Analysis of Freight Movement Mode Choice Factors

Report for

Florida Department of Transportation
Rail Planning and Safety

Award # B-D238

Prepared by:

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at the
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Introduction

Facilitating economic growth and prosperity through efficient movement of goods is at the center of any comprehensive transportation plan. Assessing the most efficient means of freight movement requires careful consideration. Concerns for open and competitive markets for the shipment of goods are weighed against concerns such as congestion mitigation and road safety. Each mode provides certain benefits when compared to the other, however those benefits typically entail a trade-off for some other cost. Advocates for the movement of goods by road point to speed and flexibility factors. Advocates for the movement of goods by rail point to safety and energy efficiency factors. This report primarily examines the movement of goods via road or rail, although the interrelated elements of air and water movement of goods should not be ignored.

In recent years, questions of how to evaluate modal tradeoffs have emerged. While the specifics of these questions vary, they can all be summarized by asking the following question, "Which mix of modal investments yields the highest returns to taxpayers?" Since there are many ways to move people and goods, each of which has its own cost structure, infrastructure requirements, and financing mechanisms, it can be both confusing and complex to make comparisons in a meaningful way. Additionally, the demand for freight movement services is changing, with significant implications for how best to address the need for reliable, flexible, cost-effective, timely, and visible door-to-door freight services. Lower inventory levels and less slack production capacity create greater dependence on transportation services.

This study was prompted by the need to address these concerns, and the issues raised by a number of reports such as one by the Washington Department of Transportation (WSDOT), which sought an answer to the question, "How would highways be impacted if all the freight currently moving by rail had to, instead, be moved by truck". The WSDOT study found that for Washington State, without rail service:

- More than 1 million trucks would be added to some interstate highway sections,

- Highway travelers would experience more than 3 million additional hours of delay,
- Travelers would incur an additional $329 million in vehicle-operating and travel-time costs,
- Transportation related accident costs would increase by $67 million per year,
- An additional $851 million in highway capacity needs would occur in the first 5 years, and
- Loss of branch-line and short-line railroad service would increase annual highway resurfacing costs by $21 million.

These findings are potentially significant for Florida, given the State's rapid growth and increasing pressure on its highways. While the WSDOT study evaluated the impacts that removing the rail system might have, the next logical step would be to evaluate the modal split of freight movement within Florida to determine the optimal mix of rail and roadway investment.

Identification of the optimal split of freight movement between road and rail could accrue as benefits in many areas, such as reduced highway congestion, improved air quality, reduced pavement preservation costs, improved safety, offsets to trucking labor short-falls and improved rail service improvements, as well as better utilizing existing infrastructure.

Economic theory suggests several methods for leveraging a shift to the optimal mode. What remains unclear, however, is which of those methods would yield the highest benefits at the lowest costs and whether the best feasible method would generate high enough net benefits to justify a shift. The objective of the tasks in this project is to make recommendations on policy actions that will achieve desirable results.

This study was undertaken as a joint effort between the Center for Urban Transportation Research at the University of South Florida (CUTR) and the University of Florida's Bureau of Economic and Business Research (BEBR). Initially, the two project teams planned to prepare a joint report, however due to the outcomes of initial investigations by both groups, it was determined that separate (though complimentary) reports would better suit the objectives of the project. Accordingly, readers are advised to review the BEBR's "Analysis of Freight Movement Mode Choice Factors – Economic Element" in conjunction with this report.

CUTR's efforts entailed a survey of available and relevant publications, reports and studies, an examination of the industry sectors where mode shift from road to rail might be most likely to occur, an investigation into the mode choice factors considered by shippers, and an overview of potential activities and policy direction to achieve an optimal split between road and rail movement of goods.

BEBR's efforts entailed a consideration in economic terms of the justification for policies designed to alter the mode split from a traffic management, social cost and infrastructure utilization perspective. The level of subsidies and taxes necessary to achieve a shift are explored, and the potential consequences of such policies are reviewed.

Chapter One: Literature Review

To familiarize the project group with current thinking on mode choice decision-making, CUTR performed a literature review of available reports and studies covering rail and road freight mode choice, mode shift, and logistics. In conducting the review, information pertaining to the key factors that affect freight mode choice and where each factor comes into play during the decision making process were noted. In conclusion, those factors that hold high potential for influence through policy intervention are listed.

This review of relevant studies found that many factors affect freight mode choice. Researchers have examined freight demand characteristics, cross elasticities, freight costs, commodity characteristics, modal characteristics and customer characteristics, and all have shown potential to influence mode choice. Consistently, it is found that trucks dominate short trip lengths and higher value goods, while rail dominates long trip lengths with bulky, low-value products. Cost benefits often have to be weighed against customer service and satisfaction for many commodities where time constraints exist. For commodities with time constraints and/or service guarantees, it is typical that truck is the preferred mode of transportation due to speed, flexibility, and reliability.

After culling all information, a table of mode choice factors was established (Table 1.1). The table identifies the type of factor whether it is a cost, physical attribute, distribution characteristic, or modal characteristic. An extension of this table is displayed in Chapter 4 (Table 4.1). The extended table breaks out the stages in the freight decision-making process when each factor comes into play. The stages are immediate, mid-term, and final. Each decision factor is also given a number from one and nine to further highlight when each factor comes into play during the mode choice decision process.

It is reasonable to deduce that policy interventions can shift the balance among these factors. Commodities with high tonnage and mileage are of particular interest as it is those characteristics that make the commodity most suitable for a shift from truck to rail. Along with determining each commodity's shift potential, the key factors that affect the mode choice decision for a particular commodity are also identified.

Total Logistics Costs [a]	Order and handling costs [a]
	Transportation charges [a]
	Loss and damage costs [a]
	Capital carrying cost in transit [a]
	Inventory carrying cost at destination [a]
	Unavailability of equipment costs [a]
	Service reliability costs [a]
	Intangible service costs e.g. Billing processes [a]
Physical Attributes of Goods [c]	Shipment size [c]
	Package characteristics [c]
	Shipment shelf life [a]
	Shipment value [a]
	Shipment density [a]
Flow and Spatial Distribution of Shipments [c]	Shipment frequency [c]
	Distance of Shipment [c]
Modal Characteristics [a]	Capacity [a]
	Trip time and reliability [a]
	Equipment availability [a]
	Customer Service [a b]
	Handling Quality – Damage Loss Reputation

a – (Cook, Das, Aeppli and Martland 1999) b - (Cullinane, and Toy 2000) c – (Jiang, Hohnson an Calzada 1999)

Table 1.1 Factors that affect freight mode choice

A review of the available literature reports that many external factors such as traffic, accidents and pollution are present in policy intervention motivations and decisions. Pollution is particularly controversial where some parties claim rail pollutes less than trucks, whereas others claim that in the long run, with new emissions standards, trucks will pollute less than rail. Highway and urban traffic congestion are thought to be worse due to trucking operations. Wear and tear on roads is another externality believed to exist due to the trucking industry. Researchers have studied social costs and benefits, and what their role should be in any decision, whether it is for investment or intervention. For example, increasing freight rail might have positive impacts on traffic by reducing the number of trucks on roadways.

In seeking an appropriate set of policies, it is recognized that fairness appears to be hard to balance between the freight rail and truck interests. A broad range of issues from emissions standards to taxes is debated. Funding and subsidies are the key topic disagreed upon in the freight industry. Railroads feel truckers receive a hidden subsidy because they use highways that are a public infrastructure. Along with hidden subsidies, trucks are also seen as benefiting from lower levels of maintenance, funded on a "pay as you go" basis. Trucking companies don't have the large up-front infrastructure costs of rail and public authorities maintain the highways they use. Trucking companies often include sales tax on truck parts such as tires, as an argument to help deny any hidden subsidies. It must be noted that no quantitative measure of the benefits received by truckers has been established. It is also argued that governments should not support freight railroads since it is inappropriate to support a private company using taxpayer's money. These arguments weigh heavily to policy intervention decisions needed to obtain the optimal mode split. The companion BEBR effort on this project examines more closely the levels and extent of subsidies and taxes, and the welfare and efficiency costs and benefits that might be achieved through policy interventions to achieve mode shift.

This literature review collected information from many diverse sources. Presented is a summary of relevant scholarly research, accompanied by journal articles and documents from relevant associations. Documents from relevant associations are of specific interest in sourcing views on subsidies and funding. A total of 38 papers are presented and are categorized as follows: nine association papers, 14 journal articles, one conference proceeding, seven government reports, three Department of Transportation (DOT) papers, and four research program/research board documents.

Summary of Literature

Anonymous. 1993. Searching for a Safer Ride. *Railway Age* 194 (6): 37-40.

Reports that US railcars handle about 65% of the setup motor vehicles moving to market. Many vehicle companies aren't happy because there is too much damage and are demanding a better ride quality. The report discusses the introduction of Autostack, a new system that minimizes the human element in loading/unloading railway cars to help reduce damage.

Armstrong, Richard. 2001. Economics 103PL. *Traffic World.* 265 (17): 23.

Identifies that as trucking prices are largely inelastic, other ways must be identified to reduce expenses for 3PL's. Mode shifting, end-to-end matching, improved carrier negotiation and shipment visibility are the four other major ways.

Key Findings:

- To reduce costs, aggregate expensive small shipments into larger ones. Timing, stop-offs etc. make aggregation difficult.

Association of American Railroads. 2001. *Falling RR Rates: Billions in Shipper Savings.*
http://www.aar.org/ViewContent.asp?Content_ID=287

Key Findings:

- Before the Staggers Rail Act in 1980, railroads were not able to differentially price. This made railroads inefficient, as they could not price according to demand. There were many regulations and processes required in order to change prices, so on the most part, prices represented historical costs and not current costs. Little competition caused low productivity and innovation.

- The Staggers Rail Act allowed the railroads to compete in the free marketplace. This caused productivity to increase and in turn, prices to fall. Rail revenue has fallen by 59 percent in the 20 years since the act. Large rate reductions have occurred for almost all commodity types.

Association of American Railroads. 2001. *Railroad Tax Burdens.*
http://www.aar.org/ViewContent.asp?Content_ID=288

This paper argues for modification of taxes that unfairly disadvantage railroads relative to trucks. Presents tax comparisons by transportation sector.

Key Findings:

- Railroads must depreciate their maintenance and repairs of infrastructure for tax purposes. Fuel taxes paid by trucking companies are used for maintenance and are immediately deductible.

Association of American Railroads. 2002. *Economic Impact of U.S. Freight Railroads.*
http://www.aar.org/ViewContent.asp?Content_ID=296

General statistics on freight railroads discussing what is carried, how much is carried, and some economic impacts of railroads.

Key findings:

- Although the cost of moving freight by rail has declined, the cost of capital is still greater than the return on investment.
- It costs 29 percent less to move freight by rail now than it did in 1981, and 59 percent less in inflation-adjusted dollars.
- Railroads carry greater than 40 percent of intercity freight in the US, approximately 70 percent of domestically manufactured vehicles and 67 percent of the nation's coal to coal-fired power plants.

Association of American Railroads. *TEA-21 Reauthorization and Railroad Infrastructure Investment.*
http://www.aar.org/ViewContent.asp?Content_ID=451

Paper argues for changes to transportation programs and provision of tax benefits for intermodal transportation to encourage public-private rail infrastructure investment partnerships.

Key Findings:

- In 1999, railroads spent almost 20 percent of revenue on capital investment compared to about 4 percent for the manufacturing sector.

Association of American Railroads. *Deficit Reduction Fuel Tax.*
http://www.aar.org/ViewContent.asp?Content_ID=476

Paper supports legislation to repeal 4.3 cent per gallon federal deficit reduction fuel tax. This tax is paid by railroads and barges but not by airlines or trucks. Airlines and trucks have their taxes redirected to their respective trust funds. These funds pay for maintenance and infrastructure. Railroads, while currently privately financing their maintenance and infrastructure, do not have these funds redirected.

Beuthe, Michel., Jourquin, Bart., Geerts Jean-Francois., Koul a Ndjang Ha, Christian. 2000. Freight Transportation Demand Elasticities: A Geographic Multimodal Transportation Network Analysis. *Transportation Research Part E* 37: 253-266.

Paper presents direct and cross-elasticity estimates for demands rail, road, and inland waterways calculated for 10 different categories. This model uses Origin-Destination (O-D) matrices and cost information to compute modal elasticities of Belgian freight instead of statistical analysis.

Key Findings:

- Results suggest truck tonnage demand is inelastic but elastic when calculated by tonnes-km. This shows a dominant position for trucking over shorter distances.
- Results suggest rail demand is elastic but less so than for inland waterways. Rail demand elasticities are larger for rail tonnage than for tonnes-km.
- Cross elasticities show that rail demand appears more sensitive to cost variation than the other modes.
- Commodity elasticites are very dispersed.
- When modal choice is an output of optimization, it suggests that shippers choose modes and routes according to the lowest cost.

Bradley, David. 2001. *CN Subsidy Proposal, Just a Taxpayer-Funded Frequent Shipper Program.* Letter to the Press.

Review and commentary on proposed Canadian Railways subsidy program. "Although rail met Canada's freight needs in the past, in today's environment of just-in-time inventory systems and synchronous manufacturing, transportation is required to be flexible and must serve shippers' rapidly changing needs".

Key Findings:

- Proposed "Road Relief and Shipper Tax Credit" subsidy would allow rail companies to increase their rates by an amount comparable to the subsidy.
- Truck emissions will decline rapidly before 2020. A shift of freight from truck to rail would increase pollution, especially of nitrous oxide.

Cambridge Systematics, Inc. 1995. *Characteristics and Changes in Freight Transport Demand: A Guidebook for Planners and Policy Analysts.* National Highway Cooperative Research Program Project 8-30.
http://ntl.bts.gov/data/ccf/ccf.html.

Intended as a reference source for analysts, policymakers, and economists, it contains examples of analyses from previous studies in a range of different issues pertaining to freight transport demand.

Appendix G – Rail/Truck Modal Diversion.
Key findings:

- The Intermodal Competition Model (ICM) and the Truck-Rail, Rail-Truck Diversion Model (T-R, R-T), have been used to model Rail/Truck Modal Diversion.
- Truck-Rail cross elasticities are used to estimate the change in rail ton-miles due to changes in truck costs. Elasticities are presented for different commodity types.
- Data taken from ICM shows high elasticities for finished and highly processed commodity groups. It shows lower elasticities for bulk materials and automobiles.
- For uniform changes in truck costs, the estimated cross elasticity for rail ton-miles is 0.5 and 0.8 for rail revenue.

Canadian National. 2001. *Unlocking the Full Potential of Canada's Railroads.*
http://www.cn.ca/PDF/shipper_tax_credit.pdf

Report is based on achieving fiscal equity across modes, promoting integrated transportation solutions and providing incentives to optimize modal choice. "For Canadian shippers to be competitive in the NAFTA marketplace, they need to reduce freight rates and improve rail services. These principles will lead to a shift from shipping on truck to rail in Canada. The proposal has the potential to offer benefits to all its stakeholders".

Key Findings:

- A freight shift from truck to rail will increase railway density, increase railway investment, reduce highway congestion and spending, reduce emissions, reduce rail rate and services.

- Proposed a "Road Relief and Shipper Tax Credit" that would use locomotive fuel taxes to fund a tax credit paid to shippers who shift freight from truck to rail. This tax is approximately $160 million per year.
- Additionally, redirected road cost savings would be diverted to rail.
- Estimated that 100 million tons of the 451 million tons already on Canadian roads could be diverted to rail. This represents over 3 million truckloads removed from roads annually.
- Tax credit gives incentive to shippers to redesign shipping processes to reap benefits of credit.
- Railroads are the most capital-intensive sector in the economy and railroads need to recover these costs from their customers. By increasing railroad densities, fixed costs would be covered by more users and allow railroads to reduce rates. US railroads are on average 57 percent denser than Canadian Railroads.
- $15.7 billion spent on transportation by the Canadian government in 1998/1999. $14 billion of this was on roads and transit and, of that, $4.15 billion is attributable to trucks.
- Long-haul freight locomotives are four to five times more fuel-efficient than trucks on a gross ton-mile basis.
- Tax credit proposal represents a step towards modal equity. Canadian railroads pay 13.8 percent of revenues in taxes while Canadian trucks pay 10.4 percent and 7.5 percent is paid by US railroads.
- Canadian railroads pay property taxes levied by local governments although they own their own infrastructure. Trucks pay no property taxes on used infrastructure and public authorities pay maintenance, snow clearing etc on roads. The difference between what trucks pay in fuel taxes and the cost to the governments of the highway system constitutes a subsidy to the truck industry. This is measured at $873 million annually.

- In the US it is estimated that the most typical semi-trailer pays only 80 percent of its costs to all governments and only 90 percent of its federal road maintenance share.

Clarke, David. 2000. *Local and Regional Rail Freight Transport.* Washington, DC: Transportation Research Board.
http://www.nationalacademies.org/trb/publications/millennium/00067.pdf

Discusses the future for local and regional freight railroads.

Key findings:

- To survive and prosper, local and regional freight railroads must increase the railroad transportation market.
- Increased Truck Sizes and Weights are a greater threat to smaller railroads. Smaller railroads have smaller haul distances and trucks have the advantage of transporting directly from shipper to destination location.
- The intermodal trend has not included small railroads and may ultimately harm them. Typically this mode uses truck for pick up and delivery of shipment and this is freight that is often transported by small railroads.
- Small railroads have knowledge of local conditions and customer service. Because of this, smaller railroads have been increasing traffic levels on local routes. Article suggests that solutions such as warehousing, transloading and just-in-time delivery may help increase traffic levels additionally.

Cook, Peter., Das, Sanjay., Aeppli, Andreas., Martland, Carl. 1999. Key Factors in Road-Rail Mode Choice in India: Applying the Logistics Cost Approach. *Proceedings of the 1999 Winter Simulation Conference.*

Discusses the main factors that determine freight mode choice in India. The results summarize a survey based on the Logistics Cost Model of shipper behavior.

Key Findings:

- Vieira (1992) modeled eight categories of logistics costs: order and handling costs, transportation charges, loss and damage costs, capital carrying cost in transit, inventory carrying cost at destination, unavailability of equipment costs, service reliability costs, and intangible service costs. Total logistics costs must be estimated first then used in a demand model.

- Logistics Cost Model Framework uses data on Commodity Characteristics, Customer Characteristics, and Modal Characteristics.
- Ranked important needs of Indian customers. Reliability ranked most important, followed by availability and price.
- Ranked customer perceptions regarding important needs for road verses rail. Road ranked higher than rail for every category. Customers perceive roadways to be able to better satisfy them.
- Compared different commodities important needs scores for selected factors. For example, price is the most important factor for coal, while transit time is the most important factor for food grains.
- The above commodity group industries rated their satisfaction with rail services for the same selected factors. Rail scores were much less and also generally out of line with original important needs. For example, consumer durables showed that rail was meeting its needs with respect to price and transit times but not for reliability or availability.

Cullinane, Kevin., Toy, Neal. 2000. Identifying Influential Attributes in Freight Route/Mode Choice decisions: A Content Analysis. *Transportation Research Part E* 36: 41-53.

This paper uses a formal approach to identify and justify attributes to be used when conducting freight route/mode choice studies using stated preference techniques.

Key Findings:

- Top five ranked attributes are:
    1. Cost/Price/Rate, Speed,
    2. Transit time
    3. Reliability,
    4. Characteristics of the goods, and

5. Service (unspecified).

Derocher, Robert., Foran, Pat. 2001. Image Restoration. *Progressive Railroading* 44(4): 30-42.

This article documents how intermodal shipping firms are trying to re-establish their image away from typically poor service. Rail has been the key player in creating this tarnished image and it is rail that will have to improve if intermodal firms are to increase market share in the future.

Key Findings:

- Burlington Northern and Santa Fe Railroad (BNSF) offers for a premium a money-back guarantee for domestic intermodal shipments. Even though this is only on lanes BNSF knows it can perform well on, it sends a signal to customers that the company is serious about being on time. Guarantees have also helped other intermodal companies land new customers.
- Reliability is a lot harder to guarantee when railroads have to work together. It is often found that with interline shipments, reliability is not as high as with single line shipments.
- Load centering (a place where containers are combined according to final destination) has shown to improve transit times and performance.
- Intermodal firms are also listening to customers who have been unhappy about the way intermodal companies have been doing business. Some companies such as UP have decided to centralize a little more since requirements for intermodal are different to other businesses.

Federal Highway Administration. 2000. *Comprehensive Truck Size and Weight Study.* U.S. Department of Transportation.

Study examines rules governing truck size and weight limits and the potential impacts of changing those limits. Paper also discusses shipper concerns and modal competition. Tables IV-8 and IV-9 from the study are provided in this report's appendix to show the competitive ranges for road versus rail movement of goods on a product value/density and distance basis

Key Findings:

- Changes in truck size and weight limits may cause a reduction in truck costs because fewer trips would be needed. Other costs such as warehousing, order processing, and loss and damage may also be reduced.
- Decreased truck costs may cause a change in mode choice and a switch from rail to truck.
- For short distance truck shipments (under 200 miles), rail and truck do not compete.
- Commodities that are both truck and rail competitive would be potential switch markets if truck size and weight limits increased. Examples of these are paper products, pulp and allied products, food and kindred products, lumber and wood products, primary metal industry products, and waste and scrap.
- Two-thirds of rail shipments are not truck competitive as they move bulk commodities in large quantities.
- The ability to measure railroad rates given the truck move does not exist.
- Railroads are a decreasing cost industry. They face high fixed costs that decrease per unit as output increases as they are spread over more units.
- Railroads increased market share particularly in intermodal freight during 1994.
- Bulk commodities are the mainstay of the U.S. railroad freight transportation market share. In order to expand market share, Class 1 carriers looked into logistics support and services and just-in-time operations.
- Railroad's return on investment was 9.4 percent in 1994 compared to 7.1 percent in 1993.
- Consensus among rail industry observers is that the railroads have exhausted the efficiencies that can be wrung from their existing plant. Any future productivity gains will require massive capital investment.

- The report models the shipper decision-making process. Step 6 is mode and carrier switching behavior. Switching carriers may be a high cost option. Factors affecting mode choice are:
  - transit time,
  - service quality,
  - asset productivity,
  - carrier use and
  - customer satisfaction.
- About 30 percent of the value and 56 percent of the commodity tonnage are shipped between places less than 50 miles apart. This is why it is not surprising that trucks are the dominant mode of freight transportation. Rail usually ships bulky commodities over long distances, and accounts for the highest proportion of total ton-miles of freight transportation (39 percent).
- In general, trucks dominate shorter trip lengths with lower lane densities and longer trip lengths, and higher lane densities are dominated by rail. Lower value products traveling longer distances are dominated by rail and higher value goods traveling shorter distances are dominated by truck.
- Over the next 10 years, strong growth in rail intermodal traffic is expected.

Federal Highway Administration Office of Freight Management and Operations. 2001. *Freight Financing Options for National Freight Productivity.*

This paper discusses current freight funding topics such as public investment in rail infrastructure. This paper also provides an overview of the different funding options for freight transportation and the difficulties in obtaining such funding for freight projects.

Key Findings:

- All truck freight transportation carriers are private companies.
- Public sector has invested heavily in the highway network and roadways that connect to private terminals (rail, air, truck etc.), and the private sector has invested heavily in the rail freight system. Both have invested in projects that benefit the other.

- Investing in roadways that connect to intermodal rail freight terminals benefits both the public and private sector.
- Maine Department of Transportation argued for public investment in rail infrastructure improvement, claiming it would reduce the DOT's highway maintenance costs by diverting traffic off highways.
- Commonwealth of Virginia and Norfolk Southern Railroad discussed using public funds to build additional intermodal tracks to divert truck traffic off I-81.
- Would a public agency be benefiting one railroad over another? Would railroads be receiving preferential treatment?
- Railroads argue trucking companies benefit from "paying as they go," instead of incurring up-front costs.
- Intermodal projects find it hard to decided who is responsible for the financing, especially when it requires a connector road.
- Five basic sources of funding: Federal-aid, federal credit, state and local funds, state and local credit, and private sector financing.

(i) Federal Funding

ISTEA (Intermodal Surface Transportation Efficiency Act) - State and local governments control transportation investment. Requires plans meet Clean Air Act. Funding flexibility for states to allocate funds. Emphasizes importance of freight transportation and economic productivity. No funding specifically for freight projects. Freight projects reduce local government funds but benefit an area much larger. Joint jurisdictional projects are a major barrier.

TEA-21 (Transportation Equity Act for the 21st Century) – four new programs to benefit freight needs.

1) National Corridor Planning and Development Program &
2) Coordinated Border Infrastructure Program. Not limited to freight projects, but have proven good fright funding sources. This is due to the national

scope of the programs and that it required the local and state governments to work with the private sector to address freight issues, especially at intermodal borders. Applications to this program have far exceeded the allocated funding.

3) Transportation Infrastructure Finance and Innovation Act (TIFIA). Provides credit for projects over $100 million. Most non-highway freight projects do not qualify since the criteria are based on the federal highway funding programs framework. Intermodal facilities can receive funds if they are adjacent to the National Highway System.

4) Rail Revitalization and Improvement Funding program (RRIF). Provides credit for rail infrastructure and equipment.

(ii) State and Local Freight Financing Programs.

Example: Florida created Florida Seaport Transportation and Economic Development (FSTED) program. It is a matching grant program that provides funds for projects that improve movement and intermodal transportation of passengers or cargo in commerce and trade. State also gave funds of $10 million for a prioritized set of projects identified by the Rail Freight Assistance Program.

- Common argument as to why freight projects cannot compete for financing against localized projects is that "freight doesn't vote."
- Recent policy proposals suggest new separate freight federal programs and expanded project eligibility.

Federal Highway Administration. *Funding and Institutional Options for Freight Infrastructure Improvements.*
http://www.ops.fhwa.dot.gov/freight/freight_finance_report.htm

Research paper examines all aspects of freight infrastructure improvement funding. Information is reviewed from Federal, State, and local sources and from a variety of project types.

Key Findings:

- Freight financing is approached in several ways and these different ways need to be made available as guidance to transportation decision makers.
- Local jurisdictions have become a common sponsoring entity for transportation improvements. This is not only with financial means but also as a liaison and filter to State and Federal levels.
- It is hard to quantify public benefits from freight investment projects. It is also difficult to compare freight against non-freight projects.
- Conflicts exist between short-term market demands and long-term project planning. Due to this, the large-scale projects typically depend on high-level financial support.
- The cost of financing varies depending on the sponsoring agency. For example municipal bonds are tax-exempt where Treasure bonds are not.
- Local sponsors often choose to issue debt instead of waiting for the once-per-year offer of federal funds.
- Shortline rail companies find it difficult to receive grants since the requirements may be beyond their financial capability.

Federal Taxation Authority. *Motor Fuel Exercise Tax Rates.*
http://www.taxadmin.org/fta/rate/motor_fl.html

Webpage that displays tax rates for gasoline, diesel fuel and gasohol for every state.

Gallagher, John. 2001. Policy Prompt. *Traffic World* 265(7): 24.

Canadian shipper association believes there are too many flaws in tax credit proposal for it to work. This is in reference to the article "Unlocking the Full Potential of Canada's Railroads."

Key Issues:

- Can shippers reconfigure shipping operations to switch from truck to rail?
- Will shippers be able to maintain service while switching from truck to rail? Many shippers have service agreements.

- How will the credit be monitored?
- Will railroads be able to handle increases in volume?

Gallagher, John. 2002. Freight Conversion. *Traffic World*: 29-30.

CSX has been able to convert truck customers to trains and generate about $100 million in new business.

- Rail usually viewed as lacking in service. With the weakened economy, many customers have switched to rail to cut costs.
- Metals customers switched to rail probably due to the economic pressure that the steel industry has been under.
- 40 percent of conversions came from food and consumer goods. They had to be taught to load boxcars. They either used existing rail facilities that hadn't been being used or reloaded from trucks onto trains.
- 30 percent of conversions were from forest products. This commodity group had been lost by rail due to poor quality handling in the past. With new pressures to reduce costs, customers are more willing to put aside skepticisms.
- The Conrail transaction has helped CSX serve its customers better. A new overnight intermodal agreement between New York and Boston has taken almost 100 loads off the highways per day. This market is normally overlooked as it is short-haul but since the train actually originates from Florida, it is seen as "long-haul economics."
- Other new rail services include an intermodal and merchandise train between St. Louis and Baltimore. It takes 12,000 units annually of the highway.
- New zip-code pricing system increased intermodal operations by 4,000 loads annually in the I-95 corridor between Ohio and Florida.

General Accounting Office. 1996. *Intermodal Freight Transportation: Projects and Planning Issues.*
http://ntl.bts.gov/data/ns96159.pdf

The Intermodal Surface Transportation Efficiency Act (ISTEA) authorized $155 billion to improve the nation's surface transportation system concentrating on intermodal connections, as these are usually the weakest links.

Key Findings:

- DOT has not yet developed a database to track use of ISTEA funds or to track public and private intermodal investment.
- Public and Private officials have experienced difficulties in improving intermodal freight transportation such as obtaining the necessary freight movement information from private companies and dealing with differences in long-term and short-term goals.

Herbert, H Josef. 2000. *New pollution rules set for trucks, buses.*
http://www.mindfully.org/Air/New-Rules-Trucks-Buses.htm

Key Findings:
Environmental Protection Agency will require large trucks to reduce pollution by more than 90 percent and it will also demand cleaner diesel fuel.

- Trucks will be required to have devices to capture exhaust chemicals.
- All diesel fuel sold will have to be virtually sulfur free (avg of 15 parts per million) by 2010.
- It is estimated that the new standards will reduce nitrous oxide levels by 95 percent, compared to the reduced levels already expected to be achieved by trucks in 2004.
- There are concerns over fuel price increases and fuel shortages due to the new requirements.

I-95 Corridor Coalition. 2001. *Mid-Atlantic Rail Operations Study.*
http://ops.fhwa.dot.gov/freight/pp/randy%20evans

Study conducted by the I-95 Coalition, five Mid-Atlantic States (Virginia, Maryland, Delaware, Pennsylvania, New Jersey and the District of Columbia) and three railroads. This study addresses the region's transportation as a system. The study discusses the situation as it stands, the need for capacity management, and funding options that work across all financial, political, and interest group boundaries.

Key Findings:

- Much of the region is extremely congested, especially the highways. This incurs costs to all people whether they be living, working, or visiting in the area. The Texas Transportation Institute's Urban Mobility Report estimates that the cost of congestion per capita in the Mid-Atlantic's major metropolitan regions is from $500 to $800 per year. Businesses are also disadvantaged due to congestion, especially with more recent "pull" logistics systems.

- The rail system is not at full capacity along many sections due to specific choke points. Choke points are commonly bridges or tunnels that are congested or don't allow for double stacked trains. Another example of choke points is insufficient rail connection lines. Also, railways use outdated information systems that rely on the use of telephone and fax to communicate.

- The study developed a set of infrastructure and technology changes to be implemented over the next 20 years with specific tasks designated as near-term, medium-term and long-term. These projects will aim at eliminating choke points and increasing efficiency for the whole system.

Jiang, Fei., Hohnson, Paul., and Calzada, Christian. 1999. Freight Demand Characteristics and Mode Choice: An Analysis of the Results of Modeling with Disaggregate Revealed Preference Data. *Journal of Transportation and Statistics* 2 (2): 149-158.
http://www.bts.gov/publications/jts/v2n2/paper4/4jiang.pdf

Due to the lack of data for freight demand, there has been less research done on modeling freight demand than on modeling passenger demand. This paper analyzes the characteristics of freight demand that influence modal choice using nested logit for a national disaggregate revealed preference database for shippers in France in 1998.

Key Findings:

- The maximum probability of choosing road transportation is at roughly 700 km, and for rail it takes place at 1,333 km.
- Three types of freight demand characteristics: firm's characteristics, physical attributes of goods, and the flow characteristics and spatial distribution of shipments.
- Rail transportation is the preferred mode choice over road for long distance shipments, shippers and receivers situated on branch lines, large firms, and firms owning smaller trucks.
- Combined transportation is favorable when there are long distance shipments, large firms and when shippers are situated on rail branches.
- When analyzing the choice between using private (in house/own account) or purchased transportation, it was found that purchased transportation is preferred for long distance shipments, high frequency shipments, shipper and receiver situated on rail branch lines, shipment in parcel, worldwide companies, manufacturing products, and metal industries.

Jiocco, M.J. 1998. *U.S. Freight: Economy in Motion.* Federal Highway Administration.
http://www.bts.gov/NTL/data/freightus98.pdf

This document explains the operations of the US freight industry. It explains the operations of the public and private entities and how they benchmark performance. It also examines the forces that change the transport system and the US's ability to transport.

Key Findings:

- Trucks face competition from railways for lower value goods.
- Trucks and railroads compete to capture market share on commodities like automobiles and auto parts, food and kindred products, and intermodal shipments.
- Shipments in excess of 50,000 pounds require a special permit to operate configured as a single load. This part of the market is usually operated by heavy single trucks and is very competitive with railroads.

Jorkenbrock, David. 2001. Comparison of External Costs of Rail and Truck Freight Transportation. ***Transportation Research: An International Journal*** **35 (4): 321-337.**

Estimates external costs for four types of freight trains and compares them with private costs experienced by railroads. These private and external costs are compared with the same costs of the trucking industry.

Key Findings:

- Non-market costs of freight rail are: Accidents, Emissions, and Noise.
- Rail external costs are 0.24 cents to 0.25 cents per ton-mile. Truck external costs are 1.11 cents per ton-mile.
- External costs relative to private costs are 9.3 percent-22.6 percent for rail and only 13.2 percent from trucks.

Morlok, Edward K. 1994. Redesigning Rail-Truck Intermodal Drayage Operation for Enhanced Service and Cost Performance. ***Journal of the Transportation Research Forum*****: 31 (7): 16-31.**

High drayage costs (the trucking portion of rail-truck intermodal freight services) decrease the market for which intermodal can compete with intercity trucking. Despite the relatively short distance trucking covers compared to the rail portion, drayage accounts for a large part of the origin/destination service quality as perceived by the shipper.

Key Findings:

- Central organization of trailers could reduce costs substantially.

Nierat, Patrick. 1997. Market area of rail-truck terminals: pertinence of the special theory. ***Transportation Research Part A, Policy and Practice*** **31A: 109-127.**

Space and location are examined as factors that contribute to the choice between truck and rail-truck. This paper defines zones in France in which each mode is most competitive.

Key Findings:

- Concludes that rail line direction, length and location all have an effect on the size of the rail-truck market.

Ontario Trucking Association. 2000. ***Transportation Briefing Document: Issues and Policy.***

http://www.ontruck.org/submissions/2000/sub00-1127-01.htm

Key Findings:

- The EPA has regulated truck engine emissions since the mid 1970's. Rail has not been subject to these standards. Rail diesel can contain up to 14 times more sulfur than truck diesel.

Ontario Trucking Association. *Truck-Rail Co-operation/Competition.*
http://www.ontruck.org/issues/docs/railcoop.htm

Paper argues that trucks are not dominant due to unfair subsidies; rather their dominant position is because they are flexible, efficient, reliable and timely. This is especially important today when manufactured goods require just-in-time deliveries.

Key Findings:

- Highway user fees for trucks would have to triple before a significant modal shift to rail would occur for the average rail haul length (700km). For short-haul lengths (under 500km), virtually no modal shift would occur due to a change in user charges. 70 percent of truck shipments are short-haul.

- Trucking and rail are not in the same industry. They specialize in different ends of the marketplace and have very different price and service packages. They only compete on about 10 percent of the freight market.

- Railways benefit from controlling their own infrastructure. They can sell unused lines.

Railway Age News Release. 3/4/2002. *BNSF: Public/private partnership at Oakland.*
http://www.railwayage.com/breaking_news_archive.shtml

Burlington Northern and Santa Fe (BNSF) will commence a public/private partnership of a new Joint Intermodal Terminal at the Port of Oakland in California.

Key Findings:

- The facility "has the capacity to initially accommodate 250,000 containers per year and features 13,300 feet of loading and unloading track that can accommodate 410 40-foot containers at a time. The facility also contains an additional 10,100 feet of storage and support tracks and parking for 1,245 containers."
- Construction cost $38 million of which $22.1 million is from federal grants using ISTEA and TEA-21 funding.
- BNSF hopes it will be able to remove 20,000 truckloads per year from Interstate 80.

Resor, Randolph., Zarembski, Allam., Patel, Pradeep. *Estimation of Investment in Track and Structures Needed to Hanle 129844-kg (286,000-lb) Railcars on Short-Line Railroads.* Transportation Research Record 1742.

Regional and short-line railroads function in conjunction with eight Class I railroads to form an integrated network. This means that equipment is interchanged and that smaller railroads must operate heavier loads on inadequate lines. If they could not handle these heavier cars they face loss of revenue and the threat of closure. This report aims at determining the costs required to enable these smaller lines to handle the heavier loads.

Key Findings:

- Class I railroads own about 70 percent of rail tracks and make about 90 percent of the industry's revenue.
- Short-line and regional railroads are collectively the non-Class I railroads. Regional railroads can have revenue similar to Class I railroads and can have the revenues to maintain their tracks. Short-line railroads are usually the railroads with very limited resources.
- ZETA-TECH conducted a survey and concluded that the cost of improving regional and short line railroads to a point where they could handle heavier cars would be $6.86 billion in 1999 dollars. The cost covers issues such as track materials, bridge repairs and replacements.

The Road Information Program. 2001. *Stuck in Traffic: How Increasing traffic Congestion is putting the Brakes on Economic Growth.*
http://www.tripnet.org/trafficcongestion.htm

Increasing traffic will slow the delivery of goods and services to consumers and therefore consumers will face increased costs in the future. This paper analyzes the relationship between traffic congestion and the standard of living in the US.

Key Findings:

- Increased productivity in the manufacturing sector and an ever-growing service economy, have increased the demand for truck and courier freight services.
- Approximately 72 percent of the value of goods shipped from locations within the US and 69 percent of the tonnage of goods shipped is carried on truck.
- Urban traffic congestion costs the US $78 billion annually in lost time and fuel.
- One problem facing freight transport is the poor conditions of the roads connecting rail and port terminals to main roads.
- US Census Bureau estimates that total freight tonnage will almost double by 2020.
- Trucking is expected to grow by 100 percent in the Western states, 89 percent in the Midwest and Planes states, 79 percent in the Mid-Atlantic and New England and 89 percent in the Southern states by the year 2020.
- 82 percent of all increases in freight movement are expected to be by truck.

Stagl, Jeff. 2001. From Improbable to Pioneering. *Progressive Railroading* 44(4): 26-29.

Reports on the creation and successes of the joint intermodal service between Santa Fe Railway and J.B. Hunt Transport Services Inc.

Key Findings:

- Partnership showed that trucking companies could be railroads' biggest customers and the two could work together.

- Chairman Hunt quote, "As railroads get better with service, and fuel prices are higher, and there're less drivers, there'll be more intermodal."

Texas Public Policy Foundation. 2001. *Freight Rail's Potential to Reduce Traffic Congestion.*
http://www.tppf.org/transit/rail/freight_rail.pdf

Examines the potential for rail movement of freight to mitigate urban congestion.

Key Findings:

Part A.

- Texas is ranked second in the largest growing states by population change.
- Florida is ranked third in the largest growing states by population change. Florida added 3,044,452 new residents between 1990 and 2000. This was a 23.5 percent increase.
- Miami-Fort Lauderdale metropolitan area grew by 21.4 percent, Tampa-St. Petersburg-Clearwater by 15.9 percent, Orlando by 34.3 percent, West Palm Beach-Boca Raton by 31 percent and Jacksonville by 21.4 percent between 1990 and 2000.
- Trucks and rail account for 64 percent of the US domestic freight volume, increasing from 57 percent in 1960. Over the same time period, rail freight's share has fallen from 38 percent to 37 percent, while truck freight's share has increased from 19 percent to 28 percent. In terms of ton-miles though, freight railroads gained the most out of all modes during this time period.
- Rail freight accounts for almost one-third more ton-miles than tuck freight.
- Single trailer trucks are equivalent to 3.77 passenger cars, double trailer trucks are equivalent to 4.47 passenger cars and large trucks are equivalent to 3.8 passenger cars on congested urban freeways.
- Between 1990 and 1999, urban truck traffic increased by 48.7 percent. This was 80 percent greater than the 26.9 percent growth rate of other traffic.

- Freight railroads are directly losing market share to freight trucks. Over the next 20 years, it is expected that truck tonnage will double in the US. This rate is 5 times higher than the population growth rate estimates. Rail volume is expected to increase by one-half over the same period; this is more than double the population growth expectations. Since truck projections are much higher than rail, these estimates predict rail freight's market share to decrease from 57.3 percent to 48.8 percent, a 15 percent loss over the 20-year period.

Part B.

- The US and Canada have retained a high rail freight market share compared to other high-income areas such as Europe and Japan.
- Analysis indicates that passenger rail service priorities can limit the market share for freight rail, this in turn increases truck traffic.
- Although Europe and Japan have small freight rail market shares, they have extensive passenger rail systems. Per capita passenger rail ridership is 12-60 times higher in Europe and Japan than in the United States. A benefit gained from canceling most of the United States passenger rail services appears to be the survival of freight rail services.
- The Northeast Corridor accounts for 80 percent of the nation's commuter rail operations and 40 percent of intercity rail ridership. Similar to Europe and Japan, the Northeast has low rail freight market shares.

Part C.

- Rail freight in the United States is most competitive in the movement of bulk and non-time sensitive commodities. On average, railroads in the US operate at less than 23 miles per hour. Railroads are very capital intensive and this provides difficulties in expending infrastructure for the future.
- Intermodal shipments (truck trailers/containers on rail) represent the greatest opportunity for rail freight to increase market share growth. Currently, intermodal

transportation only represents two percent of the total truck-rail shipment volume in the US.

- Average rail revenue per ton-mile was $0.26 while truck was much higher at $2.34.

- Railroads are less flexible than trucks running on highways, this creates competitive difficulties for railroads. Railroads must classify and transfer loads between railroads taking up time. The average delay time for shipments at rail yards in the US was almost 29 hours.

- New commuter rail systems in many cities in the US have, on average, only diverted less than 0.15 percent of freeway and principal arterial traffic. Passenger trains operate at higher speeds than freight trains and may be given priority. This could further reduce the effectiveness of rail and cause more shipping to be done by truck.

- Estimated cost per passenger hour of delay is $12.40.

- Case Study: Los Angeles Alameda corridor Project.

  Houston Light Rail Line

  - 7.5 miles from downtown to the Astrodome
  - $300 million estimated cost of capital
  - Majority of operating costs funded by tax sources
  - Expected to reduce traffic by approximately 0.4 percent in 2020
  - Reduce vehicular traffic delay by 543 hours daily with a tax cost of $123/hour
  - Small air quality impacts

  Alameda Corridor

  - Los Angeles and Long Beach harbors to rail freight yards east of downtown
  - $2.4 billion cost of capital
  - $370 million financed tax sources
  - Expected to reduce vehicular traffic delay by 14,500 hours daily at a public subsidy cost of $5.43 per hour
  - Substantial air quality impacts

- Houston–Dallas proposed intermodal system is projected to remove 88,000 truck trips per year.
- Proposed truck freeway lanes built around Austin, Texas could remove 400 million vehicle miles from Interstate 35.
- In Laredo, the large rail volumes cause traffic delays because the rail lines operate across the town at-grade.
- A 100 percent increase in transit's market share would have the same impact on traffic as a 5.3 percent reduction in truck traffic.
- There are advantages of public policy that forbid governments from implementing policy that shifts business from rail to truck. Rail has a lower fatality rate than trucks, rail moves freight with less energy, rail generally pollutes less than trucks, and rail freight rates are lower. (Graphs)
- Urban transit funding serves two basic objectives:

  1) Provides mobility to people who have limited access to automobiles
  2) Alleviation of urban traffic congestion

  Rail freight projects could be funded when they show they are the most cost effective way or reduce transportation delay

Trains Make Sense. *The Toronto Star* 9/8/2001.
Canadian Transport Minister David Collenette would like to spend $2 billion in rail line upgrades over five years to help reduce the number of trucks on highways.

Key Findings:

- Although shippers save on freights costs, the public pays for increases in air pollution, traffic congestion, and highway wear and tear.
- An option to increase rail freight is to use intermodal transport so that trucks pick up freight at a factory and goods are shipped by rail for the intercity trip. The goods would be returned to trucks for the final drop off.

- Another option to increase rail freight is to double-track and allow trains to run in opposite directions at the same time.
- Trucking companies argue it is wrong to use taxpayer's money to fund a private company.
- Public transit and rail freight are not mutually exclusive.

United States Department of Transportation. 1998. *Railroad Rehabilitation and Improvement Financing.*
http://www.fhwa.dot.gov/tea21/factsheets/r-rrehab.htm

Discussion of rail infrastructure and rehabilitation funding available through loans and loan guarantees. Information is given on selection criteria, risk premiums and loan terms.

Washington State Department of Transportation. 2001. *Benefits of Rail Freight Study.*
http://www.wsdot.wa.gov/rail/plans/DTA/default.cfm

Study aimed at showing the value of rail freight as part of the transportation system in Washington State.

Key Findings:

- Without rail service, more than 1 million trucks would be added to some interstate highway sections causing $329 million in vehicle-operating and travel-time costs to highway travelers.
- Without rail service, the increased highway capacity needed would cost $851 million.

Washington State Department of Transportation. *Local Rail Freight Assistance Program.*
http://www.wsdot.wa.gov/rail/projects/state_assistancelocal.cfm

The program is a federal program that loans money to fund freight rail rehabilitation and facility construction. This program has not received appropriations since 1995 yet remains unharmed because money is reallocated from repaid loans.

Chapter Two: Identification of Niche Groups

Just as it is unreasonable to assume that all freight could be moved by rail, it is also unrealistic to assume that all freight could be moved by truck. However, given that certain goods are best or perhaps exclusively suited to one mode or the other, there exists a "crossover" group of goods that could effectively be shipped by either mode. Examining commodity types and their characteristics provides insight into the commodity niche groups that might be well suited to a change from one mode of shipment to another.

The potential for shifting freight from truck to rail is limited by a number of factors such as size of shipment and distance of haul. For example, there are virtually no circumstances under which rail would be the preferred mode for shipping a one-pound package across town. At the opposite end of the freight spectrum, it is unlikely that a shipper would use trucks to ship 200,000-pound equipment across country. Neither of these examples describes the niches that are the target of this study. The objective of this exercise is to identify those key niche groups where mode shift is most likely to occur, or those that are "on the fence" of the mode choice decision making process, and to identify the factors used in making their mode-choice decisions. In addition to identifying these groups, a further objective is to determine the overall potential or "market" each group represents.

The characteristic of ton-miles is relevant to potential rail markets as commodities with high tonnage and high mileage, and hence high ton-mileage characteristics, are in the market where rail is most competitive. Two sets of data are analyzed; the 1997 Commodity Flow Survey (CFS) and 1998 TRANSEARCH by Reebie and Associates (REEBIE) (sourced from the Florida Department of Transportation). It is worthy of comment to report that data availability; consistency, completeness and uniformity were major challenges in conducting this study. As an example, the CFS data contain information on different shipping characteristics such as value, tons, and ton-miles, the data are only for freight flows from Florida. Although REEBIE provides data for freight flows to, from, and intra Florida, thereby presenting a much clearer picture of freight movement for the State, the data are only available by the shipping characteristic tons. (Raw data sets and an explanation of the data collection processes are provided in the Appendix.)

Hence, not all observations can be compared in a similar manner, yet the data sets do provide significant insight into freight movement in the State. An initial useful observation is that of the split of freight movement across modes in gross and relative terms. Figure 2.1 displays each transportation mode's total ton-miles. Figure 2.2 displays each transportation mode's percentage share of total ton-miles.

Four mode types are identified; Truck and Rail, Total Truck, Total Rail, and Other. Total Truck is a sum of truck (single mode), and truck and water. The same is done to compute total rail. The "Other" mode is calculated as a sum of the following modes: water, air, pipeline, parcel, U.S. Postal Service, courier, and other multiple modes.

Fifty-nine percent of ton-miles for all modes is shipped by truck or a combination of truck and water, 37 percent is shipped by rail or a combination of rail and water, three percent is shipped by other modes including air, pipe and water, and one percent is shipped by a combination of truck and rail.

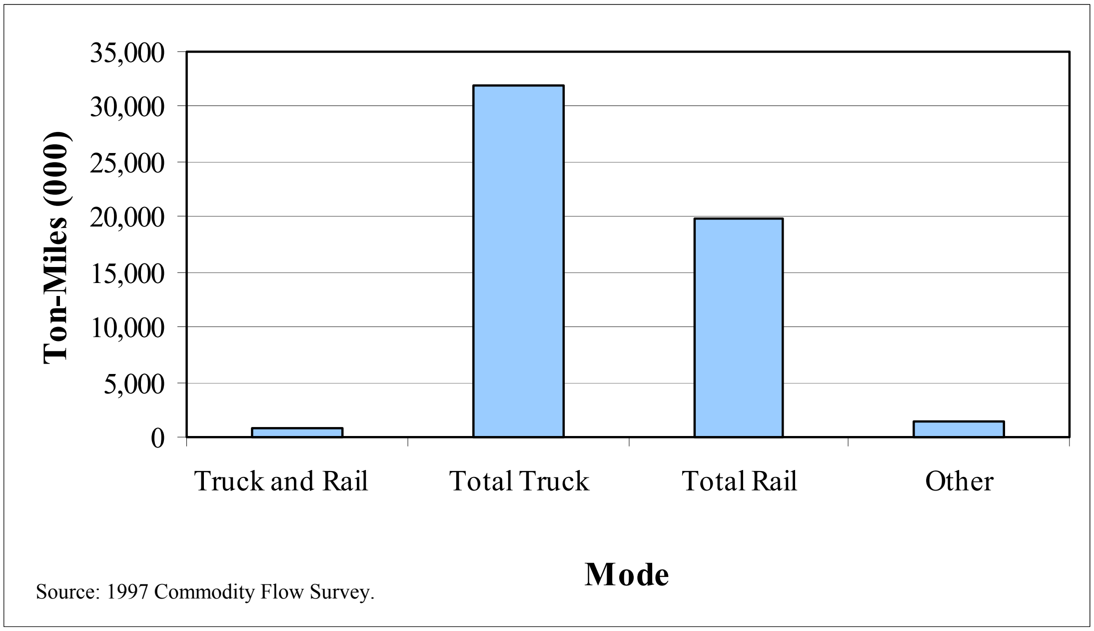

Figure 2.1 Total Ton-Mile Make Up by Mode

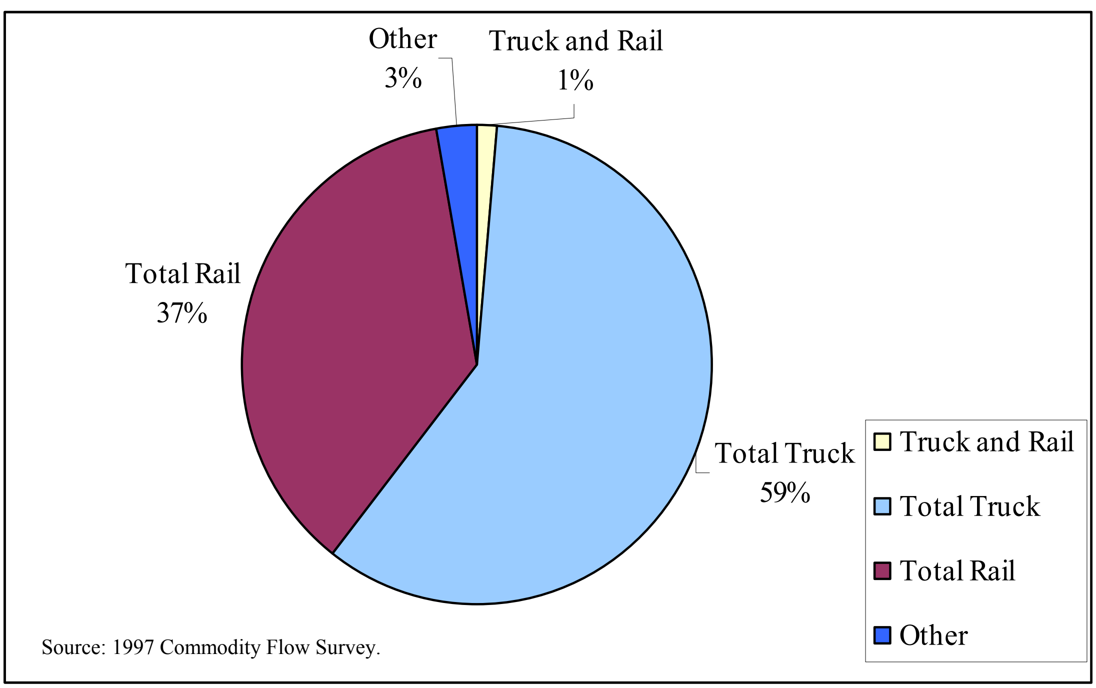

Figure 2.2 Percentage Ton-Mile Make Up by Mode

Utilizing the REEBIE data, the ten largest commodities as measured by tons were determined for each transportation mode. This was also examined by shipments to, from, and intra Florida and is presented in Tables 2.1 – 2.10. It can be noted that some commodities rank similarly whether it be a flow to, from or intra Florida. Some commodities tonnage changes significantly depending on whether the flow is to or from Florida. For example, rail carloads ship roughly seven (7) times more tons of lumber into Florida than is shipped out.

Rail Carload					
To Florida		From Florida		Intrastate	
Description	Tons	Description	Tons	Description	Tons
Nonmetallic Minerals	11,037,694	Nonmetallic Minerals	11,937,002	Nonmetallic Minerals	15,371,619
Chemicals	5,247,734	Chemicals	6,868,763	Chemicals	2,777,499
Coal	4,932,882	Coal	2,964,104	Clay,Concrete,Glass	182,700
Lumber	3,056,632	Paper	1,636,146	Coal	149,729
Transportation Equipment	2,546,836	Food	1,534,548	Lumber	104,132
Food	2,231,825	Waste	690,956	Food	87,359
Paper	1,579,926	Clay,Concrete,Glass	500,200	Waste	77,187
Clay,Concrete,Glass	1,453,175	Lumber	424,726	Paper	28,118
Metal	734,032	Metallic Ores	111,506	Metal	8,702
Agriculture	728,902	Misc Freight Shipments	57,119	Transportation Equipment	7,276

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.1 Rail Carload

Rail Intermodal					
To Florida		From Florida		Intrastate	
Description	Tons	Description	Tons	Description	Tons
Misc Mixed Shipments	3,660,404	Misc Mixed Shipments	1,068,278	Misc Mixed Shipments	1,328,652
Food	825,844	Paper	450,630	Shipping Containers	233,144
Shipper Association Traffic	181,536	Shipping Containers	399,828	Clay,Concrete,Glass	191,584
Chemicals	137,312	Food	227,278	Mail	97,906
Mail	84,586	Waste	135,566	Food	53,924
Electrical Equipment	80,930	Chemicals	101,642	Chemicals	45,322
Paper	71,120	Agriculture	72,264	Agriculture	15,192
Small Packaged Freight	54,964	Forest Products	41,840	Paper	12,610
Printed Goods	53,944	Shipper Association Traffic	32,590	Freight Forwarder Traffic	6,528
Agriculture	52,252	Mail	30,100	Metal	4,440

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.2 Rail Intermodal

For-Hire Truck TLL					
To Florida		From Florida		Intrastate	
Description	Tons	Description	Tons	Description	Tons
Secondary Traffic	5,829,425	Secondary Traffic	4,957,984	Secondary Traffic	16,694,082
Clay,Concrete,Glass	5,671,770	Chemicals	4,349,896	Truck Intermodal	8,235,695
Chemicals	4,510,737	Clay,Concrete,Glass	4,111,797	Clay,Concrete,Glass	4,574,513
Food	4,433,872	Food	3,329,348	Chemicals	3,437,629
Lumber	2,794,346	Agriculture	1,991,892	Food	1,524,406
Petroleum	1,260,858	Lumber	1,788,620	Lumber	851,554
Metal	938,493	Truck Intermodal	850,769	Truck Air Drayage	633,527
Paper	782,806	Paper	838,859	Apparel	226,532
Metal Products	719,210	Metal	716,722	Metal	207,482
Agriculture	550,997	Metal Products	469,073	Metal Products	181,365

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.3 For-Hire Truck TLL

For-Hire Truck LTL					
To Florida		From Florida		Intrastate	
Description	Tons	Description	Tons	Description	Tons
Chemicals	397,798	Secondary Traffic	313,395	Secondary Traffic	1,051,915
Secondary Traffic	372,229	Chemicals	185,950	Paper	39,211
Rubber/Plastics	284,577	Paper	124,151	Chemicals	32,009
Metal Products	229,739	Rubber/Plastics	102,123	Food	22,092
Food	200,470	Food	95,003	Lumber	15,168
Paper	192,037	Metal Products	90,113	Printed Goods	12,676
Metal	147,443	Transportation Equipment	74,254	Clay,Concrete,Glass	11,156
Transportation Equipment	146,229	Furniture	72,113	Metal Products	8,848
Machinery	138,390	Electrical Equipment	65,575	Furniture	6,367
Electrical Equipment	135,706	Printed Goods	46,883	Rubber/Plastics	5,324

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.4 For-Hire Truck LTL

Private Truck					
To Florida		From Florida		Intrastate	
Description	Tons	Description	Tons	Description	Tons
Clay,Concrete,Glass	9,171,459	Clay,Concrete,Glass	9,345,865	Secondary Traffic	25,322,089
Secondary Traffic	5,817,711	Secondary Traffic	7,223,852	Clay,Concrete,Glass	10,206,551
Food	3,033,879	Food	3,950,653	Food	2,957,968
Lumber	1,662,359	Lumber	1,548,426	Lumber	884,944
Petroleum	588,074	Printed Goods	629,752	Printed Goods	502,851
Printed Goods	531,070	Petroleum	614,198	Petroleum	401,494
Paper	472,308	Agriculture	605,398	Paper	311,663
Rubber/Plastics	274,401	Paper	399,705	Metal Products	209,843
Metal Products	250,012	Chemicals	303,987	Rubber/Plastics	54,661
Chemicals	202,095	Metal Products	217,571	Apparel	28,692

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.5 Private Truck

Air Freight					
To Florida		From Florida		Intrastate	
Description	Tons	Description	Tons	Description	Tons
Mail	138,907	Electrical Equipment	11,509	Mail	93,949
Machinery	46,231	Waste	3,350	Electrical Equipment	61,423
Transportation Equipment	36,704	Machinery	2,274	Machinery	40,615
Electrical Equipment	31,121	Transportation Equipment	1,363	Printed Goods	33,935
Chemicals	25,763	Misc Mfg Products	1,277	Instruments	25,879
Printed Goods	17,739	Instruments	1,174	Transportation Equipment	18,804
Instruments	10,882	Metal Products	883	Metal Products	17,784
Apparel	10,423	Mail	813	Apparel	14,810
Metal Products	9,977	Clay,Concrete,Glass	808	Paper	14,548
Paper	6,840	Furniture	645	Misc Mfg Products	10,266

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.6 Air Freight

Water Freight					
To Florida		From Florida		Intrastate	
Description	Tons	Description	Tons	Description	Tons
Petroleum	34,652,614	Nonmetallic Minerals	6,202,451	Petroleum	2,624,879
Coal	8,540,079	Waste	4,068,116	Nonmetallic Minerals	1,005,886
Chemicals	4,939,663	Agriculture	721,792	Waste	139,400
Waste	3,706,357	Petroleum	515,960	Metal	3,269
Nonmetallic Minerals	1,626,040	Food	200,762	Clay,Concrete,Glass	2,568
Agriculture	120,821	Metallic Ores	55,028	Transportation Equipment	2,446
Transportation Equipment	43,521	Chemicals	46,773	Machinery	2,164
Machinery	40,267	Fish	32,001	Apparel	1,560
Misc Freight Shipments	37,924	Metal	31,041	Metal Products	1,197
Apparel	25,049	Crude Petroleum	22,663	Furniture	839

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.7 Water Freight

Total Trucks					
To Florida		From Florida		Intrastate	
Description	Tons	Description	Tons	Description	Tons
Clay,Concrete,Glass	14,928,922	Clay,Concrete,Glass	13,476,787	Secondary Traffic	43,068,014
Secondary Traffic	12,019,361	Secondary Traffic	12,495,260	Clay,Concrete,Glass	14,792,216
Food	7,668,187	Food	7,374,979	Truck Intermodal	8,235,694
Chemicals	5,110,592	Chemicals	4,839,753	Food	4,504,474
Lumber	4,493,029	Lumber	3,360,195	Chemicals	3,473,964
Petroleum	1,900,226	Agriculture	2,597,279	Lumber	1,751,684
Paper	1,447,078	Paper	1,362,657	Truck Air Drayage	633,522
Metal Products	1,198,884	Truck Intermodal	850,774	Petroleum	538,212
Metal	1,116,077	Metal Products	776,672	Paper	526,284
Rubber/Plastics	944,545	Petroleum	756,268	Printed Goods	518,198

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.8 Total Trucks

Total Rail					
To Florida		From Florida		Intrastate	
Description	**Tons**	**Description**	**Tons**	**Description**	**Tons**
Nonmetallic Minerals	11,044,301	Nonmetallic Minerals	11,941,865	Nonmetallic Minerals	15,371,627
Chemicals	5,385,041	Chemicals	6,970,415	Chemicals	2,822,817
Coal	4,932,877	Coal	2,964,103	Misc Mixed Shipments	1,328,652
Misc Mixed Shipments	3,660,402	Paper	2,086,781	Clay,Concrete,Glass	374,277
Lumber	3,092,767	Food	1,761,824	Shipping Containers	233,144
Food	3,057,661	Misc Mixed Shipments	1,068,277	Coal	149,729
Transportation Equipment	2,584,192	Waste	826,519	Food	141,281
Paper	1,651,042	Clay,Concrete,Glass	512,740	Lumber	104,134
Clay,Concrete,Glass	1,494,424	Lumber	433,093	Mail	97,906
Agriculture	781,158	Shipping Containers	416,800	Waste	78,219

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.9 Total Rail

All Modes					
To Florida		From Florida		Intrastate	
Description	**Tons**	**Description**	**Tons**	**Description**	**Tons**
Petroleum	37,223,801	Nonmetallic Minerals	18,150,258	Secondary Traffic	43,068,014
Clay,Concrete,Glass	16,447,614	Clay,Concrete,Glass	13,990,480	Nonmetallic Minerals	16,377,513
Chemicals	15,461,049	Secondary Traffic	12,495,260	Clay,Concrete,Glass	15,169,064
Coal	13,609,302	Chemicals	11,857,304	Truck Intermodal	8,235,694
Nonmetallic Minerals	12,684,217	Food	9,337,975	Chemicals	6,305,161
Secondary Traffic	12,019,361	Waste	4,913,786	Food	4,650,803
Food	10,752,192	Lumber	3,793,346	Petroleum	3,168,938
Lumber	7,585,953	Paper	3,449,592	Lumber	1,856,178
Waste	4,230,940	Agriculture	3,401,977	Misc Mixed Shipments	1,328,652
Misc Mixed Shipments	3,660,402	Coal	2,964,103	Truck Air Drayage	633,522

Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.

Table 2.10 All Modes

Examining further the CFS data, there are useful observations to be made in comparing the different modes of transportation;

- Mode rank by percentage share of each shipment characteristic.
    - Truck rankings (including truck and water) by percentage value are very high compared to rail (including rail and water). Thirty-three out of 42 commodities shipped over 50% of their individual commodities value by truck. Five of the commodity groups have data that do not meet statistical requirements (small sample size, incomplete data series), and so cannot be accurately reported. Rail only has one of the 42 commodities shipping over

50% of their commodities value. It must be taken into account that 18 commodity groups have data that do not meet statistical requirements.

- Truck rankings (including truck and water) by percentage tonnage are very high compared to rail (including rail and water). Thirty-four out of 42 commodities shipped over 50% of their individual commodities tonnage by truck. Five of the commodity groups have data that do not meet statistical requirements. Rail only has three of the 42 commodities shipping over 50% of their commodities tonnage. The same data shortcomings of accuracy apply to these findings (five for truck and 18 for rail that do not meet statistical requirements).

- Commodity by average miles per shipment (truck, rail, and truck and rail modes).
  - Truck mode shipped over 250 average miles for only seven out of 42 commodity groups (20%).
  - Rail shipped over 250 average miles for 22 out of the 42 commodity groups (60%).
  - Truck and Rail shipped over 250 average miles for 18 out of the 42 commodity groups (40%).
- Mode ranked by total share of dollar value shipped.
  - All commodities with value shipped over $1,000,000,000 did so by truck, with the exception of fertilizers, which was shipped by rail.
  - Logs and other wood in the rough, gravel and crushed stone, and natural sands, were the only three commodities shipped by truck with shipment value less than $400,000,000. This could possibly be because these three commodity groups are used extensively for building materials and construction, and these locations may not always be accessible by rail.

Data from CSX was also analyzed for the years 1998 and 2000. Comparing the two different years of CSX data shows that commodity group shipments have changed. Phosphates and Fertilizer were ranked number two in 1998 by measure of carload shipments with 539,000, but fell to number four in 2000 with a slightly less 486,000 carloads. Phosphates were overtaken by Chemicals, which increased by 154,000 carloads to 598,000 and by Automotives, which increased by 174,000 carloads to 586,000. It should be noted that these changes might be due to depressed or expansionary industries, and not due to switching between modes.

Other interesting findings are the following changes in rail shipment of certain commodities:

- Phosphates and Fertilizers decreased by 9.83%.
- Iron Ore decreased by 2%.
- Coke decreased by 23.33%.
- Chemicals increased by 34.68% or 154,000 carloads.
- Automotive increased by 42.23% or by 174,000 carloads.

Chapter Three: Niche Groups with Mode Shift Potential

Having identified the major commodity groupings moved by both rail and truck in Florida, the objective of this task is to identify those niche groups that are "on the fence" of the mode choice decision making process.

Using REEBIE data, the largest commodities measured by tonnage are displayed below in Figures 3.1 – 3.3. Each graph represents a transportation mode with each commodity's percent make up. Commodities with large tonnage can be considered more "on the fence" between movement by truck or rail.

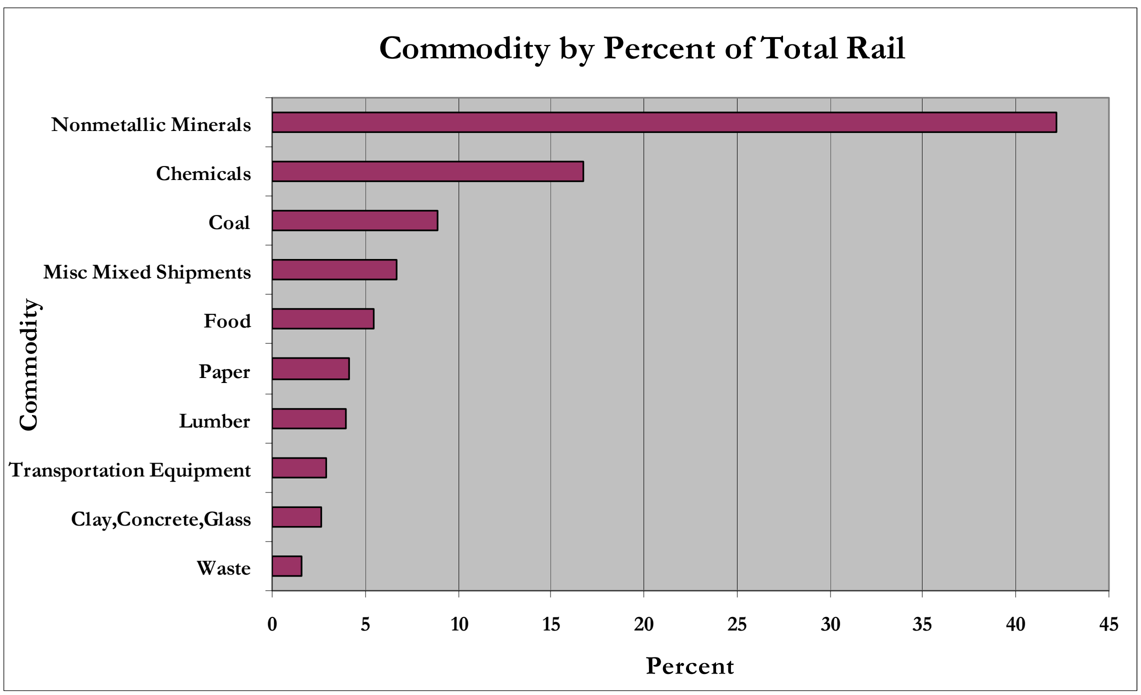

Figure 3.1 Commodities by Percent of Total Rail

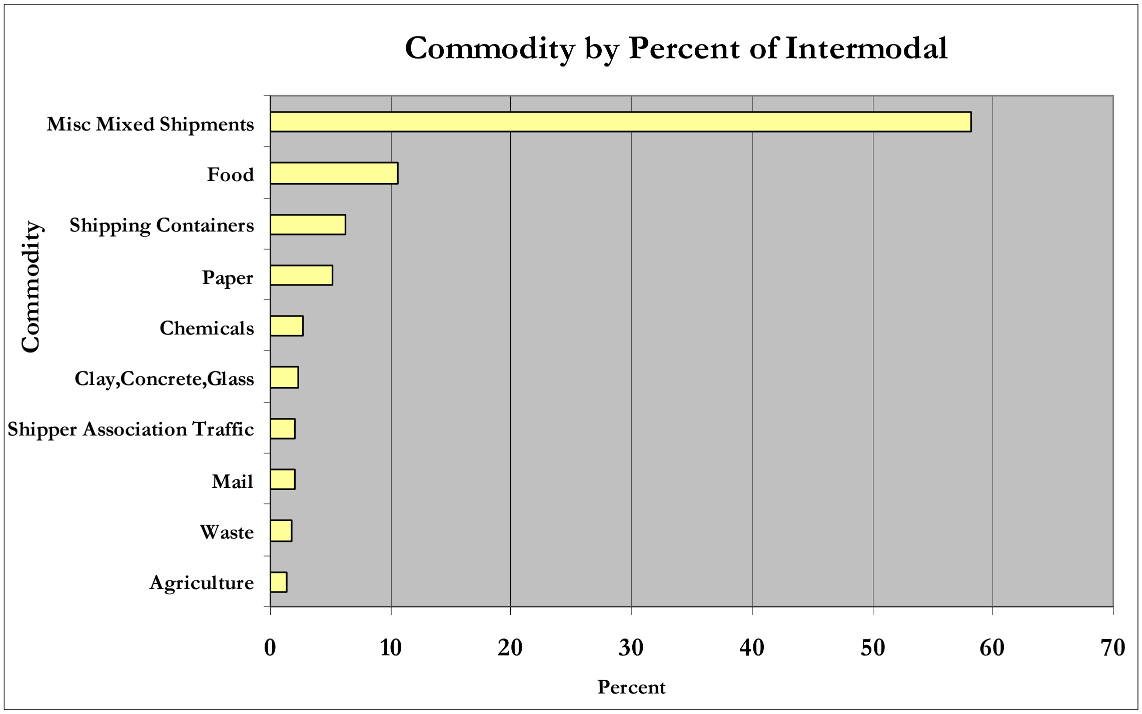

Figure 3.2 Commodities by Percent of Intermodal

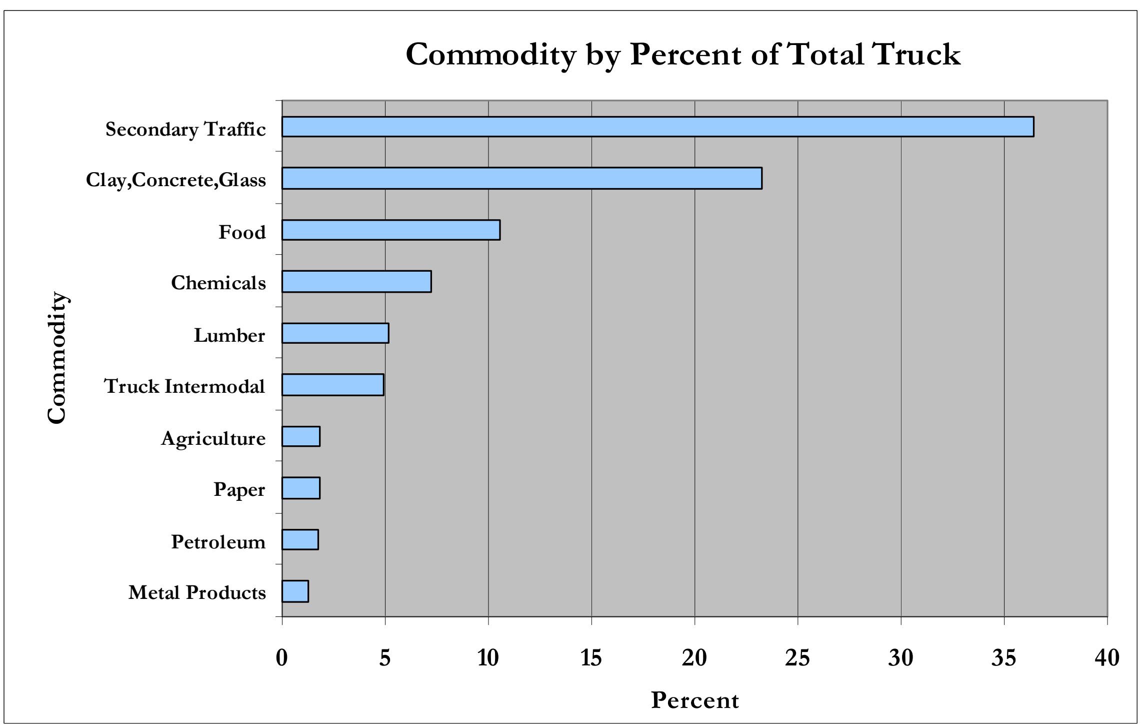

Figure 3.3 Commodities by Percent of Total Truck

To see which mode of transportation the commodities use, the ten (10) largest commodities measured by tonnage across all transportation modes are displayed showing their mode break-up in Figure 3.4. This is also done for the twenty (20) largest commodities in Figure 3.5

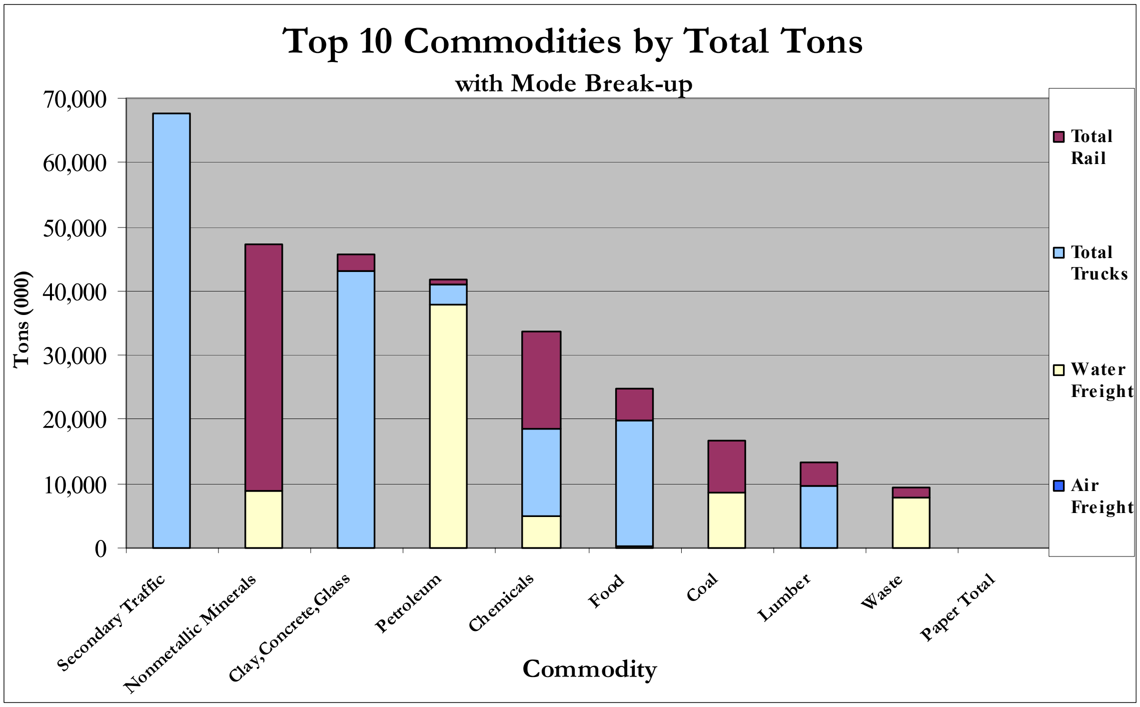

Figure 3.4 Top Ten Commodities by Tons (000) with Mode Break-up

The CFS data are used also to display the largest commodities by each mode, in Figures 3.6 and 3.7 following. The top ten commodities for truck and the top eight commodities for rail are displayed (limited rail observations were available due to statistical standards and very low values). These data are measured in ton-miles; the preferred measurement of commodities with high tonnage and high miles, and the commodities most likely "on the fence" between shipment by truck or rail. Again, a limitation to these data is that only freight flows *from* a Florida location are measured.

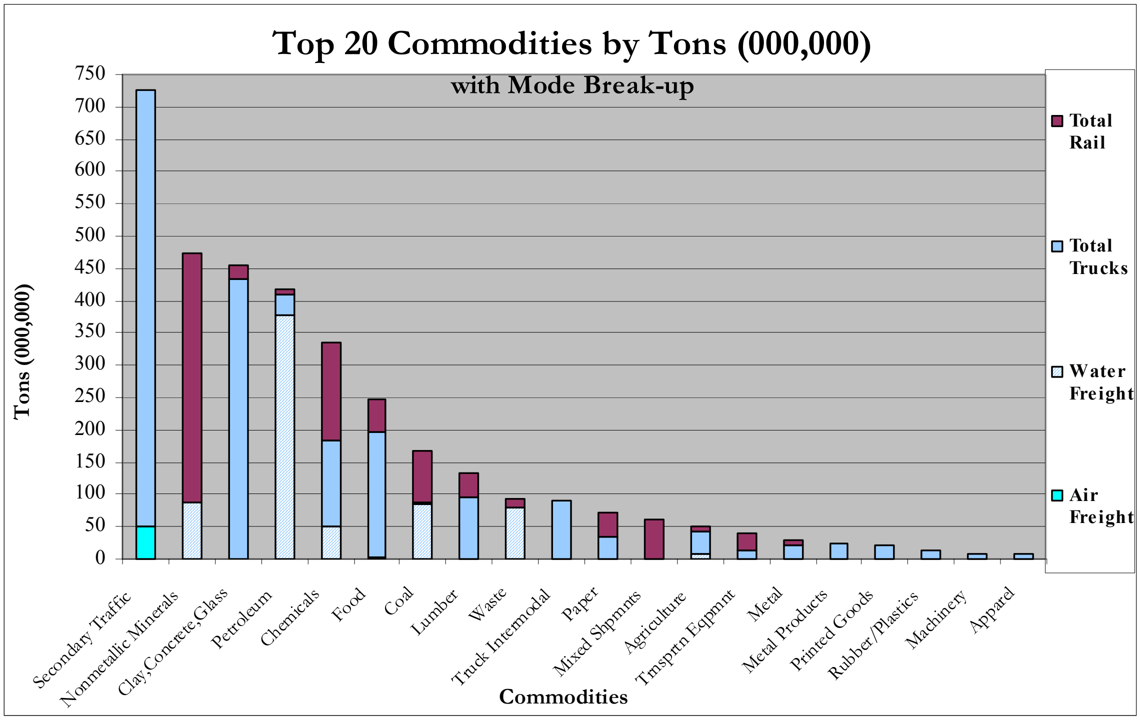

Figure 3.5 Top Twenty Commodities by Tons (000) with Mode Break-up

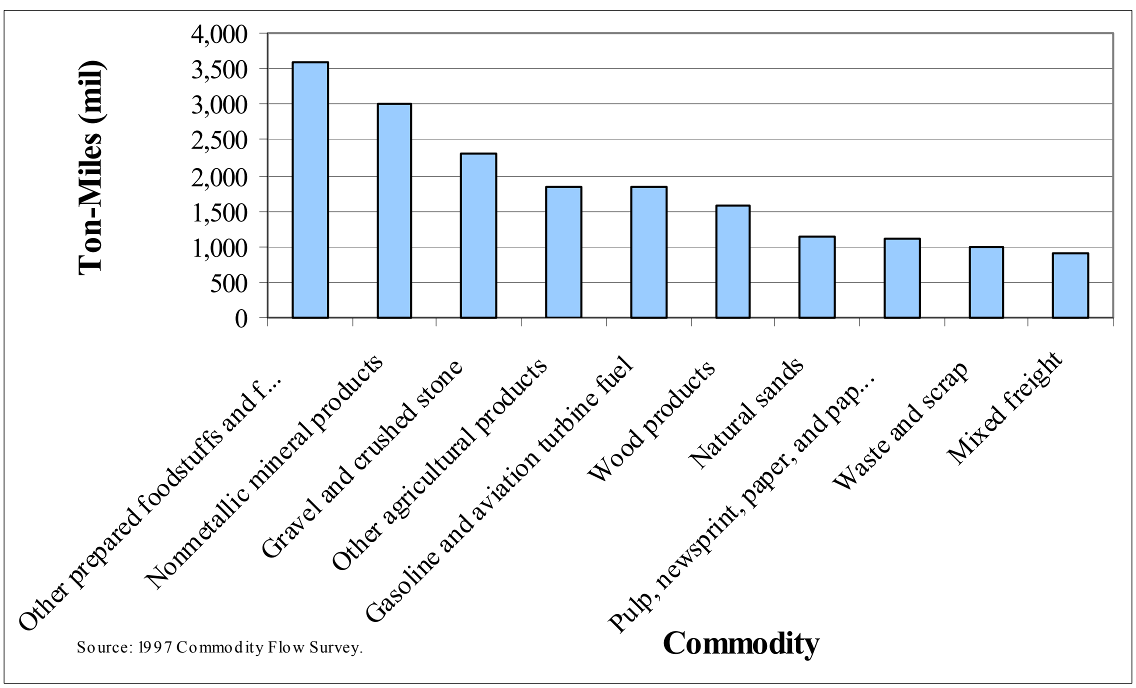

Figure 3.6 Top Ten Commodities Measured by Ton-Miles Shipped by Truck

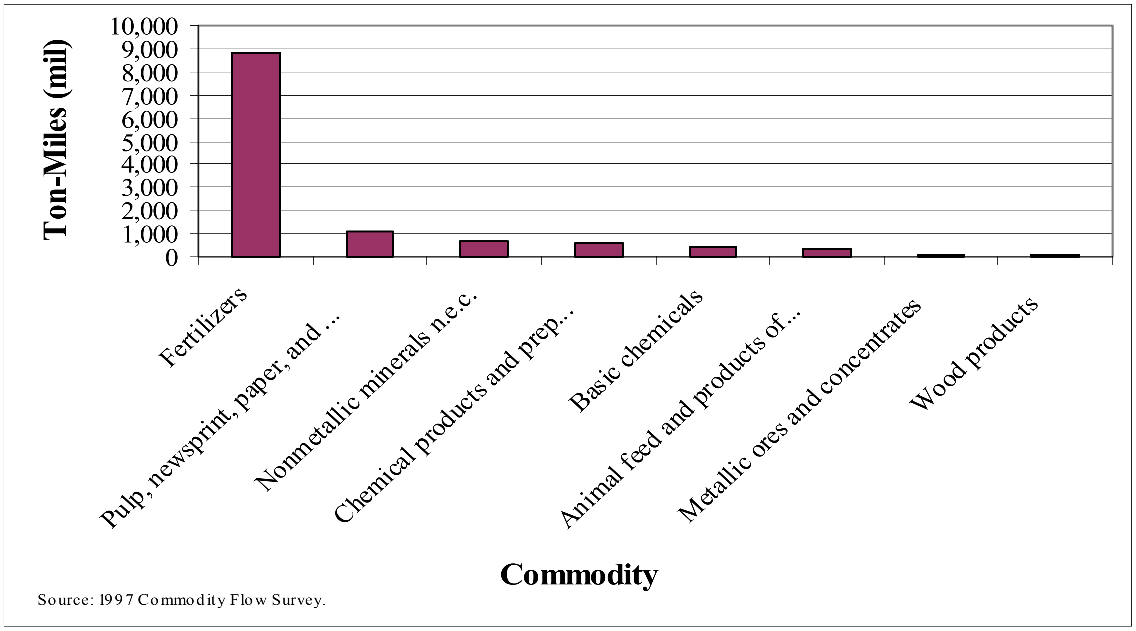

Figure 3.7 Top Eight Commodities Measured by Ton-Miles Shipped by Rail

The preceding histograms provide insight as to which commodities may possibly be "on the fence." In Table 3.1 below, these commodities are considered with other information to determine which have the greatest potential for mode shift. Four groupings are considered;

- Very Low / No Shift Potential
- Very Small Shift Potential
- Small / Moderate Shift Potential
- Possible Significant Shift Potential

In considering which commodity groups might be most receptive or suitable for a mode shift from road to rail, shipper needs and perceptions must also be addressed. The choice of mode available to shippers and factors considered by freight forwarders and shipping managers are wide and varied. The key factors listed in the following tables are those identified by various authors in reports and studies examined for the literature review. Many of these were reported in the interviews of firms the project team undertook, and will be reviewed elsewhere in this report.

The shear bulk of some items, their point of origin, and or their point of destination often dictate one particular mode. Other commodities are so low in value for their shear bulk that movement by road would not be of a scale that would provide an economic return. This is true of Waste, Coal and Non-Metallic minerals (Table 3.1). Currently, these goods are primarily carried by rail, for transfer to water dependent upon destination.

Table 3.1 Very Low/No Shift Potential

COMMODITY	REASON SHIFT IS/IS NOT POTENTIAL	KEY FACTORS IN MODE-CHOICE DECISION	MOST LIKELY MODE
Waste	• No shift required. Shipped by water and rail. • Bulky. • Not perishable.	• Transportation charges. • Distance of shipment. • Shipment value.	Rail, Water
Coal	• No shift required. Most tonnage shipped by rail and water. • Bulky. • Not perishable. • Long distances.	• Transportation charges. • Shipment density. • Shipment value.	Rail, Water
Nonmetallic Minerals	• Shift from truck to rail not required. Very small portion of tonnage shipped by truck. Shipped mostly by rail and water. • Bulky. • Not Perishable.	• Transportation charges. • Distance of shipment. • Shipment value.	Rail

Movement of petroleum (Table 3.2) has a very small but possible potential for mode shift. Significant shipments of fuels are transported by truck to airports. Shipment by rail would achieve significant gains in road safety and risk mitigation, however few airports have adjacent or on-site rail facilities.

Table 3.2 Very Small Shift Potential

COMMODITY	REASON SHIFT IS/IS NOT POTENTIAL	KEY FACTORS IN MODE-CHOICE DECISION	MOST LIKELY MODE
Petroleum	• Small potential for shift. • Most tonnage shipped by water to Florida. • Gas station customers are decentralized and not on rail lines. • Airports • Bulky. • Not perishable.	• Transportation charges. • Shippers and receivers situated on rail line. • Distance of shipment.	- Water - Within US by Truck

Other commodities fall into the category of having a small to moderate potential for mode shift. These are goods that are typically shipped in bulk, and some with a low value for their bulk. Where food products are repackaged from bulk to consumer units, a significant portion of the shipment could occur on rail.

Table 3.3 Small/Moderate Shift Potential

COMMODITY	REASON SHIFT IS/IS NOT POTENTIAL	KEY FACTORS IN MODE-CHOICE DECISION	MOST LIKELY MODE
Food	• Second ranking commodity by tons on truck and fifth ranking on rail. • Second ranked commodity for intermodal. • Overall food Cross Elasticity for a 5% decrease in rail costs is 0.15. This is low – shift may not be potential for entire food commodity group (Beuthe, Jourquin, Geerts and Koul 2000). • Perishable. • Possibly time dependent. • According to the CSX 1998 data, Coke ranked as the tenth commodity, and food and consumer products ranked ninth by total national carloads.	• Transportation charges. • Distance of shipment. • Shipment value. • Trip time and reliability.	Perishable & Time Dependant Foods – Truck
Clay, Concrete, Glass	• Ranked sixth commodity shipped intermodally. • One of the largest commodities shipped by tons. • From the CFS Data, logs and other wood in the rough, gravel and crushed stone, and natural sands, were the only three commodities shipped by truck with shipment value less than $400,000,000. • One possible reason for using such a high proportion of truck is that destinations (construction sites) are decentralized and changing. • Cross Elasticity for a 5% decrease in rail costs is 0.1 for trucks. This is very low – shift may not be potential (Beuthe, Jourquin, Geerts and Koul 2000). • Not Perishable. • Possibly time dependent.	• Transportation charges. • Shippers and receivers situated on rail line. • Shipment frequency. • Distance of shipment. • Trip time and reliability. • Handling Quality (glass).	Truck Intermodal – Maybe for Long Distances

For a number of commodities, there is significant potential for mode shift from road to rail (Table 3.4) The total tonnage for chemicals is currently well shared by truck and rail, and by their nature chemicals produced in bulk format and are typically not perishable. An investigation into where additional rail facilities could be provided would be likely to facilitate a mode shift to primarily rail movement of this commodity.

Table 3.4 Possible Significant Shift Potential			
COMMODITY	**REASON SHIFT IS/IS NOT POTENTIAL**	**KEY FACTORS IN MODE-CHOICE DECISION**	**MOST LIKELY MODE**
Chemicals	• Fifth ranking commodity by tons shipped intermodally. • Total tonnage well shared by truck and rail • Possibly bulky. • Not perishable. • Cross Elasticity for a 5% decrease in rail costs is 0.18 for trucks. This is low – shift may not be potential (Beuthe, Jourquin, Geerts and Koul 2000). • From the Florida CFS of the entire top twenty commodities ranked by ton-miles, only two commodities (Fertilizers, and Chemical Products and Preparations) had over fifty percent (50%) of their ton-miles shipped by rail. • According to the CSX 1998 data, Chemicals ranked as the forth commodity by total national carloads. • Chemicals increased by 34.68 percent or 154,000 carloads according to 1998 and 2000 national CSX data.	• Transportation charges. • Shipment size. • Shipment value. • Distance of shipment.	Rail, Truck, Intermodal
Agriculture	• Predominantly shipped by truck. • Cross Elasticity for a 5% decrease in truck costs is 13.79 for rail. This is very high – rail need to work hard to keep agriculture customers (Beuthe, Jourquin, Geerts and Koul 2000). • Possibly bulky. • Possibly perishable. • According to the CSX 1998 data, agricultural products ranked as the seventh commodity by total national carloads. • Food is very varied. Bulk/unfinished food especially would have more of a shift potential. • Bulk food has a much lower Cross Elasticity for rail if truck prices decreased than finished foods (Cambridge Systematics 1995). • Food has been known to convert to rail (Morlok 1994). • Food is a commodity that trucks and railways compete for (Jiocco 1998).	• Transportation charges. • Package characteristics. • Distance of shipment. • Trip time and reliability. • Handling quality. • Shipment shelf life.	Bulk Food – Rail Finished Foods– Truck, Rail, Intermodal Water, Truck, Rail Bulky & Non-perishable – Rail
Lumber	• Forest products have recently been reconverting to rail. More recently willing to put aside quality handling skepticisms and concentrate on lowering costs (Morlok 1994). • From the CFS Data, logs and other wood in the rough, gravel and crushed stone, and natural sands, were the only three commodities shipped by truck with shipment value less than	• Transportation charges. • Distance of shipment. • Shippers and receivers situated on rail lines.	Rail, Truck

	$400,000,000. • Bulky. • Not perishable. • Currently shared by truck and rail. • According to the CSX 1998 data, forest products and paper ranked as the third commodity by total national carloads.	lines.	
Paper	• Ranked as forth commodity shipped intermodally. • Split by truck and rail. • Not time dependent. • Not perishable. • Forest products have recently been reconverting to rail. More recently willing to put aside quality handling skepticisms and concentrate on lowering costs (Morlok 1994). • According to the CSX 1998 data, forest and paper products ranked as the third commodity by total national carloads.	• Transportation charges. • Shipment size. • Shipment frequency. • Distance of shipment.	Rail, Truck, Intermodal.
Transportation Equipment – cars (assumed to be Motor Vehicles)	• This is a commodity that railways and trucks typically compete for (Jiocco 1998) • Bulky. • Non-perishable. • Previous concerns over handling quality. New technologies for rail called Autostack (Anonymous 1993). • According to the CSX 1998 data, automotive ranked as the fifth commodity by total national carloads. • Automotive increased by 42.23 percent or by 174,000 carloads according to national 1998 and 2000 CSX data.	• Transportation charges. • Handling Quality. • Equipment availability. • Shipment size. • Capital carrying cost in transit. • Shipment value.	Rail
Metal/Metal Products.	• Metal customers have recently been switching to rail due to the economic pressure the steel industry has been under (Morlok 1994). • Cross Elasticity for a 5% decrease in rail costs is 0.68 for truck. This is relatively high compared to other commodities – possible shift potential (Beuthe, Jourquin, Geerts and Koul 2000). • Not perishable. • Finished metals have a much greater rail Cross Elasticity for a 1% decrease in truck costs than primary metals. Rail finds it harder to keep its fabricated metal customers (Cambridge Systematics 1995). • According to the CSX 1998 data, metal ranked as the eighth commodity by total national carloads.	• Transportation charges. • Trip time and reliability. • Shipment size. • Distance of shipment.	Truck/ Rail Rail (especially primary metals).

Refer to Bibliography for articles.

Many agricultural products share the same characteristics, as does lumber and by-products such as paper.

Having considered the extent and types of commodities shipped in Florida, and examined those commodities with characteristics most suitable for rail rather than road shipment, the final step is to examine the factors that shippers must consider when deciding on the most suitable mode for goods shipment.

Chapter Four: Mode Choice Decision Factors

Considerable literature is available covering the issue of mode-choice factors with the aim of determining where public expenditure can best achieve improvements to facilitate the movement of freight. Typically, such improvements have been determined through the use of technical models, reviews of regional plans, estimates of economic growth and public forums. Common opinion across the authors reviewed was that a more thorough understanding of the mode-choice factors from a shipper's perspective combined with the more traditional approaches would provide an even clearer picture of where best to direct public expenditure.

In collecting data from shippers in Florida, it was determined that information would be needed on the physical attributes of goods shipped, why the existing mode was chosen, what options currently exist for movement of goods, and what plans if any exist for goods movement in the future. Utilizing perspectives from a number of reports and studies form the literature review, a table was developed to group the various mode choice factors, then identify at which point in time the factors come in to play. Table 4.1 displays the various Mode Choice Factors that affect freight mode choice. Displayed also are the stages in the freight decision making process when each factor comes into play. The stages are:

- Immediate
- Mid-term
- Final

Each decision factor is also given a number between one and nine to further break out when the factor comes into play during the freight mode choice decision. Immediate is numbers one through three, mid-term is numbers four and five, and final is assigned numbers six through nine. Only the decision factor of "Physical Goods Attributes" is generally agreed upon to be an immediate-term decision factor. Using this table, a shipper survey was developed.

Table 4.1 Timing of Mode Choice Factors

Factor 1	Factor 2	Immediate			Mid-Term		Final			
		1	2	3	4	5	6	7	8	9
Total logistics cost	Transportation charges	■								
	Capital carrying cost in transit		■							
	Service reliability costs		■							
Modal characteristics	Trip time and reliability		■							
Physical attributes of goods	Shipment size			■						
	Package characteristics			■						
	Shipment shelf life			■						
	Shipment value			■						
	Shipment density			■						
Flow & spatial distrib. of shpmnts	Distance of shipment			■						
Firm characteristics	Shippers and receivers situated on rail line				■					
	Shippers near highway				■					
	Firms own small trucks				■					
Flow & spatial distrib. of shpmnts	Shipment frequency					■				
Modal characteristics	Capacity					■				
	Equipment availability					■				
	Handling quality - damace loss reputation					■				
Total logistics cost	Order and handling costs						■			
	Loss and damage costs							■		
	Inventory carrying cost at destination							■		
	Unavailability of equipment costs							■		
	Intangible service costs								■	
Modal characteristics	Customer service									■
Firm characteristics	Firm size	Background throughout process								

Thirty two firms across six commodity types were identified as potential survey respondents, including agricultural firms, metals and metal manufacturing firms, paper manufacturers, lumber firms, chemicals and transportation firms. Respondents were contacted via an initial phone call, a subsequent letter explaining the project and requesting a telephone interview, and finally a telephone interview itself. Twelve firms agreed to an interview, and ten surveys were conducted successfully, each on the condition of anonymity. The survey questions used are presented in Figure 4.1

FIGURE 4.1 SHIPPER INTERVIEW WORKSHEET

Contact Name: **Title:** **Tel #** **Firm:** **Location:** **Interview Date:** **Time:**	
Choice Factor	**Question/s to be asked**
Physical Attributes of Goods	
	• Shipment size? • Shipment package characteristics? • Shipment self-life? • Shipment value?
Flow/Spatial Distribution of Shipment	
	• What is your shipment frequency? • What is the average shipment distance?
Mode Used	
	• Which modes (mode) are used for freight transportation? • Do you ship intermodally?
Mode Decision	
	• How do you decide on transportation mode? • What shipment characteristics do you consider most important: price, reliability or speed? • Is reliability and speed important due to any customer contracts/guarantees? • Have you used rail in the past? • Have you been satisfied/dissatisfied and why? • Is rail frequency a problem (e.g. South Florida freight trains only run at night)? • How is the decision researched? Do they use a freight-forwarder? • Do you use one or many trucking companies? • Do you have contracts with trucking companies? If so, was rail considered before entering into such contracts? • Is rail an option? • Was highway proximity considered when deciding on location?
Accessibility / Location	
	• Is rail an option? • Are you near a railhead? • Would you consider using truck to get to rail • How did your firm decide upon its current location? • Was rail accessibility considered when deciding on a location? • Was highway proximity considered when deciding on a location? • If rail were accessible, would you consider using it? • If rail is not accessible, are you satisfied with this?, would you consider using it?
Future Plans	
	• Are you looking to relocate closer to rail? • Are you looking to build rail connections to make it accessible? • Is rail part of your company's long-term transportation goals? • What would rail have to do to become part of your future goals (e.g. increase reliability, increase shipment frequency etc)?

The choice of telephone interviews over other survey methods was prompted by the typically high response rate this approach obtains as well as the small sample size that was available. Telephone interviews permit relatively easy follow-up, often provide more detailed and direct information and are flexible – often providing useful information throughout the interview beyond the scope of structured questions. Shortcomings of this approach are: they are more time consuming (and costly) than alternative methods; the potential for lack of uniformity among interview structure; purposeful sampling (as opposed to random); respondent availability issues; and that this approach is not feasible for large numbers or surveys. Given the small number of potential respondents, the logistical, cost and sampling issues were not of great concern.

Although respondents were typically reluctant to disclose information that would reveal their identity to readers of this report, the information and insight they provided to the mode choice decision process was particularly revealing. The following provides paraphrased responses to each of the questions by many though not all of the respondents. A count is provided as to the recurrence of certain responses. **This survey was not and should not be taken as a valid statistical analysis of shippers in Florida**, as out of 32 possible respondents, successful interviews were conducted with only ten firms.

Not all respondents provided answers to all questions, hence numbers will not total to the sample size in all instances. In order of the Survey Worksheet, but not necessarily the order of questions in the interview itself, responses were as follows:

- **Physical Attributes of Good** (Shipment Size, package characteristics, self-life, value)
  - Shipments from Florida are high-end specialty products used for Pharmaceutical & personal products etc. No shelf life.
  - All bulky, shelf life not important but if exposed to the elements it can be damaged.
  - Mostly pre-packaged. Limited shelf line of some goods and those goods are separated in different coolers.

  - Both finished and raw products shipped. Kept in warehouses until shipped.
  - 30 day shelf life, bulk goods
- **Flow/Spatial Distribution of Shipment**
  - Export 40% overseas. Long distances.
  - Can take up to 30 days to ship due to long distances.
  - Ship all over world; Australia, China, North America etc.
  - Distribution center for whole of Florida.
  - 95-100 trucks/day; 35,000 trucks/year; 25 railcars/week.
  - Ship to Canada, Mexico, NE, Mid-West. 20-25% in Florida.
- **Mode Used**
  - Location receives raw materials by rail and truck by truck, ships out by truck, or by truck to rail or by truck to seaport.
  - 4 million tons shipped annually. Raw materials 100 percent truck. Finished Goods 10 percent barge, 40 percent rail, 50 percent ocean.. Sulfur: 50 percent water, 30 percent rail, 20 percent truck. Ammonia: 60 percent vessel, 40 percent pipeline.
  - Road mostly. Rail is limited and would only be used by vendors or contracted carriers shipping goods to customer distribution center
  - All truck due to speed importance.
  - Mostly truck. Some intermodal shipments over longer distances
  - Rail if vendor is adjacent rail facilities
  - All truck (perishable product)
  - Short haul rail for raw product, truck for distribution of finished goods
- **Mode Decision / Access / Location**
  - Whether customer (final destination) has a railhead is a big factor as to which mode is used.
  - Cost and customer infrastructure are the biggest mode choice factors.

- Speed is not as important as predictability.
- Use contracts with trucking companies, they keep prices competitive
- All rail lines are with one company, difficult to obtain competitive bids
- Reliability is key factor – customer service is a competitive advantage of a shipper.
- Has no service guarantees to customers but they will buy from someone else if they fail to deliver product when stated.
- Feels that once there is a railhead on property, railroad will expect to be used, anticipate poor quality.
- No market for rate bargaining with rail. Seeks to find alternatives to railroads.
- No competition in the rail sector.
- Interested in all modes of transportation, wants as many suppliers as possible and will use the one with the best rate.
- Vendor would choose rail for cost effectiveness.
- The industry worries about rail reliability most commonly. Gave example of rail tie up in Texas causing goods to be 2-3 weeks late.
- Respondent has its own Florida fleet of 82 trucks that work out of their location. Truck drivers are respondent's employees. Respondent contracts out some loads usually using one or two carriers. In hurricane season may use up to three or four contract carriers.
- Price and speed are key decision factors. Florida has a lot of empty trucks leaving the state so truck rates are as low as 82c – 83c/mile. In other states cost can be roughly $1.50/mile.
- No rail facilities in receiving locations.
- Retail warehouses don't want a lot of inventory so truck shipments are required to meet short lead and short demand requests.
- They do have contracts with a few different truck carriers. They have mainline rail nearby and also a spur line coming to facility.

- **Location / Access**
  - Location was chosen due to proximity to raw materials.
  - Production facility is tat he port.
- **Future Plans**
  - Going to set up offsite facility, rail into each location.
  - Rail is considered when deciding on location.
  - Location of rail line is factored into decision.
  - Have built rail tracks into a facility before.
  - No expansion plans at the moment.
  - Location is structured to handle more output than current, will utilize road to meet expansion needs
  - Not looking to relocate – just expand existing location.
  - Rail frequency is not a problem, they would not use rail any more than they do already.

The anecdotal evidence of shipper perceptions collected in this brief survey provide useful direction for policy makers and planners, as, combined with the substantial literature available on the mode choice decision process and the data in this report on commodity characteristics in Florida, the use of direct means (through taxes or subsidies) to stimulate mode shift may not be effective. Certainly timeliness, reliability, and cost are primary factors for choice of mode. However, the presence or lack thereof of rail facilities not just at the shipper's facility (origin), but also at the customer's facility (destination) frequently dictates choice of mode. Hence it would be reasonable to assume that even if one mode offered a more timely, reliable, and cost effective service than its competitor, the inability of customers to receive the goods via that mode would significantly impact the likelihood of that mode being chosen. Additionally, the perception of becoming a captive market to a mode (to rail in particular) was voiced repeatedly. Accordingly, addressing all those factors in a positive manner would still leave shippers with the concern that once committed to a certain mode, service levels would drop, prices would increase, and little bargaining power or ability to seek competitive bids would exist.

Chapter Five: Conclusions

The concurrent efforts undertaken by the BEBR group for this project focus on the economic gains and necessary levels of subsidy/incentive that would be required to achieve market equilibrium for rail and truck movement of freight. Identifying the potential welfare gains and resulting improvements in efficiency provide a context of the extent to which investment in achieving equilibrium is appropriate. The findings of this phase of the project therefore provide direction as to where and what type of incentive might be most effective in achieving mode shift.

Given that net economic benefits and welfare gains can be achieved through mode shifts from road to rail shipment of goods, it must be determined how best to implement such changes. Little evidence has been discovered to support traditional subsidies or taxes on either mode to prompt mode shifts. Furthermore, determining how such policy changes would achieve mode shift is difficult in the light of data gathered for this project;

- many commodity types are only suited to one mode or the other
- logistical realities such as lack of infrastructure impact the ability to choose mode
- lack of consistent, comprehensive data makes it difficult to determine the true extent of freight movement in the state

The limited anecdotal evidence collected for this study however complements the empirical data and literature on the mode choice decision process in that policy that will enhance investment in infrastructure and intermodal facilities may provide for the greatest impact in mode shift.

The findings of this report cannot determine the optimal mix of rail and roadway investment, although the BEBR companion report does identify the potential welfare gains to the state should policy achieve an economic equilibrium of rail and road freight movement. Irrespective of the extent of mode shift desirable, given the state's rapid growth and increasing pressure on its highways, it is valuable to know how any mode shift might most effectively be stimulated. At the least, shippers must be offered the same quality of service, at no greater price and with matching ease of management, if they are to ship by rail (when and if infrastructure is available) rather than road. The state should also take care to retain existing infrastructure and right-of-way; although to some extent there is considerable excess capacity for rail facilities given Florida's growth rates, such capacity will be required at some point in the future.

The findings of this report do however support the following areas to stimulate a mode shift for freight movement in Florida:

- Policy that seeks **incremental gains** rather than entire market segments in rail's share of freight movement may be most effective. Initial steps should be taken to better determine the true extent of freight movement within, through, and out of the State. Understanding which commodities are well suited to rail but are being shipped via road, and that have adjacent/accessible rail facilities, should be targeted.
- Identification of suitable sites for intermodal facilities or "**Intermodal Parks**" should be undertaken by the State, similar in concept to an industrial park. Intermodalism is a service intensive form of transport. The coordination of freight arrival, staging, and handoff, combined with the constrained footprints of many freight terminals in dense urban areas, places a premium on consistent and reliable service. The concept of the parks would be to facilitate the rapid transfer of goods from rail to or from truck for local collection or delivery, and to promote rail as a mode alternative.
- A methodology for the **management of trailers** for drayage should be adopted for the large scale and rapid collection of goods for rail shipment, and the delivery of goods from bulk rail deliveries.
- A mechanism for **financial and managerial coordination** of the parks should be developed. Given that investment in intermodal facilities is a preferred policy opposition, the issue of who finances, who leads, and who operates the infrastructure must be addressed. Planning and regulations for development of Intermodal Parks should be prepared.

- **Recognition of customer needs**, such as those created by Just-In-Time (JIT) production processes and the fast growth of e-Commerce (direct Internet sales). JIT requires smaller though continuous batch delivery of goods, and vendors wish to warehouse minimal inventories. Shippers must have confidence that timeliness and reliability will be achieved in concert with any purported cost savings. Transportation infrastructure and connectors must be able to function reliably, so that businesses can count on their deliveries being on time, with minimal delays due to congestion at or near intermodal terminals. The success of e-commerce depends greatly on an efficient, seamless freight transportation system to deliver goods quickly and as promised, and also on making returns convenient and prompt.

Although not the scope of this study, alternative approaches to better manage road movement of freight should also be considered. Consideration of pricing of roadways for heavy truck use, effectively restricting their use in peak periods, may set the scene for greater consideration of rail as a mode alternative. This may also have the effect of better utilizing existing roadway infrastructure in low demand or off-peak periods.

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Analysis of Freight Movement Mode Choice Factors

Appendix

SURVEY REQUEST LETTER

DATE

Contact Name
Firm Name
Address 1
Address 2

Dear **Contact Name**,

In accordance with our telephone conversation on April 22, I am writing to inform you further about our study and what your participation would involve.

The Center for Urban Transportation Research at the University of South Florida is performing a study for the Florida Department of Transportation on freight mode choice. We are trying to identify the factors involved in choosing the appropriate mode of shipping goods, and determine what constraints or opportunities might exist to cause a shift to the optimal mode.

What we would like to do is interview a varied sample of the private sector and ask questions pertaining to freight shipments, how the mode choice is made and what options are considered in the decision process. The interview would be conducted via telephone and should only take 10 minutes.

If you would be available to participate, please contact me at smithwick@cutr.usf.edu or at (813) 974-7949 to set up an interview time that would most suit you. We would be very thankful for you participation in this study and I look forward to speaking with you soon.

Sincerely,

Hailey Smithwick
Research Specialist

SHIPPER INTERVIEW WORKSHEET

Contact Name:
Title: **Tel #**
Firm:
Location:
Interview Date: **Time:**

Choice Factor	Question/s to be asked
Physical Attributes of Goods	
	• Shipment size? • Shipment package characteristics? • Shipment self-life? • Shipment value?
Flow/Spatial Distribution of Shipment	
	• What is your shipment frequency? • What is the average shipment distance?
Mode Used	
	• Which modes (mode) are used for freight transportation? • Do you ship intermodally?
Mode Decision	
	• How do you decide on transportation mode? • What shipment characteristics do you consider most important: price, reliability or speed? • Is reliability and speed important due to any customer contracts/guarantees? • Have you used rail in the past? • Have you been satisfied/dissatisfied and why? • Is rail frequency a problem (eg. South Florida freight trains only run at night)? • How is the decision researched? Do they use a freight-forwarder? • Do you use one or many trucking companies? • Do you have contracts with trucking companies? If so, was rail considered before entering into such contracts? • Is rail an option? • Was highway proximity considered when deciding on location?
Accessibility / Location	
	• Is rail an option? • Are you near a rail head? • Would you consider using truck to get to rail • How did your firm decide upon its current location? • Was rail accessibility considered when deciding on a location? • Was highway proximity considered when deciding on a location? • If rail were accessible, would you consider using it? • If rail is not accessible, are you satisfied with this?, would you consider using it?
Future Plans	
	• Are you looking to relocate closer to rail? • Are you looking to build rail connections to make it accessible? • Is rail part of your company's long-term transportation goals? • What would rail have to do to become part of your future goals (eg. increase reliability, increase shipment frequency etc)?

Data

CSX Data

DATA EXPLANATION	
Source	**CSX 2000 Annual Report**
Analysis	Data was sorted and ranked. 1998 data were of particular interest since our other data sets were for the year 1998 and 1997.
TAB EXPLANATION	
Original CSX Data	Data directly from CSX.
Carloads_rank	1998 data are ranked by commodity according to the most carloads shipped.
Revenue_rank	1998 data are ranked by commodity according to the most revenue.
1998 V's 2000	1998 data are compared to 2000 data and the percentage change in carloads is calculated.

Commodity	Carloads (Thousands)			Revenue (Millions of Dollars)		
	2000	1999	1998	2000	1999	1998
1 Phosphates & Fertilizer	486	527	539	$ 316	$ 318	$ 304
1 Metals	346	319	268	$ 414	$ 367	$ 307
1 Food & Consumer Products	161	150	135	$ 224	$ 184	$ 148
1 Paper & Forest Products	523	505	457	$ 657	$ 600	$ 508
1 Agricultural Products	361	326	277	$ 483	$ 442	$ 380
1 Chemicals	598	545	444	$ 993	$ 913	$ 750
1 Minerals	439	422	396	$ 398	$ 386	$ 353
1 Government	11	11	6	$ 28	$ 28	$ 16
Merchandise Total	2,925	2,805	2,522	$ 3,513	$ 3,238	$ 2,766
2 Automotive	586	553	412	$ 869	$ 760	$ 540
Automotive Total	586	553	412	$ 869	$ 760	$ 540
3 Coal	1,660	1,614	1,651	$ 1,546	$ 1,476	$ 1,503
3 Coke	46	55	60	$ 47	$ 51	$ 53
3 Iron Ore	49	61	50	$ 30	$ 38	$ 27
Coal, Coke & Iron Ore Total	1,755	1,730	1,761	$ 1,623	$ 1,565	$ 1,583
4 Other Revenue	-	-	-	$ 70	$ 60	$ 67
Other Revenue Total	-	-	-	$ 70	$ 60	$ 67
Grand Total	5,266	5,088	4,695	$ 6,075	$ 5,623	$ 4,956

Original CSX Data

Commodity	Carloads (Thousands)			Revenue (Millions of Dollars)		
	2000	1999	1998	2000	1999	1998
4 Other Revenue	-	-	-	$ 70	$ 60	$ 67
3 Coal	1,660	1,614	1,651	$ 1,546	$ 1,476	$ 1,503
1 Chemicals	598	545	444	$ 993	$ 913	$ 750
2 Automotive	586	553	412	$ 869	$ 760	$ 540
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3 Iron Ore	49	61	50	$ 30	$ 38	$ 27
3 Coke	46	55	60	$ 47	$ 51	$ 53
1 Government	11	11	6	$ 28	$ 28	$ 16

Original CSX Data - Carloads Rank

Commodity	Carloads (Thousands)			Revenue (Millions of Dollars)		
	2000	1999	1998	2000	1999	1998
3 Coal	1,660	1,614	1,651	$ 1,546	$ 1,476	$ 1,503
1 Chemicals	598	545	444	$ 993	$ 913	$ 750
2 Automotive	586	553	412	$ 869	$ 760	$ 540
1 Paper & Forest Products	523	505	457	$ 657	$ 600	$ 508
1 Agricultural Products	361	326	277	$ 483	$ 442	$ 380
1 Minerals	439	422	396	$ 398	$ 386	$ 353
1 Metals	346	319	268	$ 414	$ 367	$ 307
1 Phosphates & Fertilizer	486	527	539	$ 316	$ 318	$ 304
1 Food & Consumer Products	161	150	135	$ 224	$ 184	$ 148
4 Other Revenue	-	-	-	$ 70	$ 60	$ 67
3 Coke	46	55	60	$ 47	$ 51	$ 53
3 Iron Ore	49	61	50	$ 30	$ 38	$ 27
1 Government	11	11	6	$ 28	$ 28	$ 16

Original CSX Data - Revenue Rank

1998		
Rank	Commodity	Carloads (Thousands)
1	Coal	1,651
2	Phosphates & Fertilizer	539
3	Paper & Forest Products	457
4	Chemicals	444
5	Automotive	412
6	Minerals	396
7	Agricultural Products	277
8	Metals	268
9	Food & Consumer Products	135
10	Coke	60
11	Iron Ore	50
12	Government	6

2000		
Rank	Commodity	Carloads (Thousands)
1	Coal	1,660
2	Chemicals	598
3	Automotive	586
4	Paper & Forest Products	523
5	Phosphates & Fertilizer	486
6	Minerals	439
7	Agricultural Products	361
8	Metals	346
9	Food & Consumer Products	161
10	Iron Ore	49
11	Coke	46
12	Government	11

Original CSX Data - Carloads Rank 1998 vs. 2000

Compare

Commodity	1998	2000	Change (Thousands)	Change %
Coal	1,651	1,660	9	0.55%
Chemicals	444	598	154	34.68%
Automotive	412	586	174	42.23%
Paper & Forest Products	457	523	66	14.44%
Phosphates & Fertilizer	539	486	-53	-9.83%
Minerals	396	439	43	10.86%
Agricultural Products	277	361	84	30.32%
Metals	268	346	78	29.10%
Food & Consumer Products	135	161	26	19.26%
Iron Ore	50	49	-1	-2.00%
Coke	60	46	-14	-23.33%
Government	6	11	5	83.33%

Original CSX Data - Carloads Rank 1998 vs. 2000

Transearch (Reebie and Associates) Data

DATA EXPLANATION	
Source	Source: TRANSEARCH by Reebie and Associates via Florida Department of Transportation.
Reliability	The data were received in a database format with no written explanations. It is not know how reliable the data from Reebie and Associates are.
Analysis	Queries were run on the original data to form three (3) final spreadsheets: To Florida, From Florida and Intra Florida.
TAB EXPLANATION	
Data	These final queries were moved to excel and subtotaled forming the Data spreadsheet. Therefore, each subtotal in the data spreadsheet is the total flow of freight; in, out and intra Florida. The data uses the shipment characteristic tons as the unit of measurement.
Commodity Totals	This tab displays each commodities sum of movement to, from and intra Florida. These data can be sorted and/or filtered to rank commodities.
Top_10 Comparisons	Each graph represents a transportation mode. The largest commodities, measured by tonnage, are displayed by there percent make up of the total mode.
Top_10	The ten (10) largest commodities, measured by tonnage across all transportation modes, are displayed showing their mode break-up. This is helpful to see which mode of transportation the large commodities use.
Top_20	The twenty (20) largest commodities, measured by tonnage across all transportation modes, are displayed showing their mode break-up. This is helpful to see which mode of transportation the large commodities use.
Mode Movement	Each transportation mode is displayed showing it's ten largest commodities separated out by To Florida, From Florida and Intra Florida.

Stcc	Description	Rail Carload	Rail Intermodal	For-HireTruck	For-Hire Truck LTL	Private Truck	Air Freight	Water Freight	Total_Trucks	Total_Rail	Total_Tons
1.0	Agriculture	728,902	52,252	550,997	-	174,703	2,225	120,821	725,674	781,158	1,629,876
1.0	Agriculture	10,211	72,264	1,991,892	-	605,398	433	721,792	2,597,279	82,474	3,401,977
1.0	Agriculture	-	15,192	35,431	-	12,557	7,827	-	47,998	15,192	71,015
	Agriculture Total	739,113	139,708	2,578,320	-	792,659	10,485	842,613	3,370,951	878,824	5,102,868
23.0	Apparel	-	47,096	132,440	58,163	27,976	10,423	25,049	218,518	47,098	301,089
23.0	Apparel	-	13,778	183,733	37,184	52,070	78	355	272,939	13,778	287,150
23.0	Apparel	-	-	226,532	4,528	28,692	14,810	1,560	259,734	-	276,102
	Apparel Total	-	60,874	542,705	99,874	108,739	25,310	26,964	751,191	60,876	864,341
28.0	Chemicals	5,247,734	137,312	4,510,737	397,798	202,095	25,763	4,939,663	5,110,592	5,385,041	15,461,049
28.0	Chemicals	6,868,763	101,642	4,349,896	185,950	303,987	369	46,773	4,839,753	6,970,415	11,857,304
28.0	Chemicals	2,777,499	45,322	3,437,629	32,009	4,331	8,372	-	3,473,964	2,822,817	6,305,161
	Chemicals Total	14,893,997	284,276	12,298,263	615,757	510,414	34,504	4,986,436	13,424,309	15,178,273	33,623,514
32.0	Clay,Concrete,Glass	1,453,175	41,248	5,671,770	85,745	9,171,459	2,537	21,742	14,928,922	1,494,424	16,447,614
32.0	Clay,Concrete,Glass	500,200	12,544	4,111,797	19,186	9,345,865	808	141	13,476,787	512,740	13,990,480
32.0	Clay,Concrete,Glass	182,700	191,584	4,574,513	11,156	10,206,551	-	2,568	14,792,216	374,277	15,169,064
	Clay,Concrete,Glass Total	2,136,075	245,376	14,358,080	116,086	28,723,876	3,345	24,451	43,197,925	2,381,441	45,607,158
11.0	Coal	4,932,882	-	136,344	-	-	-	8,540,079	136,340	4,932,877	13,609,302
11.0	Coal	2,964,104	-	-	-	-	-	-	-	2,964,103	2,964,103
11.0	Coal	149,729	-	-	-	-	-	-	-	149,729	149,729
	Coal Total	8,046,714	-	136,344	-	-	-	8,540,079	136,340	8,046,709	16,723,134
13.0	Crude Petroleum	-	-	-	-	-	-	22,663	-	-	22,663
	Crude Petroleum Total	-	-	-	-	-	-	22,663	-	-	22,663
36.0	Electrical Equipment	33,941	80,930	182,680	135,706	17,510	31,121	6,049	335,837	114,872	487,881
36.0	Electrical Equipment	6,786	1,410	81,571	65,575	34,395	11,509	-	181,506	8,195	201,209
36.0	Electrical Equipment	-	4,066	1,401	2,754	5	61,423	320	4,158	4,066	69,965
	Electrical Equipment Total	40,726	86,406	265,651	204,035	51,910	104,053	6,369	521,501	127,133	759,055
9.0	Fish	1,537	11,830	872	-	-	4,716	1,670	872	13,365	20,623
9.0	Fish	-	-	65	-	-	10	32,001	65	-	32,075
9.0	Fish	-	4,264	-	-	-	6,088	-	-	4,264	10,349
	Fish Total	1,537	16,094	937	-	-	10,814	33,671	937	17,629	63,047
20.0	Food	2,231,825	825,844	4,433,872	200,470	3,033,879	4,902	21,443	7,668,187	3,057,661	10,752,192
20.0	Food	1,534,548	227,278	3,329,348	95,003	3,950,653	413	200,762	7,374,979	1,761,824	9,337,975
20.0	Food	87,359	53,924	1,524,406	22,092	2,957,968	5,045	-	4,504,474	141,281	4,650,803
	Food Total	3,853,732	1,107,046	9,287,627	317,565	9,942,500	10,361	222,205	19,547,640	4,960,766	24,740,970
8.0	Forest Products	-	5,830	4	-	-	-	-	4	5,830	5,834
8.0	Forest Products	-	41,840	605	-	-	11	-	602	41,843	42,456
	Forest Products Total	-	47,670	609	-	-	11	-	606	47,673	48,290
44.0	Freight Forwarder Traffic	-	38,914	-	-	-	-	-	-	38,914	38,914
44.0	Freight Forwarder Traffic	-	6,434	-	-	-	-	-	-	6,433	6,433
44.0	Freight Forwarder Traffic	-	6,528	-	-	-	-	-	-	6,528	6,528
	Freight Forwarder Traffic To	-	51,876	-	-	-	-	-	-	51,875	51,875
25.0	Furniture	6,440	22,482	147,651	117,675	82,137	704	14,621	347,430	28,925	391,675
25.0	Furniture	-	4,320	43,245	72,113	49,426	645	249	164,741	4,319	169,954
25.0	Furniture	-	3,836	18,054	6,367	21,522	1,227	839	45,924	3,836	51,826
	Furniture Total	6,440	30,638	208,950	196,155	153,085	2,576	15,709	558,095	37,080	613,455
48.0	Hazardous Materials/Waste	4,513	-	-	-	-	-	-	-	4,514	4,514
	Hazardous Materials/Waste T	4,513	-	-	-	-	-	-	-	4,514	4,514
38.0	Instruments	-	4,110	17,662	22,810	2,160	10,882	4,673	42,613	4,110	62,276
38.0	Instruments	-	-	20,606	7,823	7,423	1,174	-	35,801	-	36,974
38.0	Instruments	-	-	843	140	319	25,879	236	1,301	-	27,418
	Instruments Total	-	4,110	39,111	30,774	9,902	37,935	4,909	79,715	4,110	126,668
31.0	Leather	-	2,470	25,776	5,252	2,506	882	3,310	33,496	2,470	40,158
31.0	Leather	-	210	18,807	11,126	1,517	34	-	31,436	210	31,680
31.0	Leather	-	-	6,648	4	772	101	172	7,429	-	7,702
	Leather Total	-	2,680	51,232	16,383	4,796	1,017	3,482	72,361	2,680	79,540
24.0	Lumber	3,056,632	36,152	2,794,346	36,370	1,662,359	157	-	4,493,029	3,092,767	7,585,953
24.0	Lumber	424,726	8,368	1,788,620	23,179	1,548,426	61	-	3,360,195	433,093	3,793,346
24.0	Lumber	104,132	-	851,554	15,168	884,944	367	-	1,751,684	104,134	1,856,178
	Lumber Total	3,585,490	44,520	5,434,520	74,718	4,095,729	585	-	9,604,908	3,629,994	13,235,477
35.0	Machinery	3,212	20,474	257,278	138,390	56,481	46,231	40,267	452,089	23,688	562,277
35.0	Machinery	1,881	2,320	144,394	43,783	45,364	2,274	859	233,490	4,201	240,824
35.0	Machinery	-	-	16,248	793	23,613	40,615	2,164	40,645	-	83,424
	Machinery Total	5,093	22,794	417,919	182,966	125,458	89,120	43,290	726,224	27,889	886,525
43.0	Mail	-	84,586	-	-	-	138,907	-	-	84,588	223,494
43.0	Mail	-	30,100	-	-	-	813	-	-	30,100	30,912
43.0	Mail	-	97,906	-	-	-	93,949	-	-	97,906	191,856
	Mail Total	-	212,592	-	-	-	233,669	-	-	212,594	446,262
33.0	Metal	734,032	2,288	938,493	147,443	30,196	481	13,617	1,116,077	736,323	1,866,493
33.0	Metal	9,803	12,812	716,722	28,052	8,649	280	31,041	753,414	22,612	807,356
33.0	Metal	8,702	4,440	207,482	1,402	-	86	3,269	208,866	13,140	225,361
	Metal Total	752,537	19,540	1,862,697	176,897	38,845	847	47,927	2,078,357	772,075	2,899,210

34.0	Metal Products	12,006	41,280	719,210	229,739	250,012	9,977	5,678	1,198,884	53,283	1,267,819
34.0	Metal Products	1,652	7,790	469,073	90,113	217,571	883	162	776,672	9,442	787,160
34.0	Metal Products	947	490	181,365	8,848	209,843	17,784	1,197	400,057	1,438	420,473
	Metal Products Total	14,606	49,560	1,369,648	328,700	677,426	28,645	7,037	2,375,613	64,163	2,475,452
10.0	Metallic Ores	32,624	-	-	-	-	-	-	-	32,623	32,623
10.0	Metallic Ores	111,506	-	1	-	-	-	55,028	1	111,505	166,534
	Metallic Ores Total	144,130	-	1	-	-	-	55,028	1	144,128	199,157
41.0	Misc Freight Shipments	1,645	6,574	-	-	-	19	37,924	-	8,218	46,161
41.0	Misc Freight Shipments	57,119	14,024	33	-	-	3	15,620	34	71,152	86,809
	Misc Freight Shipments Tota	58,765	20,598	33	-	-	22	53,544	34	79,370	132,970
39.0	Misc Mfg Products	1,300	21,224	106,823	59,883	19,170	6,780	-	185,853	22,521	215,156
39.0	Misc Mfg Products	49	802	31,388	7,735	45,744	1,277	-	84,821	851	86,946
39.0	Misc Mfg Products	-	972	5,645	305	10,668	10,266	-	16,605	972	27,841
	Misc Mfg Products Total	1,349	22,998	143,855	67,923	75,582	18,323	-	287,279	24,344	329,943
46.0	Misc Mixed Shipments	-	3,660,404	-	-	-	-	-	-	3,660,402	3,660,402
46.0	Misc Mixed Shipments	-	1,068,278	-	-	-	-	-	-	1,068,277	1,068,277
46.0	Misc Mixed Shipments	-	1,328,652	-	-	-	-	-	-	1,328,652	1,328,652
	Misc Mixed Shipments Total	-	6,057,334	-	-	-	-	-	-	6,057,331	6,057,331
14.0	Nonmetallic Minerals	11,037,694	6,612	13,871	-	-	-	1,626,040	13,872	11,044,301	12,684,217
14.0	Nonmetallic Minerals	11,937,002	4,854	5,942	-	-	-	6,202,451	5,944	11,941,865	18,150,258
14.0	Nonmetallic Minerals	15,371,619	-	-	-	-	-	1,005,886	-	15,371,627	16,377,513
	Nonmetallic Minerals Total	38,346,316	11,466	19,813	-	-	-	8,834,377	19,816	38,357,793	47,211,988
19.0	Ordnanc	3,666	-	28	-	-	-	-	28	3,666	3,694
19.0	Ordnanc	-	-	4	-	-	-	-	4	-	4
	Ordnanc Total	3,666	-	32	-	-	-	-	32	3,666	3,698
26.0	Paper	1,579,926	71,120	782,806	192,037	472,308	6,840	-	1,447,078	1,651,042	3,104,968
26.0	Paper	1,636,146	450,630	838,859	124,151	399,705	144	-	1,362,657	2,086,781	3,449,592
26.0	Paper	28,118	12,610	175,465	39,211	311,663	14,548	-	526,284	40,725	581,554
	Paper Total	3,244,190	534,360	1,797,130	355,399	1,183,676	21,532	-	3,336,019	3,778,548	7,136,114
29.0	Petroleum	664,473	5,966	1,260,858	51,296	588,074	525	34,652,614	1,900,226	670,433	37,223,801
29.0	Petroleum	46,580	11,460	137,576	4,508	614,198	6	515,960	756,268	58,044	1,330,273
29.0	Petroleum	784	3,520	133,660	3,071	401,494	1,542	2,624,879	538,212	4,304	3,168,938
	Petroleum Total	711,838	20,946	1,532,095	58,874	1,603,767	2,073	37,793,454	3,194,706	732,781	41,723,012
27.0	Printed Goods	-	53,944	151,057	92,330	531,070	17,739	8,632	774,401	53,943	854,720
27.0	Printed Goods	10	12,800	49,718	46,883	629,752	456	147	726,277	12,810	739,690
27.0	Printed Goods	-	-	2,673	12,676	502,851	33,935	522	518,198	-	552,653
	Printed Goods Total	10	66,744	203,448	151,889	1,663,673	52,129	9,301	2,018,876	66,753	2,147,063
30.0	Rubber/Plastics	469	42,334	385,595	284,577	274,401	4,854	5,535	944,545	42,801	997,737
30.0	Rubber/Plastics	3,720	10,668	89,141	102,123	110,866	396	-	302,063	14,390	316,848
30.0	Rubber/Plastics	-	560	19,690	5,324	54,661	-	301	79,667	560	80,528
	Rubber/Plastics Total	4,189	53,562	494,425	392,024	439,928	5,250	5,836	1,326,275	57,751	1,395,113
5010.0	Secondary Traffic	-	-	5,829,425	372,229	5,817,711	-	-	12,019,361	-	12,019,361
5010.0	Secondary Traffic	-	-	4,957,984	313,395	7,223,852	-	-	12,495,260	-	12,495,260
5010.0	Secondary Traffic	-	-	16,694,082	1,051,915	25,322,089	-	-	43,068,014	-	43,068,014
	Secondary Traffic Total	-	-	27,481,492	1,737,539	38,363,652	-	-	67,582,635	-	67,582,635
45.0	Shipper Association Traffic	-	181,536	-	-	-	-	-	-	181,534	181,534
45.0	Shipper Association Traffic	-	32,590	-	-	-	-	-	-	32,587	32,587
	Shipper Association Traffic T	-	214,126	-	-	-	-	-	-	214,121	214,121
42.0	Shipping Containers	-	20,768	-	-	-	-	1,657	-	20,769	22,426
42.0	Shipping Containers	16,971	399,828	-	-	-	-	-	-	416,800	416,800
42.0	Shipping Containers	-	233,144	-	-	-	-	67	-	233,144	233,211
	Shipping Containers Total	16,971	653,740	-	-	-	-	1,724	-	670,713	672,437
47.0	Small Packaged Freight	-	54,964	-	-	-	-	-	-	54,966	54,966
47.0	Small Packaged Freight	-	2,280	-	-	-	-	-	-	2,280	2,280
47.0	Small Packaged Freight	-	2,014	-	-	-	-	-	-	2,014	2,014
	Small Packaged Freight Tota	-	59,258	-	-	-	-	-	-	59,260	59,260
22.0	Textiles	-	9,814	65,385	60,578	20,353	3,536	4,874	146,267	9,814	164,489
22.0	Textiles	119	3,312	51,858	7,938	3,989	38	-	63,765	3,431	67,232
22.0	Textiles	-	2,426	4,305	459	2,597	5	145	7,356	2,426	9,932
	Textiles Total	119	15,552	121,548	68,974	26,940	3,579	5,019	217,388	15,671	241,653
21.0	Tobacco	-	7,886	2,458	940	204	-	-	3,590	7,886	11,476
21.0	Tobacco	-	-	2,202	273	66	1	167	2,523	-	2,691
21.0	Tobacco	-	-	560	-	12	-	-	573	-	573
	Tobacco Total	-	7,886	5,220	1,213	282	1	167	6,686	7,886	14,740
37.0	Transportation Equipment	2,546,836	37,362	321,313	146,229	92,347	36,704	43,521	559,847	2,584,192	3,224,265
37.0	Transportation Equipment	27,671	19,172	390,050	74,254	107,194	1,363	586	571,432	46,843	620,225
37.0	Transportation Equipment	7,276	-	133,630	4,284	543	18,804	2,446	138,448	7,276	166,978
	Transportation Equipment T	2,581,783	56,534	844,993	224,767	200,085	56,871	46,553	1,269,727	2,638,311	4,011,468
5030.0	Truck Air Drayage	-	-	421	-	-	-	-	420	-	420
5030.0	Truck Air Drayage	-	-	74,236	-	-	-	-	74,237	-	74,237
5030.0	Truck Air Drayage	-	-	633,527	-	-	-	-	633,522	-	633,522
	Truck Air Drayage Total	-	-	708,184	-	-	-	-	708,179	-	708,179
5020.0	Truck Intermodal	-	-	23,913	-	-	-	-	23,912	-	23,912

Stcc	Description	Rail Carload	Rail Intermodal	For-HireTruck TLL	For-Hire Truck LTL	Private Truck	Air Freight	Water Freight	Total_Trucks
1.0	**Agriculture Total**	739,113	139,708	2,578,320	-	792,659	10,485	842,613	3,370,951
23.0	**Apparel Total**	-	60,874	542,705	99,874	108,739	25,310	26,964	751,191
28.0	**Chemicals Total**	14,893,997	284,276	12,298,263	615,757	510,414	34,504	4,986,436	13,424,309
32.0	**Clay,Concrete,Glass Total**	2,136,075	245,376	14,358,080	116,086	28,723,876	3,345	24,451	43,197,925
11.0	**Coal Total**	8,046,714	-	136,344	-	-	-	8,540,079	136,340
13.0	**Crude Petroleum Total**	-	-	-	-	-	-	22,663	-
36.0	**Electrical Equipment Total**	40,726	86,406	265,651	204,035	51,910	104,053	6,369	521,501
9.0	**Fish Total**	1,537	16,094	937	-	-	10,814	33,671	937
20.0	**Food Total**	3,853,732	1,107,046	9,287,627	317,565	9,942,500	10,361	222,205	19,547,640
8.0	**Forest Products Total**	-	47,670	609	-	-	11	-	606
44.0	**Freight Forwarder Traffic Total**	-	51,876	-	-	-	-	-	-
25.0	**Furniture Total**	6,440	30,638	208,950	196,155	153,085	2,576	15,709	558,095
48.0	**Hazardous Materials/Waste Total**	4,513	-	-	-	-	-	-	-
38.0	**Instruments Total**	-	4,110	39,111	30,774	9,902	37,935	4,909	79,715
31.0	**Leather Total**	-	2,680	51,232	16,383	4,796	1,017	3,482	72,361
24.0	**Lumber Total**	3,585,490	44,520	5,434,520	74,718	4,095,729	585	-	9,604,908
35.0	**Machinery Total**	5,093	22,794	417,919	182,966	125,458	89,120	43,290	726,224
43.0	**Mail Total**	-	212,592	-	-	-	233,669	-	-
33.0	**Metal Total**	752,537	19,540	1,862,697	176,897	38,845	847	47,927	2,078,357
34.0	**Metal Products Total**	14,606	49,560	1,369,648	328,700	677,426	28,645	7,037	2,375,613
10.0	**Metallic Ores Total**	144,130	-	1	-	-	-	55,028	1
41.0	**Misc Freight Shipments Total**	58,765	20,598	33	-	-	22	53,544	34
39.0	**Misc Mfg Products Total**	1,349	22,998	143,855	67,923	75,582	18,323	-	287,279
46.0	**Misc Mixed Shipments Total**	-	6,057,334	-	-	-	-	-	-
14.0	**Nonmetallic Minerals Total**	38,346,316	11,466	19,813	-	-	-	8,834,377	19,816
19.0	**Ordnanc Total**	3,666	-	32	-	-	-	-	32
26.0	**Paper Total**	3,244,190	534,360	1,797,130	355,399	1,183,676	21,532	-	3,336,019
29.0	**Petroleum Total**	711,838	20,946	1,532,095	58,874	1,603,767	2,073	37,793,454	3,194,706
27.0	**Printed Goods Total**	10	66,744	203,448	151,889	1,663,673	52,129	9,301	2,018,876
30.0	**Rubber/Plastics Total**	4,189	53,562	494,425	392,024	439,928	5,250	5,836	1,326,275
5010.0	**Secondary Traffic Total**	-	-	27,481,492	1,737,539	38,363,652	-	-	67,582,635
45.0	**Shipper Association Traffic Total**	-	214,126	-	-	-	-	-	-
42.0	**Shipping Containers Total**	16,971	653,740	-	-	-	-	1,724	-
47.0	**Small Packaged Freight Total**	-	59,258	-	-	-	-	-	-
22.0	**Textiles Total**	119	15,552	121,548	68,974	26,940	3,579	5,019	217,388
21.0	**Tobacco Total**	-	7,886	5,220	1,213	282	1	167	6,686
37.0	**Transportation Equipment Total**	2,581,783	56,534	844,993	224,767	200,085	56,871	46,553	1,269,727
5030.0	**Truck Air Drayage Total**	-	-	708,184	-	-	-	-	708,179
5020.0	**Truck Intermodal Total**	-	-	9,110,377	-	-	-	-	9,110,380
40.0	**Waste Total**	1,248,598	179,962	16,559	-	-	3,366	7,913,873	16,559

COMMODITY TOTALS