SWOT Analysis of TRANSEARCH and FAF Data

March, 2016

Prepared For:

FDOT

INTENTIONALLY LEFT BLANK

SWOT Analysis of TRANSEARCH and FAF Data

March, 2016

Project No.:
TRANSTAT TWO 7

Contract No.:
C9B48

Prepared by RS&H, Inc. at the direction of Transportation Statistics Office of the Florida Department of Transportation

FDOT

INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

BEA	Business Economic Analysis
BEBR	Bureau of Economic and Business Research
BMI	Business Market Insights
BTS	U.S. Bureau of Transportation Statistics
CBP	County Business Patterns
CERA	Cambridge Energy Research Associates
CFS	Commodity Flow Survey
DOE	U.S Department of Energy
EIA	Energy Information Administration
FAF	Freight Analysis Framework
FAF3	Freight Analysis Framework Version 3
FDOT	Florida Department of Transportation
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FMTP	Florida Mobility and Trade Plan
FTD	Foreign Trade Division
FTP	Florida Transportation Plan
GDP	Gross Domestic Product
GIS	Geographic Information Systems
IHS	IHS-Global Insight
I/O	Input/Output
IPF	Iterative Proportional Fitting
LLM	Log-Linear Modeling
LNG	Liquefied Natural Gas
MSW	Municipal Solid Waste
NAICS	North America Industry Classification System
NEC or n.e.c	Not Elsewhere Classified
NG	Natural Gas
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
O-D	Origin-Destination
OOS	Out-of-Scope
PADD	Petroleum Administration for Defense Districts
PEIRS	Port Import Export Reporting Service
QA/QC	Quality-Assurance/Quality-Control
SIS	Strategic Intermodal System
STB	Surface Transportation Board
STCC	Standard Transportation Commodity Code
TAZ	Traffic Analysis Zone
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
VIUS	Vehicle Inventory and Use Survey
WIM	Weight In Motion

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

INTENTIONALLY LEFT BLANK

This report examines the strengths, weaknesses, opportunities and threats (SWOT) of two major commodity flow datasets: the IHS-Global Insight (IHS) TRANSEARCH dataset purchased by the Florida Department of Transportation (FDOT) for the year 2011 and the Federal Highway Administration's (FHWA) Freight Analysis Framework (FAF) dataset.

E.1 DATA OVERVIEW

The Freight Analysis Framework and TRANSEARCH commodity flow datasets are used to help answer questions regarding freight movements. This includes the amount of freight produced or consumed, the origin-destination patterns, and modes used. The Freight Analysis Framework dataset is a free product that is developed by the Federal Highway Administration. It was last updated in 2007 with a provisional update available for 2012. A new version, FAF4, with 2012 base year data was released on October 14, 2015. Additional publications within this version, including new provisional estimates, network and truck assignments, and regional forecasts to 2045 are scheduled to be delivered in spring, summer, and winter of 2016. TRANSEARCH is proprietary; the most recent Florida purchase was made for 2011 TRANSEARCH data by the Florida Department of Transportation.

Generally speaking, Freight Analysis Framework contains more information for the U.S. in its entirety and it is best suited for inter-state or multi-state analysis. The TRANSEARCH data were developed for and customized specifically for Florida – so, TRANSEARCH contains very detailed information for Florida, More commodities are covered in Freight Analysis Framework while TRANSEARCH has more detail on the commodities that are included. The Freight Analysis Framework contains more modes (in particular, pipeline) but has less detail on sub modes. In contrast, TRANSEARCH distinguishes among sub modes such as truckload vs. less-than-truckload.

E.2 DATA CONSTRUCTION AND LIMITATIONS

The Freight Analysis Framework dataset is based primarily on the 2007 Commodity Flow Survey (CFS), which is estimated to cover about two-thirds of all commodity movements. About one in seven freight-heavy U.S. businesses are surveyed as part of the 2007 Commodity Flow Survey. The sample is gathered primarily from the Manufacturing and Wholesale sectors. Log-linear modeling and iterative proportional fitting are used to enhance the sample. Additional flows are developed for several other industries and commodities including Crude Petroleum, Agriculture and Moving (Household and Business). Rail, air and water information is supplemented with data collected in regulatory processes.

The TRANSEARCH data are based primarily on commodity production estimates from the county-level IHS-Global Insight's Business Market Insights (BMI) economic models along with carrier origin and destination (O-D) data from the Motor Carrier Data Exchange. Rail, air and water information is derived from data collected in regulatory processes. Additional flows are developed for several other industries and commodities including Minerals and Automobiles. Proprietary data from other IHS-Global Insight divisions is used to further enhance the table. Socioeconomic data such as Infogroup is used to apportion flows from the county to the Traffic Analysis Zone (TAZ) level.

Both datasets have the following limitations:

- They rely on data samples, which may lack information for certain industries, geographic areas, or commodities;
- They use modeling processes in which uncertainty is inherent;
- Assumptions and judgment are intrinsic to the estimation process, introducing additional uncertainty.

Because of these limitations, the data should not be treated as factual information but as estimates. It is good practice to present and describe analysis results as estimates. It is also good practice to check the flow estimates against other sources such as truck counts at Weight In Motion (WIM) stations.

E.3 USER GUIDANCE

This section indicates which dataset to use for various instances (*Table E-1*):

TABLE E-1: FAF AND TRANSEARCH USER GUIDANCE SUMMARY

	TYPE OF INSTANCE/SCENARIO	DATASET TO USE: COMMENTS/DESCRIPTION OF DATASET	
		FAF	TRANSEARCH
ANALYSIS FOR THE STATE OF FLORIDA	The state in its entirety	Yes, FAF provides coverage for entire state.	Yes, TRANSEARCH provides coverage for entire state.
	Subarea of the State	FAF is an option but must be disaggregated (see Case Studies in Chapter 5). While the FHWA does not recommend using FAF for subareas of the state, it is possible and sometimes FAF is the only source for the desired information (such as pipeline flows).	TRANSEARCH can be used to analyze flows for any subarea of Florida down to the TAZ level.
	Specific water ports, airports, or rail yards	It is possible to use FAF but, since the FAF zones are large, disaggregation should be used to estimate flows at specific points. PIERS and BTS air data are examples of datasets to use for this.	TRANSEARCH provides the appropriate geographic resolution for this.
	Truck, Rail, Air and Water	Yes, FAF provides coverage for these modes.	Yes, TRANSEARCH provides coverage for these modes.
	Pipeline	Yes, FAF provides coverage for pipeline data.	No, TRANSEARCH does not provide coverage for pipeline data.
	Multiple modes & mail	Yes, FAF provides coverage for Multiple modes & mail data.	Yes, TRANSEARCH does provide coverage for Multiple modes & mail data. But, is not included in the 2011 data purchased.

TABLE E-1: FAF AND TRANSEARCH USER GUIDANCE SUMMARY CONTINUED…

	TYPE OF INSTANCE/SCENARIO	DATASET TO USE: COMMENTS/DESCRIPTION OF DATASET	
		FAF	TRANSEARCH
ANALYSIS FOR THE STATE OF FLORIDA	Truck and rail sub-modes (eg. Truckload vs. less-than-truckloads)	No, FAF does not have sub-modes detail. Therefore, assumptions would have to be made for percentages in each sub-mode.**	Yes, TRANSEARCH has the details by sub-modes.
	Logs, crude petroleum, live animals/fish, waste/scrap, household & business moves, and construction debris	Yes, FAF has the details for these commodities.	No, TRANSEARCH does not have details for these commodities.
	Secondary traffic (trips from warehouses and distribution centers)	No, FAF does not provide details for secondary traffic.	Yes, TRANSEARCH provides details for secondary traffic.
	Empty truck trips	No, FAF does not provide details for empty truck trips.	Yes, TRANSEARCH provides details for empty truck trips.
	Production-consumption flows	Yes, FAF has more complete coverage.	Yes, but TRANSEARCH flows coverage is not as complete due to secondary traffic coverage.
	Origin-destination flows	Yes, FAF provides information on origin-destination flows but it is not as complete as TRANSEARCH.	Yes, TRANSEARCH has a more complete coverage of unchained trips due to its secondary traffic coverage, although information is excluded for trips outside of Florida
	Tons or dollar value of goods	Yes, FAF provides information on tons and dollar value of goods.	Yes, TRANSEARCH provides information on tons and dollar value of goods.
	Vehicle units (number of trucks)	No, FAF does not provide information on number of trucks.	Yes, TRANSEARCH provides information on number of trucks.
ANALYSIS FOR ANOTHER STATE	Another state or specific areas (metro region, ports, etc.) outside of Florida	Yes, FAF must be used since TRANSEARCH is Florida-specific	No, TRANSEARCH can only be used for ports in the Top-10 list in FDOT TRANSEARCH dataset.
TIME SENSITIVE ANALYSIS	Quick estimate needed	Yes, FAF data can be downloaded and analyzed within a few hours to quickly develop estimate.	No, there is an approval review process for utilizing TRANSEARCH for FDOT purposes.

*** It should be noted that although FAF does not have sub-modes detail, the "Multiple and Mail" mode in the FAF data include containerized and trailer-on-flatcar shipments.*

INTENTIONALLY LEFT BLANK

CHAPTER 1
INTRODUCTION

INTENTIONALLY LEFT BLANK

This report provides a SWOT analysis of two major commodity flow datasets: the IHS TRANSEARCH dataset purchased by FDOT for the year of 2011 for the state of Florida and the FAF dataset developed by FHWA. Understanding the strengths and weaknesses of these datasets in comparison to each other is critical since these are the most widely used commodity flow datasets in transportation planning. In order to make informed decisions on data purchases and data use policies, FDOT needs to understand how each dataset can support planning, policy and data analysis for freight, trade, and mobility.

As part of this effort, the RS&H Team provided an update to FSUTMS Model Task Force attendees at its May 5-7, 2015 meeting in Orlando. RS&H presented the work to both the Freight Subcommittee on May 5th and the general audience on May 6th.

1.1 DEFINITIONS OF SWOT COMPONENTS

To evaluate these datasets, the strengths, weaknesses, opportunities and threats are understood by the following descriptions (*Figure 1-1*):

FIGURE 1.1: DEFINITIONS OF SWOT COMPONENTS

STRENGTHS:	Geographic coverage, comprehensiveness of underlying data sources, update frequency, cost, ease of use, etc. – *How can the dataset "benefit" FDOT in its overall mission as it relates to the analysis of freight movements, which have an impact on (for example) traffic congestion, air quality, and the economy*.
WEAKNESSES:	Geographic coverage, comprehensiveness of underlying data sources, update frequency, cost, ease of use, etc. – *What facets of the dataset do NOT assist FDOT in its overall mission and freight-related outcomes as well as what additional data sources are needed to fill the "gaps"?*
OPPORTUNITIES:	How the datasets can be used – e.g., what policy, planning and other questions can be supported using the data to include, but not limited to updating: modal plans, FMTP, FTP, Systems Planning Office County freight profiles, Performance Measures, GIS analysis, State model application (FreightSim). – *Thinking beyond the obvious in terms of standard FDOT practices, but inferring others such as private sector use and collaborative applications.*
THREATS:	The potential for problems in the analysis or interpretation of the data; for example, the potential for the end user to make erroneous conclusions (whether through user error or not understanding the limitations of the data). – *Will key on how dataset can be misused by or confuse end users*.

1.2 INTRODUCTION TO COMMODITY FLOW DATASETS

Commodity flow data refers to data that illustrate the amount of goods that flow between origins and destinations. In this context, "goods" may be raw products such as corn, natural gas, sand, or phosphates; intermediate goods such as textiles, steel, or lumber; or finished products including clothing, furniture or newspapers.

The most commonly used commodity flow datasets in transportation planning are the IHS TRANSEARCH database and the FHWA FAF database.

The FAF dataset contains flow estimates by mode of transportation for 43 commodity types, 131 origins and 131 destinations. Annual dollars and tons are estimated and can be tabulated to, from, and within regions. Provisional estimates are available for the current year with forecasts to 2040. The TRANSEARCH database is similar in its overall structure but provides greater geographic and commodity detail per agency needs.

The primary sources of commodity flow information are:

- Studies of companies that ship commodities;
- Surveys of carriers, or companies that transport shipments; and
- Information that is reported through regulatory processes, such as Customs data.

Each of these sources has major gaps. For example, in a survey, data is only collected from a sample of companies. Further, regulatory processes typically cover shipments only for one mode or market (such as import/export shipments that pass through a seaport). To overcome these gaps, the developers of FAF and TRANSEARCH employ additional methods that help expand the data to cover the universe of commodity flows. The principal methods used are:

- FAF: Iterative proportional fitting (IPF), log-linear modeling (LLM), gravity models and adjustments based on the Bureau of Economic Analysis (BEA) Input/Output Make and Use tables; and
- TRANSEARCH: an economic model of commodity productions and consumptions by county (based on IHS Economics' BMI database), gravity models and adjustments based on the BEA Input/Output Make and Use tables.

1.3 REPORT OUTLINE

This report is broken down into three more chapters as outlined below:

- Chapter 2 – Data Development explains the processes used to develop each dataset and details the quality control checks of the datasets.
- Chapter 3 – SWOT Analysis compares the strengths and weaknesses of the datasets and summarizes what each dataset offers.
- Chapter 4 – User Guidance provides training recommendations for a broad base of users.

CHAPTER 2
DATA DEVELOPMENT

INTENTIONALLY LEFT BLANK

2.1 INTRODUCTION

Commodity flows pertain to the movement of goods. Both the FAF3 and the TRANSEARCH datasets include commodity shipments that are generated by companies that harvest, extract, or otherwise produce goods that are then shipped to a point of use or consumption. While wholesale distributors and merchants do not produce or consume goods, they receive and sell shipped goods. As such, they are an important sector in goods movement. *Table 2-1* lists various industry sectors using the North American Industry Classification System (NAICS) and indicates whether each sector is a major generator of commodity shipments.

TABLE 2-1: INDUSTRY SECTORS IN THE 2012 NAICS CODING SYSTEM

2012 NAICS CODE	2012 NAICS US TITLE	MAJOR PRODUCER OF COMMODITIES?*
11	Agriculture, Forestry, Fishing and Hunting	Yes
21	Mining, Quarrying, and Oil and Gas Extraction	Yes
22	Utilities	No
23	Construction	Moderate
31-33	Manufacturing	Yes
42	Wholesale Trade	Yes
44-45	Retail Trade	Moderate
48-49	Transportation and Warehousing	No
51	Information	No
52	Finance and Insurance	No
53	Real Estate and Rental and Leasing	No
54	Professional, Scientific, and Technical Services	No
55	Management of Companies and Enterprises	No
56	Administrative and Support and Waste Management and Remediation Services	No
61	Educational Services	No
62	Health Care and Social Assistance	No
71	Arts, Entertainment, and Recreation	No
72	Accommodation and Food Services	No
81	Other Services (except Public Administration)	No
92	Public Administration	No

** FAF and TRANSEARCH documentation were utilized to determine freight-heavy NAICS industries.*

This chapter presents a summary of the methods used to construct each dataset. Information from existing documentation is summarized. The existing reports describe how commodity shipments, including their O-D patterns, are estimated for various industries. These shipments, which are generated by individual establishments, are summarized at a zonal level to estimate the total O-D volumes for each commodity. In addition, existing QA/QC checks of the data and existing comparisons of TRANSEARCH and FAF are documented.

The principal reports that are examined in this section are:

- Documentation of the FAF Database Construction: The Freight Analysis Framework Version 3 (FAF3): A Description of the FAF3 Regional Database And How It Is Constructed. Prepared for the FHWA. Prepared by Frank Southworth, Bruce E. Peterson, Ho-Ling Hwang, Shih-Miao Chin, & Diane Davidson, Oak Ridge National Laboratory. June 16, 2011.
- Documentation of the TRANSEARCH Database Construction:
  - TRANSEARCH 2011 Modeling Methodology Documentation. Prepared for FDOT. Prepared by IHS, Inc. February 28, 2014.
  - IHS TRANSEARCH TRAINING: Statewide TRANSEARCH & Freight Data Workshop. Delivered by IHS, Inc. staff. May 14, 2014.
  - The BCC Engineering TRANSEARCH Review: IHS Global TRANSEARCH: Data Review and Analysis. Prepared for the Florida Department of Transportation Systems Planning Office. Prepared by BCC Engineering, Inc. September 2014.

2.2 DATA DEVELOPMENT: 2007 FAF (FAF3)

The primary data source used to construct the 2007 FAF dataset is the 2007 U.S. Census CFS. In the CFS, each business provides shipment information for one week in each quarter of the year. Roughly 12 million domestic shipments across air, rail, highway and water modes are obtained in this survey. This information is used to generate a snapshot of shipment activity in the U.S.

2.2.1 THE 2007 COMMODITY FLOW SURVEY (CFS)

The sampling frame of the CFS survey is designed to target businesses that create the majority of commodity shipments in the U.S. As such, approximately 90% of establishments that are surveyed in the CFS are in the manufacturing and wholesale sectors. The remaining are in mining, retail, service and auxiliary (e.g. warehouses) sectors (where the selected auxiliary companies are typically headquarters or regional offices that ship some goods from the premises). The survey excludes farms, forestry, fishery, construction, transportation, foreign, governments, services, and most of retail establishments. In the CFS, approximately one out of every seven (14%) businesses in these commodity-heavy sectors are surveyed (*Table 2-2*).

TABLE 2-2: 2007 CFS SAMPLING FRAME: TOTAL UNIVERSE AND SAMPLE SIZE

TRADE AREA	ESTABLISHMENTS	PERCENT OF ESTABLISHMENTS IN SAMPLING FRAME
Mining	6,789	1%
Manufacturing	327,826	43%
Wholesale	356,477	47%
Retail	25,190	3%
Services	22,539	3%
Auxiliaries	14,878	2%
Total Universe	753,699	100%
Sample	**102,369**	**14%**

Source: 2007 CFS Overview and Methodology
http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/commodity_flow_survey/html/methodology.html#first_stage, Accessed in June 2015

For industrial sectors that produce two or more commodities, I/O make-and-use tables were used to estimate the production volume of each commodity type. State and county data on production (sales, employment, etc.) were used to help allocate flows between origins and destinations. Spatial allocation formulas were then used to produce O-D flow volumes and distribute flows across counties for cross-FAF3 regional boundary issues.

However, the CFS has the following gaps, which are referred to as the Out-of-Scope (OOS) flows:

- Multi-Modal Truck, Rail & Water Flows associated with: Crude Petroleum, Petroleum Products & Natural Gas Flows
- Truck-Only Flows associated With: Farm Based, Fisheries, Logging, Construction, Retail, Services, Municipal Solid Waste, and Household & Business Moves
- International (Import & Export) Flows:
    - Deep Sea Shipping Flows
    - Air Freight Flows
    - Transborder Truck & Rail Flows

It is estimated that OOS flows represent about 32% of all U.S. tons shipped. Due to the significance of this figure, steps were taken to fill these data gaps in FAF. Data for OOS flows are mostly derived from data reported by freight carriers. In some cases, secondary or indirect data (such as industrial activity, employment or population) are used to allocate flows to specific geographic regions.

In addition, the CFS in-scope flow data have gaps where survey data are missing or where the sample size is too small to report. Missing cells are filled using a combination of LLM and IPF.

2.2.2 ESTIMATION OF NON-CFS (OOS) DOMESTIC FLOWS

U.S. freight shipping establishments in the following industrial sectors were not surveyed as part of the 2007 US Commodity Flow Survey. The following OOS industries therefore had to be assigned commodity and mode specific O-D flows using other methods:

- Farm Based
- Fishery
- Logging
- Construction
- Services
- Retail
- Household and Business Moves
- Municipal Solid Waste
- Crude Petroleum
- Natural Gas Products

Flows for these OOS industries were estimated in FAF3 using the following process:

- Step 1—Estimate national shipments totals for each industry by FAF3 commodity classes
- Step 2—Regionalize these national shipments (by ton and value) down to the level of U.S. counties
- Step 3—Estimate O-D flows at the county level
- Step 4—Aggregate the O-D estimates from counties back up to FAF3 region-to-region flows.

The specific details in the above process vary by sector as follows.

2.2.2.1 Farms

Farm-based flows are assumed to be moved entirely by truck. They are assumed to be nearly all farm-to-storage or farm-to-distribution/processing center. FAF3 tons and dollars shipped were estimated using county and state data published in the U.S. Department of Agriculture's (USDA) 2007 Census of Agriculture and the 2008 Agricultural Statistics. The information was supplemented with data from USDA's Statistical Bulletins. Origin totals (produced at farms) are derived from USDA county production data with gaps filled in using acreage by county devoted to specific crops. Destination totals (at storage and processing centers, such as grain elevators) are derived from 2007 CFS agricultural commodity originations, which typically are reported at storage/DC/processing centers. O-D flows are then estimated using 2002 Vehicle Inventory and Use Survey (VIUS) truck trip length distributions.

2.2.2.2 Fisheries

Fishery flows are based on port data for commercial landings by US fisherman. The process relies mainly on statistics published in the Fisheries of the United States 2008, an annual report prepared by the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA). Northwestern Pacific (near Washington, Oregon, and Alaska) fish that are processed on-board are credited to landing in the state nearest the capture.

Fish movements are assumed to be all local & all truck.

2.2.2.3 Construction, Services, Retail, and Household and Business Moves

Flows associated with the Construction, Services, Retail, and Household and Business Moves sectors were developed for FAF3 by MacroSys, LLC using 2002 US I-O Make and Use tables. Dollar values from Make and Use tables were converted to tonnages using 2007 CFS for similar commodities and other industry-specific data sources.

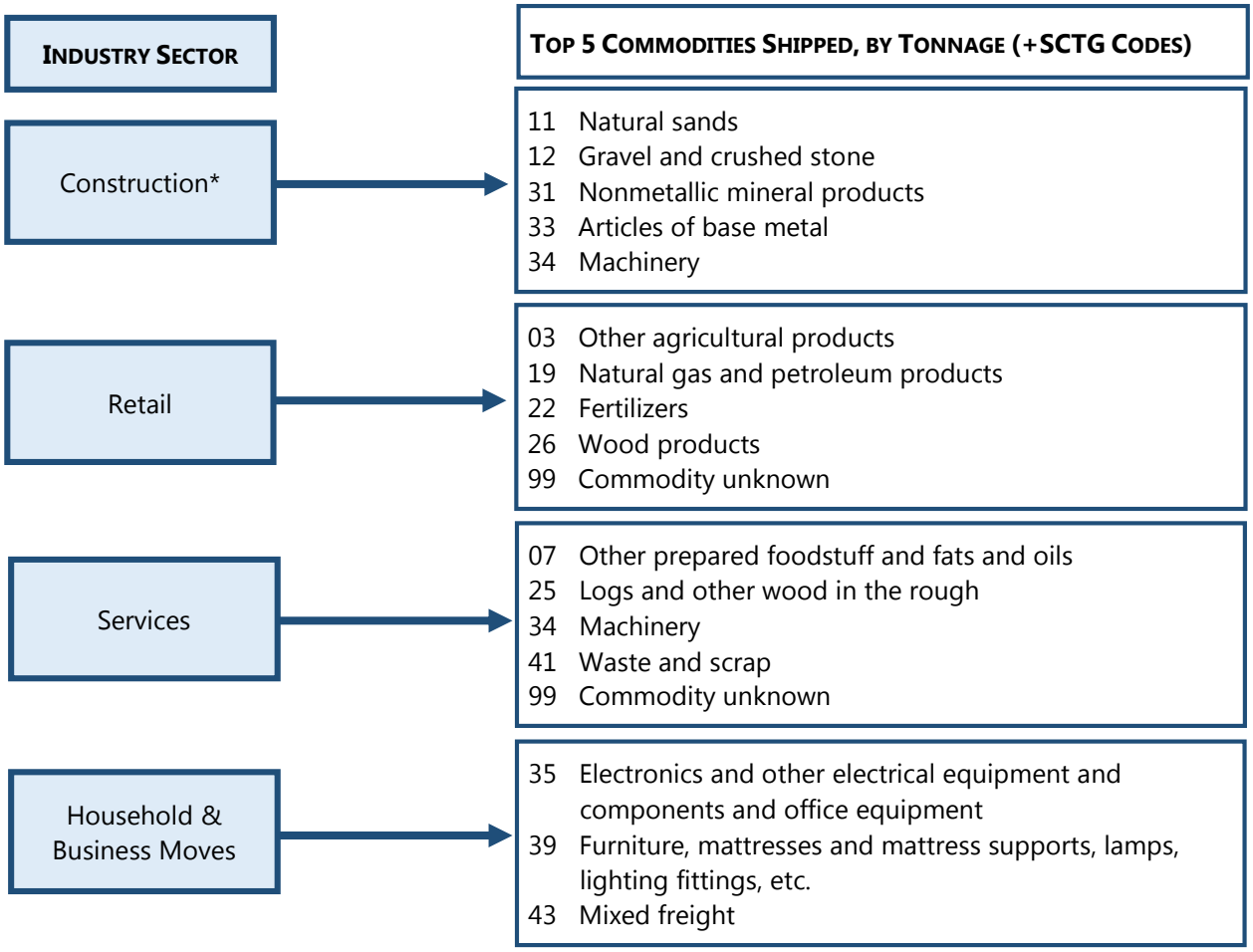
These flows were assumed to be all truck. Also, only domestic shipments were estimated.

Figure 2-1 shows the top five commodities are assumed to be shipped by the Construction, Services, Retail, and Household and Business Moves sectors.

For the construction industry, debris estimates are developed using U.S. Environmental Protection Agency (EPA) publications, the National Demolition Association, Construction Materials Recycling Association, and Gershman, Brickner & Bratton, Inc. Shipment volumes were assigned to FAF3 regions based on: sales data from the 2007 Economic Census; 2007 county level employment data from the Census Bureau's County Business Patterns (CBP) dataset, multiplied by Census-developed labor productivity rates by industry class. Volumes of these goods are assumed to begin and end within the same FAF zone.

It is estimated that the Service Sector generates significant amounts of both commodity freight and mail. Non-mail attractions are based on industrial employment and the amount of commodities used by industries according to the Use table. A gravity model is used to distribute flows of the non-mail commodities. Mail attractions are based on total service employment; i.e., mail is assumed to be shipped from one service establishment to another service establishment. There is no distance decay effect.

FIGURE 2-1: COMMODITIES SHIPPED BY THE CONSTRUCTION, SERVICES, RETAIL, AND HOUSEHOLD AND BUSINESS MOVES SECTORS



* Debris is included in SCTG 41

Source: The Freight Analysis Framework Version 3 (FAF3): A Description of the FAF3 Regional Database And How It Is Constructed

Household and business moves involve the shipping of used household and office furniture, electronic products, and other commodities. According to the FAF documentations, these moves are assumed to be all truck. Data sources used to estimate these flows include: U.S. Census Bureau's Annual Services Survey, and related studies conducted by the American Trucking Association and the American Moving and Storage Association. Flows are allocated to counties based on sector employment. Distance decay not used in the O-D pattern estimation. Instead, O-D distribution is estimated based on IRS-reported county level in-migration and out-migration totals.

2.2.2.4 Logging

Logging flows (principally logs) are assumed to be transported by truck from domestic forests to nearby sawmills and other sites. These flows are estimated using CBP employment and average tons-per-employee multipliers. The estimated O-D distribution are based on average haul-to-market distances.

2.2.2.5 Municipal Solid Waste

Examples of Municipal solid waste (MSW):

- Containers and packaging, such as soft drink bottles and cardboard boxes,
- Durable goods, such as furniture and appliances,
- Nondurable goods, such as newspapers, trash bags, and clothing, and
- Other wastes, such as food scraps and yard trimmings.

MSW shipments are based on information from Franklin Associates in collaboration with the U.S. EPA and information in the BioCycle journal. Mode specific data was also obtained from the U.S Army Corps of Engineers Waterborne Commerce statistics, and from the Surface Transportation Board's Railcar Waybill sample.

All MSW is collected at the source and transported to one of four types of processing facility: local landfills, local incineration facilities, local material recovery facilities, and waste transfer stations. Garbage trucks are assumed to unload MSW at these processing sites for accumulation and transfer to larger transport vehicles (truck, rail, or barge), for more economical long-distance hauling to a final disposal site.

State-to-state O-D flows of MSW are estimated using Congressional Research Service information and discussions with ORNL staff and local officials. These flows are mostly truck movements but a large amount longer distance, inter-state shipments are by rail or barge; still, this is less than 4% of all MSW shipments.

O-D estimation for truck-only MSW between FAF3 regions below state level used county population and spatial interaction models; average O-D distance assumed to be about 32 miles based on the documented sources.

2.2.2.6 Crude Petroleum

Crude petroleum shipments originate at domestic oil fields or marine terminals where foreign oil imports arrive. These shipments are delivered to either refineries or long-term storage facilities.

Prominent modes in shipping crude petroleum include: pipeline, marine vessels (inland barge and ocean tankers), rail tanker, and tanker trucks. National data on shipments by mode from Shifts in Petroleum Transportation, an annual report published by Association of Oil Pipelines. Information in the Shifts report is based on:

- Oil Pipelines: Annual Report of oil pipeline companies provided to the Federal Energy Regulatory Commission (FERC Form 6);
- Water Carriers: Waterborne Commerce of the United States, U.S. Army Corps of Engineers (USACE);
- Motor Carriers: Petroleum Tank Truck Carriers Annual Report, American Trucking Association, Inc. and Petroleum Supply Annual, Energy Information Administration (EIA); and
- Railroads: Carload Waybill Statistics, Report TD-1, USDOT, Federal Railroad Administration, and Freight Commodity Statistics, Association of American Railroads.

O-D flows are derived from US DOE/EIA information, including EIA's Petroleum Supply Annual (2010) data on:

- Production of Crude oil by PADD (Petroleum Administration for Defense Districts) and State,
- Refinery Input of Crude Oil by Refining Districts, and
- Refinery Receipts of Crude Oil by Method of Transportation, by PADD.

In the flow estimation process, first domestic crude production and inputs are estimated at FAF3 regional level. Second, a gravity model is used to estimate O-D between FAF3 regions. Third, flows are apportioned by mode using "interactive proportional process". Domestic mode shares were informed using EIA's Refinery Receipts table (which has mode shares by district) and EIA's Movements of Crude Oil between PADD.

2.2.2.7 Natural Gas Products

Total National Natural Gas and O-D region-to-region flows are derived from EIA's 2010 Natural Gas Annual, which includes gas productions or "gross withdrawals" by state and Gulf of Mexico. The estimation of O-D distribution patterns is similar to the estimation process for crude petroleum.

2.2.3 IMPORTS AND EXPORTS

Imports are commodities that are transported from another country into the United States and exports are commodities that are transported from the United States to a foreign country.

Import and export flows are generally constructed for FAF using mode-specific data sources: airborne, waterborne, and land-based (border-crossing, mainly truck and rail) datasets. Import and export flow estimates of crude petroleum and natural gas are developed separately.

2.2.3.1 Water

Water imports and exports are developed for FAF using:

- The USACE International Waterborne Commerce Database
- The US Census Bureau's Foreign Trade Database
- A FAF3-specific extraction of state-to/from-US port data from the Port Import Export Reporting Service (PIERS) Import/Export Database; at its base, PIERS data is from shipment records collected by US Customs and Border Protection

Since the PIERS dataset contains the most O-D and commodity specificity, the PIERS data (after some adjustments to the raw data) are the basis of the FAF waterborne flows. PIERS tonnages were adjusted to be consistent with USACE waterborne tonnages and PIERS dollar trades to be consistent with Census FTD totals. Geocoding was adjusted to infer (1) zip codes when this information was missing; and (2) the correct origination/termination when company headquarters was reported in the documentation. These inferences were made based on patterns from the 2007 CFS. The developers of FAF consider these geocoding issues to be a major concern with additional research needed to understand the extent of the misreporting.

Inland mode is generally not available for the PIERS information. The exception occurs for PIERS shipments that reported usage of rail-inclusive container shipments were treated as truck-rail IMX (i.e., "multiple

mode") in FAF3. It is not clear from the FAF documentation how inland mode is inferred for other shipment records.

2.2.3.2 Air

Airport-to-airport flows of air-based imports and exports are determined using total tonnage statistics from the T-100 dataset published by the Office of Airline Information (OAI) of the U.S. Bureau of Transportation Statistics (BTS) along with US Customs data on commodities and value of goods shipped as reported by Foreign Trade Division (FTD) of the U.S. Department of Commerce's Bureau of the Census.

The FTD database includes shipments for all merchandise between foreign countries and US Customs Territories (typically at state level & Washington, DC). Available information includes the value, quantity, method of transportation, and shipping weights for some 9,000 export commodities, 17,000 imported commodities, 240 trading partners, and 45 U.S. Customs Districts. The two FTD databases used are the U.S. Exports of Merchandise – Monthly and U.S. Imports of Merchandise – Monthly.

The Bureau of Transportation Statistics OAI T-100 Data is the definitive source of tonnages shipped on US airlines. The dataset includes ports of entry/exit but lacks ultimate origin/destination of shipments with multiple stops. Since it also lacks information on value and commodity type, this information was obtained from US Customs FTD data then combined with the OAI data.

Spatial and commodity information in the OAI and FTD data were reconciled to create a single FAF3 air O-D flow dataset. Control totals for the flows were based on OAI total tonnages and FTD commodity percentages. FTD data were also used to assign and value-to-weight ratios.

Some quality issues with the OAI and FTD data were noted. First, while the FTD dataset does not include transshipments the OAI data does. Large differences between the datasets are observed at major transshipment airports (Anchorage, Miami, New York). Other issues are:

- OAI is missing information for some all-cargo airlines;
- FAF may double-count some mail shipments (as both mail and freight) since FedEx includes mail as part of total freight when reporting to OAI;
- Since OAI is carrier-based, shipments using two or more carriers will have incorrect origin and/or destination information; and
- While in-transit shipments are supposed to be completely excluded from the data, intermediate stops of in-transit shipments may sometimes be reported as the origin or destination airport.

2.2.3.3 Truck and Rail

Overland movements (by truck & rail) between US and Canada/Mexico are from the BTS TransBorder Freight Database, which is based on FTD trade data. The following tables are used:

- U.S. Trade with Canada and Mexico with State and Port Detail
- U.S. Trade with Canada and Mexico with State and Commodity Detail
- U.S. Trade with Canada and Mexico with Port and Commodity Detail

Modal detail is provided. To estimate truck and rail O-D flows, movements by vessel, air and pipeline were first removed. Next, CBP information was used to allocate flows from states to FAF3 regions. When an FTD

Port was not specified but the FTD Port District was known, flows were assigned to the most likely port for that District on the basis of tons or dollars of a specific commodity passing through each port.

Shipment weights are not reported. Weights are estimated for FAF based on average dollar per ton statistics by commodity class, mode and country.

2.2.3.4 Crude Petroleum

Imports of crude petroleum are reported to the EIA monthly at the company level. This information tracks the complete movement of imported crude oil including the foreign source country, the U.S. port used, and the refinery that is the domestic destination of the shipment. The company-level monthly EIA reporting is used to establish O-D flow patterns.

U.S. flows are allocated to modes based on modal information from EIA refinery receipts. A single mode was determined for each port-to-refinery pair. Flows between the foreign country and the U.S. port are generally assumed to be made by ocean tankers. The exception is for Canada-to-U.S. flows, which are assumed to be pipeline flows from Alberta and offshore of the Atlantic Ocean.
Data sources include:

- Form EIA-810: Monthly Refinery Report;
- Form EIA-814: Monthly Imports Report;
- Form EIA-815: Monthly Terminal Blenders Report;
- Form EIA-820: Annual Refinery Report; and
- The EIA State Level Production dataset.

2.2.3.5 Natural Gas

Liquefied Natural Gas (LNG) imports and exports are made using large tanker ships. EIA reports contain information on directional LNG volumes by U.S. seaport, natural gas (NG) pipeline volumes between the U.S. and Canada and Mexico, and total import/export volumes by state.

O-D patterns are determined using the EIA information along with CBP data. The FAF documentation notes that there are very few inter-regional movements of imported or exported NG/LNG.

2.3 DATA DEVELOPMENT: 2011 TRANSEARCH

Like the FAF data, the TRANSEARCH dataset is developed with the goal of capturing commodity shipments generated by various industry sectors. However, while the FAF development relies primarily a survey of major freight-related industries, the TRANSEARCH development relies fundamentally on economic models that are used to estimate the amount of each commodity that is produced and consumed in each U.S. county. Volumes for non-truck modes, which constitute less than 50% of tonnages in Florida, are first estimated based primarily on data from regulatory agencies. These non-truck volumes are then subtracted from the total volume estimate to estimate truck volumes, which make up the majority of flows. As such, the majority of commodity flows in TRANSEARCH are based primarily on the economic models with enhancements from other sources.

Empty truck flows as well as truck flows for secondary shipments, agricultural products, coal, and chemicals are derived from other sources. These are described in the Specialized Truck Flows section.

Data from truck carriers, public sources, and other propriety sources are used to estimate O-D flow patterns.

2.3.1 COUNTY-LEVEL PRODUCTION AND CONSUMPTION VOLUMES

The IHS Economics' BMI database is used to estimate output volumes by industry and commodity at the county level. This database is supplemented with trade association and industry reports and U.S. government-collected data. The estimated outputs are combined with information from the I/O tables to estimate the values of goods produced and consumed in each county for each commodity.

The BMI-based methodology does not include all industries. Production volumes for the following commodities are estimated using other sources:

- Agricultural products and livestock (sourced from the U.S. Department of Agriculture)
- Coal and automobiles (sourced from other IHS in-house databases)
- Selected chemicals (sourced from IHS Chemical group)
- Minerals (sourced from the U.S. Geological Survey).

In addition, import and export volumes are estimated using port-level census statistics. These volumes are added into the domestic county-level estimates. Finally, demand levels from households, the public sector and the financial sector are estimated based on tax revenue and similar sources then are also incorporated into the county-level estimates.

2.3.2 COMMODITY FLOWS FOR RAIL, WATER AND AIR MODES

Commodity volumes for rail, water, air and pipeline moves are relatively well understood due to government regulated reporting requirements. The O-D volumes by commodity for each mode are evaluated. Then, these volumes are subtracted from the total volumes that were initially estimated. The remaining flows are assumed to be transported using trucks and are allocated to truck O-D and distribution patterns. The non-truck commodity flows are developed using the following processes.

2.3.2.1 Rail

Rail flows are developed using a survey of rail carload and intermodal shipments that were reported in the Surface Transportation Board (STB) Waybill sample. There are two versions of the Waybill data. One is very detailed and the other is less detailed. Two versions of TRANSEARCH were developed for FDOT, one with each version of the Waybill data. Usage of the more detailed version requires special clearance from the STB. While the Waybill data has full coverage of US-Canada rail flows, US-Mexico rail flows were derived from BTS border crossing statistics as well as (indirectly) from Waybill routing information.

2.3.2.2 Water

Water shipments are estimated primarily using the U.S. Army Corps of Engineers annual waterborne commerce data.

2.3.2.3 Air

The BTS T-100 data set on airport activity is the primary information source for TRANSEARCH air-based moves. The T-100 dataset provides total tonnages. Commodity details are derived from CFS information. According to the TRANSEARCH documentation, the tonnages include only cargo that is drayed to or from the airport.

2.3.3 TRUCK FLOWS

As described in the introduction, most truck-based commodity production and consumption volumes are derived by subtracting rail, water and air moves from the total estimates of production and consumption volumes. (Other truck-based commodity flows are described as Specialized Truck Flows and are discussed in the next section.)

The truck-based productions and consumptions are distributed using a gravity model to create O-D flows. The model inputs are (1) the production and consumption volumes and (2) trip length distributions for each commodity from publicly available sources.

The estimated O-D flows from the gravity model are then validated using observed commodity flow information collected by the carrier industry. The data source used is the Motor Carrier Data Exchange program, which includes annual tonnage or truckloads for each O-D pair with information provided at the zip code level. The Motor Carrier Data Exchange program data are further supplemented as follows. First, for truck trip origins, the dataset is supplemented with proprietary data on industrial output, employment and sales level data from specific locations of manufacturing and distribution facilities. Second, for truck trip destinations / consumption locations, the dataset is supplemented with BEA Industrial I/O tables.

CFS information is used to allocate the percentage split between for-hire and private fleets. Data from the Motor Carrier Data Exchange program are then used to infer the split of for-hire trips between truckload and LTL and commodity type (where equipment – truck body type – is reported).

Since the Motor Carrier Data Exchange program dataset is critical to establishing truck flows, it is important to understand it. The TRANSEARCH documentation reports that: "Participating carriers are primarily large truckload and LTL operators with average lengths of haul over 500 miles. However, the sample also includes owner-operator business, portions of private carriage and dray activity, and significant amounts of regional (under 500-mile) traffic. The sampling rate is about 7% overall, 3% under 500 miles, and 1% under 100 miles. (As another point of comparison, the STB Waybill Sample runs 2.8% of shipments, but it is a stratified random sample and thus includes 22.5% of tonnage.)"

The TRANSEARCH documentation further notes that one drawback of the Motor Carrier Data Exchange data is that the collected data does not constitute a stratified random sample. In other words, the data might have insufficient coverage of certain markets. However, the documentation suggests that the program's diverse coverage across industrial and geographic segments helps compensate for this.

2.3.4 SPECIALIZED TRUCK FLOWS

Secondary Shipments, Agricultural Products, Coal, Chemicals, Automobiles, Minerals and Empty Movements are considered Specialized Truck Flows. Unlike the other TRANSEARCH truck flows, these do not use the BMI economic model. These flows are developing using alternative processes as described below.

2.3.4.1 Secondary Shipments

Secondary shipments originate at intermediate handling locations such as warehouses, distribution centers, or other non-production facilities. The ultimate destination of these shipments (where the commodity is consumed or used) is mirrored in the TRANSEARCH data – for example, destinations in the dataset may be manufacturing plants for raw materials, or supermarkets or department stores for consumer goods. In reality, the shipment may move through a series of regional distribution centers or warehouses. However, the source data do not permit the accurate identification of individual legs of this type of journey.

2.3.4.2 Agriculture

The main data sources used to develop agricultural production volumes are statistics on county production by type of crop, product or livestock from the USDA. States with major agricultural industries provide additional data. The documentation indicates that IHS Agriculture Crop Production and Forecasts is another source of information. County-level consumption volumes are based on industry factors for agricultural facilities such as grain elevators, processing businesses, and rail and water transfer points. County-level consumption also reflects output portrayed elsewhere in TRANSEARCH. Agricultural flows are distributed to O-D pairs based on historical patterns, which incorporate information on travel distances by use, product, and body type.

2.3.4.3 Coal

Truck movements of coal are developed using information from the U.S. Department of Energy's EIA. The EIA datasets include state-to-state truck volumes and production and consumption information for specific locations. Consumption is allocated more specifically based on relative consumption by industry (manufacturing, power generation etc.). The TRANSEARCH documentation indicates that the proprietary source Cambridge Energy Research Associates (CERA) Electric Plant Statistics and Forecasts provides information on its energy analysis.

2.3.4.4 Chemicals

Truck movements of chemicals are developed using data from the IHS Chemical Group on production volumes and plant information (the IHS Chemical Plant Production and Consumption Statistics). Intra-plant and intra-company movements are accounted for.

2.3.4.5 Automobiles

Automobile flows by truck are developed using proprietary data from in-house IHS databases such as the IHS Automotive Plant Production, Consumption, and Supplier Data.

2.3.4.6 Minerals

Truck transportation estimates of mineral flows are developed in part using U.S. Geological Survey Mineral Industry Reports.

2.3.4.7 Empty Trucks (Empties)

Empty truck movements are estimated for TRANSEARCH as follows. County imbalances of inbound and outbound loads by trailer category are examined at the aggregate (nationwide) level. Results are checked against market conditions and industry factors. Flows between the US and Canada/Mexico are developed separately then combined with the U.S. dataset.

2.3.5 IMPORTS AND EXPORTS

Important data sources for determining import and export flows include:

- The BTS TransBorder Freight Database, which is constructed using FTD trade data;
- US Customs data on commodities and value of goods shipped (reported by Foreign Trade Division (FTD) of the U.S. Department of Commerce's Bureau of the Census);
- Data from the Mexico Economic Census (conducted by the Instituto Nacional de Estadística y Geografía, or INEGI);
- The TRANSEARCH Data Exchange program

Overland U.S.-Mexico flows are enhanced using data from the Mexico Economic Census, internal IHS Mexican intelligence, and cross border information from the TRANSEARCH Data Exchange program. Flows are converted into truck and rail unit counts using averages from the data exchange or commodity specific defaults. Flows are further adjusted where the data exchange contains additional information of observed flows.

Water-based flows between the U.S. and Mexico are determined using BTS TransBorder data and statistics for Mexican ports from the Mexican Secretaría de Comunicaciones y Transportes (SCT). While the overall quality of the data and process are unclear, the results are then checked using US-Mexico truck traffic Data from the TRANSEARCH Data Exchange information.

Flows between the U.S. and Canada rely primarily on the BTS TransBorder data, which reports truck, rail, water, air, and pipeline, and "other" (unspecified) modes. (The U.S.-Mexico BTS data has truck, rail and pipeline only.) These cross-border markets are the only areas of TRANSEARCH where pipeline data is available; crude petroleum and natural gas are dominant in these moves.

For both Canadian and Mexican commodity moves, traffic volumes are used to allocate the flows to the county level within the U.S. On the Canadian side, flows are allocated to metro areas based on Statistics Canada truck traffic reports. Canadian O-D flows are apportioned to specific metropolitan markets based on Canadian truck traffic data from Statistics Canada.

2.3.6 OTHER FLOWS – NOT COVERED

The standard TRANSEARCH product does not include the following shipments:

- Primary (raw) products of forests and fisheries;
- Household goods; and
- Haulage of waste and scrap.

It is worth noting that commodities in these three categories are included in FAF, which is the source of some tonnage differences between the two data sources.

2.3.7 APPORTIONMENT TO THE TAZ LEVEL

The TRANSEARCH commodity flow data are developed at the county level as described above. For the FDOT 2011 dataset purchase, the data were apportioned from the 67 Florida counties to Florida's 8,518 TAZs. Outbound flows are disaggregated from the county to TAZ level based on relative output (such as employment or sales volumes) of commodity-generating industries in each TAZ. Inbound flows are apportioned in a similar manner except that commodity-consuming industries are used instead of commodity-producing industries.

The apportionment primarily utilized socio-economic data as well as establishment and industry data from InfoUSA business listings. These data were supplemented with information from the IHS-Global Insight Freight Finder tool, which contains tonnages for specific facilities.

Numerous assumptions were used in this process. The assumptions are described in detail in the *TRANSEARCH 2011 Modeling Methodology* documentation on pages 19-22. For purposes of interpreting the data for the SWOT analysis, key assumptions are:

- Secondary traffic:
  - Distribution centers are often associated with low sales volumes. Presumably this happens mostly at facilities that handle internal distribution where the passage of goods does not involve sales activity.
    - If retailers belonging to the same company could be identified and if the retailer sales volumes exceeded the distribution center sales volume, then the distribution center sales volume was set to the total sales volume of the associated retailers.
    - For distribution centers with matched retailers, total inbound tons of secondary traffic are set to match outbound tons of secondary traffic
    - If a distribution center could not be matched to a retailer, then total outbound tons is set to match non-secondary inbound tons.
  - Retailers are assumed to receive 80% of inbound goods from distribution centers (STCC 5010) and 20% from factories. Auto retailers are handled in a separate process.
  - Volumes of less than 100 tons per year of a single commodity are considered Secondary Traffic.
- Private truck assumptions: Inbound shipments to companies with large private fleets (not including distribution centers) are assumed to be made by private truck. These companies are identified using secondary data sources. The total TRANSEARCH private truck tonnage is maintained for each county.
- Empty truck assumptions: Empty truck origins are assumed to be generated in the same proportion as inbound loaded moves. Empty truck destinations are apportioned in a similar fashion using outbound loaded moves. Equipment type and mode are considered.
- Industry assumptions:
  - Retail facilities generally are assumed to have no outbound shipments. There are two exceptions for this: brewpubs are assumed to ship beer and new car dealers ship small volumes of cars to other dealers.
  - Construction firms are assumed to receive no inbound goods at their offices, except for 2% of sales of STCC 5010 for general office use.

- Geocoding: Flows to headquarters, administrative facilities, PO boxes, and establishments on the 2nd story or higher are generally assumed to be non-existent.
- Modal assumptions:
  - Proximity to a rail line is used to assign rail traffic.
  - For each county, estimates of outbound rail tons of commodities in the 2011-3999 range are adjusted to match total estimates of TRANSEARCH trucks.
  - Air shipments are assigned to the TAZ for airports. The drayage of these shipments is then assigned to warehouses in TAZs based on transportation and warehouse employment.
  - By default, rail shipments are assigned to the TAZ in which the reported FRA 100k Network node is located. This information is overridden for some major establishments including power plants, copper mines and smelters, and auto ramps.
  - Truck traffic to and from ports is assumed to begin and end in the TAZ in which the port is located. TAZ allocation for ports that span multiple TAZs are further informed based on ship location data (AIS) and PIERS data on port call information.
  - Intermodal shipments are assigned to specific ramps in proportion to tons terminating at each ramp. Customer establishments are assigned in proportion to truck flows by commodity type as determined in the commodity flow development process.
- New motor vehicles are assigned to the TAZ of auto ramps to the extent they don't exceed total rail terminations. Mode is truckload or private.

Other assumptions, including assumptions made specifically for origin and destination TAZs, are further detailed in the official documentation.

2.4 FORECASTING PROCEDURES

Both the FAF and TRANSEARCH data products include forecast commodity flows for a long-term horizon. Projections for each dataset are largely consistent with the base year development with forecast totals controlled by both U.S. and international trade patterns.

2.4.1 FAF FORECASTS

The FAF3 data suite includes baseline flow estimates for year 2007 and forecasts for 2015, 2020, 2025, 2030, 2035, and 2040.

The FAF forecasts are an extrapolation of baseline commodity flow trends with current flows projected to the future based on national and global economic patterns.

The following processes are used to develop the forecasts:

- Using economic models, forecast national consumption and foreign trade patterns are converted into purchase volumes across industries.
- Future mode shares are estimated by applying current mode shares by commodity to the forecasted mix of commodities.

The disadvantages of the methodology are that the forecasts do not reflect:

- Major changes in the national economy;
- Future limitations in capacity; or
- Changes in transportation costs, technology, or other aspects of the transportation system.

2.4.2 TRANSEARCH FORECASTS

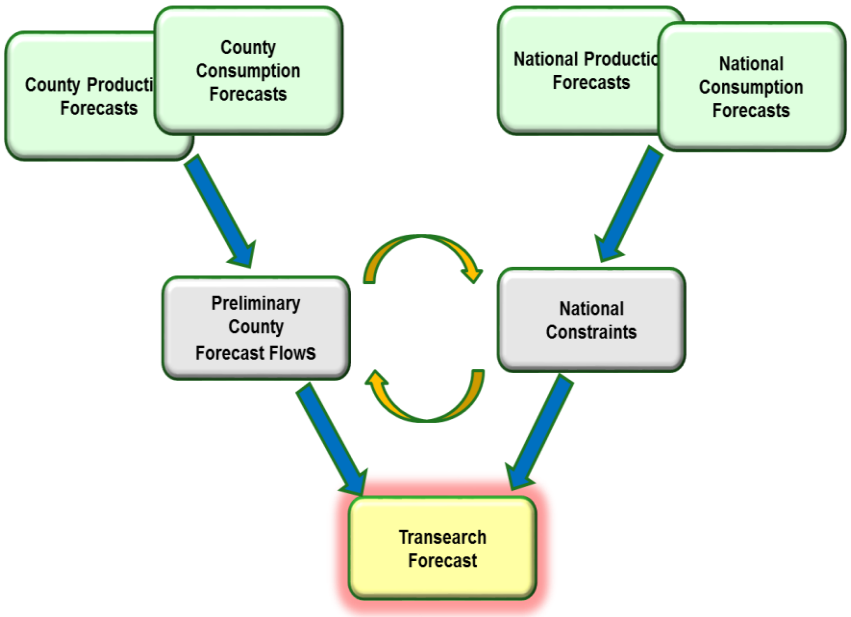
The TRANSEARCH forecasts are developed for up to a 30-year time horizon. Forecast years include: 2015, 2020, 2025, 2030, 2035 and 2040. The methodology utilizes the forecasting tools of IHS Economics.

The TRANSEARCH forecasts are constructed using methods that are consistent with the base year development – for example, through the use of BMI economic models. Like the FAF forecasts, the process is consistent with forecasted national and global economic patterns.

The following processes are used to develop the forecasts (*Figure 2-2*):

- Supply (freight originations) and demand (freight destinations) projections are estimated for each county and commodity type using BMI forecasts. Employment, output, and purchases by industry and county are included in the supply and demand estimates.
- The aggregated county-level flows are constrained to national totals from the proprietary IHS U.S. Macroeconomic long-term forecasts.
- International flows are forecast using information from the World Trade Service, which includes imports and exports to/from Canada and Mexico and at U.S. seaports.
- The process is also informed by propriety data and services from IHS-Global Insight: U.S. Agricultural Service, Energy Service, Automotive Service, World Trade Service, and the Business Transactions Matrix (which contains forecasts of the BEA's I/O tables).

FIGURE 2-2: TRANSEARCH FORECAST DEVELOPMENT



Source: TRANSEARCH 2011 Modeling Methodology Documentation. Prepared for Florida DOT. Prepared by IHS, Inc. February 28, 2014.

The State of Florida data purchase was customized to include a range of forecasts based on optimistic and pessimistic economic scenarios. The following factors were utilized in this process:

- National factors for imports, exports and through traffic:
  - Real Gross Domestic Product (GDP);
  - Total value of exported goods; and
  - Total value of imported goods.
- Florida factors:
  - Production by select industries including manufacturing, apparel, chemicals, durable goods, non-durable goods, mining, petroleum, and coal products;
  - Gross state product for select industries including agriculture, construction, transportation, warehousing, retail trade and wholesale trade;
  - Housing starts;
  - New vehicle registrations of passenger cars and light trucks; and
  - Population growth.

The optimistic and pessimistic scenarios were applied in a stratified fashion. The application categories were (1) commodity and (2) geography (two categories are used: within Florida and external to Florida).

2.5 QA/QC AND COMPARISONS OF FAF AND TRANSEARCH

The FAF and TRANSEARCH datasets have been examined individually and/or compared against one another. This section describes and summarizes the data checks that are documented in the IHS and BCC reports cited earlier in this report. The *TRANSEARCH 2011 Modeling Methodology* documentation contains summary information of FAF-TRANSEARCH comparisons while the IHS TRANSEARCH TRAINING delves into this topic in more detail. The BCC report is a QA/QC review of TRANSEARCH.

2.5.1 IHS COMPARISONS: FAF VS. TRANSEARCH

Based on IHS's review, the key differences between TRANSEARCH and FAF are summarized in *Table 2-3*. Additional features of the datasets are compared in the next chapter.

2.5.1.1 Tonnage Comparisons

IHS conducted a summary comparison of truck trips that originate in Florida, which includes both internal (intrastate) and internal-to-external flows. The report first compares flows for all commodities in each database then focuses only on commodities which are included in both. The latter comparison shows that total ton-miles (for the comparable set of commodities) is close – within about 10% - but that the tonnage totals differ by a factor of approximately two, with FAF having about twice the tonnage that TRANSEARCH has.

TABLE 3-3: KEY DATASET DIFFERENCES AS SUMMARIZED BY IHS

DATASET CHARACTERISTIC	PRODUCT	
	FAF	TRANSEARCH
Development frequency	Every 5 years	Annual
Forecast availability	Forecasts updates available in 5-year increments	Annual forecasts updates available
Main source of shipment information	Commodity Flow Survey (CFS)	Motor Carrier Data Exchange program
Sample size of main dataset	About 6 million shipment records from 100,000 establishments*; collected quarterly	About 75 million shipment records from carriers*
Primary geography used in data construction	123 state & metro areas	U.S. counties (about 3,000); Zip code and TAZ geographies also available
Commodity detail	2-digit (43 commodity types) SCTG classification	4-digit (about 500 commodity types) STCC classification
Modes	8 modes	15 modes & 8 truck equipment types
Trip legs available; warehouse & distribution center trips reflected	No*	Yes*

**These characteristics are related to important fundamental differences in the sample data which are discussed more fully in the SWOT section*

2.5.1.2 Comment on Tonnage Comparisons

The IHS documentation suggests an explanation that concludes that FAF is double-counting certain trips. In particular, the IHS documentation suggests that the CFS counts trips that originate at warehouses and distribution centers. However, due to the CFS sampling methodology, this does not appear to be an issue as "only captive warehouses that provide storage and shipping support to a single company" are included while "warehouses offering their services to the general public and other businesses are excluded"[1].

Furthermore, these kinds of establishments constitute only two percent of the establishments in the CFS. Therefore, even if this issue occurred, its impact on the flow estimates would be marginal.

2.5.2 BCC EXAMINATION OF THE TRANSEARCH DATASET

BCC Engineering checked the TRANSEARCH data against publicly available sources, many of which are also used by IHS to develop the TRANSEARCH data. The objective of this effort was to identify any areas of concern with the data. BCC also considered the impacts of changes in dataset construction on analysis that would involve comparing the 2011 purchase to older TRANSEARCH data.

[1] *Source: "2012 Commodity Flow Survey Methodology" Revised 12/03/2014 accessed in June 2015 at: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/commodity_flow_survey/html/methodology_2012.html*

2.5.2.1 Documentation of Underlying Data Sources

The construction of the TRANSEARCH dataset is detailed earlier in this report. Several of the underlying data sources that are used to construct the TRANSEARCH data are reviewed by BCC. These include:

- The BTS border crossing data;
- The BTS T-100 air cargo dataset;
- The STB Carload Waybill sample;
- The EIA coal distribution data;
- Commodity Flow Survey statistics;
- County Business Patterns employment data;
- USDA crop production data;
- University of Florida's Bureau of Economic and Business Research (BEBR) population projections for Florida;
- Freight Analysis Framework;
- American Transportation Research Institute (ATRI; note: this was not a TRANSEARCH input);
- Gross Domestic Product (GDP);
- InfoGroup business data;
- Longitudinal Employer Household Dynamics;
- Mexico Economic Census;
- Army Corps of Engineers U.S. Waterway data; and
- Historical REEBIE and TRANSEARCH data.

The BCC report describes each dataset and its relevance to commodity flow projections.

2.5.2.2 TRANSEARCH QA/QC

Tonnages from the TRANSEARCH data were summarized across origins, destinations, and modes. The data were then examined and compared to other sources.

The BCC report concluded that overall the 2011 TRANSEARCH database is a good source of information for stakeholders across Florida. Additionally, the report concluded that the data development process is sound.

BCC also found the following concerns with the data:

- The growth rates in commodity flows decline in year 2020 (in comparison with years 2011 to 2020). This impacts various areas of the dataset such as total flows in Santa Rosa County and in rail tonnages.
- A decrease in commodity flow tonnage originations is predicted for Hernando County from 2011 to 2040 in spite of projected increases in population and destination traffic. BCC raised the question of how the BEBR population projections are used for production and consumption estimates.
- Waterborne tonnages are projected to increase in TRANSEARCH, which is contrary to the trend exhibited in the observed data and the FAF data.
- TRANSEARCH exhibits an increase in rail tonnages although rail tonnage declined in recent years.
- Rail tonnage in TRANSEARCH exceeds the Waybill sample and FAF3 forecast (through 2030), which may be only partly explained by sample obfuscation.

BCC suggested inquiring with IHS to determine possible explanations to these questions. BCC also recommended further avenues of data exploration to provide additional insights into the TRANSEARCH data:

- Examine correlation between the food/crop industry and population growth;
- Calculate growth in commodity flows by mode by county;
- Examine growth and decline in flows by commodity type; and
- Evaluate the predicted Panama Canal impact to determine if it is factored into the post-2020 flows.

2.5.2.3 Comparing the 2000 and 2011 TRANSEARCH Datasets

The TRANSEARCH data have undergone changes over the years. The IHS methodology report documents the TRANSEARCH dataset development history. The most recent changes are documented in release notes provided with the data purchase. The historical evolution of the data construction process, including recent dataset adjustments, would likely have a notable impact on any analysis that involves comparisons of the 2011 data and historical data.

These changes could have two main impacts. First, since the 2011 TRANSEARCH dataset relied partly on historical TRANSEARCH (and REEBIE) data for dataset construction, it is possible that erroneous trends from previous years are reflected in the 2011 version. However, IHS has likely addressed any major known issues already. Second, if the 2011 version is compared to the 2000 data (which is the FDOT's last purchase prior to the 2011 purchase), then differences in the underlying data or dataset construction may be interpreted as differences in commodity flow patterns. Therefore, if this becomes a topic of interest, then it will be important to consider changes in the underlying data when the analysis is conducted. In addition, as BCC also noted, the historical data appears to have issues in tonnages by mode. Such concerns should be examined in more detail if a 2000 vs. 2011 analysis is undertaken. Furthermore, a 1998 TRANSEARCH (REEBIE) dataset was also noted in the BCC report

CHAPTER 3

SWOT ANALYSIS

INTENTIONALLY LEFT BLANK

This chapter is dedicated to comparing the FAF and TRANSEARCH datasets from a user perspective. First, the datasets are compared and their strengths and weaknesses are discussed. Next, opportunities and threats of the datasets are discussed. The discussion will be framed around policy, planning and other questions that frequently arise in the context of commodity flows analysis. The opportunities and threats described in this section follow naturally from the strengths and weaknesses of each dataset (see *Table 3-1*).

Commodity flow data can be used to answer many freight-related questions. The volume of goods that is produced in, consumed in, or passes through a region is of great interest to policy-makers and analysts. Questions around this issue are essential for freight plans, the FMTP, economic studies, highway planning, last-mile studies, congestion analysis, pavement / maintenance planning, air quality analysis, and other studies. Typical quantifications of volume may include:

- The volume of goods (in tons or dollar value) that is produced or consumed in a given region
- The origin-destination patterns of goods
- Volumes by mode (e.g., by truck vs. rail)
- Volumes by commodity type (e.g., tonnage of agricultural goods)

The case studies shown later in this section illustrate SWOT implications for the two datasets.

3.1 STRENGTH AND WEAKNESSES

For ease of understanding, the dataset comparison is presented in the following tables:

- *Table 3-1*: Features of each dataset are summarized briefly along with their similarities and differences. A strengths and weaknesses discussion is also provided within the table. *Table 4-1* is presented in three subsets based on the following categories.
  - *Table 3-1-A*: Overview and Coverage – Focuses on the purpose of the dataset, the different acquisition options, the geographic coverage, as well as the freight commodity coverages for the two datasets. The representation of commodity flows is also described in this table.
  - *Table 3-1-B*: Data Development Process – Focuses on the data sources and development process for the two datasets along with the development time and update frequency for each dataset. A brief description of the forecasting process behind each dataset is also provide within this table.
  - *Table 3-1-C*: Using the Data – This table focuses specifically on the users of the data by provided descriptions for potential uses and analysis options, the ease of use in regards to documentation and usage restrictions for each dataset. The table also focuses on the dataset sizes and issues with management, storage and dissemination of the data along with a potential learning curve for using data from the two datasets.
- *Table 3-2*: This table is an accompaniment to *Table 3-1*. Underlying data sources that were used in constructing the datasets are listed.

INTENTIONALLY LEFT BLANK

TABLE 3-1-A: FAF AND TRANSEARCH: SIMILARITIES, DIFFERENCES, AND STRENGTHS & WEAKNESSES (OVERVIEW AND COVERAGE)

CATEGORY	FEATURE	DATASET		SIMILARITIES	DIFFERENCES	STRENGTHS & WEAKNESSES
		TRANSEARCH	FAF			
OVERVIEW AND COVERAGE	DATASET PURPOSE	To provide O-D and modal information on commodity flows	To provide O-D and modal information on commodity flows	Both datasets provide O-D and modal information on commodity flows.	TRANSEARCH provides more coverage in some ways while FAF provides more coverage in other ways. These differences are described below in "Geographic coverage", "Commodities covered", and "Mode/submode options".	See below ("Geographic coverage", "Commodities covered", and "Mode/submode options").
	ACQUISITION OPTIONS	IHS prepares a customized dataset, offering varying levels of detail for each purchase. Common options are: geographic resolution (e.g., TAZ vs. county) and commodity classes (e.g., 2-digit vs. 4-digit). More detailed options are more expensive.	n/a - the FAF data are provided free of charge to all users	n/a	FAF is free of charge while TRANSEARCH is purchased with varying degrees of detail (note: Florida TRANSEARCH data were previously obtained for 1998 and 2000).	FAF is freely available to all users and can be downloaded from the FHWA website. The website also has an easy-to-use tabulation tool. TRANSEARCH typically takes some time to procure since users must arrange use with FDOT.
	GEOGRAPHIC COVERAGE	Dataset is limited to commodity flows that originate or terminate in the State of Florida (with supplemental O-D information for select ports outside of Florida).	Dataset covers all commodity flows that originate or terminate anywhere in the United States.	Both datasets provide information on commodity flows that originate in, terminate in, or travel through Florida.	TRANSEARCH provides more detailed information for Florida but excludes flows that do not touch Florida (exception: flows for select non-Florida ports). FAF provides less detailed information for Florida but has greater geographical coverage outside of Florida.	TRANSEARCH can be used for detailed geographic analysis of Florida flows but does not contain comprehensive information for other states. FAF can be used to analyze flows for all states.
	COMMODITIES COVERED	Covers most commodities	Covers all commodities	The datasets include most of the same commodities.	TRANSEARCH has limited or no information on Logs, Crude Petroleum, Live Animals/Fish, Waste/Scrap, Household & Business Moves, and construction debris; these are included in FAF. Unlike FAF, TRANSEARCH represents Secondary Traffic (trips from warehouses and distribution centers) and empty truck trips.	FAF can be used to evaluate several commodities that are not included in TRANSEARCH. However, FAF does not explicitly categorize secondary truck trips, which are available in TRANSEARCH. TRANSEARCH also contains empty truck trip estimates.
	REPRESENTATION OF FLOWS	Generally production-to-consumption format	Generally origin-to-destination format	The beginning and end of a goods movement is represented in each dataset.	FAF shows where the commodity is produced and where it is consumed (exception: some flows start or end at a wholesale establishment). TRANSEARCH shows where a specific trip starts and ends. So, in TRANSEARCH, many flows originate at warehouses and distribution centers.	FAF is suitable for production-consumption analysis but does not provide comprehensive information on intermediate stops (such as stops at a distribution center). The trip information provided by TRANSEARCH has strengths for truck trip analysis, secondary traffic analysis, and other trip-related analysis. However, the production (or consumption) end of secondary trips may be missing from the data, potentially creating gaps in production-consumption analysis. For example, the production end of goods that are distributed in Atlanta then trucked to Florida would be excluded.

TABLE 3-1-B: FAF AND TRANSEARCH: SIMILARITIES, DIFFERENCES, AND STRENGTHS & WEAKNESSES (DATA DEVELOPMENT PROCESS)

CATEGORY	FEATURE	DATASET		SIMILARITIES	DIFFERENCES	STRENGTHS & WEAKNESSES
		TRANSEARCH	FAF			
DATASET DEVELOPMENT PROCESSES	DATA SOURCES	See Table 3-2. The main sources are proprietary economic models and truck carrier data.	See Table 3-2. The main source is the CFS.	Many of the same sources are used	Key differences: TRANSEARCH relies more heavily on the Motor Carrier Data Exchange Program and propriety economic models. FAF relies mainly on the Commodity Flow Survey.	TRANSEARCH may be advantageous for evaluating individual trips, especially truck trips. FAF may be advantageous for evaluating the "chained" trip from a production-to-consumption perspective. It is important to note that TRANSEARCH also contains production-consumption data.
	DATA DEVELOPMENT PROCESS	See Chapter 2. IHS' economic BMI models generate production and consumption information; O-D patterns are determined mainly using carrier data; and other sources are used to supplement other commodities and modes.	See Chapter 2. CFS data are supplemented with models to fill in O-D gaps plus estimation of flows for commodities that are not covered in the CFS scope.	Both databases fundamentally try to reflect the activities of companies that generate (or consume) commodity shipments.	Business activity is captured more through economic models in TRANSEARCH and through shipping surveys in FAF.	While the data construction approaches have some major differences, the assessment of the overall strength of each approach requires more evaluation.
	DATA DEVELOPMENT TIME	Approximately 3 months - 2 years depending on level of detail requested	Approximately 3 years	Both datasets present historical data; neither is "real-time"	TRANSEARCH has a faster preparation time.	TRANSEARCH's faster preparation time should improve its representation of current freight flows. A longer time lag in development may decrease the accuracy of the data due to fluctuations in economic cycles.
	UPDATE FREQUENCY	Annual	Every five years with provisional estimates for the current year	Updates occur on a regular basis	TRANSEARCH is updated more frequently	While more regular updates typically provide more up-to-date information, TRANSEARCH updates must be purchased. In contrast, FAF data are updated less frequently but the updates are free.
	FORECASTING PROCESS	See Chapter 2. Freight supply and demand is forecast at the county level using the BMI models; projected national and global economic trends are used as control totals. A range of forecasts was developed for the 2011 purchase.	See Chapter 2. Projected national and global economic trends are used.	Projected national and global economic trends are used.	TRANSEARCH includes more distinctions in freight forecasts at the county level. The 2011 TRANSEARCH data also includes high-medium-low estimates based on economic alternatives.	The TRANSEARCH forecasting process is consistent with the theoretical foundation of the base year construction process (i.e., the use of the BMI models for both processes). Since the CFS is not available for future years, FAF relies more on a factoring approach. The high-medium-low ranges provided by TRANSEARCH provide the user with more evaluation options.

TABLE 3-1-C: FAF AND TRANSEARCH: SIMILARITIES, DIFFERENCES, AND STRENGTHS & WEAKNESSES (USING THE DATA)

CATEGORY	FEATURE	DATASET		SIMILARITIES	DIFFERENCES	STRENGTHS & WEAKNESSES
		TRANSEARCH	FAF			
USING THE DATA	POTENTIAL USES & ANALYSIS OPTIONS	Tons, value and units (e.g., number of trucks) of goods that originate in, terminate in, or flow between zones; Includes assignment information (volume estimates) for the highway and rail networks.	Tons and value of goods that originate in, terminate in, or flow between zones; Includes assignment information (volume estimates) for the highway network.	Tons and value of goods that originate in, terminate in, or flow between zones; Highway assignment information.	TRANSEARCH also includes units and rail assignment information.	FAF is well suited for interstate analysis. Limited geographic detail and potential sample size limitations in FAF make it less suited for intra-Florida analysis. TRANSEARCH is well suited for detailed analysis of trips that begin or end in Florida. The availability of units (e.g., number of trucks) and a rail assignment are TRANSEARCH analysis options that are unavailable in FAF without additional analysis by the user.
	POTENTIAL USERS	Types of users: GIS analysts, policy makers, modelers, operations analysts, economists, and others in public sector agencies, private sector researchers, and academia	(Same)	Same types of users	n/a	n/a
	EASE OF USE: USAGE RESTRICTIONS	Users must first get approval from FDOT. The default version has limited rail information - those who want to use the Waybill-enhanced version must also get permission from the STB. Usage restrictions must be observed.	No restrictions.	Both are readily available to FDOT staff and consultants who work on FDOT projects.	TRANSEARCH has restrictions on who can use it and how the data can be published given its confidential nature.	Usage of FAF is unrestricted. TRANSEARCH users must adhere to restrictions on use or publication of the data as described in the licensing agreement.
	EASE OF USE: COMPREHENSIVENESS OF DOCUMENTATION	Documentation is very thorough.	Documentation is very thorough.	The documentation is of similar quality and completeness.	n/a	n/a
	POTENTIAL USERS	FDOT has contracted with IHS to provide technical support.	The FHWA or other developers may be able to assist with answering some questions.	Technical support and a community of users are options for assistance with both products.	Since IHS is under contract to FDOT, TRANSEARCH users might be able to procure greater assistance from IHS.	Users have good options for support, whether from the user community or from Global Insight representatives.
	EASE OF USE: DATASET SIZE	The Access database is about 1.5 GB.	The Access version is about 230 MB.	Both datasets are large, but manageable with most computers.	The TRANSEARCH data, which is six times larger than FAF, may require longer processing times on older computers.	FAF's smaller size makes it faster to process and analyze, but both datasets can be analyzed in reasonable timeframes using modern computers.
	EASE OF USE: MANAGEMENT, STORAGE AND DISSEMINATION OF THE DATA	Due to proprietary restrictions, FDOT must assign staff resources to manage the dissemination of the data.	The data are readily available online, so this is not an issue with FAF.	n/a	TRANSEARCH storage and dissemination requires management from FDOT staff. FAF requires no FDOT resources.	TRANSEARCH licensing requirements effectively require FDOT staff to devote some time to disseminating the data and/or managing its use. Usage of FAF does not require this kind of oversight since FAF does not have restrictions on use or dissemination.
	EASE OF USE: LEARNING CURVE	The learning curve is comparable for each.	The learning curve is comparable for each.	The learning curve is comparable for each.	n/a	n/a

INTENTIONALLY LEFT BLANK

TABLE 3-2: DATA SOURCES USED IN CONSTRUCTING FAF AND TRANSEARCH

SOURCE	FAF	TRANSEARCH
PRIMARY SOURCE	***CFS***	***BMI ECONOMIC MODELS***
OTHER SOURCES		
County Business Patterns	X	X
Census Sales Data	X	
BEA I-O Make and Use Table	X	X
CFS (Summary Statistics)	n/a	X
SUPPLEMENTAL COMMODITY INFORMATION:		
USDA (US Dept. of Agriculture)	X	X
NOAA Fisheries of the United States Report	X	
IHS Agriculture Crop Production and Forecasts		X
Shifts in Petroleum Transportation (Association of Oil Pipelines)	X	
US Dept. of Energy: Energy Information Administration (EIA)	X	X
Cambridge Energy Research Associates (CERA) Electric Plant Statistics and Forecasts		X
IHS Chemical Plant Production and Consumption Statistics		X
U.S. Geological Survey		X
IHS Automotive Plant Production, Consumption, and Supplier Data		X
Congressional Research Service, U.S. EPA, National Demolition Association, Construction Materials Recycling Association, U.S. Census Annual Services Survey, American Trucking Association, American Moving and Storage Association, BioCycle journal	X	
MODE-SPECIFIC DATA:		
U.S Army Corps of Engineers Waterborne Commerce	X	X
Surface Transportation Board's Railcar Waybill	X	X
U.S. Bureau of Transportation Statistics (BTS) Office of Airline Information (OAI): T-100 Data	X	X
Vehicle Inventory and Use Survey (Summary Statistics)	X	
IMPORT-EXPORT SUPPLEMENTS:		
US Census Bureau's Foreign Trade Database (FTD)	X	X
Port Import Export Reporting Service (PIERS) Import/Export Database	X	
BTS TransBorder Freight Database	X	X
Motor Carrier Data Exchange program		X
Mexico Economic Census (Instituto Nacional de Estadística y Geografía)		X
Mexican Secretaría de Comunicaciones y Transportes		X

X – Indicates that the data source was used during the construction of the FAF or TRANSEARCH dataset respectively.

3.2 OPPORTUNITIES

While both FAF and TRANSEARCH can be used to answer the same types of questions, the datasets offer different opportunities in terms of the level of detail that can be used to answer questions. In most ways, TRANSEARCH presents more opportunities for analysis of commodities in Florida while FAF presents more opportunities for analysis throughout the U.S. This difference in application options occurs because the datasets contain different levels of resolution in regards to commodity type, geographic resolution and modal information.

Generally speaking, the Florida TRANSEARCH data product allows the user the opportunity to summarize commodity flows over a wide range of geographies, commodities, and modes throughout Florida. The dataset is extremely detailed in terms of geographic resolution (about 8,500 TAZs in Florida), commodity resolution (hundreds of categories are delineated), and modal detail (it includes rail, air, water and truck modes plus equipment type for truck). Therefore, TRANSEARCH offers the user the capability to evaluate commodity flow questions down to the TAZ level for any mode and commodity in the dataset. The data can be aggregated to the municipal, MPO, county, district or other level as needed as long as the area of interest is within Florida (or in the included nearby areas in Alabama and Georgia). TRANSEARCH flows can be studies at the 4-digit STCC level or aggregated to a higher level. Similarly, the flows can be studies based on the detailed mode and equipment type information or it can be summarized at an aggregate level.

FAF, on the other hand, has only five zones in the State of Florida and contains less commodity and modal detail than TRANSEARCH. As the case studies below illustrate, the FAF zones do not nest exactly with Florida districts, although they are comparable in size to the average district. Therefore, by default the FAF data can be used for analyzing flows for the state in its entirety or for a sub-region within the state based on the FAF zonal boundaries.

While FAF is less detailed than TRANSEARCH in Florida, FAF contains more information for the rest of the U.S. The Florida TRANSEARCH purchase only contains flows that touch Florida (plus some area on its northern edges and a select sample of non-Florida ports). For users that need to evaluate other flows, FAF is the better option. For example, a user might want to compare flows of manufactured products in Florida vs. other southern states. TRANSEARCH contains comprehensive information for Florida only while FAF contains similar information for all states of interest.

It is important to understand the difference between commodity coverage and commodity resolution. The TRANSEARCH data has very detailed commodity resolution, meaning that there are hundreds of different categories of commodities. On the other hand, while FAF has only about 40 commodity categories, it covers more commodities than TRANSEARCH. For example, Crude Petroleum is covered in FAF but not in TRANSEARCH – as a result, FAF is the main option for evaluating Crude Petroleum flows. Copper Ore, Lead Ore, Zinc Ore and other ores are differentiated in TRANSEARCH while all Metallic Ores are grouped in a single commodity category in FAF. As a result, studying all metallic ores in aggregate can be accomplished using either dataset. But if the user wants to evaluate a specific ore, then TRANSEARCH presents more opportunities for analysis. *Appendix A* provides the detailed commodity classes for FAF and TRANSEARCH databases.

3.3 THREATS

One of the main "threats" of commodity flows analysis relates to the accuracy of the data and the potential to treat the flow estimates as factual information. Both datasets have major sources of uncertainty that can impact the accuracy of analysis, including:

- The use of data samples to develop commodity flow estimates:
  - The FAF dataset is built primarily using the CFS, which samples about one in seven businesses and gathers shipment information for about four weeks of the year from each business. The CFS is administered every five years. Therefore, major changes in the economy could impact the accuracy of the flow estimates.
  - The TRANSEARCH dataset relies heavily on the Motor Carrier Program survey data, which annually samples about four percent of all dry van traffic based on 22 carriers. The sample consists predominantly of longer distance hauls by large carriers with lower rates of shorter-distance trips and less participation by smaller carriers. One possible implication for analysis is that the truck flow estimates may be more accurate for long-distance flows than for intra-state movements.
  - For both data samples, various sectors or geographic areas could be relatively under-sampled or missing. This reduces the level of confidence in the flow estimates.
- The use of models to develop commodity flow estimates:
  - Both data construction efforts use modeling processes to enhance the flow estimates. The objective in both instances is to add value for the user. The TRANSEARCH estimates are developed first at the county level using the company's proprietary BMI models. The FAF data construction process uses statistical processes (iterative proportional fitting and log-linear modeling) to estimate values for O-D pairs for which information was missing or unavailable in the CFS sample.
  - While these practices ultimately allow the end user to conduct analysis at a more detailed level, the user must remember that uncertainty is an inherent feature in any model. Just as modeling output is presented as an estimate, it is good practice to treat the results of commodity flows analysis as an estimate.
- The use of alternative methods to expand the flow estimates:
  - The main FAF and TRANSEARCH data sample and modeling processes do not account for numerous commodity types such as coal and crops. Estimates on these flows were developed using a mix of data, models, factors, and judgment. Uncertainty is inherent in all of these elements.

3.4 SUMMARY OF SWOT ANALYSIS

Overall, while more information means more analysis opportunities, understanding the limitations of the data is critical. The user must remember that more information does not necessarily equal greater accuracy. More detail can also make it more difficult to check and verify findings. A certain amount of caution is helpful both when conducting analysis and conveying results to others, such as an audience of policy-makers.

INTENTIONALLY LEFT BLANK

CHAPTER 4
USER GUIDANCE

INTENTIONALLY LEFT BLANK

This chapter provides an overview of how to use FAF and TRANSEARCH. First, case studies are presented to demonstrate important data characteristics to be aware of when conducting analysis. Second, existing training and recommendations for new training modules are discussed. Finally, the section concludes with a summary of the critical information on these two datasets including a "how-to" primer and which dataset is more appropriate for use in various types of analysis.

4.1 CASE STUDIES: EXAMPLES OF USING THE DATA

The case studies in this section demonstrate the analysis capabilities of FAF and TRANSEARCH. These visual and technical comparisons were created to enhance understanding and relevance for the end user. This exercise will focus on:

- State Totals
- District Comparison Analysis (District 5)
- Miami-Dade County Profile Comparison with FAF/TRANSEARCH
- Port analysis: Comparison of Port of Jacksonville, Port of Tampa, and Port of Savannah. In addition, the report will describe how to compare Savannah flows to flows from the top three Florida ports
- How the data can be compared with information from the State Intermodal System (SIS) and the National Highway System (NHS)

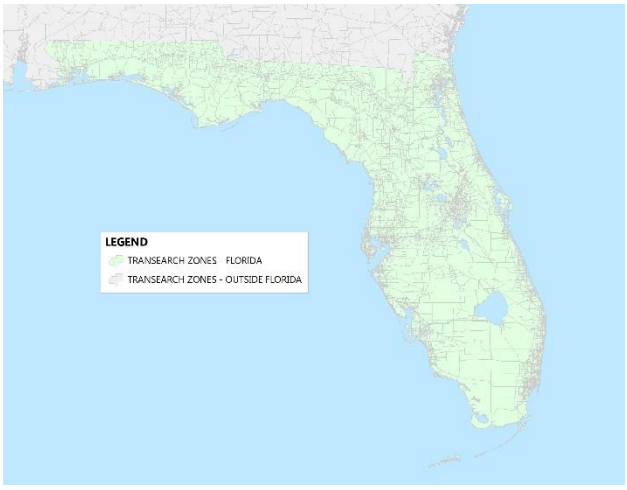
The TRANSEARCH dataset that was provided to the consultant team for this project contains flow detail at the county level within Florida. Therefore, the highest geographic resolution of analysis for the Case Studies shown later is the county level. In addition, the FAF data used for this analysis is the 2012 provisional update of the 2007 FAF3 product. So, the base years for comparison are 2011 (TRANSEARCH) and 2012 (FAF).

4.1.1 STATE TOTALS

Figure 4-1 shows that there are five FAF regions in the State of Florida. There are over 8,500 TRANSEARCH TAZs in the state. Total tons entering, leaving, and within the state are tabulated by mode in *Figure 4-1*. In general, FAF tonnage is greater than TRANSEARCH tonnage in part because FAF covers more commodities.

FIGURE 4-1: STATE OF FLORIDA TRANSEARCH AND FAF ZONES AND TONNAGE DATA

TRANSEARCH



FAF

FIGURE 4-1: STATE OF FLORIDA TRANSEARCH AND FAF ZONES AND TONNAGE DATA CONTINUED…

TRANSEARCH DATA

Mode of Transportation		Total Florida Tons			Total
		Entering Florida	Leaving Florida	Within Florida	
		Sum	Sum	Sum	
Truck	Truck Truckload	51,139,719	26,470,052	101,799,240	179,409,011
	Truck L-T-L	3,038,374	891,725	1,355,109	5,285,208
	Truck PVT	23,014,337	15,121,543	90,100,276	128,236,156
	Truck NEC	872,364	975,590	0	1,847,954
	Subtotal	**78,064,795**	**43,458,910**	**193,254,625**	**314,778,329**
Rail	Rail NEC	1,483,863	1,166,487	0	2,650,350
	Subtotal	**1,483,863**	**1,166,487**	**0**	**2,650,350**
Water	Water	44,775,218	5,114,063	1,068,575	50,957,856
	Subtotal	**44,775,218**	**5,114,063**	**1,068,575**	**50,957,856**
Air	Air	156,423	79,010	3,532	238,965
	Subtotal	**156,423**	**79,010**	**3,532**	**238,965**
Other and Unknown	Foreign Trade Zones	520	0	0	520
	Other	1,043	1,307	0	2,350
	Subtotal	**1,563**	**1,307**	**0**	**2,870**
Total, All Modes		**124,481,862**	**49,819,777**	**194,326,731**	**368,628,370**

FAF DATA

Mode of Transportation	Total Florida Tons			Total
	Entering Florida	Leaving Florida	Within Florida	
	Sum	Sum	Sum	
Truck	71,833,827	48,177,106	694,300,485	814,311,419
Rail	41,472,840	11,193,638	18,520,171	71,186,649
Water	18,874,256	3,959,847	59,873	22,893,976
Air (incl. Truck-Air)	203,762	100,157	2,023	305,941
Multiple Modes & Mail	18,510,302	19,191,445	9,151,560	46,853,307
Pipeline	23,525,731	338,185	410,886	24,274,801
Other and Unknown	1,653,256	1,496,387	8,257,061	11,406,703
Total, All Modes	**176,073,973**	**84,456,766**	**730,702,058**	**991,232,797**

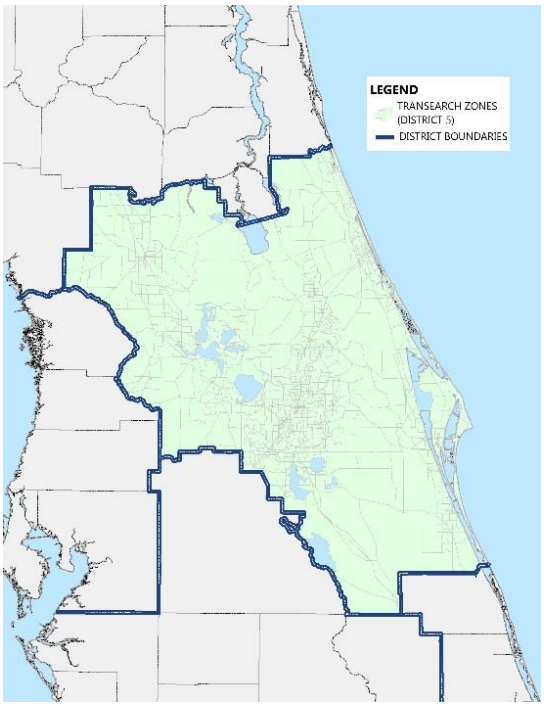
4.1.2 DISTRICT FIVE ANALYSIS

Figure 4-2 shows that the TRANSEARCH zones can be summarized for the District Five boundaries. The Orlando area FAF zone is comparable to District Five but does not match the boundaries exactly. The FAF zone is smaller than District Five. Total tons entering, leaving, and within the area are tabulated by mode in *Figure 4-2*.

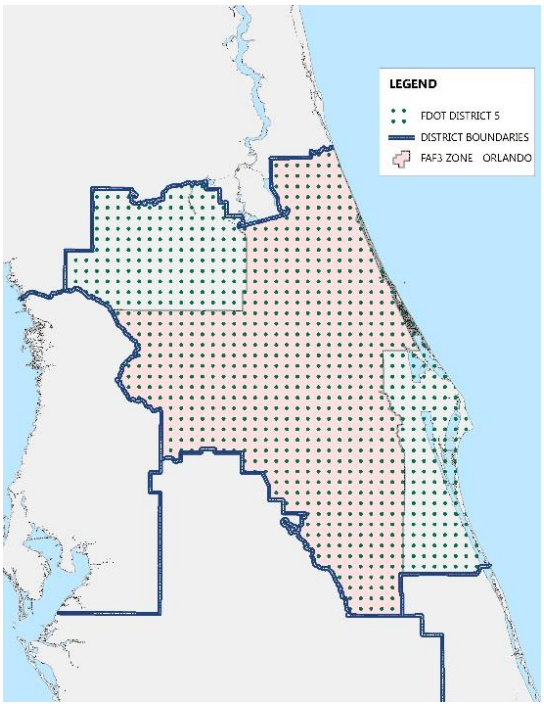
The next example, Miami-Dade County, shows how geographic differences in zonal structure can be addressed to develop refined estimates. However, as the SWOT discussion emphasizes, the data may be less accurate at these more detailed levels.

FIGURE 4-2: DISTRICT FIVE TRANSEARCH AND FAF ZONES AND TONNAGE DATA

TRANSEARCH



FAF



TRANSEARCH DATA

Mode of Transportation		Total District 5 Tons					
		Entering District 5		Leaving District 5		Within District 5	Total
		From the rest of Florida	From the Rest of the Country	To the rest of Florida	To the Rest of the Country		
Truck	Truck Truckload	8,767,670	8,366,610	6,995,531	2,233,565	6,645,154	33,008,530
	Truck L-T-L	194,130	556,071	178,383	127,159	46,237	1,101,980
	Truck PVT	8,842,494	3,315,969	7,547,481	1,624,528	6,080,121	27,410,592
	Truck NEC	0	120,741	0	126,392	0	247,133
	Subtotal	**17,804,294**	**12,359,391**	**14,721,395**		**12,771,512**	**61,768,234**
Rail	Rail NEC	0	127,178	0	135,443	0	262,621
	Subtotal	**0**	**127,178**	**0**	**135,443**	**0**	**262,621**
Water	Water	23,818	1,835,716	75,034	19,269	35,203	1,989,039
	Subtotal	**23,818**	**1,835,716**	**75,034**	**19,269**	**35,203**	**1,989,039**
Air	Air	1,008	25,763	258	6,958	18	34,004
	Subtotal	**1,008**	**25,763**	**258**	**6,958**	**18**	**34,004**
Other and Unknown	Foreign Trade Zones	0	92	0	0	0	92
	Other	0	192	0	267	0	460
	Subtotal	**0**	**284**	**0**	**267**	**0**	**552**
Total, All Modes		**17,829,120**	**14,348,332**	**14,796,686**	**4,273,581**	**12,806,732**	**64,054,450**

FIGURE 4-2: DISTRICT FIVE TRANSEARCH AND FAF ZONES AND TONNAGE DATA CONTINUED …

FAF DATA

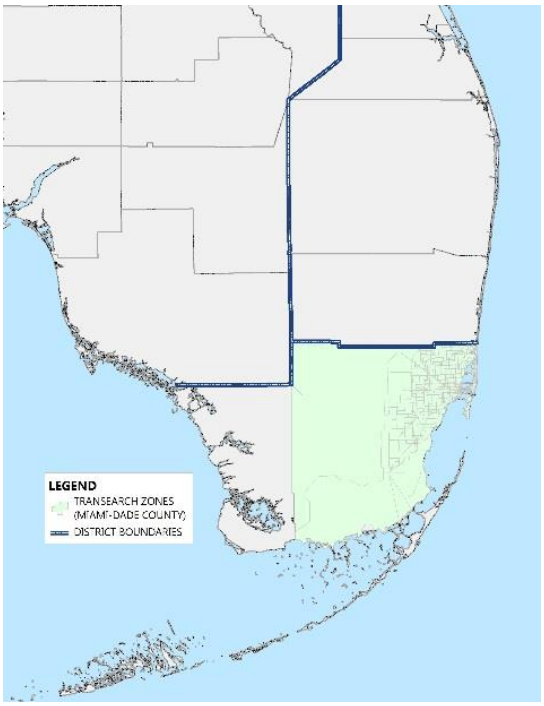
MODE OF TRANSPORTATION	TOTAL DISTRICT 5 TONS					TOTAL
	ENTERING ORLANDO METRO AREA		LEAVING ORLANDO METRO AREA		WITHIN DISTRICT 5	
	FROM THE REST OF FLORIDA	FROM THE REST OF THE COUNTRY	TO THE REST OF FLORIDA	TO THE REST OF THE COUNTRY		
Truck	36,548,281	8,777,884	32,768,890	3,273,693	72,078,927	153,447,674
Rail	51,789	1,865,737	45,070	439,720	3,451	2,405,766
Water	3	71,497	7	1,490	0	72,996
Air (incl. Truck-Air)	1,111	21,700	10	7,630	0	30,450
Multiple Modes & Mail	1,130,746	1,134,350	72,672	96,096	54,061	2,487,925
Pipeline	30	3,537,239	7	1,799	0	3,539,076
Other and Unknown	162,568	179,230	188,172	90,026	808,546	1,428,541
Total, All Modes	**37,894,527**	**15,587,637**	**33,074,827**	**3,910,452**	**72,944,985**	**163,412,427**

4.1.3 MIAMI-DADE COUNTY

Figure 4-3 shows that the TRANSEARCH data can be summarized to Miami-Dade County according to the county boundaries. The FAF zone for this area, however, covers three counties: Miami-Dade, Broward and Palm Beach Counties. This section illustrates a common technique used to apportion commodity flow data from a larger geography to a smaller geography.

FIGURE 4-3: MIAMI-DADE COUNTY TRANSEARCH AND FAF ZONES AND TONNAGE DATA

TRANSEARCH



FAF

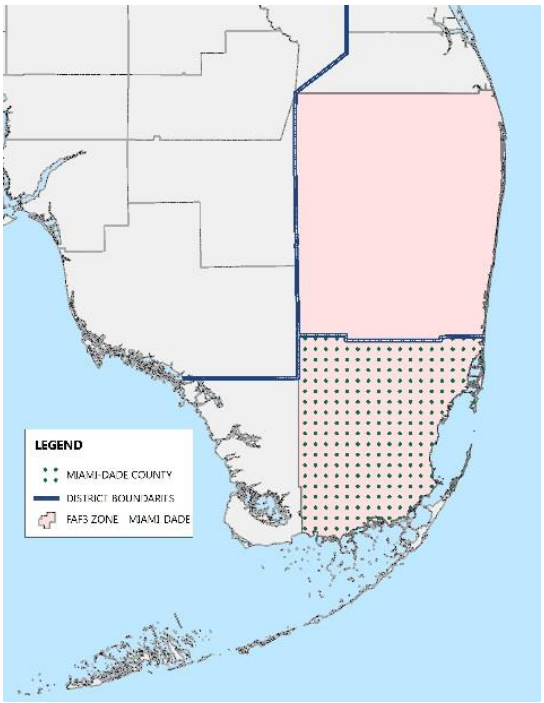


FIGURE 4-3: MIAMI-DADE COUNTY TRANSEARCH AND FAF ZONES AND TONNAGE DATA CONTINUED

TRANSEARCH DATA

Mode of Transportation		Total District 5 Tons					Total
		Entering Miami-Dade County		Leaving Miami-Dade County		Within Miami-Dade County	
		From the rest of Florida	From the Rest of the Country	To the rest of Florida	To the Rest of the Country		
Truck	Truck Truckload	7,455,742	9,770,514	11,939,057	2,496,743	8,580,930	40,242,986
	Truck L-T-L	171,143	586,204	337,433	208,190	71,080	1,374,050
	Truck PVT	6,985,597	4,686,192	12,880,078	1,342,523	6,691,342	32,585,732
	Truck NEC	0	183,243	0	178,254	0	361,497
	Subtotal	**14,612,482**	**15,226,153**	**25,156,568**	**4,225,710**	**15,343,351**	**74,564,265**
Rail	Rail NEC	0	212,747	0	7,778	0	220,525
	Subtotal	**0**	**212,747**	**0**	**7,778**	**0**	**220,525**
Water	Water	158,220	2,870,199	65,757	49,134	79,256	3,222,566
	Subtotal	**158,220**	**2,870,199**	**65,757**	**49,134**	**79,256**	**3,222,566**
Air	Air	1,485	78,971	344	33,902	0	114,702
	Subtotal	**1,485**	**78,971**	**344**	**33,902**	**0**	**114,702**
Other and Unknown	Foreign Trade Zones	0	64	0	0	0	64
	Other	0	149	0	258	0	407
	Subtotal	**0**	**213**	**0**	**258**	**0**	**471**
Total, All Modes		**14,772,186**	**18,388,282**	**25,222,670**	**4,316,783**	**15,422,607**	**78,122,529**

FAF DATA

Mode of Transportation	Total District 5 Tons					Total
	Entering Miami Metro Area		Leaving Miami Metro Area		Within Miami Metro Area	
	From the rest of Florida	From the Rest of the Country	To the rest of Florida	To the rest of the Country		
Truck	18,362,141	17,207,193	28,007,639	9,637,935	183,183,882	256,398,790
Rail	375,006	2,172,659	751,680	2,512,963	939,123	6,751,430
Water	104	3,826,209	885	3,066,226	22,792	6,916,215
Air (incl. Truck-Air)	391	115,306	511	37,460	0	153,668
Multiple Modes & Mail	733,658	2,791,375	2,672,718	6,811,676	1,113,737	14,123,163
Pipeline	92	8,630,802	16	17,917	0	8,648,827
Other and Unknown	148,144	436,057	200,383	1,130,313	4,173,496	6,088,393
Total, All Modes	**19,619,536**	**35,179,600**	**31,633,832**	**23,214,489**	**189,433,029**	**299,080,485**

One basic apportionment method involves using employment, population, or other data that reflect the amount of activity in an area. More detailed categories of data can be used such as manufacturing and transportation employment. For this example, total estimated employment for year 2013 (source: Census Quickfacts) is used to apportion the FAF 2012 provisional estimates from the FAF Miami region to Miami-Dade County. *Table 4-1* demonstrates this common, basic method of apportioning the regional total to counties based on the percentage of employment in each county. Using this method, an estimate of FAF-based tons in Miami-Dade County is 133,944,935 annual tons. If needed, the user now can present two estimates of commodity flows for Miami-Dade County (78,122,529 tons from TRANSEARCH and 133,944,935 tons using FAF) provided that these estimates are accompanied with the necessary caveats regarding dataset differences and data limitations.

TABLE 4-1: EXAMPLE APPORTIONMENT OF FAF TONNAGE FROM THE FAF ZONE TO THE COUNTY LEVEL

COUNTY	EMPLOYMENT 2013	% EMPLOYMENT 2013	ESTIMATED % OF FAF TONS	ESTIMATED FAF TONS
Broward	626,529	31.65%	31.65%	94,658,974
Miami-Dade	886,497	44.79%	44.79%	133,958,149
Palm Beach	466,399	23.56%	23.56%	70,463,362

In general, TRANSEARCH is the better candidate for analysis at the county level or lower (e.g., TAZ), or for more customized areas such as MPOs. This is because TRANSEARCH was created at the detailed county level while FAF was created using system of larger zones. Because the TRANSEARCH data are available, the user generally will not need to apportion the FAF data to these refined geographic levels.

However, there may be instances where the FAF data are the better option. Examples where FAF would be used include:

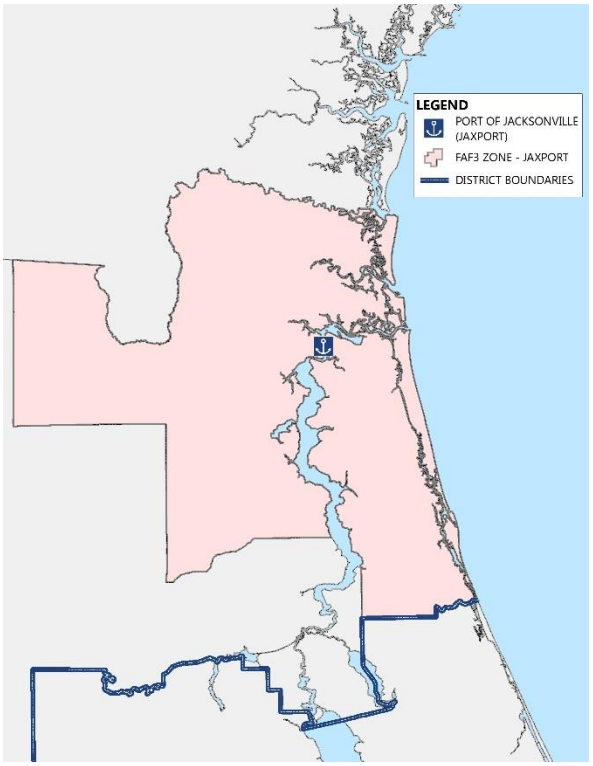
- The commodity being studied is included in FAF but not TRANSEARCH
- Out-of-state comparisons are important to the analysis – for example, the user might want to compare tonnages in the Miami-Dade region vs. Los Angeles region.
- A range of commodity flow estimates is desired – in this case, the user may want to analyze TRANSEARCH and FAF as well as data checks using PIERS or other sources

4.1.4 PORT COMPARISON

Figure 4-4, Figure 4-5, and Figure 4-6 show the geographic units that were used to develop port-based estimates of flows for JAXPORT, Port of Tampa and Port of Savannah and the corresponding tonnages, respectively. There are major differences in the tonnage estimates. While some of the difference is attributable to the differences in commodity coverage between the datasets, these differences are compounded by differences in geography. For example, the FAF zone in which JAXPORT is located spans multiple counties in the Jacksonville MSA zone while the TRANSEARCH data provided for this project includes Duval County as a single zone. Because of this, TRANSEARCH offers a more refined estimate of flows specific to JAXPORT. The FAF zone covers JAXPORT as well as all import/export activity in the rest of the Jacksonville MSA, which is a large area. This is the case for all of the port comparisons, where the TRANSEARCH data offers a more refined estimate of the flows specific to the port because it covers a smaller geographic area.

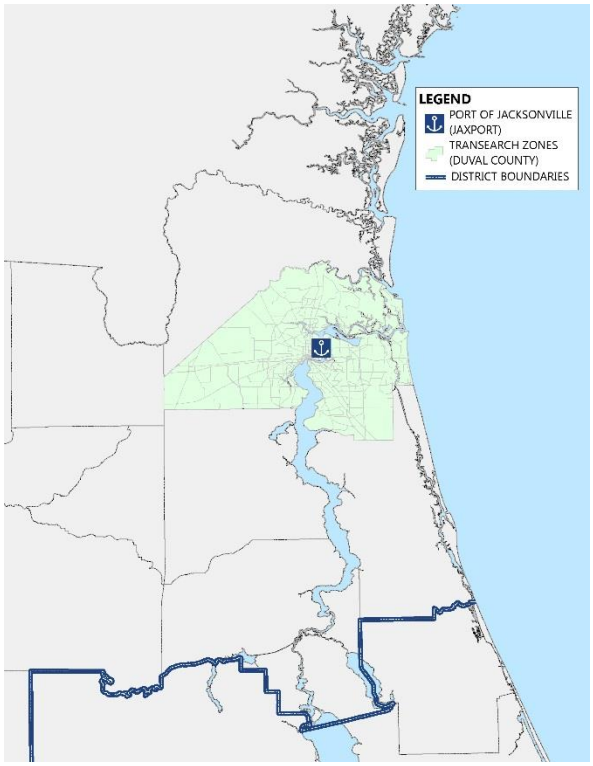
FIGURE 4-4: JAXPORT FAF AND TRANSEARCH ZONES AND TONNAGE DATA

FAF



TRADE TYPE		SUM
IMPORT	Imports to Florida Using JAXPORT	6,838,661
	Imports to Other States Using JAXPORT	3,884,898
	Subtotal	**10,723,559**
EXPORT	Exports from Florida Using JAXPORT	1,780,761
	Exports from Other States Using JAXPORT	2,632,132
	Subtotal	**4,412,893**
TOTAL IMPORTS & EXPORTS		**15,136,452**

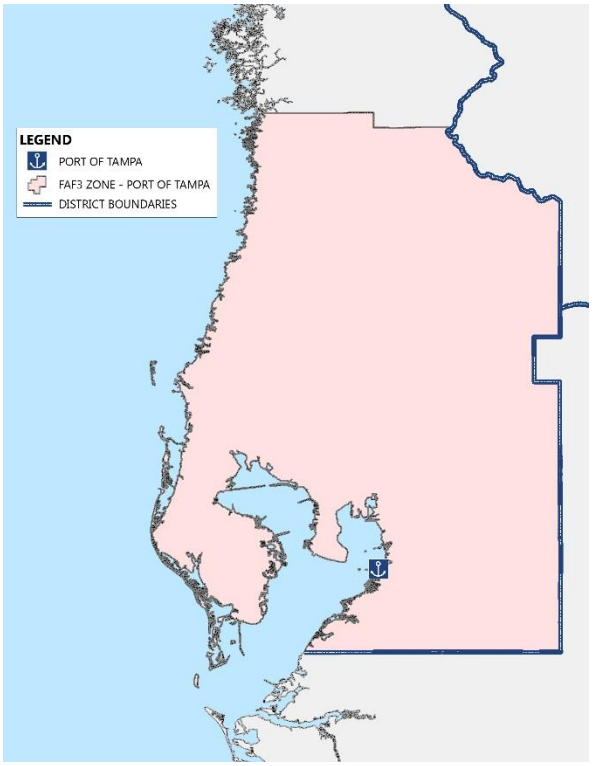
TRANSEARCH



TRADE TYPE		SUM
IMPORT	Imports to Florida Using JAXPORT	367,248
	Imports to Other States Using JAXPORT	376,766
	Subtotal	**744,014**
EXPORT	Exports from Florida Using JAXPORT	338,329
	Exports from Other States Using JAXPORT	843,811
	Subtotal	**1,182,141**
TOTAL IMPORTS & EXPORTS		**1,926,155**

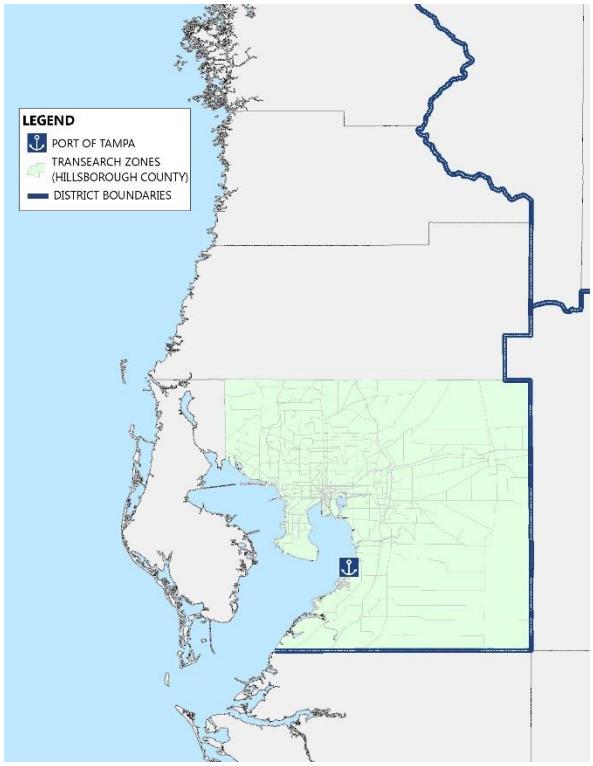
FIGURE 4-5: PORT OF TAMPA FAF AND TRANSEARCH ZONES AND TONNAGE DATA

FAF



TRADE TYPE		SUM
IMPORT	Imports to Florida Using Port of Tampa	7,858,927
	Imports to Other States Using Port of Tampa	4,105,837
	Subtotal	**11,964,764**
EXPORT	Exports from Florida Using Port of Tampa	2,528,052
	Exports from Other States Using Port of Tampa	1,858,167
	Subtotal	**4,386,219**
TOTAL IMPORTS & EXPORTS		**16,350,983**

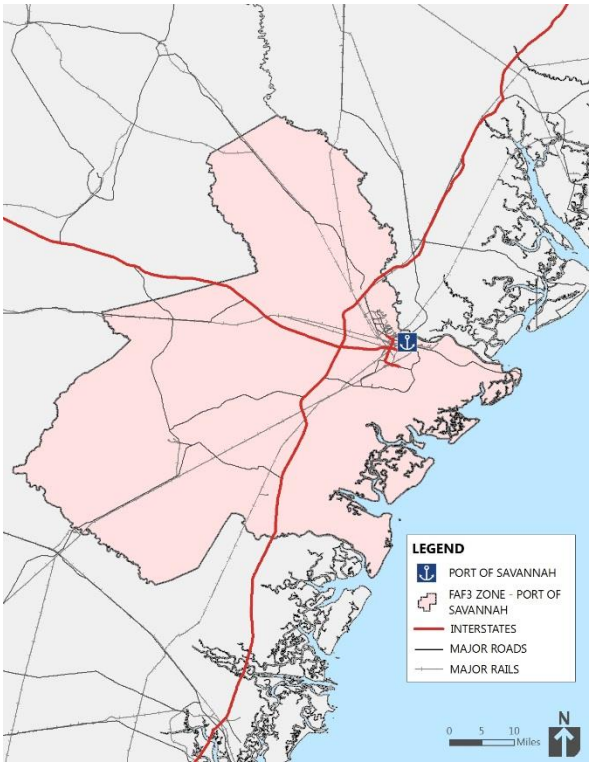
TRANSEARCH



TRADE TYPE		SUM
IMPORT	Imports to Florida Using Port of Tampa	807,341
	Imports to Other States Using Port of Tampa	1,125,230
	Subtotal	**1,932,571**
EXPORT	Exports from Florida Using Port of Tampa	271,921
	Exports from Other States Using Port of Tampa	579,244
	Subtotal	**851,165**
TOTAL IMPORTS & EXPORTS		**2,783,736**

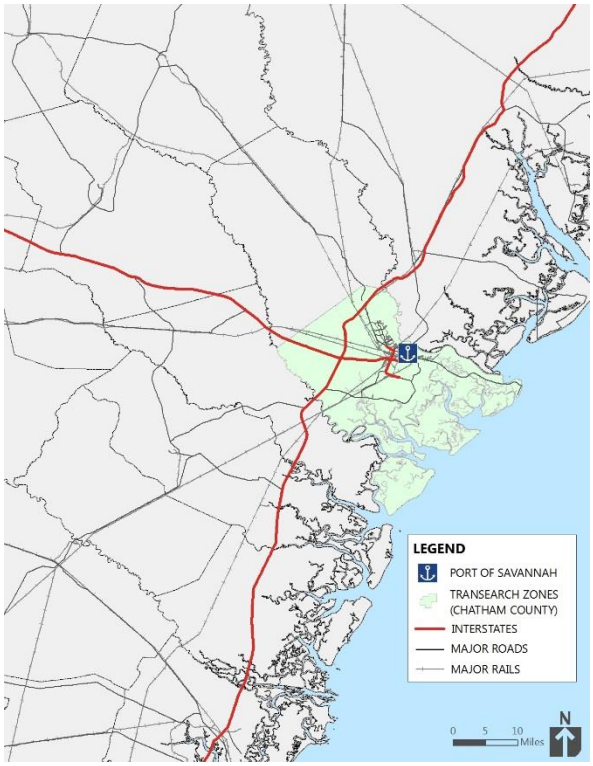
FIGURE 4-6: PORT OF SAVANNAH FAF AND TRANSEARCH ZONES AND TONNAGE DATA

FAF



Trade Type		Sum
Import	Imports to Florida Using Port of Savannah	1,423,570
	Imports to Other States Using Port of Savannah	20,928,835
	Subtotal	**22,352,404**
Export	Exports from Florida Using Port of Savannah	822,275
	Exports from Other States Using Port of Savannah	19,391,110
	Subtotal	**20,213,384**
Total Imports & Exports		**42,565,789**

TRANSEARCH



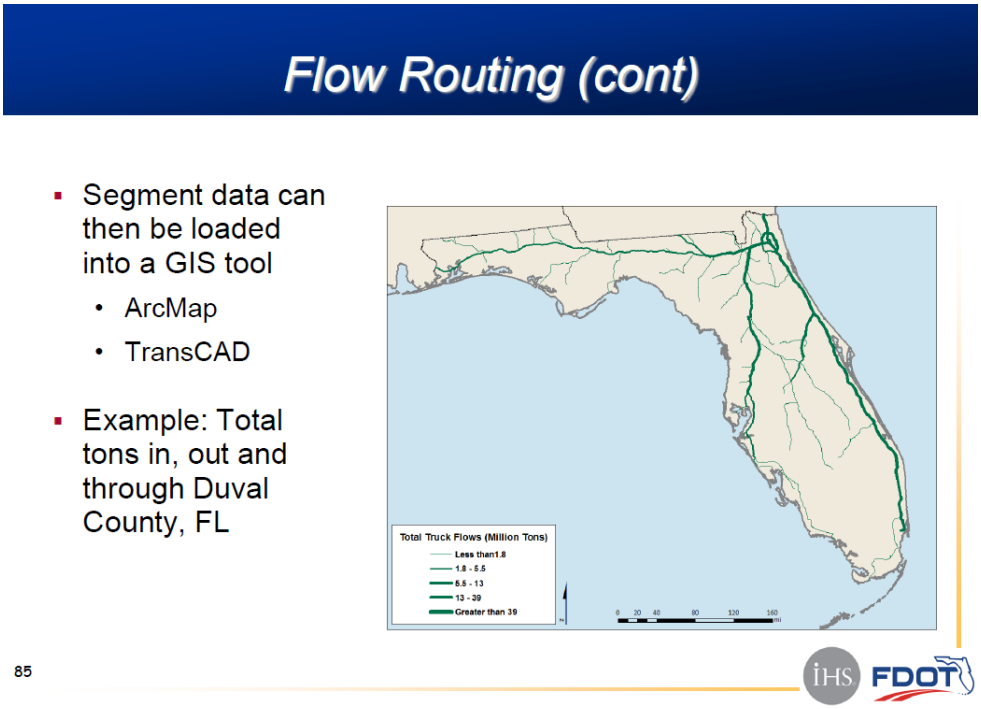
Trade Type		Sum
Import	Imports to Florida Using Port of Savannah	1,149,642
	Imports to Other States Using Port of Savannah	1,527
	Subtotal	**1,151,169**
Export	Exports from Florida Using Port of Savannah	806,603
	Exports from Other States Using Port of Savannah	306
	Subtotal	**806,909**
Total Imports & Exports		**1,958,078**

4.1.5 COMPARISON TO SIS AND NHS

Estimates of commodity-carrying trucks on the highway network have been developed for both TRANSEARCH and FAF. These volume estimates can be compared to observed truck count volumes on the SIS and NHS networks. In general, the TRANSEARCH and FAF estimates should be compared to count volumes for FHWA vehicle classes 8-13, which represent the type of heavy trucks that are typically used for commodity transport.

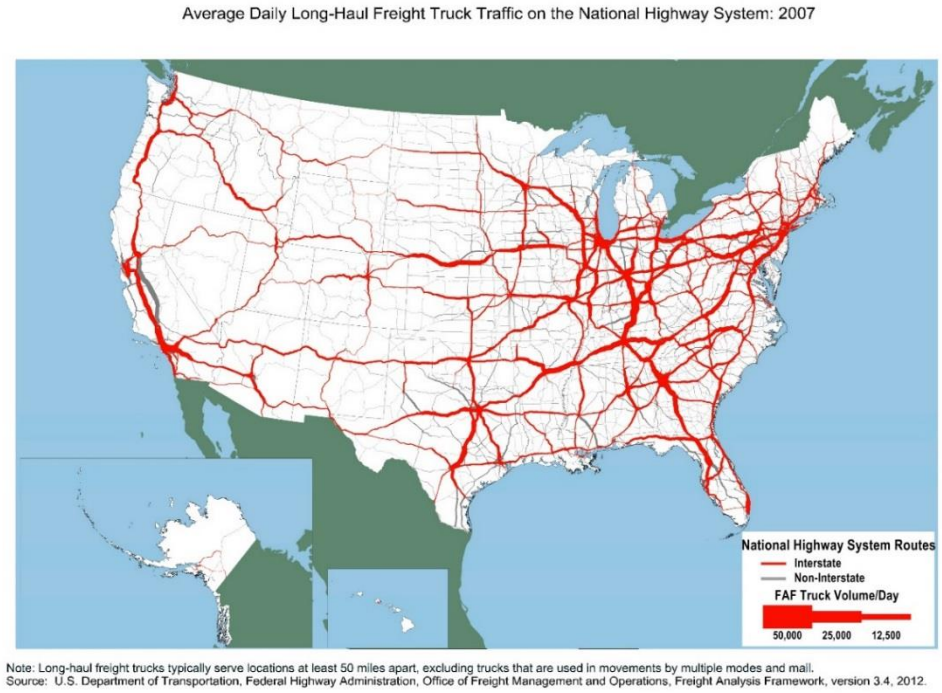
The TRANSEARCH training slides illustrate how to evaluate TRANSEARCH commodity flows on the highway network using ArcGIS (*Figure 4-7*). A loaded network is available for FAF (*Figure 4-8*) at http://faf.ornl.gov/fafweb/networkdata.aspx.

FIGURE 4-7: HOW TO ROUTE 2011 TRANSEARCH FLOWS



Source: TRANSEARCH training slides

FIGURE 4-8: 2007 FAF ASSIGNMENT



Source: FHWA and Oak Ridge National Laboratory

4.2 TRAINING OPTIONS

This section describes training materials for the user. Existing materials are described and recommendations for future training are made.

4.2.1 EXISTING TRAINING MATERIALS

IHS provided documentation and training to FDOT regarding how to use the data. In addition to these documents, the TRANSEARCH Data Reference Guide and TRANSEARCH 2011 Project Documentation provide useful documentation to the user. These documents describe the level of detail in the raw data as well as how to analyze the data. For example, the TRANSEARCH training slides describe how to:

- Estimate volumes of commodity carrying trucks on the highway network: Route TRANSEARCH trucks using the Highway Table and the accompanying highway shapefile
- Extract subsets that address particular needs:
  - Base Year vs. Forecasts
  - Selected Modes
  - Specific Geographic Markets
  - Inbound or Outbound Orientation
  - Length of Haul Limitations
- Aggregate data to reduced levels of detail – for example:
  - 2-digit commodity summaries or no commodity detail (total flows)
  - Total truck vs. sub-modes
  - Larger geographic market areas

The TRANSEARCH 2011 Project Documentation provides specific SQL queries that illustrate how to summarize the data, which is delivered as a Microsoft Access database. IHS is also on contract to provide technical support to users of the data.

There are two main options for using the FAF3 data. The FAF3 data may be downloaded from the web at:
http://ops.fhwa.dot.gov/freight/freight_analysis/faf/index.htm
The raw O-D tables may be downloaded here as well as state level and other summaries.

FAF3 network and zone shapefiles are available at:
http://ops.fhwa.dot.gov/freight/freight_analysis/faf/faf3/netwkdbflow/index.htm

FHWA also provides an online tabulation tool at:
http://faf.ornl.gov/fafweb/Extraction0.aspx

The FAF3 website contains information for the user in its Freight Analysis Framework 3 User Guide. This document is readily available online at:
http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf3/userguide/

General inquiries about FAF3 may be directed to:

- Federal Highway Administration, U.S. Department of Transportation
- Phone: 202-366-0408; Fax: 202-366-3225
- FreightFeedback@dot.gov

FHWA has provided numerous webinars and listening sessions on how to use the FAF data for analysis. These are found at the http://ops.fhwa.dot.gov/freight/freight_analysis/faf/index.htm site. These include:

- "Using FAF Data for Freight Planning"
- "How the FAF Can Help You"
- "Using Freight Analysis Framework Data in Economic Analysis"
- "Using Freight Analysis Framework Data for Freight Planning"
- Archived FAF Listening Sessions from December 2013 and January 2014 provide additional material on the FAF data products

Finally, in addition to the main data development report, documentation on the network assignment and how it was prepared can be found in the FAF3 FREIGHT TRAFFIC ANALYSIS: Final Draft Report by Batelle. The report was submitted to Oak Ridge National Laboratory on March 23, 2001 and can be accessed through the following link: http://faf.ornl.gov/fafweb/Data/Freight_Traffic_Analysis/faf_fta.pdf.

4.2.2 TRAINING RECOMMENDATIONS

While the existing training materials are already prepared, are readily accessible, and are fairly comprehensive, the following adjustments are recommended to better facilitate user understanding.

While the existing TRANSEARCH training and documentation materials provide valuable information on the assembly and usage of the data, the casual user may feel overwhelmed by the amount of information that is presented. Additionally, the training slides contain a limited number of example applications. The training slides focus more on "what the dataset is" than "what the dataset can do" in application. A condensed version of the background with an expanded examples section may provide more practical information to new or occasional analysts. Ideally, the examples will show step-by-step how the analysis can be conducted using readily available processing tools such as Microsoft Access and ESRI ArcGIS.

In addition, improved naming conventions would help users understand the current TRANSEARCH documentation. In the version that was received by our consultant team, the TRANSEARCH data was accompanied by a total of seven documentation files. The naming of these files is rather unclear, as "Project Documentation" can be easily confused with "Methodology Documentation" or "Reference Guide". FDOT (or IHS) may rename these before distribution to enhance their usefulness. Possible improved names are:

- "TRANSEARCH Field Descriptions and Querying Processes" instead of "TRANSEARCH 2011 Project Documentation"
- "TRANSEARCH Dataset Construction" instead of "TRANSEARCH Methodology Documentation"
- "TRANSEARCH Field Codes and Geographies" instead of "TS Reference Guide"

Reorganizing the content would also help the user. Field descriptions and field codes, which are currently in two separate documents, would logically fit into one document along with the description of TRANSEARCH geographies. The Querying Processes illustrations fit logically into the training guide.

The FAF online tabulation tool makes the FAF product very easy to use. The documentation, also online, is straightforward and it coherently describes the data limitations. However, it is difficult to determine based on the documentation how the FAF differs from TRANSEARCH or whether FAF can be used for fairly specific flow questions such as those related to port flows. Therefore, while the existing documentation is good and useful, a few enhancements can make it more practical to the end user.

The following recommendations are made for commodity flow training modules.

4.2.2.1 Overview of Data and Analysis Purposes

The data should be briefly described and key terms like "commodity flow" and "modes" defined. Analysis purposes can be contrived based on actual examples from the FMTP, regional freight plans, and other documents. Illustrations should be utilized where possible.

4.2.2.2 Data Construction and Data Limitations

The user should be briefly acquainted with the basics of the underlying data (e.g., the CFS and BMI models). A single table can be used to list each data source used in the data development. The practical emphasis should be twofold. First, the training should demonstrate that the data were developed for user applications, and that developing flow estimates from these underlying data sources is a big part of that. Second, it should convey the uncertainties that are inherent in the data and help users understand the implications of these limitations on analysis and interpretation of findings.

4.2.2.3 Application Examples

The training should first define various types of analysis. For example, different processes are used to analyze flows by mode vs. production tonnages. The training should enumerate all of the common types of analysis and provide a step-by-step overview on how to analyze each type. Next, examples in each category should be demonstrated. Hands-on examples in Microsoft and ESRI platforms will show the user the details of conducting analysis. The demonstration should inform the user on how to produce (or analyze) the information as well as how to interpret the findings. Discussion of data limitations is an integral part of the interpretation of findings.

4.3 DATA PURCHASE CONSIDERATIONS

The TRANSEARCH data provides Florida with the opportunity to evaluate commodity flows at a very detailed level. IHS offers a variety of purchase options, including:

- Geographic level of detail: available levels include the state, county, zip code or TAZ levels
- Commodity level of detail: STCC4 is often used, but more or less detail may be an option (depending on the commodity)
- Commodity coverage: the company will prepare estimates of commodities that are not typically covered for clients that are interested
- Scenario offerings: while this category has many options, commonly requested scenarios are typically based around macroeconomic scenarios. For example, the State of Florida purchase includes high-medium-low flow estimates based on optimistic and pessimistic socioeconomic conditions.

Full consideration of potential uses can help FDOT assess whether to purchase TRANSEARCH data and at what level of customization. Each purchase option has its pros and cons. The more detailed data can be used to answer more detailed questions as described throughout this report. For questions regarding very specific industries, commodities, or geographic areas, TRANSEARCH will likely provide the best insights.

Alternately, experienced analysts may be able to develop a commodity flows with a similar level of detail using readily available sources. For example, the user can disaggregate FAF data based on Census or Infogroup employment data combined with production/consumption information from various sources. The user could also try to replicate the IHS process of constructing commodity flow data based on county level information in an economic modeling construct. Depending on the geography and commodity coverage of the analysis, the amount of information can quickly become overwhelming to manage. However, for a high level of detail or a broad analysis area, this option may be viable.

INTENTIONALLY LEFT BLANK

APPENDIX A

COMMODITY CLASSES USED IN FAF AND TRANSEARCH

INTENTIONALLY LEFT BLANK

A.1 FAF – SCTG

SCTG2	DESCRIPTION
1	Live Animals and Live Fish
2	Cereal Grains (including seed)
3	Other Agricultural Products, except for Animal Feed
4	Animal Feed and Products of Animal Origin n.e.c.
5	Meat, Fish, Seafood, and Their Preparations
6	Milled Grain Products and Preparations, and Bakery Products
7	Other Prepared Foodstuffs, and Fats and Oils
8	Alcoholic Beverages
9	Tobacco Products
10	Calcareous Monumental or Building Stone
11	Natural Sands
12	Gravel and Crushed Stone
13	Nonmetallic Minerals, n.e.c.
14	Metallic Ores and Concentrates
15	Non-agglomerated Bituminous Coal
16	Crude Petroleum
17	Gasoline and Aviation Turbine Fuel
18	Fuel Oils
19	Coal and Petroleum Products, n.e.c.
20	Basic Chemicals
21	Pharmaceutical Products
22	Fertilizers
23	Chemical Products and Preparations, n.e.c.
24	Plastics and Rubber
25	Logs and Other Wood in the Rough
26	Wood Products
27	Pulp, Newsprint, Paper, and Paperboard
28	Paper or Paperboard Articles
29	Printed Products
30	Textiles, Leather, and Articles of Textiles or Leather
31	Nonmetallic Mineral Products
32	Base Metal Forms & Finished Basic Shapes
33	Articles of Base Metal
34	Machinery
35	Electronic & Other Electrical Equipment and Components, and Office Equipment
36	Motorized and Other Vehicles (including parts)
37	Transportation Equipment, n.e.c.
38	Precision Instruments and Apparatus
39	Furniture, Mattresses & Mattress Supports, Lamps, Lighting Fittings, and Illuminated Signs
40	Miscellaneous Manufactured Products
41	Waste and Scrap
43	Mixed Freight
99	Commodity Unknown *(S= data suppressed in 2007 CFS)205014

n.e.c = not elsewhere classified

A.2 TRANSEARCH – 2-DIGIT STCC CODES

STCC2	DESCRIPTION
100	Farm Products
800	Forest Products
900	Fresh Fish or Marine Products
1000	Metallic Ores
1100	Coal
1300	Crude Petrol. or Natural Gas
1400	Nonmetallic Minerals
1900	Ordnance or Accessories
2000	Food or Kindred Products
2100	Tobacco Products
2200	Textile Mill Products
2300	Apparel or Related Products
2400	Lumber or Wood Products
2500	Furniture or Fixtures
2600	Pulp, Paper or Allied Products
2700	Printed Matter
2800	Chemicals or Allied Products
2900	Petroleum or Coal Products
3000	Rubber or Miscellaneous Plastics Products
3100	Leather or Leather Products
3200	Clay, Concrete, Glass or Stone
3300	Primary Metal Products
3400	Fabricated Metal Products
3500	Machinery
3600	Electrical Equipment
3700	Transportation Equipment
3800	Instruments, Photographic Goods, Optical Goods, Watches, or Clocks
3900	Miscellaneous Products of Manufacturing
4000	Waste or Scrap Materials
4100	Miscellaneous Freight Shipments
4200	Containers, Carriers or Devices, Shipping, Returned Empty
4300	Mail or Contract Traffic
4400	Freight Forwarder Traffic
4500	Shipper Association Traffic
4600	Miscellaneous Mixed Shipments
4700	Small Packaged Freight Shipments
4900	Hazardous Materials
5000	Secondary Traffic
6000	Unclassified

A.3 FAF MODES

CODE	MODE
1	Truck
2	Rail
3	Water
4	Air (includes truck-air)
5	Multiple Modes and Mail
6	Pipeline
7	Other and Unknown
8	No Domestic Mode

A.4 TRANSEARCH MODES

CODE	MODE
1	Rail Carload
2	Rail Intermodal
3	Rail NEC
4	Truck Truckload
5	Truck Less-Than-Truckload (L-T-L)
6	Truck PVT
7	Truck NEC
8	Air
9	Water
10	Other
11	Pipeline

INTENTIONALLY LEFT BLANK