CHAPTER 3

Moving Goods

An efficient and reliable freight transportation network is critical for linking natural resources, manufacturing facilities, labor markets, and customers across the nation and with international trading partners. In 2009, the freight transportation system served 7.4 million business establishments, 117 million households, and more than 89,000 government units [USDOC Census CBP, StatAb, and Govs]. In recent years the freight transportation network has handled growth in domestic freight and increasing amounts of international freight shipments in response to large increases in U.S. international trade. Not only has the network had to adapt to handle international traffic, but the growth in international freight has also had an effect on the way that freight moves domestically. All of these changes in the freight network have created new challenges for the industry.

- The Nation's freight system moves 48.3 million tons of goods worth $46 billion each day. This amounts to 57 tons of freight per year for every man, woman, and child in the United States.
- While nearly three-quarters of those 48.3 million tons are moved to places within 250 miles of where the shipment originates, the remainder accounts for over 80 percent of the ton-miles moved in the United States.
- Trucks carry the largest share of shipments moving 500 miles or less from the point of origin. Railroads and pipelines, combined, carry over half of the tonnage shipped between 750 and 1,000 miles. Air cargo and shipments by multiple modes (e.g., shipments transferred from rail to truck) account for over half the value of freight moving more than 2,000 miles.
- The value of international trade has increased from $1.5 trillion in 1990 (adjusted for inflation using the Consumer Price Index) to $3.2 trillion in 2010. This increase has created additional traffic between international gateways and domestic destinations.

Volume and Value

The U.S. freight transportation system moved more than 17.6 billion tons of goods valued at $16.8 trillion in 2011, according to estimates derived from the Federal Highway Administration's Freight Analysis Framework (FAF) (table 3-1). That means the freight transportation system carried, on average, about 48.3 million tons of goods worth more than $46 billion each day [USDOT FHWA 2012]. This amounts to 57 tons of freight per year for every man, woman, and child in the United States. See box 3-A for information about the FAF and the Commodity Flow Survey.

Following the economic turndown in 2007, freight volumes registered large decreases in 2008 and 2009. However, there were clear signs of a recovering economy in 2011 as volumes reached 93 percent of the 2007 levels. FAF paints a similar picture for the value of freight shipments: value decreased in 2008 and 2009 and increased in 2011 to approximately 101 percent of 2007 estimates in inflation adjusted dolars.

FAF forecasts freight volumes will grow 1.7 percent annually between 2011 and 2040. The value of goods moved, in constant dollars, is expected to increase faster than tonnage during this time [USDOT FHWA 2012].

Exports and imports accounted for 13 percent of the weight and 21 percent of the value of freight transported throughout the United States in 2011. FAF forecasts that exports and imports will account for an even greater share of freight movements in 2040, reaching 19 percent of the weight and 31 percent of the value of goods [USDOT FHWA 2012].

Population growth and economic activity are the primary factors that determine freight

TABLE 3-1 Weight and Value of Shipments by Transportation Mode: 2007, 2011, and 2040 Estimates

	2007		2011		2040	
	Weight	Value	Weight	Value	Weight	Value
	Millions of tons	Billions of 2007 U.S. Dollars	Millions of tons	Billions of 2007 U.S. Dollars	Millions of tons	Billions of 2007 U.S. Dollars
All modes, total	**18,879**	**16,651**	**17,622**	**16,804**	**28,520**	**39,265**
Truck	12,778	10,780	11,301	10,573	18,786	21,465
Rail	1,900	512	1,895	515	2,770	898
Water	950	340	825	279	1,070	337
Air, air & truck	13	1,077	17	1,219	53	5,043
Multiple modes & mail	1,415	2,877	1,618	3,099	3,575	9,925
Pipeline	1,507	723	1,652	779	1,740	776
Other & unknown	316	341	313	341	526	821

NOTES: Numbers may not add to total due to rounding. The 2011 data are provisional estimates based on selected modal and economic trend data. All truck, rail, water, and pipeline movements that involve more than one mode, including exports and imports that change mode at international gateways, are included in multiple modes & mail to avoid double counting. As a consequence, rail and water totals in this table are less than those reported in other sources.

SOURCE: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, version 3.4, 2012.

BOX 3-A The Commodity Flow Survey (CFS) and the Freight Analysis Framework (FAF)

The CFS is the foundation for the FAF. The CFS is conducted every 5 years by the Bureau of Transportation Statistics (BTS) in partnership with the U.S. Census Bureau as part of the Economic Census. The CFS provides data for most of the economy on commodities shipped, their value and weight, mode of transport, and origin and destination within and between all U.S. regions. The survey covers about three-fourths of the tonnage shipped from a domestic origin to a domestic destination.

The FAF supplements CFS data with a variety of other sources to estimate total tonnage and value, commodity type, mode, origin, and destination for 1997, 2002, 2007, 2011, and 2040. It also assigns truck flows to the highway network for 2007 and 2040 to provide a picture of freight truck volumes.

While the FAF is more complete, the CFS provides greater commodity detail and additional shipment characteristics, such as hazardous materials class. The most recently published CFS data covers 2007, while earlier surveys cover 1993, 1997, and 2002. The 2012 CFS data are being processed as this report goes to press.

FAF forecasts are based on long-term U.S. economic projections, including real gross domestic product growth, nonfarm business productivity, real oil prices, and the Federal budget deficit. Detailed information on CFS data and methodologies are available at www.bts.gov/publications/commodity_flow_survey/. Information on FAF data and methodologies are available at www.ops.fhwa.dot.gov/freight/freight_analysis/faf/index.htm.

demand. As population increases or economic activity expands, more goods are produced and used resulting in additional freight movement.

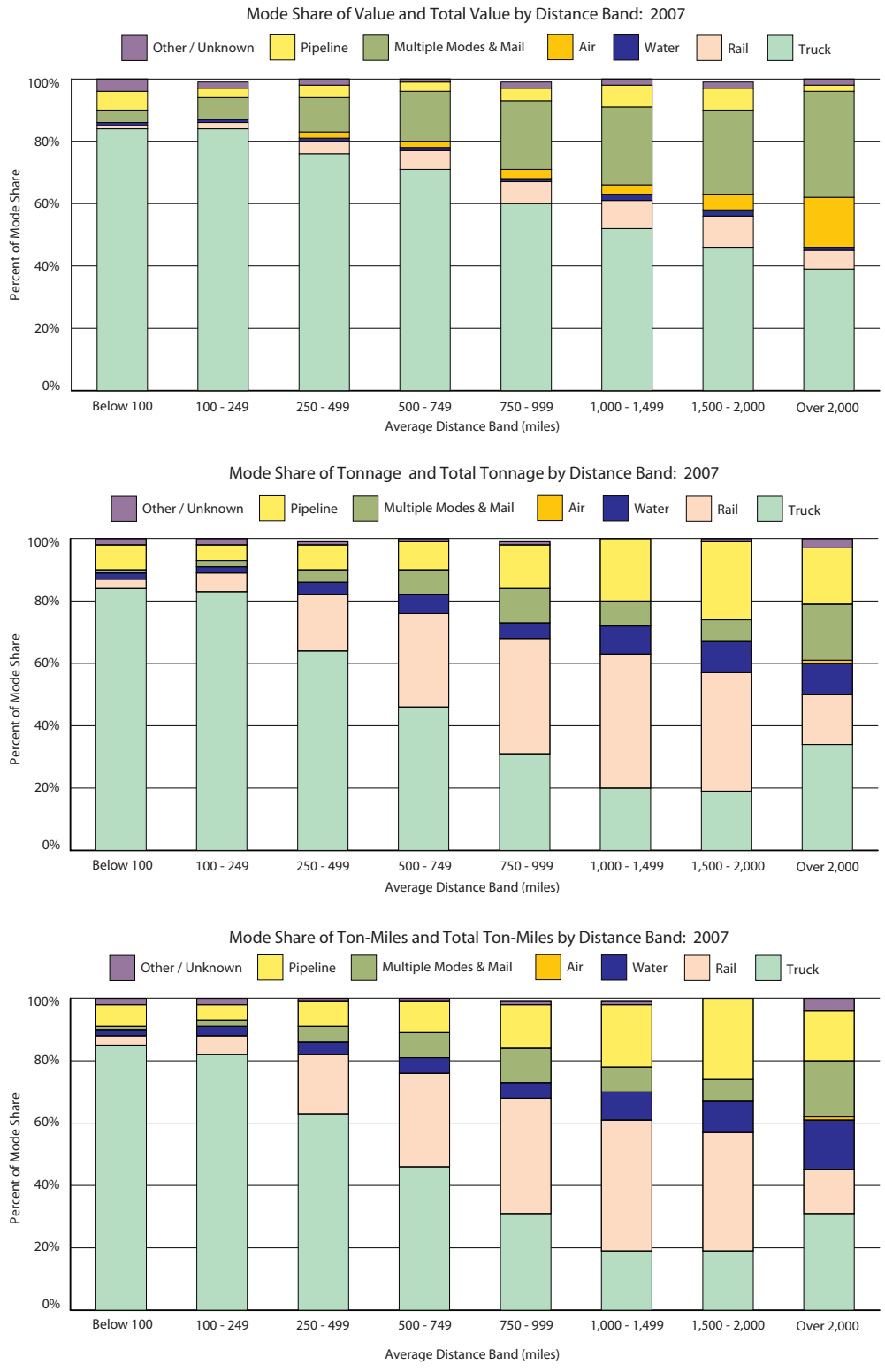
Since 1990, the U.S. population increased by 24.9 percent [USDOC Census 2011], and U.S. gross domestic product grew by nearly 65.7 percent [USDOC BEA 2011]. In addition to these factors, changes in the composition of goods demanded affect what goods are moved, the modes used to transport them, and where they go. Freight traffic, which fluctuates with economy activity, remained stable after 2011. According to the Freight Transportation Service Index, developed by the Bureau of Transportation Statistics (BTS), freight movements were unchanged from January through December 2012.

How Domestic Freight Moves

The freight industry moves goods over a network that includes 4.1 million miles of highways, 139,000 miles of railroads, 12,000 miles of inland and intercoastal waterways, 2.6 million miles of pipelines, more than 5,000 U.S. public use airports, and over 170 maritime ports (see box 1-A in chapter 1).

Each transportation mode plays a distinct role in goods movement, and often multiple modes are used to transport any given shipment. The distance a shipment must travel,

FIGURE 3-1 Modal Shares of Shipments by Value, Weight, and Ton-Miles: 2007



SOURCE: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, version 3.4, 2012.

either by single mode or during any particular leg of a multimodal journey, plays a major part in determining what mode or modes are used. An understanding of the distance, weight, and value of a shipment, the availability and cost of transportation modes, and the relationships these variables have to one another is essential to a complete comprehension of freight transportation (see figure 3-1).

Most goods are moved short distances (less than 250 miles), accounting for over one-half of the value and nearly three-quarters of the weight of all shipments within the United States. Because of the mileages involved, shipments of more than 250 miles constitute 83.3 percent of ton-miles. Modal shares of freight vary considerably by distance. While trucks carry the largest share of value, tons, and ton-miles for shipments moving 500 miles or less, rail and pipeline together account for over half the tons and ton-miles of shipments between 750 and 2,000 miles, and air and multiple modes account for over half the value of shipments moving more than 2,000 miles [USDOT FHWA 2012].

Although trucks carry the highest percentage of the tonnage and the value of goods in the United States, railroads and waterways also carry large volumes, especially bulk commodities, over long distances (figure 3-2). Rail and water combined account for about 15.4 percent of the total volume and 4.7 percent of the total value of freight moved in the United States in 2011. The use of air carriers as movers of high-value, low-weight products is underscored by the relatively extreme value-to-weight ratio of air cargo, which exceeds $70,000 per ton. In comparison, the overall value-to-weight ratio of cargo carried by all modes combined is less than $1,000 per ton. Pipelines move 1.7 billion tons and $779 billion in commodities, which is approximately the same annual tonnage as rail, which moved nearly 1.9 billion tons, valued at $515 billion in 2011. Rail represents approximately 10.8 percent of the total tonnage and 3.1 percent of the total value of shipments, about the same shares as reported in 2007. While rail shipments by tonnage are projected to increase by 46.2 percent between 2011 and 2040, this volume increase is expected to be in line with the overall increase in freight volumes, thus rail's share of total shipments will likely remain unchanged [USDOT FHWA 2012].

The water mode typically carries low-value, bulk products.[1] In 2011, the maritime industry moved 825 million tons worth $279 billion, representing about 4.7 percent of the tonnage and 1.7 percent of the value of all freight shipments. Shipping via inland waterways is subject to influence from both high and low water levels as experienced in recent years. The Mississippi River, our Nation's busiest waterway, handles large volumes of agricultural and petroleum products moving between U.S. markets and to and from ports. In 2011, approximately 500 million tons of cargo was

[1] Many shipments arriving in the United States by rail and water are transferred to another mode for delivery to their final destination. These shipments are counted under multiple modes. Thus, the rail and water numbers discussed here may be lower than other published sources.

FIGURE 3-2 Freight Flows by Highway, Railroad, Air, and Waterway: 2010

NOTES: Air gateways include a low level (generally less than 3% of the total value) of freight shipped through small user-fee airports located in the same area as the gateways listed. Air gateways not identified by airport name (e.g., Chicago, IL) include major airport(s) in that area and small regional airports. Due to Census Bureau confidentiality regulations, courier operations are included in airport totals for only New York (JFK), Los Angeles, Chicago, and Anchorage.

SOURCES: **Air**—U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, USA Trade Online, **Land**—U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, TransBorder Freight Data, **Water**— U.S. Army Corps of Engineers, Navigation Data Center, personal communication, as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, National Transportation Statistics, table 1-51, available at http://www.bts.gov/publications/national_transportation_statistics/ as of October 2012.

moved by vessel along the Mississippi River [USACE 2011].

While waterborne shipments, by tonnage and value, declined in 2008 and 2009, they have since rebounded. Between 2011 and 2040, waterborne freight tonnage and value are projected to increase by 29.6 and 21.0 percent, respectively [USDOT FHWA 2012].

In comparison with the rail and water modes, air transport carries high-value products, such as electronics, precision instruments, and pharmaceuticals that require quick delivery. Of all modes, the value of air-freight shipments is projected to increase the fastest from 2011 to 2040, growing by 313.6 percent [USDOT FHWA 2012].

Over the last 20 years, the U.S. transportation system has become increasingly intermodal. Although intermodal services account for a relatively small share (9.2 percent) of freight tonnage, they moved approximately 18.4 percent of the value of the goods in 2011. FAF forecasts the value of intermodal shipments to increase significantly between 2011 and 2040 [USDOT FHWA 2012].[2]

The growth in intermodal freight movement is driven, in part, by global supply chain requirements to move goods quickly, cost effectively, and reliably. It also reflects a growing trend over the last few decades for each mode to focus on its most profitable market segment or commodity, rather than trying to transport the type of shipments that it cannot handle competitively. Between 1990 and 2010, the railroad industry reported an 82 percent increase in trailer and container traffic [AAR 2011]. Preliminary data from the Association of American Railroads show that rail intermodal traffic accounted for nearly 13 percent of U.S. Class I railroad revenue in 2011. Only coal along with chemicals and allied products accounted for a larger share of revenue [AAR 2013]. With the growth in container trade and improvements in information and logistics technologies, the stage is set for increased reliance on intermodal transportation to move goods from manufacturers to consumers.

Pipelines move vast quantities of petroleum, petroleum products, and natural gas to meet U.S. energy needs. In 2011, pipelines moved 1.7 billion tons worth $779 billion. Their share of total tonnage is projected to decrease from 9.4 percent in 2011 to 6.1 percent in 2040 [USDOT FHWA 2012].

Commodities Moved Domestically

Bulk products, such as gravel, cereal grains, natural gas, coke, and asphalt, comprise a large share of the tonnage moved in any given year, but not a large share of the value of the Nation's freight. In fact, in 2011 the top 10 commodities by weight accounted for 65 percent of total tonnage but only 19 percent of the value of goods. Rounding out the top 10 by weight were coal, waste/scrap, nonmetallic products, gasoline, fuel oils, crude petroleum, and natural sands [USDOT FHWA 2012].

[2] The FAF category for multiple modes and mail includes all multimodal movements and is not limited to traditional intermodal services, such as trailer-on-flatcar and container-on-flatcar rail.

TABLE 3-2 Hazardous Materials Shipments by Hazard Class: 2007

		Value		Tons		Ton-miles	
Hazard Class	Description	Billions of 2007 U.S. Dollars	Percent	Millions	Percent	Billions	Percent
Class 1	Explosives	12	0.8	3	0.1	<1	<0.1
Class 2	Gases	132	9.1	251	11.2	55	17.1
Class 3	Flammable liquids	1,170	80.8	1,753	78.6	182	56.1
Class 4	Flammable solids	4	0.3	20	0.9	6	1.7
Class 5	Oxidizers and organic peroxides	7	0.5	15	0.7	7	2.2
Class 6	Toxic (poison)	21	1.5	11	0.5	6	1.8
Class 7	Radioactive materials	21	1.4	<1	<0.1	<1	<0.1
Class 8	Corrosive materials	51	3.6	114	5.1	44	13.7
Class 9	Miscellaneous dangerous goods	30	7.1	7.1	7.1	7.1	7.1
Total		**1,448**	**100.0**	**2,231**	**100.0**	**323**	**100.0**

NOTE: Numbers and percents may not add to totals due to rounding.
SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics and U.S. Department of Commerce, Census Bureau, *2007 Commodity Flow Survey, Hazardous Materials, table 1a* (Washington, DC: February 2010), available at www.bts.gov/publications/commodity_flow_survey/ as of August 2011.

The picture changes significantly when looking at the value of goods shipped. The highest value goods were those that are time-sensitive, including electronics, pharmaceuticals, and textiles. Other top commodities by value are machinery, motorized vehicles, and plastics/rubber. In 2011, the top 10 commodities by value accounted for 57 percent of total value but only 16 percent of total tonnage [USDOT FHWA 2012].

Hazardous Materials

According to the CFS, more than 2.2 billion tons of hazardous materials were moved by all transportation modes combined in 2007. That volume is essentially unchanged from the tonnage of hazardous materials reported in the 2002 CFS. However, the value of those materials doubled between 2002 and 2007, fueled by increases in the price of refined petroleum products [USDOT RITA BTS 2011b]. Flammable liquids are by far the most dominant class of hazardous materials shipped, followed by gases, a distant second (table 3-2).

Trucks moved more than half of all hazardous materials shipments, calculated both by weight and value. Pipelines handled about 28.2 percent of the tonnage, followed by water (6.7 percent) and rail (5.8 percent). Trucks accounted for approximately 32.2 percent of all hazardous materials ton-miles because of the relatively short distances these products are transported. Rail accounted for 28.5 percent of the hazardous material ton-miles (table 3-3).

Safety and environmental issues associated with transportation of hazardous materials are discussed in chapter 5.

International Trade

Households and businesses increasingly rely on imports to satisfy their demand for goods and services, and U.S. businesses also seek to export goods to other countries. As a result,

between 1990 and 2010, the value of total U.S. international merchandise trade increased from $1.5 trillion in 1990[3] to $3.2 trillion in 2010 [USITC DataWeb 2013]. This is a 115.1 percent inflation adjusted increase. Several factors have brought about this growth, including the shift from a manufacturing to a service economy in the United States, globalization of international trade spurred by advancements in information technologies and supply-chain management tools, and the liberalization of trade policies.

[3] The 1990 U.S. International Trade Commission trade data has been adjusted to 2010 dollars using the U.S. Department of Labor Bureau of Labor Statistics' Consumer Price Index (CPI) Inflation Calculator.

The growth in trade has created additional traffic within our domestic transportation network as imported and exported goods flow to and from international gateways. Not only has the growth in international trade affected the domestic freight network, it has changed the geography of trade, the distance goods are shipped, how they are shipped, and the location of transportation facilities. The increased international freight flows have especially been felt at transportation facilities along the U.S. border and at ports.

Seven of the top 15 U.S. trading partners were Asian countries in 2010. Trade with China has grown the fastest, from 6 percent of the total

TABLE 3-3 Hazardous Materials Shipments by Transportation Mode: 2007

	Value		Tons		Ton-miles		Miles
Transportation mode	$ Billions	Percent	Millions	Percent	Billions	Percent	Average distance per shipment
TOTAL All modes	**1,448**	**100.0**	**2,231**	**100.0**	**323**	**100.0**	**96**
Single modes, total	**1,371**	**94.6**	**2,112**	**94.6**	**279**	**86.3**	**65**
Truck[a]	837	57.8	1,203	53.9	104	32.2	59
For-hire	359	24.8	495	22.2	63	19.6	214
Private[b]	478	33.0	708	31.7	41	12.6	32
Rail	69	4.8	130	5.8	92	28.5	578
Water	69	4.8	150	6.7	37	11.5	383
Air	2	0.1	S	S	S	S	1,095
Pipeline[c]	393	27.2	629	28.2	S	S	S
Multiple modes, total	**71**	**4.9**	**111**	**5.0**	**43**	**13.3**	**834**
Parcel, U.S. Postal Service, or Courier	8	0.5	<1	<0.1	<1	<0.1	836
Other multiple modes	28	1.9	57	2.5	17	5.3	233
Unknown and other modes, total	**7**	**0.5**	**8**	**0.4**	**1**	**0.5**	**58**

[a] Truck as a single mode includes shipments that went by private truck only, for-hire truck only, or a combination of both. [b] Private truck refers to a truck operated by a temporary or permanent employee of an establishment or the buyer/receiver of the shipment. [c] Excludes crude oil shipments.

KEY: S = data are not published because of high sampling variability or other reasons.

NOTE: Numbers and percents may not add to totals due to rounding.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics and U.S. Department of Commerce, Census Bureau, *2007 Commodity Flow Survey, Hazardous Materials table 1a* (Washington, DC: February 2010), available at www.bts.gov/publications/commodity_flow_survey/ as of August 2011.

value of U.S. merchandise trade in 2000 to 14 percent in 2011 [USDOC ITA 2012]. In 2000, China ranked 10th; today it is second only to Canada while Mexico, Japan, and Germany, respectively, round out the top five U.S. trading partners.

Together, trade with Canada and Mexico represents about 29 percent ($1.06 trillion) of the value of U.S. merchandise trade [USDOC ITA 2012]. Over the 2000 to 2011 period, trade with Mexico increased by 59 percent while trade with Canada grew by 29 percent. Trucks carried about 30.8 percent of the tonnage and 59.2 percent of the value of trade with these two countries (table 3-4). Rail is also an important mover of exports and imports between the United States and these two countries, and pipelines carry a large volume of imports, mostly oil, from Canada [USDOT RITA BTS 2012a].

In 2011, U.S.-Canada merchandise trade by surface transportation modes was split about evenly between exports and imports, while U.S. imports from Mexico exceeded exports to that country. The top commodity category for goods transported by land modes between the United States and Canada was "automotive vehicles and parts." The leading state for surface trade with Canada was Michigan, which has a high auto industry concentration and which borders southern Ontario, which also has a high concentration. Texas, which accounts for almost two-thirds of the U.S.-Mexico border, led all other U.S. states in surface trade with Mexico. "Electrical machinery, equipment, and parts" was the top commodity category transported between the United States and Mexico [USDOT RITA BTS 2012b].

A large volume of U.S. international merchandise trade passes through a relatively small

TABLE 3-4 Value and Tonnage of U.S. Merchandise Trade with Canada and Mexico by Transportation Mode: 2000, 2005, 2010, and 2011

Billions of current U.S. dollars and millions of short tons

	2000		2005		2010		2011	
Mode	**Value**	**Weight**	**Value**	**Weight**	**Value**	**Weight**	**Value**	**Weight**
Truck[a]	429	NA	491	191	557	187	626	208
Rail[a]	94	NA	116	141	131	134	152	142
Air	45	<1	33	<1	45	<1	46	<1
Water	33	194	58	256	81	210	108	188
Pipeline[a]	24	NA	52	86	63	106	81	123
Other[a]	29	NA	39	5	40	9	46	13
Total[a]	**653**	**NA**	**790**	**679**	**918**	**646**	**1,058**	**675**

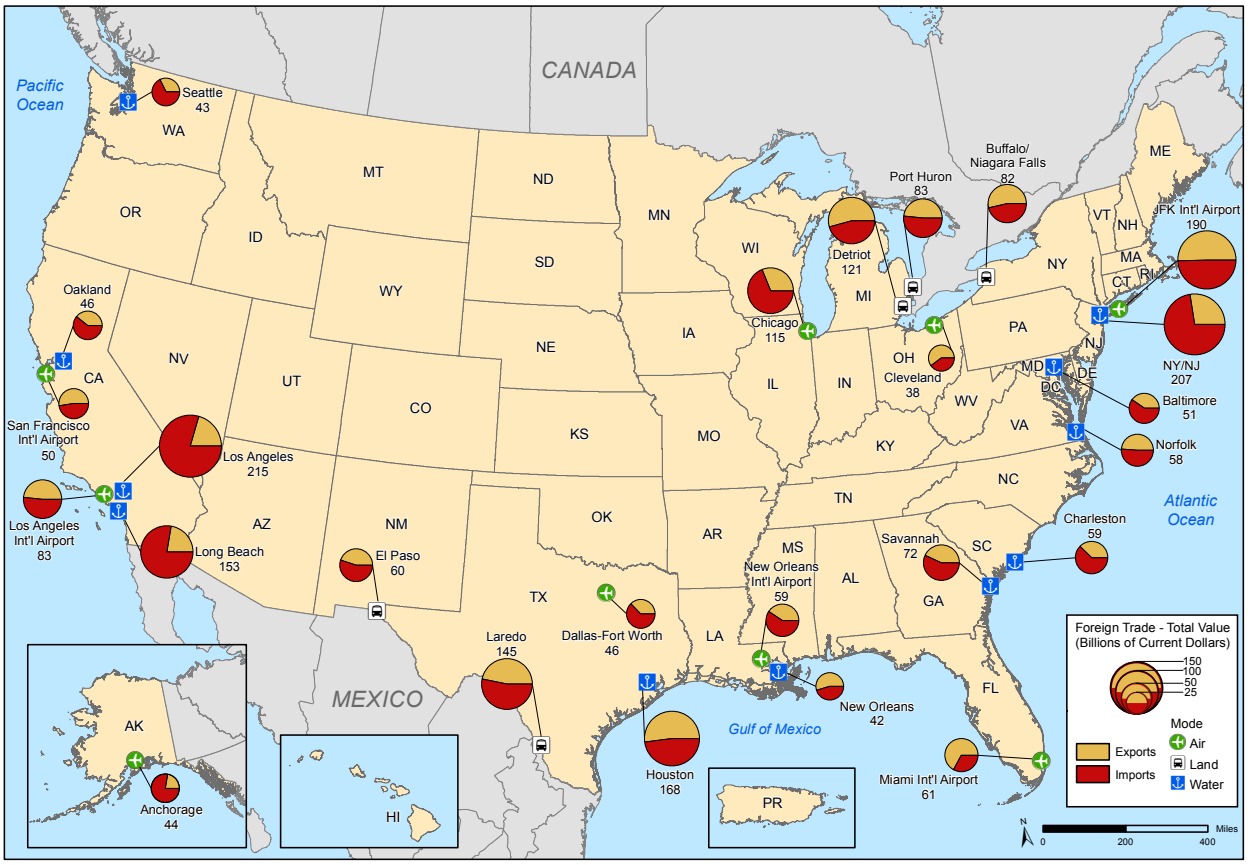
[a] The U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics estimated the weight of exports for truck, rail, pipeline, and other modes using weight-to-value ratios derived from imported commodities.

KEY: NA = not available.

NOTES: 1 short ton = 2,000 pounds. "Other" includes shipments transported by mail, other and unknown modes, and shipments through Foreign Trade Zones. Numbers may not add to totals due to rounding.

SOURCES: **Truck, Rail, Pipeline, and Other modes:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, North American Transborder Freight Data, available at www.bts.gov/transborder as of June 2012; **Air and Water:** U.S. Department of Commerce, Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: annual issues).

FIGURE 3-3 Top 25 U.S. Foreign-Trade Gateways by Value: 2011



NOTES: Air gateways include a low level (generally less than 3% of the total value) of freight shipped through small user-fee airports located in the same area as the gateways listed. Air gateways not identified by airport name (e.g., Chicago, IL) include major airport(s) in that area and small regional airports. Due to Census Bureau confidentiality regulations, courier operations are included in airport totals for only New York (JFK), Los Angeles, Chicago, and Anchorage.

SOURCE: **Air**—U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *USA Trade Online*, **Land**—U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *TransBorder Freight Data*, **Water**— U.S. Army Corps of Engineers, Navigation Data Center, personal communication, as cited in U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *National Transportation Statistics*, table 1-51, available at http://www.bts.gov/publications/national_transportation_statistics/ as of October 2012.

number of freight gateways—the entry and exit points for trade between the United States and other countries. In 2011, the Port of Los Angeles was the top water gateway, handling more than $215 billion in cargo, most of which were imports, while on the other coast the port of New York and New Jersey ranked second handling $207 billion, three-fourths of which were imports (figure 3-3). That year, John F. Kennedy International Airport was the leading air gateway handling $190 billion, with the value of exports slightly exceeding imports, while Laredo, the top land-border crossing, handled $145 billion [USDOT RITA BTS 2013].

Water is the leading transportation mode for U.S. foreign trade both in terms of tonnage and

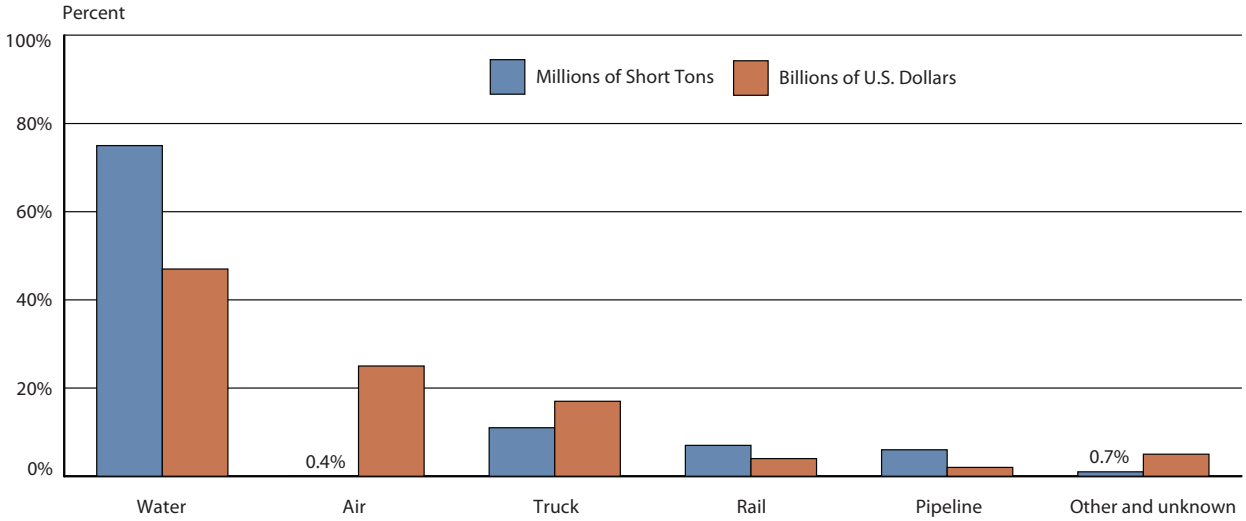
value. Ships account for more than three-fourths of trade tonnage and 46.9 percent of trade value. Although air handles less than one percent of trade tonnage, air's focus on high-value, time-sensitive, and perishable commodities gives the mode a 24.9 percent share of import-export freight value. Trucks, which carry a significant share of imports and exports between U.S. international gateways and inland locations, handle 10.5 percent of the tonnage and 17.0 percent of the value of total U.S. international trade (figure 3-4).

As a result of the growth in international trade, the number of container vessels calling at U.S. ports has increased. Between 2009 and 2010, container vessel calls at U.S. ports rose by 7.3 percent after declining in 2008. In 2010, U.S. ports handled 27 million twenty-foot equivalent units[4] (TEUs) of containerized cargo, approximately 55 percent more than what was handled in 2000 [USDOT MARAD 2011b].

The geographic distribution of container ports (figure 3-5) is more concentrated along the Pacific and Atlantic coasts, without the large volumes of bulk commodity movements through the gulf coast (figure 3-2).

[4] TEU is a nominal unit of measure equivalent to a 20' x 8' x 8' shipping container. For example, a 50 ft. container equals 2.5 TEU.

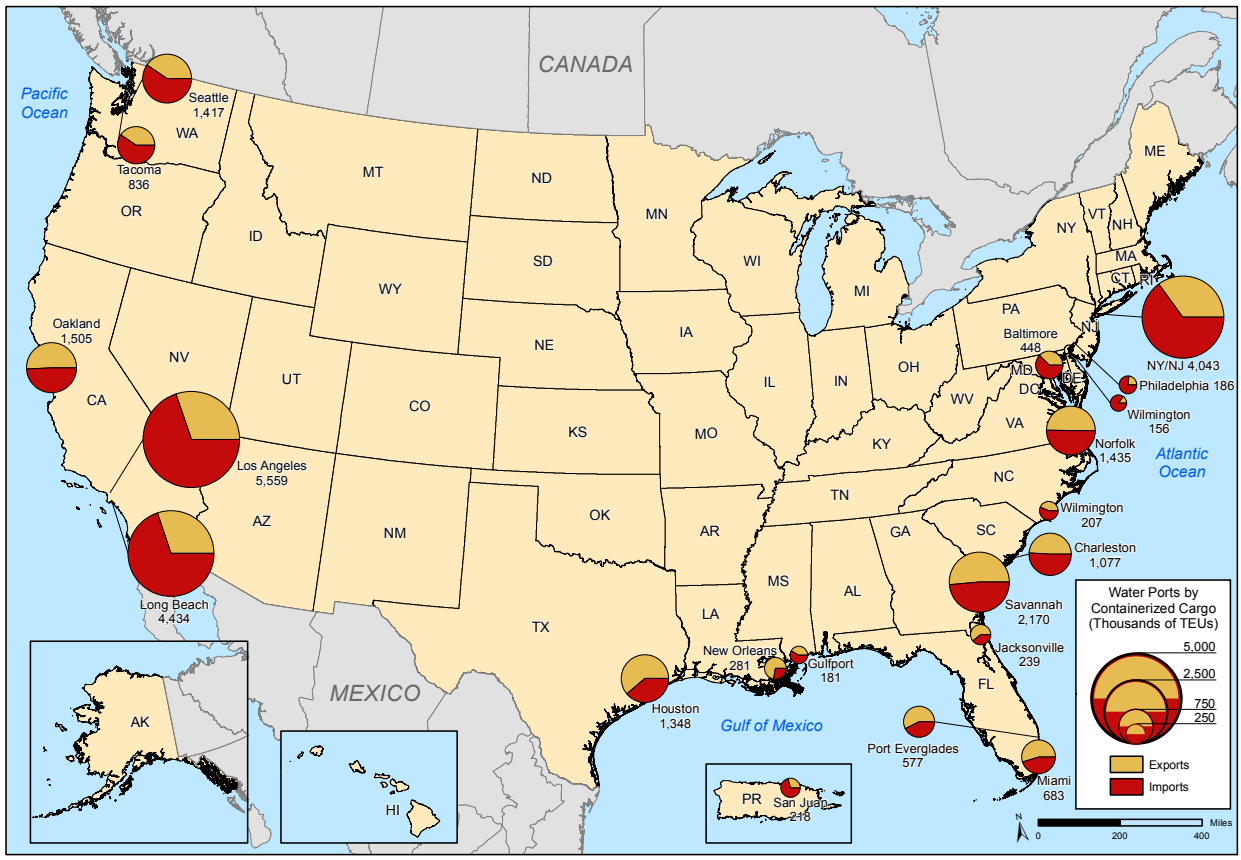
FIGURE 3-4 U.S. International Merchandise Trade by Transportation Mode: 2011



NOTES: 1 short ton = 2,000 pounds. The U.S. Department of Transportation (USDOT), Research and Innovative Technology Administration, Bureau of Transportation Statistics estimated 2010 weight data for truck, rail, pipeline, and other and unknown modes using value-to-weight ratios derived from imported commodities. Totals for the most recent year differ slightly from the USDOT, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF) due to variations in coverage and FAF conversion of values to constant dollars. Numbers may not add to totals due to rounding.

SOURCES: **Total, water and air data**: U.S. Department of Commerce, Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: December 2011). **Truck, rail, and pipeline data**: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transporation Statistics, North American Transborder Freight Data, available at www.bts.gov/transborder as of August 2012. **Other and unknown**: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transporation Statistics, special tabulation, August 2012.

FIGURE 3-5 Top 20 Water Ports by Containerized Cargo: 2010



KEY: TEUs = twenty-foot equivalent units.

NOTE: The statistics include both government and non-government shipments by vessel into and out of U.S. foreign trade zones, the 50 states, District of Columbia, and Puerto Rico.

SOURCE: U.S. Department of Transportation, Maritime Administration, *U.S. Waterborne Container Trade by U.S. Custom Ports*, based on data provided by Port Import/Export Reporting Service, available at www.marad.dot.gov/library_landing_page/data_and_statistics/Data_and_Statistics.htm as of August 2011.

The average displacement of container vessels has increased from 42,158 deadweight tons (DWT) in 2002[5] to 51,262 DWT in 2010, an increase of 21.6 percent. The movement toward larger containerships has led to a concentration of liner service at ports with ample overhead clearance and water draft; intermodal connections, such as double stack rail; and room to grow. This trend is expected to continue, especially as the new larger Panama Canal locks open next year [USDOT RITA BTS 2011a]. The top 10 container ports accounted for 57.9 percent of all oceangoing vessel calls at U.S. ports in 2010 [USDOT MARAD 2011a].

The major increase in trade with China has resulted in the large share of trade through

[5] DWT is the total weight of cargo, fuel, fresh water, stores and crew that a ship can carry when immersed to its load line.

Pacific coast ports since 1990 (figure 3-6). Between 2002 and 2010, container vessel calls at Atlantic and gulf coast ports increased by 22.5 percent and 54.0 percent, respectively, while Pacific coast container vessel calls declined by 4.8 percent [USDOT RITA BTS 2011a].

Increases in U.S. international trade over the past 20 years have increased freight volumes on major freight highway, rail, and waterway routes as international trade competes with domestic freight and passenger traffic for use of the transportation infrastructure. Moreover, trade growth between Canada and Mexico generates increased north-south traffic flows on a domestic transportation infrastructure that was initially developed along east-west corridors during the westward development of the nation.

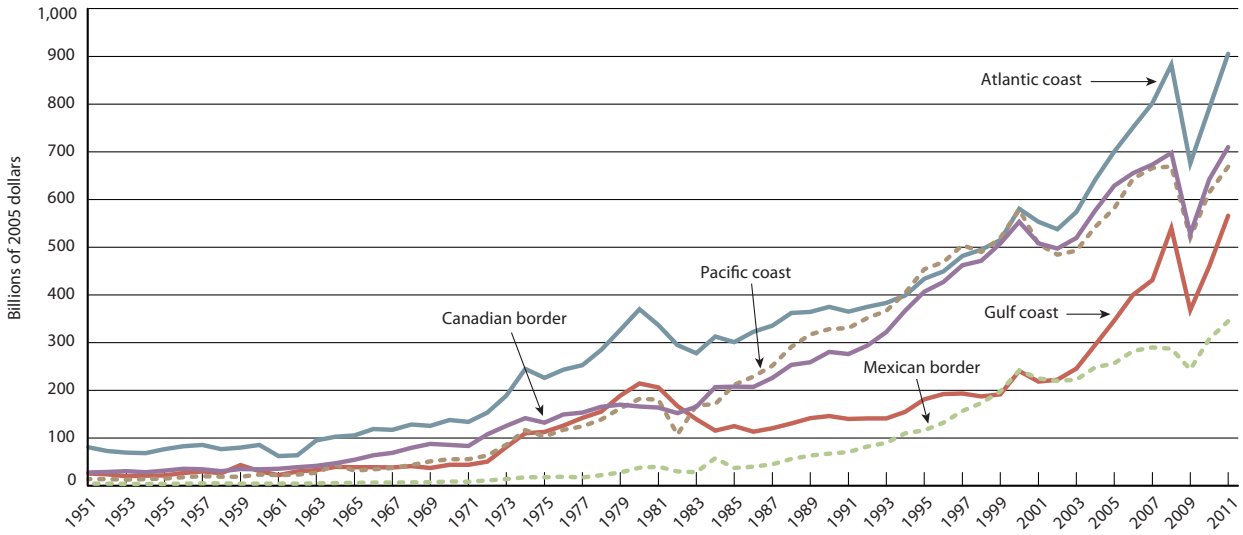
References

Association of American Railroads (AAR).

—2011. *Railroad Facts 2011* (Washington, DC: November).

—2013. *Class I Railroad Statistics*, Jan. 10, 2013. Available at www.aar.org/StatisticsAndPublications as of January 2013.

FIGURE 3-6 Value of U.S. Merchandise Trade by Coasts and Borders: 1951-2011



NOTES: The value of 2011 coal exports ($9.42 bilion) from Mobile, AL, Charleston, SC, and Norfolk, VA are considered proprietary information and are consolidated. In this figure, the total value of coal exports for the above three cities are included under the Atlantic Coast Customs District.

SOURCES: **1951-1970**: U.S. Department of Commerce, Census Bureau, *Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition* (Washington, DC: 1975); **1970-2000**: U.S. Department of Commerce, Census Bureau, *Statistical Abstract of the United States* (Washington, DC: annual issues); **2000-2011**: U.S. Department of Commerce, Census Bureau, *Foreign Trade Division, FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: annual issues). **Implicit GDP Deflator**: U.S. Department of Commerce, Bureau of Economic Analysis, Current-Dollar and "Real" Gross Domestic Product, available at www.bea.gov as of August 2012 as cited in U.S. Department of Transportation, Federal Highway Administration, *Freight Facts and Figures 2012*, available at http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/ as of February 2013.

U.S. Department of Commerce (USDOC), Bureau of Economic Analysis (BEA). 2011. National Income and Product Accounts Tables, tables 1.15, 1.16, and 4.2.4. Available at www.bea.gov/national as of January 2012.

U.S. Department of Commerce (USDOC), Census Bureau (Census):

—County Business Patterns (CBP). 2011. *Press Release*. "Census Bureau Reports U.S. Employer Firms Show Declines in Number of Establishments and Employees, June 30". Available at www.census.gov/newsroom/releases/archives/county_business_patterns as of April 2012;

—International Trade Administration (ITA). 2012. TradeStats Express. Available at www.ita.doc.gov accessed December 2012.

—2011. *Population Profiles of the United States. 2011.* Available at www.census.gov/popest as of January 2012.

—Statistical Abstract (StatAb), Table 59. Available at www.census.gov/compendia/statab as of April 2012.

—Census of Governments (Govs). Available at www.census.gov/govs as of April 2012.

U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA):

—2012. Freight Analysis Framework, version 3.4, special tabulation, 2012.

U.S. Department of Transportation (USDOT), Maritime Administration (MARAD):

—2011a. *Vessel Calls Snapshot, 2010.* Available at www.marad.dot.gov/library_landing_page/data_and_statistics/Data_and_Statistics.htm as of February 2012.

—2011b. *U.S. Waterborne Container Trade by U.S. Custom Ports*. Available at www.marad.dot.gov/library_landing_page/data_and_statistics/Data_and_Statistics.htm as of February 2012.

U.S. Department of Transportation (USDOT), Research and Innovative Technology Administration (RITA), Bureau of Transportation Statistics (BTS):

—2013. *Pocket Guide to Transportation*. Available at www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/pocket_guide_to_transportation/index.html as of June 2012.

—2012a. North American Transborder Freight Data. Available at transborder.bts.gov/transborder/ as of December 2012.

—2012b. BTS Press Release: *2011 Surface Trade with Canada and Mexico Rose 14.3 Percent from 2010*. March 21. Available at www.rita.dot.gov/bts/press_room accessed December 2012.

—2011a. BTS Special Report: *The Changing Tide of U.S.-International Container Trade: Differences Among the U.S. Atlantic, Gulf, and Pacific Coasts*. December. Available at www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/special_reports_and_is-

sue_briefs/index.html as of February 2012.

—2011b. Hazardous Materials Highlights—2007 Commodity Flow Survey. January. Available at www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/commodity_flow_survey/index.html as of January 2012.

U.S. International Trade Commission (USITC). Interactive Tariff and Trade DataWeb. 2013. Available at dataweb.usitc.gov as of January 2013.

U.S. Army Corps of Engineers (USACE), Institute for Water Resources, Navigation Data Center, Waterborne Commerce Statistics Center.

—2011. *Waterborne Commerce of the United States Part 2*. Available at http://www.ndc.iwr.usace.army.mil/wcsc/wcsc.htm as of April 2013.