable, and on-site equipment and storage capabilities, if available. The air cargo inventory was based on FDOT SIS and Strategic Growth airports in combination with air cargo data from the Bureau of Transportation Statistics' (BTS) Air Carrier Traffic and Capacity On-Flight Market Data (T-100).
The point-based inventory is aggregated to the county level for input into the FRSCOM. The multimodal

network module includes fields that are used to constrain the FRSCOM by indicating both the presence or absence of access to the rail, water, and air networks as well as the ability to service various types of equipment within each of Florida's counties. The FRSCOM constrains the commodity flow movements using the following equipment/commodity types:

- Dry Bulk
- Liquid Bulk
- General (break bulk, project cargo)
- Intermodal Containers
- Refrigerated
- Roll-On/Roll-Off (RORO)

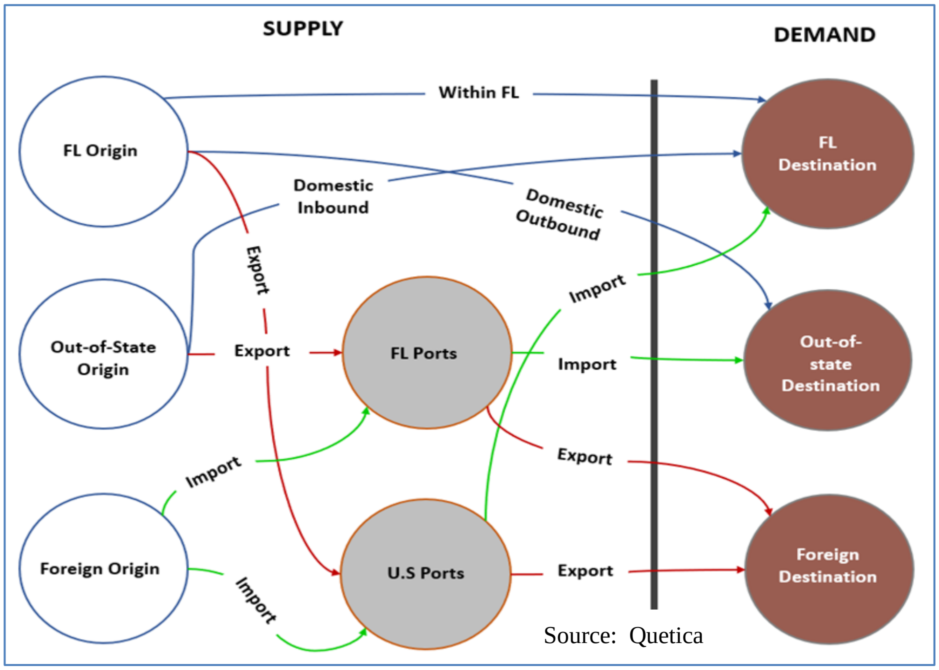
FRSCOM's network module also contains capacity information at the county level. Rail transload capacity is measured by the number of railcar spots. Marine capacity is measured by the number of terminals located in a county. Marine-rail capacity is measured by the estimated miles of rail track within each county's marine terminals. Air cargo capacity is based on the reported annual BTS weight in air freight. Additional details about the supply module, including a complete list of facilities by mode can be found in the Freight Infrastructure Supply Analysis Technical Memorandum.

Populating The Demand Module

The FRSCOM's Demand Module includes three types of commodity demand, or flows:

- **Domestic flows:** Shipments expressed in tons moving to, from and within the study area based on disaggregated Freight Analysis Framework Version 5 (FAF-5)
- **Import/Export flows:** The Florida portion of import/export flows from WISER Trade data
- **Through flows**: Domestic portions of import/export flows to/from other states that travel through the study area.

Exhibit 5: How Freight Demand Flows are Modeled in FRSCOM



Source: Quetica

Domestic flows are derived from disaggregated FAF-5 commodity data for shipments originating or terminating in Florida. As illustrated in Exhibit 5, the domestic flows include inbound, outbound, and internal (within) Florida freight flows. Import demand flows document freight from a foreign origin to a U.S. port, then from the U.S. port to a Florida destination. Export flows document freight originating in Florida and transported to a U.S. port, and then from the port to a foreign destination. Flows in the Demand Module move to or from eight different node types. The eight nodes shown graphically in Exhibit 5 are described below:

1. **Florida Origin:** Florida origins are modeled at the county level. There are 67 counties in Florida. Each county can have inbound, outbound, and within commodify flows.
2. **Florida Destination:** Same as above, Florida destinations were modeled at the county level.
3. **Out-of-State Origin:** A domestic out-of-state origin is modeled at the county level with a 3-digit ZIP code (ZIP3) assigned. There are approximately 3,143 counties in the U.S. A county can have multiple ZIP3 codes. When a county is assigned more than one ZIP3, the ZIP3 with the highest population in the county is selected as the main ZIP3 representing the county.
4. **Out-of-State Destination:** Same as above, a domestic out-of-state destination is modeled at the county level with a 3-digit ZIP code (ZIP3) assigned. When a county is assigned more than one ZIP3, the highest population ZIP3 represents the county.
5. **U.S. Port:** Florida import/export commodity flows are modeled to include two legs: a domestic leg between a FL site and a U.S. port and international leg between a U.S. port and a foreign site. This design allows trade route analysis in the optimization process. Like the domestic out-of-state origin/destination (O/D), U.S. ports are modeled at the county level with a ZIP3 assigned in this study. In the instance that a port spans multiple counties, the county that provides more multimodal connection points is selected to represent the port in FRSCOM. A connection point is either a rail station defined in the Standard Point Location Code (SPLC) database from the National Motor Freight Traffic Association (NMNFTA), Inc.[8] or a dock defined in the U.S. Army Corps of Engineers (USACE) Complete Dock List.[9] These connection ports enable multimodal transportation combinations, such as, truck-rail or truck-water. For example, the Port of Tampa in Florida spans areas in Lee, Pinellas, Manatee, and Hillsborough counties. Hillsborough county is selected to represent the port since it has the most rail and water connection points.
6. **Florida Ports:** All import/export commodity flows from/to US states other than Florida via a Florida port are modeled including flows between domestic US sites and Florida ports. This design allows freight analysis in the optimization process by considering the freight flows that are not originated in or destined to Florida but use Florida ports for international flows. There are 39 ports in Florida: 24 International Airports and 15 Seaports.
7. **Foreign Origin:** There are 41 foreign countries or country groups in the model for import/export analysis. Each foreign O/D pair is modeled using the geographic location of the largest port city in the area. A list of the foreign countries or country groups is provided within a full listing of the countries to country groups in Appendix A.
8. **Foreign Destination:** Same as about there are 41 foreign countries or country groups in the model for import/export analysis. Each foreign destination is modeled using the geographic location of the largest port city in the area.

The network demand data is based primarily on two data sources integrated to form the underlying

[8] https://store.nmfta.org/Products/ProductDetail?SKU=SPLC_ONLINE

[9] http://www.navigationdatacenter.us/ports/ports.htm

commodity flow table for the optimization model. Each data source is briefly discussed below:[10]

- **FAF-5 domestic flows** form the foundation of the FRSCOM's freight demand module. FAF is a USDOT product detailing freight movements between and within 132 domestic regions known as FAF zones. FAF also reports imports and exports to eight foreign regions: Canada; Mexico; Rest of Americas; Europe; Africa; Southern, Central, and Western Asia; Eastern Asia; and Southeastern Asia and Oceania. Freight origin/destination movements by tonnage, value and ton-miles are estimated across eight modes/modal combinations: 1) truck; 2) rail; 3) water; 4) air (including truck-air); 5) multiple modes and mail; 6) pipeline; 7) other and unknown; and 8) no domestic mode. Derived from the Commodity Flow Survey (CFS) conducted by the U.S. Census Bureau every five years, FAF provides information on 43 commodity groups. Commodity groups are aggregated to the 2-digit SCTG level.[11] FHWA released FAF-5 in 2021 based on the 2017 CFS, international trade data from the Census Bureau, and other data sources related to goods movement for agriculture, mining, utility, construction, retail, services, and other sectors.
- **Import/export trade data** is an important measure of economic activity for many states and industries, especially for coastal gateway states like Florida. However, because of data limitations related to how FAF often captures domestic and international portions of a single shipment, the true origin of exports and true destination of imports is inaccurate. Analysis of FAF export data suggests that interior states' exports to be undervalued, while exports from coastal gateway states are overvalued. The misrepresentation is especially skewed for certain "out-of-scope" CFS commodity groups like Cereal Grains. The FRSCOM's import and export flows have been corrected by the World Institute for Strategic Economic Research (WISER). WISER uses a proprietary process to re-assign exports to their true domestic source. WISER Trade Data also disaggregates import and export flows from FAF's eight international regions to 41 country/ country groups to provide a higher level of detail about key foreign markets.

***Disaggregating FAF Data**:* The FAF data used for this analysis has been disaggregated from the 132 FAF zones, to a county level geography. A multiple linear regression approach was used to allocate commodity flows from FAF zones to counties. The underlining assumption is that sub-state commodity volumes as a percentage of statewide volumes are correlated to sub-state socioeconomic variables as a percentage of statewide socioeconomic variables for the same commodities/industries. Regression models were established for each of the 42 SCTG commodity groups leveraging a proprietary regression tool to test the correlations between the commodity flows and a variety of explanatory variables to find the best fit variables.

Generally, population and employment are good predictors of commodity origins and destinations. However, past research and regression testing has confirmed that not all industries demonstrate high freight flow correlations using only population and employment. Agriculture is one of several industries where other explanatory variables must be used to develop better fit regression equations. An array of data from both public and private sources were collected for use in the regression equations. For additional details about the regression variables and goodness of fit for commodity productions and attraction see the Model Development and Baseline Analysis Technical Memorandum.

[10] Additional details about

[11] The most detailed SCTG commodity/product descriptions are provided at the 5-digit code level.

Defining Benchmarks for Freight Services and Local Commodities/Products

Transportation cost benchmarks are one of the critical datasets used in freight network optimization. Benchmark data provides information on the cost of freight services across modes for shippers in the study area. Benchmarks also include metrics about specific products within commodity groups relevant to the study area. Most two-digit commodity classification categories have dozens if not hundreds of specific products each requiring different types of equipment based on their handling characteristics. Shipping records from the study area provide insights into the specific equipment and facility needs required to transport local products within a commodity group.

A key feature of the benchmark data collection effort included stakeholder interviews with senior executives from more than 20 companies that operate in Northern Florida. While a primary goal of the interviews was to ask participants to share data, interviews were also used to gain a qualitative understanding of regional supply chains. Nondisclosure agreements (NDA) were executed with stakeholders willing to share shipping records, to protect the propriety nature of the information. Due to COVID-19, would be stakeholder interviews were conducted virtually through webinars. Exhibit 6 shows the list of companies/entities interviewed for the project.

Exhibit 6: Stakeholder Outreach List of Participating Organizations

	Entity	Stakeholder Type
1.	Anderson Columbia	Shipper / Contractor
2.	Atlantic Logistics	Carrier/3PL
3.	Bridgestone Americas	Shipper
4.	Tallahassee International Airport	Terminal Operator
5.	CSX	Carrier/3PL
6.	Enterprise Florida, Inc.	Economic Development
7.	Florida East Coast Railway (FEC)	Carrier/3PL
8.	Florida Economic Development Council	Economic Development
9.	Florida's Great Northwest	Economic Development
10.	Florida Gulf & Atlantic (FG&A)	Carrier/3PL
11.	Florida Chamber of Commerce	Business Association
12.	Florida Trucking Association	Business Association
13.	Floridians for Better Transportation	Business Association
14.	JAXPORT	Terminal Operator
15.	Jacksonville International Airport	Terminal Operator
16.	Norfolk Southern (NS)	Carrier/3PL
17.	N Florida Economic Development Partnership	Economic Development
18.	Patriot Rail	Carrier/3PL
19.	Patriot Holdings Florida Tank & Rock Lines	Carrier/3PL
20.	Port Panama City	Terminal Operator
21.	Suddath Transportation & Logistics	Carrier/3PL
22.	Total Distribution	Carrier/3PL

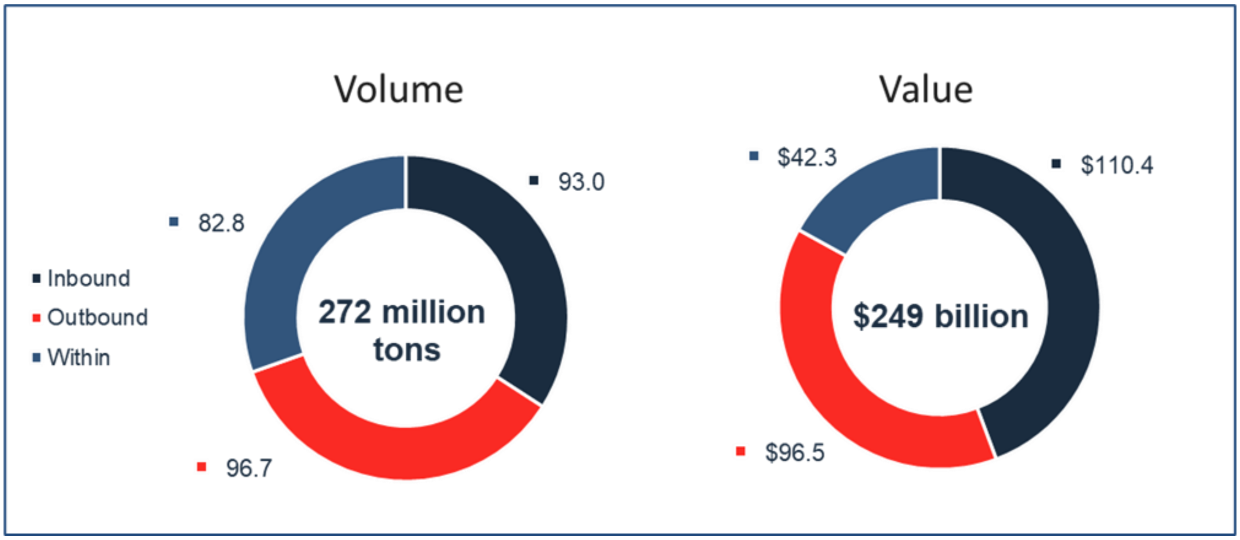
23.	United States Gypsum Company (USG)	Carrier/3PL
24.	Vision First Advisors	Economic Development
25.	Weyerhaeuser	Shipper / Developer

North Florida Commodity Flow Profile

Once the demand module was assembled the commodity flows for FDOT Districts 1 and 2 were reviewed and summarized. The following section provides a brief overview of the results from the analysis of disaggregated FAF-5 commodity flows.

The pie charts presented in Exhibit 7 show the directional flows for North Florida in tonnage and value. Directional movements capture shipments with a destination to the region (inbound), an origin in the region with an external destination (outbound) or both an origin and a destination in the region (within). By volume, the study area shows a surprising balance in flows with 93 million tons (34%) characterized as inbound, 96.7 million tons (36%) outbound, and 82.8 million tons (30%) staying within the region. By value, the share of directional flows changes considerably: inbound flows by value equal $110.4 billion (44%), outbound value equals $96.5 billion (39%), and internal value flows equal just $42.3 billion or (17%). The difference between volume and value flow metrics are indicative of higher value consumer goods moving into the region, while lower value raw or unfinished goods comprise a higher share of outbound and internal flows.

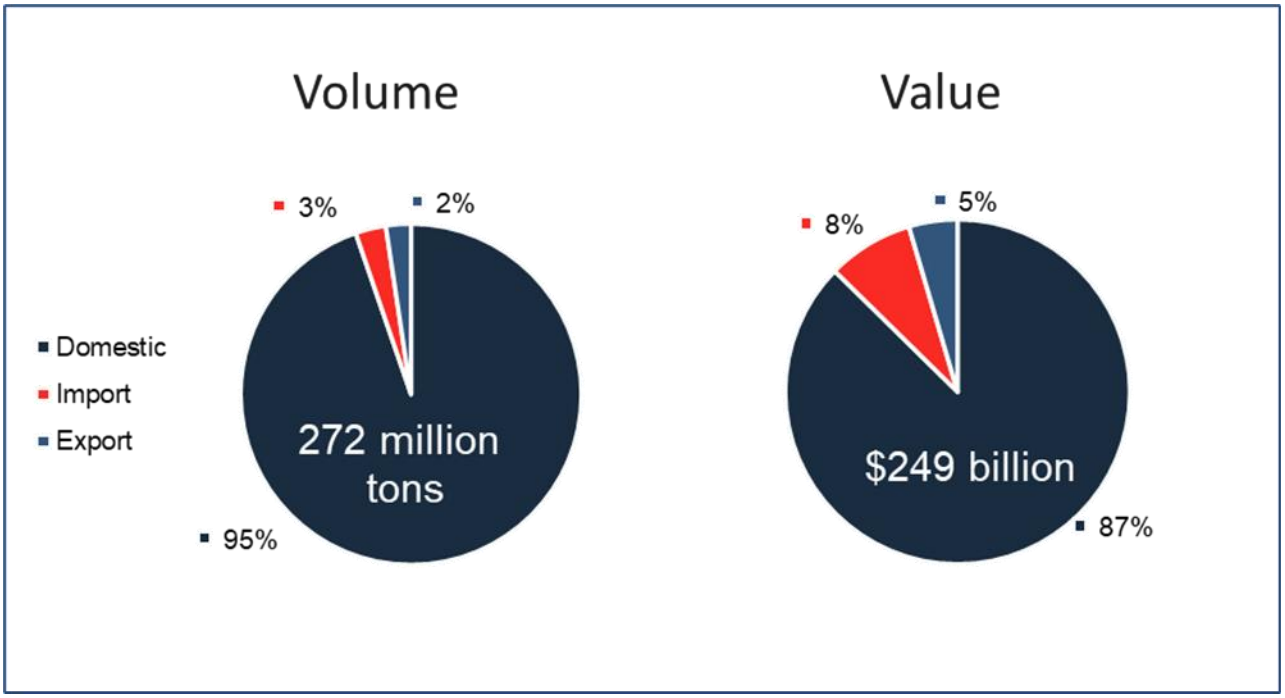
Exhibit 7: Study Area Total Commodity Flows by Direction



Domestic flows represented 95% of North Florida's 272 million tons and 87% of the study area's $249 billion flow value (Exhibit 8). Imports slightly exceed exports, (7.9 million tons vs. 6.5 million tons), and imports have a value nearly double that of exports ($20 billion vs. 11.3 billion).

The pie charts in Exhibit 8 show the volume and value of domestic and foreign trade in North Florida. When examined by the volume or tonnage, 95% of the regions total flows is moving in domestic commerce. Just 5% (3% imports, 2% exports) is moving internationally. By value the domestic share declines to 87%. Foreign trade is split 8% imports and 5% exports.

Exhibit 8: Study Area Commodity Flows: Domestic, Import, Export



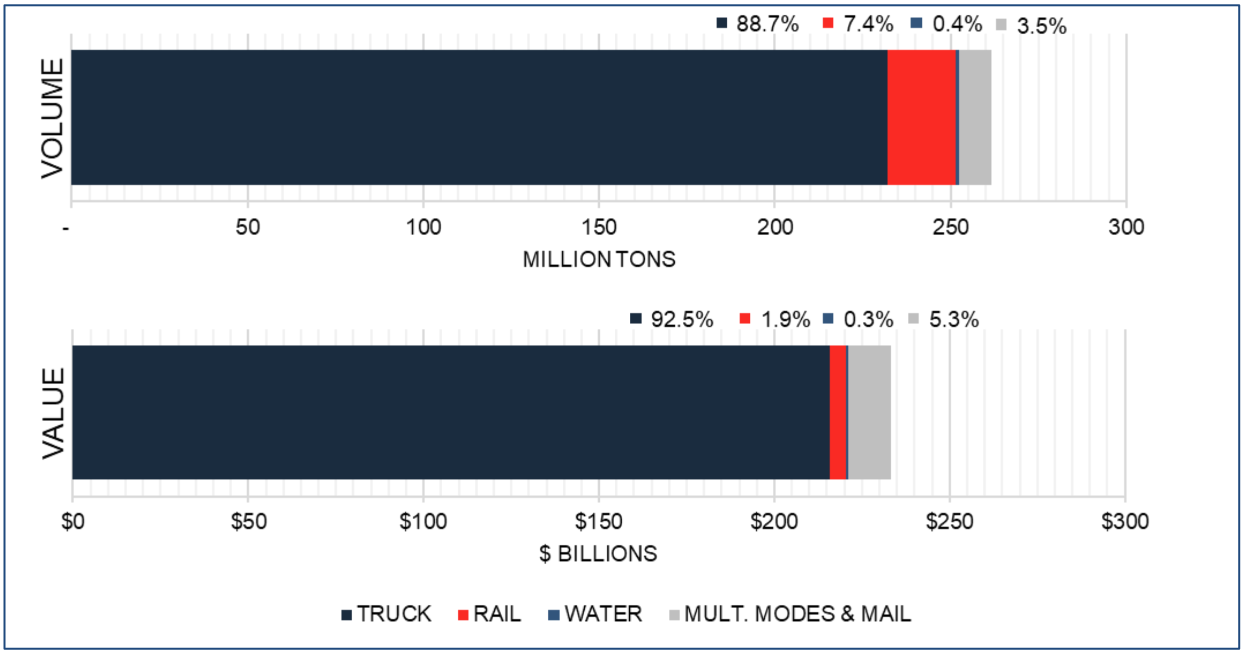
The bar charts of Exhibit 9 show the modal makeup of commodity movements in North Florida by volume and value. Trucking dominated the Study Area's market share with more than 232 million tons, or 88% of its total volume, and nearly $216 billion, or more than 92% of the value. This compares to trucking's national share of 65% by volume and 72% by value.

Rail carried the second most tonnage with 19 million tons, responsible for 7.4% of all tonnage in the Study Area, somewhat lower than the national rail share of 9.7%. The value of rail shipments totaled $4.5 billion, accounting for less than 2% of commodity flow value in the Study Area. Nationally, rail carries 4% of all goods by value.

The modal category *Multiple Modes and Mail* includes shipments up to 150 pounds using parcel delivery services, U.S. Postal Service, couriers or using multiple modes. In North Florida these smaller package shipments accounted for the second highest value with $12.3 billion based on more than 9 million tons. Small package shipments make up nearly 3.5% of shipments in the Study Area by weight and 5.3% by value. Nationally this category was less than 3% of total volume, but approximately 13% by value in 2017.

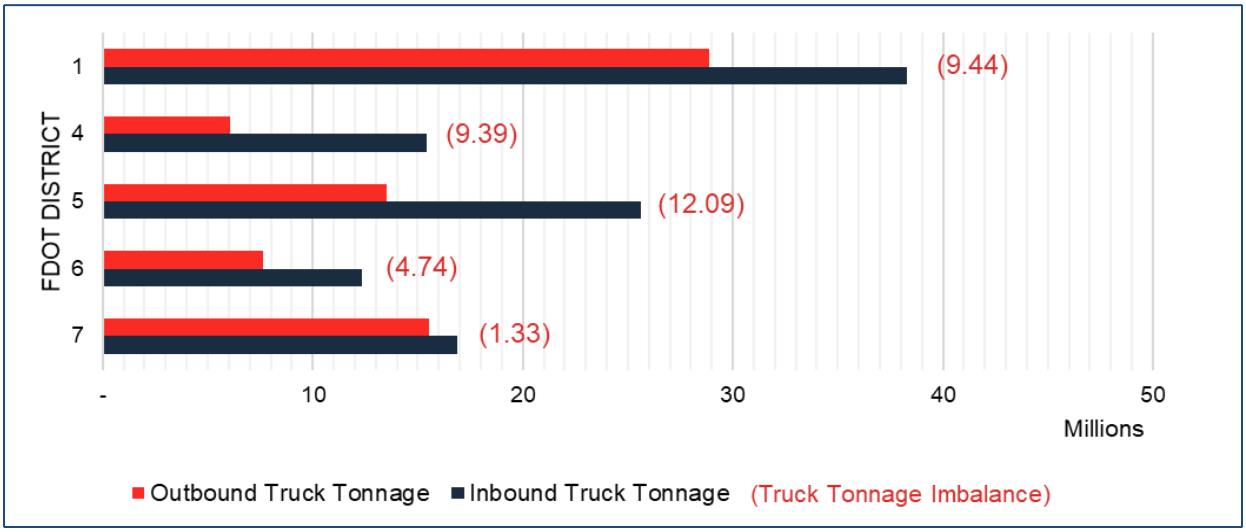
Waterborne commerce accounted for more than 921 thousand tons and $625 million represented less than one percent of the Study Area's volume and value as the commodity flow analysis does not capture the international leg of imports and exports, only the domestic leg.

Exhibit 9: Study Area Modal Share



Florida has been characterized as a "consumption" state that receives more goods than it sends out. The bar chart in Exhibit 10 examines the balance of truck volumes (in versus out) for the FDOT districts outside of the study region. As the bar chart shows, all districts have a greater flow of inbound truck tonnage than outbound tonnage. District 5 has the highest imbalance with 12 million more inbound tons than outbound and is followed by Districts 1 and 4 with imbalances of roughly 9.4 million tons. District 7 has the smallest imbalance with only 1.3 million more inbound tons than outbound. Combined, there are nearly 37 million more tons of freight moving north to south through the study region than moving south to north through the region. This suggests there are opportunities to improve asset utilization either through modal diversion or load consolidation.

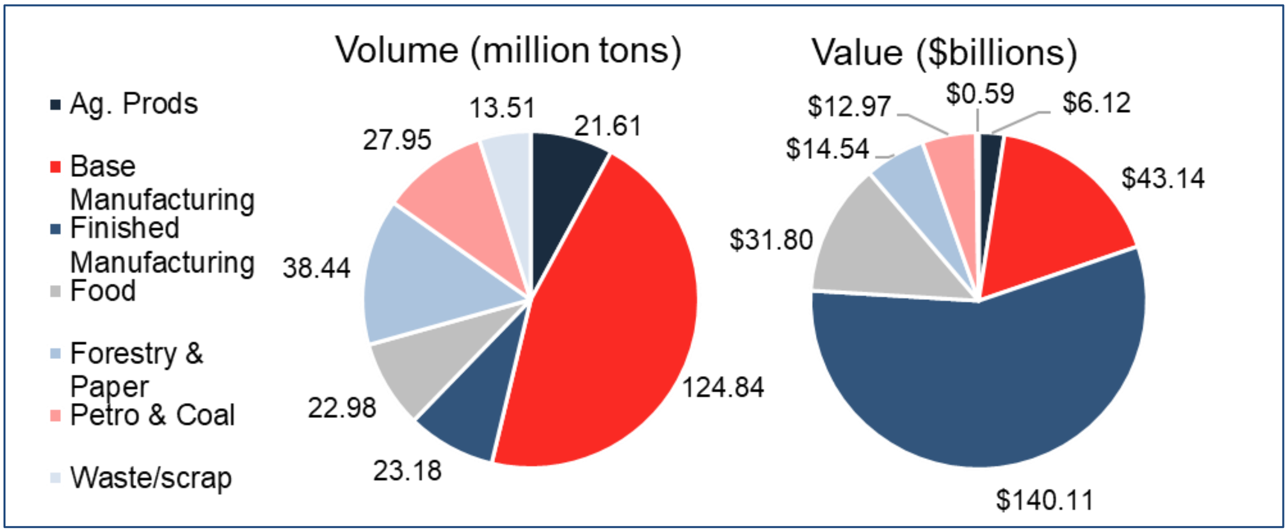
Exhibit 10: Truck Tonnage Imbalance by FDOT District



By weight, the most prominent commodity flows in North Florida are in the *Base Manufacturing* category which includes aggregates, non-metallic minerals like salt, base metals like steel coils and other inputs to into manufacturing processes. Base manufacturing products accounted for almost 125 million tons worth $43 billion, 45% and 17% of the Study Area's total (Exhibit Exhibit10). These high-volume/low-value flows were relatively balanced consisting of 35% of inbound flows, 37% of outbound flows, and 28% of flows moving within the Study Area. On the other hand, finished manufactured product flows are of lower volume and higher value. These products totaled $140 billion in value and 23 million tons, 56% and 8.5% respectively. Inbound flows accounted for the highest share of the flows with 43% followed by outbound flows with 41%.

The remaining commodity groups account for roughly 45% of the volume and 37% of the value. Agricultural and food product flows were similar in that both consisted of roughly 42% of both inbound and outbound flows with the remaining 16% having been within the Study Area. Forestry and paper flows on the other hand were split in a similar fashion but weighted towards outbound and within flows. 52% of petroleum and coal flows were within the Study Area while inbound flows represented 38%. 45% of Waste/scrap flows were also within the Study Area.

Exhibit 11: Study Area Commodity Flows by Commodity Group



Exhibits 12 and 13 show Study Area flows by trade partners, both within Florida between other FDOT Districts and with other U.S. Regions. Other FDOT Districts comprise five of the top six trade partners by volume with District 1 ranking as the top trade partner overall. The Southeast region represents the Study Area's top trade partner by value with nearly $55 billion and its second ranked partner by volume with more than 34 million tons.

Exhibit 12: Study Area Commodity Flow Volumes by Trading Partner

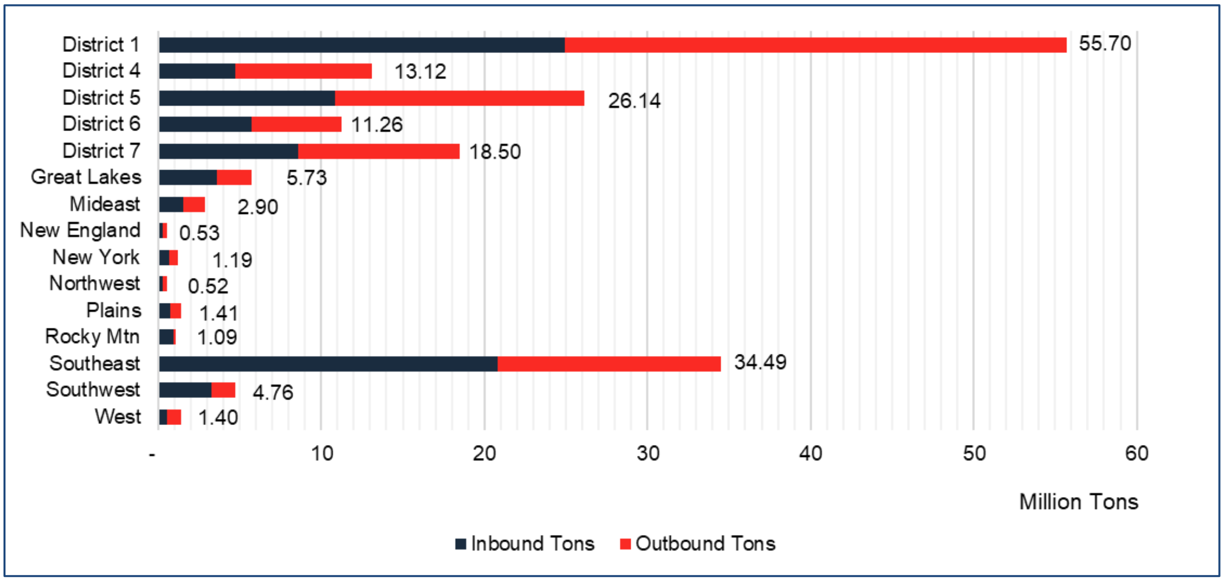
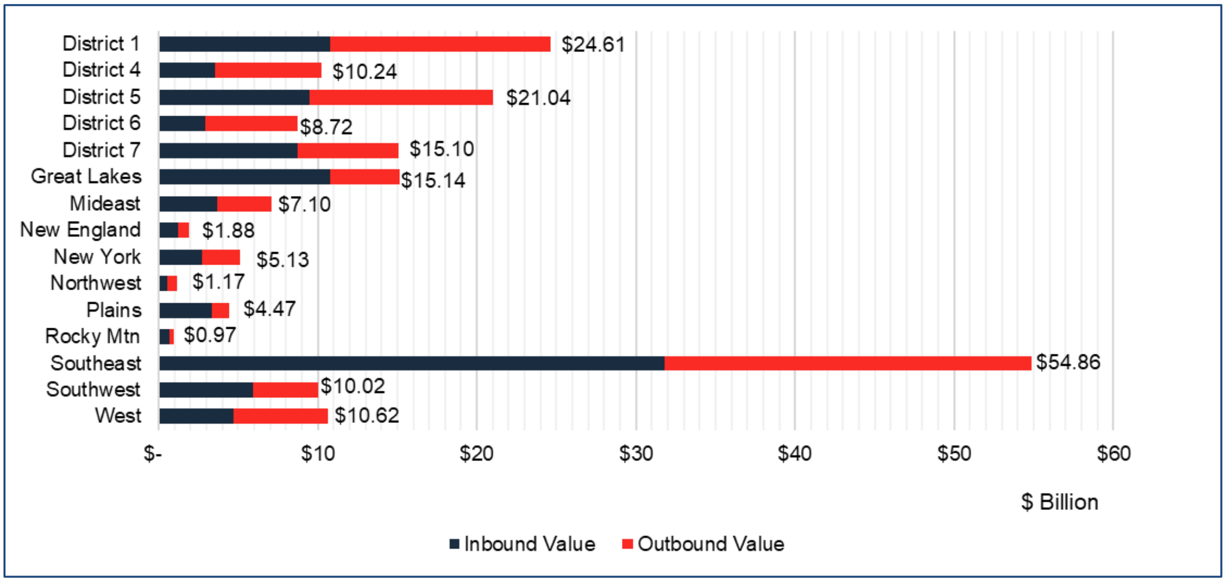
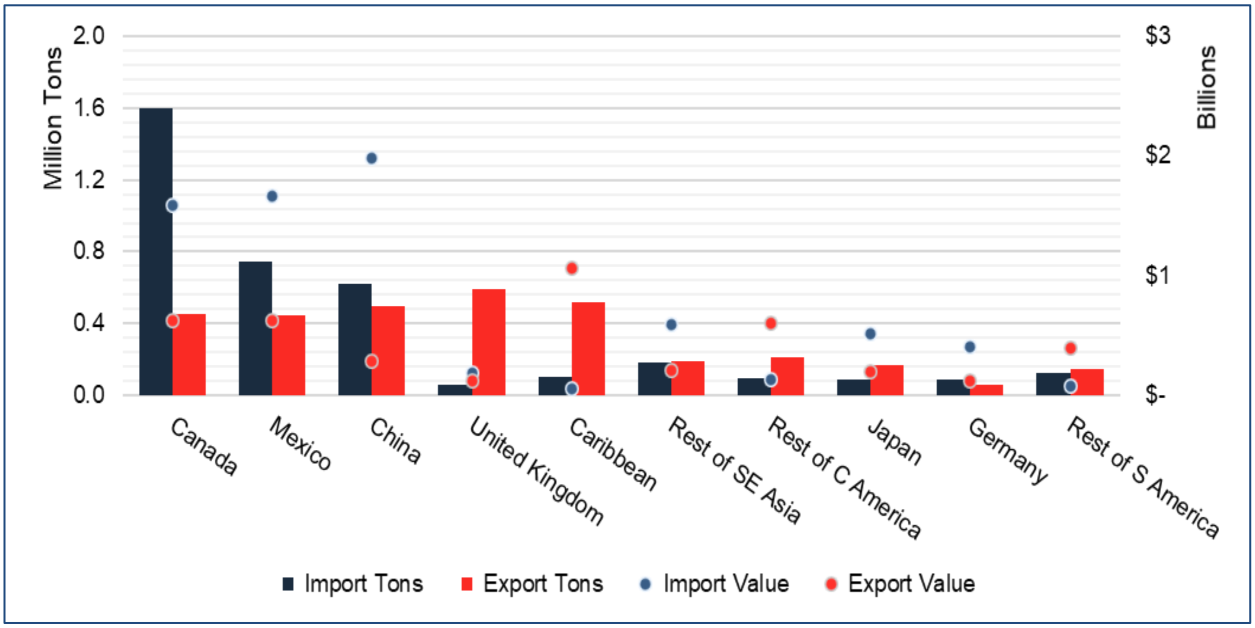


Exhibit 13: Study Area Commodity Flow Values By Trading Partner



Canada was the Study Area's top international trade partner by volume with more than 2 million tons (Exhibit 1Exhibit 14). Roughly three-quarters of this tonnage was imported from Canada. Canada and Mexico each had flows valued at more than $2 billion. Imports from China represented more than 87% of the trade value. The United Kingdom (Great Britain and Northern Ireland) and the Caribbean were the Study Area's top two export markets by volume with each totaling more than 500 thousand tons. The Caribbean was the top export market by value at more than $1 billion.

Exhibit 14: Study Area Top International Trading Partners By Volume And Value



The Study Area originated and attracted more than 11.7 million tons worth $29 billion of import and export flows. However, most of these international flows, more than 8.2 million tons worth $22.2 billion, utilized a non-Florida gateway. Exhibit 15 shows the top non-Florida gateways for the Study Area's international flows. Other than Georgia, Virginia, and Alabama, the majority of the opportunities to increase the flows through Florida gateways is on the import side of flows. Exhibit 16 shows that the majority of these flows' domestic leg is moved by trucks with nearly 6 million tons followed by multiple modes and mail (17%) and rail (9%).

Exhibit 15: Study Area Top Non-Florida Gateways of International Flows

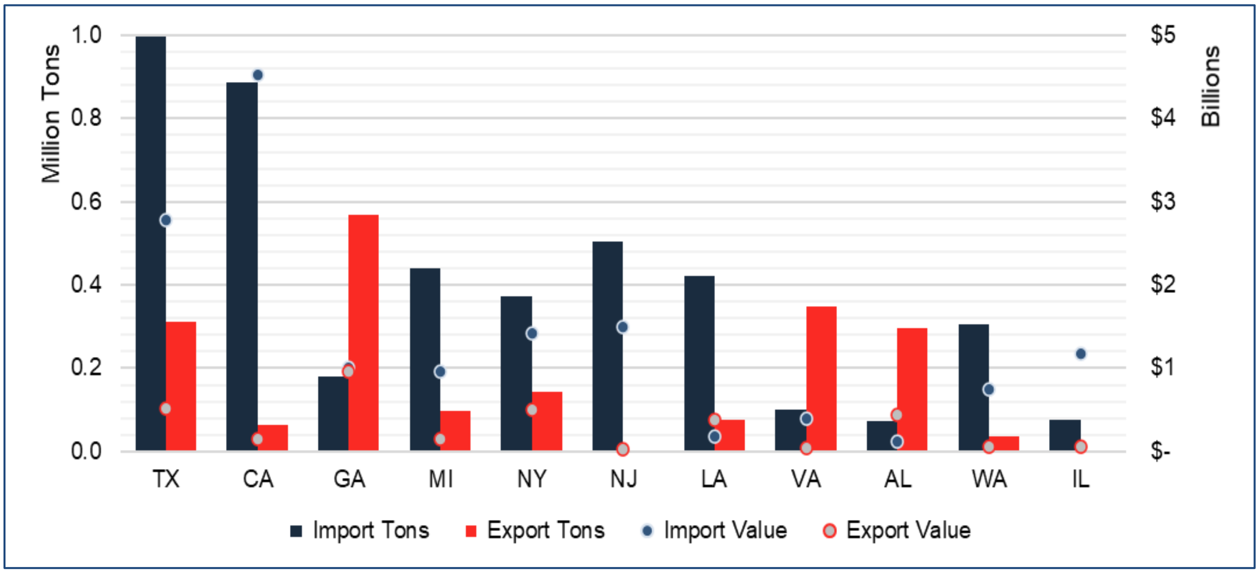
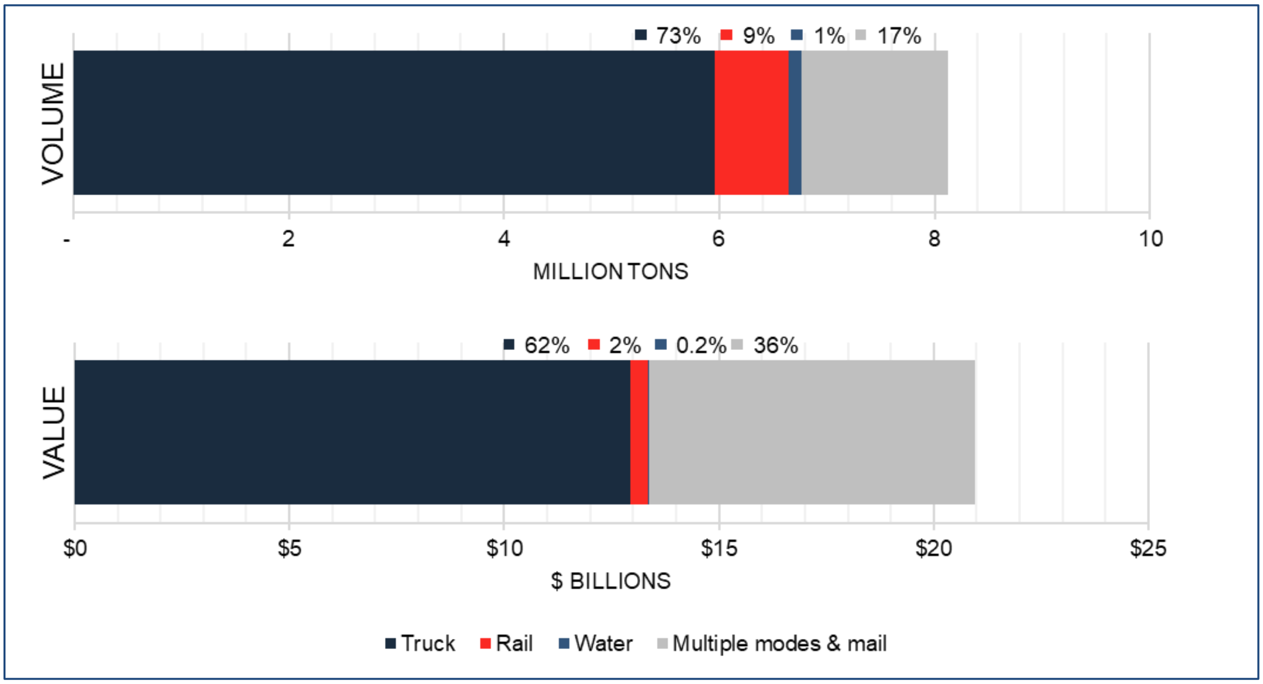
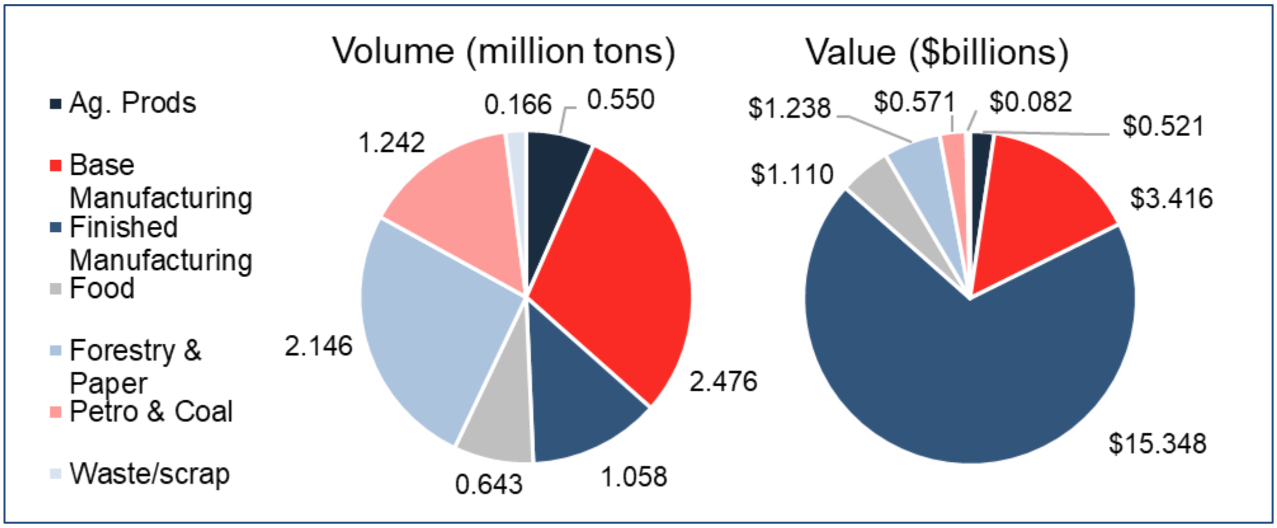


Exhibit 16: Study Area Domestic Modes Of International Flows Not Using A Florida Gateway



Base manufacturing products represented the highest volume of the international flows via non-Florida gateways with 2.475 million tons followed closely by forestry and paper products with 2.145 million tons (Exhibit 17). While 78% of the base manufacturing products were comprised of imported tonnage, 72% of the forestry and paper products were comprised of exported tonnage. Finished manufacturing products accounted for nearly 70% of the total value of these North Florida flows and was essentially split evenly between imported and exported flows.

Exhibit 17: Study Area Commodity Share of International Flows Not Using a Florida Gateway



PHASE 2: FRSCOM MODEL RESULTS

Phase 2 of the FRSCOM project includes three primary subtasks:

- Baseline model development and optimization
- What-if scenario model runs and analysis
- Identification of potential supply chain network solutions/modifications

Optimization models are a mathematical approach to make data-driven decisions. Over the past 30 years, the application of network optimization modeling has become a common planning tool for both strategic and operational planning in the transportation industry to minimize costs, maximize efficiency, and prioritize investments, especially among private sector shippers and carriers.

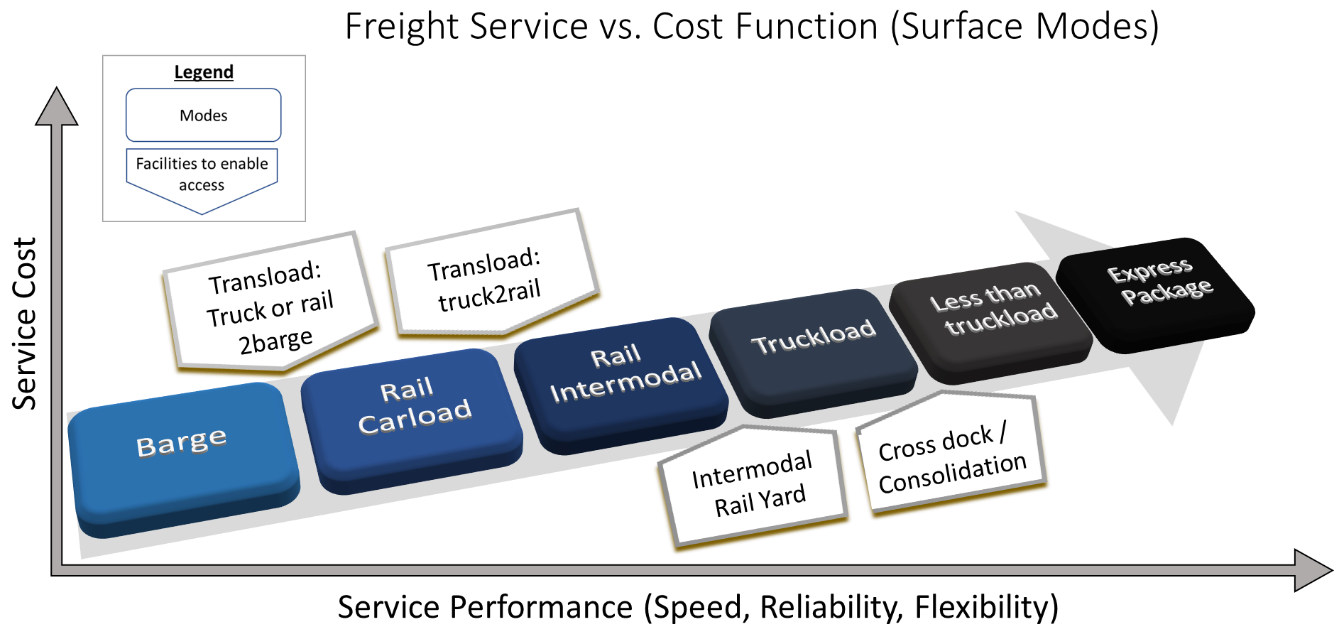
At an elementary level, optimization models can be defined as having four basic components.

a) ***Objective function***: The objective function defines what the model is attempting to optimize. Since supply chains include many links including inbound and outbound transportation, inventory, procurement and restocking, optimization functions can focus on one link or the entire supply chain network. For the FRSCOM model, the objective function is to minimize total transportation costs for shippers in the North Florida study area.
b) ***Model parameters***: Parameters are inputs to the optimization model. FRSCOM parameters include freight service demand and the existing infrastructure available to meet the demand (current and future). For example, FRSCOM does not include pipeline or air cargo network elements in the supply module.
c) ***Decision variables:*** A decision variable is a metric used by the optimization algorithm to make decisions about meeting the objective. For example, a potato chip company might have access to rail carload services, but the handling characteristics for carload products would likely damage potato chip shipments. So, one decision variable is the type of freight services that can meet freight demands of various products. For FRSCOM, the focus is on lowering costs associated with moving freight by surface transportation modes. Air cargo transport and pipeline transport are not modeled.
d) ***Constraints:*** Constraints in supply chain demand include operational constraints, such as the availability of modal services in a local area, or access to particular types of equipment, etc.

Using FRSCOM to Explore Network Opportunities: Green Field Analysis

The primary objective function of FRSCOM is to increase North Florida freight network efficiency through opportunities for reducing private sector freight expenditures. The commodity flow analysis shows that whether measured by volume or value roughly 90% of North Florida freight moves in trucks. In general terms, each freight transportation mode offers different levels of cost, speed, accessibility, and flexibility that shapes its service offering, market niche and cost. The graphic in Exhibit 18 shows a common spectrum of freight services across several modes. Competition between modes is greatest where service and price options are similar. Access to a particular more or service alters the ability to substitute one service for another, especially when initial capital costs are high.

Exhibit 18: Generic Modal Service Attributes and Cost



On the spectrum of freight services in the graphic above, trucking services fall between rail intermodal and express package: the combination of truck and air cargo. After reviewing results from the initial commodity analysis, the project team identified four "what-if" scenarios that test strategies for shifting demand from more costly services/modes to lower cost services/modes. Since most freight in Florida moves by truck, one type of cost reduction FRSCOM can analyze is whether better access to rail services can shift demand from long-haul truckload demand to rail demand. An often-used strategy for improving rail access is through transload services. Another strategy that can shift demand from less-than-truckload services to truckload services is a freight consolidation or cross-dock facility.

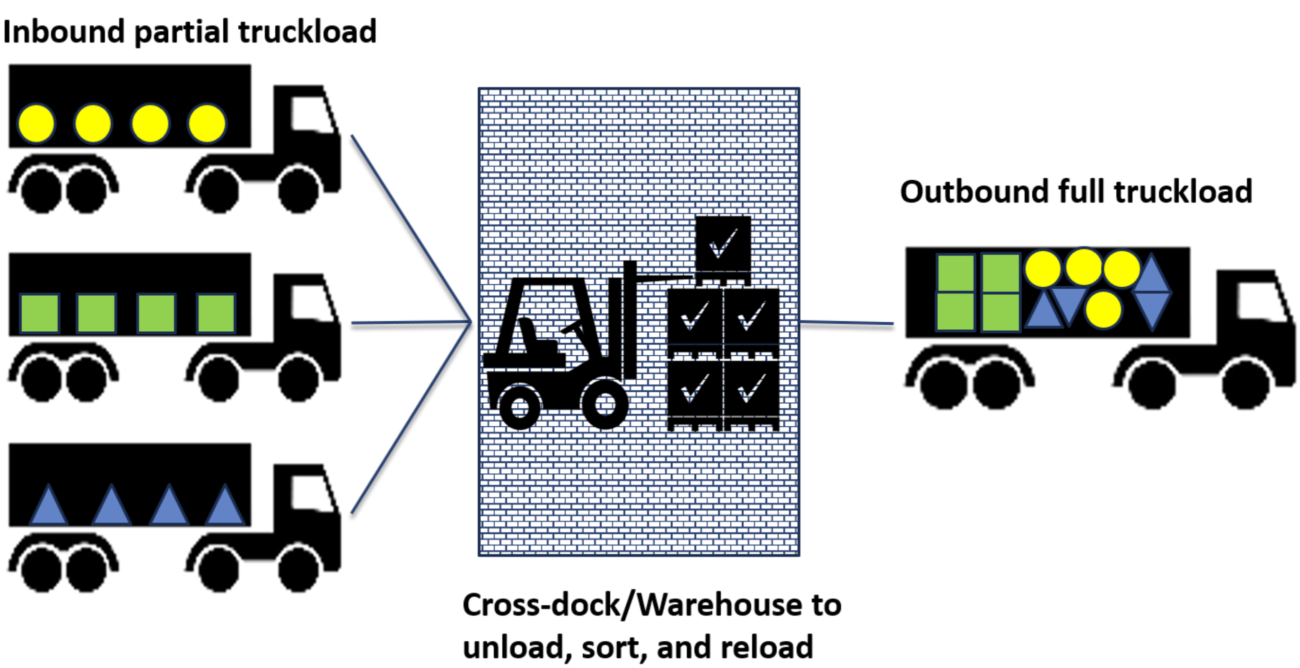
Each of the four scenario strategies is described in the following section. It is followed by results of a "green field analysis" for that strategy using FRSCOM. A green field analysis is an often-used initial step in facility location decisions. As the name implies it examines existing demand, in this case freight transport demand, without constraints on the existing multimodal networks. As it applies to North Florida it is used for identifying the best potential locations for implementing each scenario solution, based solely on current freight tonnages moving between counties in the study area and all other locations.

1. **Freight Consolidation / Deconsolidation**: This scenario analyzes commodities currently using trucking services in lanes where shipment data suggests that many loads are moving in trucks at less than full capacity. The scenario examines opportunities to consolidate commodities moving in partial truckload, partial container load or LTL (Exhibit 19). *Justification: Partial load or partial container rates can be 3-4 times higher that full truckload or full-container rates.* Cross-docking can be used in several logistics situations, including:

- *Transportation cross-dock*. Cross-docking is used to consolidate shipments from several suppliers (often in LTL batches) to FTL shipments, achieving economies of scale. Transportation companies sort and consolidate parcels and pallet loads based on geographic destination. The cross-docking services can be provided by a pure cross-docking service provider or owned and operated by a trucking company to offer more competitive rates to shippers.
- *Manufacturing cross-dock*. Cross-docking is used for the receipt, consolidation, and shipment of raw materials or component parts from many suppliers for TL shipments to a manufacturing plant.
- *Distributor cross-docking*. Multiple manufacturers ship merchandise to a common distributor's cross dock facility. The distributor assembles or partially assembles products on a multi-SKU (stock keeping unit) pallet before delivery to the next receiver in the supply chain.
- *Retail cross-docking*. Products from multiple suppliers are received at a retailer's distribution center, moved across the dock, and consolidated with other products bound for the same store. Wal-Mart delivers about 85% of its merchandises using a cross-docking system.

Because rates for dedicated door to door truckload service are typically much less that less-than-truckload (LTL) services, many shippers choose to contract for truckload services even though they may not be able to fill a truck or container on a consistent basis. LTL rates are higher because most LTL carriers maintain a regional or nationwide hub and spoke network. Cross-docking fills an often-overlooked gap in the market between dedicated truckload and the established networks of LTL carriers.

Exhibit 19: Representation of Freight Consolidation Scenario



Source Quetica, LLC.

North Florida Greenfield Analysis of Freight Consolidation

The parameters applied to the greenfield analysis were based on the commodity flow analysis and interviews with regional stakeholders during the discovery phase. Key parameters for the freight consolidation greenfield analysis are:

- Existing demand in tons, for shipments moving over 300 miles in dry van equipment
- Focus is on commodities considered acquiescent to being consolidated. For the study area these most probable commodities include food products, medical supplies, manufactured products, and mixed freight. The full list of commodities included in the consolidation scenario are highlighted in the green shaded cells of the following table (Exhibit 20).

Exhibit 20: In-Scope Commodities for Greenfield Analysis of Cross-dock Consolidation Scenario

SCTG	Commodity	SCTG	Commodity	SCTG	Commodity	SCTG	Commodity
01	Live animals/fish	12	Gravel	23	Chemical prods.	34	Machinery
02	Cereal grains	13	Nonmetallic minerals	24	Plastics/rubber	35	Electronics
03	Other ag prods.	14	Metallic ores	25	Logs	36	Motorized vehicles
04	Animal feed	15	Coal	26	Wood prods.	37	Transport equip.
05	Meat/seafood	16	Crude petroleum	27	Newsprint/paper	38	Precision instruments
06	Milled grain prods.	17	Gasoline	28	Paper articles	39	Furniture
07	Other foodstuffs	18	Fuel oils	29	Printed prods.	40	Misc. mfg. prods.
08	Alcoholic beverages	19	Coal-n.e.c.	30	Textiles/leather	41	Waste/scrap
09	Tobacco prods.	20	Basic chemicals	31	Nonmetal min. prods.	43	Mixed freight
10	Building stone	21	Pharmaceuticals	32	Base metals		
11	Natural sands	22	Fertilizers	33	Articles-base metal		

Based on FRSCOM outputs, five locations were identified as potential development locations for freight consolidation/cross docking facilities. First the model estimates the total truck tonnage attracted to a city/county location. The greenfield analysis then uses a derived market average of 30% of the total volume as the truck consolidation opportunity. Using an average payload of 21 tons for a full truckload in the study region, the estimated full truck count is presented in Exhibit 21. The goal of the greenfield analysis is to narrow the top potential candidates for the next round of optimization analysis.

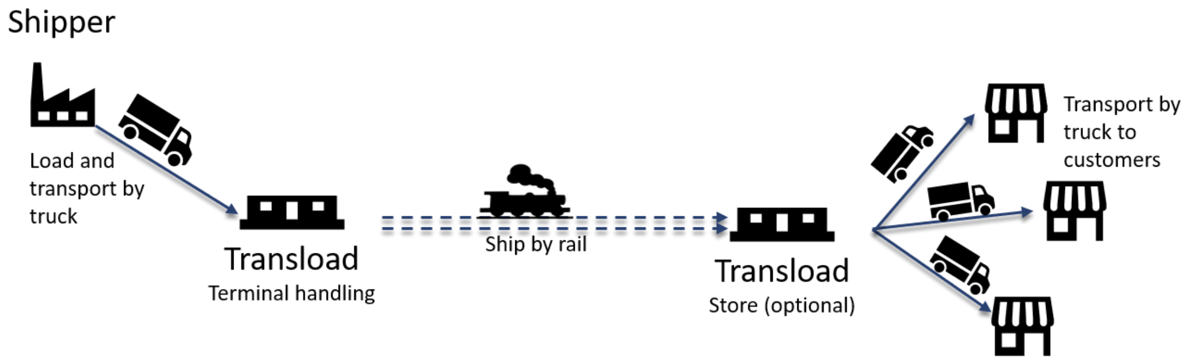
Exhibit 21: Top Locations from Greenfield Analysis of North Florida Cross-dock Scenario

Top City O/D	County	Est, Demand (million tons)	Estimated total truckloads
Bonifay/Chipley	Holmes County	3.2	152,526
Pensacola	Escambia County	2.8	133,460
Jacksonville	Duval County	2.4	114,395
Tallahassee	Leon County	2.3	109,628
Lake City	Columbia County	2.2	104,862

2. **Transload Analysis - Rail:** Transload facilities involve transferring non-containerized commodities from one mode to another. Transloading can be used to effectively leverage railroad services where shippers/receivers do not have direct rail access to their production or warehousing facilities.

Transloading works for many commodities such as construction products including lumber, metal products, and building materials; a variety of packaged bulk commodities such as agriculture and mining products; and special shipments that cannot travel their entire route by road. The greenfield analysis focus is on the potential volumes for truck-to-rail and rail-to-truck transloading for dry cargo commodities. The scenario targets high volume, non-containerized long-haul shipments currently moving on trucks more than 250 miles. This includes construction materials, rolled steel, grains and animal feeds, metallic ores, and scrap metal. An overview of the transloading process is presented in Exhibit 22.

Exhibit 22: Summary of End-To-End Truck To Rail Transload Process



Inbound	Process	Outbound	Description
↑	Load	↓	The commodity is loaded on a short-haul truck for delivery to a transload facility
	Transport by truck		The truck delivers the commodity to a transload facility, usually within 50 miles of origin.
	Transload		The commodity is loaded onto rail cars. This can be accomplished in many ways depending on the commodity. Transload facilities for bulk liquid commodities will have specialized bays where liquids are pumped through a pipeline to a rail tank car. Dry bulk commodities may use gravity, pneumatics, or a mechanical means to transfer from one mode to another. Forklifts, cranes, and other lifting equipment may be used for other commodities.
	Terminal handling		The loaded rail car will be spotted for pick up by a railroad carrier. Transload facilities may be served by a single railroad or multiple railroads. Multiple railroad carriers serving a transload facility offer the advantage of price competitiveness and routing options.
	Ship by rail		The loaded rail cars are routed to the transload facility near the destination, or may be delivered directly to the customer if they are rail served.
	Store (optional)		Sometimes, at the option of the customer (and when available) the transload will store the commodity on-site until the customer requests the material. Options may exist for either long- or short-term storage.
	Transport by truck		The commodity is transloaded to short-haul trucks for the final leg of the journey and the cycle is complete.

Source: Quetica and Iowa DOT (Iowa DOT, 2014b)

The transload greenfield market demand examines long-haul truck tonnage moving over 250 miles to and from study area counties with a focus on dry and liquid bulk commodities. The specific in-scope commodities are shown in the green highlighted cells of Exhibit 23.

Exhibit 23: In-Scope Commodities for Greenfield Analysis Of Truck/Rail Transload Scenario

SCTG	Commodity	SCTG	Commodity	SCTG	Commodity	SCTG	Commodity
01	Live animals/fish	12	Gravel	23	Chemical prods.	34	Machinery
02	Cereal grains	13	Nonmetallic minerals	24	Plastics/rubber	35	Electronics
03	Other ag prods.	14	Metallic ores	25	Logs	36	Motorized vehicles
04	Animal feed	15	Coal	26	Wood prods.	37	Transport equip.
05	Meat/seafood	16	Crude petroleum	27	Newsprint/paper	38	Precision instruments
06	Milled grain prods.	17	Gasoline	28	Paper articles	39	Furniture
07	Other foodstuffs	18	Fuel oils	29	Printed prods.	40	Misc. mfg. prods.
08	Alcoholic beverages	19	Coal-n.e.c.	30	Textiles/leather	41	Waste/scrap
09	Tobacco prods.	20	Basic chemicals	31	Nonmetal min. prods.	43	Mixed freight
10	Building stone	21	Pharmaceuticals	32	Base metals		
11	Natural sands	22	Fertilizers	33	Articles-base metal		

The Greenfield Analysis found the largest demand for truck-to-rail transloading services in Escambia County, including Pensacola. Its estimated 10.7 million tons equates to roughly 30,244 annual carloads. Columbia and Leon counties were both estimated to have over 9 million tons of demand.

Exhibit 24: Top Locations From Greenfield Analysis Of North Florida Truck/Rail Transload Scenario

Top City O/D	County	Est. Demand (million tons)	Estimated Total Car loads
Pensacola	Escambia County	10.7	30,244
Lake City/Live Oak	Columbia County	9.7	39,945
Tallahassee	Leon County	9.1	36,689
Panama City	Bay County	6.8	46,108
Bonifay/Chipley	Holmes County	6.6	26,609
Jacksonville	Duval County	5.0	20,159
Greenville	Madison County	4.7	18,949

It should be noted that during the development of the supply data module, a network analysis identified 21 existing transload facilities currently operating in North Florida. Many of the existing facilities are dedicated operations serving a single shipper or single commodity group. Among the products handled include aggregates, lumber and construction products, scrap metal and automobiles. During the next step in the process, the top locations from the greenfield analysis will be examined further to identify key commodities and trade lanes for expanded or new transload opportunities.

3. **Transload Scenario – Intra Coastal Barge:** In 2009 the I-95 Corridor Coalition, a group of 15 states including Florida applied to the USDOT Maritime Administration (MARAD) to designate the

coastal waters from Florida to Maine as a marine highway. The goal of the marine highway program is to expand the use of marine corridors through targeted investments.

In 2010 MARAD officially designated the coastal waters, inland navigation channels, ports, and harbors between Miami, Fl, and Portland, ME as the M-95 Marine Highway (Exhibit 25).

Exhibit 25: Map of the M-95 Marine Highway Corridor

Source: USDOT

The greenfield analysis also analyzed two portions of the M-95 corridor to examine the potential for moving freight flows off the heavily travelled I-95 landside corridors to water transport by intracoastal barge transport.

- The segment of the corridor from the NY/NJ/Philadelphia/Boston area and Jacksonville identified approximately 700,000 tons that could potentially move by intracoastal barge. Approximately 30% of the estimated volume currently moves by rail along the Atlantic Coast.
- An analysis also examined the corridor between Jacksonville and Fort Lauderdale/Miami. The analysis identified approximately 2.25 million tons of freight that could potentially move to barge. Less than 1% of that traffic currently moves by rail.

Discussions with several stakeholders about M-95 corridor potential indicated that previous attempts to move goods by the water route have struggled. In 2019, MARAD announced nine new Marine Highway program grants including $1.3 million to the Port of Fernandina to support a new barge service between the port and Charleston.

4. **Intermodal Service Scenario:** In private industry, "intermodal" refers to cargo that is containerized in steel boxes. Most international ocean containerized trade is done using 20 or 40-foot ISO containers.[12] "Domestic containers" used for inland transport by truck or rail are more often 48 or 53-foot containers. Domestic containers are used to maximize the cubic capacity of over-the-road tractor semitrailers for products that do not weigh-out, i.e., violate state and federal roadway weight limits. There are several variations to rail intermodal service that range from "piggy-back" service where semitrailers are loaded on to flatcars, to premium service involving double-stacking containers in well cars. Due to the higher productivity that double stack service provides, piggy-back services have been in decline and some analysts predict they may be phased out altogether over the next several years. Long-haul double-stack service is less expensive than truckload service because one train can move 200 containers whereas 200 trucks and drivers would be needed to move 200 highway truckloads. However, due to terminal in-gating, loading and off-loading containers onto the trains, interchanging trains, and drayage delivery, intermodal transit usually takes longer to complete than door to door truck delivery. Exhibit 26 shows examples of double stack and trailer on flatcar (TOFC) services.

Exhibit 26: Examples of Rail Intermodal Services

[12] ISO stands for International Standards Organization, an international body that establishes the dimensions for shipping containers used in international commerce.

For North Florida the intermodal service scenario focuses on commodities currently moving via truckload services to/from markets over 300 miles from study area locations. Traditionally, premium intermodal services are priced lower than truckload services, with comparable time schedules. Demand for the intermodal greenfield analysis used commodities in the green shaded groups of Exhibit 27.

Exhibit 27: In-Scope Commodities for Greenfield Analysis Of Rail Intermodal Service Scenario

SCTG	Commodity	SCTG	Commodity	SCTG	Commodity	SCTG	Commodity
01	Live animals/fish	12	Gravel	23	Chemical prods.	34	Machinery
02	Cereal grains	13	Nonmetallic minerals	24	Plastics/rubber	35	Electronics
03	Other ag prods.	14	Metallic ores	25	Logs	36	Motorized vehicles
04	Animal feed	15	Coal	26	Wood prods.	37	Transport equip.
05	Meat/seafood	16	Crude petroleum	27	Newsprint/paper	38	Precision instruments
06	Milled grain prods.	17	Gasoline	28	Paper articles	39	Furniture
07	Other foodstuffs	18	Fuel oils	29	Printed prods.	40	Misc. mfg. prods.
08	Alcoholic beverages	19	Coal-n.e.c.	30	Textiles/leather	41	Waste/scrap
09	Tobacco prods.	20	Basic chemicals	31	Nonmetal min. prods.	43	Mixed freight
10	Building stone	21	Pharmaceuticals	32	Base metals		
11	Natural sands	22	Fertilizers	33	Articles-base metal		

The Greenfield Analysis found the highest opportunity for intermodal demand to be in Bay County, including Panama City, with more than 20 million tons annually (Exhibit 28). This tonnage equates to 278,789 containers. Duval County had the second highest demand with 14.1 million tons, followed by Escambia County with 10.8 million tons.

Exhibit 28: Top Locations from Greenfield Analysis Of North Florida Intermodal Rail Scenario

Top City O/D	County	Est. Demand (million tons)	Estimated Total Containers
Panama City	Bay County	20.1	278,789
Jacksonville	Duval County	14.1	195,569
Pensacola	Escambia County	10.8	149,797

There are currently intermodal services offered in Mobile AL, approximately 60 miles from Pensacola. In addition, the Alabama Port Authority announced in January 2022 the purchase of 272 acres in Montgomery, Ala., to construct an inland container intermodal transfer facility there. Jacksonville also has three existing intermodal facilities. It is also unlikely that that both Pensacola and Panama City can both support intermodal facilities as they are only 100 miles apart.

Narrowing Candidates for Additional Analysis

Results from the green field analysis were presented to FDOT staff at a virtual project meeting in mid-August 2021. In addition to the quantitative analysis from the FRSCOM greenfield analysis, the consultant team also assembled a listing of industrial development sites and proposed freight projects that were uncovered during stakeholder outreach efforts with economic development and local government representatives. Following a review period FDOT requested the following potentials be moved to the next round of analysis:

1. Rail intermodal service in Bay County (Panama City area)
2. Truck/rail transload in Bay County (Panama City area)
3. Truck/rail transload in Escambia County (Pensacola area)
4. Freight consolidation/cross dock service in Escambia County (Pensacola area)
5. Truck/rail transload in Columbia County (Lake City area)
6. Truck/rail transload in Nassau County (Callahan area)

What-If Scenario Runs Using FRSCOM

"What-if scenarios" represent the next step in the winnowing process of using the FRSCOM for identifying opportunities to expand multimodal shipping options in the North Florida Region. Each scenario tests the market opportunity and cost impacts of adding a particular type of facility or service to the existing network. Unlike the greenfield analysis, the scenario analysis considers existing network constraints and makes assumptions about the level of cost savings required to entice shippers to make changes to their existing supply chain networks.

For each scenario a set of assumptions are presented that summarize thresholds or constraints applied to the scenario to represent real market decisions. For example, if a new service would save a prospective business only a few dollars per shipment on what might be hundreds or thousands of dollars in transportation costs, the shipper is unlikely to change their existing business practices. Therefore, the model is programmed to estimate the Total Market Opportunity (TMO) only if shippers are likely to see a significant cost saving. The costs for various service offerings and ancillary services such as drayage charges or handling charges are based on benchmarks created from private bill of lading or waybill records assembled for the project. Finally, during the scenario analysis the focus is on the TMO; later in the business case analysis the cost of a new or expanded facility is weighed against a percentage of the TMO to estimate a more realistic return on investment (ROI).

Rail Transload

The rail transload scenario is modeled to estimate the truck to rail conversion market for dry and liquid commodities at four locations: Bay County, Columbia County, Escambia County, and Nassau County. The TMO for each location is based on the estimated annual flows between origins and destinations at the county level when all of the following criteria are met:

- The modal shift to rail transload would result in a savings of at least $5 per ton after including a $8 per ton transload cost.
- The distance between origin and destination is over 250 miles: leveraging transload and rail carload services usually makes economic sense only for long haul shipments. (Note: What constitutes a "long-haul" is typically dictated by market conditions such as population density

and traffic congestion. The 250-mile threshold used is based on stakeholder feedback from the North Florida region.)

- The drayage distance used in the scenario is up to 50 miles. Longer dray movements can increase the market opportunity but will also increase the total shipment costs. As the drayage distance increases, costs increase and the likelihood that shippers will use the transload service decrease.
- The rail transload scenario is based on including a single drayage movement. The scenario assumes direct rail access on one end of the move.
- The average truck payload applied to truckload movements in North Florida is 20.98 tons (41,960 lbs.), based on analysis of 2017 CFS Public Use Microdata (PUM) File and private sector shipment data in the area.
- The average railcar payload is 87.62 tons (175,240 lbs.), based on analysis of the 2017 STB confidential rail waybill data in Florida.

The commodities considered for shifting to rail transload include both dry and liquid bulk commodities are shown in Exhibit 29.

Exhibit 29: Dry and Liquid Commodity Groups Included in Rail Transload Scenario

SCTG	Commodity	SCTG	Commodity	SCTG	Commodity	SCTG	Commodity
1	Live animals/fish	12	Gravel	23	Chemical prods.	34	Machinery
2	Cereal grains	13	Nonmetallic minerals	24	Plastics/rubber	35	Electronics
3	Other ag prods.	14	Metallic ores	25	Logs	36	Motorized vehicles
4	Animal feed	15	Coal	26	Wood prods.	37	Transport equip.
5	Meat/seafood	16	Crude petroleum	27	Newsprint/paper	38	Precision instruments
6	Milled grain prods.	17	Gasoline	28	Paper articles	39	Furniture
7	Other foodstuffs	18	Fuel oils	29	Printed prods.	40	Misc. mfg. prods.
8	Alcoholic beverages	19	Coal-n.e.c.	30	Textiles/leather	41	Waste/scrap
9	Tobacco prods.	20	Basic chemicals	31	Nonmetal min. prods.	43	Mixed freight
10	Building stone	21	Pharmaceuticals	32	Base metals		
11	Natural sands	22	Fertilizers	33	Articles-base metal		

Legend	(green)	=	Dry Bulk Transload Commodity Group
	(orange)	=	Dry and Liquid Bulk Transload Commodities

The results are presented using the largest freight activity centers/cities in each of the counties in the analysis. The TMO across the four locations total 14.1 million tons and represent potential transportation related savings of more than $707 million on an annual basis. Most of the estimated TMO is for dry bulk commodities which account for 13.1 million of the tons and $628.5 million of the savings versus 1 million tons and $79.3 million in savings related to liquid commodities. As can be seen in Exhibit 30, there are differences in the liquid commodity share across the four locations with Callahan experiencing the highest share with 17% of the liquid bulk commodity tons and 41% of the savings followed by Lake City with 8% and 9% respectively, and Pensacola and Panama City under 4% for both liquid tonnage and savings.

Exhibit 30: Dry and Liquid Commodity Tons And Savings By Site

The TMO for each of the four county/city locations is shown in Exhibit 31. Estimated volumes of freight flows across the four locations total 13.1 million tons. This equates to almost 150 thousand annual railcars or roughly 2,900 a week. The market opportunities are relatively balanced with Panama City accounting for 30%, Lake City and Callahan 25% each, and Pensacola 20% of the estimated transload market. From a cost perspective, transloading to rail as a substitute for long-haul truck services is estimated save shippers in the four combined markets more than $628.5 million a year. These savings represent a nearly 45 percent reduction over the baseline total of $1.4 billion shippers currently spend on truckload services. Looking at the savings by county, transloading could save the Callahan area 41% over baseline truckload costs, Lake City 46%, Panama City 43%, and Pensacola 49%.

Exhibit 31: Total Market Opportunity for Dry Commodities

	Callahan	Lake City	Panama City	Pensacola	Grand Total
Total Tonnage	3,338,190	3,233,714	3,974,631	2,562,229	13,108,764
Total Railcars	38,098	36,906	45,362	29,243	149,609
Weekly Railcars	733	710	872	562	2,877
Baseline Total Cost	$329M	$330M	$437M	$310M	$1,406M
Total Savings	$133M	$152M	$190M	$153M	$629M
Baseline Truck Ton-Mile	2.760B	2.072B	1.934B	1.576B	8.342B
Optimized Truck Ton-Mile	0.092B	0.114B	0.108B	0.046B	0.359B
Reduced Truck Miles	127M	93M	87M	73M	380M
Optimized Rail Ton-Mile	3.027B	2.319B	2.296B	1.797B	9.440B

If the commodity volumes identified in the data are converted to rail transport through transloading, they represent an opportunity to drastically reduce truck ton-miles on Florida highways. Across the four sites, converting goods from truck to rail via transloads would introduce 9.44 billion additional ton-miles to the rail network, while reducing the estimated 8.34 billion current truck ton-miles to roughly 360 million. Due to rail's ability to provide economies of scale to freight movements as compared to truck, the substitution of rail ton-miles for truck ton-miles provides public benefits through reduced emissions, less wear on Florida highways and bridges, and fewer truck related crashes.

Intra-Florida (Florida to Florida) movements would account for 58% of the nearly 150,000 estimated additional annual railcars in the TMO. The remaining top origin-destination pairs are shown in Exhibit 32. Florida to North Carolina is the top interstate lane with an estimated count of 4,451 railcars, followed closely by Alabama to Florida and Georgia to Florida. Reverse flows from North Carolina to Florida are estimated at 2,384 rail cars bringing the total additional lane volume between the two states to 6,835 rail cars.

Exhibit 32: Top Dry Origin to Destination Trade Lanes by Railcars

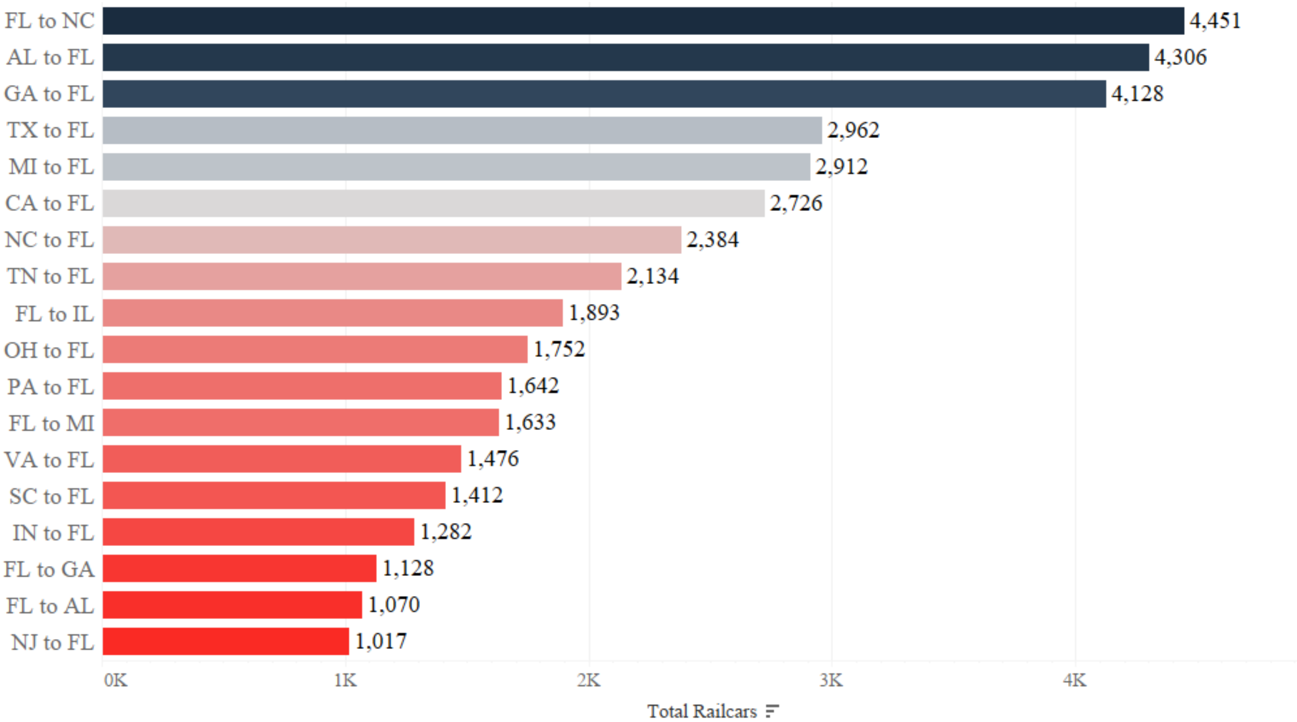


Exhibit 33 shows the TMO for dry bulk transload commodities identified in the scenario run for each transload scenario site by commodity group. The top six commodity groups, with more than 8.7 million tons, account for two-thirds of the estimated 13.1 million tons in total and two-thirds of the estimated total cost savings ($418 of the total $628.5 million). It is clear that aggregate materials represent the largest opportunity for truck to rail transload operations. The combined 5.147 million tons and $241.7 million in savings from Natural Sands and Gravel accounted for roughly 40% of the TMO's tons and 58% percent of the savings.

Amongst the four sites, Panama City has the largest opportunity with roughly 39% of the tons and 34% of the savings. While Lake City and Pensacola both represent a quarter of the aggregate volumes, savings accruing to Pensacola account for 35% of the total versus 26% for Lake City.

Logs represent the second largest opportunity, and particularly in Panama City with nearly 680 thousand tons worth an estimated $40.6 million in transportation cost savings. Other top opportunities include Motorized Vehicles in Callahan (818 thousand tons worth $35.6 million), Waste/scrap in Panama City

(276 thousand tons worth $17.5 million), and Plastics/rubber in Pensacola (281 thousand tons worth $13.9).

Exhibit 33: Dry Transload Commodity Savings and Tons by Location

SCTG	Product		Callahan	Lake City	Panama City	Pensacola	Total
11	Natural sands	Savings	$2.3M	$42.8M	$43.4M	$52.9M	$141.5M
		Tons	74.5K	833.0K	1,151.7K	784.3K	2,843.5K
12	Gravel	Savings	$11.2M	$19.7M	$38.0M	$31.4M	$100.2M
		Tons	510.3K	479.6K	831.8K	482.2K	2,303.9K
36	Motorized vehicles	Savings	$35.6M	$7.8M	$2.4M	$3.5M	$49.4M
		Tons	818.2K	167.8K	52.4K	63.7K	1,102.1K
25	Logs	Savings	$1.6M	$6.6M	$40.6M	$3.3M	$52.1M
		Tons	53.9K	170.9K	679.7K	88.8K	993.3K
24	Plastics/ rubber	Savings	$13.3M	$6.1M	$2.7M	$13.9M	$36.1M
		Tons	280.9K	149.7K	65.1K	281.4K	777.1K
41	Waste/scrap	Savings	$5.4M	$5.6M	$17.5M	$10.2M	$38.7M
		Tons	112.0K	141.1K	276.2K	176.9K	706.2K
32	Base metals	Savings	$8.5M	$8.0M	$3.6M	$3.3M	$23.4M
		Tons	264.3K	211.2K	80.4K	64.0K	619.9K
34	Machinery	Savings	$10.6M	$11.1M	$6.6M	$4.6M	$33.0M
		Tons	190.7K	204.7K	119.3K	77.6K	592.4K
33	Articles-base metal	Savings	$10.5M	$4.6M	$2.8M	$6.0M	$24.0M
		Tons	256.7K	92.4K	66.1K	94.1K	509.4K
40	Misc. mfg. prods.	Savings	$7.7M	$3.9M	$4.1M	$3.9M	$19.6M
		Tons	189.2K	79.7K	88.9K	74.1K	431.9K
02	Cereal grains	Savings	$0.9M	$3.8M	$11.4M	$3.6M	$19.7M
		Tons	32.6K	87.8K	198.1K	74.8K	393.3K
13	Nonmetallic minerals	Savings	$4.3M	$7.8M	$5.4M	$2.5M	$20.0M
		Tons	112.3K	129.5K	88.7K	49.1K	379.7K
06	Milled grain prods.	Savings	$8.6M	$6.3M	$2.6M	$2.3M	$19.9M
		Tons	142.9K	124.7K	51.0K	37.3K	355.9K
04	Animal feed	Savings	$2.3M	$5.0M	$3.4M	$3.0M	$13.7M
		Tons	45.8K	110.9K	80.1K	65.4K	302.2K
22	Fertilizers	Savings	$1.6M	$7.6M	$2.5M	$4.0M	$15.7M
		Tons	18.4K	118.5K	57.9K	61.7K	256.4K
20	Basic chemicals	Savings	$2.4M	$2.5M	$1.6M	$2.6M	$9.1M
		Tons	60.9K	66.4K	50.1K	52.8K	230.1K
23	Chemical prods.	Savings	$3.7M	$1.5M	$0.7M	$1.3M	$7.4M
		Tons	106.7K	39.3K	21.3K	23.4K	190.7K
14	Metallic ores	Savings	$1.3M	$0.3M	$0.0M	$0.0M	$1.7M
		Tons	41.8K	7.9K	0.6K	0.6K	51.0K
18	Fuel oils	Savings	$1.2M	$0.1M	$0.4M	$0.2M	$1.9M
		Tons	18.1K	3.6K	7.9K	3.4K	33.0K
10	Building stone	Savings	$0.1M	$0.5M	$0.4M	$0.4M	$1.4M
		Tons	1.7K	11.9K	7.3K	5.7K	26.6K

SCTG	Product		Callahan	Lake City	Panama City	Pensacola	Total
15	Coal	Savings	$0.1M	$0.1M	$0.0M	$0.0M	$0.2M
		Tons	6.4K	3.0K	0.1K	0.8K	10.3K

* The top savings and tons are highlighted

The TMO for liquid commodities is considerably less than dry, with results shown by location in Exhibit 34. Liquid commodities totaled just over 1 million tons and $79 million savings versus dry commodities' 13.1 million tons and $628.5 million savings. Would be Callahan transloads are responsible for roughly 58% of the liquid volume and nearly 70% of the transportation cost savings. By switching roughly 130 weekly long-haul truck movements with rail transload in Callahan, truck ton-miles would be reduced by more than 564 million to only 16.2 million. In total, the 220 weekly carloads would reduce truck ton-miles by 985 million.

Exhibit 34: Total Market Opportunity for Liquid Commodities

	Callahan	Lake City	Panama City	Pensacola	Grand Total
Total Tonnage	581,602	268,092	69,293	86,851	1,005,838
Total Railcars	6,638	3,060	791	991	11,480
Weekly Railcars	128	59	15	19	221
Baseline Total Cost	$90.0M	$35.0M	$9.0M	$14.1M	$148.0M
Total Savings	$54.8M	$14.0M	$4.0M	$6.6M	$79.3M
Baseline Truck Ton-Mile	580.89M	259.76M	68.64M	104.77M	1,014.05M
Optimized Truck Ton-Mile	16.15M	9.17M	1.76M	1.45M	28.54M
Reduced Truck Miles	26.9M	11.9M	3.2M	4.9M	47.0M
Optimized Rail Ton-Mile	643.14M	287.64M	76.96M	114.67M	1,122.42M

On a location and commodity basis, 70% of the Callahan TMO volume and 80% of the savings resides in Fuel Oils (Exhibit 35). The more than 407 thousand tons would equate to roughly 90 weekly carloads of traffic. While basic chemicals represent the second largest opportunity by volume with 161 thousand tons worth $6.5 million, chemical products represent the second largest opportunity for savings with nearly 160 thousand tons and $9.5 million in savings.

Exhibit 35: Liquid Commodity Tons and Savings by Location

SCTG	Product		Callahan	Lake City	Panama City	Pensacola	Grand Total
18	Fuel oils	Savings	$44,025,079	$4,098,531	$1,814,113	$3,968,868	$53,906,590
		Tons	407.9K	61.7K	16.5K	39.4K	525.6K
20	Basic Chemicals	Savings	$1,561,701	$3,176,574	$855,432	$954,431	$6,548,137
		Tons	32.8K	85.1K	26.8K	16.5K	161.2K
23	Chemical prods.	Savings	$6,194,662	$2,376,908	$474,165	$481,198	$9,526,933
		Tons	101.6K	40.1K	9.1K	8.4K	159.2K
24	Plastics/ rubber	Savings	$1,535,293	$516,459	$135,100	$641,602	$2,828,455
		Tons	21.5K	11.0K	3.3K	13.4K	49.2K
13	Nonmetallic minerals	Savings	$464,848	$1,046,327	$291,874	$198,318	$2,001,368
		Tons	7.7K	23.0K	6.5K	4.6K	41.8K
22	Fertilizers	Savings	$503,658	$1,860,706	$207,495	$193,784	$2,765,643
		Tons	4.0K	24.9K	3.1K	2.0K	34.0K
04	Animal feed	Savings	$489,813	$921,656	$171,044	$113,750	$1,696,262
		Tons	5.6K	21.8K	3.7K	2.3K	33.4K
41	Waste/ scrap	Savings	$27,535	$13,480	$6,837	$7,391	$55,242
		Tons	0.5K	0.5K	0.3K	0.2K	1.4K
Grand Total			$54,802,588	$14,010,641	$3,956,059	$6,559,343	$79,328,631
			581.6K	268.1K	69.3K	86.9K	1,005.8K

Rail Intermodal Scenario for Bay County

The intermodal scenario was modeled to estimate the TMO for intermodal services in Bay County. The commodities considered for shifting to rail intermodal are shown in Exhibit 36. TMO's account for estimated annual flows between origins and destinations at the county level based on the following criteria and assumptions:

- The modal shift to intermodal rail would result in a savings of at least $5 per ton.
- The distance between origin and destination is greater than 300 miles based on stakeholder feedback.
- The shipment cost is the door-to-door cost without the service charges. In the case of intermodal costs, the door-to-door cost includes truck drayage cost from origin to the origin intermodal ramp, the intermodal rail cost from the origin intermodal ramp to the destination intermodal ramp, and the truck drayage cost from the destination intermodal ramp to the final destination.
- The average container payload is assumed to be the equivalent of one full truckload. In Districts 2 and 3, the average payload is 20.98 tons (41,960 lbs.)
- New facility intermodal rates are assumed to be similar to existing Florida intermodal ramps.
- Dry and refrigerated commodities are included.
- Open competition in that if the cost is lower to use nearby existing intermodal ramps, the existing ramp is used. The new facility is only selected if the cost is lower going through the new ramp.

Exhibit 36: Commodities in Intermodal Scenario

SCTG	Commodity	SCTG	Commodity	SCTG	Commodity	SCTG	Commodity
1	Live animals/fish	12	Gravel	23	Chemical prods.	34	Machinery
2	Cereal grains	13	Nonmetallic minerals	24	Plastics/rubber	35	Electronics
3	Other ag prods.	14	Metallic ores	25	Logs	36	Motorized vehicles
4	Animal feed	15	Coal	26	Wood prods.	37	Transport equip.
5	Meat/seafood	16	Crude petroleum	27	Newsprint/paper	38	Precision instruments
6	Milled grain prods.	17	Gasoline	28	Paper articles	39	Furniture
7	Other foodstuffs	18	Fuel oils	29	Printed prods.	40	Misc. mfg. prods.
8	Alcoholic beverages	19	Coal-n.e.c.	30	Textiles/leather	41	Waste/scrap
9	Tobacco prods.	20	Basic chemicals	31	Nonmetal min. prods.	43	Mixed freight
10	Building stone	21	Pharmaceuticals	32	Base metals		
11	Natural sands	22	Fertilizers	33	Articles-base metal		

In should also be noted that while commodity categories or groups are sometimes used in more than one scenario, there is no overlap in the demand volumes between scenarios. For example, liquid tonnage from a commodity group in a particular trade lane assigned to the transload scenario would not be available as demand in the intermodal scenario.

Exhibit 37 shows the summary results from the Bay County/Panama City intermodal scenario. The scenario estimates that the TMO for an intermodal facility in Bay County is nearly six million tons; equivalent to nearly 280,000 filled intermodal containers, of which 52.6% of the demand is outbound and 47.4% is inbound. The FRSCOM also estimates that converting the entire available tonnage from truckload service to intermodal rail container, would reduce highway demand by 4.3 billion ton-miles, and result in savings to regional shippers of $355 million.

Exhibit 37: Intermodal Scenario Summary, Inbound and Outbound

Total Annual Tonnage	5,850K
Outbound Containers	146,716
Inbound Containers	132,112
Total Savings	$355M
Reduced Truck Ton-Miles	4.327B
Reduced Truck Miles	206M
Average LOH	1,109

The bar chart in Exhibit 38 shows the market demand for a Bay County intermodal facility by geographic region. The Southeast Region represents the largest share of the market opportunity with 2.48 million tons, more than 42% of the TMO. The Great Lakes region ranks second, with all other regions failing to exceed one million tons.

Exhibit 38: Bay County Intermodal Tonnage by US Region

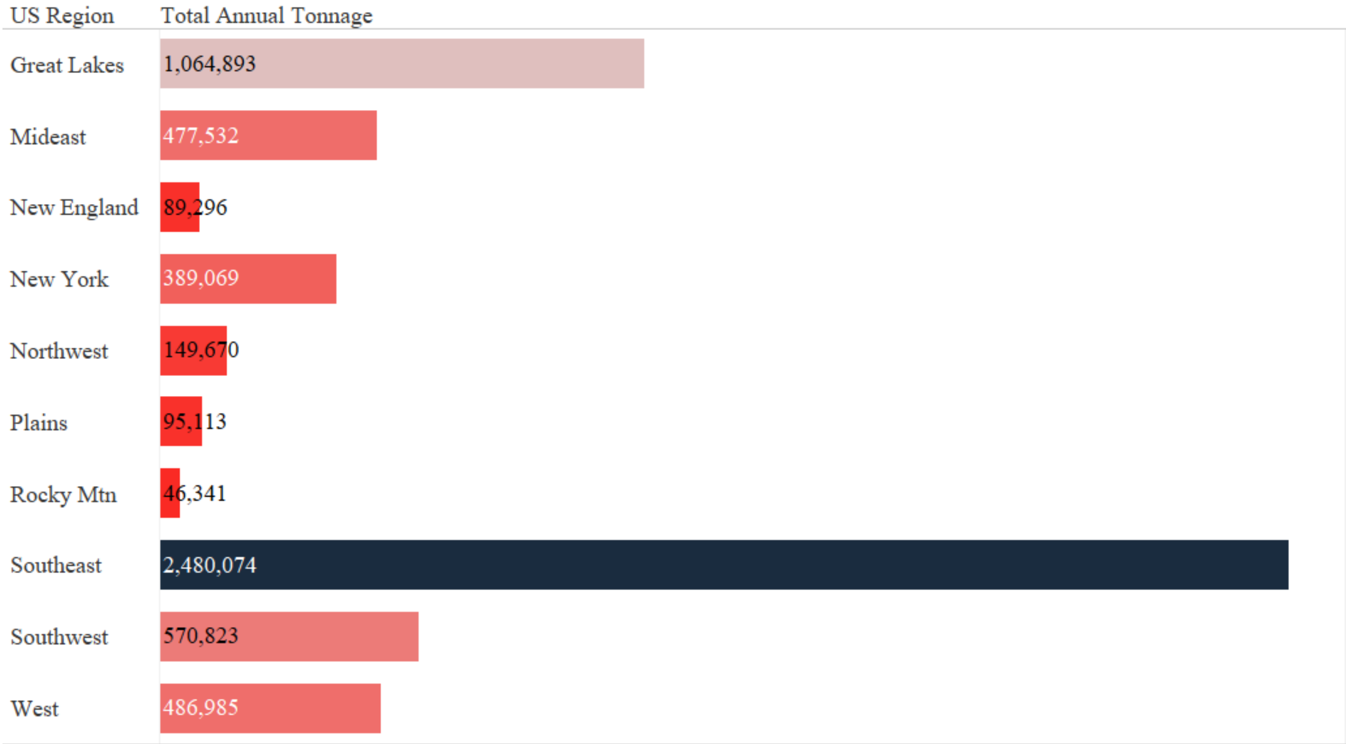
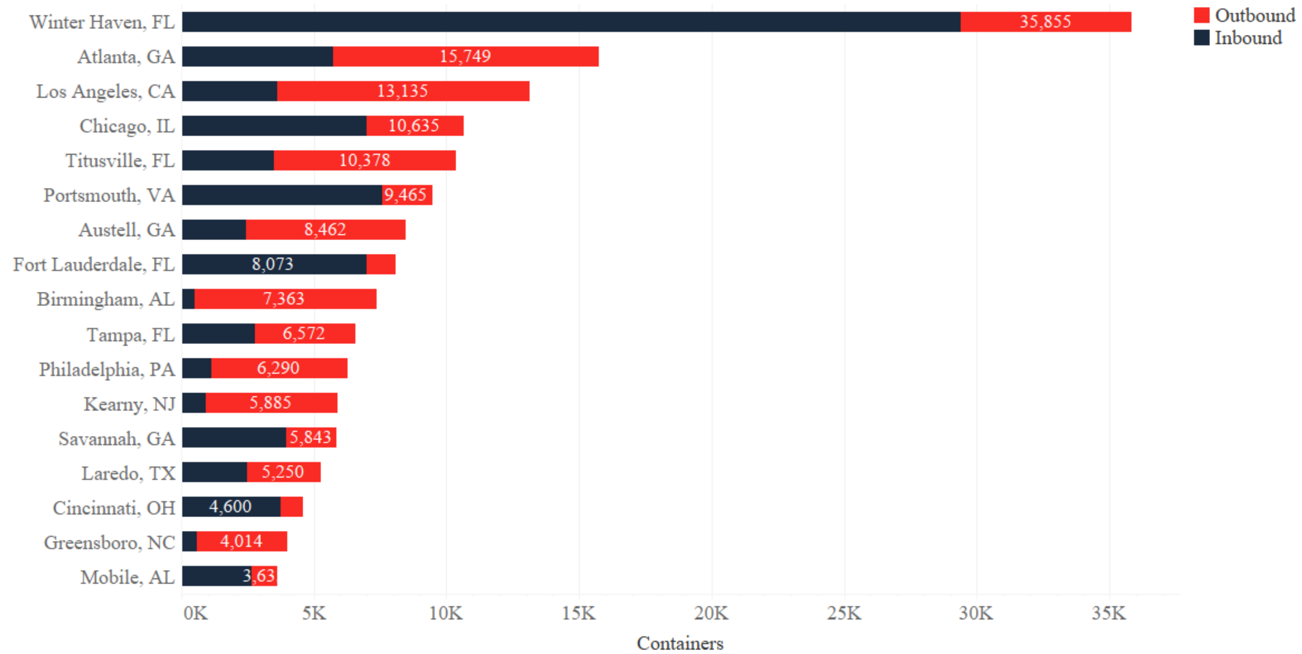


Exhibit 39 looks more specifically at key market areas for intermodal demand to and from Bay County. Winter Haven Florida is top market with 82% of the 35,855 containers being inbound to Panama City. Winter Haven's market opportunity represents roughly 13% of the 278,827 total containers.

Exhibit 39: Top Intermodal Markets for Bay County By Container Volume



In terms of transportation cost savings, the top three markets are all in Florida: Winter Haven, Titusville, and Tampa (Exhibit 40). The combined total savings for shifting truckload freight to rail intermodal is nearly $158 million, accounting for more than 44% of the TMO savings to shippers.

Exhibit 40: Top Intermodal Markets for Bay County by Total Savings In Transportation Costs

Market	Containers	Full Truckload	Intermodal	Total Savings
Winter Haven, FL	35,855	$172,383,980	$80,122,308	$92M
Atlanta, GA	15,749	$21,289,774	$15,868,381	$5M
Los Angeles, CA	13,135	$61,398,818	$45,904,187	$15M
Chicago, IL	10,635	$23,350,997	$13,538,299	$10M
Titusville, FL	10,378	$56,150,927	$22,542,414	$34M
Portsmouth, VA	9,465	$18,365,708	$13,663,274	$5M
Austell, GA	8,462	$11,721,573	$8,402,040	$3M
Fort Lauderdale, FL	8,073	$30,638,754	$23,435,874	$7M
Birmingham, AL	7,363	$11,788,750	$8,687,056	$3M
Tampa, FL	6,572	$46,702,002	$14,711,689	$32M
Philadelphia, PA	6,290	$20,264,074	$11,413,411	$9M
Kearny, NJ	5,885	$15,315,676	$9,842,894	$5M
Savannah, GA	5,843	$10,256,150	$7,274,561	$3M
Laredo, TX	5,250	$12,487,744	$8,491,358	$4M
Cincinnati, OH	4,600	$8,385,740	$5,376,125	$3M
Greensboro, NC	4,014	$8,515,284	$6,703,900	$2M
Mobile, AL	3,635	$5,339,229	$4,485,370	$1M

The market opportunity for converting truckload shipments to/from Bay County and Los Angeles, CA alone is estimated to reduce truck ton-miles by 561 million annually. Other sites with opportunities to reduce truck ton-miles by more than 100 million tons include Chicago, Winter Haven, Portsmouth, Kearny, and Philadelphia (Exhibit 41).

Exhibit 41: Top Intermodal Trade Lanes for Reducing Truck Ton-Miles (TTM)

Market	Containers	Baseline TTM	Optimized TTM	Optimized IM Rail Ton-Miles	Reduced TTM
Winter Haven, FL	35,855	275,979,282	96,671,997	346,781,514	0.179B
Atlanta, GA	15,749	121,444,499	54,283,048	123,346,068	0.067B
Los Angeles, CA	13,135	599,146,760	37,737,119	661,996,763	0.561B
Chicago, IL	10,635	217,915,043	37,319,151	211,890,949	0.181B
Titusville, FL	10,378	81,587,863	23,891,864	99,063,705	0.058B
Portsmouth, VA	9,465	168,717,538	14,920,655	169,226,653	0.154B
Austell, GA	8,462	65,225,935	26,012,482	69,330,170	0.039B
Fort Lauderdale, FL	8,073	97,127,290	20,633,283	109,518,206	0.076B
Birmingham, AL	7,363	56,568,339	26,868,672	45,958,306	0.030B
Tampa, FL	6,572	51,525,623	18,226,602	63,677,077	0.033B
Philadelphia, PA	6,290	136,338,231	17,833,256	147,171,852	0.119B
Kearny, NJ	5,885	145,195,119	12,679,144	147,780,895	0.133B
Savannah, GA	5,843	53,386,624	15,008,615	45,197,820	0.038B
Laredo, TX	5,250	100,669,173	14,848,206	125,019,259	0.086B
Cincinnati, OH	4,600	72,387,050	16,746,545	77,297,553	0.056B
Greensboro, NC	4,014	57,351,271	14,791,910	60,733,367	0.043B
Mobile, AL	3,635	25,677,251	15,362,318	21,371,458	0.010B

Exhibit 42: Equipment Type Volume, Dry and Reefer

The pie chart in Exhibit 42 shows the breakout of dry and refrigerated commodity demand by tonnage. Dry commodities represented 84% of the TMO and refrigerated commodities 18%. Exhibit 40 lists the dry commodity types in rank order by volume. Exhibit 43 provides the rank order of refrigerated commodities by volume.

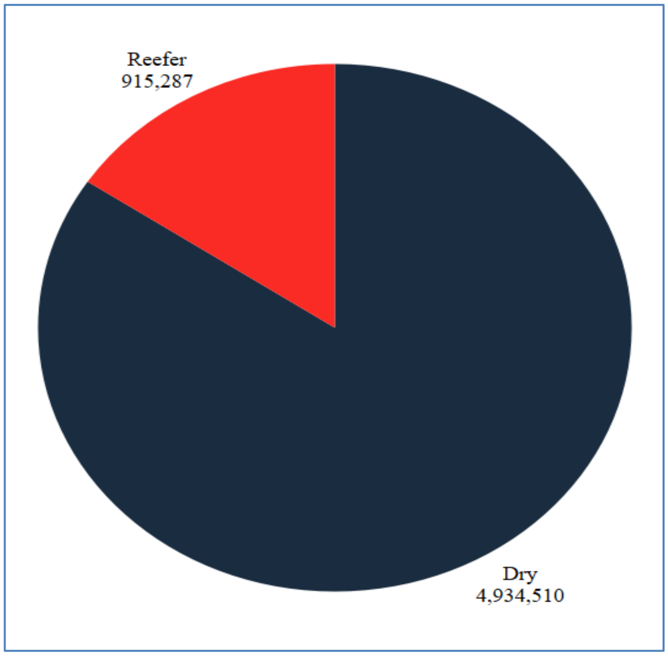


Exhibit 43: Dry Intermodal Commodity Volumes and Savings

SCTG	Product	Tonnage	Savings
31	Nonmetal min. prods.	548,108	$66,406,657
26	Wood prods.	508,121	$22,797,892
03	Other ag prods.	404,735	$38,282,454
07	Other foodstuffs	388,416	$22,956,301
34	Machinery	378,971	$18,224,684
43	Mixed freight	365,150	$13,140,559
24	Plastics/rubber	314,018	$12,771,028
41	Waste/scrap	237,526	$29,138,792
27	Newsprint/paper	219,877	$8,881,864
36	Motorized vehicles	194,976	$9,152,682
13	Nonmetallic minerals	178,688	$14,590,875
33	Articles-base metal	173,395	$10,049,952
06	Milled grain prods.	169,030	$8,178,870
39	Furniture	161,097	$8,602,461
04	Animal feed	150,399	$8,143,699
40	Misc. mfg. prods.	122,892	$8,506,133
30	Textiles/leather	119,294	$6,206,978
35	Electronics	91,764	$4,590,259
28	Paper articles	66,689	$2,461,970
38	Precision instruments	58,449	$3,522,586
21	Pharmaceuticals	25,621	$2,427,291
29	Printed prods.	24,971	$1,490,873
05	Meat/seafood	22,323	$892,841
37	Transport equip.	10,001	$333,748

The TMO for the top three refrigerated commodity groups totals 870,421 tons worth a potential $32 million in transportation savings to regional shippers (Exhibit 44). When combined with the dry TMO in the same commodity group, the total nearly reaches 1.7 million tons and savings worth more than $94 million.

Exhibit 44: Reefer Intermodal Commodity Volumes and Savings

SCTG	Product	Tonnage	Savings
07	Other foodstuffs	407,412	$14,586,588
03	Other ag prods.	311,785	$11,497,578
05	Meat/seafood	151,225	$5,986,399
06	Milled grain prods.	34,578	$1,135,306
21	Pharmaceuticals	7,991	$212,742
04	Animal feed	2,297	$93,894

Freight Consolidation / Cross Dock Facility for Escambia County

The final scenario modeled using FRSCOM examined the estimated market for freight consolidation services through a cross-dock facility in the Escambia County/Pensacola region of North Florida. The consolidation scenario examines the market for aggregating partial loads currently moving on long-haul truck dry van shipments. The commodities considered for truck consolidation include dry freight in the commodity groups highlighted in Exhibit 42. The TMO's account for estimated annual flows between origins and destinations at the county level under the following criteria and assumptions:

- The shift to truck consolidation services, including cross-docking and stop-off charges, would result in a savings of at least $400 per truck.
- The distance between origin and destination is greater than 300 miles.
- Partial truckload weight is between 10,000 and 30,000 lbs. Loads over 30,000 lbs. are assumed to be full truckload. Based on analysis of 2017 CFS Public Use Microdata (PUM) File and private sector shipment data in the area, it is estimated that 2.25 loads of partial truckloads can be consolidated into a full truckload.
- Approximately 15% of total truck volumes in Districts 2 and 3 are partial truckloads targeted for truck consolidation, based on analysis of 2017 CFS Public Use Microdata (PUM) File and private sector shipment data in the area.
- Partial truckloads within a 50-mile radius are included in the scenario run

The commodities considered for shifting to full truckload via consolidation are shown in Exhibit 45.

Exhibit 45: Commodities Included in Truck Consolidation Scenario

SCTG	Commodity	SCTG	Commodity	SCTG	Commodity	SCTG	Commodity
1	Live animals/fish	12	Gravel	23	Chemical prods.	34	Machinery
2	Cereal grains	13	Nonmetallic minerals	24	Plastics/rubber	35	Electronics
3	Other ag prods.	14	Metallic ores	25	Logs	36	Motorized vehicles
4	Animal feed	15	Coal	26	Wood prods.	37	Transport equip.
5	Meat/seafood	16	Crude petroleum	27	Newsprint/paper	38	Precision instruments
6	Milled grain prods.	17	Gasoline	28	Paper articles	39	Furniture
7	Other foodstuffs	18	Fuel oils	29	Printed prods.	40	Misc. mfg. prods.
8	Alcoholic beverages	19	Coal-n.e.c.	30	Textiles/leather	41	Waste/scrap
9	Tobacco prods.	20	Basic chemicals	31	Nonmetal min. prods.	43	Mixed freight
10	Building stone	21	Pharmaceuticals	32	Base metals		
11	Natural sands	22	Fertilizers	33	Articles-base metal		

Exhibit 46 shows the summary results from the Escambia County/Pensacola consolidation scenario. The scenario estimates that the TMO for a cross dock facility in Escambia County is just over one million tons; the equivalent of 43,375 full truckloads. While the TMO estimate is for both inbound and outbound freight, the consolidation focus is typically placed on outbound volumes. Inbound volumes assume that partial inbound truckloads would be consolidated at the origin location and would provide warehousing deconsolidation opportunities in Escambia County. The FRSCOM also estimates that the entire demand for consolidation/deconsolidation would result in savings to regional shippers of $99.4 million.

Exhibit 46: Truck Consolidation Scenario Summary, Inbound and Outbound

Total Annual Tonnage	1.015M
Full Truckloads	48,375
Baseline Cost	$224.3M
Optimized Cost	$124.9M
Total Savings	$99.4M

The bar chart in Exhibit 47 shows the market demand for an Escambia County consolidated freight volume by end market region. The rest of Florida beyond Districts 2 and 3 represent the largest share of the market opportunity with 826,942 tons, representing more than 81 percent of the TMO. The Great Lakes region ranks a distant second.

Exhibit 47: Truck Consolidation Tonnage by Region

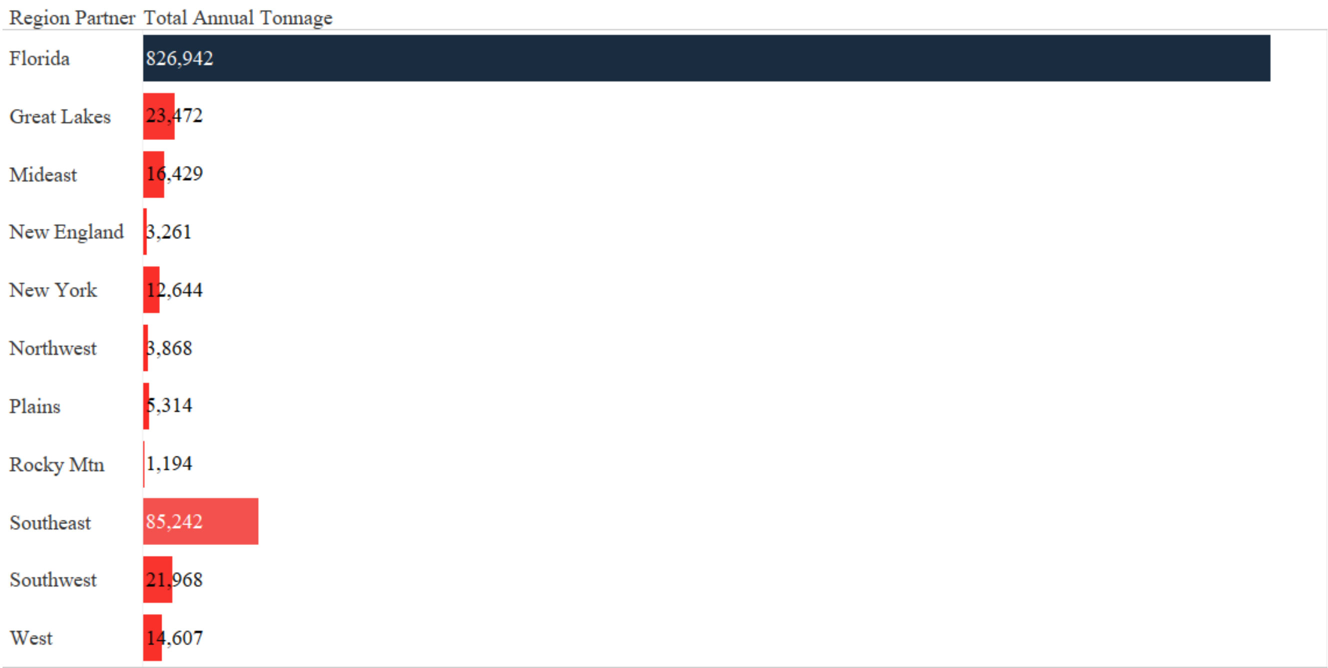
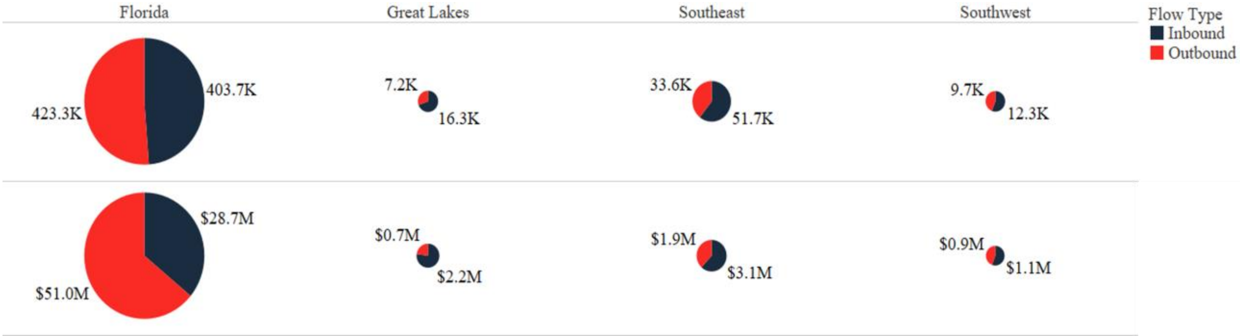


Exhibit 48 shows the division of outbound and inbound consolidation/deconsolidation volumes and cost savings by market region. While Florida volumes are essentially balanced between inbound consolidation opportunities and outbound, the transportation cost savings are weighted towards outbound consolidations with 64 percent of the opportunity.

Exhibit 48: Total Market Opportunity By Region And Flow Type



The table in Exhibit 49 shows the top freight consolidation demand markets by the estimated number of full truckloads, the estimated average length of haul, along with the current baseline cost by market and the optimized cost by market if the TMO is consolidated through cross-docking. Flows with the rest of Florida represent an opportunity to consolidate freight into more than 39,400 truckloads. These truckloads have an average length of haul of 494 miles and create a reduction in transportation costs to regional shippers of nearly $80 million annually.

Exhibit 49: Top Truck Consolidation Trade Regions

Region Partner	Full Truckloads	Average LOH	Baseline Cost	Optimized Cost
Florida	39,416	494	$180.7M	$101.1M
Southeast	4,063	482	$12.6M	$7.6M
Great Lakes	1,119	1,001	$6.2M	$3.3M
Southwest	1,047	758	$4.4M	$2.5M
Total	45,645	719	$203.9M	$114.5M

The table in Exhibit 50 lists the tonnage and estimated cost savings by commodity group. Nonmetallic Mineral Products is the top commodity by volume and value. The data estimates that 48 percent of the 256,000 total tons of Non-metallic Minerals are outbound flows. Consolidation of this outbound tonnage is estimated to result in shipper savings of nearly $15 million annually. Mixed Freight represents the second largest volume at 122,000 tons, but a majority of this freight; 64% is coming into Escambia County from other locations, resulting in just 43,000 tons available for outbound consolidation. Other Agriculture Products is the third largest freight consolidation commodity market with a market of 119,000 tons. Fifty-five percent of Other Agriculture Products are outbound movements, with potential savings from consolidation of $6.2 million annually.

Exhibit 50: Truck Consolidation Commodities, Tonnage and Savings

SCTG	Product	Total Tonnage	Total Savings
31	Nonmetal min. prods.	242,533	$21.5M
03	Other ag prods.	109,033	$11.6M

SCTG	Product	Total Tonnage	Total Savings
41	Waste/scrap	106,752	$10.8M
43	Mixed freight	93,963	$8.8M
26	Wood prods.	73,365	$7.7M
24	Plastics/rubber	44,419	$4.2M
07	Other foodstuffs	35,623	$3.8M
40	Misc. mfg. prods.	20,867	$2.0M
13	Nonmetallic minerals	17,203	$1.6M
33	Articles-base metal	15,254	$1.3M
04	Animal feed	14,593	$1.3M
39	Furniture	8,264	$0.7M
27	Newsprint/paper	6,476	$0.7M
35	Electronics	6,139	$0.5M
21	Pharmaceuticals	2,995	$0.3M
06	Milled grain prods.	2,845	$0.3M
28	Paper articles	1,821	$0.2M
29	Printed prods.	908	$0.1M
30	Textiles/leather	565	$0.1M
05	Meat/seafood	147	$0.0M
38	Precision instruments	66	$0.0M
	Grand Total	**803,834**	**$77.3M**

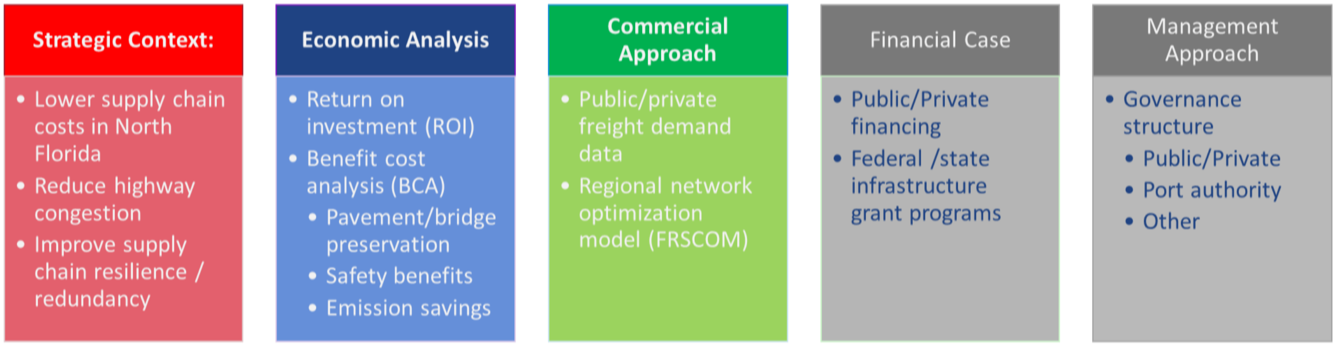
BUSINESS CASE ANALYSIS

A business case is generally interpreted as a written value proposition that presents the risks and rewards for undertaking a specific plan of action. The Association for Project Management defines a business case as: "*[The] justification for undertaking a project, program, or portfolio. It evaluates the benefit, cost and risk of alternative options and provides a rationale for the preferred solution.*"[13]

Some common elements of a business case are presented in Exhibit 48. For the FRSCOM project, and the value proposition presented in this tech memo, the focus is on the first three elements shown in Exhibit 51. The financial case and management approach are beyond the scope of the current project. The business case analysis presented in the remainder of this document focuses on analyzing the economic value measured by transportation cost savings versus an engineering-based approximation of the initial investment.

[13] Association for Project Management online: https://www.apm.org.uk/

Exhibit 51: Elements of the Business Case



Source: Quetica (adapted from Association for Project Management)

Rail Transload Business Case Analysis

As discussed previously, truck to rail transload scenarios were modeled to estimate the truck to rail conversion market for dry and liquid commodities at four locations: Bay County, Columbia County, Escambia County, and Nassau County. The TMO for each location is based on the estimated annual flows between origins and destinations at the county level when the rail transload criteria were met.

Dry commodity TMO for each of the four rail transload locations is shown in Exhibit 52. This equates to almost 150 thousand annual railcars, or roughly 2,900 a week. The market opportunities are relatively balanced with Panama City accounting for 30%, Lake City and Callahan 25% each, and Pensacola 20% of the estimated transload market. Rail transloading services are projected to save shippers an estimated $628.5 million a year across the combined scenarios. These savings represent a nearly 45% reduction over the $1.4 billion shippers currently spend on truckload services.

Exhibit 52: Dry Commodity Total Market Opportunity

	Nassau Co	Columbia Co	Bay Co	Escambia Co	
Metric	Callahan	Lake City	Panama City	Pensacola	Total
Total Tonnage	3,338,190	3,233,714	3,974,631	2,562,229	13,108,764
Total Railcars	38,098	36,906	45,362	29,243	149,609
Weekly Railcars	733	710	872	562	2,877
Baseline Total Cost	$329M	$330M	$437M	$310M	$1,406M
Total Savings	$133M	$152M	$190M	$153M	$629M
Baseline TTM	2.760B	2.072B	1.934B	1.576B	8.342B
Optimized TTM	0.092B	0.114B	0.108B	0.046B	0.359B
Reduced Truck Miles	127M	93M	87M	73M	380M
Optimized Rail Ton-Mi.	3.027B	2.319B	2.296B	1.797B	9.440B

Introducing Market Capture Rates

A market capture rate is a percentage (%) of the TMO that is likely to be converted from the current state (truckload services) to the optimized network state (rail transload, intermodal, or consolidation). Market capture rates based on similar real-world experiences serve to produce a more realistic, as well as a more fiscally conservative estimate of annual volumes and savings from the proposed network enhancement. Exhibit 53 shows the estimated tonnage, rail carloads and cost savings to regional shippers using 10% and 15% market capture rates. In other words, if expanded transloading services in the Panama City region captured just 10% of the existing truckload market, it would result in nearly 400,000 additional tons moving by rail, enough to fill 4,535 rail cars and save regional shippers approximately $19 million in transportation costs annually. Expanding rail transload services in Lake City and Pensacola would save regional shippers in those locations between $15 and $23 million, while savings for shippers in the Callahan region would total between $13.3 and $20 million depending on level of market converted from truckload to rail.

Exhibit 53: Annual Rail Transload Volumes and Savings – 10 & 15 Percent Capture Rate

Location	10 Percent Capture Rate			15 Percent Capture Rate		
	Tons	*Carloads*	*Savings*	*Tons*	*Carloads*	*Savings*
Callahan	333,820	3,810	$13,316,400	500,730	5,715	$19,974,600
Lake City	323,370	3,690	$15,191,300	485,060	5,535	$22,787,000
Panama City	397,460	4,535	$19,025,900	596,195	6,805	$28,538,900
Pensacola	256,220	2,925	$15,318,500	384,335	4,385	$22,977,800

Sketch-Level Cost Estimates for Transload Facilities In North Florida

For the transload business cases it is important to note that estimated transportation cost savings are projected as savings to regional shippers. During the initial business case development, "sketch-level" construction costs were developed for a North Florida rail transload site. At this point in the business case development process, many factors that influence a specific facility build out have not yet been determined, such as the exact location, current market conditions for construction material and labor, and so on. The analysis doesn't include facility operating revenue or operating expenses. In general, it is assumed that revenues from transload fees would be sufficient to support the ongoing operation.

Sketch-level cost estimates are derived from historical construction costs for similar facilities with adjustments made to reflect local conditions at any given point in time. The goal in producing cost estimates at this stage is to identify the most promising projects to move forward for a timelier and more specific site location when building an investment grade financial case. Engineering cost estimates for a North Florida transload facility were estimated with enough capacity to handle both transload volumes associated with capturing 10% and 15% of the TMO (Exhibit 54). These range from nearly $17.4 million to $23.4 million. Costs related to the site include:

- Site Costs – Assumes the acquisition of between 7 and 11 acres of land dependent on overall size, site clearing to remove trees and such, and earthwork to grade and cut and fill the site.
- Building Costs – office, warehouse, silo, heavy duty pavement, unpaved storage, and employee parking.
- Mode Costs – loading dock, truck scales, rail line, and rail turnout.
- Equipment Costs – car puller, conveyor system, crane, forklift, pallet jacks, wheel loader air compressor, and excavator.
- Contingency Costs – 40% of cost estimate to cover unanticipated costs or schedule delays.

Exhibit 54: Rail Transload Terminal Construction Sketch-level Costs Estimates

Facility Cost Item	Market Capture Rate	
	10%	15%
Site Costs	$395,100	$584,400
Building Costs	$8,921,800	$12,583,400
Mode Costs	$952,000	$1,406,400
Equipment Costs	$2,126,000	$2,126,000
Contingency Costs	$4,957,960	$6,680,080
TOTAL COSTS	**$17,352,860**	**$23,380,280**

Exhibit 55 summarizes the results of comparing projected cost savings to sketch-level construction costs for rail transload facilities. All four rail transload sites show strong ROI payback periods ranging from 0.82 for the Panama City location under the 15% market capture rate assumption to 1.30 for the Callahan location under the 10% market capture rate assumption. ROI ratios equal to one suggest investing in the facility would provide savings to regional shippers that would cover the cost of the original investment in one year. All sites showed smaller payback periods with the 15% market capture rates. The rail transload site in Panama City, with potential savings ranging from $19 to $28.5 million, shows the strongest payback with 0.91 years for the 10 percent market capture rate and 0.82 years for the 15%. The payback periods were almost identical for the Lake City and Pensacola locations.

Exhibit 55: Business Case Payback Periods for Four Rail Transload Scenarios

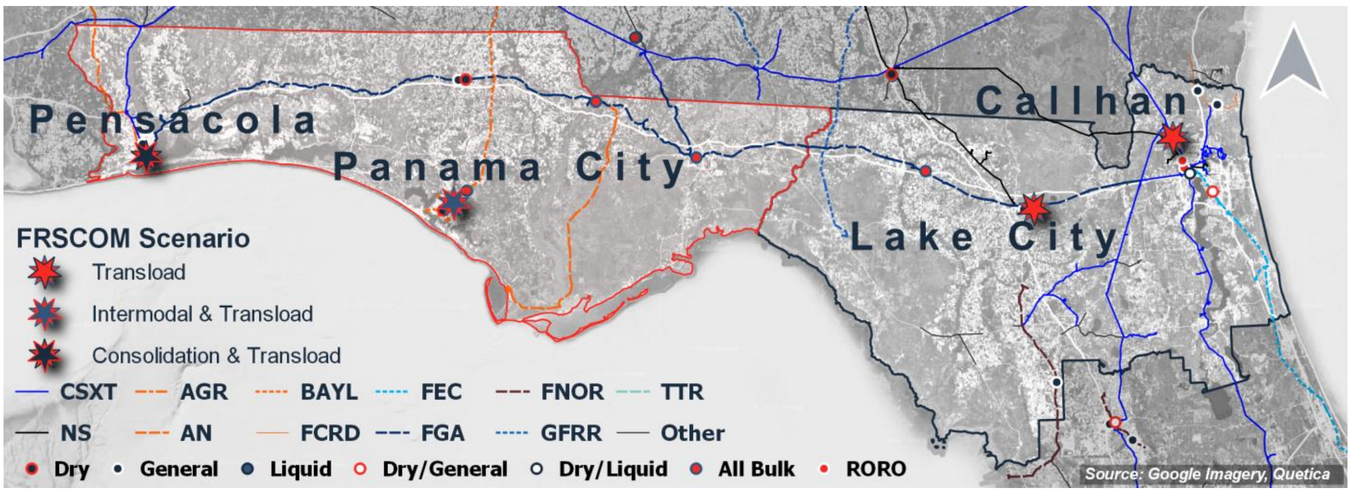
Location	Annual Carloads		Annual Savings		Investment		ROI Period	
Market Capture Rate	10%	15%	10%	15%	10%	15%	10%	15%
Callahan	3,810	5,715	$13.1M	$20.0M	$17.4M	$23.4M	1.30	1.17
Lake City	3,690	5,535	$15.2M	$22.8M	$17.4M	$23.4M	1.14	1.03

Panama City	4,535	6,800	$19.0M	$28.5M	$17.4M	$23.4M	0.91	0.82
Pensacola	2,925	4,385	$15.3M	$23.0M	$17.4M	$23.4M	1.13	1.02

Summary Findings and Stakeholder Feedback from Scenario Results

Aggregates make up a large share of the opportunity in the North Florida Region. There are currently a number of bulk transload facilities in the region that handle aggregates. For example, Anderson Columbia, a large roadway construction firm with headquarters in Lake City, operates nine rail facilities in the North Florida Region that handle aggregates. During initial interviews, bulk material shippers indicated they use rail, when possible, but noted that materials like aggregates are often viewed as low priority for railroads resulting in inconsistent service. Many of the existing transloads for bulk materials are company owned or dedicated to a single shipper. The map in Exhibit 56 shows truck to rail transload facilities in the North Florida Region.

Exhibit 56: Existing Truck Rail Transload Facilities and Proposed FRSCOM Nodes



During the post-scenario interviews, it was noted that many shippers make investments in temporary transload terminals near large projects, such as a major road construction project. Stakeholders also provided several messages regarding the marketability and demand for rail transload services, noting the short haul nature of many bulk commodities and the ongoing efforts by the trucking industry to raise size and weight limits to increase productivity. Some stakeholders believe the primary market presence of a single Class 1 rail carrier in North Florida inflates rail rates to the point where margins between truckload and rail service are thin.

Stakeholders noted that service constraints at JAXPORT result in motorized vehicles being trucked to South Florida. Some believed that the large volumes of transportation equipment moving by truck was likely from parts being railed to Mobile and then distributed by truck, to manufacturing facilities in North Florida and Southern Georgia.

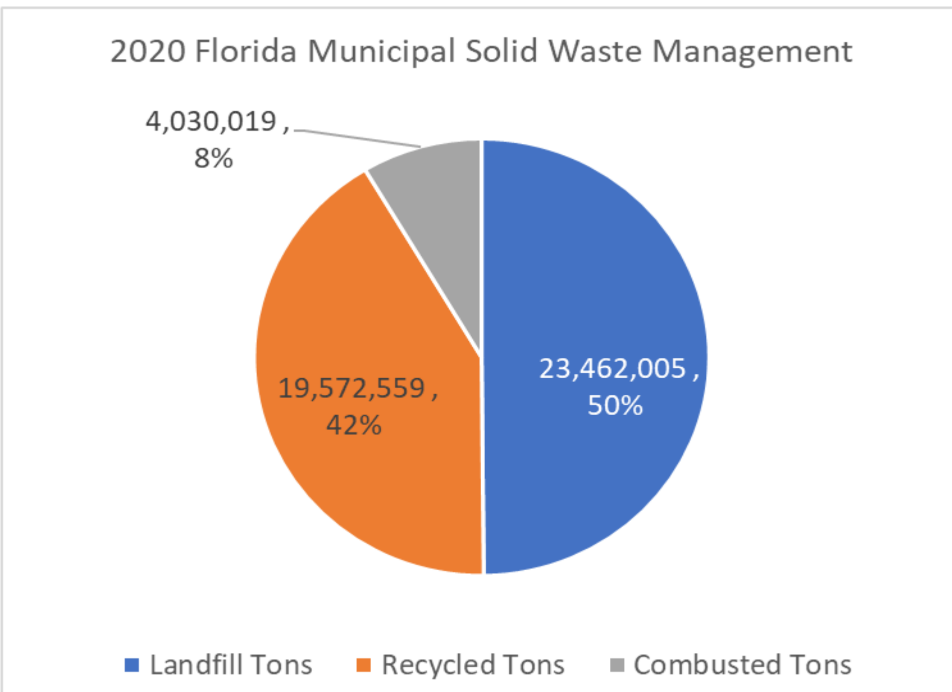
When asked about logs, several respondents noted that moving logs/timber by rail is challenging as the handling characteristics and equipment make it cost prohibitive. One respondent noted that they had investigated the log supply chain extensively noting that while many papermills closed after 2012, there are still seven pulp mills within about a 100-mile radius of Lake City. Two in Nassau County and two in Putnam as well as several in southern Georgia. These pulp mills support paper mills making tissue paper or cellulose products which are in high demand. As a result, the pulp market is competitive and the mills prefer to source pulp logs as close as possible to the mills, within a radius of about 160-miles. To make the logistics of log transloading to work, it was believed it would require a user of whole logs like a furniture manufacturer.

However, comments regarding the handling of lumber and other construction materials were far more positive. The Florida Office of Economic and Demographic Research (EDR) projects that Florida's population will grow by more than 300,000 residents per year through 2025. Robust population growth is likely to translate into strong demand for building materials.

Another area that stakeholders suggested warranted further investigation is waste and scrap materials, including municipal solid waste (MSW) and recycling. Stakeholders noted that large volumes of MSW leave the state on trucks, which is a big cost to the state.

Summary data from the Florida Department of Environmental Protection presented in Exhibit 57 shows that one-half of the state's solid waste goes into landfills, totaling more than 23 million tons.

Exhibit 57: The Disposition of Florida's Municipal Solid Waste In 2020



Source: Florida Department of Environmental Protection

More detailed data for the counties that make up FDOT Districts 2 and 3 is presented in Exhibit 58. With a population of nearly 4 million, the North Florida Region generated 7.8 million tons of MSW in 2020, of which nearly 5 million tons went into landfills. If all of that MSW were converted from trucks to rail through transloading, it would remove over 225,000 trucks from the highway and fill nearly 55,000 rail cars.

Exhibit 58: Municipal Solid Waste Data for Counties in FDOT Districts 2 And 3

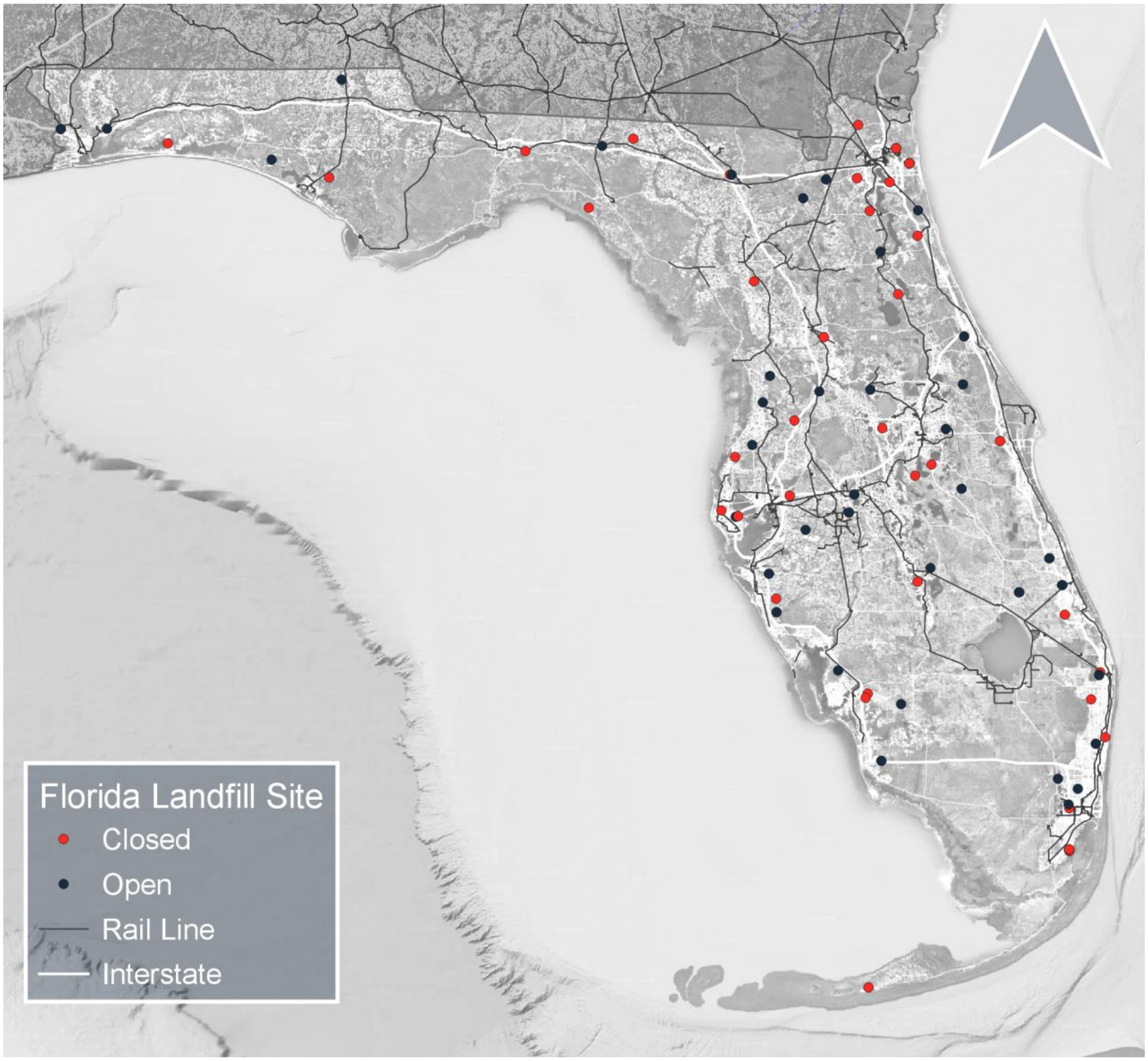
	District 2	District 3	North Florida Total
Population	2,228,152	1,488,536	**3,716,688**
Total MSW Collected Tons	4,743,962	3,105,481	**7,849,443**
Total MSW Tons Recycled	2,038,474	905,178	**2,943,652**
% Recycled	23%	17%	**20%**
MSW Tons Landfilled	2,649,641	2,133,823	**4,783,464**
% Landfilled	76%	82%	**79%**

Source: Florida Department of Environmental Protection

In a follow-up interview with stakeholders to discuss the market assessment data for the Columbia County location, the issue of MSW was revisited. Members of the consulting team made a phone inquiry with the Florida Department of Environmental Protection. The staff person said they rely on reports from each county on the disposition of MSW and assumed that if MSW was going into a landfill, it was a local landfill. A landfill database from US EPA, lists 109 landfills in Florida as shown in Exhibit 59. The EPA database shows that more than half of Florida's landfills have closed, with 53 remaining open. Other statistics from the Florida DEP show that of an estimated nearly 8 million tons of MSW produced in North Florida, approximately 80%, goes into landfills. While statewide about 50% of all MSW goes to landfills.

MSW is a commodity that could be moved out of Florida via rail through transload facilities seems to be a potential project for further examination. Population growth will continue to stress those landfills that remain open, and it is likely that in the future more waste will be moved to landfills outside of the state. Understanding the current life expectancy of existing sites could help determine where demand for MSW transportation services will be highest demand in the future.

Exhibit 59: Landfills in Florida by Status



Source: Environmental Protection Agency: https://www.epa.gov/lmop/project-and-landfill-data-state

Intermodal Business Case Analysis

In private industry, "intermodal" refers to cargo that is containerized in steel boxes and uses multiple modes. Intermodal is designed to capture the best of each mode by combining the economies of rail linehaul (with a much lower average cost per mile) with the flexibility of trucking for local drayage. Electronics, mail, food, paper products, clothes, appliances, textiles, and auto parts, all take a ride on the country's intermodal network.

Nearby access to an intermodal rail yard is crucial if companies are to leverage lower cost intermodal services. An intermodal rail yard is a facility where containers or trailers are transferred between truck and rail, or rail and truck. Transportation costs are optimized when goods travel long distance by rail and move locally by truck. Intermodal yards typically consist of loading tracks and paved areas to support lift equipment, truck movements and storage areas. A gate area, similar to a toll booth facility, is provided to control access to the yard and log vehicles in and out.

The FRSCOM was used to estimate the TMO for intermodal services in Bay County. The TMO is based on the estimated annual flows between origins and destinations at the county level when the intermodal scenario criteria were met.

Exhibit 60 shows the summary results from the Bay County/Panama City intermodal scenario. The scenario estimates that the TMO for an intermodal facility in Bay County is nearly six million tons; equivalent to just under 279,000 filled intermodal containers. Market capture rates are introduced to produce a more realistic and conservative estimate of annual volumes and savings from the introduction of additional intermodal services. It is estimated the Panama City Region would support between 584,980 and 877,470 tons per year, equating to 27,880 and 41,820 annual containers. The results suggest that introducing intermodal services in Panama City with a 10 percent capture rate would fill approximately 535 containers per week, enough to build more than two double stack intermodal unit trains per week. At a 15% capture rate, the volume is estimated to fill 800 containers or nearly four double stack intermodal unit trains per week. The associated savings to regional shippers range from $35.5 and $53.3 million per year.

Exhibit 60: Intermodal Scenario Summary with 10% and 15% Market Capture

	Total	Market Capture Rate	
		10%	15%
Total Annual Tonnage	5,849,800	584,980	877,470
Outbound Containers	146,716	14,671	22,006
Inbound Containers	132,112	13,211	19,816
Total Containers	278,828	27,882	41,822
Total Savings	$355 million	$35,526,400	$53,289,600
Reduced Truck Ton-Miles	4.327 billion	432 million	649 million
Reduced Truck Miles	206 million	20.6 million	30.9 million
Average LOH	1,109 miles		

Sketch level construction costs for a North Florida rail intermodal site in the Panama City Region were estimated through a combination of engineering estimates and the cost of comparable intermodal facility developments in the Southeastern U.S. The engineering estimates ranged from approximately $33.2 million to $41.1 million (Exhibit 61). A recent announcement of a CSX served intermodal facility in Montgomery Alabama was estimated to cost $54 million. To be conservative as possible, the estimated costs were rounded up to $35 million for a small intermodal facility and $50 million for a larger facility.

- Land costs – estimated at a cost of $56,845 per acre, for parcels of 56 and 66 acres.
- Building Costs – office, silo, heavy duty pavement, site utilities, and employee parking.
- Mode Costs – truck scales, new rail line, and rail turnout.

- Equipment Costs – car puller, C hook, conveyor system, gantry cranes, top loader container lifts, forklift, wheel loader air compressor, excavator, and roll clamp.
- Contingency Costs – 40% of cost estimate to cover unanticipated costs or schedule delays.

Exhibit 61: Intermodal Ramp Construction Costs Estimate

Facility Cost Item	Market Capture Rate	
	10%	15%
Land Costs	$3,665,433	$4,279,176
Building Costs	$9,103,682	$12,611,771
Mode Costs	$3,741,567	$4,642,706
Equipment Costs	$7,171,965	$7,814,265
Contingency Costs	$9,473,059	$11,739,167
Total Costs	$33,155,706	$41,087,085
Est. for ROI	**$35 million**	**$50 million**

Exhibit 62 shows the ROI for the Panama City rail intermodal site with investment payback between 0.99 and 0.94 years for the 10% and 15% capture rates, respectively. ROI ratios under 1.0 suggest investing in the facility would return the original investment in the form of savings from transportation costs to regional shippers in under a year.

Exhibit 62: Business Case Payback Periods for Intermodal Scenario

	Containers		Annual Savings		Investment		ROI Period	
Location	10%	15%	10%	15%	10%	15%	10%	15%
Panama City Intermodal	27,880	41,820	$35.5M	$53.3M	$35M	$50M	0.99	0.94

Summary Findings and Stakeholder Feedback from Scenario Results

The FRSCOM data and modeling effort found the highest TMO by volume were products in the *Non-Metallic Mineral* and *Wood Products* commodity categories. *Other Foodstuffs* and *Other Agricultural Products*, that utilize both dry and refrigerated containers, were also identified in the FRSCOM analysis as having significant volumes that currently move long distances on truckload services. Containerized waste and scrap also showed up as a large opportunity in terms of shipper savings, the third largest commodity group by savings in the scenario.

Stakeholders generally concurred with the results, noting the anticipated economic growth that is likely to accompany projected increases in population. When the results were discussed with stakeholders, a number of concerns were voiced, including how well the existing rail network aligns with the top origin-destination (O-D) pairs, making it likely that operations would require switching thereby raising costs, and reducing potential savings. Another challenge is filling outbound containers (loaded in but empty out) due to the lack of manufacturing in Florida. Stakeholders suggested that Florida is a difficult business environment because manufacturing has historically is less expensive in nearby southern states.

Truck Consolidation Business Case Analysis

The truck consolidation scenario analyzes commodities currently using trucking services in lanes where shipment data suggests that many loads are moving in trucks at less than full capacity. The scenario examines opportunities to consolidate freight moving in partial truckload, or partial container load, in the Pensacola region since partial load or partial container rates can be 3-4 times higher that of full truckload or full-container rates.

The FRSCOM was used to estimate the TMO for truck consolidation services in Escambia County. The TMO is based on the estimated annual flows between origins and destinations at the county level under criteria and assumptions previously presented for the cross-dock consolidation scenario. Exhibit 63 shows the summary results from the Escambia County/Pensacola consolidation scenario. The scenario estimates that the TMO for a cross dock facility in Escambia County is just over one million tons, or the equivalent of 43,377 full truckloads. While the TMO estimate is for both inbound and outbound freight, the consolidation focus is typically placed on outbound volumes. Market capture rates are used in conjunction with the TMO to produce a more realistic and conservative estimate of annual volumes and savings. It is estimated the Pensacola Region would support between 202,990 and 304,485 tons per year, (Exhibit 64), which equates to roughly 185 and 280 full truckloads per week. The associated savings to regional shippers range from just under $19.9 million and $29.8 million per year.

Exhibit 63: Truck Consolidation Scenario Summary, Inbound and Outbound

	Total	10% capture	15% capture
Total Tonnage	1,014,941	202,990	304,485.0
Full Truckloads	48,377	9,680	14,510
Baseline Total Cost	$224,299,869		
Optimized Total Cost	$124,869,630		
Total Savings	$99,430,240	$19,890,000	$29,835,000

Sketch level construction costs for a North Florida consolidation site in the Pensacola Region were estimated with capacity to handle consolidation volumes associated with capturing both 10% and 15% of the TMO. The estimated construction costs for a cross-dock facility range from $13.3 million to $18.6 million. Costs related to the site include:

- Site Costs – acquire between 3-4 acres, site clearing to remove trees and such, and earthwork to grade and cut and fill the site.
- Building Costs – enclosed warehouse, heavy duty pavement, site utilities, and employee parking
- Mode Costs – loading docks and truck scales.

- Equipment Costs – C hook, conveyor system, crane, forklift, pallet jacks, wheel loader air compressor, excavator, and roll clamp.
- Contingency Costs – 40% of cost estimate to cover unanticipated costs or schedule delays.

Exhibit 64 presents the ROI for a Pensacola truck consolidation site. The payback period for a cross-dock facility is between 0.67 years and 0.62 years using the 10% and 15% capture rates, respectively. These low ROI ratios mean the annual savings are greater than the initial costs to make the investment.

Exhibit 64: Business Case Payback Periods for Truck Consolidation Scenario

	Full Truckloads		Savings		Investment		ROI Period	
Location	10%	15%	10%	15%	10%	15%	10%	15%
Pensacola Consolidation	9,680	14,510	$19.9M	$29.8M	$13.3M	$18.6M	0.67	0.62

Summary Findings from Scenario Results

Because the focus of the post scenario stakeholder feedback was on rail connectivity, there was only one stakeholder group that reviewed the freight consolidation scenario. Overall, they liked the strategy and would be interested in a consolidation scenario for the Lake City Region. The strategy was not discussed at this point with anyone from the Pensacola Area.

The rest of Florida beyond Districts 2 and 3 represent the largest share of the market opportunity with 826,942 tons, representing more than 81% of the TMO. While Florida volumes are essentially balanced between inbound consolidation opportunities and outbound, the transportation cost savings are weighted towards outbound consolidations with 64% of the opportunity.

CONCLUSIONS AND RECOMMENDATIONS

The table in Exhibit 65 shows the combined ROI results for all six scenarios examined in greater detail as part of the FRSCOM initial effort. All of the scenarios examined presented very strong ROI metrics based upon the initial facility investment costs assembled. The consolidation scenario in the Pensacola region shows the best ROI among the six facilities examined, based on initial facility costs, followed by the transload and the intermodal scenarios in the Panama City region.

While the case for an intermodal rail facility in the Bay County/Panama City Area appear strong, railroad officials were more reserved in their outlook for additional intermodal services in the North Florida market, with lane imbalance noted as a significant concern. In addition, Bay County is only served by a short line railroad. The short line would have to reach an interchange agreement with CSX to provide intermodal services in the area. Currently CSX an existing intermodal terminal in Mobile, AL, 180 miles west of Panama City. And, in early February of 2022, CSX and the Alabama Port Authority announced a new intermodal facility will be developed in Montgomery, AL 180 miles to the north of Panama City.

Among the four transload scenarios examined, Panama City had the strongest ROI, however follow-on interviews with railroads and developers suggest that some of the bulk commodities the data suggests would be strong markets may have marketplace realities that diminish the TMO in some cases. However, it was also suggested that more market competition in rail services might increase the margin between truckload and rail carload, expanding the market for transload facilities further.

Exhibit 65: Summary Table for North Florida FRSCOM Business Case Analysis

Scenario	Annual Carloads/ FTLs/Containers		Annual Savings		Investment		ROI Period	
Capture Rate	10%	15%	10%	15%	10%	15%	10%	15%
Callahan Transload	3,810	5,715	$13.12M	$19.97M	$17.4M	$23.4M	1.30	1.17
Lake City Transload	3,690	5,535	$15.19M	$22.79M	$17.4M	$23.4M	1.14	1.03
Panama City Transload	4,535	6,800	$19.03M	$28.54M	$17.4M	$23.4M	0.91	0.82
Panama City Intermodal	27,880	41,820	$35.50M	$53.30M	$35M	$50M	0.99	0.94
Pensacola Transload	2,925	4,385	$15.32M	$22.98M	$17.4M	$23.4M	1.13	1.02
Pensacola Consolidation	9,680	14,510	$19.90M	$29.80M	$9.5M	$13.3M	0.67	0.62

One commodity group that appears to make a strong case for further investigation is MSW. The current system for tracking MSW sent to landfills appears to lack specificity regarding whether the final disposition is to local landfills or whether significant volumes may be trucked long distances to landfills located out-of-state.

In summary, it is important to note that the “What-if” scenarios tested only represent potential opportunities and were developed to present the application of the FRSCOM and its abilities. In other words, the FRSCOM represents an evaluation tool used to evaluate the private sector-based freight and supply chain business opportunities. These opportunities translate into economic development outcomes as well as positive impacts to the use, maintenance, and life-span of public infrastructure.

It is this direct relationship between public infrastructure and private sector use of the infrastructure that offers Florida the opportunity to evaluate and growth the freight and logistics industry as well as the related manufacturing and support industries. Future use of the FRSCOM by economic development entities such as Enterprise Florida, Inc. as well as regional and local entities represents the on-going benefits for this tool.