



*I-95 Corridor Coalition*

# Short-Sea and Coastal Shipping Options Study

*Final Report*



*November 2005*

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*Final Report*

*Prepared for:*

I-95 Corridor Coalition

*Prepared by:*

Cambridge Systematics, Inc.

*November 2005*

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## 1.0 Introduction and Background

The I-95 Corridor Coalition is a partnership of state departments of transportation (DOT), regional and local transportation agencies, toll authorities, and related organizations (including law enforcement, transit, port, and rail organizations) from Maine to Florida with affiliate members in Canada. With a population of almost 108 million, the Coalition region is home to nearly 37 percent of the nation's inhabitants and one-third of the nation's jobs, yet only contains 10 percent of the total U.S. landmass.<sup>1</sup> Between 1970 and 2004, the total population of the Coalition region increased by almost 30 million, or 37 percent. The New York-Northern New Jersey metropolitan area alone grew by 2.0 million while the Washington-Baltimore region added more than 2.5 million new residents. North Carolina has undergone rapid population growth, with an increase of almost 3.5 million, or 67 percent, over the 34-year period. The largest increase in population has been in Florida, with the addition of more than 10 million new residents in that same period, accounting for growth of 250 percent. The U.S. Census Bureau estimates that by 2025, an additional 26 million people will live in the Coalition region, bringing the population total to 134 million.

In the midst of this rapidly growing population, a greater percentage of the region's population is taking more frequent and longer trips, more than three-quarters of which are occurring on the region's highway system. As a result, annual vehicle miles of travel (VMT) within the region has been increasing rapidly and currently exceeds 550 billion, representing a 140 percent increase since 1970. Truck movements also are significant – more than 195 billion ton-miles of the region's freight moved by truck in 1997. One result of these trends has been increasing congestion on the region's highway system. As shown in Figure 1.1, overall VMT in the 16-state Coalition region has increased at a faster rate than population and highway capacity.

The volume of intermodal (containerized) freight also is growing significantly, placing increased stress on the capacity of the region's ports and intermodal terminals, as well as the highways, rail lines, and waterways that serve them. The total number of 20-foot equivalent units (TEU) that moved through ports in the Coalition region rose by more than 35 percent from 1999 to 2004,<sup>2</sup> and volumes are expected to continue to grow significantly over the next decade. In addition, non-containerized freight movements through ports within the Coalition region have increased by more than 11 percent from 1999 to 2003.<sup>3</sup>

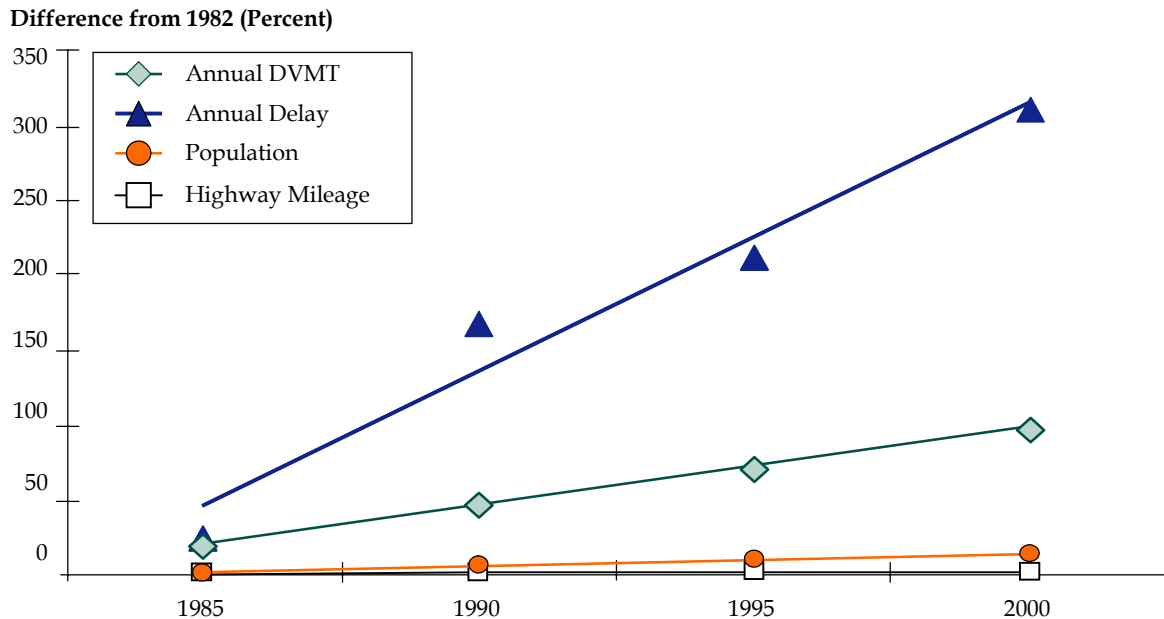
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<sup>1</sup> U.S. Census Bureau.

<sup>2</sup> American Association of Port Authorities.

<sup>3</sup> U.S. Army Corps of Engineers, Waterborne Commerce Statistics.

**Figure 1.1** Increases in Population, VMT, Highway Mileage, and Delay in the I-95 Corridor Region  
1985-2000



In addition to the growth in freight movements from within the Coalition region itself, the region's transportation system is being affected by growth in freight volumes in other areas and changing logistics patterns. Post-9/11 security requirements, the rise of China as a major trading partner, and the continued use of just-in-time logistics practices have changed the ways in which shippers and manufacturers use the transportation system to transport goods to major distribution, warehousing, and population centers in the region. Taken together, these trends will result in impacts to the I-95 Corridor Coalition in four key areas: mobility; safety and security; economic competitiveness; and community/environmental vitality.

- Mobility Impacts** - Increasing freight volumes will continue to strain the region's already-congested transportation system, placing particular stress on the highway and rail networks. The Coalition region's major metropolitan areas, including New York, Boston, Philadelphia, Washington, D.C., and Miami are not only home to many of the region's major load centers, but also were among the top 12 most congested areas in the United States in 2003.<sup>4</sup> While congestion in these areas will not shut down local ports, terminals, and distribution centers, it can degrade the reliability and predictability of intermodal service for shippers and receivers, as well as affect passenger movements in localized areas and along the Corridor as a whole.

<sup>4</sup> Texas Transportation Institute, Urban Mobility Study.

- **Safety and Security Impacts** - In addition to the degradation of overall reliability and predictability of intermodal service, highway congestion and delays also can have a detrimental effect on overall freight security efforts. The volume of traffic at port and intermodal facilities, combined with the pressure to maintain continuous traffic flows through facility gates, could increase the vulnerability of port facilities to terrorist activities. In addition, increasing volumes of truck traffic, particularly international containerized traffic secured outside U.S. borders, may strain the resources of Federal, state, and local commercial vehicle and other enforcement staff, which also will have a detrimental effect on overall commercial vehicle safety.
- **Economic Impacts** - Congestion at landside access points to marine ports and intermodal facilities decreases the reliability of the freight transportation system, often resulting in inefficient terminal operations and/or missed intermodal connections. Drayage operations are particularly affected, as excessive congestion and unreliability limits the amount of “turns,” or number of shipments, that a drayage operator can make in a single day. As the number of turns decreases, the drayage operator loses income; those losses are often passed on to shippers and ultimately to consumers. In addition, many ports and terminals in the region are physically constrained, making capacity expansions challenging. These constraints lead to ingress and egress limitations that can result in long queues at terminal entrances and exits, preventing these marine facilities and their access routes from operating at peak efficiency. Ports, in particular, are vulnerable to the effects of congestion. If the Coalition’s ports are not able to continue to operate efficiently, they risk losing market share to other North American ports, such as those located in Atlantic Canada, the Caribbean, or the Gulf Coast.
- **Community/Environmental Impacts** - Many ports, terminals, and intermodal facilities in the Coalition region are located in mixed land use areas that contain residential neighborhoods in addition to transportation and warehousing facilities. Trucks that access facilities located in such areas are often forced to travel along local streets and roads that are fraught with obsolete bridges and connectors, and along pavements occasionally not sturdy enough for use by heavy vehicles. Rail is an important and growing service alternative, but high infrastructure development costs and network capacity bottlenecks can limit its potential as a viable option to trucking. In addition, while increased congestion at ports, terminals, and intermodal facilities and their access routes will certainly have a major effect on the efficiency of national and international freight systems, their impacts are felt locally through increased noise and air pollution.

One strategy that may help to alleviate these impacts, and in so doing effectively increase the capacity available to freight shipments, is to expand the use of short-sea shipping. Short-sea shipping describes marine shipping operations between ports along a single coast or shipments that involve a short-sea crossing. Examples of short-sea routes include Jacksonville to San Juan; Albany to Boston; Philadelphia to New York; Tacoma to Anchorage; Los Angeles to Seattle; or St. Louis to New Orleans.

Proponents argue that in situations where freight could be moved economically and reliably by short-sea shipping, the increasing need for parallel truck or rail operations may be reduced, thereby helping to mitigate highway and rail congestion. Many agencies,



industry groups, and academic institutions have conducted or are in the process of conducting studies of how short-sea shipping could become a more viable option for shippers in North America. While these previous and ongoing short-sea shipping studies have been effective in raising the profile of short-sea shipping and its potential to relieve highway and rail congestion, few have provided an understanding of how short-sea operations fit within existing intermodal transportation systems and supply chains. Still fewer have identified short-sea shipping's potential impacts on statewide, regional, and local transportation systems and economic development efforts.

This study, which complements and enhances existing short-sea study and research already conducted by the U.S. Maritime Administration (MARAD) and other organizations, will help state DOTs and metropolitan planning organizations (MPO) better understand how short-sea shipping fits within local, statewide, and regional transportation systems. In addition, this study will help MARAD and the I-95 Corridor Coalition better understand the role that state DOTs and MPOs could play in supporting short-sea shipping initiatives. The project has four specific objectives:

1. Identify and engage the full range of domestic short-sea shipping stakeholders, including state DOTs and MPOs, and help assess their roles in supporting short-sea shipping activities and initiatives;
2. Identify existing short-sea operations in the Coalition region and provide a better understanding of why these services may not be used to their full potentials;
3. Preliminarily identify commodity types and general traffic lanes that could be amenable to short-sea shipping operations; and
4. Develop recommendations to further guide development of MARAD's short-sea shipping initiative and help determine the role that the I-95 Corridor Coalition and its member agencies may play in addressing short-sea shipping issues.

## ■ 1.1 Approach

While short-sea shipping-related reports conducted to date have made it apparent that the potential to offer a realistic alternative to freight movements by truck and rail modes exists, there is no clear understanding of how short-sea operations could be integrated into a cohesive component of an intermodal transportation system. There also is a lack of understanding of the potential impacts of increased short-sea shipping activities on regional and local transportation systems and economic development efforts. The approach to this study was developed in such a way as to address these gaps and provide a more comprehensive understanding of how short-sea shipping could fit within metropolitan, statewide, and regional transportation planning and policy-making activities. Specifically, the activities conducted as part of this study were designed to:

- **Maintain a system-level view of transportation networks and modes** – Supply chains have become increasingly national and global in scope, with numerous domestic companies managing worldwide production and distribution systems with facilities located in areas throughout the world. The ability of the transportation system to provide reliable door-to-door services across continents, countries, and modes of transportation is becoming increasingly important to the private-sector freight industry. At the same time, public-sector transportation agencies are increasingly planning and managing the nation’s transportation system in an integrated and systematic fashion rather than as a collection of individual modes and networks. When developing or supporting short-sea shipping activities, it is important to understand how the various elements of the supply chain and transportation systems work together to meet the needs of users and to determine how the use of short-sea shipping operations can complement and support these systems.
- **Develop a better understanding of the short-sea shipping markets** – While a significant body of work has assessed the current supply of short-sea services, there is only a limited understanding of the current and potential international and domestic markets for these services. A fundamental step in understanding short-sea shipping and its potential to become a viable component of an intermodal transportation system is to develop a detailed comprehension of the types of commodities that could be served by short-sea operations, along with the origins and destinations that could be linked. It also is important to understand the existing market for short-sea shipping, and to determine the obstacles that prevent those services from being utilized to their full potentials.
- **Engage all of the short-sea shipping stakeholders** – While previous studies and initiatives have been effective in raising the profile of short-sea shipping and providing a forum for maritime industry stakeholders to discuss the issues and challenges that surround short-sea operations, some stakeholders have not been fully represented up to this point. State DOTs and MPOs are important stakeholders to include in the discussion, as they provide important transportation perspectives and also would bear the traffic, economic development, and environmental costs and benefits associated with increased short-sea shipping operations. This is particularly true for MPOs in areas with underutilized ports, which may be magnets for short-sea shipping operations. Development of short-sea shipping activities at these and other smaller ports could have a tremendous effect on traffic patterns, economic development activities, and community and environmental vitality in these areas.
- **Identify potential public policy implications associated with short-sea shipping** – Finally, little has been done to investigate the public policy implications of short-sea shipping or the roles of Federal, state, and local governments in short-sea operations. In addition to infrastructure and operational strategies that may make short-sea shipping a more integral part of the regional and national transportation systems, there also are public policy strategies that may make short-sea shipping more attractive to shippers and carriers.

This project provided an opportunity for the Coalition and MARAD to more fully engage all of the short-sea shipping stakeholders in the Coalition region; identify the commodity types that could be attractive candidates for short-sea operations; more fully describe the infrastructure, operational, and policy challenges surrounding short-sea shipping; and make recommendations to guide the further development of MARAD's short-sea shipping program and the role that the I-95 Corridor Coalition and its member agencies could play in addressing short-sea shipping issues.

## ■ 1.2 Organization of this Report

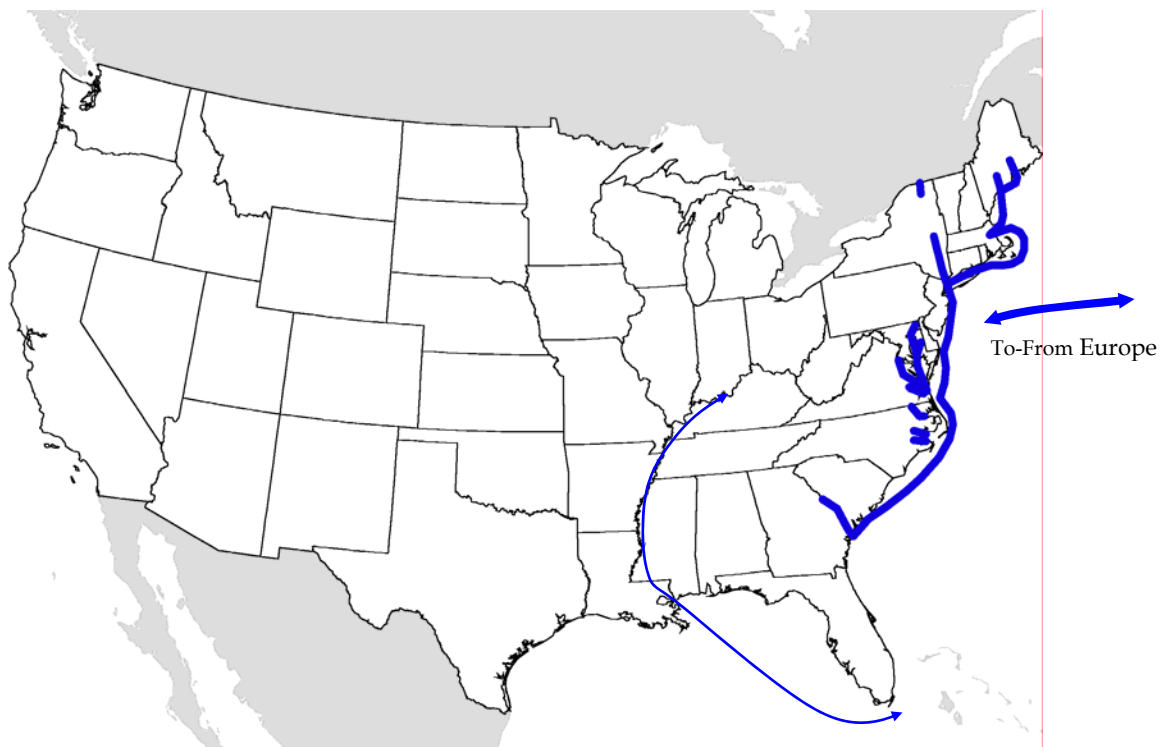
This report is organized as follows:

- **Section 2.0, Overview of Short-Sea Shipping in the Coalition Region**, maps and details those ports that currently utilize short-sea shipping operations, describes the primary short-sea shipping operators, and describes the key issues that affect short-sea shipping operations in the region.
- **Section 3.0, Summary of Interviews**, details the results of more than 40 interviews with short-sea shipping stakeholders within the I-95 Corridor Coalition region, incorporating general findings, current obstacles to short-sea shipping, the potential effects and impacts of increased short-sea shipping operations, and the potential role of MPOs, DOTs, and Port Authorities in promoting short-sea shipping.
- **Section 4.0, Potential Short-Sea Shipping Market in the Coalition Region**, uses the Federal Highway Administration's (FHWA) Freight Analysis Framework (FAF) to quantify current freight flows that originate or terminate in the I-95 Corridor Coalition region; and maps key flows to highlight the primary freight movements that are most applicable to short-sea shipping operations.
- **Section 5.0, Conclusions and Recommendations**, details conclusions about the potential for expanded short-sea shipping operations, and provides recommendations to assist MARAD and the Coalition in outlining potential next steps in supporting short-sea shipping activities and initiatives.

## 2.0 Overview of Short-Sea Shipping in the Coalition Region

The use of barges and ships to transport goods has long been an important part of the Coalition region's transportation system. A look at historical trade patterns, as shown in Figure 2.1, shows that water transport was the dominant mode of transportation in the Coalition region through the 18<sup>th</sup> century.

**Figure 2.1** Trade Patterns of the 18<sup>th</sup> Century



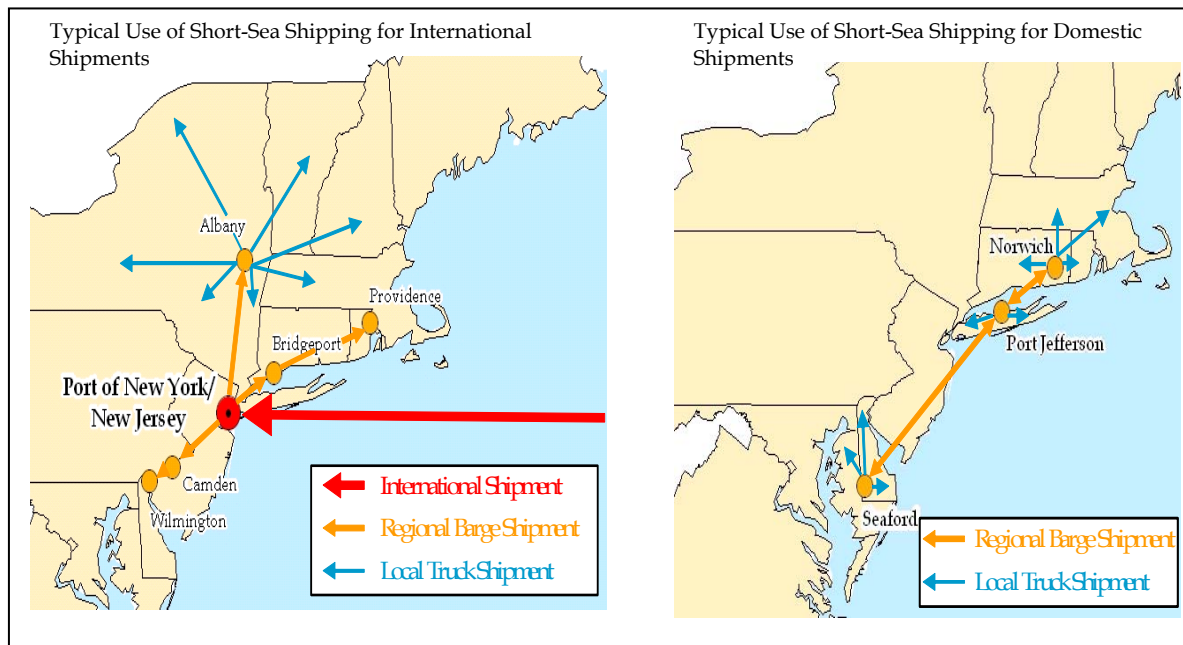
In fact, colonial economies were built on water transport: two-thirds of the population lived within 50 miles of the Atlantic Coast and it cost as much to move one ton of goods 30 miles inland as it did across the Atlantic or up and down the East Coast. The evolution of the rail and highway networks in the 19<sup>th</sup> and 20<sup>th</sup> centuries allowed shippers to serve existing markets more efficiently and access distant markets more effectively, decreasing their reliance on waterborne modes and port infrastructure. However, short-sea and coastal shipping has remained an attractive option for some businesses in the region and an important – if somewhat underutilized – element of the region's transportation system.

There currently are two distinct markets for short-sea shipping: international and domestic. The characteristics of these markets are described in Table 2.1 and illustrated in Figure 2.2, below.

**Table 2.1 International and Domestic Short-Sea Shipping Characteristics**

Characteristic	International Market	Domestic Market
Operations	Lift-on/Lift-off (lo/lo)	Roll-on/Roll-off (ro/ro)
Equipment	ISO Containers (typically 40 x 8 x 8.5 feet)	Domestic containers (53-foot) or truck trailers
Service Area	Major deepwater port to secondary port (or vice versa)	Secondary port to secondary port
Customer Base	Mainly international	Mainly domestic
Infrastructure Requirements	Shore-side cranes and container storage areas	Minimal, particularly if vessels have self-sustaining ramps

**Figure 2.2 Use of Short-Sea Shipping for International Movements versus Domestic Movements Shipments**



When considering how to make short-sea shipping a more viable mode choice for shippers, it is first important to understand the extent of existing short-sea shipping services and initiatives and the reasons they may not be fully utilized. In addition, it also is important to identify the key factors that contribute to the success of the short-sea shipping operations that do exist. Understanding these factors is critically important to states,

MPOs, and economic development agencies, as they work with local Port Authorities, MARAD, industry, and other stakeholders to attract new or additional short-sea shipping operations to their areas. This section describes existing short-sea shipping services within the Coalition region and the ports that currently actively support short-sea shipping operations. The section concludes with a discussion of the factors necessary to support new or expanded short-sea shipping activities within the Coalition region.

## ■ 2.1 Current East Coast Short-Sea Shipping Operations and Initiatives

There are a number of short-sea shipping operations and initiatives within the I-95 Corridor Coalition region. A handful of the larger, more active services are described in this section. A more comprehensive list of companies providing short-sea shipping operations within the Coalition region is provided in Appendix A.

### **Port Inland Distribution Network**

The Port Inland Distribution Network (PIDN) is a public/private partnership that seeks to distribute containers moving through the Port Authority of New York and New Jersey (PANYNJ) by barge and rail – in addition to trucks. The Albany ExpressBarge provides twice-weekly service between the PANYNJ and the Port of Albany. This service started in April 2003 and served approximately 540 containers per month in 2004. Studies are underway to expand the network to water-accessible points such as Camden, New Jersey; Bridgeport, Connecticut; Providence, Rhode Island; and Wilmington, Delaware.

The PIDN program aims to lower inland distribution costs; reduce truck trips; improve air quality; save energy through reduced truck fuel use; and increase port throughput capacity and spur economic development at feeder ports and hinterlands by providing new port platforms for warehousing and distribution opportunities.

### **Columbia Coastal Transport**

Columbia Coastal is a U.S. flag barge operator that provides containerized cargo feeder services between ports in North America, plus Freeport, Bahamas, and Cuba. The company transports 20-, 40-, and 45-foot containers, including refrigerated units, aboard feeder barges. They offer complete transportation services for project cargo, including heavy-haul truck/rail coordination, lift-on/lift-off (lo/lo) at all points, roll-on/roll-off (ro/ro) barges, and logistics services.

The company has been offering container barge services as a partner to international ship operators since 1990. They currently provide services to Halifax (Nova Scotia), Portland (Maine), Boston (Massachusetts), Norfolk (Virginia), Baltimore (Maryland), Charleston (South Carolina), Elizabeth (New Jersey), Jacksonville (Florida), Miami (Florida), Newark

(New Jersey), New York (New York), Philadelphia (Pennsylvania), and Savannah (Georgia) along the following routes:

- **Northern Service** - Between New York/New Jersey, Boston, and Portland (Maine) (twice weekly);
- **Mid-Atlantic Service** - Between New York/New Jersey, Baltimore, and Philadelphia (twice weekly);
- **Chesapeake Service** - Between Norfolk and Baltimore (four times weekly);
- **Wilmington Service** - Between Wilmington (Delaware), Charleston, and Savannah (twice weekly);
- **Southern Service** - Between Charleston, Savannah, Jacksonville, Port Canaveral, Port Everglades, and Miami (twice weekly); and
- **Gulf Service** - Between Houston and New Orleans (twice weekly).

In addition, Columbia Coastal provides service to Freeport and Cuba on demand.

## **Gateway Terminal**

Gateway Terminal is a private deep-water marine terminal operator located in New Haven (Connecticut) that handles various types of dry and liquid bulk and break bulk cargoes. The company provides tug and barge services to major transportation centers along the East Coast, Gulf of Mexico, and Puerto Rico, with a fleet of six tugs and nine barges.

The barges transport mainly rocks and woodchips from the terminal in New Haven. Products coming into New Haven include sand and salt. Gateway's terminal is located near I-91 and I-95, which allow for easy truck access. The company also features an intermodal facility, allowing for direct throughput from vessel and barge to rail for cargoes destined for the Midwest, Northern New England, and Eastern Canada.

## **Buchanan Marine**

Buchanan Marine, also based in New Haven (Connecticut), is a private barge and tug operator with terminals in Delaware, Virginia, New Jersey, New York, and Connecticut. The company operates a fleet of approximately 250 barges and 20 tugboats along the East Coast, between Tampa Bay (Florida) and the Connecticut Region. The barges transport metals and other commodities to the New York metropolitan area and Connecticut; these are then hauled by truck to Massachusetts, Vermont, upstate New York, and Canada using I-84, I-91, and I-95.

Buchanan Marine also owns an intermodal facility in Norwich (Connecticut) along the Thames River. The site includes access to the New England Central Railroad and is located near major highways in the region for easy truck access. Out of this facility, Buchanan provides barge service primarily for break bulk items such as lumber, steel, pipe, sand, and aggregate.

## **Trailer Bridge**

Trailer Bridge began operations in 1991 and currently provides twice-weekly short-sea service between Jacksonville and Puerto Rico on three lo/lo and five ro/ro barges. Trailer Bridge's ro/ro barges are designed to haul domestic 53-foot containers. Trailer Bridge is a combination service, providing integrated highway and barge transportation to its customers in the mainland United States and in Puerto Rico. Trailer Bridge provides direct service to:

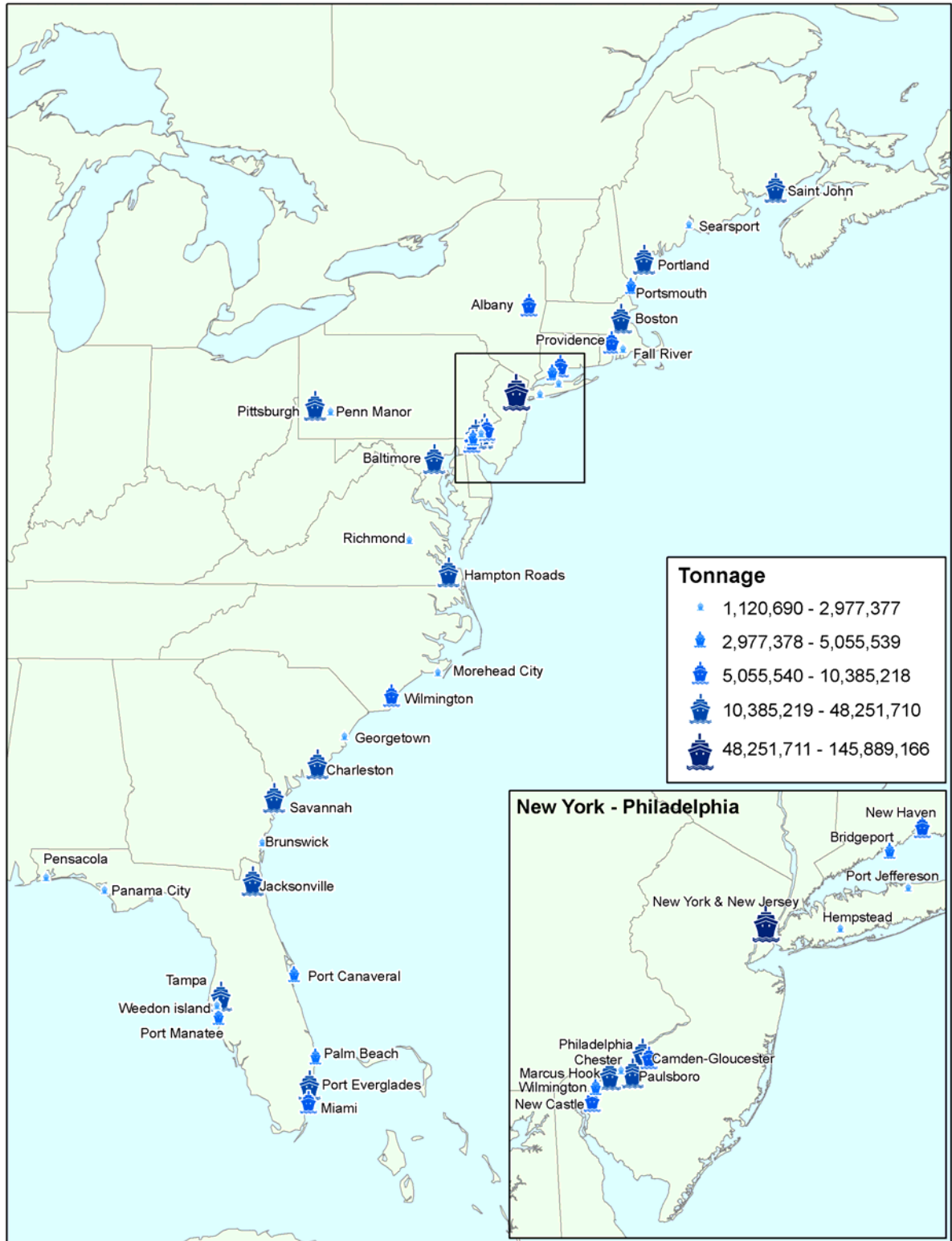
- Atlanta (six-day total transit);
- Charlotte (six-day total transit);
- Chicago (seven-day total transit);
- Columbus, Ohio (six-day total transit);
- Dallas (seven-day total transit);
- Houston (six-day total transit);
- Louisville (six-day total transit);
- Memphis (six-day total transit);
- Minneapolis (eight-day total transit);
- Newark, New Jersey (seven-day total transit); and
- St. Louis (six-day total transit).

## ■ **2.2 Hubs for Short-Sea Shipping in the Coalition Region**

The I-95 Corridor region is home to 31 of the largest 150 marine ports in the United States (as ranked by total throughput). Figures 2.3 and 2.4 show the top Coalition ports by tonnage and TEUs.



**Figure 2.3 Top Coalition Region Ports  
By Tonnage**



**Figure 2.4 Top Coalition Region Ports  
By TEUs**



While a number of these ports and port facilities support both deepwater and short-sea shipping operations in the Coalition region, ocean-going containerships are the primary customers of many, particularly those located in or near major urban markets. As such, ocean-going containerships often have preference when it comes to berth, labor, and equipment availability. This can be a concern for short-sea shipping operations, which can require a significant amount of labor and equipment for loading and off-loading of cargo. In fact, coastal lo/lo ships typically have to allocate 24 hours per port call, though only eight to 12 hours are required for on-load and offload of cargo.<sup>1</sup> There are, however, several ports in the Coalition region that actively cater to and support short-sea shipping operations in the region, including:

- **Ports of New York/New Jersey and Albany** - As discussed earlier, the Albany ExpressBarge provides twice-weekly service between the PANYNJ and the Port of Albany as part of PANYNJ's PIDN. Studies are underway to expand the network to water-accessible points such as Camden, New Jersey; Providence, Rhode Island; and Wilmington, Delaware.
- **Port of Bridgeport** - The Bridgeport Port Authority recently began offering daily ro/ro container barge feeder service between the Port of Bridgeport and the Port of New York and New Jersey.
- **Port of Pittsburgh** - In an effort to attract potential barge shippers, the Port developed SmartBarge, an Internet portal designed to allow potential shippers to receive quotes for barge transport between specific origin/destination (O/D) pairs; compare barge transport prices with truck prices; and inquire as to the availability of barge equipment on any given date.
- **Port Canaveral** - The Canaveral Port Authority published a short-sea shipping study in March 2005 that analyzed current and historic short-sea shipping activities (both domestic and international) and determined the attractiveness of Port Canaveral as a short-sea shipping hub based on critical factors such as demand, infrastructure, location, cost, congestion, and environmental effects. The study showed that Canaveral has a fair to good probability of attracting short-sea shipping activities as it stands today, and a very good probability in the future.<sup>2</sup>

In addition to these ports, there are several other ports in the Coalition region that currently serve short-sea operations. Just as important, though, is the fact that there are many underutilized ports and facilities within the Coalition region. As discussed earlier, the economy of the East Coast of the United States (and the Northeast and Mid-Atlantic, in particular) was built on water transport. Metropolitan areas of all sizes often grew up around local ports, which provided jobs and markets for the local population. The

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<sup>1</sup> National Ports and Waterways Institute at Louisiana State University, *High-Speed Ferries and Coastwise Vessels: Evaluation of Parameters and Markets for Application*, 2000.

<sup>2</sup> Maritime Transport & Logistics Providers, LLC, *Port Canaveral Short-Sea Shipping Study*.

evolution of the rail and highway networks in the 19<sup>th</sup> and 20<sup>th</sup> centuries allowed shippers to serve existing markets more efficiently and access distant markets more effectively, giving rise to major load center ports and causing smaller ports to become less important in the overall supply and distribution chain. More recently, though, some areas in the Coalition region are looking at their underutilized ports and seeing economic development potential in the form of expanded short-sea shipping operations. Expanded short-sea shipping operations may then generate other industrial or commercial developments in these areas, providing additional revenues for cities and municipalities and employment opportunities for local residents. When considering where expanded short-sea shipping operations may have the highest probability of success, it is important to look at several factors, including:

- **Modal Access** – Potential short-sea ports must have effective, efficient access to other modal networks (highway and rail). This is critically important as trucks and/or rail will be used to make the final door-to-door delivery of products moved by short-sea. The most successful short-sea shipping operations include efficient access to the interstate system and Class I rail mainlines.
- **Berth Availability** – As discussed earlier, short-sea operations calling at some major deepwater seaports often do not receive a high priority for berthing, particularly in comparison to large, ocean-going containerships. Ports that can regularly offer berths may be better able to attract short-sea traffic. This is a major advantage of using underutilized ports as magnets for short-sea shipping.
- **Crane/Stevedore Cargo Handling Capacity** – Potential short-sea ports must have the ability to load and off-load ships quickly and efficiently. This also is an important component, as efficient loading and offloading will help short-sea shipping operations match the cost, speed, and reliability characteristics of competing modes. For international movements, shore-based cranes or self-gearred vessels are often required. Ro/Ro movements, more common for domestic shipments, often do not require as much cargo handling infrastructure. Those ports wishing to enhance their abilities to attract short-sea services – international or domestic – must ensure that adequate and appropriate cargo handling capacity exists.
- **Access to Capital** – Finally, access to capital is a critical element, as ports must be able to raise capital quickly in order to make infrastructure improvements to retain existing customers and attract new ones.

## 3.0 Summary of Interviews

### ■ 3.1 Introduction

As discussed earlier, previous short-sea shipping studies conducted by MARAD and others have been effective in raising the profile of short-sea shipping and providing a forum for maritime industry stakeholders to discuss the issues and challenges that surround short-sea operations. However, the perspectives of some key short-sea shipping stakeholders have not been fully investigated in many of these existing efforts. State DOTs and MPOs are important stakeholders to include in a discussion of short-sea shipping, as these agencies can provide important transportation perspectives and would also bear the traffic, economic development, and environmental costs and benefits associated with increased short-sea shipping operations. This is particularly true for MPOs in areas with under-utilized ports, which may be magnets for short-sea shipping operations because of their existing infrastructures and/or access to potential markets. Development of short-sea shipping activities at these and other smaller ports could have a tremendous effect on traffic patterns, economic development activities, and community and environmental vitality in these areas.

To ensure the perspectives of all potential short-sea shipping stakeholders were understood and addressed, a series of in-depth interviews with MPOs, state DOTs, Port Authorities, and the private-sector freight and maritime community were conducted as part of this study. These interviews were used to assess the degree of knowledge of short-sea shipping among these key stakeholders; discuss the potential transportation and economic development impacts associated with short-sea shipping; and assess the degree of cooperation among DOTs, MPOs, Port Authorities, and other stakeholders in planning and supporting short-sea shipping-related activities.

Completion of these interviews had two important outcomes. First, they allowed MARAD and the I-95 Corridor Coalition to better understand the roles or potential roles of DOTs and MPOs in encouraging or supporting short-sea shipping operations as part of comprehensive transportation systems – a perspective that has not been fully addressed to date. Second, these interviews provided an opportunity for MARAD to educate these potential stakeholders about short-sea shipping and MARAD’s role in supporting enhanced short-sea shipping operations. As a result, these interviews allowed MARAD and the I-95 Corridor Coalition to collect valuable information from DOTs and MPOs while simultaneously providing an opportunity to conduct short-sea shipping outreach activities to these important agencies. An overview of these interviews and their key findings is provided in the following sections.

## ■ 3.2 Overview of Interviewees

Interviews were conducted with several types of short-sea shipping stakeholders within the I-95 Corridor Coalition region; these were classified in four groups:

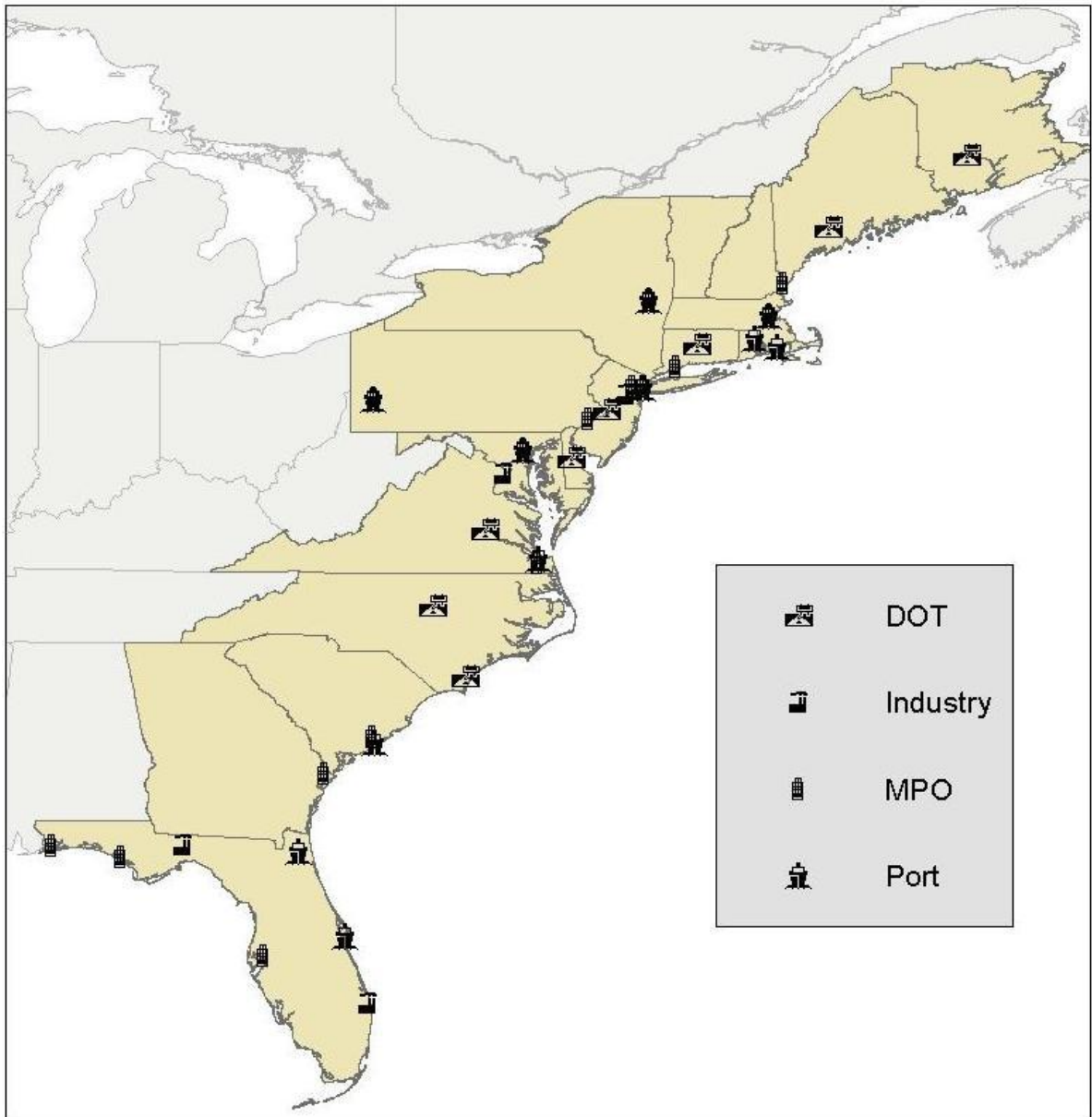
1. State DOT transportation planning staff;
2. MPO transportation planning staff;
3. Port and terminal operators; and
4. Maritime industry groups.

Table 3.1 provides a summary of the interviews conducted with each group. As shown, a total of 42 interviews were completed throughout the study. The geographical distribution of these agencies is presented in Figure 3.1. A full list of the participating organizations is provided in Appendix B. While this section details the key findings from the interviews, a comprehensive analysis of the interviews is presented in Appendix C.

**Table 3.1 Interviews by Stakeholder Type**

Organization Type	Number of Interviews Completed
State DOT	8
MPO	15
Port Authority	12
Industry	7
<b>Total</b>	<b>42</b>

Figure 3.1 Geographical Distribution of Interviews



### ■ 3.3 Key Interview Findings

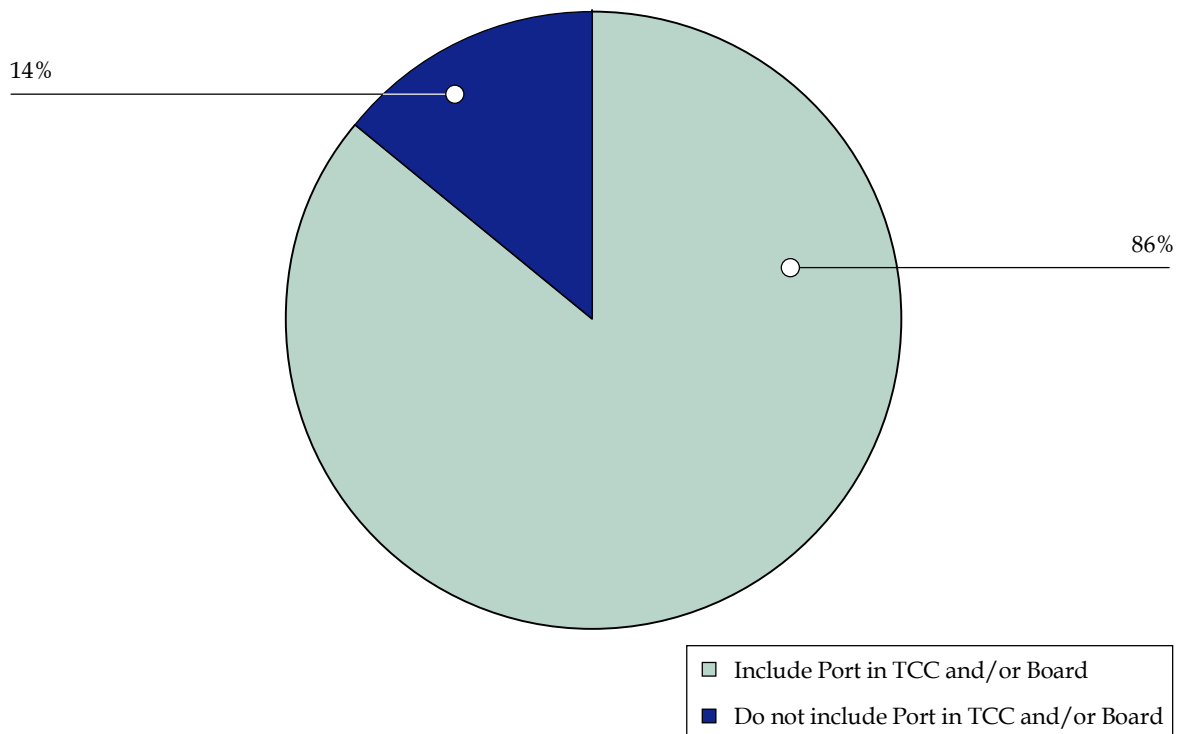
The key interview findings are presented in four sections:

1. **General Findings**, which presents the overall impression from interviewees regarding short-sea shipping and the degree of cooperation among DOTs, MPOs, Port Authorities, and other short-sea shipping stakeholders in planning for short-sea shipping and freight operations.
2. **Obstacles to Short-Sea Shipping**, which details some of the hindrances to short-sea shipping along the East Coast, as described by the interviewees.
3. **Possible Effects of Enhanced Short-Sea Shipping Operations**, which describes the possible impact on the transportation system, economic development, and other effects that increased use of short-sea shipping could have in the interviewees' regions.
4. **MPO/DOT/Port Authority Role in Short-Sea Shipping**, which describes the potential role of DOTs, MPOs, Port Authorities, and other stakeholders in facilitating or supporting short-sea shipping operations.

#### General Findings

- **Short-sea shipping may be a viable option to shippers ... but it must be proven.** Most interviewees agreed that short-sea shipping could be developed into a viable option for shippers in the region. Several challenges exist, though, not the least of which is encouraging shippers to adapt their operations to make better use of short-sea shipping services. Many interviewees felt that this kind of change in operational strategy can only happen through high-visibility demonstration projects and studies that prove to shippers that the short-sea shipping concept can work in practice.
- **Many MPOs communicate with their local port officials and include them in their planning efforts.** The majority of MPOs stated that port officials are members of their Technical Coordinating Committees (or equivalent), as shown on Figure 3.2, and some Port Authority members maintain voting power as part of an MPO board. The extent to which the ports and Port Authorities are actually involved in the transportation planning and programming processes of MPOs is not often clear and could be worth studying further. However, the fact that the majority of MPOs include port members in their advisory committee structures does indicate a willingness by these MPOs to pay attention to ports and port-related issues. The relationships between DOTs and Port Authorities appear to be less formal, and more limited.



**Figure 3.2 Port Representation on MPO's Technical or Policy Board**

### Obstacles to Short-Sea Shipping

- **There is a limited understanding of the costs and benefits associated with short-sea shipping.** Many interviewees indicated that short-sea shipping studies targeted specifically at DOTs and MPOs need to be conducted and made available so that these stakeholders can gain a more thorough understanding of the costs and benefits associated with short-sea shipping. These studies should quantify short-sea shipping's potential impacts on key DOT and MPO issues, such as congestion, port and terminal access, mobility, safety and security, and job creation and retention. Although Port Authorities do understand short-sea shipping from an operational standpoint, they (as well as planning organizations) often find it difficult to quantify the public benefits and costs derived from increased use of these services. Most interviewees agreed that increased use of short-sea shipping services would eliminate some traffic from regional highway networks, but do not have a good sense of the potential extent of this traffic reduction. This is critical, as potential short-sea shipping projects and studies must compete with other transportation improvements for funding from and the support of DOTs and MPOs. Many interviewees mentioned that the "case" for short-sea shipping would be much stronger if its full costs and benefits (to both the public and private sectors) could be better quantified.

- **There is a lack of “port partnering.”** Some stakeholders indicated that some ports are still very “parochial,” each looking to preserve its existing market share. Several interviewees – particularly DOTs and MPOs – believe that ports should be looking to partner with smaller, non-load center ports that could act as “reliever” facilities. These smaller ports could help relieve the burden at the congested load centers, make them more efficient, and allow them to attract more traffic (a “win/win” for both ports). As smaller ports often have trouble marketing their services and attracting large amounts of traffic, support of the larger load centers is often necessary.
- **Industry involvement with DOT/MPO planning efforts can be limited.** Many MPOs/DOTs explained that they find it hard to involve the private-sector freight industry in their transportation planning efforts. Though some states and MPOs have reached out to the private sector and some have even created freight advisory or other such groups, many DOTs and MPOs find it challenging to get the private sector truly engaged within the planning process. One factor that was mentioned by many states and MPOs is the mismatch in planning horizons between the public and private sector. State DOTs and MPOs often conduct long-range planning on a 20- to 30-year timeframe, while the private-sector freight industry often conducts long-range planning on a six- to 18-month timeframe. This mismatch in planning horizons complicates efforts to fully engage the private-sector freight community in a process that they perceive to be long, cumbersome, and overly bureaucratic.
- **Existing infrastructure may not be capable of handling large volumes of short-sea traffic.** There are two infrastructure issues that interviewees mentioned. The first is the condition of the U.S. inland and coastal waterway systems, which have not been maintained effectively over the last several years. In many cases, the waterway infrastructure (locks/dams, channels, bridge clearances) is not robust enough to handle commercial traffic. This results in somewhat of a “Catch-22” situation: it is unlikely that major investments to maintain or improve the coastal/inland waterway infrastructure will be made until there is sufficient commercial traffic; and commercial users are not likely to consider short-sea/coastal shipping as a viable option until the system is improved (and can provide some degree of transit time reliability). The other infrastructure issue is the condition of existing port and terminal infrastructure. Many of the under-utilized ports that would benefit from increased short-sea shipping operations do not have sufficient infrastructure (berths, cranes, access) to support efficient short-sea shipping; the ports that do have that kind of infrastructure are typically larger, load center ports that already are nearing capacity and that often give preference to larger, oceangoing, international container ships.
- **Frequency and flexibility of service does not meet shipper requirements.** Many interviewees indicated that in order to compete effectively with trucks, short-sea shipping operations must offer regularly scheduled service. Service flexibility – a key component of trucking operations – is something that short-sea shipping must attempt to offer, as well.

- **Operational costs can be high.** Some interviewees cited operational costs as a major concern for some operators and for some areas. Port fees, navigation fees, and ice-breaking fees (in northern states and provinces) might increase overall costs associated with short-sea shipping, making it a less viable option in comparison to other modes (particularly trucks) and also discouraging potential short-sea shipping operators from getting involved or increasing the use of short-sea shipping.
- **Jones Act.** The Jones Act, which requires that ships engaged in domestic maritime trade be U.S.-built, U.S.-owned, U.S.-flagged, and U.S.-operated, was cited by many interviewees as a key obstacle to expanding the use of short-sea shipping operations in the region.
- **There is a shortage of vessels suitable for use in short-sea trade.** Due in part to the requirements of the Jones Act, many interviewees indicated that there is a lack of vessels that are appropriate for use in short-sea operations. Many interviewees stated that high-speed vessels (capable of attaining speeds of 25 to 30 knots) are necessary to support short-sea shipping operations. These vessels are expensive to construct and maintain, requiring a long-term commitment by shippers who would use a short-sea service. This results in another “Catch-22” situation: shippers often do not want to commit to the service until a vessel is constructed that can support it and operators often do not want to invest in new ships unless they have long-term commitments from shippers.
- **Reasons for shippers to switch modes/operations have not been effectively demonstrated or communicated.** There is a lot of awareness of short-sea shipping within the maritime community and among state DOTs and MPOs in the Coalition region. Many shippers in the region believe it could become a more viable option in the region. However, there have been few real incentives for shippers to abandon their existing business models/mode choices. Until short-sea shipping can “beat the competition at its own game,” there may be only incremental increases in the use of short-sea shipping services.
- **Labor costs can be high.** High union labor rates can potentially act as a barrier against increased short-sea shipping operations, which typically require boxes to be loaded from one ship onto another, and then onto a truck for transportation to their final destinations. The cost of loading and unloading a container can add up to \$100 per box, which substantially increases the profitability of moving the goods. Two scenarios exist that avoid this problem. First, operations that originate or terminate at a facility that uses or produces the goods allows for direct unloading. Second, in ro/ro operations, trucks or other rolling cargo can be loaded onto secondary barges at a lower cost than lo/lo operations.

## Possible Effects of Enhanced Short-Sea Shipping Operations

- **Overall improvement of freight movement through the region.** Some organizations in the Coalition region agreed that increased use of short-sea shipping could have regionwide benefits, such as a reduction in truck VMT, an increase in port throughput capacity, and economic development at feeder ports and hinterland by providing new platforms for value-added, warehousing, and distribution opportunities. However, it is difficult to quantify these benefits, and few states or MPOs have done so.
- **More stress could be placed on already congested port access roads.** Various DOT and MPO interviewees stated that the added business for the port might create an issue with roadside access. These ports are already expecting a significant increase in business, and so added business from short-sea shipping might not be welcome. Another issue is that some of the regions have many tunnels and bridges that create bottlenecks, which means that an increase in truck traffic around the ports might lead to significant levels of congestion in those areas. As discussed above, though, it is difficult to quantify these impacts and few states or MPOs have done so. However, one study conducted by an interviewee indicated that only five percent of goods currently transported within the state have the potential to shift to barge. This translates to approximately 10,000 annual containers or roughly 15 trucks per hour. The interviewee noted that this difference may be too small to justify the potential costs of the operation.
- **Container imbalances among ports could arise.** Several DOTs and MPOs (especially those with ports in smaller cities) were highly concerned about the possibility of having stacks of empty containers on their yards. Some interviewees indicated that they wanted to avoid ending up with large container stacks in and around port facilities, as can be the case in large port facilities.
- **Enhanced transportation system redundancy.** In addition to mitigating highway and rail congestion and increasing the number of transportation options available to shippers, enhanced use of the inland and coastal waterway system may also have important system redundancy benefits. Just-in-time logistics practices, coupled with the globalization freight operations, have caused supply and distribution chains to become highly sensitive to service disruptions caused by natural disasters (e.g., hurricanes), labor issues (e.g., West Coast ports lockout of 2002), security threats (e.g., Baltimore Harbor Tunnel closure of 2005), and non-recurring congestion caused by traffic incidents or other events. Making better use of the inland and coastal waterway system could have important benefits by helping to sustain regional mobility during and immediately after these kinds of events.

## MPO/DOT/Port Authority Role in Short-Sea Shipping

- **The U.S. DOT could play an important role in jump-starting/supporting the increased use of short-sea shipping.** Most interviewees stated that because the benefits of increased use of short-sea shipping are likely to accrue across more than a single jurisdiction, the U.S. DOT could and should play an important role in supporting and/or jump-starting and maintaining short-sea shipping operations. Interviewees stressed that it is very important to understand how the costs and benefits of increased short-sea shipping operations may accrue across different DOTs and MPOs, as DOTs and MPOs could be wary about investing in short-sea shipping when most of the benefits might be reaped by other states. The U.S. DOT could play a lead role in helping states and MPOs better understand and quantify costs and benefits. Some interviewees felt that there may be an opportunity for the U.S. DOT to take the lead in providing incentives through tax breaks to industrial shippers, the construction of a high-speed vessel to use in a demonstration project, or other strategies.
- **Public-sector transportation agencies could help provide more feedback from current short-sea shipping operations.** The vast majority of interviewees said that in theory short-sea shipping could diminish highway truck traffic, lower pollution, and promote some economic development in the region. However, many do not know if this would really be the case in their specific areas, and could not describe the extent to which it may be successful. As discussed above, some interviewees indicated that there may be an opportunity for the U.S. DOT, state DOTs, or MPOs to take a lead role in quantifying these costs and benefits. Some interviewees also indicated that it may be useful to identify current users of short-sea shipping services, discuss lessons learned and best practices, and use that information to identify common characteristics of a successful short-sea shipping operation. This information could be used to target potential users of short-sea shipping.
- **DOTs and MPOs should more effectively engage the private-sector freight community in the transportation planning process.** The majority of states and MPOs stated that they need to better engage the private-sector freight community within the planning process through the creation of a freight taskforce or other such group. Through this taskforce, states and MPOs would be better able to collect data, conduct studies, and involve members of the freight community in their planning efforts.
- **MPOs should include port representatives on their boards or advisory committees.** In addition to engaging the private-sector freight community in their planning efforts, most MPOs agreed that they should include a member of the local Port Authority on their policy and/or technical boards. As shown on Figure 3.2, approximately 86 percent of the MPOs interviewed said that they currently do include the ports in their boards. However, it is unclear how active these port representatives are in the MPO planning and programming process and what impact, if any, they have on MPO decision-making. MPOs should encourage port representatives to become active members of MPO boards and/or technical advisory committees.

- **DOTs and MPOs should enhance freight education and outreach efforts.** Many interviewees indicated that more education and outreach is necessary – particularly to the trucking industry, who may see short-sea shipping as a threat (rather than an opportunity). Education and outreach should not just focus on the potential environmental, social, and congestion benefits of short-sea shipping. Rather, it should focus on integrating short-sea shipping into existing supply chains. Clearly there is a role for the U.S. DOT, state DOTs, and MPOs in conducting education and outreach efforts.
- **Public-sector transportation agencies should provide incentives to encourage the use of short-sea shipping.** As discussed above, while the maritime industry is well aware of short-sea shipping operations, there are few financial incentives to encourage their use. Incentives, such as tax breaks, breaks on handling fees, and others will be necessary for shippers to begin to use short-sea shipping operations. State and MPO interviewees stressed the importance of state/metropolitan government involvement. Some Federal agencies, particularly the FHWA and Federal Transit Administration (FTA), have difficulty providing funding for the operation of freight facilities. Most of the funding available from these agencies is targeted to infrastructure improvements. States and MPOs can often work with these agencies to support the transfer of “infrastructure” funds to “operational” funds. State support is also required to support use of Congestion Mitigation and Air Quality Improvement Program (CMAQ) funding, which must be approved for specific uses by the DOT. The New York State DOT is an example of a very supportive DOT – one interviewee cited this as one of the reasons why the Port of Albany has been able to get their short-sea shipping project off the ground more easily. Finally, MPOs can play a major role in attracting short-sea shipping to an area and ensuring that marine issues are addressed as part of the transportation planning process. This is particularly true in areas with smaller ports, where MPOs and Port Authorities often work together more frequently than in areas with large port facilities. In addition, MPOs are also “politically connected” through their boards and may have an easier time making things happen (if they can build advocacy).
- **The U.S. DOT and other stakeholders should conduct, support, or advocate for a short-sea shipping demonstration project.** Many interviewees indicated that it is essential to develop a demonstration project to “prove” that short-sea shipping can work. This is being done, to some degree, with PANYNJ’s PIDN, but many interviewees would like to see a high-speed (25 to 30 knot) demonstration project. Demonstration projects are key in building and maintaining momentum for short-sea shipping, but must include a long-term (more than five-year) commitment to truly demonstrate the feasibility of a short-sea shipping operation. Some interviewees encouraged the U.S. DOT to find an industrial partner that would be willing to sponsor a demonstration and be capable of providing large volumes of freight (400 to 500 boxes per month, minimum).
- **DOTs and MPOs should encourage the sharing of success stories/lessons learned.** Many ports and terminals and some MPOs have experimented with or currently serve short-sea shipping operations. There is an opportunity for these ports to share their experiences with those peers that may be interested in attracting short-sea operations.

- **DOTs should encourage or facilitate port partnering.** As discussed above, ports are still very “parochial,” each looking to preserve existing market share. There is an opportunity for larger, load center ports to “partner” with smaller, niche ports to act as congestion relievers. Larger ports would benefit from reduced on-port congestion; smaller ports would benefit from increased throughput. Some interviewees noted that until the larger, load center ports “feel the pain” of congestion (either on-port or along access routes), this type of arrangement is unlikely.
- **Public-sector transportation planning organizations should concentrate their short-sea shipping initiatives on domestic cargo.** Some interviewees feel that short-sea shipping operations should be targeted towards domestic cargo. Many international shippers are not interested in short-sea shipping operations, and customs requirements for international shipments can introduce delay, making short-sea a less attractive option in comparison to other modes.
- **DOTs and MPOs should work with ports on access issues and on-port projects.** Some MPOs/DOTs agreed that they should work with the local port(s) to maintain a proper level of port access, and assist the port in obtaining funds for some on-port projects that might have benefits to the community in general.

## 4.0 Potential Short-Sea Shipping Market in the Coalition Region

This section provides a preliminary assessment of the potential for new or enhanced short-sea shipping operations within the I-95 Corridor Coalition region. This assessment was conducted by analyzing the FHWA's FAF database and displaying the results in a geographic information system (GIS). A two-tiered analysis was conducted:

1. **Identify commodities** that could potentially be transported using short-sea shipping by analyzing commodity flows available in the FAF. By better understanding the overall weight and value of key commodities moving within the region and the modes that they currently utilize, we can make inferences about those commodities that may be attractive candidates for short-sea shipping operations.
2. **Identify markets** by mapping the origins and destinations of the key commodity groups within a GIS. By graphically displaying commodity flow patterns, we can make inferences about those markets that may be potential hubs for short-sea shipping operations.

The remaining sections describe the results of this two-tiered analysis.

### ■ 4.1 Identify Commodities

#### Overview

As described above, the commodity flow analysis was accomplished using data provided in the FAF. The FAF was an effort of the FHWA in 1998 as part of a program to better understand the magnitude and geography of freight moving within the United States; analyze changes in freight flows and networks; highlight mismatches in national and regional freight demand and supply; and understand the regional significance of freight corridors and nodes. The FAF is made up of more than 60,000 individual records, each of which describes a single freight movement between two locations. While the FAF data do not provide the level of geographic detail useful for detailed regional, statewide, or metropolitan freight planning, they can be useful in identifying key transportation corridors for specific commodity groups and were used in this study to conduct the analysis.

The FAF dataset records commodities using the Standard Transportation Commodity Group (STCC) codes at the two-digit level, a list of which are provided in Appendix D. While commodity flows are provided for 1998 on four modes (truck, rail, air, and water), only domestic commodity flows that occurred on the truck and water modes were analyzed as part of this study.



## Approach

The STCC codes used in the FAF were regrouped into 10 commodity groups using the Standard Classification of Transported Good (SCTG) system. These commodity groupings consist of individual goods that share similar industry transportation characteristics. Table 4.1 describes the commodity groupings and the SCTG codes included in those groupings. A detailed description of each of the SCTG codes is provided in Appendix D.

**Table 4.1 Commodity Groupings and Description**

SCTG Codes	Description
01-05	Agricultural products and fish
06-09	Grains, alcoholic beverages, and tobacco
10-14	Stone, minerals, and ores
15-20	Coal and petroleum products
21-24	Pharmaceutical and chemical products
25-30	Wood products, textiles, and leather
31-34	Metal products and machinery
35-38	Electronics, vehicles, and precision goods
39-43	Furniture and miscellaneous products
-	Hazardous materials

Commodity flows were analyzed and reported by both weight (in U.S. short tons) and value (in U.S. dollars). Insight into the weight of commodities that are transported along the I-95 Corridor Coalition’s highway and water networks is important in understanding the ways in which trucking and shipping companies use the transportation network, and can facilitate the identification of key routes that could potentially incorporate short-sea shipping routes in order to alleviate congested areas. An understanding of the value of freight shipments within the region is also important, particularly because the Corridor region accounts for the movement of such a large percentage of the nation’s goods. As the FAF dataset does not include a value component, value per ton information derived from the Commodity Flow Survey (conducted every five years by the Census in conjunction with the Bureau of Transportation Statistics) were applied to the FAF database.

Freight flows from the FAF were organized and calculated in two ways:

1. Imports by road and by water of commodities that originated outside the Coalition region and terminated within the region; and
2. Exports by road and water of commodities that originated within the Coalition region and terminated outside the region.

This approach allowed for a better understanding of freight traffic moving into and out of the Coalition region and allowed us to make some judgments about which commodities and traffic lanes that are currently served by both trucks and waterborne operations.

## Results

A summary of the inbound and outbound commodity flows by road and water is provided in Table 4.2. State-specific tables are provided in Appendix E. This summary table provides a better understanding of the type and volume of commodities moving within the Coalition region. To make a better assessment of the potential for short-sea shipping in this region, though, it is important to identify the commodities that are being served by both truck and waterborne movements. As the capacity of the highway system continues to tighten, it is these commodities that may be targets for enhanced short-sea shipping operations.

Figure 4.1 shows the top commodities (ranked by total weight) that were imported into the Coalition's region by truck and by water. As can be seen, road and water handle comparable shares of two commodity types: pharmaceutical and chemical products (14 percent by road; 10 percent by water); and stone, minerals, and ores (six percent by road; four percent by water). The similar shares between the two represents the potential for a mode shift from truck to a short-sea shipping, if an affordable and reliable service were available. Other goods groups, such as coal and petroleum products, that already account for a much larger share of water flows than road flows may be less likely to experience this mode shift.

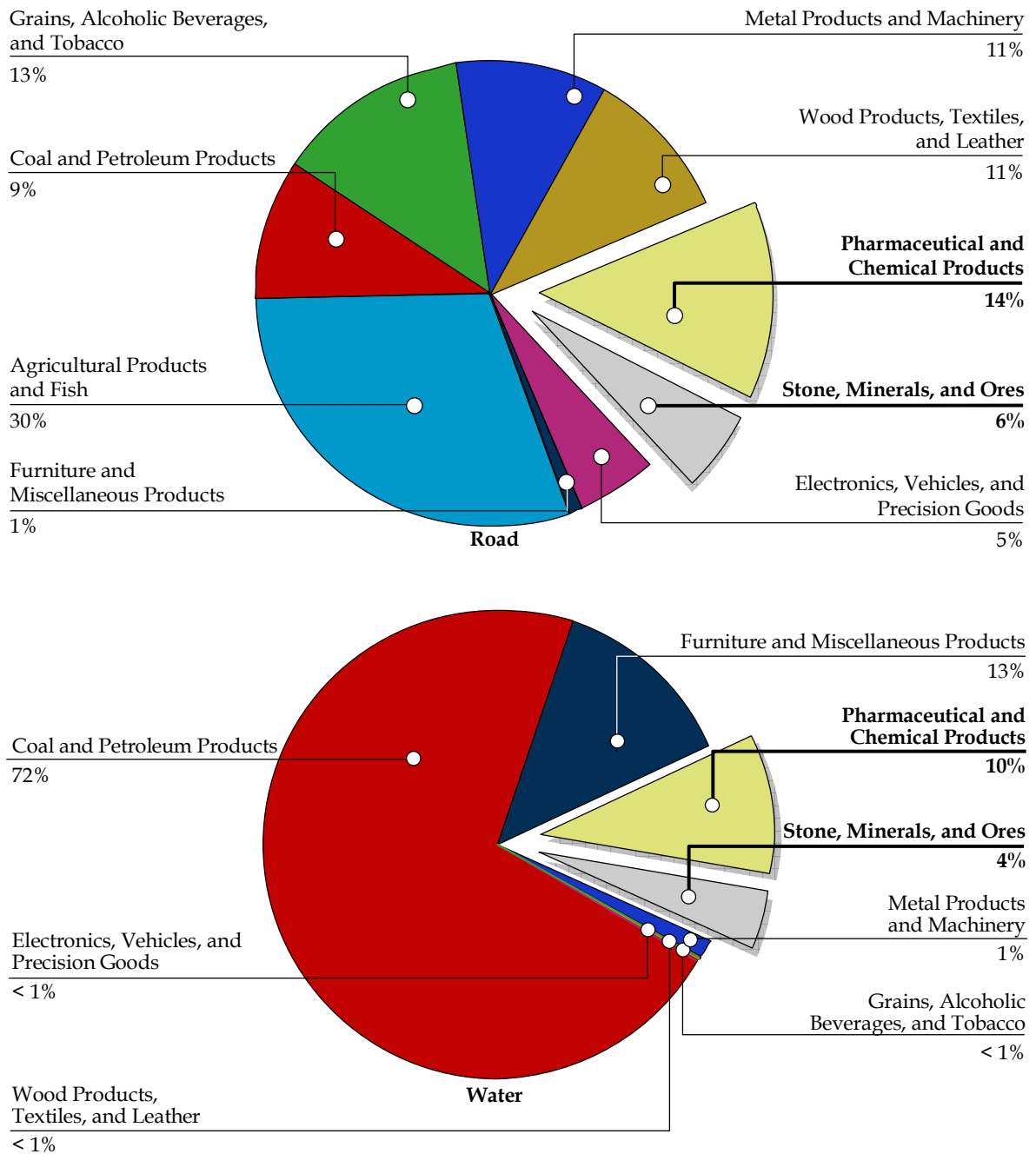
Figure 4.2 shows the top commodities (ranked by total weight) that were exported from the Coalition's region by truck and by water. In this case, road and water handle comparable shares of two commodity types: stone, minerals, and ores (13 percent by road; 36 percent by water); and coal and petroleum products (nine percent by road; 24 percent by water). Again, because both modes currently handle substantial volumes of these commodity types, there is the potential for a mode shift from truck to a short-sea shipping, if an affordable and reliable service were to be made available.

The charts contained in the full commodity analysis, presented in Appendix F, clearly indicate that short-sea shipping is the dominant mode for some freight movements, particularly high-weight, low-value goods such as coal and petroleum products and furniture and miscellaneous products; and that the highway network is the dominant mode for other freight movements, particularly high-value, low-weight goods such as grains, alcoholic beverages, and tobacco. However, some goods, such as pharmaceutical and chemical products and stone, minerals, and ores, are hauled to a similar degree by both modes and could be candidates for diversion or augmentation by short-sea shipping.

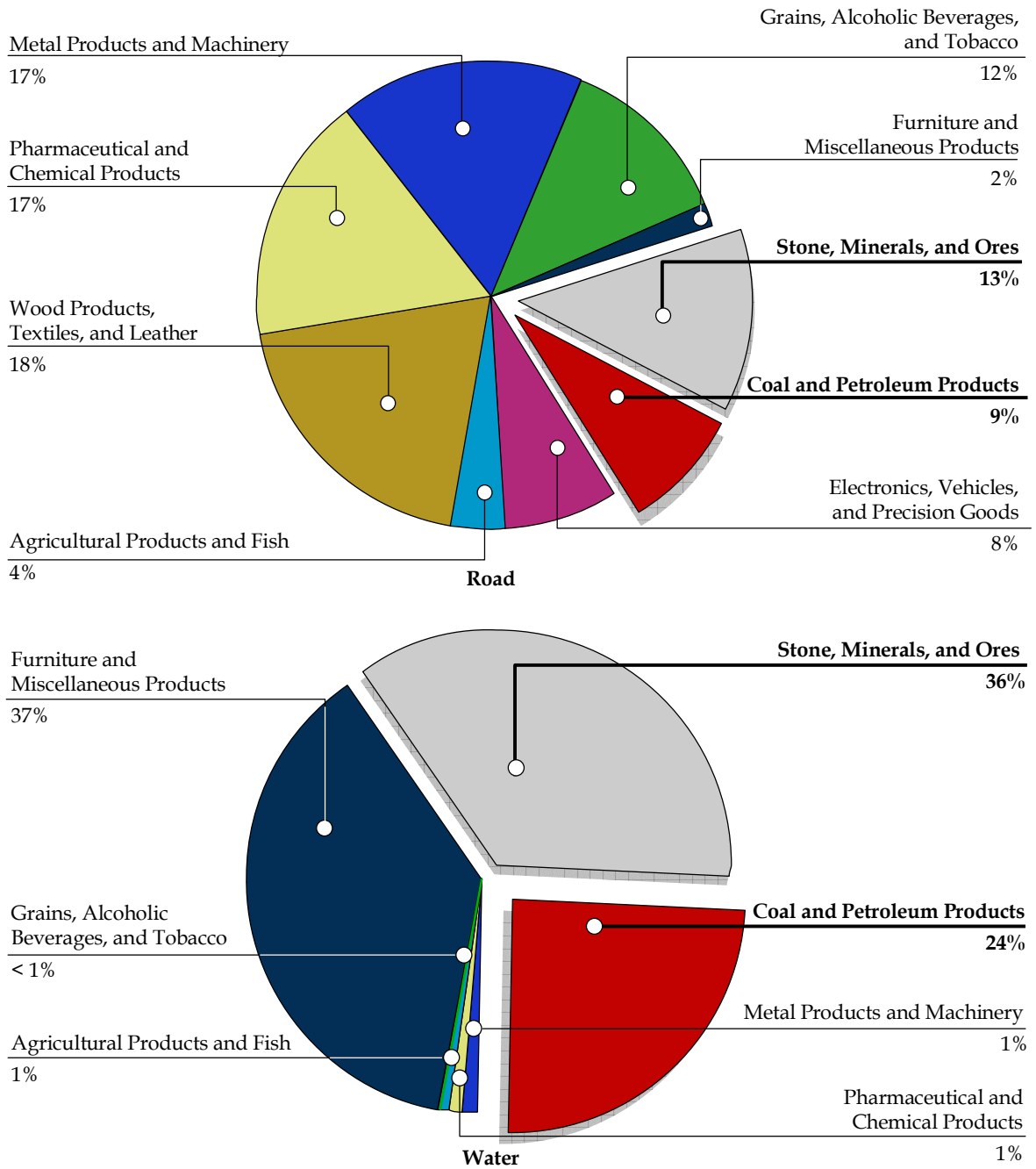
**Table 4.2 Weight and Value of Freight Movements Into and Out of the I-95 Corridor Coalition Region by Road and Water**

	<b>Weight</b>	<b>Good Type</b>	<b>Value</b>	<b>Good Type</b>
<b>Road Import</b>	125,726,842	Agricultural Products and Fish	\$ 238,107,590,737	Electronics, Vehicles, and Precision Goods
	58,499,181	Pharmaceutical and Chemical Products	\$ 157,936,120,562	Metal Products and Machinery
	56,171,694	Grains, Alcoholic Beverages, and Tobacco	\$ 102,678,415,413	Wood Products, Textiles, and Leather
	44,450,671	Metal Products and Machinery	\$ 89,128,381,613	Pharmaceutical and Chemical Products
	44,391,609	Wood Products, Textiles, and Leather	\$ 63,037,637,844	Grains, Alcoholic Beverages, and Tobacco
	39,165,821	Coal and Petroleum Products	\$ 30,880,245,562	Agricultural Products and Fish
	23,495,293	Stone, Minerals, and Ores	\$ 24,430,953,304	Furniture and Miscellaneous Products
	23,023,861	Electronics, Vehicles, and Precision Goods	\$ 7,509,989,797	Coal and Petroleum Products
	3,927,091	Furniture and Miscellaneous Products	\$ 2,507,749,919	Stone, Minerals, and Ores
<b>Road Exports</b>	36,227,993	Wood Products, Textiles, and Leather	\$ 161,825,180,236	Electronics, Vehicles, and Precision Goods
	31,952,944	Pharmaceutical and Chemical Products	\$ 99,692,622,982	Metal Products and Machinery
	31,542,551	Metal Products and Machinery	\$ 86,680,533,010	Wood Products, Textiles, and Leather
	23,794,351	Stone, Minerals, and Ores	\$ 50,296,312,068	Pharmaceutical and Chemical Products
	22,333,351	Grains, Alcoholic Beverages, and Tobacco	\$ 33,829,316,097	Grains, Alcoholic Beverages, and Tobacco
	15,936,972	Coal and Petroleum Products	\$ 16,729,813,966	Furniture and Miscellaneous Products
	14,550,105	Electronics, Vehicles, and Precision Goods	\$ 2,759,612,787	Coal and Petroleum Products
	6,880,083	Agricultural Products and Fish	\$ 1,886,668,243	Stone, Minerals, and Ores
	3,266,530	Furniture and Miscellaneous Products	\$ 1,765,479,471	Agricultural Products and Fish
<b>Water Imports</b>	47,362,514	Coal and Petroleum Products	\$ 6,735,773,099	Pharmaceutical and Chemical Products
	8,424,630	Furniture and Miscellaneous Products	\$ 6,505,556,510	Coal and Petroleum Products
	6,273,148	Pharmaceutical and Chemical Products	\$ 1,916,166,153	Furniture and Miscellaneous Products
	2,591,869	Stone, Minerals, and Ores	\$ 1,832,137,463	Metal Products and Machinery
	946,708	Metal Products and Machinery	\$ 504,711,143	Wood Products, Textiles, and Leather
	156,423	Wood Products, Textiles, and Leather	\$ 263,263,919	Electronics, Vehicles, and Precision Goods
	23,864	Electronics, Vehicles, and Precision Goods	\$ 96,950,175	Stone, Minerals, and Ores
	21,835	Agricultural Products and Fish	\$ 14,422,655	Agricultural Products and Fish
	1,731	Grains, Alcoholic Beverages, and Tobacco	\$ 1,893,179	Grains, Alcoholic Beverages, and Tobacco
<b>Water Exports</b>	5,684,330	Furniture and Miscellaneous Products	\$ 1,000,465,092	Furniture and Miscellaneous Products
	5,417,975	Stone, Minerals, and Ores	\$ 233,402,545	Metal Products and Machinery
	3,704,981	Coal and Petroleum Products	\$ 157,497,479	Coal and Petroleum Products
	148,524	Metal Products and Machinery	\$ 134,035,753	Pharmaceutical and Chemical Products
	124,980	Pharmaceutical and Chemical Products	\$ 79,983,075	Stone, Minerals, and Ores
	80,955	Agricultural Products and Fish	\$ 43,293,834	Agricultural Products and Fish
	15,082	Grains, Alcoholic Beverages, and Tobacco	\$ 16,499,082	Grains, Alcoholic Beverages, and Tobacco

**Figure 4.1 Road and Water Imports by Weight**



**Figure 4.2 Road and Water Exports by Weight**



## ■ 4.2 Identify Markets

### Overview

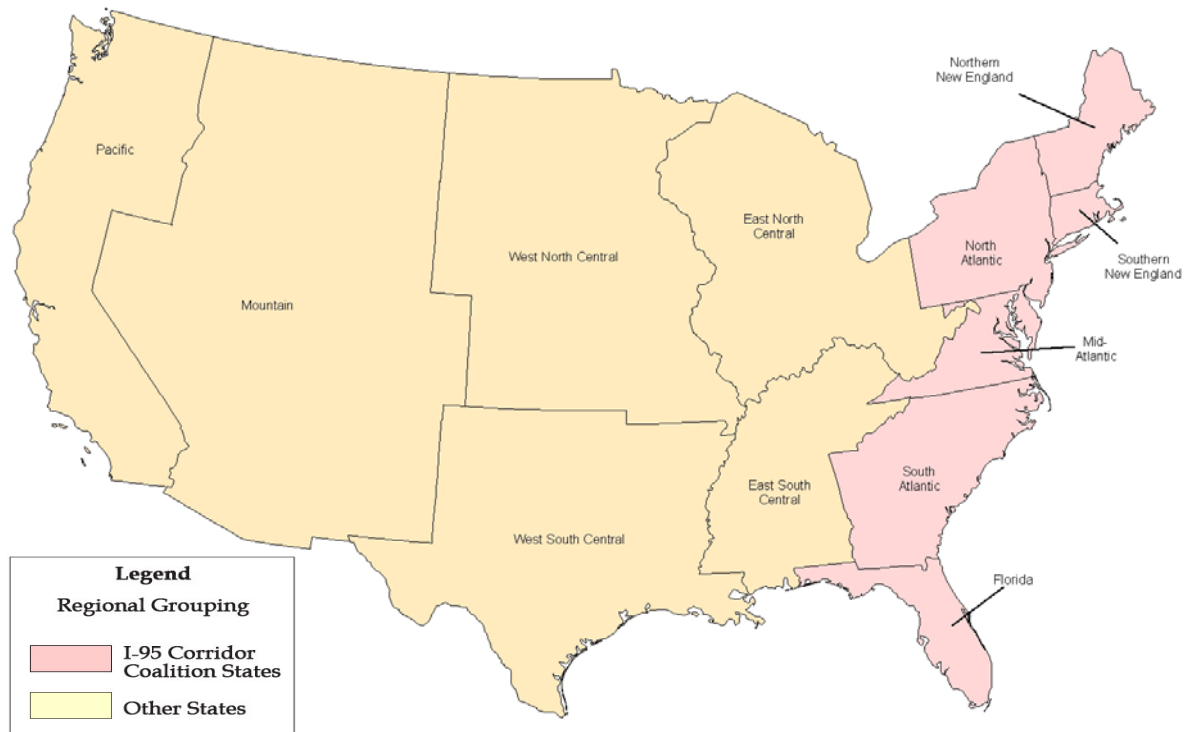
While the FAF records can be collated and totaled up into more meaningful information, the overall picture of the movements of goods is still hidden when the data are presented in a tabular format. By integrating the tables into a GIS, the key corridors of travel can quickly become apparent, revealing information that may otherwise have escaped notice. Doing so allows for an understanding of the potential market that exists for enhanced short-sea operations. This section uses a GIS to map current freight flows within the United States, both on land and water.

### Approach

In order to more effectively highlight the national-level freight flows provided by the FAF, the 50 states and the District of Columbia were grouped into 11 regions, detailed in Table 4.3. The regional groups are based on those used by the U.S. Census Bureau, although in several instances groups were partitioned to allow a finer level of detail to be analyzed. Figure 4.3 illustrates the location of the regional groups.

**Table 4.3 Regional Grouping of States**

Region	States
Northern New England	Maine, New Hampshire, Vermont
Southern New England	Connecticut, Massachusetts, Rhode Island
North Atlantic	New Jersey, New York, Pennsylvania
Mid-Atlantic	Delaware, District of Columbia, Maryland, Virginia
South Atlantic	Georgia, North Carolina, South Carolina
Florida	Florida
Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
East North Central	Indiana, Michigan, Ohio, West Virginia, Wisconsin, Alabama, Kentucky, Mississippi, Tennessee
West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
West South Central	Arkansas, Louisiana, Oklahoma, Texas
Pacific	Alaska, California, Hawaii, Oregon, Washington

**Figure 4.3 Regional Grouping of States**

To better understand the existing flows of goods among these regions, desire line maps were created. Desire line maps are schematic representations of travel between origins and destinations. Maps are built from a series of straight lines that connect trip origins and destinations, the relative width of each indicating the amount of travel that passes between those origins and destinations. As these maps do not assign freight flows to transportation networks, they do not distinguish between specific routes. As such, it is impossible to tell from the maps whether a line that connects Northern New England to Florida represents a northbound or southbound freight movement. However, these maps are effective in providing insight into the types of goods that are flowing between origins and destinations and allow local and regional planners to identify the routes and facilities they would be most likely to utilize.

## Results

Figures 4.4 through 4.7 show desire lines for one of the commodity groups identified in the previous section: stone, minerals, and ore (SCTG 10-14). Desire lines showing the flows of the remaining commodity groups are provided in Appendix F.

Figure 4.4 details the flows of stone, minerals, and ore that are exported out of I-95 Corridor region by road. It can be clearly seen that the South Atlantic region is responsible for a large share of the total amount of stone, mineral, and ore that is exported from the region. In particular, those regions responsible for importing most heavily from the South Atlantic region include West North Central, East North Central, and East South

Central. Freight flows are also relatively heavy within the I-95 Corridor, most notably between the North Atlantic, Mid-Atlantic, and South Atlantic regions.

**Figure 4.4 Road Exports by Weight**  
*Stone, Minerals, and Ore*

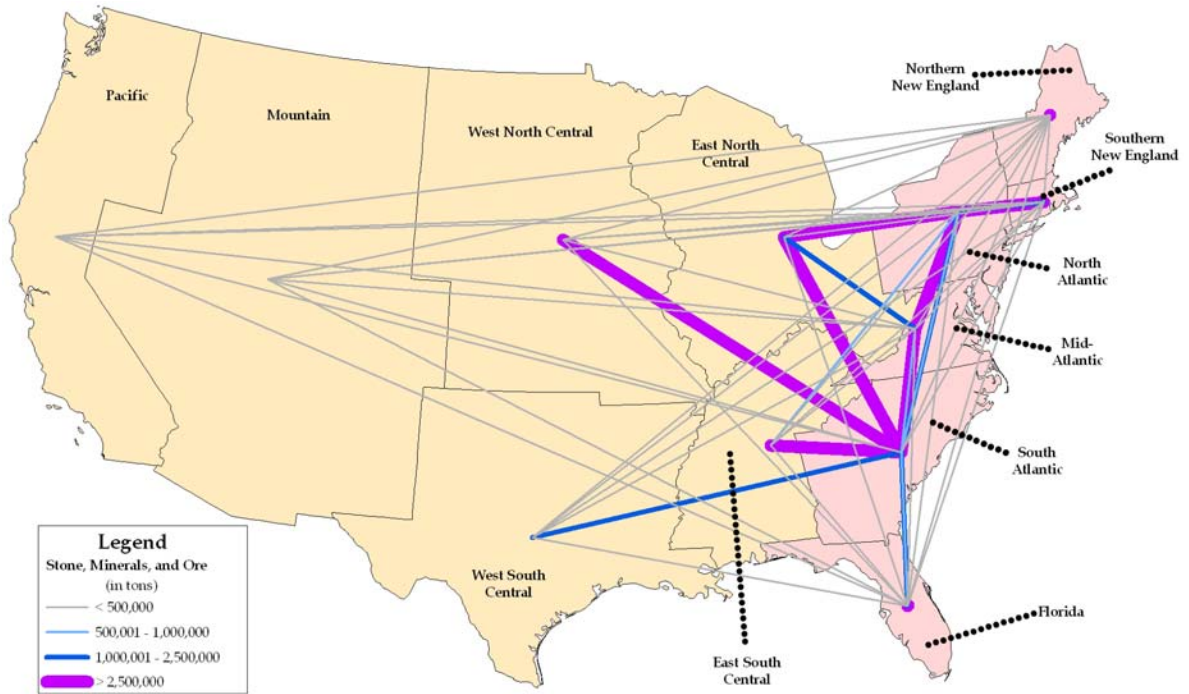


Figure 4.5 illustrates the flows of stone, minerals, and ore that are exported out of I-95 Corridor region by water. As would be expected, fewer desire lines exist as the connectivity of the network is more limited in scope. The movement of this commodity group throughout the nation is much more limited in scale by ship than by truck, with the exception of flows between Florida and the West South Central region.



**Figure 4.5 Water Exports by Weight**  
*Stone, Minerals, and Ore*

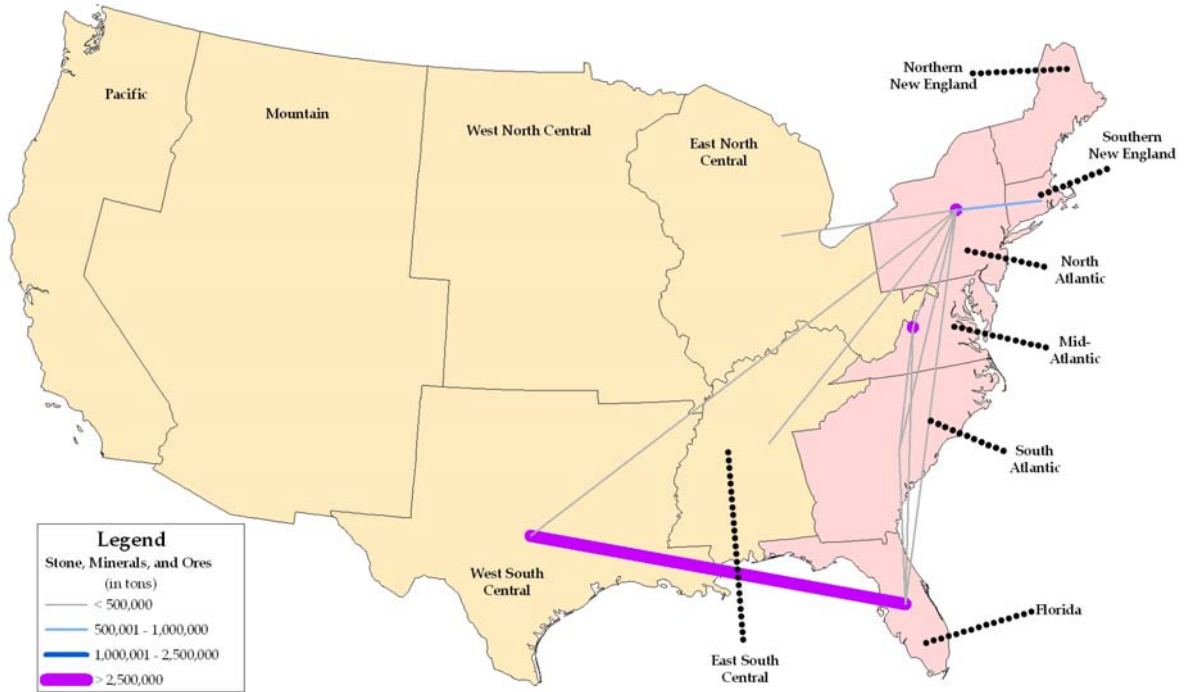


Figure 4.6 details the flows of stone, minerals, and ore that are imported into the I-95 Corridor region by road. Once again, few coast-to-coast long-haul flows exist, with the largest share of imports into the region having their origins in the neighboring East North Central and East South Central regions.

**Figure 4.6 Road Imports by Weight**  
*Stone, Minerals, and Ore*

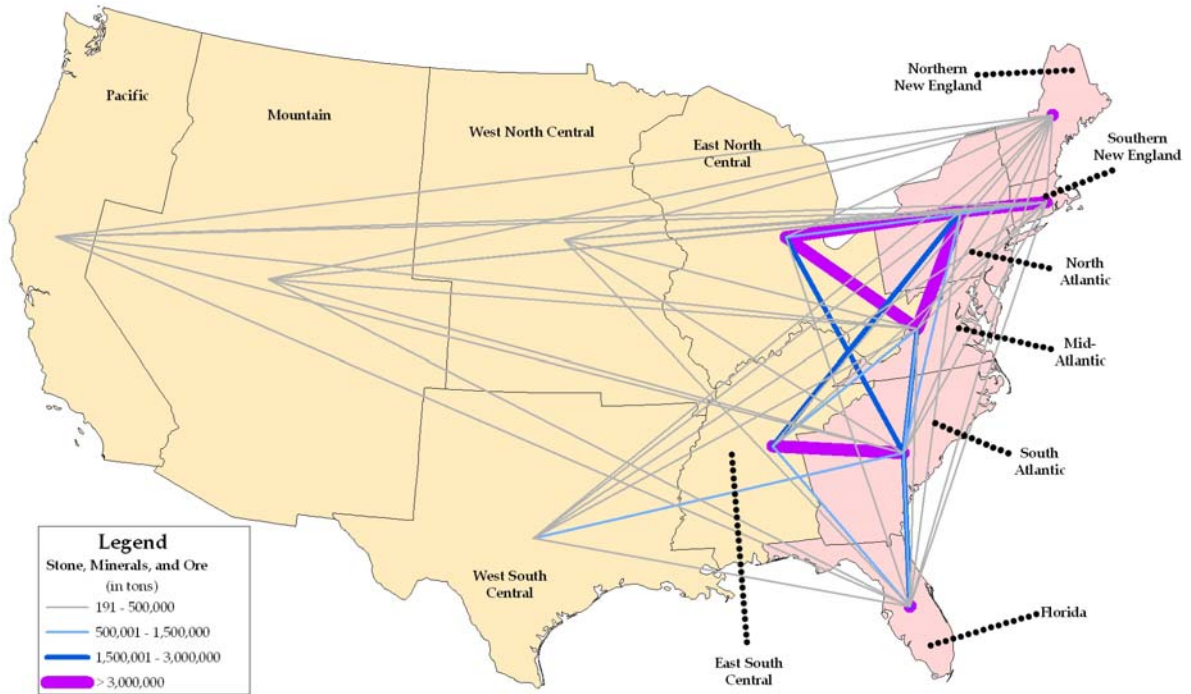
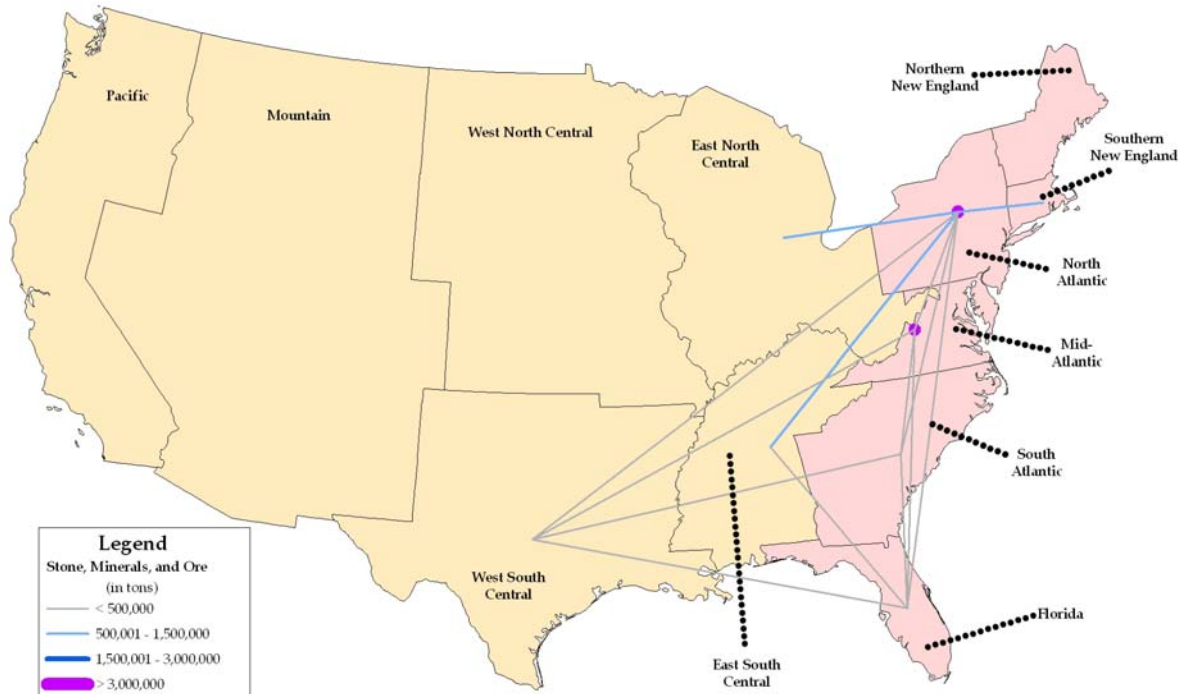


Figure 4.7 illustrates the flows of stone, minerals, and ore that are imported into the I-95 Corridor’s region by water. Once again, the network of desire lines is more limited due to the infeasibility of coast-to-coast water transportation. Only the North Atlantic region registers as importing more than a minimum level of stone, minerals, and ore by water, while much of the rest of the Coalition is dependent on the nation’s highways for the importation of the commodity group.

**Figure 4.7 Water Imports by Weight**  
*Stone, Minerals, and Ore*



Although only a snapshot of freight movements, these four maps indicate that the potential for expanded short-sea shipping operations within the I-95 Corridor region may exist. The maps demonstrate that stone, minerals, and ore are transported along the Coalition region's highways in high volumes, yet the coastal traffic lanes are barely used to transport those same commodities. There is also a heavy flow of stone, minerals, and ore along the highways between the East North Central and the North Atlantic regions, while the flow of the same commodity group along the water network is minimal. In these cases, the opportunity exists for the transportation of rock, minerals, and ore to undergo a mode shift from truck to water, as the water routes already handle the commodity group to some degree already.

### ■ 4.3 Key Findings

The key findings of this section are presented in two areas:

1. **Commodity identification**, which addresses the volume and type of highway and water freight that moves into and out of the I-95 Corridor Coalition and identifies those commodities that may be attractive candidates for short-sea shipping operations; and

2. **Market identification**, which addresses the pattern of highway and water freight shipments within the United States and identifies those markets that may be potential hubs for short-sea shipping operations.

## Commodity Identification

The analysis of the FAF provided insight into the volume of freight flows imported and exported into and out of the Coalition region, as well as the breakdown in the types of goods transported by either mode. There are several key findings of the analysis of the existing freight flows that either originate or terminate within the I-95 Corridor Coalition, including:

- **Imports into the Coalition region vastly exceed exports.** Total imports borne along the highways and waterways into the I-95 Corridor Coalition weighed just under 359 million tons, or 65 percent of the total analyzed, while total exports weighed 195 million tons, or 35 percent of the total. This disparity is slightly reduced when the value of freight movements is compared, with \$703 billion worth of goods imported, or 61 percent of the total, and \$455 billion worth of goods exported, or 39 percent of the total.
- **A larger share of freight, whether measured by weight or value, is moved by trucks than by water vessels.** A total of 473 million tons was moved along the nation's highways, which represents 85 percent of the total freight movements analyzed. Waterborne movements accounted for 81 million tons, or 15 percent of the total. This difference is even more dramatic when the value of goods is analyzed, with 98 percent of the total value moved along the highways and only two percent moved along the waterways.
- **Goods shipped along the highway are more diverse in nature than those shipped by water.** The more balanced spread of goods that are transported along the nation's highways indicates an increased flexibility in what trucks can carry in comparison to water vessels, which tend to focus on high-bulk, low-value goods. The faster transportation times associated with truck freight movements also likely plays a factor in the types of goods shipped.
- **Those goods that were shipped along the highway were typically of a higher value per ton than those shipped by water.** Goods moved by water tended to be primarily bulk goods that were less time sensitive in nature. This is logical given the potentially longer travel time of waterborne cargo in comparison to freight moved along the nation's highways. Those industries that take advantage of the waterways clearly value the reduced costs associated with waterborne freight movements over the increased travel times.
- **Road and water modes handle comparable shares of several commodity types.** There are several commodity types that are handled by both road and water in similar shares, included pharmaceutical and chemical products (14 percent by road; 10 percent by water); stone, minerals, and ores (six percent by road; four percent by

water); and coal and petroleum products (nine percent by road; 24 percent by water). The similar shares between these two modes represents the potential for a mode shift from truck to short-sea shipping, if an affordable and reliable service were available.

## Market Identification

The desire line maps developed within the GIS provide insight into the direction and volume of freight flows imported and exported to and from the Coalition region. There are several key findings from the analysis of the pattern of existing freight flows that either originate or terminate within the Coalition region, including:

- **The top commodity types transported by road tend to travel a farther distance than those transported by water.** This disparity was even more pronounced when the commodity types were ranked by value, with, for example, electronics, vehicles, and precision goods traveling across the country accounting for a significant share of the total value of that group's movements. This is to be expected, as there are no cross-country all-water routes currently in use. Water shipments were frequently most concentrated between neighboring regions or near-neighbors, whereas highway shipments tended to be more diversified throughout the country.
- **The potential exists for enhanced short-sea shipping operations between some O/D pairs.** In several cases, significant freight movements exist between O/D pairs for the same commodity types. This indicates that the necessary infrastructure already exists for those goods to be shipped by water vessel rather than truck, and that the potential therefore exists for the initiation or expansion of short-sea shipping operations. While further research would have to be performed in order to determine specifically if short-sea shipping operations could be implemented or enhanced, it is clear that some origins and destinations within the Coalition region are already being served by short-sea operations and that there may be the potential to enhance the attractiveness of these services.
- **Some goods may be better suited to short-sea shipping operations than others.** Some goods imported by states in the Coalition region, such as coal and petroleum products and pharmaceutical and chemical products, tend to originate outside the region, while other goods, such as wood, textiles, and leather, are imported and exported within the Coalition region. Those goods traded within the Coalition may make good candidates for short-sea shipping operations along the eastern seaboard.

These observations indicate that current waterborne shipments are most likely to be high-weight, low-value goods that are transported short to medium distances. Some water routes are in relative demand, such as between West South Central and Florida, while others seem to be less utilized. It is likely, however, that all-water routes would have extra capacity for increased short-sea shipping operations.

## 5.0 Conclusions and Recommendations

This section presents the conclusions of the study, which are derived from the interview findings, the analysis of the FAF commodity flow data, and the use of GIS to identify potential markets for new or enhanced short-sea shipping services within the I-95 Corridor Coalition region. This section also recommends next steps for MARAD and the Coalition in supporting short-sea shipping-related programs, activities, and strategies.

### ■ 5.1 Conclusions

**There are many existing short-sea shipping services within the Coalition region.**

There are more than 100 short-sea shipping operators within the Coalition region that provide a variety of transportation, salvage, towing, and other maritime services. However, these services currently do not handle a significant volume of freight within the region, currently accounting for approximately 13 percent of the overall weight and less than two percent of the overall value of freight shipments moving into and out of the region.<sup>1</sup>

**Many ports in the Coalition region have taken an interest in short-sea shipping.**

Many ports in the region have undertaken or currently are undertaking short-sea shipping initiatives. Of particular note is the PIDN, a public/private partnership aimed at increasing barge's mode share for container traffic moving out of the Port of New York and New Jersey. Current destinations include the Ports of Albany, New York, and Boston, Massachusetts, with several other cities under study for expanded service. In addition, the Port of Bridgeport, Connecticut, has recently begun short-sea shipping service, while several other ports in the region, including Port Canaveral, Florida, and the Ports of Fall River and New Bedford, Massachusetts, are studying ways to attract short-sea shipping operations. The activities of these and other ports and terminals in the Coalition region indicate ports have recognized enhanced short-sea shipping as a way to improve their operations (by reducing truck and rail-related congestion in and around port areas) and/or attract additional business.

**Short-sea operations can be limited by infrastructure and operational issues as well as market forces.**

Short-sea shipping operations in the region can be hindered in many ways. Infrastructure issues, such as the ability of the region's ports to effectively serve short-sea operations or the condition of locks, dams, and overhead clearances on the inland waterway system, can impact successful short-sea shipping operations. Operational issues, such as the ability of larger ports in the region to serve short-sea shipping operators in conjunction with the

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<sup>1</sup> FHWA Freight Analysis Framework.

oceangoing containerships, which may be their primary customers, also can impact short-sea shipping. The availability of vessels appropriate for use in short-sea operations also is an issue. Appropriate vessels can be expensive to construct and maintain, requiring a long-term commitment by shippers who would use a short-sea service. Most importantly, though, are market and frequency of service issues. The most successful short-sea shipping services are those that are able to capture the low cost of water transit without incurring the high costs of drayage, handling, and storage. The markets that can be structured to make these types of services work while offering competitive cost, speed, and reliability characteristics can be limited. The ability to offer cost-competitive and frequent service is a significant challenge to expanding short-sea shipping in the region.

**There are several commodities that may be served by new or enhanced short-sea shipping operations.**

Several publicly available datasets provide some level of detail on waterborne commodity movements, including the FHWA's FAF data, which was used to assess the potential short-sea shipping market as part of this study. While the FAF and other publicly available datasets are adequate for identifying and describing historical flow patterns of waterborne movements and in identifying industry trends, they do not provide the level of geographic, commodity, and shipment detail necessary to support a comprehensive analysis of the potential short-sea shipping market. Despite the limitations of the commodity flow data used in this study, there do appear to be several commodity types that could be served by new or enhanced short-sea shipping operations within the Coalition region. There are several bulk commodities, particularly stone, minerals, and ore; coal and petroleum products; and pharmaceutical and chemical products, that currently are being served by both truck and waterborne movements in the region. Clearly, short-sea shipping has the potential to capture an increased share of these markets in some areas.

**There are several traffic lanes that may be served by new or enhanced short-sea shipping operations.**

The GIS analysis of freight movements indicated that the potential for expanded short-sea shipping operations within the I-95 Corridor region may exist. The analysis demonstrated that stone, minerals, and ore are transported along the Coalition region's highways in high volumes, yet the coastal traffic lanes are barely used to transport those same commodities. There also is a heavy flow of stone, minerals, and ore along the highways between the East North Central and the North Atlantic regions, while the flow of the same commodity group along the water network is minimal. In these cases, the opportunity exists for the transportation of rock, minerals, and ore to undergo a mode shift from truck to water, as the water routes already handle the commodity group to some degree already.

**States and MPOs can play a critical role in supporting short-sea shipping operations.**

State DOTs and MPOs are critical stakeholders to engage in short-sea shipping activities and initiatives for several reasons. First, these agencies provide a systems-level view of transportation and are increasingly planning and managing their transportation systems in an integrated and systematic fashion rather than as a collection of individual modes

and networks. State DOTs and MPOs can help articulate how the various elements of the supply chain and transportation systems work together to meet the needs of users and assist in determining how short-sea shipping can complement and support these systems while improving the mobility of both people and goods. Second, these agencies are often the conduit to Federal transportation funds and other capital improvement funding programs and can play an important role by improving access to port and intermodal facilities, improving connections to highway and rail mainlines. Thirdly, as managers of statewide and local intelligent transportation systems (ITS), these agencies can help ports, terminal operators, and short-sea shipping providers understand how existing maritime information systems, such as hazardous cargo tracking systems, vessel tracking systems, and automatic identification systems can fit within a local, statewide, or regional ITS architecture to improve the safety, mobility, and efficiency of intermodal movements. Finally, many of these agencies have existing relationships with the private-sector freight industry, economic development agencies, and Port Authorities and could leverage these existing relationships to build advocates for increased short-sea shipping or develop public-private partnerships to support short-sea shipping activities. MPOs, in particular, are well suited to supporting short-sea shipping activities, as they are consensus-building, regional organizations that often have solid relationships with local partners, including the freight industry and local ports.

**States and MPOs are aware of short-sea shipping but do not understand its potential implications to transportation or economic development activities.**

Most state DOTs and MPOs in the region, particularly those with active freight planning programs or with significant regional freight activity, are aware of short-sea shipping and the efforts of MARAD and others to develop it into a more viable mode for shippers. Few of these agencies, though, have a solid understanding of how enhanced short-sea shipping operations would impact their transportation planning or economic development activities. In addition, few states and MPOs are aware of the Marine Transportation System (MTS) and where their transportation planning activities fit within that system. It is critically important that these agencies begin to understand how short-sea shipping fits within a statewide or regional transportation system, as potential short-sea shipping projects and studies, intermodal access improvements, and other activities must compete with other transportation improvements for funding and support of DOTs and MPOs.

**Domestic commodity movements represent a potential focus area for enhanced short-sea shipping activities.**

Domestic commodity movements could offer more potential for short-sea shipping than international shipments for several reasons. First, international shipments have many characteristics that are not conducive to short-sea shipping operations. They typically are located at major load center ports that cannot always accommodate short-sea shipping activities among their existing traffic mix. In addition, the increased handling and storage fees that are often related to customs requirements can drive up costs for these international shipments, making short-sea shipping a less attractive option for the outbound movement. Domestic shipments, on the other hand, have fewer customs requirements and often do not have to be concentrated at major load center ports, which may allow for the use of underutilized ports in the region. Most importantly, though, is the sheer



volume of domestic freight flows, which outnumber international volumes by almost a 2:1 ratio. Domestic shipments not only offer more volume, they also consist of a more diverse commodity mix and move between a larger number of origins and destinations. As a result, domestic shipments offer many more opportunities for short-sea shipping to increase its overall market share for freight shipments in the region.

**The Coalition region is a logical place for expanded short-sea operations.**

The Coalition region could be an excellent test bed for enhanced short-sea shipping operations. The region's economy and industry base is very diverse, consisting of high value-added manufacturing, which produces finished or semifinished consumer goods; resource-based industries, which often ship raw materials for use in secondary manufacturing processes; and national and international freight gateways. As a result, a wide variety of commodity types are shipped into, out of, and within the Coalition region. The region's population base also is a key asset, as it includes major urban markets up and down the eastern seaboard. There are many potential markets for short-sea shipping operations and many areas within the region – particularly in the Northeast – have ports that currently are underutilized. These ports, many of which are located within or near major urban markets, could be attractive areas on which to focus expanded short-sea shipping operations. Finally, the region's increasing highway and rail congestion coupled with the projected increase in both international and domestic freight traffic over the next decade could result in the more effective use of the region's coastal and inland waterway system.

**The inland and coastal waterway system may provide important transportation system redundancy benefits.**

In addition to mitigating highway and rail congestion and increasing the number of transportation options available to shippers, enhanced use of the inland and coastal waterway system may also have important system redundancy benefits. Just-in-time logistics practices, coupled with the globalization freight operations, have caused supply and distribution chains to become highly sensitive to service disruptions caused by natural disasters (e.g., hurricanes), labor issues (e.g., West Coast ports lockout of 2002), security threats (e.g., Baltimore Harbor Tunnel closure of 2005), and non-recurring congestion caused by traffic incidents or other events. Making better use of the inland and coastal waterway system could have important benefits by helping to sustain regional mobility during and immediately after these kinds of events.

**Publicly available commodity flow data are not detailed enough to fully assess the potential short-sea shipping market.**

Several publicly available datasets provide some level of detail on waterborne commodity movements, including the FHWA's FAF data, which was used to assess the potential short-sea shipping market as part of this study. Other datasets include the U.S. Army Corps of Engineers Waterborne Commerce statistics, commodity flow data available from the American Association of Port Authorities (AAPA), and Commodity Flow Survey data available from the U.S. Bureau of Transportation Statistics. While these publicly available datasets are adequate for identifying and describing historical flow patterns of waterborne movements and in identifying industry trends, they are not appropriate for use in a

regional short-sea shipping study because they do not provide the level of geographic, commodity, and shipment detail necessary to support a comprehensive analysis of the potential short-sea shipping market. While the FAF were effectively used in this study to develop an initial estimation of potential short-sea shipping commodities and markets, a more detailed market assessment would require more detailed commodity flow data.

**GIS is an effective tool in assessing the market for short-sea shipping.**

This study demonstrated how GIS can be used to better understand the market for short-sea shipping. By integrating a commodity flow analysis into a GIS using a desire line analysis, the key corridors of travel were quickly made apparent, revealing information that may otherwise have escaped notice. These and other maps proved effective in providing insight into the types of goods that are flowing between origins and destinations and can allow MARAD, the Coalition, and local and regional planners to identify the areas and facilities that short-sea shipping activities could be most effective.

## ■ 5.2 Recommendations

There are several opportunities for increased short-sea shipping-related activities and possible next action steps for MARAD and the I-95 Corridor Coalition to consider. These are presented below.

- **Enhance existing short-sea shipping education and outreach efforts** – As described earlier, many DOTs and MPOs in the Coalition region have heard of short-sea shipping and MARAD’s short-sea shipping initiative, but few understand the potential implications that enhanced short-sea shipping operations may have on statewide and local transportation systems and economic development efforts. MARAD and the I-95 Corridor Coalition should continue to reach out to these important stakeholders both formally, through recruitment and participation in the Short-Sea Shipping Cooperative Program (SCOOP) and the I-95 Corridor Coalition Intermodal Program Track Committee; and informally, through participation in industry associations, the marine-related activities of the Transportation Research Board, and other associations. MARAD may even consider developing marketing materials targeted at shippers, intermodal marketing companies, and third-party logistics providers that describe short-sea shipping, where it is being used, and its effectiveness. This effort could help raise the awareness of short-sea shipping among the shipper community.
- **Continue to engage all the short-sea shipping stakeholders** – State DOTs and MPOs are important stakeholders to include in the short-sea shipping discussion, as they provide an important transportation perspective and also would bear the traffic, economic development, and environmental costs and benefits associated with increased short-sea shipping operations. This is particularly true for MPOs in areas with underutilized ports, which may be magnets for short-sea shipping operations. Development of short-sea shipping activities at these and other smaller ports could have a tremendous effect on traffic patterns, economic development activities, and community and environmental vitality in these areas. MARAD should actively recruit state DOT and

MPO representatives to participate in the SCOOP. Similarly, the I-95 Corridor Coalition's Intermodal Program Track Committee should continue to engage the maritime community and continue to support regional short-sea shipping activities. Both MARAD and the I-95 Corridor Coalition should consider using this report as an outreach tool to galvanize these stakeholders around short-sea shipping and other maritime-related issues, such as port and terminal access, landside and waterside capacity, and port security.

- **Conduct a more detailed market assessment of short-sea shipping** – The results of this study indicate that there are commodity types and markets that could be effectively served by short-sea shipping. However, a more comprehensive assessment of the potential market, using more detailed commodity flow data, is necessary so that this potential can be better quantified. MARAD and the I-95 Corridor Coalition should consider acquiring more detailed commodity flow data and conducting a more detailed market assessment for short-sea shipping that builds on the initial estimations provided in this study. This effort should focus on domestic freight movements, as those movements may offer the most potential for increasing the market share of short-sea shipping.
- **Develop detailed case studies of existing short-sea shipping activities** – There are several successful short-sea shipping operations within the I-95 Corridor Coalition region, including operations associated with the PIDN and the Port of Bridgeport. MARAD and the I-95 Corridor Coalition should develop detailed case studies of these and other efforts in order to provide updates on existing and future markets for these services, their status, and lessons learned. The I-95 Corridor Coalition has proven to be an effective forum for discussing lessons learned in ITS deployments, commercial vehicle operations (CVO) deployments, and others. Developing lessons learned from existing short-sea shipping services would not only allow Coalition member agencies to benefit from the experiences of others, but also allow them to attract additional membership from the maritime community, maintain awareness of short-sea shipping by existing DOT and MPO members, and encourage short-sea shipping stakeholders in other areas to develop short-sea shipping strategies and programs.
- **Develop a list of desirable characteristics for ports interested in attracting or enhancing short-sea shipping activities** – Many DOTs, MPOs, Port Authorities, and others are interested in developing or expanding short-sea shipping operations. To assist these agencies in understanding the types of characteristics that may lead to successful short-sea shipping activities, MARAD and the I-95 Corridor Coalition may wish to develop a list of short-sea shipping characteristics. Better understanding the specific characteristics that can lead to a successful short-sea shipping deployment can help states, MPOs, and industry identify the locations in their regions that may have the most potential and the types of improvements that may be required. Examples of characteristics discussed in this study include intermodal access, berth availability, crane/stevedore handling capacity, and access to capital. MARAD and the Coalition should work with the maritime industry, DOTs and MPOs, and other stakeholders to refine this list.

- **Develop a GIS program to support short-sea shipping activities** - GIS can be effective tools in displaying commodity flow and other data in ways that make sense to policy-makers, management, and others. Graphic displays of commodity flows allow users to make quick inferences about the potential markets for short-sea shipping and can even be used to identify and define the effects of increased short-sea shipping activities on transportation networks. MARAD should consider developing a GIS program to support its short-sea shipping activities to help build awareness of the effects of short-sea shipping among transportation agencies at the Federal, state, and local levels. In addition, the Coalition should consider incorporating short-sea shipping data and information into the Integrated Corridor Analysis Tool (ICAT), currently under development. Incorporating short-sea shipping information into ICAT may enhance its ability to coordinate transportation planning, operations planning, and investment options across modes making it a more useful tool for Coalition members.

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# Appendix A

*I-95 Corridor, List of Barge and Push Boat Operators by State*

# Appendix A

**Table A.1 I-95 Corridor, List of Barge and Push Boat Operators by State**  
Sorted by Total Barges

State	Operator Name	Push Boats	Dry Covered Barges	Dry Open Barges	Deck Barges	LASH and SEABEE Barges	Other Dry Barges	Single-Hull Tank Barges	Double-Hull Tank Barges	Other Tank Barges	Total Barges
CT	Penn Maritime, Inc. 2379	0	0	0	0	0	0	5	5	8	18
	Rhodia, Inc.	0	0	0	0	0	0	0	18	0	18
	Seaboard Barge Corporation	0	0	0	0	0	0	7	2	0	9
	Gateway Towing	0	2	4	1	0	0	0	0	0	7
	Moran Dry Bulk Carriers	0	4	1	0	0	0	0	0	0	5
DE	No Information Available										
DC	No Information Available										
FL	Mobro Marine, Inc.	0	4	2	68	0	1	0	0	2	77
	Seminole Electric Cooperative, Inc.	0	0	73	0	0	0	0	0	0	73
	Eckstein, Kathryn A.	0	53	0	0	0	0	0	0	0	53
	Wood Hopkins Const.	1	4	0	21	0	0	0	0	0	25
	Sun State Marine Services, Inc.	7	0	0	0	0	0	11	6	0	17
	Coastal Tug And Barge, Inc.	4	0	0	0	0	0	11	4	1	16
	Cross-State Towing Co., Inc.	0	1	1	6	0	0	6	0	1	15
	Gulfcoast Transit Company	0	12	0	0	0	0	0	0	0	12
	Misener Marine Construction Co.	4	0	0	12	0	0	0	0	0	12
	Hendry Corporation	5	0	0	9	0	0	2	0	0	11
	Martin Marietta Aggregates	0	0	0	11	0	0	0	0	0	11
	Grady Marine Const.	1	0	0	6	0	1	0	0	0	7
	American Barge And Boat Services, Inc.	0	0	0	6	0	0	0	0	0	6
	Dixie Towing Corp.	0	0	0	6	0	0	0	0	0	6
	Granite Construction Company	2	0	0	6	0	0	0	0	0	6
	Tampa Barge Co.	0	6	0	0	0	0	0	0	0	6
	Harders, H.G. & Son	3	0	0	5	0	0	0	0	0	5
Trailer Bridge	0	0	0	2	0	3	0	0	0	5	

**Table A.1 I-95 Corridor, List of Barge and Push Boat Operators by State**  
*Sorted by Total Barges (continued)*

State	Operator Name	Push Boats	Dry Covered Barges	Dry Open Barges	Deck Barges	LASH and SEABEE Barges	Other Dry Barges	Single-Hull Tank Barges	Double-Hull Tank Barges	Other Tank Barges	Total Barges
GA	Chatham Towing Company, Inc.	3	0	0	0	0	0	5	0	0	5
	T.I.C.	2	0	0	5	0	0	0	0	0	5
ME	Sheepscot Pilots, Inc.	0	0	1	4	0	0	0	0	0	5
MD	Mclean Contracting Co.	0	0	0	29	0	2	0	0	0	31
	Smith Marine Equipment Co.	0	0	0	28	0	0	0	0	0	28
	Salisbury Towing Corp.	4	0	0	24	0	0	0	0	0	24
	Vane Brothers Company, The	0	0	0	0	0	0	9	4	6	19
	Langenfelder, C.J. & Son, Inc.	1	0	2	12	0	0	0	0	0	14
	Baltimore Gas And Electric Company	0	0	10	0	0	0	0	2	0	12
	Imbach, Martin G., Inc.	0	0	1	10	0	0	0	0	0	11
	Crandell, Edwin A. & John O., Inc.	0	0	0	9	0	0	0	0	0	9
	Smith Bros.	0	0	0	6	0	0	0	0	0	6
	Vane Line Bunkering, Inc.	2	0	0	0	0	0	5	0	1	6
Hale Intermodal Marine Co.	0	0	0	0	0	5	0	0	0	5	
MA	Buchanan Marine, L.P., A.P. Franz, Jr., Trustee of the Buchanan Trust	0	4	120	1	0	0	0	0	0	125
	Franz, A.P., Jr., Trustee of Buchanan Trust, Delaware Limited Partnership	0	0	64	0	0	0	0	0	0	64
	Franz, A.P., Jr., Trustee of the Buchanan Trust	0	0	44	2	0	1	0	0	0	47
	Cashman Equipment Corp.	0	0	0	29	0	0	0	0	0	29
	Franz, A.P., Jr., Trustee of Buchanan Trust For Benefit of Buchanan Marine	0	0	18	0	0	0	0	0	0	18
	Tisbury Towing & Transportation, Inc.	0	0	0	4	0	0	3	0	0	7
NH	No Information Available										

**Table A.1 I-95 Corridor, List of Barge and Push Boat Operators by State**  
*Sorted by Total Barges (continued)*

State	Operator Name	Push Boats	Dry Covered Barges	Dry Open Barges	Deck Barges	LASH and SEABEE Barges	Other Dry Barges	Single-Hull Tank Barges	Double-Hull Tank Barges	Other Tank Barges	Total Barges
NJ	Weeks Marine, Inc.	0	0	17	75	0	8	0	0	2	102
	Hughes Bros., Inc.	3	2	2	50	0	1	0	0	0	55
	Inland Water Transportation LLC	0	51	0	0	0	0	0	0	0	51
	Hugo Neu Schnitzer East	0	0	18	23	0	0	0	0	0	41
	Amboy Aggregates	0	0	0	31	0	0	0	0	0	31
	Coen Marine Equipment, Inc.	0	0	0	15	0	2	0	0	0	17
	Express Marine, Inc.	0	4	11	0	0	0	0	0	0	15
	Maritime Transport, Inc.	0	0	0	13	0	0	0	0	0	13
	Loveland, S.C. Co., Inc.	0	4	0	3	0	0	0	0	0	7
	Columbia Coastal Transport, Inc.	0	0	0	2	0	4	0	0	0	6
	Camden Iron & Metal Construction & Marine	0	0	5	0	0	0	0	0	0	5
			0	1	0	4	0	0	0	0	0
NY	New York, City of - (Department of Sanitation, Marine Transportation Division) Unloading Plant No. 1	0	0	89	0	0	0	0	0	0	89
	Reinauer Transportation Co., Inc.	1	0	0	0	0	0	1	0	29	30
	Bouchard Transportation Co.	0	0	0	0	0	0	21	4	2	27
	K-Sea Transportation Corp.	0	1	0	0	0	0	11	4	4	20
	Seariver Maritime, Inc. - Northeast Fleet	0	0	0	0	0	0	0	20	0	20
	S C F Barge Line Ii, Inc.	0	2	16	0	0	0	0	0	0	18
	Spearin, Preston & Burrows, Inc.	0	0	0	18	0	0	0	0	0	18
	E.W. Holding Corp.	0	2	0	0	0	0	5	9	1	17
	S C F Towboat Iii	0	6	5	0	0	0	0	0	0	11
	Shipyard Marketing, Inc.	0	0	0	0	0	0	1	10	0	11
	Spentonbush/Red Star Co., Inc.	0	0	0	0	0	0	0	0	10	10
	Fabrikant International Corp.	0	6	1	0	0	0	0	0	0	7
	Hampton Barge Line, Inc.	0	6	0	0	0	0	0	0	0	6
	Mcallister Towing & Transportation Co., Inc.	0	5	0	0	0	1	0	0	0	6
	Gellatly Petroleum & Towing Corp.	0	0	0	0	0	0	3	0	2	5
Midland Marine Corp.	0	0	0	0	0	0	1	4	0	5	



**Table A.1 I-95 Corridor, List of Barge and Push Boat Operators by State**  
*Sorted by Total Barges (continued)*

State	Operator Name	Push Boats	Dry Covered Barges	Dry Open Barges	Deck Barges	LASH and SEABEE Barges	Other Dry Barges	Single-Hull Tank Barges	Double-Hull Tank Barges	Other Tank Barges	Total Barges
NC	Sunn Enterprises, Inc.	0	106	1	0	0	0	0	0	0	107
	Wasson Barge Co., Inc.	0	27	0	0	0	0	0	0	0	27
	Sunn Barges, LLC	0	25	0	0	0	0	0	0	0	25
	Wasson Investment Corp.	0	17	0	0	0	0	0	0	0	17
	P C S Phosphate	0	2	0	6	0	0	0	0	5	13
	Jones, J.A. Construction Co.	1	0	0	6	0	0	0	0	0	6
PA	Campbell Transportation Co.	19	1	432	17	0	0	0	0	0	450
	Consolidation Coal Co. (River Division)	0	0	280	0	0	0	0	0	0	280
	Mon River Towing, Inc.	17	0	204	0	0	0	0	2	4	210
	Senstar Capital Corporation	0	105	40	0	0	0	0	0	0	145
	Bryan, Frank, Inc.	0	0	118	25	0	0	0	0	0	143
	Pioneer - Mid-Atlantic, Inc.	0	0	3	31	0	0	0	0	0	34
	Pnc Leasing, LLC	0	0	32	0	0	0	0	0	0	32
	Marine Leasing Corp.	0	0	21	5	0	0	0	0	0	26
	Canestrале, Matthew	0	0	17	0	0	0	0	0	0	17
	J.A.R. Barge Lines	0	0	0	0	0	0	0	12	0	12
	Maritrans Operating Partners L.P.	0	0	0	0	0	0	8	4	0	12
	Willis, C.G., Inc.	0	10	2	0	0	0	0	0	0	12
	Glacial Sand And Gravel Co.	0	0	4	5	0	0	0	0	0	9
	Brown, Robert J. Towing Company	2	0	4	1	0	2	0	0	0	7
	River Associates, Inc.	0	0	0	1	0	0	2	4	0	7
	River Salvage Company, Inc.	8	0	7	0	0	0	0	0	0	7
	Annex Marine, Inc.	0	0	0	0	0	0	0	6	0	6
	General Trade Corp.	0	0	6	0	0	0	0	0	0	6
	Hays Tug & Launch Service, Inc.	1	0	1	4	0	0	0	1	0	6
	American Bridge Company	0	0	0	5	0	0	0	0	0	5
Marine Contractors, Inc.	1	1	2	2	0	0	0	0	0	5	
Tonomo Marine	0	0	2	3	0	0	0	0	0	5	
RI	None over 5 barges (three with one each)	0	0	0	1	0	0	0	0	0	1
SC	Stevens Towing Co., Inc.	2	0	0	2	2	0	0	0	0	4
VT	No Information Available										

**Table A.1 I-95 Corridor, List of Barge and Push Boat Operators by State**  
*Sorted by Total Barges (continued)*

State	Operator Name	Push Boats	Dry Covered Barges	Dry Open Barges	Deck Barges	LASH and SEABEE Barges	Other Dry Barges	Single-Hull Tank Barges	Double-Hull Tank Barges	Other Tank Barges	Total Barges
VA	Tarmac-America	0	0	0	115	0	0	0	0	0	115
	Allied Transportation Company	0	3	0	0	0	0	5	5	1	14
	St. Laurent Forest Products Corp.	0	0	13	0	0	0	0	1	0	14
	Norfolk Towing & Lighterage, Inc.	0	0	0	13	0	0	0	0	0	13
	Norfolk Dredging Co.	0	0	0	12	0	0	0	0	0	12
	Bay Gulf Trading Company, Limited	0	0	0	0	0	0	7	1	1	9
	Sea Land Transport Co.	0	6	0	0	0	0	0	0	0	6
	Transerve Marine, Inc.	0	1	0	0	0	0	0	4	1	6
	Perdue Farms	0	5	0	0	0	0	0	0	0	5
	Ref Barge Company	0	5	0	0	0	0	0	0	0	5

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# Appendix B

*List of Interviewees*

# Appendix B

## ■ List of Interviewees

### *Connecticut*

- Carmine Trotta, Connecticut Department of Transportation
- James Wang, Greater Bridgeport Regional Planning Agency

### *Delaware*

- Mike Kirkpatrick, Delaware Department of Transportation

### *Florida*

- David Roach, Florida Inland Navigation District
- Nancy Leikauf, Florida Ports Council
- Joe Zambito, Hillsborough County Metropolitan Planning Organization
- David Kaufmann, Jacksonville Port Authority
- Mac McCloud, Port Canaveral
- Mike Zeigler, West Florida Regional Planning Council

### *Georgia*

- Mark Wilkes, Chatham-County-Savannah Metropolitan Planning Committee

### *Maine*

- Rob Elder, Maine Department of Transportation
- Brian Nutter, Maine Department of Transportation

### *Maryland*

- Regina Aris and Karin Foster, Baltimore Metropolitan Transportation Council
- Sam Azavello, Maryland Port Administration
- Crystal Darcy, Port of Baltimore

***Massachusetts***

- Anne McGahan, Boston Metropolitan Planning Organization
- Brad Wellock, Massachusetts Port Authority
- Rick Armstrong, Massachusetts Seaport Council

***New Brunswick (Canada)***

- Neill McKay, New Brunswick Department of Transportation

***New Hampshire***

- John Burke, Seacoast Metropolitan Planning Organization

***New Jersey***

- Talvin Davis and James Baker, New Jersey Department of Transportation
- John Hummer, North Jersey Transportation Planning Authority

***New York***

- John Poorman, Capital District Transportation Committee
- Frank McDonough, New York Shipping Association
- Howard Mann, New York Metropolitan Transportation Council
- Frank W. Keane, Port of Albany

***North Carolina***

- Alpesh Patel, North Carolina Department of Transportation
- Jonathan David, Wilmington Metropolitan Planning Organization

***Pennsylvania***

- Jim McCarville, Port of Pittsburgh
- Sara Walfoort, Southwestern Pennsylvania Commission
- Herb Packer, Office of PennPorts, Department of Community and Economic Development
- Sharon Daboin, Pennsylvania Department of Transportation

***Rhode Island***

- Ray Meader, Port of Providence

***South Carolina***

- Haila Maze, Berkeley-Charleston-Dorchester Council of Governments
- Fred Stribling, South Carolina State Ports Authority

***Virginia***

- Camelia Ravanbakht, Hampton Roads Planning District Commission
- Jeff Florin, Port of Virginia
- Erik Johnson, Virginia Department of Transportation

***Regional/National***

- Ted Dahlburg, Delaware Valley Regional Planning Commission (Pennsylvania and New Jersey)
- Tom Hannan, Port Authority of New York and New Jersey (PANYNJ)
- Rexford Sherman, American Association of Port Authorities
- Rosemary Lynch, Atlantic Intercoastal Waterway Association
- Raymond Butler, Gulf Intracoastal Canal Association (GICA)
- David White, South Atlantic Marine Transportation System Organization (SAMTSO)

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# Appendix C

*Technical Memorandum No. 1 –  
Interview Findings*

# Technical Memorandum No. 1 – Interview Findings

## ■ Introduction and Background

The volume of freight traffic within the Coalition region is growing significantly. Non-containerized freight movements through ports within the 16-state Coalition region have increased more than 11 percent from 1991 to 1999. At the same time, container movements through Coalition region ports have also been growing rapidly. Between 1990 and 2002, container traffic at seven major Coalition region ports – New York/New Jersey, Charleston, Virginia, Wilmington (Delaware), Miami, Palm Beach, and Savannah – was up sharply, increasing 26 percent, from 7.5 million to 9.5 million TEUs.<sup>1</sup> Freight volumes are expected to double again over the next decade.

In response to this anticipated growth in freight traffic as well as the rising levels of congestion along the region’s highway and rail networks, the concept of short-sea shipping has received a significant amount of attention over the past several years. Proponents argue that increased use of short-sea shipping services could be an effective strategy in helping to relieve existing and anticipated congestion on the region’s highway and rail networks. Although several short-sea shipping studies have been conducted or are now underway, few have provided an understanding of how short-sea operations fit within existing intermodal transportation systems and supply chains. Still fewer have identified short-sea shipping’s potential impacts on statewide, regional, and local transportation systems and economic development efforts. In order to address these issues, MARAD has partnered with the I-95 Corridor Coalition to sponsor a short-sea shipping study. This study, which will complement and enhance existing short-sea study and research already conducted by MARAD and other organizations, is designed to help MARAD and the Coalition better understand the role of state DOTs and MPOs in supporting short-sea shipping initiatives.

The study included a series of in-depth interviews with MPOs, state DOTs, Port Authorities, and the private-sector freight and maritime community. These interviews were used to assess the degree of knowledge of short-sea shipping among these key stakeholders; discuss the potential transportation and economic development impacts associated with short-sea shipping; and assess the degree of cooperation among DOTs, MPOs, Port Authorities, and other short-sea shipping stakeholders in planning for short-sea shipping. This technical memorandum presents the key findings from these interviews.

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<sup>1</sup> Most of the increase occurred at the port of New York/New Jersey, which handled nearly four million TEUs in 2002, nearly one million more than just 12 years earlier. The Port of Savannah grew the fastest in percentage terms, increasing by two-thirds the number of containers it handled.



## ■ Summary of Interviews

More than 40 interviews were conducted with several types of short-sea shipping stakeholders within the I-95 Corridor Coalition region:

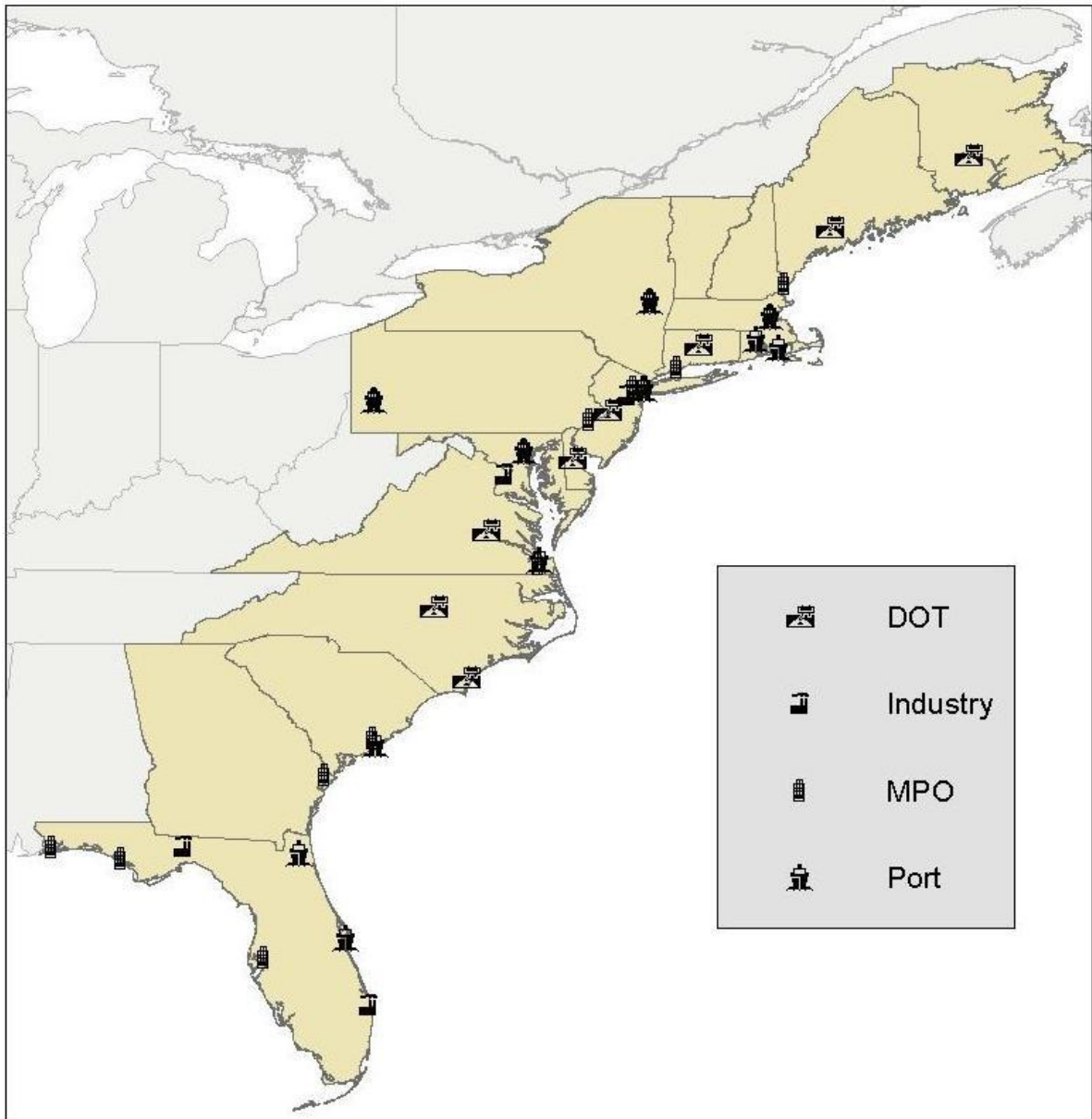
- State DOT transportation planning staff;
- MPO transportation planning staff;
- Port and terminal operators; and
- Maritime industry groups.

Table 1 provides a summary of the interviews conducted with each group. As shown, a total of 42 interviews were completed throughout the study. The geographical distribution of these agencies is presented in Figure 1. A full list of the participating organizations is provided in Appendix B of this report.

**Table 1. Interviews by Stakeholder Type**

Organization Type	Number of Interviews Completed
State DOT	8
MPO	15
Port Authority	12
Industry	7
<b>Total</b>	<b>42</b>

**Figure 1. Geographical Distribution of Agencies Interviewed**



## ■ Key Interview Findings

Key interview findings are presented in four sections:

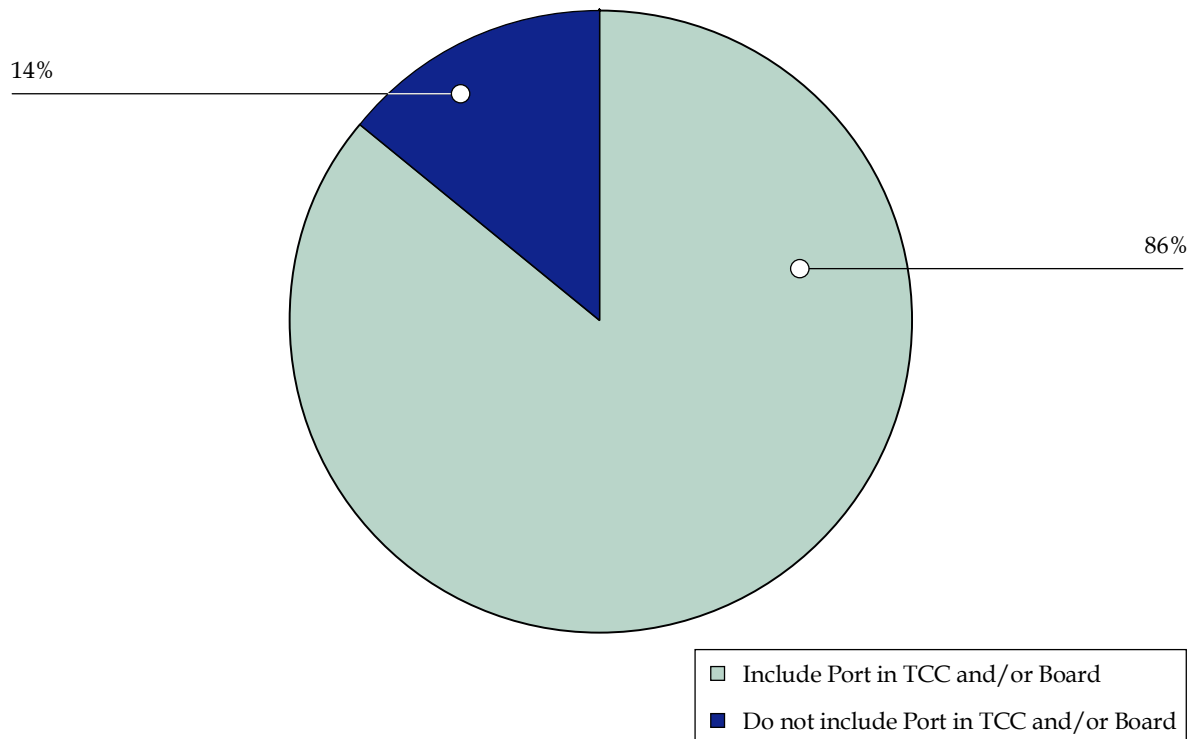
1. **General Findings**, which presents the overall impression from interviewees regarding short-sea shipping and the degree of cooperation among DOTs, MPOs, Port

Authorities, and other short-sea shipping stakeholders in planning for short-sea shipping and general freight operations.

2. **Obstacles to Short-Sea Shipping**, which details some of the hindrances to short-sea shipping in the East Coast, as described by the interviewees.
3. **Possible Effects of Short-Sea Shipping**, which describes the possible transportation system, economic development, and other effects that increased use of short-sea shipping could have in the interviewees' regions.
4. **MPO/DOT/Port Authority Role in Promoting Short-Sea Shipping**, which describes potential role of DOTs, MPOs, Port Authorities, and other stakeholders in promoting and maintaining short-sea shipping operations.

## General Findings

- **There are several existing short-sea shipping services in the I-95 Corridor Coalition region.** Several interviewees indicated that there are already several successful short-sea shipping operations in the region. In addition to the PANYNJ's PIDN services (PANYNJ-Albany and PANYNJ-Bridgeport), Columbia Coastal (a U.S. flag barge operator) provides regular service between Halifax, Portland, Maine, and Boston. Columbia Coastal, as well as Evans Delivery Company, also provides regular container barge service from Norfolk (Virginia) to Baltimore (Maryland). There have also been some discussions between the Port of Fall River and Port Canaveral, as well as the Port of New Brunswick and the Port of Newfoundland to begin a short-sea operation.
- **Short-sea shipping may be a viable option to shippers ... but it must be proven.** Most interviewees agreed that short-sea shipping could be developed into a viable option for shippers in the region. Several challenges exist, not the least of which is getting shippers to adapt their operations to make better use of short-sea shipping services. Many interviewees felt that this kind of change in operational strategy can only happen through high-visibility demonstration projects and studies that prove to shippers that the short-sea shipping concept can work in practice.
- **Many MPOs communicate with their local port officials and include them in their planning efforts.** The majority of MPOs stated that port officials are members of their Technical Coordinating Committees, as shown on Figure 2, and some Port Authority members maintain voting power as part of an MPO board. The extent to which the ports and Port Authorities are actually involved in the transportation planning and programming processes of MPOs is not often clear and could be worth studying further. However, the fact that the majority of MPOs include port members in their advisory committee structures does indicate a willingness by these MPOs to pay attention to ports and port-related issues. The relationships between DOTs and Port Authorities appear to be less formal, and more limited.

**Figure 2. Port Representation on MPO’s Technical or Policy Board**

### Obstacles to Short-Sea Shipping

- **There is a limited understanding of short-sea shipping costs and benefits.** Many interviewees indicated that more studies need to be conducted and made available in order to get a more thorough understanding of the costs and benefits associated with short-sea shipping. Although Port Authorities do understand short-sea shipping from an operational standpoint, they (as well as planning organizations) often find it difficult to quantify the benefits produced and costs. Most interviewees agreed that increased use of short-sea shipping services would eliminate some traffic from the road, but have no idea of the extent. Some interviewees mentioned that the “case” for short-sea shipping would be much stronger if its full costs and benefits (to both the public and private sectors) could be better quantified.
- **There is a lack of “port partnering.”** Some stakeholders indicated that ports are still very “parochial,” each looking out for its own market share. Several interviewees believe that ports should be looking to partner with “reliever” facilities that could relieve the burden at the congested load centers, make them more efficient, and allow them to attract more traffic (a “win/win” for both ports). As smaller ports often have trouble marketing their services and attracting large amounts of traffic, support of the larger load centers is often necessary.

- **Industry involvement with DOT/MPO planning efforts can be limited.** Many MPOs/DOTs explained that they find it hard to involve the private-sector freight industry in their transportation planning efforts. Though some states and MPOs have reached out to the private sector and some have even created freight advisory or other such groups, many DOTs and MPOs find it challenging to get the private sector truly engaged within the planning process. One factor that was mentioned by many states and MPOs is the mismatch in planning horizons between the public and private sector. State DOTs and MPOs often conduct long-range planning on a 20- to 30-year timeframe, while the private-sector freight industry often conducts long-range planning on a six- to 18-month timeframe. This mismatch in planning horizons complicates efforts to fully engage the private-sector freight community in a process that they perceive to be long, cumbersome, and overly bureaucratic.
- **Existing infrastructure may not be capable of handling large volumes of short-sea traffic.** There are two infrastructure issues that interviewees mentioned. The first is the condition of the U.S. inland and coastal waterway systems, which have not been maintained effectively over the last several years. In many cases, the waterway infrastructure (locks/dams, channels, bridge clearances) is not robust enough to handle commercial traffic. This results in somewhat of a “Catch-22”: government is not likely to invest in maintaining and improving the coastal/inland waterway infrastructure until there is sufficient commercial traffic; and commercial users are not likely to consider short-sea/coastal shipping as a viable option until the system is improved (and can provide some degree of transit time reliability). The other infrastructure issue is the condition of existing port and terminal infrastructure. Many of the “second-tier” ports that would benefit from increased short-sea shipping operations do not have sufficient infrastructure (berths, cranes, access) to support efficient short-sea shipping; the ports that do have that kind of infrastructure are typically larger, load center ports that already are nearing capacity and give preference to larger, oceangoing, international container ships.
- **Frequency and flexibility of service does not meet shipper requirements.** Many interviewees indicated that, in order to compete effectively with trucks, short-sea shipping operations must offer regularly scheduled service. Service flexibility – a key component of trucking operations – is something that short-sea shipping must attempt to offer, as well.
- **Operational costs can be high.** Some interviewees cited operational costs as a major concern for some operators and for some areas. Port fees, navigation fees, and (in northern states and provinces) ice-breaking fees might increase overall costs associated with short-sea shipping, making it a less viable option in comparison to other modes (particularly trucks) and also discouraging potential short-sea shipping operators from getting involved or increasing the use of short-sea shipping.
- **Jones Act.** The Jones Act, which requires that ships engaged in domestic maritime trade be U.S.-built, U.S.-owned, U.S.-flagged, and U.S.-operated, was cited by many interviewees as a key obstacle to expanding the use of short-sea shipping operations in the region.

- **There is a shortage of vessels suitable for use in short-sea trade.** Due in part to the requirements of the Jones Act, many interviewees indicated that there is a lack of vessels that are appropriate for use in short-sea operations. Many interviewees stated that high-speed vessels (capable of attaining speeds of 30 knots) are necessary to support short-sea shipping operations. These vessels are expensive to construct and maintain, requiring a long-term commitment by shippers who would use a short-sea service. This results in another “Catch-22”: shippers often do not want to commit to the service until a vessel is constructed that can support it and operators often do not want to invest in new ships unless they have long-term commitments from shippers.
- **Reasons for shippers to switch modes/operations have not been effectively demonstrated or communicated.** There is a lot of awareness of short-sea shipping within the maritime community and among state DOTs and MPOs in the Coalition region. Many shippers in the region believe it could work. However, there have been few real incentives for shippers to abandon their existing business models/mode choices. Until short-sea shipping can “beat the competition at its own game,” there may be only incremental increases in the use of short-sea shipping services.
- **Labor costs can be high.** High union labor rates can potentially act as a barrier against increased short-sea shipping operations, which typically require boxes to be loaded from one ship onto another, and then onto a truck for transportation to their final destination. The cost of loading and unloading a container can add up to \$100 per box, which substantially increases the profitability of moving the goods. Two scenarios exist that avoid this problem. First, operations that originate or terminate at a facility that uses or produces the goods allows for direct unloading. Second, in roll-on/roll-off operations, trucks or other rolling cargo can be loaded onto secondary barges at a lower cost than lift-on/lift-off operations.

## Possible Effects of Short-Sea Shipping

- **Overall improvement of freight movement through the region.** Some organizations in the Coalition region agreed that increased use of short-sea shipping could have regionwide benefits, such as a reduction in truck VMT, an increase in port throughput capacity, and economic development at feeder ports and hinterland by providing new platforms for value-added, warehousing, and distribution opportunities. However, it is difficult to quantify these benefits, and few states or MPOs have done so.
- **More stress could be placed on already congested port access roads.** Various DOT and MPO interviewees stated that the added business for the port might create an issue with roadside access. These ports are already expecting a significant increase in business, therefore added business from short-sea shipping might not be welcome. Another issue is that some of the regions have many tunnels and bridges that create bottlenecks, an increase in truck traffic around the ports might lead to significant levels of congestion in those areas. As discussed above, though, it is difficult to quantify these impacts and few states or MPOs have done so. However, one study conducted by an interviewee indicated that only five percent of goods currently transported

within the state have the potential to shift to barge. This translates to approximately 10,000 annual containers or roughly 15 trucks per hour. The interviewee noted that this difference may be too small to justify the potential costs of the operation.

- **Container imbalances among ports could arise.** Several DOTs and MPOs (especially those with ports in smaller cities) were highly concerned about the possibility of having stacks of empty containers on their yards. Some interviewees indicated that they wanted to avoid ending up having large container stacks in and around port facilities, as can be the case in large port facilities.

## MPO/DOT/Port Authority Role in Short-Sea Shipping

- **The U.S. DOT could play an important role in jump-starting/supporting the increased use of short-sea shipping.** Most interviewees stated that because the benefits of increased use of short-sea shipping are likely to accrue across more than a single jurisdiction, the U.S. DOT could and should play an important role in supporting and/or jump-starting and maintaining short-sea shipping operations. Interviewees stressed that it is very important to understand how the costs and benefits of increased short-sea shipping operations may accrue across different DOTs and MPOs, as DOTs and MPOs could be wary about investing in short-sea shipping when most of the benefits might be reaped by other states. The U.S. DOT could play a lead role in helping states and MPOs better understand and quantify costs and benefits. Some interviewees felt that there may be an opportunity for the U.S. DOT to take the lead in providing incentives through tax breaks to industrial shippers, the construction of a high-speed vessel to use in a demonstration project, or other strategies.
- **Public-sector transportation agencies could help provide more feedback from current short-sea shipping operations.** The vast majority of interviewees said that in theory short-sea shipping could diminish highway truck traffic, lower pollution, and promote some economic development in the region. However, they do not know if this would really be the case in their regions, and the extent to which it may be successful. As discussed above, some interviewees indicated that there may be an opportunity for the U.S. DOT, state DOTs, or MPOs to take a lead role in quantifying these costs and benefits. Some interviewees also indicated that it may be useful identify current users of short-sea shipping services, discuss lessons learned and best practices, and use that information to identify common characteristics of a successful short-sea shipping operation. This information could be used to target potential users of short-sea shipping.
- **DOTs and MPOs should more effectively engage the private-sector freight community in the transportation planning process.** The majority of states and MPOs stated that they need to better engage the private-sector freight community within the planning process, through the creation of a freight taskforce or other such group. Through this taskforce states and MPOs could be better able to collect data, conduct studies, and involve members of the freight community in their planning efforts.

- **MPOs should include port representatives on their boards or advisory committees.** In addition to engaging the private-sector freight community in their planning efforts, most MPOs agreed that they should include a member of the local Port Authority in their policy and/or technical boards. As shown on Figure 2, approximately 86 percent of the MPOs interviewed said that they currently do include the ports in their boards. However, it is unclear how active these port representatives are in the MPO planning and programming process and what impact, if any, they have on MPO decision-making. MPOs should encourage port representatives to become active members of MPO boards and/or technical advisory committees.
- **DOTs and MPOs should enhance freight education and outreach efforts.** Many interviewees indicated that more education and outreach is necessary – particularly to the trucking industry, who may see short-sea shipping as a threat (rather than an opportunity). Education and outreach should not just focus on the potential environmental, social, and congestion benefits of short-sea shipping. Rather, it should focus on integrating short-sea shipping into existing supply chains. Clearly there is a role for the U.S. DOT, state DOTs, and MPOs in conducting education and outreach efforts.
- **Public-sector transportation agencies should provide incentives to encourage the use of short-sea shipping.** As discussed above, while the maritime industry is well aware of short-sea shipping operations, there are few financial incentives to encourage their use. Incentives, such as tax breaks, breaks on handling fees, and others will be necessary for shippers to begin to use short-sea shipping operations. State and MPO interviewees stressed the importance of state/metropolitan government involvement. Some Federal agencies, particularly the FHWA and FTA, have difficulty providing funding for the operation of freight facilities. Most of the funding available from these agencies is targeted to infrastructure improvements. States and MPOs can often work with these agencies to support the transfer of “infrastructure” funds to “operational” funds. State support is also required to support use of CMAQ funding, which must be approved for specific uses by the DOT. The New York State DOT is an example of a very supportive DOT – one interviewee cited this as one of the reasons why the Port of Albany has been able to get their short-sea shipping project off the ground more easily. Finally, MPOs can play a major role in attracting short-sea shipping to an area and ensuring that marine issues are addressed as part of the transportation planning process. This is particularly true in areas with smaller ports, where MPOs and Port Authorities often work together more frequently than in areas with large port facilities. In addition, MPOs are also “politically connected” through their boards and may have an easier time making things happen (if they can build advocacy).
- **The U.S. DOT and other stakeholders should conduct, support, or advocate for a short-sea shipping demonstration project.** Many interviewees indicated that it is essential to develop a demonstration project to “prove” that short-sea shipping can work. This is being done, to some degree, with PANYNJ’s PIDN, but many interviewees would like to see a high-speed (30-knot) demonstration project. Demonstration projects are key in building and maintaining momentum for short-sea shipping, but must include a long-term (more than five-year) commitment to truly demonstrate the feasibility of a short-sea shipping operation. Some interviewees encouraged the



U.S. DOT to find an industrial partner that would be willing to sponsor a demonstration and be capable of providing large volumes of freight (400 to 500 boxes per month, minimum).

- **DOTs and MPOs should encourage the sharing of success stories/lessons learned.** Many ports and terminals and some MPOs have experimented with or currently serve short-sea shipping operations. There is an opportunity for these ports to share their experiences with those peers that may be interested in attracting short-sea operations.
- **DOTs should encourage or facilitate port partnering.** As discussed above, ports are still very “parochial,” each looking out for its own market share. There is an opportunity for larger, load center ports to “partner” with smaller, niche ports to act as congestion relievers. Larger ports would benefit from reduced on-port congestion; smaller ports would benefit from increased throughput. Some interviewees noted that until the larger, load center ports “feel the pain” of congestion (either on-port or along access routes), this type of arrangement is unlikely.
- **Public-sector transportation planning organizations should concentrate their short-sea shipping initiatives on domestic cargo.** Some interviewees feel that short-sea shipping operations should be targeted towards domestic cargo. Many international shippers are not interested in short-sea shipping operations, and customs requirements for international shipments can introduce delay, making short-sea a less attractive option in comparison to other modes.
- **DOTs and MPOs should work with ports on access issues and on-port projects.** Some MPOs/DOTs agreed that they should work with the local port(s) to maintain a proper level of port access, and assist the port on obtaining funds for some on-port projects that might have benefits to the community in general.

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# Appendix D

*Standard Classification of Transported Good (SCTG)  
Codes*

# Appendix D

Table D.1 provides a list of the Standard Classification of Transported Good (SCTG) codes and associated commodity descriptions.

**Table D.1 Standard Classification of Transported Good (SCTG) Codes**

SCTG Code	Commodity Name
01	Live animals and live fish
02	Cereal grains
03	Other agricultural products
04	Animal feed and products of animal origin, n.e.c.
05	Meat, fish, seafood, and their preparations
06	Milled grain products and preparations, and bakery products
07	Other prepared foodstuffs and fats and oils
08	Alcoholic beverages
09	Tobacco products
10	Monumental or building stone
11	Natural sands
12	Gravel and crushed stone
13	Nonmetallic minerals, n.e.c.
14	Metallic ores and concentrates
15	Coal
16	Crude petroleum oil and bituminous mineral oil
17	Gasoline and aviation turbine fuel
18	Fuel oils
19	Coal and petroleum products, n.e.c.
20	Basic chemicals
21	Pharmaceutical products
22	Fertilizers
23	Chemical products and preparations, n.e.c.
24	Plastics and rubber
25	Logs and other wood in the rough
26	Wood products
27	Pulp, newsprint, paper, and paperboard
28	Paper or paperboard articles
29	Printed products
30	Textiles, leather, and articles of textiles or leather
31	Nonmetallic mineral products
32	Base metal in primary or semi-finished forms and in finished basic shapes

**Table D.1 Standard Classification of Transported Good (SCTG) Codes  
(continued)**

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<b>SCTG Code</b>	<b>Commodity Name</b>
33	Articles of base metal
34	Machinery
35	Electronic and other electrical equipment and components, and office equipment
36	Motorized and other vehicles (including parts)
37	Transportation equipment, n.e.c.
38	Precision instruments and apparatus
39	Furniture, mattresses and mattress supports, lamps, lighting fittings, and illuminated signs
40	Miscellaneous manufactured products
41	Waste and scrap
42	Miscellaneous Transported Products

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# Appendix E

*Inbound and Outbound Commodity Flows by State*

# Appendix E

Appendix E contains a series of 16 tables that were created during the freight analysis. The first set of eight tables detail the total amount of each good type that was both imported into and exported out of each of the I-95 Corridor Coalition states. The second set of eight tables examine only the goods that were imported into and exported out of each of the I-95 Corridor states from the rest of the nation, excluding the 16 states that make up the coalition. For the sake of clarity, only the top three goods for each state are provided.

Table E.17 provides a list of the Standard Classification of Transported Good (SCTG) codes and associated commodity descriptions.

**Table E.1 Top Goods by Weight Imported into the I-95 Corridor Coalition  
By Road (Tons)**

State	Commodity Group	Weight
Connecticut	Agricultural Products and Fish	3,303,709
	Metal Products and Machinery	1,981,451
	Pharmaceutical and Chemical Products	1,580,182
Delaware	Grains, Alcoholic Beverages, and Tobacco	1,543,351
	Pharmaceutical and Chemical Products	1,260,817
	Agricultural Products and Fish	602,679
Florida	Agricultural Products and Fish	21,229,556
	Coal and Petroleum Products	20,623,652
	Pharmaceutical and Chemical Products	8,367,414
Georgia	Agricultural Products and Fish	23,256,015
	Grains, Alcoholic Beverages, and Tobacco	9,381,167
	Pharmaceutical and Chemical Products	8,277,309
Maine	Agricultural Products and Fish	2,471,202
	Pharmaceutical and Chemical Products	369,417
	Wood Products, Textiles, and Leather	256,093
Maryland	Grains, Alcoholic Beverages, and Tobacco	3,463,129
	Agricultural Products and Fish	2,828,333
	Metal Products and Machinery	2,797,084
Massachusetts	Agricultural Products and Fish	6,598,319
	Grains, Alcoholic Beverages, and Tobacco	3,320,762
	Metal Products and Machinery	3,005,943
New Hampshire	Agricultural Products and Fish	2,459,114
	Pharmaceutical and Chemical Products	640,086
	Metal Products and Machinery	498,380
New Jersey	Agricultural Products and Fish	7,286,621
	Pharmaceutical and Chemical Products	4,619,307
	Grains, Alcoholic Beverages, and Tobacco	4,410,037
New York	Agricultural Products and Fish	8,373,534
	Metal Products and Machinery	7,782,947
	Grains, Alcoholic Beverages, and Tobacco	6,989,560
North Carolina	Agricultural Products and Fish	16,015,256
	Grains, Alcoholic Beverages, and Tobacco	6,394,540
	Pharmaceutical and Chemical Products	6,207,108
Pennsylvania	Agricultural Products and Fish	12,404,020
	Metal Products and Machinery	9,476,678
	Pharmaceutical and Chemical Products	7,664,497
Rhode Island	Agricultural Products and Fish	1,424,406
	Pharmaceutical and Chemical Products	435,704
	Coal and Petroleum Products	272,631
South Carolina	Agricultural Products and Fish	7,083,535
	Pharmaceutical and Chemical Products	4,564,110
	Wood Products, Textiles, and Leather	2,206,090
Vermont	Agricultural Products and Fish	1,468,994
	Wood Products, Textiles, and Leather	192,705
	Metal Products and Machinery	139,459
Virginia	Agricultural Products and Fish	8,921,548
	Pharmaceutical and Chemical Products	4,886,677
	Wood Products, Textiles, and Leather	3,772,156

**Table E.2 Top Goods by Weight Exported from the I-95 Corridor Coalition  
By Road (Tons)**

State	Commodity Group	Weight
Connecticut	Metal Products and Machinery	667,675
	Pharmaceutical and Chemical Products	401,870
	Electronics, Vehicles, and Precision Goods	111,098
Delaware	Pharmaceutical and Chemical Products	1,074,906
	Metal Products and Machinery	426,224
	Coal and Petroleum Products	180,330
Florida	Pharmaceutical and Chemical Products	5,119,154
	Grains, Alcoholic Beverages, and Tobacco	3,148,644
	Wood Products, Textiles, and Leather	2,930,078
Georgia	Wood Products, Textiles, and Leather	8,355,447
	Stone, Minerals, and Ores	6,224,158
	Grains, Alcoholic Beverages, and Tobacco	4,948,490
Maine	Wood Products, Textiles, and Leather	3,253,032
	Grains, Alcoholic Beverages, and Tobacco	1,021,046
	Pharmaceutical and Chemical Products	127,871
Maryland	Coal and Petroleum Products	2,931,561
	Stone, Minerals, and Ores	1,861,972
	Metal Products and Machinery	1,815,374
Massachusetts	Pharmaceutical and Chemical Products	690,204
	Wood Products, Textiles, and Leather	632,445
	Metal Products and Machinery	371,327
New Hampshire	Wood Products, Textiles, and Leather	234,925
	Pharmaceutical and Chemical Products	127,082
	Metal Products and Machinery	107,819
New Jersey	Pharmaceutical and Chemical Products	2,072,034
	Metal Products and Machinery	1,566,689
	Wood Products, Textiles, and Leather	730,658
New York	Metal Products and Machinery	5,474,811
	Wood Products, Textiles, and Leather	3,358,732
	Pharmaceutical and Chemical Products	3,179,110
North Carolina	Wood Products, Textiles, and Leather	6,569,073
	Stone, Minerals, and Ores	6,342,472
	Pharmaceutical and Chemical Products	6,234,774
Pennsylvania	Metal Products and Machinery	10,166,243
	Coal and Petroleum Products	9,199,916
	Stone, Minerals, and Ores	3,746,115
Rhode Island	Metal Products and Machinery	176,584
	Pharmaceutical and Chemical Products	104,986
	Wood Products, Textiles, and Leather	72,370
South Carolina	Wood Products, Textiles, and Leather	2,768,623
	Pharmaceutical and Chemical Products	1,848,341
	Metal Products and Machinery	1,758,407
Vermont	Wood Products, Textiles, and Leather	165,737
	Stone, Minerals, and Ores	85,110
	Pharmaceutical and Chemical Products	48,516
Virginia	Wood Products, Textiles, and Leather	2,939,521
	Pharmaceutical and Chemical Products	2,543,593
	Electronics, Vehicles, and Precision Goods	2,207,074



**Table E.3 Top Goods by Weight Imported into the I-95 Corridor Coalition  
By Water (Tons)**

State	Commodity Group	Weight
Connecticut	Furniture and Miscellaneous Products	81,469
	Coal and Petroleum Products	77,200
Delaware	Pharmaceutical and Chemical Products	49,387
	Furniture and Miscellaneous Products	6,197
Florida	Coal and Petroleum Products	33,325,034
	Furniture and Miscellaneous Products	5,312,752
	Pharmaceutical and Chemical Products	2,607,381
Georgia	Coal and Petroleum Products	750,047
	Pharmaceutical and Chemical Products	195,520
	Furniture and Miscellaneous Products	31,995
Maine	Furniture and Miscellaneous Products	99,557
Maryland	Furniture and Miscellaneous Products	93,256
Massachusetts	Coal and Petroleum Products	273,837
	Furniture and Miscellaneous Products	10,907
New Hampshire	Furniture and Miscellaneous Products	12,638
New Jersey	Pharmaceutical and Chemical Products	607,910
	Coal and Petroleum Products	287,324
	Stone, Minerals, and Ores	1,116
New York	Furniture and Miscellaneous Products	1,869,632
	Coal and Petroleum Products	448,153
	Pharmaceutical and Chemical Products	303,909
North Carolina	Pharmaceutical and Chemical Products	424,380
	Coal and Petroleum Products	304,790
	Furniture and Miscellaneous Products	36,637
Pennsylvania	Coal and Petroleum Products	11,242,454
	Stone, Minerals, and Ores	2,284,566
	Pharmaceutical and Chemical Products	1,302,033
Rhode Island	Coal and Petroleum Products	69,391
	Furniture and Miscellaneous Products	8,094
South Carolina	Pharmaceutical and Chemical Products	759,772
	Coal and Petroleum Products	566,337
	Furniture and Miscellaneous Products	59,811
Virginia	Furniture and Miscellaneous Products	48,447
	Pharmaceutical and Chemical Products	22,857
	Coal and Petroleum Products	17,948

**Table E.4 Top Goods by Weight Exported from the I-95 Corridor Coalition  
By Water (Tons)**

State	Commodity Group	Weight
Connecticut	Furniture and Miscellaneous Products	11,462
Delaware	Furniture and Miscellaneous Products	23,765
Florida	Stone, Minerals, and Ores	5,310,907
	Furniture and Miscellaneous Products	2,125,371
	Coal and Petroleum Products	89,984
Georgia	Furniture and Miscellaneous Products	81,422
Maryland	Furniture and Miscellaneous Products	555,755
New Jersey	Furniture and Miscellaneous Products	191,188
	Coal and Petroleum Products	89,255
New York	Furniture and Miscellaneous Products	268,037
	Coal and Petroleum Products	3,494,393
Pennsylvania	Furniture and Miscellaneous Products	2,348,130
	Metal Products and Machinery	148,524
Rhode Island	Furniture and Miscellaneous Products	14,723
South Carolina	Furniture and Miscellaneous Products	56,011
Virginia	Coal and Petroleum Products	31,349
	Furniture and Miscellaneous Products	8,466

**Table E.5 Top Goods by Value Imported into the I-95 Corridor Coalition  
By Road (Dollars)**

State	Commodity Group	Value
Connecticut	Metal Products and Machinery	\$ 5,932,714,088
	Pharmaceutical and Chemical Products	\$ 2,920,287,836
	Wood Products, Textiles, and Leather	\$ 2,916,720,826
Delaware	Grains, Alcoholic Beverages, and Tobacco	\$ 4,902,232,964
	Pharmaceutical and Chemical Products	\$ 1,866,615,309
	Electronics, Vehicles, and Precision Goods	\$ 1,688,319,521
Florida	Coal and Petroleum Products	\$ 28,878,272,597
	Pharmaceutical and Chemical Products	\$ 14,252,229,002
	Grains, Alcoholic Beverages, and Tobacco	\$ 13,086,801,654
Georgia	Grains, Alcoholic Beverages, and Tobacco	\$ 18,771,996,347
	Pharmaceutical and Chemical Products	\$ 15,737,146,948
	Wood Products, Textiles, and Leather	\$ 12,199,829,072
Maine	Pharmaceutical and Chemical Products	\$ 1,096,619,536
	Wood Products, Textiles, and Leather	\$ 757,881,327
	Grains, Alcoholic Beverages, and Tobacco	\$ 618,577,984
Maryland	Grains, Alcoholic Beverages, and Tobacco	\$ 22,962,160,252
	Metal Products and Machinery	\$ 11,421,648,209
	Wood Products, Textiles, and Leather	\$ 4,410,788,677
Massachusetts	Grains, Alcoholic Beverages, and Tobacco	\$ 18,045,548,553
	Metal Products and Machinery	\$ 11,318,691,611
	Pharmaceutical and Chemical Products	\$ 7,021,791,346
New Hampshire	Pharmaceutical and Chemical Products	\$ 1,964,896,513
	Metal Products and Machinery	\$ 1,914,656,186
	Wood Products, Textiles, and Leather	\$ 1,291,492,184
New Jersey	Pharmaceutical and Chemical Products	\$ 27,778,952,485
	Grains, Alcoholic Beverages, and Tobacco	\$ 12,806,260,709
	Coal and Petroleum Products	\$ 11,881,794,236
New York	Metal Products and Machinery	\$ 32,306,503,411
	Grains, Alcoholic Beverages, and Tobacco	\$ 19,329,297,670
	Pharmaceutical and Chemical Products	\$ 15,244,374,260
North Carolina	Grains, Alcoholic Beverages, and Tobacco	\$ 19,609,049,561
	Pharmaceutical and Chemical Products	\$ 14,388,116,785
	Wood Products, Textiles, and Leather	\$ 12,021,772,097
Pennsylvania	Metal Products and Machinery	\$ 31,409,411,448
	Pharmaceutical and Chemical Products	\$ 22,684,436,367
	Grains, Alcoholic Beverages, and Tobacco	\$ 11,053,271,918
Rhode Island	Pharmaceutical and Chemical Products	\$ 1,875,120,726
	Coal and Petroleum Products	\$ 1,137,322,494
	Wood Products, Textiles, and Leather	\$ 1,091,875,466
South Carolina	Pharmaceutical and Chemical Products	\$ 8,913,577,498
	Wood Products, Textiles, and Leather	\$ 7,428,019,151
	Grains, Alcoholic Beverages, and Tobacco	\$ 6,485,983,543
Vermont	Wood Products, Textiles, and Leather	\$ 1,143,490,482
	Metal Products and Machinery	\$ 360,759,857
	Pharmaceutical and Chemical Products	\$ 353,822,972
Virginia	Pharmaceutical and Chemical Products	\$ 24,315,642,101
	Wood Products, Textiles, and Leather	\$ 11,175,837,804
	Stone, Minerals, and Ores	\$ 9,269,551,842

**Table E.6 Top Goods by Value Exported from the I-95 Corridor Coalition  
By Road (Dollars)**

State	Commodity Group	Value
Connecticut	Metal Products and Machinery	\$ 2,381,953,158
	Pharmaceutical and Chemical Products	\$ 1,622,748,516
	Wood Products, Textiles, and Leather	\$ 648,932,093
Delaware	Grains, Alcoholic Beverages, and Tobacco	\$ 1,949,842,099
	Pharmaceutical and Chemical Products	\$ 1,453,005,032
	Electronics, Vehicles, and Precision Goods	\$ 1,132,942,806
Florida	Coal and Petroleum Products	\$ 15,560,344,899
	Pharmaceutical and Chemical Products	\$ 9,777,059,463
	Grains, Alcoholic Beverages, and Tobacco	\$ 5,954,836,601
Georgia	Grains, Alcoholic Beverages, and Tobacco	\$ 15,402,715,208
	Pharmaceutical and Chemical Products	\$ 14,055,128,325
	Wood Products, Textiles, and Leather	\$ 8,870,661,210
Maine	Pharmaceutical and Chemical Products	\$ 5,109,557,390
	Wood Products, Textiles, and Leather	\$ 1,222,873,411
	Grains, Alcoholic Beverages, and Tobacco	\$ 1,116,953,343
Maryland	Grains, Alcoholic Beverages, and Tobacco	\$ 8,695,586,471
	Metal Products and Machinery	\$ 7,690,616,105
	Wood Products, Textiles, and Leather	\$ 2,702,511,681
Massachusetts	Grains, Alcoholic Beverages, and Tobacco	\$ 4,069,058,925
	Metal Products and Machinery	\$ 1,864,602,730
	Pharmaceutical and Chemical Products	\$ 1,595,233,478
New Hampshire	Pharmaceutical and Chemical Products	\$ 1,276,985,765
	Metal Products and Machinery	\$ 979,255,399
	Wood Products, Textiles, and Leather	\$ 588,709,504
New Jersey	Pharmaceutical and Chemical Products	\$ 4,239,020,501
	Grains, Alcoholic Beverages, and Tobacco	\$ 3,900,745,036
	Coal and Petroleum Products	\$ 3,007,083,000
New York	Metal Products and Machinery	\$ 27,223,338,944
	Grains, Alcoholic Beverages, and Tobacco	\$ 16,062,456,230
	Pharmaceutical and Chemical Products	\$ 11,593,330,261
North Carolina	Grains, Alcoholic Beverages, and Tobacco	\$ 28,989,382,752
	Pharmaceutical and Chemical Products	\$ 19,384,703,560
	Wood Products, Textiles, and Leather	\$ 14,336,847,914
Pennsylvania	Metal Products and Machinery	\$ 19,785,015,593
	Pharmaceutical and Chemical Products	\$ 15,850,998,853
	Grains, Alcoholic Beverages, and Tobacco	\$ 6,843,001,500
Rhode Island	Pharmaceutical and Chemical Products	\$ 657,210,382
	Coal and Petroleum Products	\$ 358,402,463
	Wood Products, Textiles, and Leather	\$ 358,021,102
South Carolina	Pharmaceutical and Chemical Products	\$ 15,774,302,409
	Wood Products, Textiles, and Leather	\$ 10,469,923,656
	Grains, Alcoholic Beverages, and Tobacco	\$ 6,313,706,988
Vermont	Wood Products, Textiles, and Leather	\$ 371,494,646
	Metal Products and Machinery	\$ 267,687,547
	Pharmaceutical and Chemical Products	\$ 198,880,057
Virginia	Pharmaceutical and Chemical Products	\$ 19,416,113,522
	Wood Products, Textiles, and Leather	\$ 5,765,587,563
	Stone, Minerals, and Ores	\$ 5,481,553,568

**Table E.7 Top Goods by Value Imported into the I-95 Corridor Coalition  
By Water (Dollars)**

State	Commodity Group	Value
Connecticut	Furniture and Miscellaneous Products	\$ 103,019,613
	Coal and Petroleum Products	\$ 16,151,975
Delaware	Pharmaceutical and Chemical Products	\$ 52,965,723
	Furniture and Miscellaneous Products	\$ 6,357,050
Florida	Coal and Petroleum Products	\$ 5,369,505,976
	Pharmaceutical and Chemical Products	\$ 2,804,399,741
	Furniture and Miscellaneous Products	\$ 931,449,362
Georgia	Pharmaceutical and Chemical Products	\$ 209,686,493
	Coal and Petroleum Products	\$ 156,926,408
	Furniture and Miscellaneous Products	\$ 4,898,425
Maine	Furniture and Miscellaneous Products	\$ 68,398,157
Maryland	Furniture and Miscellaneous Products	\$ 81,358,526
Massachusetts	Coal and Petroleum Products	\$ 57,292,762
	Furniture and Miscellaneous Products	\$ 16,447,270
New Hampshire	Furniture and Miscellaneous Products	\$ 18,189,003
New Jersey	Pharmaceutical and Chemical Products	\$ 651,956,568
	Coal and Petroleum Products	\$ 60,114,524
	Furniture and Miscellaneous Products	\$ 86,060
New York	Furniture and Miscellaneous Products	\$ 438,645,270
	Pharmaceutical and Chemical Products	\$ 325,928,999
	Coal and Petroleum Products	\$ 93,763,529
North Carolina	Pharmaceutical and Chemical Products	\$ 455,128,416
	Coal and Petroleum Products	\$ 63,768,916
	Furniture and Miscellaneous Products	\$ 11,897,559
Pennsylvania	Metal Products and Machinery	\$ 1,440,290,406
	Pharmaceutical and Chemical Products	\$ 1,396,372,929
	Coal and Petroleum Products	\$ 551,268,958
Rhode Island	Coal and Petroleum Products	\$ 14,518,079
	Furniture and Miscellaneous Products	\$ 5,858,645
South Carolina	Pharmaceutical and Chemical Products	\$ 814,821,449
	Coal and Petroleum Products	\$ 118,490,300
	Furniture and Miscellaneous Products	\$ 52,103,462
Virginia	Furniture and Miscellaneous Products	\$ 48,178,794
	Pharmaceutical and Chemical Products	\$ 24,512,781
	Coal and Petroleum Products	\$ 3,755,082

**Table E.8 Top Goods by Value Exported from the I-95 Corridor Coalition  
By Water (Dollars)**

State	Commodity Group	Value
Connecticut	Furniture and Miscellaneous Products	\$ 1,754,862
Delaware	Furniture and Miscellaneous Products	\$ 3,638,421
Florida	Furniture and Miscellaneous Products	\$ 341,872,825
	Stone, Minerals, and Ores	\$ 73,697,901
	Coal and Petroleum Products	\$ 17,839,306
Georgia	Furniture and Miscellaneous Products	\$ 26,796,479
Maryland	Furniture and Miscellaneous Products	\$ 85,325,971
New Jersey	Furniture and Miscellaneous Products	\$ 40,065,388
	Coal and Petroleum Products	\$ 18,674,094
New York	Furniture and Miscellaneous Products	\$ 78,393,653
Pennsylvania	Furniture and Miscellaneous Products	\$ 391,432,922
	Metal Products and Machinery	\$ 233,402,545
	Pharmaceutical and Chemical Products	\$ 134,035,753
Rhode Island	Furniture and Miscellaneous Products	\$ 5,613,803
South Carolina	Furniture and Miscellaneous Products	\$ 24,274,660
Virginia	Coal and Petroleum Products	\$ 6,558,968
	Furniture and Miscellaneous Products	\$ 1,296,109

**Table E.9 Top Goods by Weight Imported into and within the I-95 Corridor Coalition**  
By Road (Tons)

State	Commodity Group	Weight
Connecticut	Stone, Minerals, and Ores	27,558,550
	Coal and Petroleum Products	9,153,335
	Metal Products and Machinery	5,112,181
Delaware	Stone, Minerals, and Ores	5,590,582
	Coal and Petroleum Products	4,739,307
	Grains, Alcoholic Beverages, and Tobacco	4,058,932
Florida	Stone, Minerals, and Ores	227,053,276
	Pharmaceutical and Chemical Products	34,929,515
	Agricultural Products and Fish	32,837,462
Georgia	Stone, Minerals, and Ores	194,907,967
	Wood Products, Textiles, and Leather	56,924,981
	Grains, Alcoholic Beverages, and Tobacco	32,044,837
Maine	Coal and Petroleum Products	20,426,534
	Wood Products, Textiles, and Leather	8,391,970
	Stone, Minerals, and Ores	5,331,167
Maryland	Stone, Minerals, and Ores	65,183,530
	Grains, Alcoholic Beverages, and Tobacco	13,346,407
	Metal Products and Machinery	9,552,533
Massachusetts	Stone, Minerals, and Ores	64,439,281
	Coal and Petroleum Products	21,119,054
	Grains, Alcoholic Beverages, and Tobacco	8,877,278
New Hampshire	Coal and Petroleum Products	14,891,763
	Stone, Minerals, and Ores	7,740,553
	Wood Products, Textiles, and Leather	5,042,967
New Jersey	Stone, Minerals, and Ores	101,851,685
	Coal and Petroleum Products	21,783,122
	Pharmaceutical and Chemical Products	16,137,760
New York	Stone, Minerals, and Ores	241,337,848
	Grains, Alcoholic Beverages, and Tobacco	36,442,854
	Agricultural Products and Fish	26,256,295
North Carolina	Stone, Minerals, and Ores	129,095,861
	Wood Products, Textiles, and Leather	38,088,324
	Grains, Alcoholic Beverages, and Tobacco	27,010,518
Pennsylvania	Stone, Minerals, and Ores	269,392,779
	Coal and Petroleum Products	47,470,898
	Metal Products and Machinery	32,080,620
Rhode Island	Coal and Petroleum Products	5,808,552
	Stone, Minerals, and Ores	1,747,001
	Metal Products and Machinery	1,610,326
South Carolina	Stone, Minerals, and Ores	64,053,299
	Wood Products, Textiles, and Leather	28,844,286
	Pharmaceutical and Chemical Products	15,166,754
Vermont	Stone, Minerals, and Ores	2,805,144
	Agricultural Products and Fish	2,366,666
	Wood Products, Textiles, and Leather	1,770,675
Virginia	Stone, Minerals, and Ores	130,454,073
	Wood Products, Textiles, and Leather	31,165,954
	Grains, Alcoholic Beverages, and Tobacco	18,935,604

**Table E.10 Top Goods by Weight Exported from and within the I-95  
Corridor Coalition**  
*By Road (Tons)*

State	Commodity Group	Weight
Connecticut	Stone, Minerals, and Ores	28,731,245
	Coal and Petroleum Products	5,145,674
	Metal Products and Machinery	4,842,585
Delaware	Stone, Minerals, and Ores	5,034,013
	Coal and Petroleum Products	4,581,699
	Grains, Alcoholic Beverages, and Tobacco	4,306,290
Florida	Stone, Minerals, and Ores	224,687,952
	Pharmaceutical and Chemical Products	29,799,910
	Agricultural Products and Fish	23,691,294
Georgia	Stone, Minerals, and Ores	201,063,844
	Wood Products, Textiles, and Leather	60,283,816
	Grains, Alcoholic Beverages, and Tobacco	20,549,801
Maine	Coal and Petroleum Products	19,020,509
	Wood Products, Textiles, and Leather	11,197,107
	Stone, Minerals, and Ores	7,552,972
Maryland	Stone, Minerals, and Ores	56,824,059
	Grains, Alcoholic Beverages, and Tobacco	12,585,133
	Metal Products and Machinery	8,335,090
Massachusetts	Stone, Minerals, and Ores	64,520,664
	Coal and Petroleum Products	21,713,445
	Grains, Alcoholic Beverages, and Tobacco	4,929,108
New Hampshire	Coal and Petroleum Products	14,041,782
	Stone, Minerals, and Ores	7,652,958
	Wood Products, Textiles, and Leather	6,037,463
New Jersey	Stone, Minerals, and Ores	91,784,242
	Coal and Petroleum Products	21,118,440
	Pharmaceutical and Chemical Products	14,857,003
New York	Stone, Minerals, and Ores	240,663,635
	Grains, Alcoholic Beverages, and Tobacco	30,674,967
	Agricultural Products and Fish	21,905,726
North Carolina	Stone, Minerals, and Ores	132,690,917
	Wood Products, Textiles, and Leather	40,790,315
	Grains, Alcoholic Beverages, and Tobacco	23,215,712
Pennsylvania	Stone, Minerals, and Ores	281,945,155
	Coal and Petroleum Products	58,853,885
	Metal Products and Machinery	26,295,558
Rhode Island	Coal and Petroleum Products	3,441,987
	Stone, Minerals, and Ores	1,088,710
	Metal Products and Machinery	520,158
South Carolina	Stone, Minerals, and Ores	61,394,456
	Wood Products, Textiles, and Leather	31,847,403
	Pharmaceutical and Chemical Products	13,828,027
Vermont	Stone, Minerals, and Ores	1,597,875
	Agricultural Products and Fish	1,423,170
	Wood Products, Textiles, and Leather	1,412,455
Virginia	Stone, Minerals, and Ores	131,645,872
	Wood Products, Textiles, and Leather	29,912,059
	Grains, Alcoholic Beverages, and Tobacco	12,678,862



**Table E.11 Top Goods by Weight Imported into and within the I-95 Corridor Coalition**  
By Water (Tons)

State	Commodity Group	Weight
Connecticut	Coal and Petroleum Products	9,321,370
	Furniture and Miscellaneous Products	2,694,270
	Stone, Minerals, and Ores	850,381
Delaware	Coal and Petroleum Products	1,416,853
	Furniture and Miscellaneous Products	1,261,454
	Pharmaceutical and Chemical Products	137,511
Florida	Coal and Petroleum Products	48,429,827
	Furniture and Miscellaneous Products	9,821,091
	Pharmaceutical and Chemical Products	3,440,211
Georgia	Furniture and Miscellaneous Products	873,659
	Coal and Petroleum Products	774,471
	Pharmaceutical and Chemical Products	316,659
Maine	Coal and Petroleum Products	2,233,087
	Furniture and Miscellaneous Products	450,994
Maryland	Furniture and Miscellaneous Products	3,772,237
	Coal and Petroleum Products	3,026,322
	Stone, Minerals, and Ores	2,197,061
Massachusetts	Coal and Petroleum Products	6,958,561
	Furniture and Miscellaneous Products	2,708,740
	Stone, Minerals, and Ores	690,900
New Hampshire	Coal and Petroleum Products	689,069
	Furniture and Miscellaneous Products	43,691
New Jersey	Coal and Petroleum Products	15,370,295
	Furniture and Miscellaneous Products	8,056,355
	Pharmaceutical and Chemical Products	1,286,672
New York	Coal and Petroleum Products	27,633,213
	Furniture and Miscellaneous Products	7,181,931
	Stone, Minerals, and Ores	569,820
North Carolina	Pharmaceutical and Chemical Products	2,181,520
	Furniture and Miscellaneous Products	1,305,675
	Coal and Petroleum Products	1,294,104
Pennsylvania	Coal and Petroleum Products	38,213,442
	Furniture and Miscellaneous Products	9,959,043
	Stone, Minerals, and Ores	6,299,140
Rhode Island	Coal and Petroleum Products	3,118,167
	Furniture and Miscellaneous Products	1,112,938
South Carolina	Furniture and Miscellaneous Products	836,707
	Pharmaceutical and Chemical Products	759,772
	Coal and Petroleum Products	738,503
Virginia	Furniture and Miscellaneous Products	7,579,995
	Stone, Minerals, and Ores	4,504,526
	Coal and Petroleum Products	3,208,125

**Table E.12 Top Goods by Weight Exported from and within the I-95 Corridor Coalition**  
By Water (Tons)

State	Commodity Group	Weight
Connecticut	Coal and Petroleum Products	2,523,153
	Stone, Minerals, and Ores	1,415,358
	Furniture and Miscellaneous Products	543,198
Delaware	Furniture and Miscellaneous Products	11,122,882
	Coal and Petroleum Products	2,171,741
Florida	Coal and Petroleum Products	14,885,849
	Furniture and Miscellaneous Products	6,991,005
	Stone, Minerals, and Ores	6,168,710
Georgia	Furniture and Miscellaneous Products	593,763
	Coal and Petroleum Products	328,837
	Pharmaceutical and Chemical Products	121,140
Maine	Coal and Petroleum Products	188,136
	Furniture and Miscellaneous Products	128,715
Maryland	Furniture and Miscellaneous Products	4,794,700
	Stone, Minerals, and Ores	2,190,639
	Coal and Petroleum Products	1,045,779
Massachusetts	Furniture and Miscellaneous Products	1,916,077
	Coal and Petroleum Products	1,664,058
	Stone, Minerals, and Ores	10,990
New Hampshire	Furniture and Miscellaneous Products	667
New Jersey	Coal and Petroleum Products	29,557,364
	Furniture and Miscellaneous Products	2,479,450
	Pharmaceutical and Chemical Products	478,540
New York	Coal and Petroleum Products	26,493,706
	Furniture and Miscellaneous Products	9,384,485
	Stone, Minerals, and Ores	683,787
North Carolina	Pharmaceutical and Chemical Products	1,757,140
	Furniture and Miscellaneous Products	1,349,962
	Coal and Petroleum Products	732,689
Pennsylvania	Coal and Petroleum Products	35,111,019
	Furniture and Miscellaneous Products	4,799,723
	Stone, Minerals, and Ores	4,121,400
Rhode Island	Furniture and Miscellaneous Products	119,512
	Coal and Petroleum Products	37,861
South Carolina	Furniture and Miscellaneous Products	370,875
	Coal and Petroleum Products	68,813
	Metal Products and Machinery	51,051
Virginia	Furniture and Miscellaneous Products	10,323,465
	Stone, Minerals, and Ores	4,507,705
	Coal and Petroleum Products	3,958,870

**Table E.13 Top Goods by Value Imported into and within the I-95 Corridor Coalition**  
By Road (Dollars)

State	Commodity Group	Value
Connecticut	Metal Products and Machinery	\$ 12,955,956,320
	Electronics, Vehicles, and Precision Goods	\$ 8,372,022,126
	Pharmaceutical and Chemical Products	\$ 8,265,479,689
Delaware	Electronics, Vehicles, and Precision Goods	\$ 8,604,463,250
	Pharmaceutical and Chemical Products	\$ 6,117,062,684
	Grains, Alcoholic Beverages, and Tobacco	\$ 3,648,859,632
Florida	Wood Products, Textiles, and Leather	\$ 55,346,581,224
	Pharmaceutical and Chemical Products	\$ 48,312,794,773
	Electronics, Vehicles, and Precision Goods	\$ 41,168,066,676
Georgia	Wood Products, Textiles, and Leather	\$ 57,329,812,517
	Electronics, Vehicles, and Precision Goods	\$ 46,121,161,831
	Grains, Alcoholic Beverages, and Tobacco	\$ 35,802,574,023
Maine	Wood Products, Textiles, and Leather	\$ 6,138,090,075
	Electronics, Vehicles, and Precision Goods	\$ 4,273,583,226
	Grains, Alcoholic Beverages, and Tobacco	\$ 3,918,436,167
Maryland	Metal Products and Machinery	\$ 33,015,570,170
	Electronics, Vehicles, and Precision Goods	\$ 21,913,383,740
	Grains, Alcoholic Beverages, and Tobacco	\$ 14,790,282,291
Massachusetts	Electronics, Vehicles, and Precision Goods	\$ 27,428,480,829
	Metal Products and Machinery	\$ 22,154,864,929
	Wood Products, Textiles, and Leather	\$ 20,668,139,379
New Hampshire	Metal Products and Machinery	\$ 8,036,234,373
	Wood Products, Textiles, and Leather	\$ 5,207,513,640
	Electronics, Vehicles, and Precision Goods	\$ 5,192,037,710
New Jersey	Furniture and Miscellaneous Products	\$ 49,089,741,032
	Electronics, Vehicles, and Precision Goods	\$ 35,410,874,778
	Pharmaceutical and Chemical Products	\$ 26,810,624,797
New York	Wood Products, Textiles, and Leather	\$ 79,761,645,999
	Electronics, Vehicles, and Precision Goods	\$ 70,046,057,398
	Metal Products and Machinery	\$ 55,900,504,673
North Carolina	Wood Products, Textiles, and Leather	\$ 44,130,693,504
	Electronics, Vehicles, and Precision Goods	\$ 42,606,336,767
	Grains, Alcoholic Beverages, and Tobacco	\$ 29,130,289,944
Pennsylvania	Metal Products and Machinery	\$ 60,948,340,369
	Electronics, Vehicles, and Precision Goods	\$ 53,626,725,156
	Wood Products, Textiles, and Leather	\$ 36,031,716,073
Rhode Island	Electronics, Vehicles, and Precision Goods	\$ 4,336,810,624
	Wood Products, Textiles, and Leather	\$ 3,264,693,929
	Metal Products and Machinery	\$ 2,295,612,570
South Carolina	Wood Products, Textiles, and Leather	\$ 42,781,907,932
	Electronics, Vehicles, and Precision Goods	\$ 27,101,745,725
	Metal Products and Machinery	\$ 25,163,671,516
Vermont	Electronics, Vehicles, and Precision Goods	\$ 4,161,382,515
	Wood Products, Textiles, and Leather	\$ 3,040,692,533
	Grains, Alcoholic Beverages, and Tobacco	\$ 2,613,941,376
Virginia	Electronics, Vehicles, and Precision Goods	\$ 53,695,063,921
	Wood Products, Textiles, and Leather	\$ 31,204,446,231
	Metal Products and Machinery	\$ 30,342,692,197

**Table E.14 Top Goods by Value Exported from and within the I-95 Corridor Coalition**  
By Road (Dollars)

State	Commodity Group	Value
Connecticut	Metal Products and Machinery	\$ 12,563,262,789
	Electronics, Vehicles, and Precision Goods	\$ 6,941,115,657
	Pharmaceutical and Chemical Products	\$ 5,898,286,931
Delaware	Electronics, Vehicles, and Precision Goods	\$ 5,493,864,634
	Pharmaceutical and Chemical Products	\$ 5,423,484,061
	Grains, Alcoholic Beverages, and Tobacco	\$ 4,710,784,201
Florida	Wood Products, Textiles, and Leather	\$ 56,360,484,468
	Pharmaceutical and Chemical Products	\$ 34,218,906,141
	Electronics, Vehicles, and Precision Goods	\$ 32,731,351,213
Georgia	Wood Products, Textiles, and Leather	\$ 64,677,935,700
	Electronics, Vehicles, and Precision Goods	\$ 45,813,610,948
	Grains, Alcoholic Beverages, and Tobacco	\$ 28,346,473,727
Maine	Wood Products, Textiles, and Leather	\$ 15,758,581,001
	Electronics, Vehicles, and Precision Goods	\$ 9,396,984,013
	Grains, Alcoholic Beverages, and Tobacco	\$ 4,615,885,487
Maryland	Metal Products and Machinery	\$ 22,448,750,571
	Electronics, Vehicles, and Precision Goods	\$ 19,119,363,878
	Grains, Alcoholic Beverages, and Tobacco	\$ 13,860,198,916
Massachusetts	Electronics, Vehicles, and Precision Goods	\$ 16,154,617,446
	Metal Products and Machinery	\$ 11,919,332,842
	Wood Products, Textiles, and Leather	\$ 10,957,948,982
New Hampshire	Metal Products and Machinery	\$ 7,033,693,973
	Wood Products, Textiles, and Leather	\$ 4,955,346,267
	Electronics, Vehicles, and Precision Goods	\$ 4,321,137,764
New Jersey	Furniture and Miscellaneous Products	\$ 22,394,896,810
	Electronics, Vehicles, and Precision Goods	\$ 20,361,671,825
	Pharmaceutical and Chemical Products	\$ 20,199,470,549
New York	Wood Products, Textiles, and Leather	\$ 73,981,681,233
	Electronics, Vehicles, and Precision Goods	\$ 69,740,115,762
	Metal Products and Machinery	\$ 51,175,344,597
North Carolina	Wood Products, Textiles, and Leather	\$ 58,431,855,493
	Electronics, Vehicles, and Precision Goods	\$ 53,389,951,630
	Grains, Alcoholic Beverages, and Tobacco	\$ 34,806,337,727
Pennsylvania	Metal Products and Machinery	\$ 53,988,457,380
	Electronics, Vehicles, and Precision Goods	\$ 33,361,380,134
	Wood Products, Textiles, and Leather	\$ 32,939,888,707
Rhode Island	Electronics, Vehicles, and Precision Goods	\$ 1,478,889,174
	Wood Products, Textiles, and Leather	\$ 1,472,666,989
	Metal Products and Machinery	\$ 988,051,950
South Carolina	Wood Products, Textiles, and Leather	\$ 42,850,159,155
	Electronics, Vehicles, and Precision Goods	\$ 33,567,076,454
	Metal Products and Machinery	\$ 31,838,193,927
Vermont	Electronics, Vehicles, and Precision Goods	\$ 2,141,110,169
	Wood Products, Textiles, and Leather	\$ 1,397,063,397
	Grains, Alcoholic Beverages, and Tobacco	\$ 1,257,045,466
Virginia	Electronics, Vehicles, and Precision Goods	\$ 46,012,060,136
	Wood Products, Textiles, and Leather	\$ 29,287,670,432
	Metal Products and Machinery	\$ 23,741,877,003

**Table E.15 Top Goods by Value Imported into and within the I-95  
Corridor Coalition**  
*By Water (Dollars)*

State	Commodity Group	Value
Connecticut	Coal and Petroleum Products	\$ 1,950,237,452
	Furniture and Miscellaneous Products	\$ 562,168,456
	Pharmaceutical and Chemical Products	\$ 13,519,915
Delaware	Coal and Petroleum Products	\$ 296,436,998
	Furniture and Miscellaneous Products	\$ 200,100,394
	Pharmaceutical and Chemical Products	\$ 147,474,977
Florida	Coal and Petroleum Products	\$ 8,529,262,416
	Pharmaceutical and Chemical Products	\$ 3,700,091,132
	Furniture and Miscellaneous Products	\$ 1,675,517,168
Georgia	Pharmaceutical and Chemical Products	\$ 339,603,308
	Coal and Petroleum Products	\$ 162,036,457
	Furniture and Miscellaneous Products	\$ 136,383,642
Maine	Coal and Petroleum Products	\$ 467,211,407
	Furniture and Miscellaneous Products	\$ 156,916,770
Maryland	Furniture and Miscellaneous Products	\$ 723,106,450
	Coal and Petroleum Products	\$ 633,173,785
	Pharmaceutical and Chemical Products	\$ 186,761,580
Massachusetts	Coal and Petroleum Products	\$ 1,455,885,339
	Furniture and Miscellaneous Products	\$ 443,572,355
	Stone, Minerals, and Ores	\$ 86,642,240
New Hampshire	Coal and Petroleum Products	\$ 144,168,508
	Furniture and Miscellaneous Products	\$ 27,011,491
New Jersey	Coal and Petroleum Products	\$ 3,215,806,972
	Furniture and Miscellaneous Products	\$ 2,112,926,721
	Pharmaceutical and Chemical Products	\$ 1,379,898,613
New York	Coal and Petroleum Products	\$ 5,776,522,862
	Furniture and Miscellaneous Products	\$ 1,431,011,445
	Wood Products, Textiles, and Leather	\$ 1,193,789,264
North Carolina	Pharmaceutical and Chemical Products	\$ 2,339,583,963
	Furniture and Miscellaneous Products	\$ 292,262,016
	Coal and Petroleum Products	\$ 270,755,303
Pennsylvania	Pharmaceutical and Chemical Products	\$ 2,263,040,922
	Coal and Petroleum Products	\$ 2,155,925,553
	Metal Products and Machinery	\$ 1,686,440,700
Rhode Island	Coal and Petroleum Products	\$ 652,389,704
	Furniture and Miscellaneous Products	\$ 230,861,718
South Carolina	Pharmaceutical and Chemical Products	\$ 814,821,449
	Furniture and Miscellaneous Products	\$ 264,544,548
	Coal and Petroleum Products	\$ 154,511,249
Virginia	Wood Products, Textiles, and Leather	\$ 4,734,317,032
	Metal Products and Machinery	\$ 3,707,035,888
	Electronics, Vehicles, and Precision Goods	\$ 3,661,648,516

**Table E.16 Top Goods by Value Exported from and within the I-95 Corridor Coalition**  
*By Water (Dollars)*

State	Commodity Group	Value
Connecticut	Coal and Petroleum Products	\$ 527,899,535
	Furniture and Miscellaneous Products	\$ 140,052,580
	Stone, Minerals, and Ores	\$ 18,517,335
Delaware	Furniture and Miscellaneous Products	\$ 1,702,934,337
	Coal and Petroleum Products	\$ 454,376,405
Florida	Coal and Petroleum Products	\$ 3,112,961,113
	Furniture and Miscellaneous Products	\$ 1,135,383,171
	Pharmaceutical and Chemical Products	\$ 895,691,390
Georgia	Pharmaceutical and Chemical Products	\$ 129,916,815
	Furniture and Miscellaneous Products	\$ 106,490,692
	Coal and Petroleum Products	\$ 68,800,064
Maine	Furniture and Miscellaneous Products	\$ 58,377,698
	Coal and Petroleum Products	\$ 39,362,247
Maryland	Wood Products, Textiles, and Leather	\$ 2,202,630,483
	Metal Products and Machinery	\$ 1,732,556,594
	Electronics, Vehicles, and Precision Goods	\$ 1,700,442,902
Massachusetts	Coal and Petroleum Products	\$ 348,157,877
	Furniture and Miscellaneous Products	\$ 295,622,952
	Wood Products, Textiles, and Leather	\$ 18,784,140
New Hampshire	Furniture and Miscellaneous Products	\$ 102,163
New Jersey	Coal and Petroleum Products	\$ 6,184,056,810
	Pharmaceutical and Chemical Products	\$ 513,212,511
	Furniture and Miscellaneous Products	\$ 470,500,963
New York	Coal and Petroleum Products	\$ 5,538,112,610
	Furniture and Miscellaneous Products	\$ 2,636,755,397
	Wood Products, Textiles, and Leather	\$ 1,255,681,136
North Carolina	Pharmaceutical and Chemical Products	\$ 1,884,455,547
	Furniture and Miscellaneous Products	\$ 303,775,748
	Coal and Petroleum Products	\$ 153,294,739
Pennsylvania	Coal and Petroleum Products	\$ 2,691,052,333
	Pharmaceutical and Chemical Products	\$ 927,898,994
	Furniture and Miscellaneous Products	\$ 787,714,190
Rhode Island	Furniture and Miscellaneous Products	\$ 51,287,089
	Coal and Petroleum Products	\$ 7,921,454
South Carolina	Furniture and Miscellaneous Products	\$ 150,923,637
	Metal Products and Machinery	\$ 79,261,723
	Coal and Petroleum Products	\$ 14,397,170
Virginia	Wood Products, Textiles, and Leather	\$ 2,541,692,475
	Metal Products and Machinery	\$ 1,986,264,504
	Electronics, Vehicles, and Precision Goods	\$ 1,965,635,221

**Table E.17 Standard Classification of Transported Good (SCTG) Codes**

<b>SCTG Code</b>	<b>Commodity Name</b>
01	Live animals and live fish
02	Cereal grains
03	Other agricultural products
04	Animal feed and products of animal origin, n.e.c.
05	Meat, fish, seafood, and their preparations
06	Milled grain products and preparations, and bakery products
07	Other prepared foodstuffs and fats and oils
08	Alcoholic beverages
09	Tobacco products
10	Monumental or building stone
11	Natural sands
12	Gravel and crushed stone
13	Nonmetallic minerals, n.e.c.
14	Metallic ores and concentrates
15	Coal
16	Crude petroleum oil and bituminous mineral oil
17	Gasoline and aviation turbine fuel
18	Fuel oils
19	Coal and petroleum products, n.e.c.
20	Basic chemicals
21	Pharmaceutical products
22	Fertilizers
23	Chemical products and preparations, n.e.c.
24	Plastics and rubber
25	Logs and other wood in the rough
26	Wood products
27	Pulp, newsprint, paper, and paperboard
28	Paper or paperboard articles
29	Printed products
30	Textiles, leather, and articles of textiles or leather
31	Nonmetallic mineral products
32	Base metal in primary or semi-finished forms and in finished basic shapes
33	Articles of base metal
34	Machinery
35	Electronic and other electrical equipment and components, and office equipment
36	Motorized and other vehicles (including parts)
37	Transportation equipment, n.e.c.
38	Precision instruments and apparatus
39	Furniture, mattresses and mattress supports, lamps, lighting fittings, and illuminated signs
40	Miscellaneous manufactured products
41	Waste and scrap
42	Miscellaneous Transported Products

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# Appendix F

*Technical Memorandum No. 2 –  
Application of GIS to Short-Sea Shipping*



# **Technical Memorandum No. 2 – Application of GIS to Short-Sea Shipping**

## ■ **1.0 Applications of GIS in Transportation Studies**

Industry and government continue to be concerned about the capacity of ports and intermodal terminals – and the highways, rail lines, and waterways that serve them – to handle steadily increasing volumes of intermodal freight traffic. The volume of intermodal freight traffic is growing significantly, and is expected to double over the next decade.

One strategy that may mitigate the current and projected effects of congestion and effectively increase the capacity available to freight shipments is to expand the use of short-sea shipping (SSS). Short-sea shipping describes marine shipping operations between ports along a single coast or involving a short-sea crossing. Examples of these routes include Jacksonville to San Juan; Tacoma to Anchorage; Los Angeles to Seattle; or St. Louis to New Orleans. Where freight can be moved economically and reliably by short-sea shipping, it may reduce the need for parallel truck or rail moves and help relieve highway and rail congestion.

The concept of using short-sea shipping as a strategy to handle steadily growing freight volumes while mitigating highway and rail congestion has received a significant amount of attention over the last several years. MARAD is beginning to focus on investigating ways the U.S. marine transportation system can be used to more effectively manage freight growth and provide an effective alternative to the landside transportation system. Specifically, MARAD is exploring the development of a robust short-sea shipping system to aid in the reduction of growing freight congestion on the nation’s rail and highway systems. As part of its Short-Sea Initiative, MARAD has formed a Short-Sea Shipping Cooperative Program (SCOOP), consisting of short-sea shipping stakeholders from government entities and the maritime industry, to help guide the development of an integrated short-sea system.

This technical memorandum will highlight a variety of analytical transportation tasks with which GIS is able to assist, and will detail how a combination of spreadsheet, relational database, and GIS software was used to develop an understanding of current freight flow patterns and begin to develop an understanding of potential SSS markets. While this memorandum discusses the procedures and methodologies used to apply GIS to this study, it is not intended to serve as a “how-to” guide on how to use the various software applications that were required in the analysis. Rather, it is designed to provide guidance to the I-95 Corridor Coalition and MARAD in the use of GIS in future short-sea shipping and other analyses.

## What Is GIS?

A GIS is a spatial database that is able to display vast numbers of records in a graphical manner, linking information to specific locations. Multiple layers of spatial information can be layered over each other and viewed simultaneously, allowing for trends and patterns within the database to become readily apparent to those who view the map. The key strength of a GIS is its ability to turn a database that contains thousands of records that are not necessarily easy to interpret into a map that is able to convey a pattern or meaning in a matter of seconds. There are a number of transportation-related applications for GIS and many Federal, state, and local agencies use GIS applications in support of their transportation planning and policy activities. Examples include freight flow mapping, asset management of roads and bridges, bus service coverage assessments, and emission impact mapping.

The ability of GIS to turn data into information that is useful to transportation planners and policy-makers is one of its key strengths. GIS analyses can be run quickly and cost effectively, facilitating the identification of historical trends and impacts. However, GIS applications are dependent upon robust and accurate data. Data collection and integration is a particular problem for freight transportation-related activities, as data that describe the movement of commodities or freight vehicles can be difficult or expensive to obtain and validate. Despite these challenges, the interface between the user and the GIS itself is simple, allowing even novice users to mine useful, detailed information from the completed database that can help guide decisions at the operational or strategic level.

Once a GIS database has been established, queries can be made based on the information contained within the map, including:

- Location-based queries (e.g., where is the nearest port/distribution facility?);
- Route queries (e.g., what is the most efficient route to take?);
- Pattern detection (e.g., which routes tend to have high volumes of traffic?);
- Change detection (e.g., how have freight flows changed over time?); and
- Modeling scenarios (e.g., how many ships pass a planned pier-loading facility?).

Although a GIS itself can never be a panacea to an organization's problems, it does have the ability to shed light on the causes of those problems and what may be the best way to tackle those problems.

## ■ 2.0 Use of GIS within this Study

There are two key areas in which GIS played a significant role in this study, namely the mapping of current freight flows and in mapping existing SSS operations. The following sections describe how GIS was used in mapping freight shipments along both land and water networks and in displaying current waterborne operations.

### 2.1 Freight Flow Mapping

One of the strengths of GIS is the ability to reduce large amounts of complex data into more meaningful graphics that convey the same information visually. This SSS study uses the FHWA FAF database to calculate the volume and direction of freight shipments within the United States. The FAF is made up of more than 60,000 individual records, each of which describes a single freight movement between two locations. While these records can be collated and totaled up into more meaningful numbers (as is the case in the following two sections), the overall picture of the movements of goods is still hidden when the data are presented in a tabular format. By integrating the tables into a GIS, the key corridors of travel can quickly become apparent, revealing information that may otherwise have escaped notice.

This technical memorandum uses GIS to map current freight flows within the United States, both on land and water; it does not, however, map future freight flows.

### 2.2 SSS Operations Mapping

An additional strength of GIS is the ability to place complex concepts in a visual context, thereby allowing patterns to be clearly seen. One such concept is the mapping of current SSS operations. While the number of firms that currently provide SSS services is limited, the number of routes traversed is more numerous. Interviews with shippers could identify the spectrum of routes that are currently in use, and an overlay pattern in a GIS would clearly indicate those routes that are most heavily traveled. In addition to displaying the trade paths that are most traveled, the analysis would provide insight into those routes that are also currently underserved.

This technical memorandum incorporates a sample image, Figure 2.1, of how current SSS operations could be mapped. While interviews with some short-sea shipping operators were conducted for this project, an insufficient level of data exists to justify the necessary level of effort required to map a complete picture of existing SSS trade routes. As such, Figure 2.1 displays only those routes currently operated by Columbia Coastal on the Eastern Seaboard.

**Figure 2.1** Columbia Coastal's Primary SSS Routes



## ■ 3.0 Use of GIS in Displaying Existing Freight Flows

This section provides a detailed description of how a GIS was used to analyze and display commodity movements provided by the FHWA FAF database along the U.S. highway and waterway networks.

### 3.1 Introduction to the Freight Analysis Framework

Commodity flows were based on values included in the FHWA FAF project. The FAF was an effort of the FHWA in 1998 as part of a program to better understand the magnitude and geography of freight moving within the United States; analyze changes in freight flows and networks; highlight mismatches in national and regional freight demand and supply; and understand the regional significance of freight corridors and nodes. While the FAF data do not provide the level of geographic detail useful for detailed regional, statewide, or metropolitan freight planning, they can be useful in identifying key transportation corridors for specific commodity groups.

The FAF dataset records commodities using the Standard Transportation Commodity Group (STCC) codes at the two-digit level. Commodity flows are provided for 1998 on four modes: truck, rail, air, and water. Forecasts are provided for 2010 and 2020. Additional details about the FAF, including the methodology and assumptions used in the forecast development, are available from FHWA's Office of Freight Management and Operations. The FAF provides commodity flow data for both Canada and the United States, with a state level of detail provided for flows within the United States and a country level of detail for imports and exports. For this study, only domestic movements were analyzed due to the lack of detail for origins or destinations beyond the Canada-U.S. border.

The STCC codes used in the FAF were assigned to 10 commodity groups that were based on the Standard Classification of Transported Good (SCTG) system for analysis in order to allow for a clearer understanding of the commodity flow patterns. Table 3.1 describes the commodity groupings and the SCTG codes included in those groupings. A detailed description of each of the SCTG codes is provided in Appendix A.

Commodity flows were analyzed and reported by both weight (in U.S. short tons) and value (in U.S. dollars). Insight into the weight of commodities that are transported along the I-95 Corridor Coalition's highway and water networks is important in understanding the ways in which trucking and shipping companies use the transportation network, and can facilitate the identification of key routes that could potentially incorporate SSS routes in order to alleviate congested areas.

**Table 3.1 Commodity Groupings and Description**

SCTG Codes	Description
01-05	Agricultural products and fish
06-09	Grains, alcoholic beverages, and tobacco
10-14	Stone, minerals, and ores
15-20	Coal and petroleum products
21-24	Pharmaceutical and chemical products
25-30	Wood products, textiles, and leather
31-34	Metal products and machinery
35-38	Electronics, vehicles, and precision goods
39-43	Furniture and miscellaneous products
-	Hazardous materials

An understanding of the value of freight shipments within the region is also important, particularly because the corridor accounts for the movement of such a large percentage of the nation's goods. As the FAF dataset does not include a value component, it was necessary to assign values that would reflect the worth of each shipment. Using information derived from the U.S. Commodity Flow Survey (CFS), an average value per ton for each commodity classification was calculated and applied to the FAF database.

It is important to note that the FAF forecasts were developed in 1998 following a period of strong economic and trade growth, and reflect neither the 2001-2002 economic downturn nor the impacts of new security requirements instituted in the wake of 9/11. Given this fact, the decision was made to use the 1998 values contained within the FAF rather than attempt to extrapolate 2005 values using the 2010 forecast.

### 3.2 Freight Analysis Methodology

The state-to-state-level data contained within the FAF allowed for numerous types of analysis. The FAF data were imported into Microsoft Access where a relational database was assembled. This database converted the STCC codes into SCTG groupings, assigned a dollar value to each freight shipment, and grouped the shipments by state and commodity grouping. Queries were developed in order to create tables that detailed freight transportation along both highway and water routes, measured in both weight and value.

A series of eight tables were created for these scenarios that detailed the total amount of each good type that was both imported into and exported out of each of the I-95 Corridor states. A further set of eight tables were developed that examined only the goods that were imported into and exported out of each of the I-95 Corridor states from the rest of the

nation, excluding the 16 states that make up the coalition. Appendix B contains these 16 tables, although for clarity only the top three goods for each state are provided. A series of charts were created from the tables that highlight the breakdown in good type that are imported into and exported out of the I-95 Corridor by water and road; these charts will be discussed in the following section.

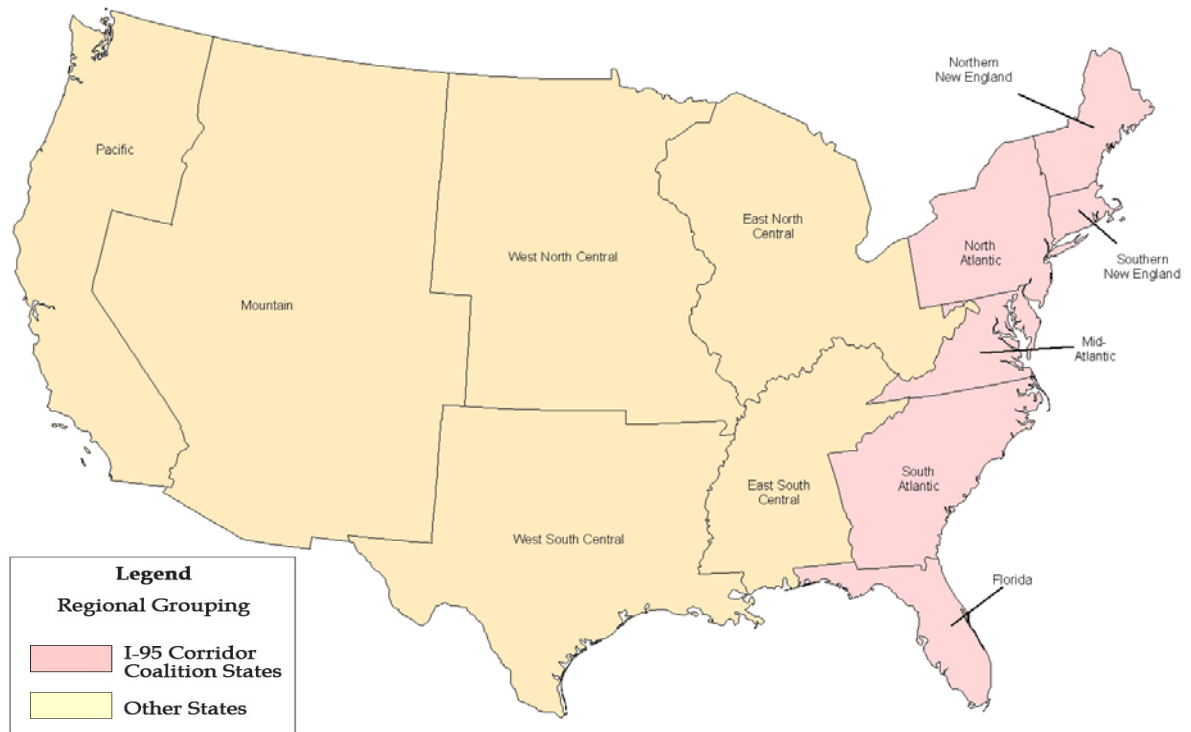
### 3.3 GIS Analysis Methodology

In order to more effectively highlight the national freight flows provided by the FAF, the 50 states and the District of Columbia were grouped into 11 regions, detailed in Table 3.2. The regional groups are based on those used by the U.S. Census bureau, although in several instances groups were partitioned to allow a finer level of detail to be analyzed. Figure 3.1 illustrates the location of the regional groups.

**Table 3.2 Regional Grouping of States**

Region	States
Northern New England	Maine, New Hampshire, Vermont
Southern New England	Connecticut, Massachusetts, Rhode Island
North Atlantic	New Jersey, New York, Pennsylvania
Mid-Atlantic	Delaware, District of Columbia, Maryland, Virginia
South Atlantic	Georgia, North Carolina, South Carolina
Florida	Florida
Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
East North Central	Indiana, Michigan, Ohio, West Virginia, Wisconsin, Alabama, Kentucky, Mississippi, Tennessee
West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
West South Central	Arkansas, Louisiana, Oklahoma, Texas
Pacific	Alaska, California, Hawaii, Oregon, Washington

**Figure 3.1 Regional Grouping of States**



A further set of queries were performed in Microsoft Access that grouped the state-to-state freight flows into region-to-region flows. The queries were exported into Microsoft Excel, which was used to create pivot tables that compared the origins and destinations of the weight and value of freight movements. The output from the pivot tables was imported into ESRI's ArcGIS for GIS analysis.

A desire line map (within a GIS) is a schematic representation of travel between an origin and a destination. The map is built from a series of straight lines that connect trip origins and destinations, the relative width of each indicating the amount of travel that passes along that particular route. As with most GIS maps, the purpose of a desire line map is to convey a large amount of information in a simple, easily understood manner. The map provides insight into what goods are flowing where without assigning those flows to a specific transportation network, thereby keeping the map relatively uncluttered despite the large amount of data required to build the desire lines. The desire lines between each region were created through the use of a proprietary script, to which the origin-destination data for imports and exports by weight and value was linked. The top three commodity movements for each of the eight categories were mapped, and are presented in Section 5.0. Each of the commodities mapped within a category utilized the same scale in order to assist with the analysis of freight flow patterns.



## ■ 4.0 Freight Flow Analysis

This section details the results of the analysis performed on the FAF dataset. The tables and charts presented below highlight the types of goods that are moved along U.S. road and water routes, categorizing the top goods in terms of both weight and value. This kind of analysis can provide insight into which industries are using the region’s transportation network and the markets that they are currently serving, allowing analysts to determine potential targets for future SSS programs and initiatives. To prevent “double counting,” the tables and charts do not include internal movements within the I-95 Corridor Coalition region.

Table 4.1 details the top freight groups that are transported into and out of the I-95 Corridor Coalition region by road and by water in terms of weight, in tons and value, in dollars.

**Table 4.1 Weight and Value of Freight Movements Into and Out of the I-95 Corridor Coalition Region by Road and Water**

	<b>Weight</b>	<b>Good Type</b>	<b>Value</b>	<b>Good Type</b>
<b>Road Import</b>	125,726,842	Agricultural Products and Fish	\$ 238,107,590,737	Electronics, Vehicles, and Precision Goods
	58,499,181	Pharmaceutical and Chemical Products	\$ 157,936,120,562	Metal Products and Machinery
	56,171,694	Grains, Alcoholic Beverages, and Tobacco	\$ 102,678,415,413	Wood Products, Textiles, and Leather
	44,450,671	Metal Products and Machinery	\$ 89,128,381,613	Pharmaceutical and Chemical Products
	44,391,609	Wood Products, Textiles, and Leather	\$ 63,037,637,844	Grains, Alcoholic Beverages, and Tobacco
	39,165,821	Coal and Petroleum Products	\$ 30,880,245,562	Agricultural Products and Fish
	23,495,293	Stone, Minerals, and Ores	\$ 24,430,953,304	Furniture and Miscellaneous Products
	23,023,861	Electronics, Vehicles, and Precision Goods	\$ 7,509,989,797	Coal and Petroleum Products
	3,927,091	Furniture and Miscellaneous Products	\$ 2,507,749,919	Stone, Minerals, and Ores
<b>Road Exports</b>	36,227,993	Wood Products, Textiles, and Leather	\$ 161,825,180,236	Electronics, Vehicles, and Precision Goods
	31,952,944	Pharmaceutical and Chemical Products	\$ 99,692,622,982	Metal Products and Machinery
	31,542,551	Metal Products and Machinery	\$ 86,680,533,010	Wood Products, Textiles, and Leather
	23,794,351	Stone, Minerals, and Ores	\$ 50,296,312,068	Pharmaceutical and Chemical Products
	22,333,351	Grains, Alcoholic Beverages, and Tobacco	\$ 33,829,316,097	Grains, Alcoholic Beverages, and Tobacco
	15,936,972	Coal and Petroleum Products	\$ 16,729,813,966	Furniture and Miscellaneous Products
	14,550,105	Electronics, Vehicles, and Precision Goods	\$ 2,759,612,787	Coal and Petroleum Products
	6,880,083	Agricultural Products and Fish	\$ 1,886,668,243	Stone, Minerals, and Ores
	3,266,530	Furniture and Miscellaneous Products	\$ 1,765,479,471	Agricultural Products and Fish
<b>Water Imports</b>	47,362,514	Coal and Petroleum Products	\$ 6,735,773,099	Pharmaceutical and Chemical Products
	8,424,630	Furniture and Miscellaneous Products	\$ 6,505,556,510	Coal and Petroleum Products
	6,273,148	Pharmaceutical and Chemical Products	\$ 1,916,166,153	Furniture and Miscellaneous Products
	2,591,869	Stone, Minerals, and Ores	\$ 1,832,137,463	Metal Products and Machinery
	946,708	Metal Products and Machinery	\$ 504,711,143	Wood Products, Textiles, and Leather
	156,423	Wood Products, Textiles, and Leather	\$ 263,263,919	Electronics, Vehicles, and Precision Goods
	23,864	Electronics, Vehicles, and Precision Goods	\$ 96,950,175	Stone, Minerals, and Ores
	21,835	Agricultural Products and Fish	\$ 14,422,655	Agricultural Products and Fish
	1,731	Grains, Alcoholic Beverages, and Tobacco	\$ 1,893,179	Grains, Alcoholic Beverages, and Tobacco
<b>Water Exports</b>	5,684,330	Furniture and Miscellaneous Products	\$ 1,000,465,092	Furniture and Miscellaneous Products
	5,417,975	Stone, Minerals, and Ores	\$ 233,402,545	Metal Products and Machinery
	3,704,981	Coal and Petroleum Products	\$ 157,497,479	Coal and Petroleum Products
	148,524	Metal Products and Machinery	\$ 134,035,753	Pharmaceutical and Chemical Products
	124,980	Pharmaceutical and Chemical Products	\$ 79,983,075	Stone, Minerals, and Ores
	80,955	Agricultural Products and Fish	\$ 43,293,834	Agricultural Products and Fish
15,082	Grains, Alcoholic Beverages, and Tobacco	\$ 16,499,082	Grains, Alcoholic Beverages, and Tobacco	

Figure 4.1 shows the top commodities that were imported into the Coalition’s region by truck by weight. The top three commodity groups accounted for 57 percent of the total flows by weight, or 240 million tons. These commodity groups consisted of agricultural products and fish (30 percent), pharmaceutical and chemical products (14 percent); and grains, alcoholic beverages, and tobacco (13 percent).

**Figure 4.1 Road Imports by Weight**

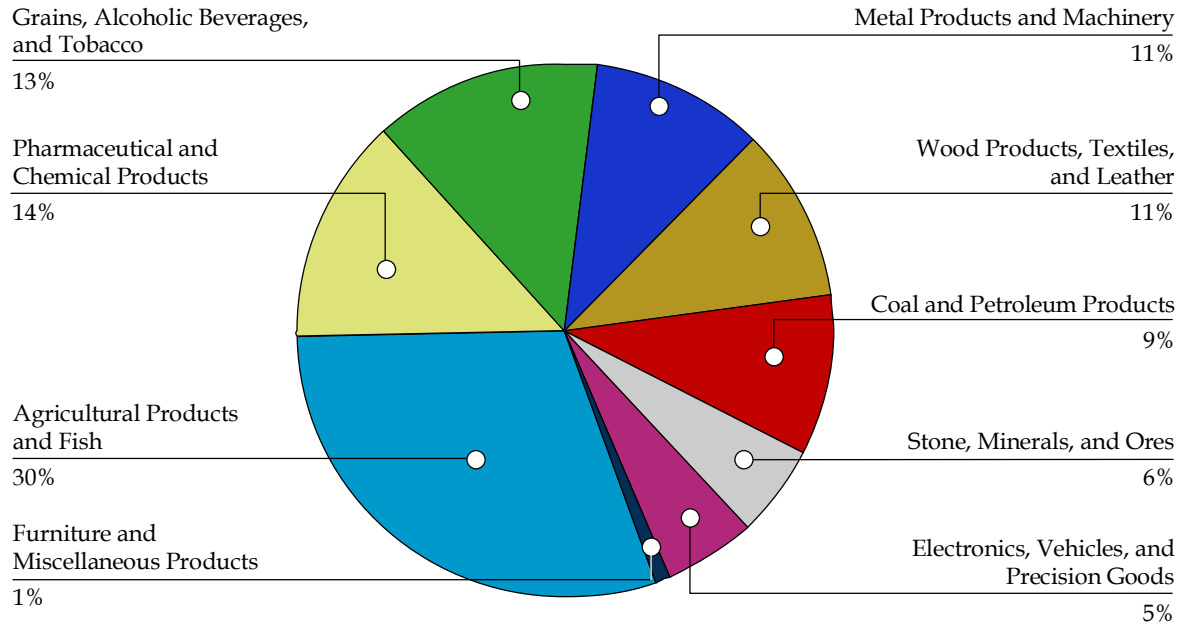


Figure 4.2 shows the top commodities that were exported out of the Coalition’s region by truck by weight. The top three commodity groups accounted for 53 percent of the total flows by weight, or 100 million tons. These commodity groups consisted of wood products, textiles, and leather (19 percent); wood pharmaceutical and chemical products (17 percent); and metal products and machinery (17 percent).

**Figure 4.2 Road Exports by Weight**

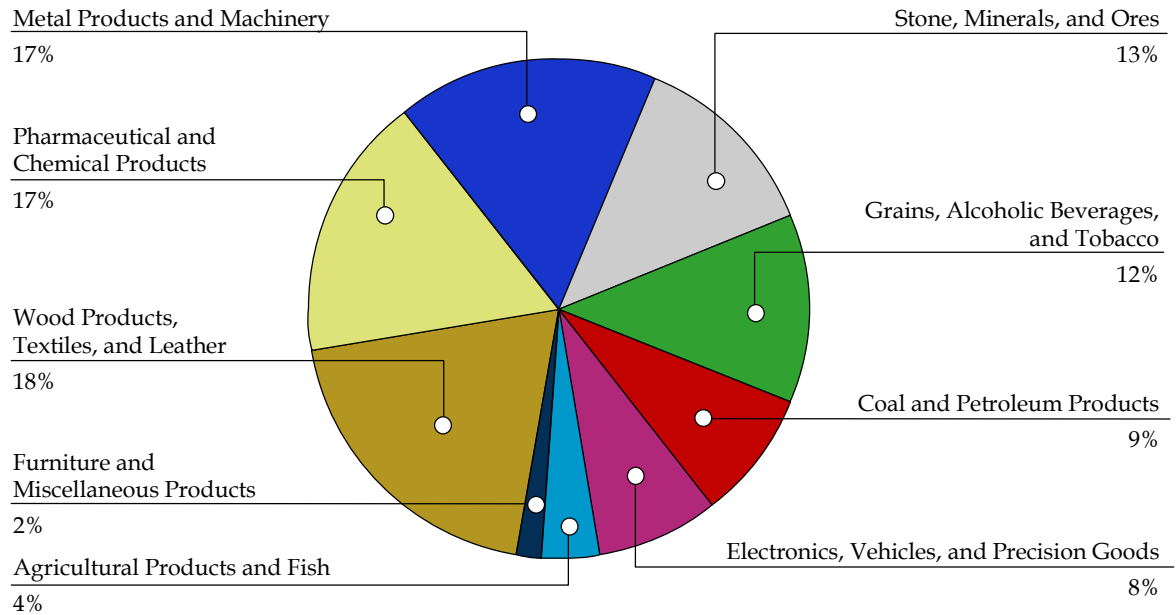


Figure 4.3 shows the top commodities that were imported into the Coalition’s region by ship by weight. The top three commodity groups accounted for 94 percent of the total flows by weight, or 62 million tons. These commodity groups consisted of coal and petroleum products (72 percent); furniture and miscellaneous products (13 percent); and pharmaceutical and chemical products (10 percent).

**Figure 4.3 Water Imports by Weight**

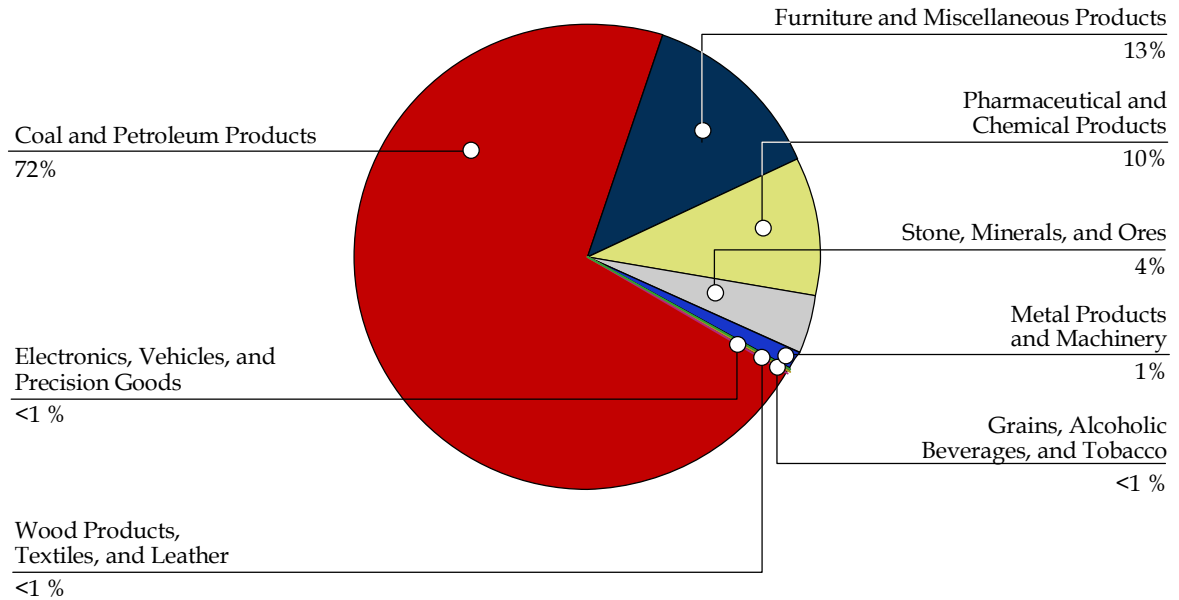


Figure 4.4 shows the top commodities that were exported out of the Coalition’s region by ship by weight. The top three commodity groups accounted for 94 percent of the total flows by weight, or 15 million tons. These commodity groups consisted of furniture and miscellaneous products (37 percent); stone, minerals, and ores (36 percent); and stone coal and petroleum products (24 percent).

**Figure 4.4 Water Exports by Weight**

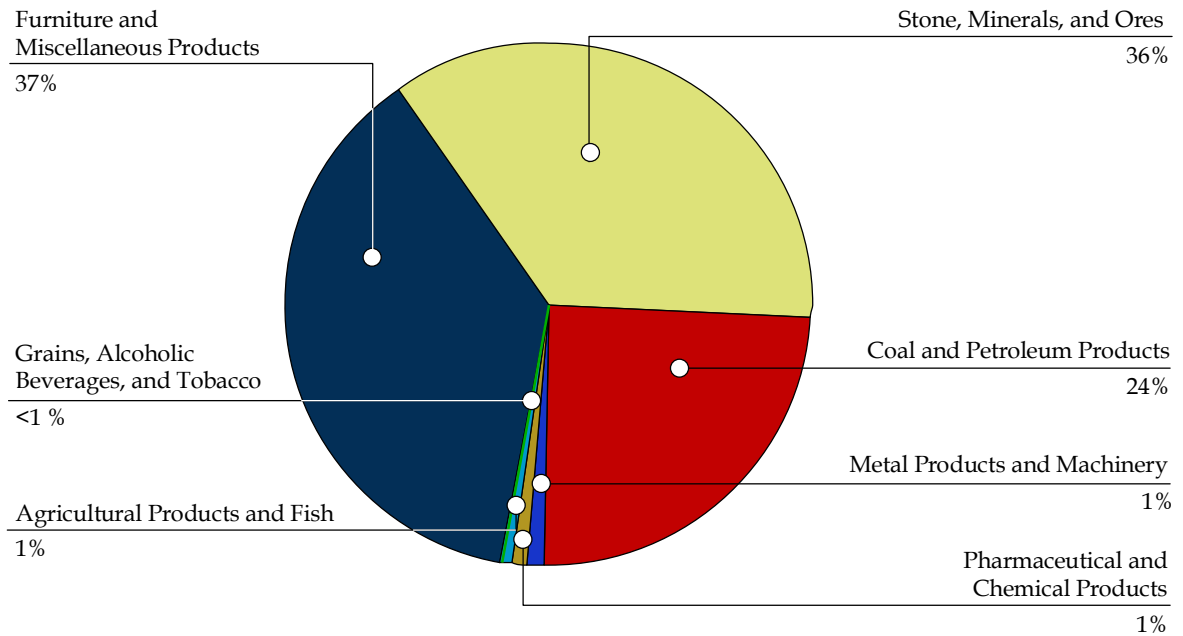


Figure 4.5 shows the top commodities that were imported into the Coalition’s region by truck by value. The top three commodity groups accounted for 70 percent of the total flows by value, or \$498.7 billion. These commodity groups consisted of electronics, vehicles, and precision goods (30 percent); metal products and machinery (14 percent); and wood products, textiles, and leather (14 percent).

**Figure 4.5 Road Imports by Value**

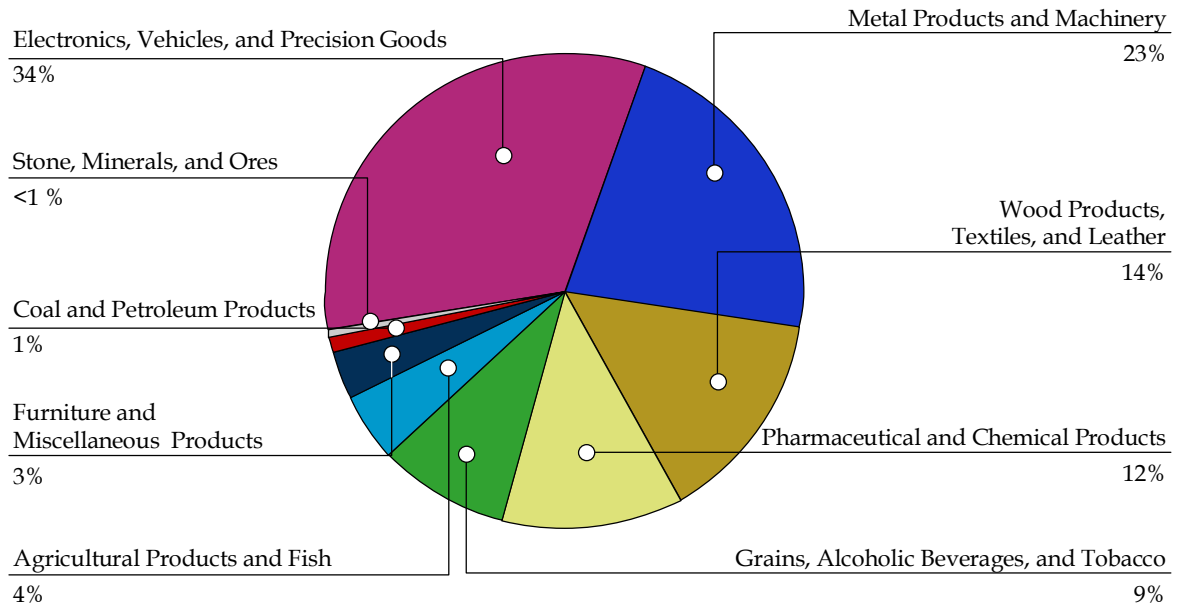


Figure 4.6 shows the top commodities that were exported out of the Coalition’s region by truck by value. The top three commodity groups accounted for 76 percent of the total flows by value, or \$348.2 billion. These commodity groups consisted of electronics, vehicles, and precision goods (36 percent); metal products and machinery (22 percent); and wood products, textiles, and leather (19 percent).

**Figure 4.6 Road Exports by Value**

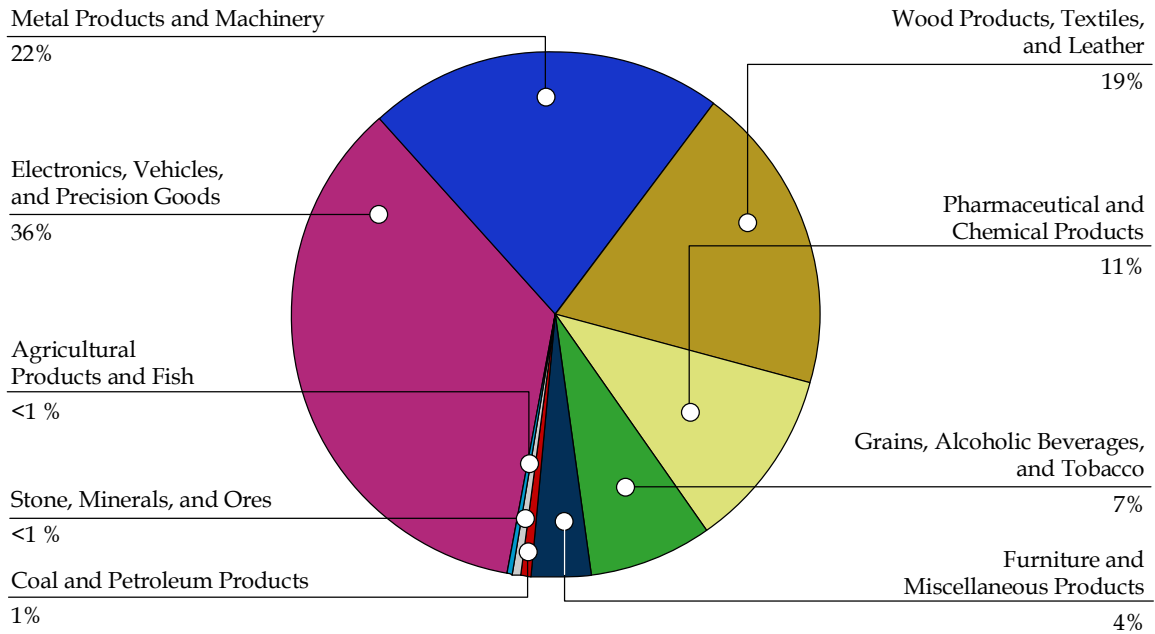


Figure 4.7 shows the top commodities that were imported into the Coalition’s region by ship by value. The top three commodity groups accounted for 85 percent of the total flows by value, or \$15.2 billion. These commodity groups consisted of pharmaceutical and chemical products (38 percent); coal and petroleum products (36 percent); and furniture and miscellaneous products (11 percent).

**Figure 4.7 Water Imports by Value**

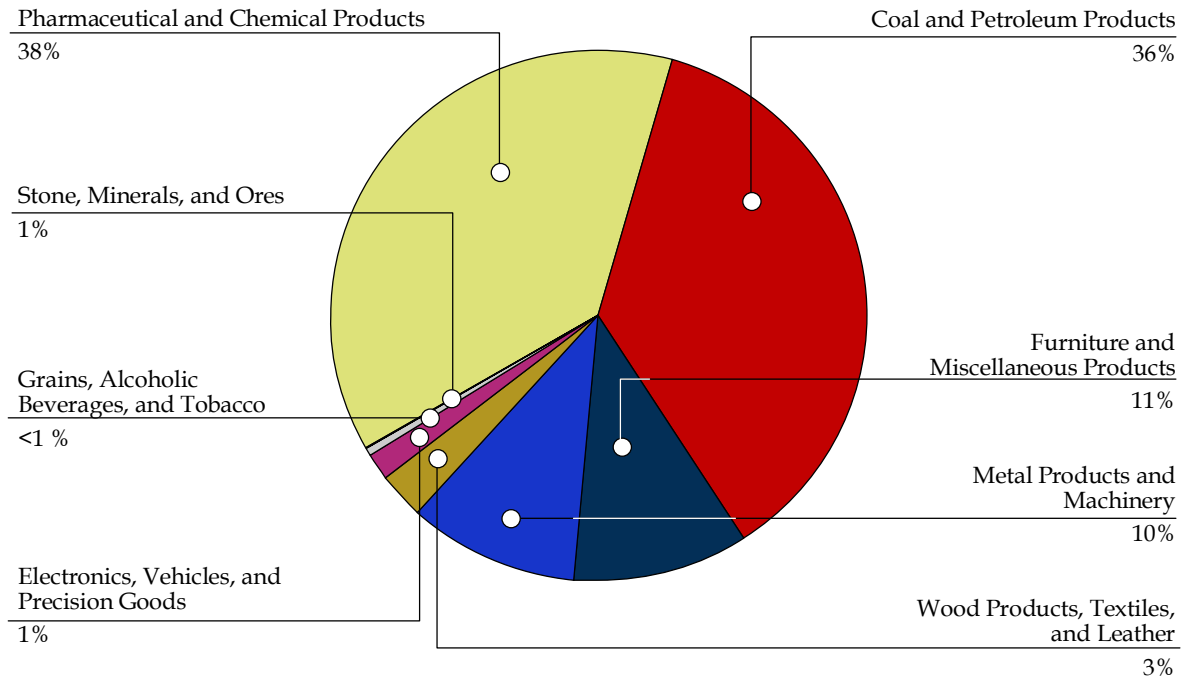
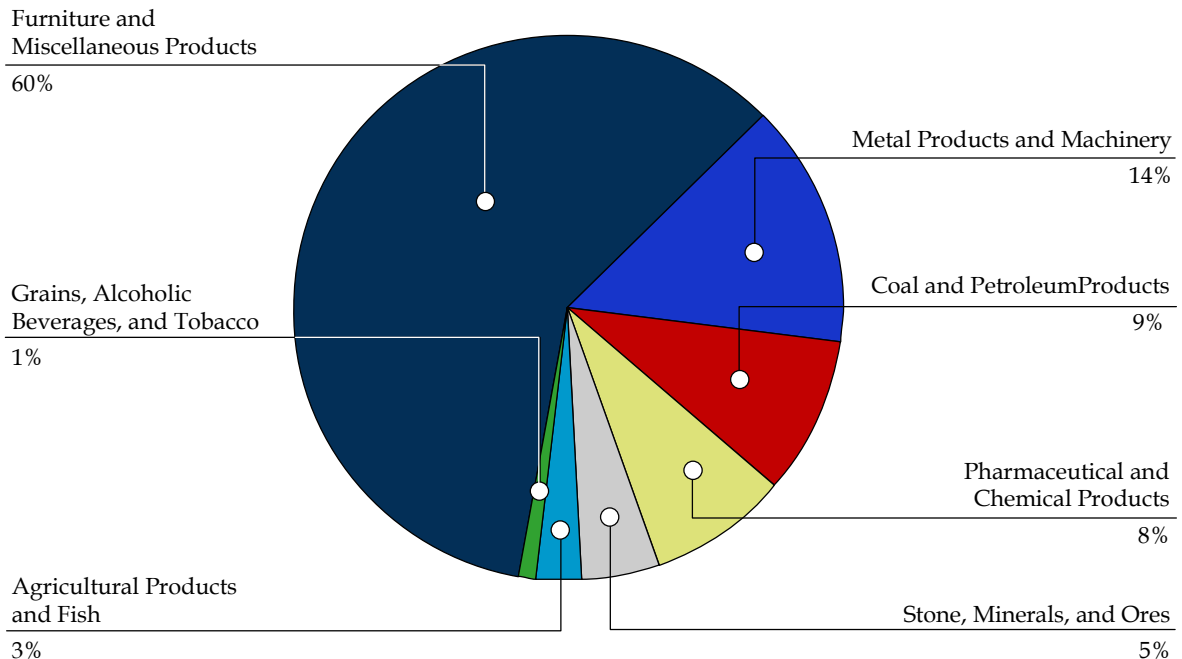




Figure 4.8 shows the top commodities that were exported out of the Coalition's region by ship by value. The top three commodity groups accounted for 84 percent of the total flows by value, or \$1.4 billion dollars. These commodity groups consisted of furniture and miscellaneous products (60 percent); metal products and machinery (14 percent); and coal and petroleum products (nine percent).

**Figure 4.8 Water Exports by Value**



The results of the analysis clearly demonstrate that the top-tier goods typically moved along the highway network differ from those moved along the water network. Also of note is the relative concentration of waterborne movements in a few key categories, namely coal and petroleum products and furniture and miscellaneous products, with metal products and machinery and pharmaceutical and chemical products to a lesser degree. In contrast, land freight movements are more evenly distributed amongst the various product groups.

One aspect of current freight movements that is important to make clear is the difference in total weight that is shipped along the road network versus the water network. While the total weight of imports into and exports out of the I-95 Corridor Coalition region on land is 605 million tons, the total weight on water is just 90 million tons. This represents a 13 percent share of the total goods that move in and out of the region. The waterborne share of the total value of freight movement is even smaller, at just \$20 billion of the \$1,172 billion in total movements, which represents a 1.7 percent share.

## ■ 5.0 GIS Mapping Analysis

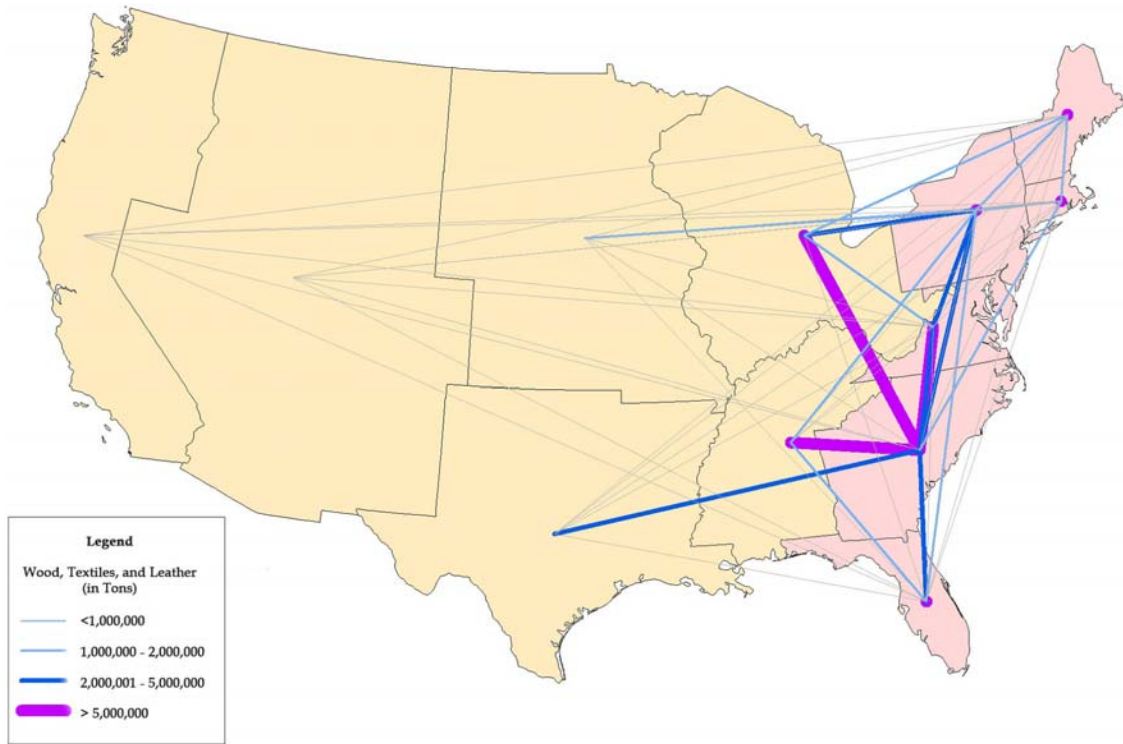
The following maps (Figures 5.1 through 5.24) were created by plotting the total weight or value of freight movements for one good type along the region-to-region trade routes. While the charts in the previous section provided insight into the split of the type of goods shipped along the road and water networks within the United States, they do not facilitate a clear understanding of the origins and destinations.

For the sake of increased clarity, the maps within this section focus primarily on the overall trade patterns and do not distinguish between specific routes. As such, it is impossible to tell from the maps whether a line that connects Northern New England to Florida represents a northbound or southbound freight movement. Those maps that display exports illustrate all freight flows that originate within the I-95 Corridor Coalition region, while all those that display imports illustrate freight flows that terminate in the region. Three maps were created for each of the eight categories (such as water exports measured by weight), one for each of the top three good types in that category. Each of the three maps incorporates the same scale so as to facilitate comparison within a category, although scales differ between categories.

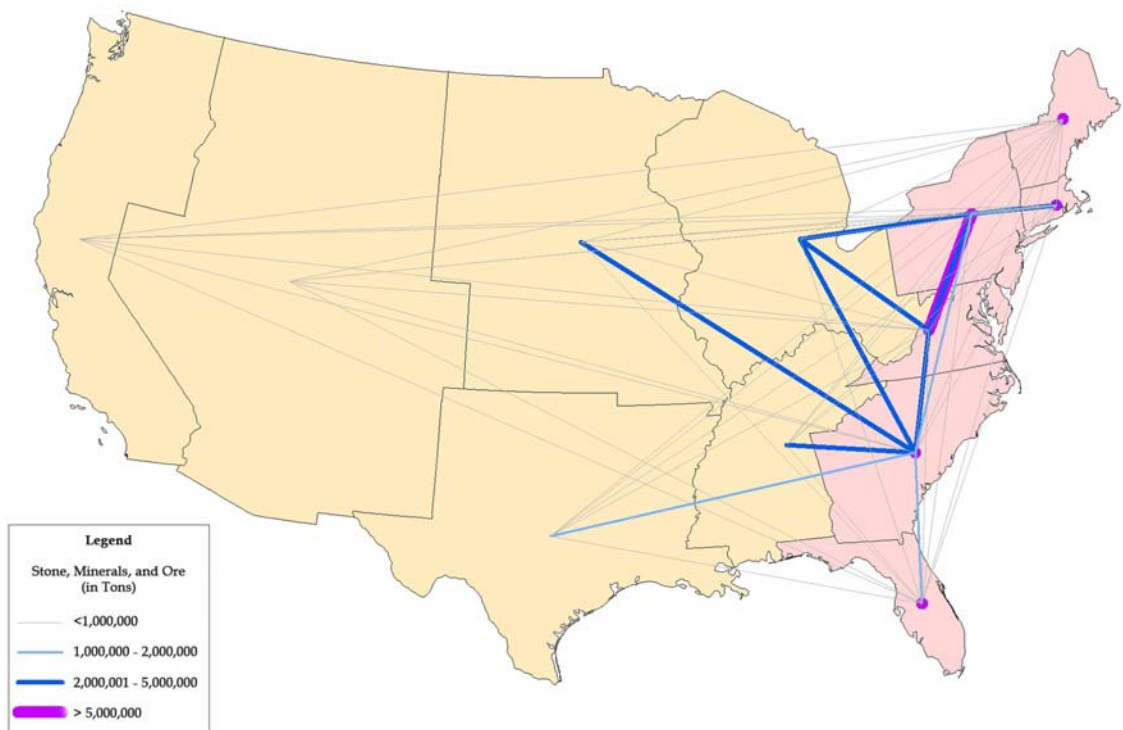
One important aspect of the FAF dataset that should be noted is that it details freight movements between two points, not just the initial origin and final destination. For example, a shipment of electronic goods from Miami to Boston that is reloaded at New York will be represented as two shipments. As such, the total weight and value of flows portrayed in these maps may be an overestimate of actual total freight flows.

Figures 5.1 through 5.3 show the desire lines of the top three goods groups by weight that are shipped from states within the I-95 Corridor Coalition region along the highway network. The top goods group was wood, textiles, and leather, with total shipments weighing more than 77.8 million tons, and was followed by stone, minerals, and ore, with 50.2 million tons, and grains, alcohol and tobacco, with 49.5 million tons. In all three cases, trade was focused most heavily between neighboring regions, with the East North Central/Mid-Atlantic corridor and North Atlantic/Mid-Atlantic pairings in particular accounting for large freight flows. The single largest movement by a group was stone, mineral, and ore traveling between the North Atlantic region and the Mid-Atlantic region, which accounted for 9.6 million tons, or 19 percent, of the total for that goods group. The largest movement for wood, textiles, and leather was 6.9 million tons, which moved from the South Atlantic region to the East North Central region, while the largest flow for grains, alcohol, and tobacco was from the Mid-Atlantic region to the North Atlantic region, with 5.4 million tons.

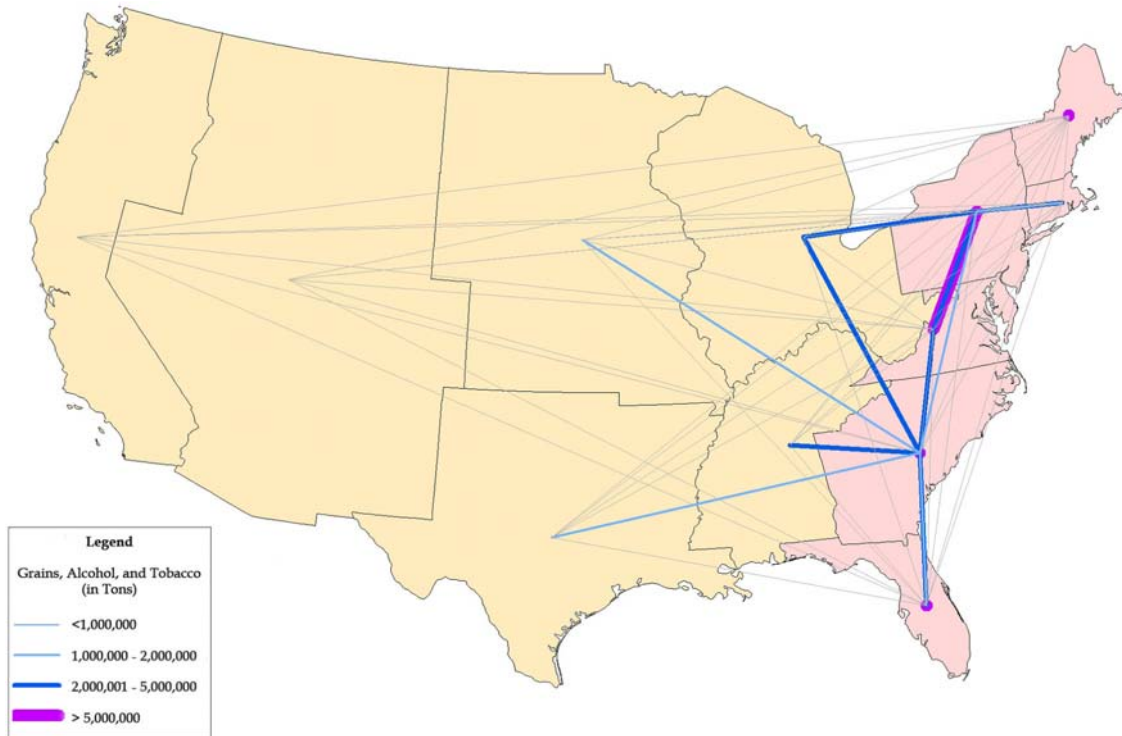
**Figure 5.1 Road Exports by Weight – Wood, Textiles, and Leather**



**Figure 5.2 Road Exports by Weight – Stone, Minerals, and Ore**

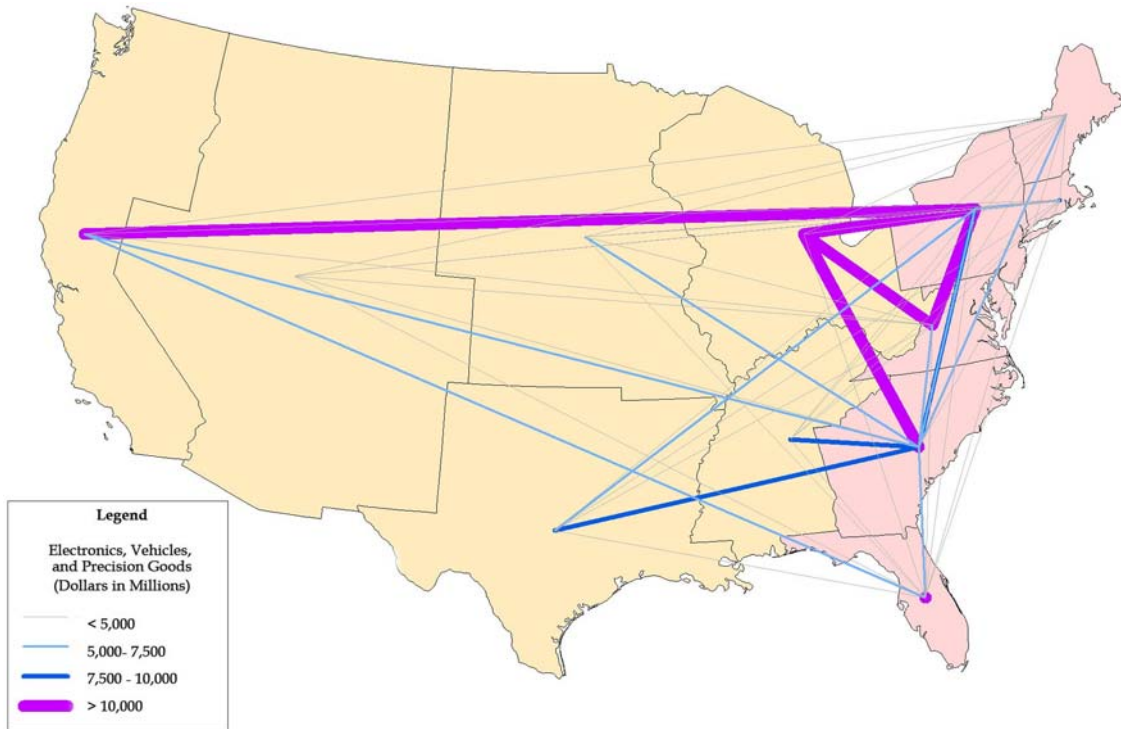


**Figure 5.3 Road Exports by Weight - Grains, Alcohol, and Tobacco**

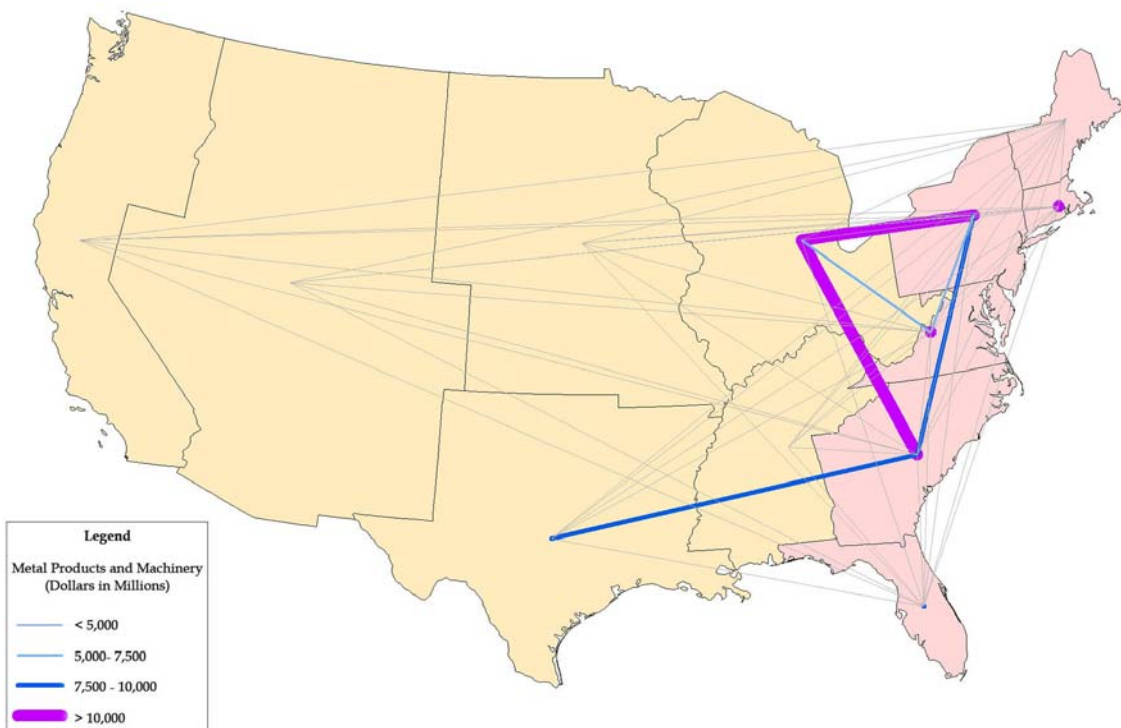


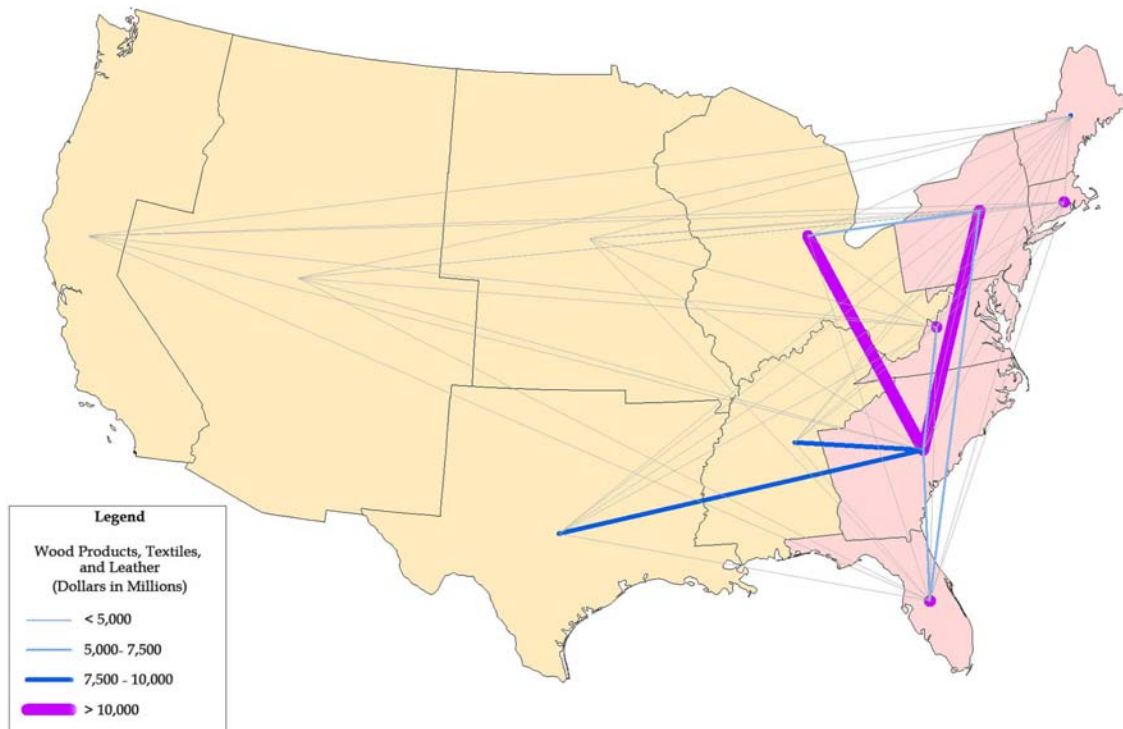
Figures 5.4 through 5.6 show the desire lines of the top three goods groups by value that are shipped from states within the I-95 Corridor Coalition region along the highway network. The top goods group was electronics, vehicles, and precision goods, with total shipments valued at more than \$26.2 billion. The second most valuable goods group was metal products and machinery, with a value of \$21.7 billion, followed by wood, textiles, and leather, with a value of \$15.4 billion. While the value of trade was for the most part focused between the same regions that were visible when the weight of trade was examined, it is interesting to note the large value of electronics, vehicles, and precision goods that are transported by highway from the North Atlantic region to the Pacific region, which accounts for \$10.9 billion. The largest origin-destination pair for this goods group is the South Atlantic region to East North Central region, with a trade flow of \$26.2 billion, which accounts for 11 percent of the total value of trade for that goods group. The largest movement for metal products and machinery was also between these two regions, and was valued at \$15.4 billion, while the largest flow for wood, textiles, and leather was from the North Atlantic region to the East North Central region and was worth \$21.7 billion.

**Figure 5.4 Road Exports by Value - Electronics, Vehicles, and Precision Goods**



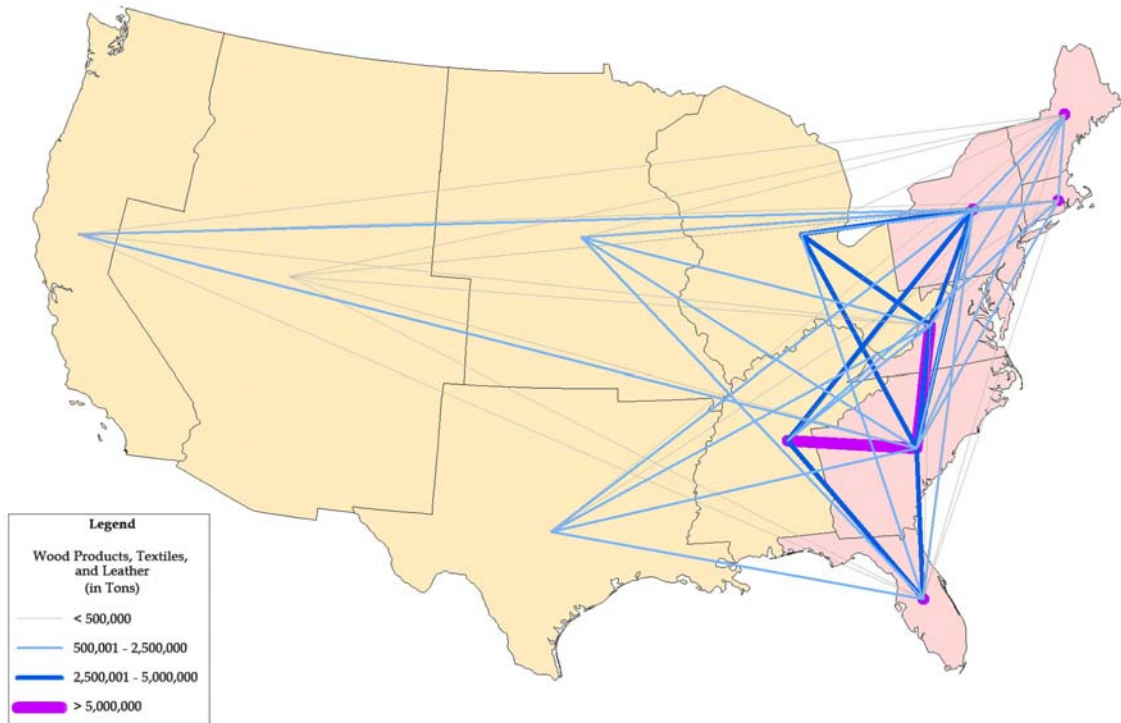
**Figure 5.5 Road Exports by Value - Metal Products and Machinery**



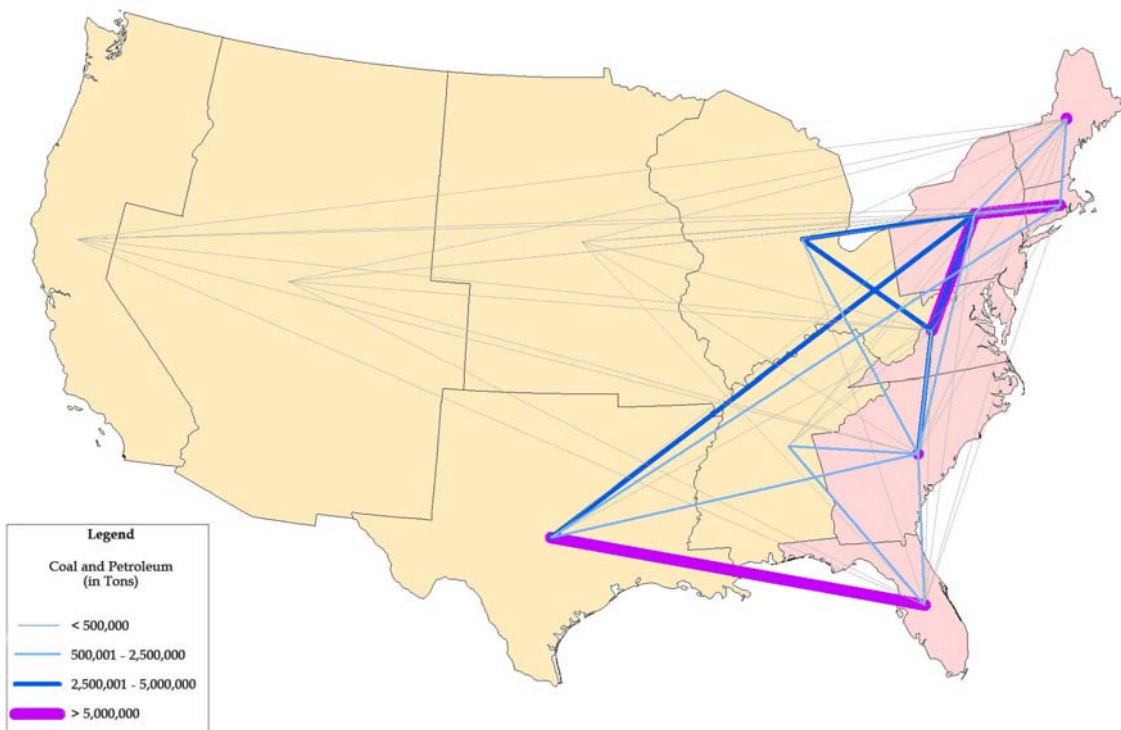
**Figure 5.6 Road Exports by Value – Wood Products, Textiles, and Leather**

Figures 5.7 through 5.9 show the desire lines of the top three goods groups by weight that are shipped to states within the I-95 Corridor Coalition region along the highway network. The top goods group was wood, textiles, and leather, with total shipments weighing more than 88.2 million tons, and was followed by coal and petroleum products, with 66.5 million tons, and stone, minerals and ore, with 51.2 million tons. In the case of the wood products, textiles and leather goods group and the stone, minerals, and ore group, trade was focused most heavily between neighboring regions. However, the coal and petroleum products group saw large numbers of movements from the West South Central region, which is not surprising given Texas' oil industry. The single largest movement by a group was coal and petroleum products traveling between the West South Central region and Florida, which accounted for 18.2 million tons, or 27 percent, of the total for that goods group. The largest movement for wood, textiles, and leather was 8.3 million tons, which moved from the East South Central region to the South Atlantic region, while the largest flow for stone, minerals, and ore was from the North Atlantic region to the Mid-Atlantic region, with 9.5 million tons.

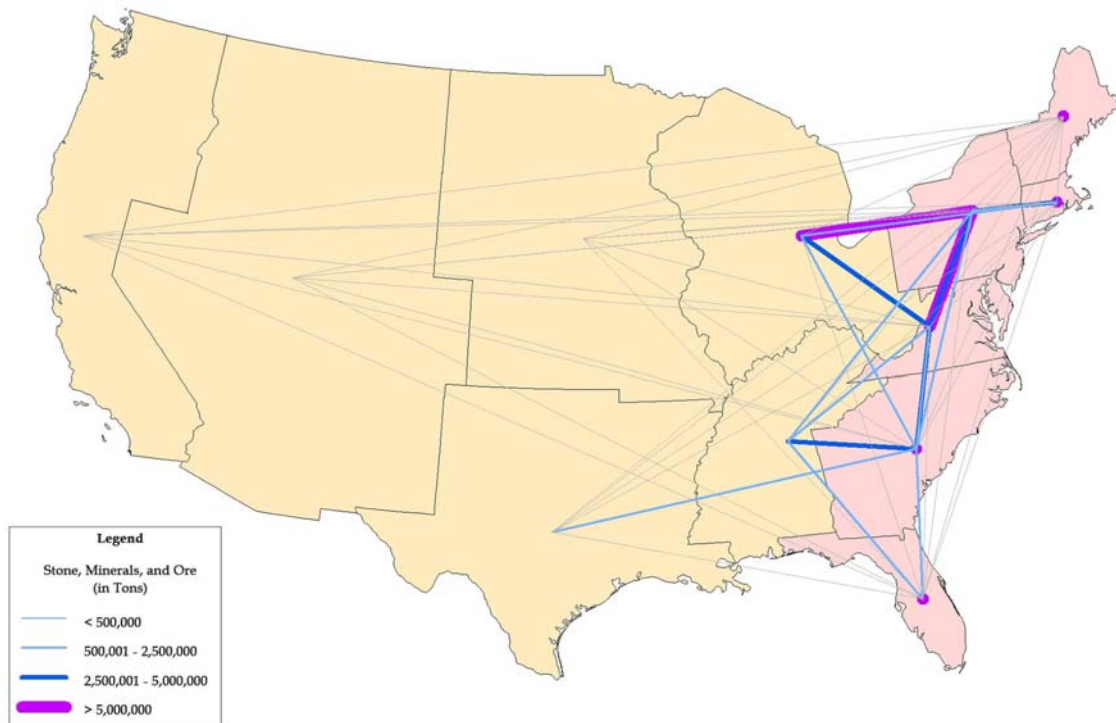
**Figure 5.7 Road Imports by Weight - Wood Products, Textiles, and Leather**



**Figure 5.8 Road Imports by Weight - Coal and Petroleum Products**



**Figure 5.9 Road Imports by Weight - Stone, Minerals, and Ore**



Figures 5.10 through 5.12 show the desire lines of the top three goods groups by value that are imported into the states within the I-95 Corridor Coalition region along the highway network. The top goods group was electronics, vehicles, and precision goods, with total shipments valued at more than \$323.8 billion. The second most valuable goods group was metal products and machinery, with a value of \$211.5 billion, followed by wood, textiles, and leather, with a value of \$176.3 billion. While the value of trade was for the most part focused between the same regions that were visible when the weight of trade was examined, it is again interesting to note the large value of electronics, vehicles, and precision goods that are transported by highway from the Pacific region to the North Atlantic region, which accounts for \$15.2 billion. The largest origin-destination pair for this goods group is the East North Central region to the North Atlantic region, with a trade flow of \$40.9 billion, which accounts for 13 percent of the total value of trade for that goods group. The largest movement for metal products and machinery was also between these two regions, and was valued at \$24.3 billion, while the largest flow for wood, textiles, and leather was from the Pacific region to the North Atlantic region and was worth \$13.4 billion.



Figure 5.10 Road Imports by Value - Electronics, Vehicles, and Precision Goods

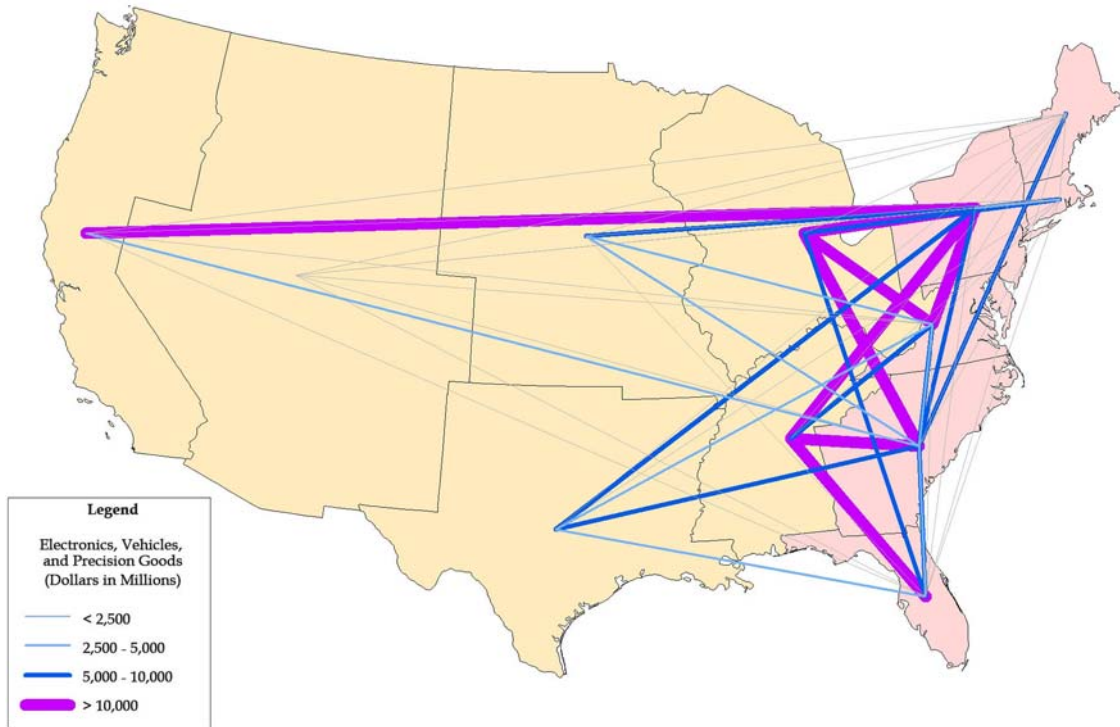
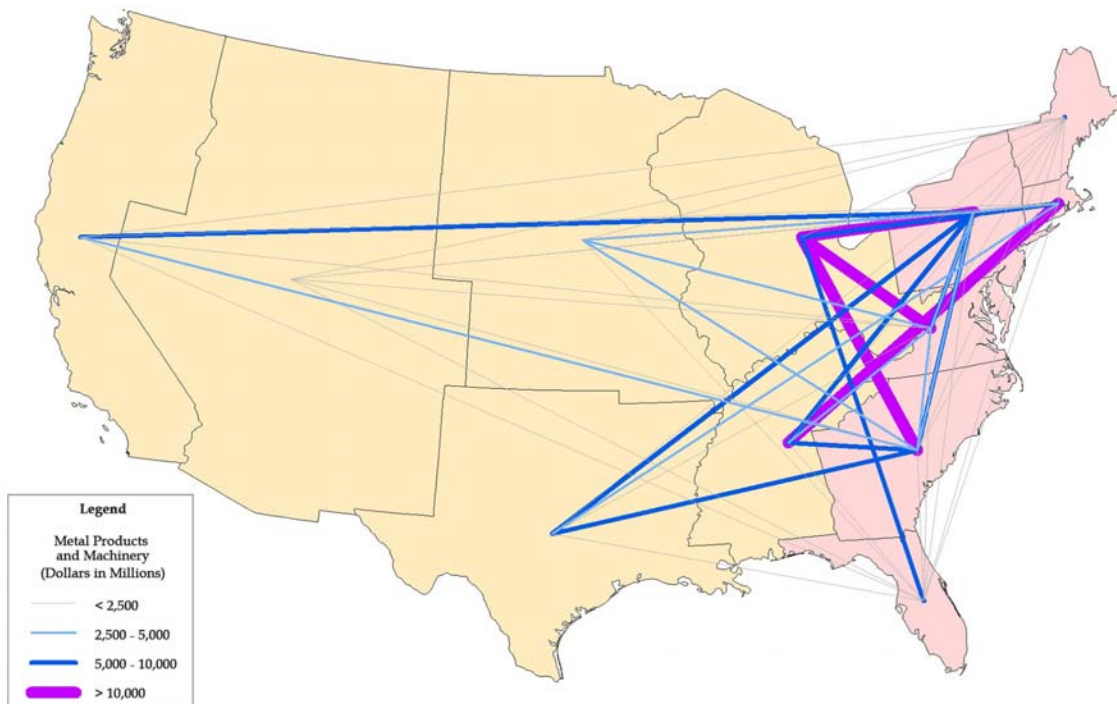
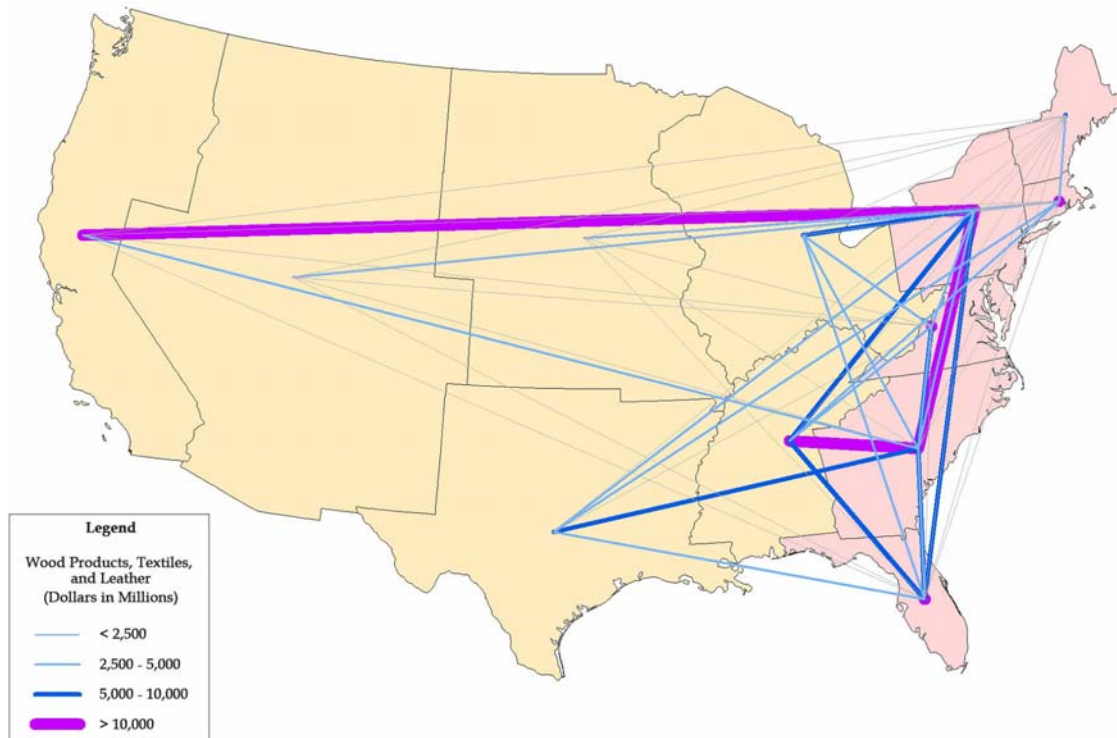


Figure 5.11 Road Imports by Value - Metal Products and Machinery



**Figure 5.12 Road Imports by Value – Wood Products, Textiles, and Leather**

Figures 5.13 through 5.15 show the desire lines of the top three goods groups by weight that are shipped from states within the I-95 Corridor Coalition region along the nation's water network. As would be expected, a far more limited number of desire lines exist, as the connectivity of the network is limited in scope. The top goods group was coal and petroleum products, with total shipments weighing more than 26.7 million tons, and was followed by furniture and miscellaneous goods, with 23.6 million tons, and stone, minerals and ore, with 6.7 million tons. In all three cases, the heaviest flows occurred between neighbors and near neighbors (such as West South Central and Florida, for example). The single largest movement by a group was coal and petroleum products traveling between the North Atlantic region and Southern New England, which accounted for 14.6 million tons, or 54 percent, of the total for that goods group. The largest movement for furniture and miscellaneous goods was 10.6 million tons (45 percent), which moved from the East South Central region to the South Atlantic region, while the largest flow for stone, minerals, and ore was from the North Atlantic region to the Mid-Atlantic region, with 5.3 million tons (79 percent). As can be seen from the percentage shares, whereas the highway borne movements were more equally distributed amongst the various regions, the waterborne movements typically occur between two regions in particular for any given goods group.

Figure 5.13 Water Exports by Weight - Coal and Petroleum Products

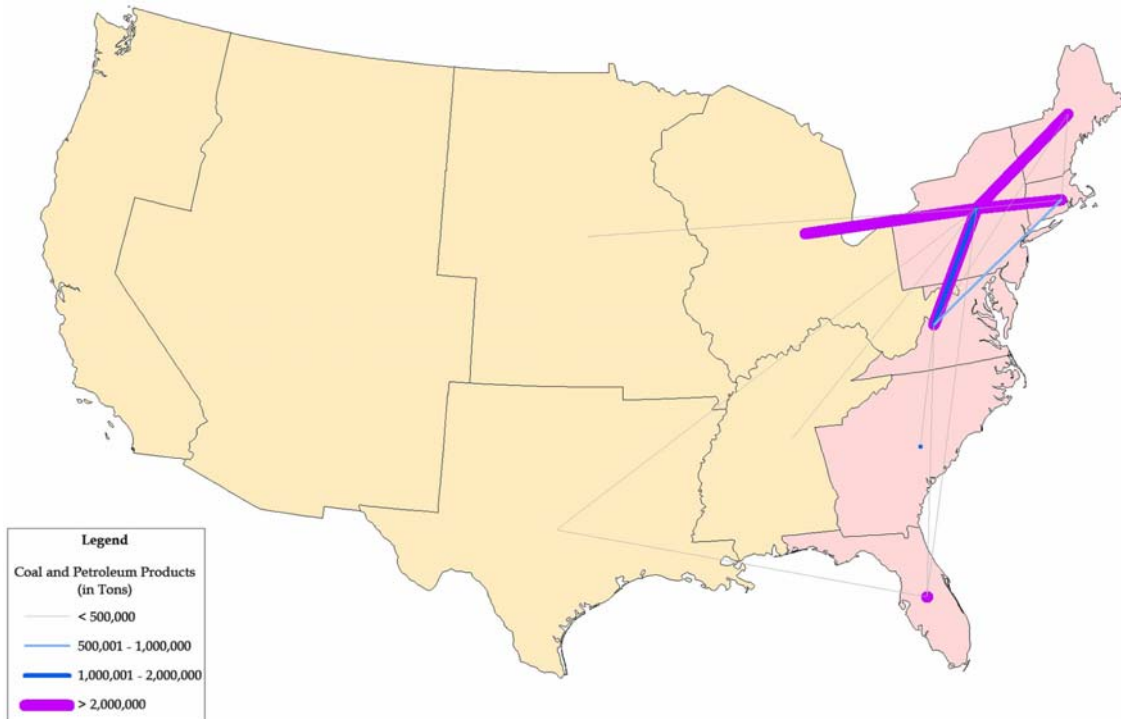
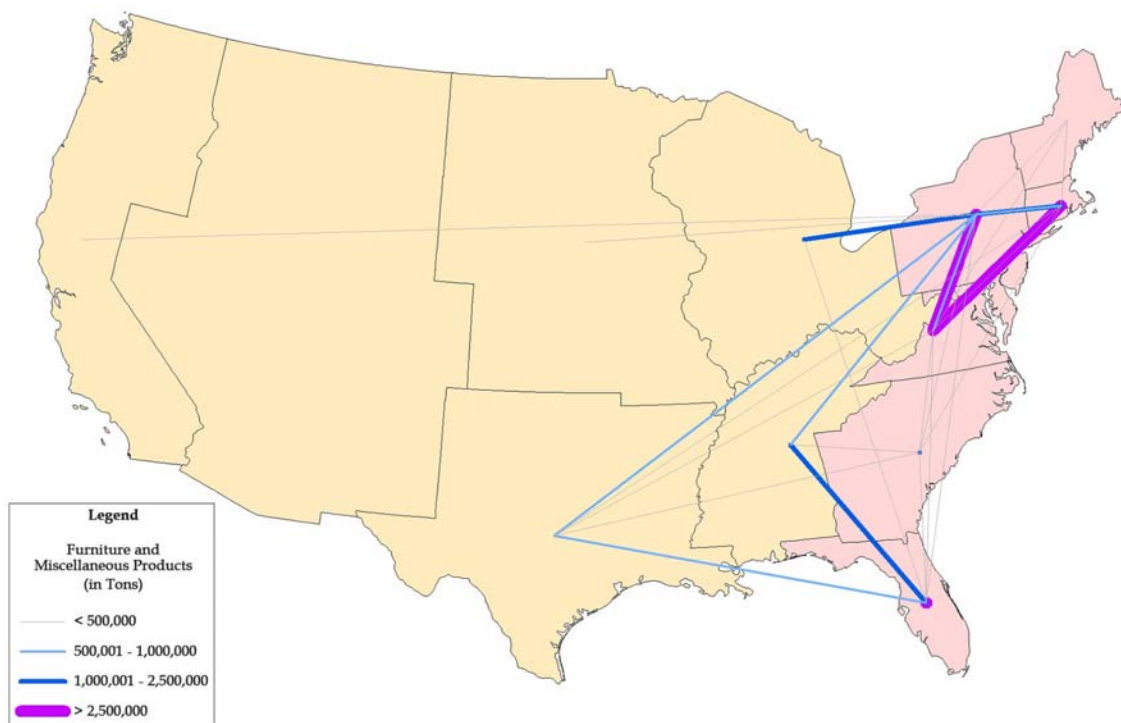
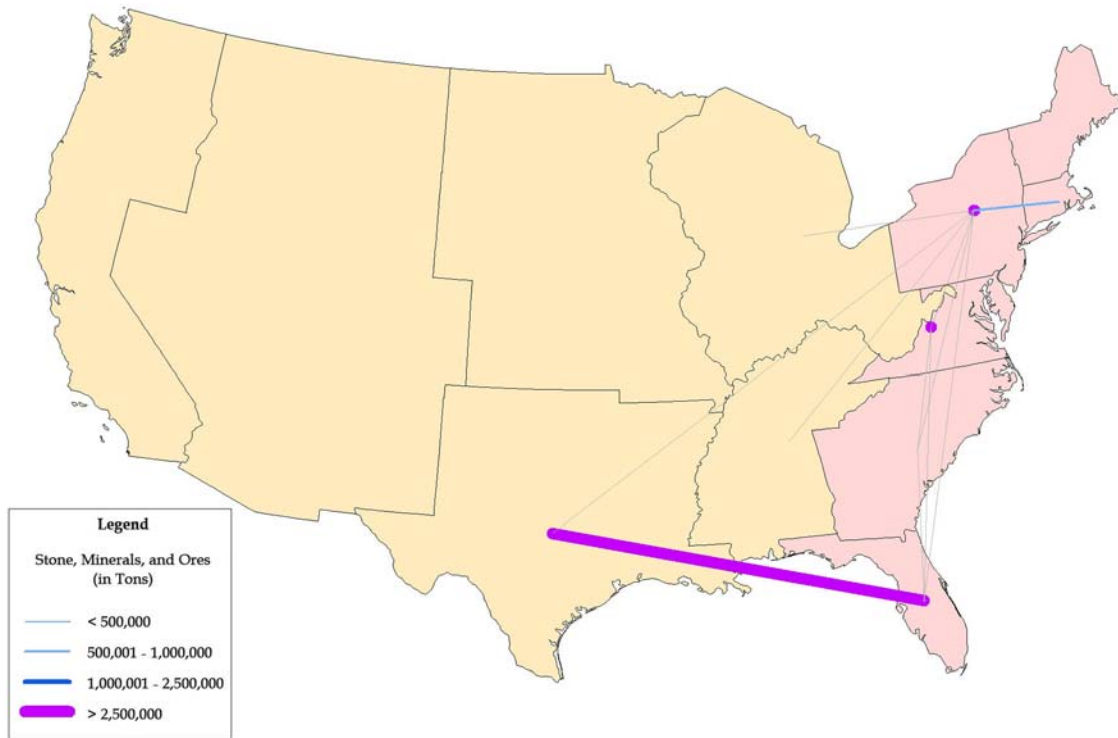


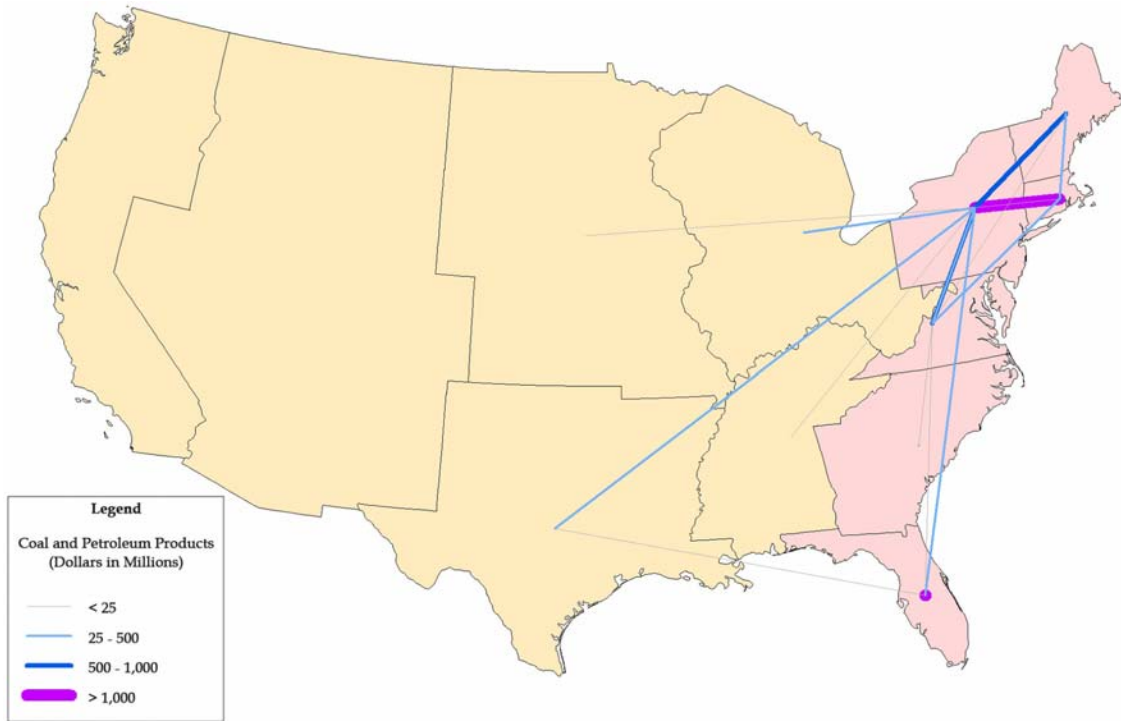
Figure 5.14 Water Exports by Weight - Furniture and Miscellaneous Products



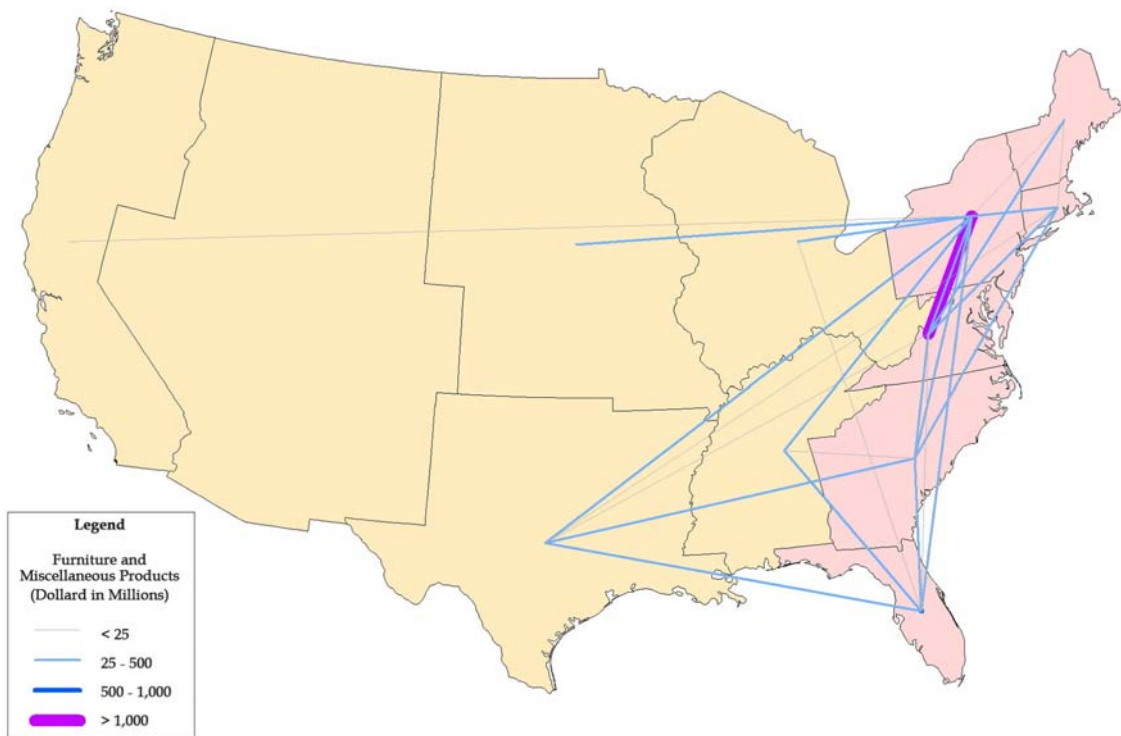
**Figure 5.15 Water Exports by Weight – Stone, Minerals, and Ore**

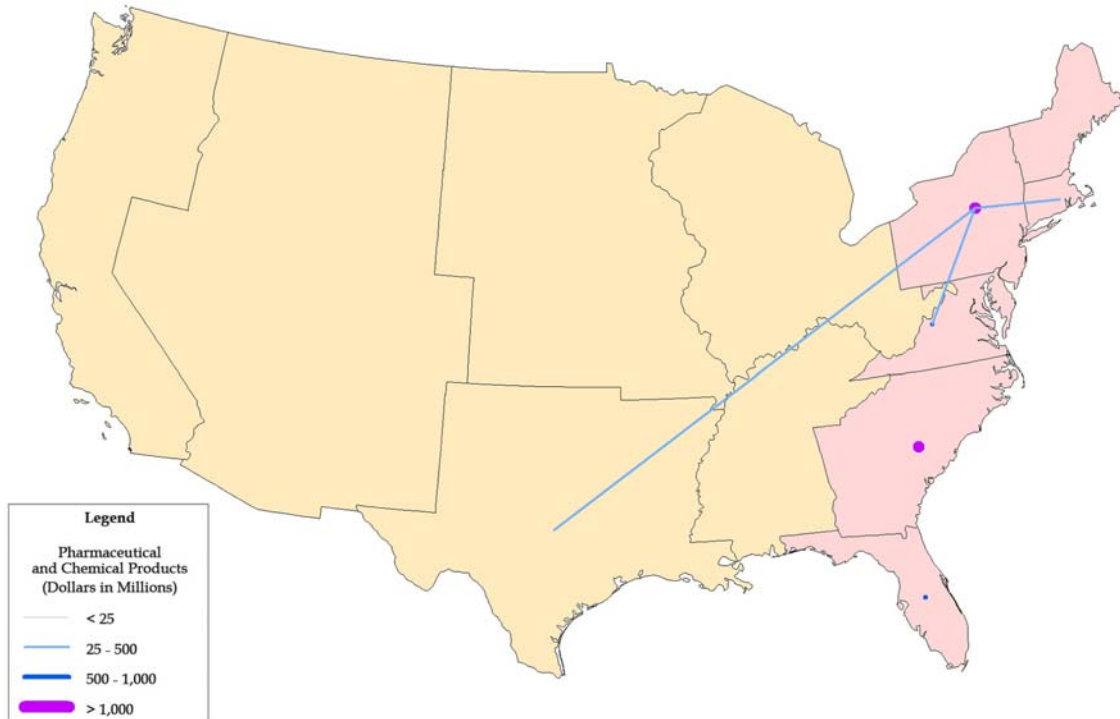
Figures 5.16 through 5.18 show the desire lines of the top three goods groups by value that are exported from the states within the I-95 Corridor Coalition region by waterborne vehicles. The top goods group was coal and petroleum products, with total shipments valued at more than \$5.0 billion. The second most valuable goods group was furniture and miscellaneous products, with a value of \$4.0 billion, followed by pharmaceutical and chemical products, with a value of \$0.2 billion. The largest share of the trade was once again between neighbors and near-neighbors. The largest origin-destination pair for the coal and petroleum products group is the North Atlantic region to the Southern New England region, with a trade flow of \$3.0 billion, which accounts for 61 percent of the total value of trade for that goods group. The largest movement for furniture and miscellaneous products group was from the Mid-Atlantic region to the North Atlantic region, and was valued at \$1.6 billion, while the largest flow for pharmaceutical and chemical products group was from the North Atlantic region to the West South Central region, and was worth \$0.1 billion. It is worth noting that even though movements were recorded for only three origin-destination pairs for the pharmaceutical and chemical products group, the value of the goods shipped was in excess of the stones, minerals and ore goods group that had a more extensive trade network in place.

**Figure 5.16 Water Exports by Value - Coal and Petroleum Products**



**Figure 5.17 Water Exports by Value - Furniture and Miscellaneous Products**



**Figure 5.18 Water Exports by Value - Pharmaceutical and Chemical Products**

Figures 5.19 through 5.21 show the desire lines of the top three goods groups by weight that are shipped to states within the I-95 Corridor Coalition region over the water network. The top goods group was coal and petroleum products, with total shipments weighing more than 70.4 million tons, and was followed by furniture and miscellaneous products, with 26.9 million tons, and stone, minerals and ore, with 3.9 million tons. As was the case with other waterborne shipments, most tended to travel limited distances rather than cross-country. The single largest movement by a group was coal and petroleum products traveling between the West South Central region and Florida, which accounted for 28.3 million tons, or 40 percent, of the total for that goods group. The largest movement for furniture and miscellaneous products was 10.6 million tons, which moved from the Mid-Atlantic region to the North Atlantic region, while the largest flow for stone, minerals, and ore was from the East North Central region to the North Atlantic region, with 1.1 million tons.

Figure 5.19 Water Imports by Weight - Coal and Petroleum Products

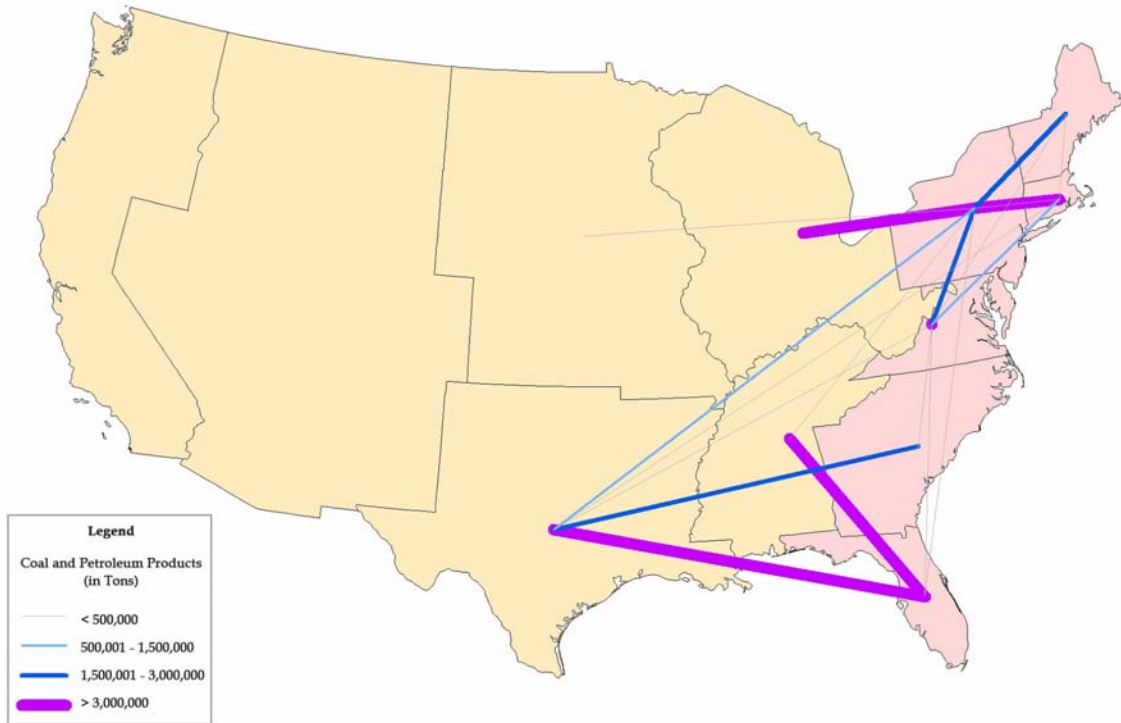
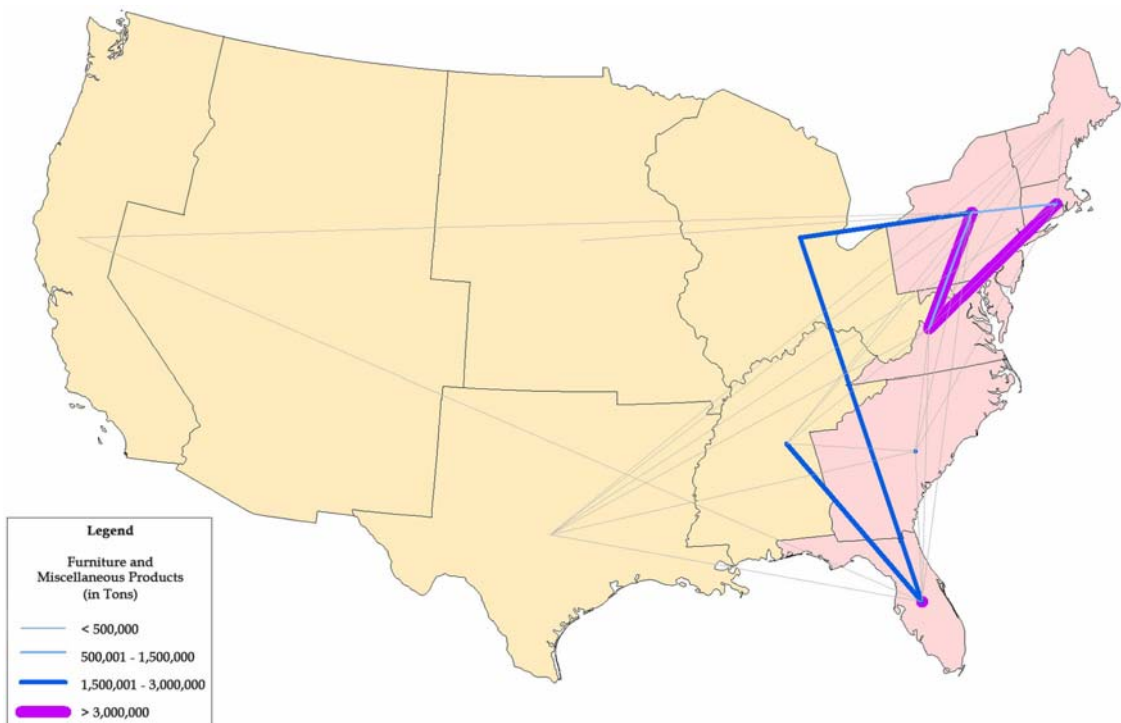
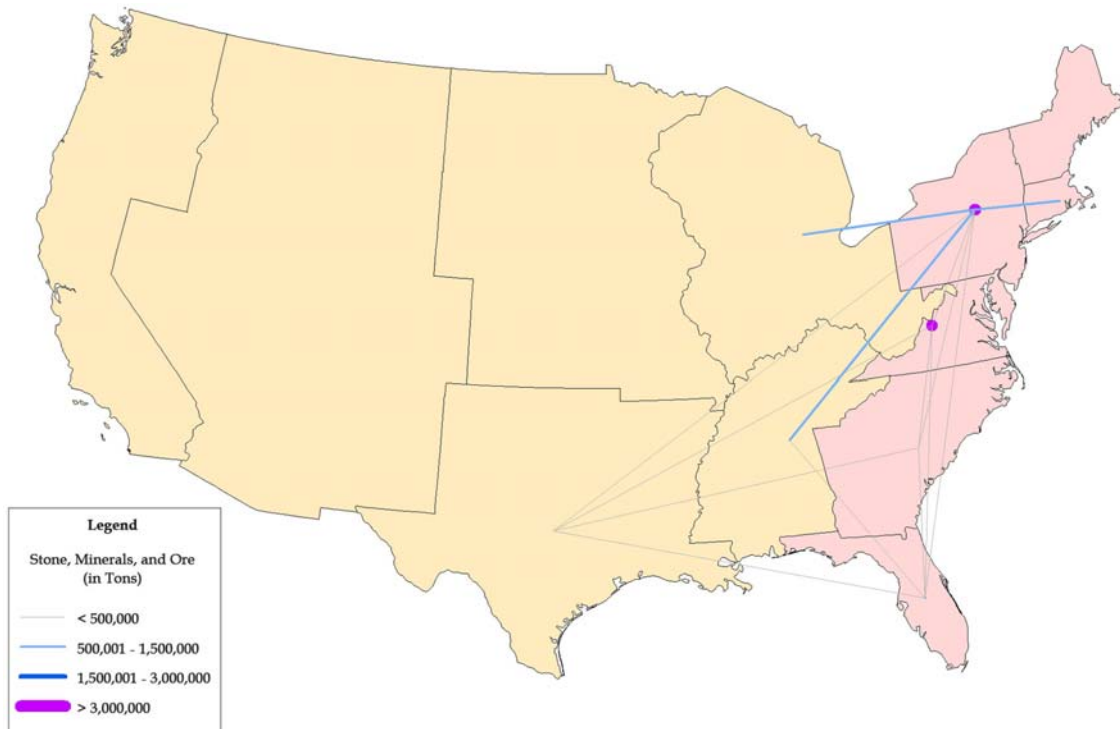


Figure 5.20 Water Imports by Weight - Furniture and Miscellaneous Products



**Figure 5.21 Water Imports by Weight – Stone, Minerals, and Ore**

Figures 5.22 through 5.24 show the desire lines of the top three goods groups by value that are imported into the states within the I-95 Corridor Coalition region by waterborne vessels. The top goods group was coal and petroleum products, with total shipments valued at more than \$11.3 billion. The second most valuable goods group was pharmaceutical and chemical products, with a value of \$6.8 billion, followed by furniture and miscellaneous products, with a value of \$5.0 billion. Freight tended to be shipped from a greater number of regions than was the case with the top goods groups when ranked by weight. The largest origin-destination pair for the coal and petroleum products group is the West South Central region to Florida, with a trade flow of \$4.3 billion, which accounts for 38 percent of the total value of trade for that goods group. This was the same origin-destination pair that served found in the largest movement for the pharmaceutical and chemical products group which was valued at \$2.7 billion, while the largest flow for the furniture and miscellaneous products group was from the Mid-Atlantic region to the North Atlantic region, and was worth \$1.6 billion.



Figure 5.22 Water Imports by Value - Coal and Petroleum Products

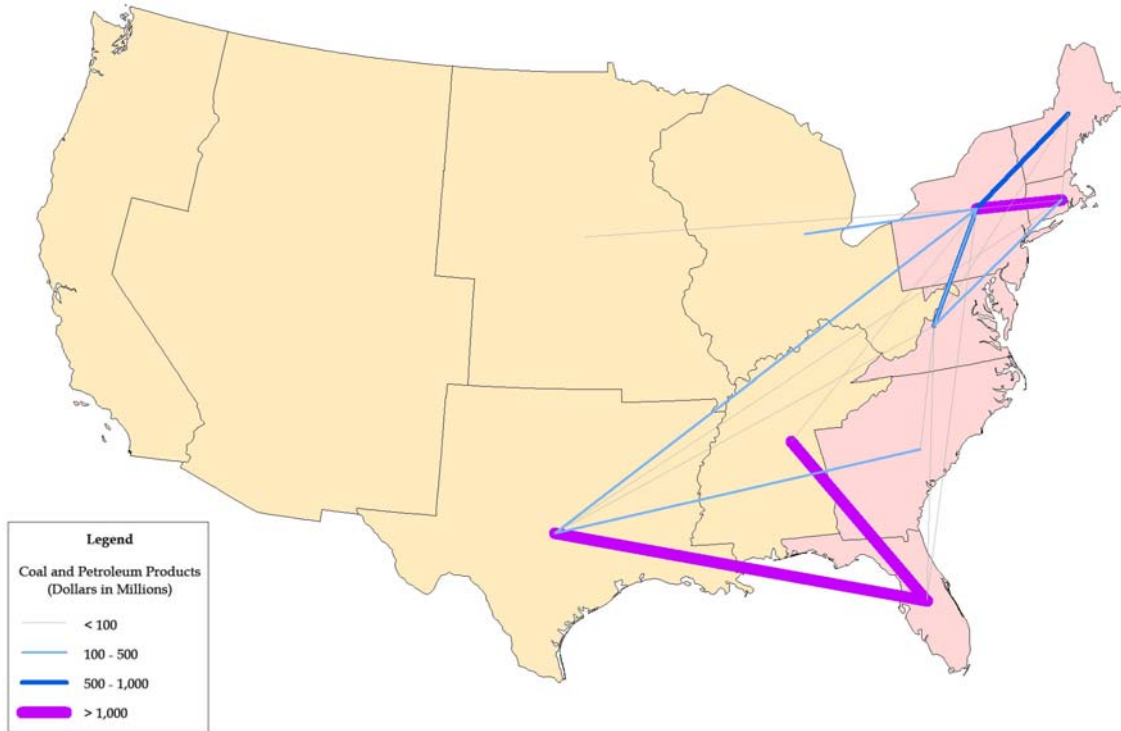


Figure 5.23 Water Imports by Value - Pharmaceutical and Chemical Products

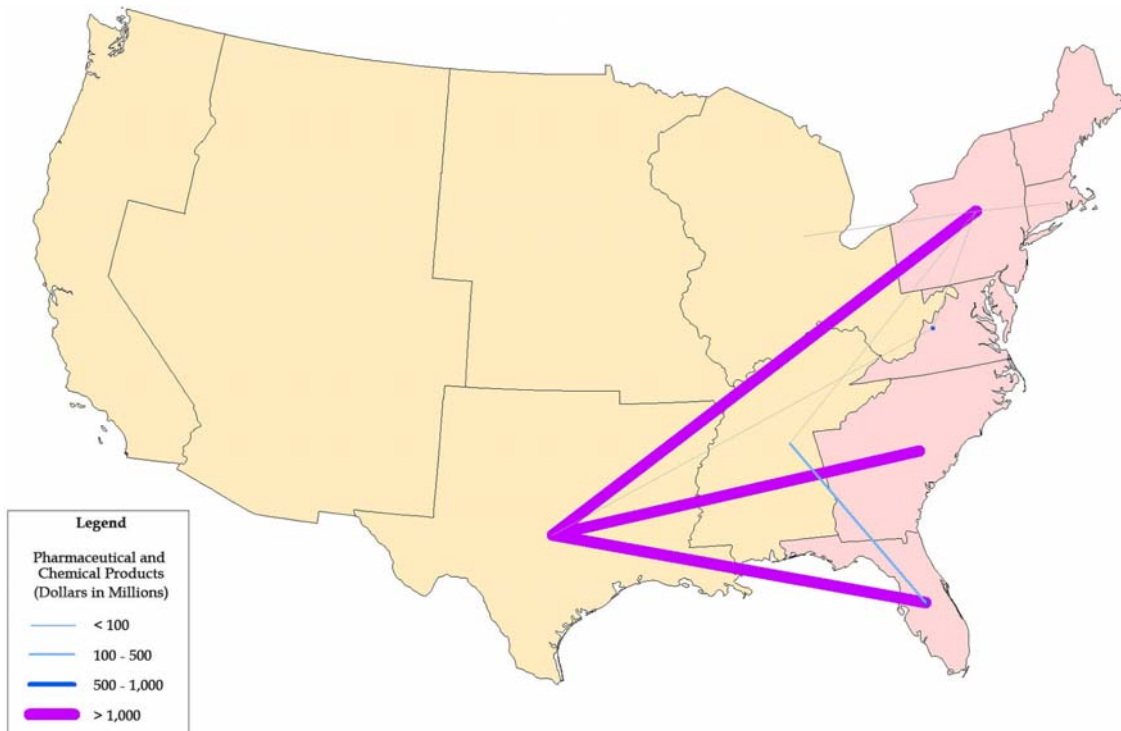
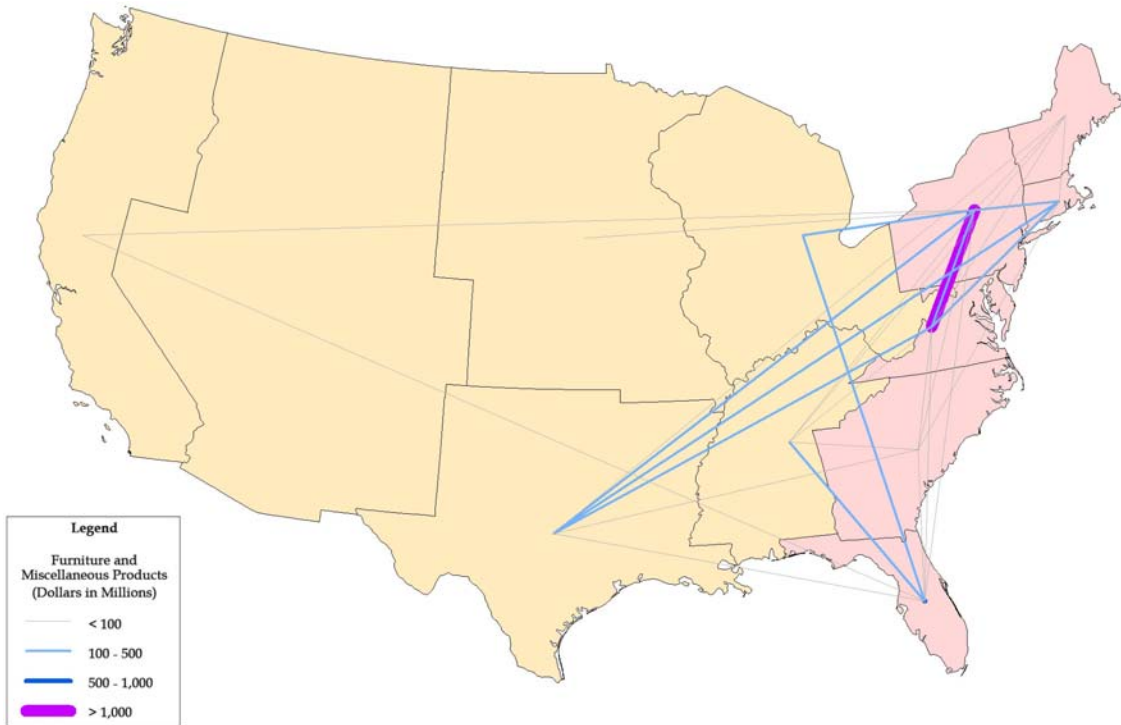


Figure 5.24 Water Imports by Value - Furniture and Miscellaneous Products



## ■ 6.0 Key Findings

Key findings of this technical memorandum are presented in two areas:

1. **Freight flow analysis**, which addresses the volume and type of highway and water freight that moves into and out of the I-95 Corridor Coalition; and
2. **Desire line mapping analysis**, which addresses the pattern of highway and water freight shipments within the United States.

### Freight Flow Analysis

The table and charts provide insight into the volume of freight flows imported and exported to those states within the I-95 Corridor Coalition, as well as the breakdown in the types of goods transported by either mode. There are several key findings of the analysis of the existing freight flows that either originate or terminate within the I-95 Corridor Coalition, including:

- **Imports into the coalition states vastly exceed exports from those states.** Total imports along borne along the highways and waterways into the I-95 Corridor Coalition weighed just under 359 million tons, or 65 percent of the total analyzed, while total exports weighed 195 million tons, or 35 percent of the total. This disparity is slightly reduced when the value of freight movements is compared, with \$703 billion worth of goods imported, or 61 percent of the total, and \$455 billion worth of goods exported, or 39 percent of the total.
- **A larger share of freight, whether measured by weight or value, is moved by trucks than by water vessels.** A total of 473 million tons was moved along the nation's highways, which represents 85 percent of the total freight movements analyzed. Waterborne movements accounted for 81 million tons, or 15 percent of the total. This difference is even more dramatic when the value of goods is analyzed, with 98 percent of the total value moved along the highways and only two percent moved along the waterways.
- **Goods shipped along the highway are more diverse in nature than those shipped by water.** The more balanced spread of goods that are transported along the nation's highways indicates an increased flexibility in what trucks can carry in comparison to water vessels, which tend to focus on high-bulk, low-value goods. The faster transportation times associated with truck freight movements also likely plays a factor in the types of goods shipped.

## Desire Line Mapping Analysis

The desire line maps provide insight into the direction and volume of freight flows imported and exported to those states within the I-95 Corridor Coalition. There are several key findings of the analysis of the pattern of existing freight flows that either originate or terminate within the I-95 Corridor Coalition, including:

- **Imports into the Coalition states vastly exceed exports from those states.** The desire line maps visually support the data extracted from the FAF database. The maps also highlight that internal freight movements account for much of the weight and value of total flows that either have an origin or a destination within the I-95 Corridor Coalition.
- **A larger share of freight, whether measured by weight or value, is moved by trucks than by water vessels.** The desire line maps once again visually support the data extracted from the FAF database. The maps also reinforce the fact that there are no cross-country waterborne freight movements due to a lack of a network.
- **The top goods groups by weight that were transported by road tended to travel a farther distance than those that were transported by water.** This disparity was even more pronounced when the goods groups were ranked by value, with, for example, electronics, vehicles, and precision goods traveling across the country accounting for a significant share of the total value of that group's movements. This is to be expected, as there are no cross-country water routes currently in use. Water shipments were frequently most concentrated between neighboring regions or near-neighbors, whereas highway shipments tended to be more diversified throughout the country.
- **Those goods that were shipped along the highway were typically of a higher value per ton than those shipped by water.** Goods moved by water tended to be primarily bulk goods that were less time sensitive in nature. This is logical given the potentially longer travel time of waterborne cargo in comparison to freight moved along the nation's highways. Those industries that take advantage of the waterways clearly value the reduced costs associated with waterborne freight movements over the increased travel times.
- **The potential exists for SSS operations between some origin-destination pairs.** In several cases, strong freight movements exist between origin-destination pairs for the same goods group. This indicates that the necessary infrastructure already exists for those goods to be shipped by water vessel rather than truck, and that the potential therefore exists for the initiation or expansion of SSS operations. Due to the broad nature of the groups in the analysis, however, further research would have to be performed in order to determine specifically if SSS operations could be implemented.
- **Some goods are better suited to SSS operations than others.** Some goods imported by states in the I-95 Corridor Coalition, such as coal and petroleum products and pharmaceutical and chemical products, tend to originate outside the coalition, while other goods are, such as wood, textiles, and leather, are imported and exported within

the Coalition. Those goods traded within the Coalition may make good candidates for SSS operations along the eastern seaboard.

These observations indicate that current waterborne shipments are most likely to be high-weight, low-value goods that are transported short to medium distances. Some water routes are in relative demand, such as between West South Central and Florida, while others seem to be less utilized. It is likely, however, that all water routes would have extra capacity for increased SSS operations.