

Moving Texas Exports

Examining the role of transportation in export
commodity supply chains

Executive Summary



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by

JOLANDA PROZZI

Research Scientist
Texas A&M Transportation Institute

MEGAN KENNEY

Assistant Transportation Researcher
Texas A&M Transportation Institute



The Texas A&M University System
College Station, Texas 77843-3135

Published: March 2016

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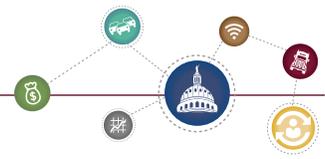
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Introduction

In 2014, Texas was the number-one exporting state in the United States and had been for 13 consecutive years (1). Texas' strategic location in terms of trade with Mexico, Central America, and South America; major gateways; extensive multimodal surface transportation infrastructure; diverse workforce; and pro-business climate facilitate the state's competitive position in international trade.

In general, the number of exports (i.e., value, volume, or tonnage) is a function of a number of factors:

- Regional, national, and international economic and market conditions.
- Operational/transportation mode choice.
- Transportation infrastructure capacity and condition.
- Public policy and regulations.
- Environmental conditions.

Any change within one of these factors could potentially impact any or all of the other factors, as well as the amount and mode of freight exports.

The freight transportation system of a region or state—its infrastructure capacity and condition, modes, and supporting policies—therefore has a direct and indirect impact on international trade, specifically exports. Freight transportation infrastructure factors relate to the capacity and condition of the freight transportation system and thus impact freight demand indirectly through service levels and costs. For example, freight transportation infrastructure investments that increase system capacity could reduce travel times and costs, which can translate into increased economic productivity, enhanced labor and market access, and increased economic competitiveness (2) that can result in increased exports. On the other hand, the mode of transportation has a direct impact on the cost, efficiency, and reliability of moving export products to overseas markets.

The purpose of this series of reports is to:

- Document the characteristics of Texas' export trade.
- Describe the supply chains for six of Texas' major export commodities—cotton; motor vehicle parts; electronic instruments; plastic resin; timber, wood, and wood products; and liquefied natural gas (LNG).
- Examine the role of transportation in the export supply chains.
- Identify the transportation concerns of exporters that affect the costs of exports and Texas' competitiveness in global markets.



Characteristics of Texas' Export Trade

Texas is a major exporter and importer of goods. In 2014, Texas' merchandise exports totaled \$288.0 billion—49 percent of its total international trade (see Figure 1). Texas' imports totaled \$302.3 billion in 2014. The \$288.0 billion in exports from Texas supported an estimated 1.1 million jobs in 2014 (3).



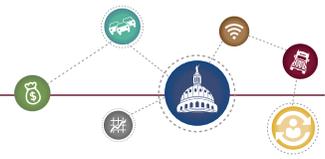
Figure 1. Texas' 2014 Trade Statistics—Imports and Exports
(Billions of Dollars).
Source: (4).

Texas' Major Trading Partners

In 2014, Texas' top five export trading partners (in terms of value) were Mexico, Canada, Brazil, China, and South Korea (see Figure 2). Mexico was Texas' main export trading partner. In 2014, Texas exported \$102.6 billion in merchandise to Mexico—or 36 percent of the state's total export value. Exports to Canada amounted to \$31.3 billion (11 percent of the state's export value), followed by \$11.8 billion in exports to Brazil, \$10.9 billion to China, and \$8.9 billion to South Korea.



Figure 2. Texas' Major Export Trading Partners in 2014
(Billions of Dollars).
Source: (5).



Texas' Major Export Commodities

In 2014, Texas' largest export commodity (in terms of value) was petroleum and coal products, which accounted for \$58.0 billion (or 28 percent of Texas' total merchandise export value in 2014). Texas' other top four export commodities were (see Figure 3):

- Computer and electronic products at \$46.6 billion.
- Chemicals at \$46.1 billion.
- Machinery (except electrical) at \$29.9 billion.
- Transportation equipment at \$23.2 billion.

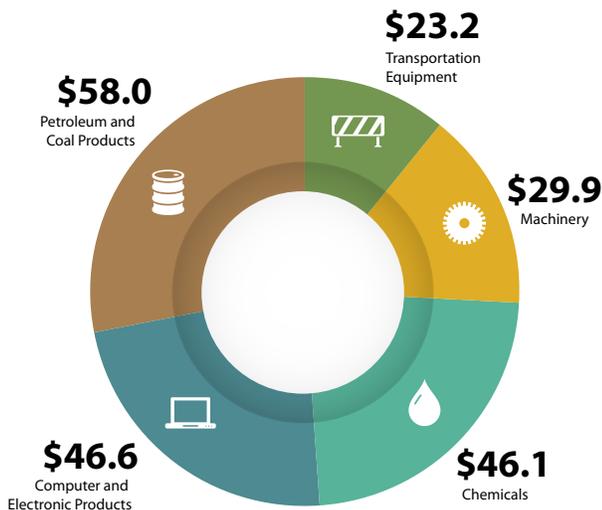


Figure 3. Texas' Major Export Commodities in 2014 (Billions of Dollars).

Source: (6).

In 2014, Texas' largest export commodity (in terms of value) was petroleum and coal products, which accounted for \$58.0 billion (or 28 percent of Texas' total merchandise export value in 2014).



Texas' Major Export Commodities by Trading Partner

Table 1 lists the major export commodities traded with Texas's top five export trading partners in 2014. The table shows that the most important commodity (in terms of value) exported to:

- Mexico was computer and electronic products valued at \$24.8 billion.
- Canada was oil and gas valued at \$7.8 billion.
- Brazil was petroleum and coal products valued at \$4.2 billion.
- China was chemicals valued at \$3.1 billion.
- South Korea was computer and electronic products valued at \$2.7 billion (7).

In 2014, Texas' top five export trading partners (in terms of value) were Mexico, Canada, Brazil, China, and South Korea.

Table 1. Texas’ Major Export Commodities by Major Trading Partner in 2014.

TRADING PARTNER	EXPORT COMMODITY	EXPORT VALUE (BILLIONS OF DOLLARS)
Mexico	Computer and electronic products	24.8
	Petroleum and coal products	13.0
	Transportation equipment	11.3
	Chemicals	10.7
Canada	Oil and gas	7.8
	Chemicals	4.8
	Computer and electronic products	3.5
	Petroleum and coal products	3.3
Brazil	Petroleum and coal products	4.2
	Chemicals	3.1
	Oil and gas	1.0
	Machinery (except electrical)	0.9
China	Chemicals	3.1
	Machinery (except electrical)	1.5
	Agricultural products	1.4
	Computer and electronic products	1.3
South Korea	Computer and electronic products	2.7
	Chemicals	2.0
	Machinery (except electrical)	1.4
	Fabricated metal products	0.6

Transportation Modes Used

Export commodities can be moved by multiple modes of transportation: road, rail, pipelines, water, air, and a number of intermodal options. The capacity and condition of the infrastructure of each mode are major factors in facilitating or impeding export trade. The type of merchandise and the destination also influence the mode(s) of transportation used. For example, for a shipper exporting perishable merchandise, speed/travel time is a major factor in choosing the mode of transportation. Seafood and flowers will thus most likely ship by air. For other commodities, such as bulk cotton, rail and marine vessels will potentially be more cost efficient and profitable to reach the export destination.

This analysis used the Freight Analysis Framework (FAF4),¹ a publicly available freight database, to provide information on Texas’ merchandise exports by transportation mode to its major trading partners/regions. FAF4 includes eight international trade region destinations for exports: Mexico, Europe, the rest of the Americas, Canada, Southwest and Central Asia, Eastern Asia, Africa, and Southeast Asia and Oceania. This section therefore summarizes Texas’ export trade value by transportation mode to Mexico (Texas’ largest export trading partner), Canada (Texas’ second largest export trading partner, the rest of the Americas (as the region includes Brazil, which is Texas’ third largest export trading partner), and Eastern Asia (as the region includes China and South Korea, which are Texas’ fourth and fifth largest export trading partners, respectively).

¹ The FAF4 web tabulation tool was used to extract 2012 export flows (in terms of dollar value) with Texas as the domestic origin and the mode of transportation used. FAF4 includes export exit zone details for all 50 states, the foreign destination region, the mode(s) used domestically, the foreign mode of exit, and the commodities exported. FAF4 follows the five-digit Standard Classification of Transported Goods (see [https://bhs.econ.census.gov/bhs/cfs/Commodity%20Code%20Manual%20\(CFS-1200\).pdf](https://bhs.econ.census.gov/bhs/cfs/Commodity%20Code%20Manual%20(CFS-1200).pdf)). For exports, the domestic mode is the transportation mode(s) used between the domestic origin and the exit zone. The foreign mode is the mode of departure from the exit zone; it does not include the mode(s) used in foreign countries.

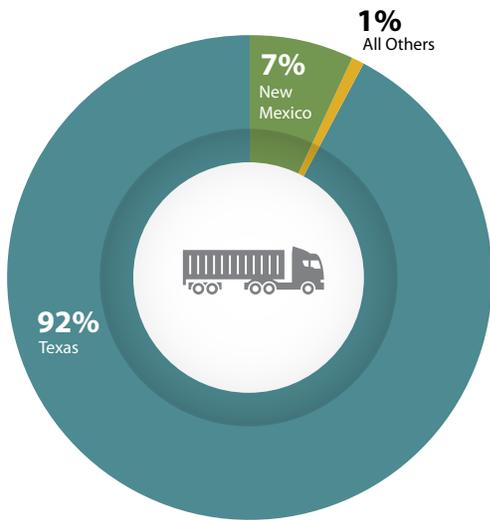
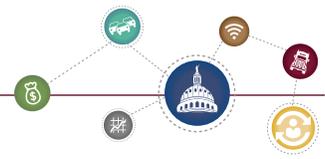


Figure 4. Major Exit States for Texas' Exports by Truck to Mexico in 2012.

Texas' Exports to Mexico

The FAF4 analysis showed that 68.0 percent of the value of Texas' exports to Mexico moves by truck. In addition, 8.4 percent of the value of Texas' exports to Mexico moves by rail or truck on the domestic leg of the trip and departs on rail on the exit leg of the trip. The remaining 23.6 percent moves by water, air, pipeline, multiple modes, or an unknown mode.

Figure 4 shows that approximately 92 percent of Texas' exports (in terms of value) by truck to Mexico exited the United States through gateways in Texas. Only 8 percent of Texas' exports by truck to Mexico exited a gateway in another state (the most notably being New Mexico).

Similarly, Figure 5 shows that approximately 97 percent of Texas' exports (in terms of value) where the exit mode is rail to Mexico exited through gateways in Texas. The remaining 3 percent exited through gateways in Arizona or California.

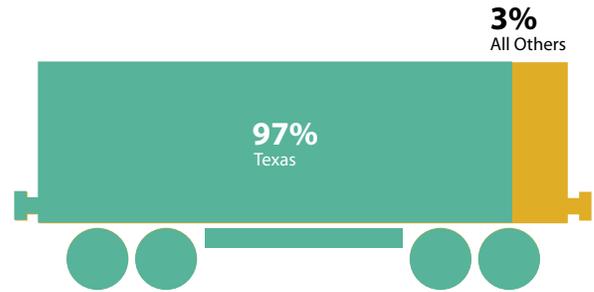
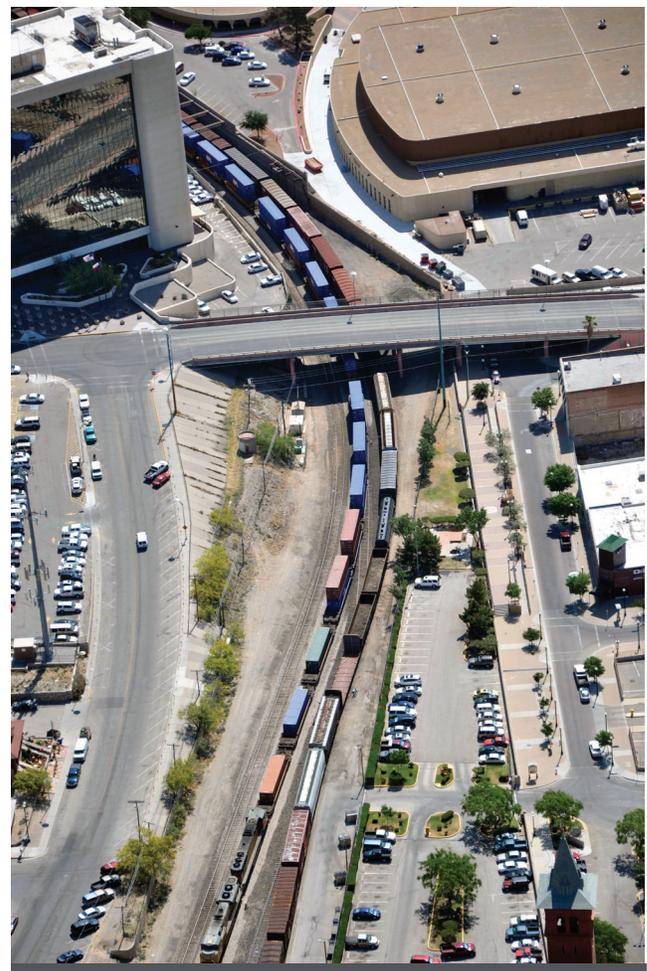


Figure 5. Major Exit States for Texas' Exports by Rail to Mexico in 2012.



Texas' Exports to Canada

The FAF4 analysis showed that 69.6 percent of the value of Texas' exports to Canada moves by truck. In addition, 19.6 percent of the value of Texas' exports to Canada moves by rail. The remaining 10.8 percent moves by water, air, multiple modes, or an unknown mode.

Figure 6 shows that approximately 52 percent of Texas' exports by truck to Canada (in terms of value) exited through gateways in Michigan, 19 percent exited through gateways in Montana, and 14 percent exited through gateways in North Dakota.

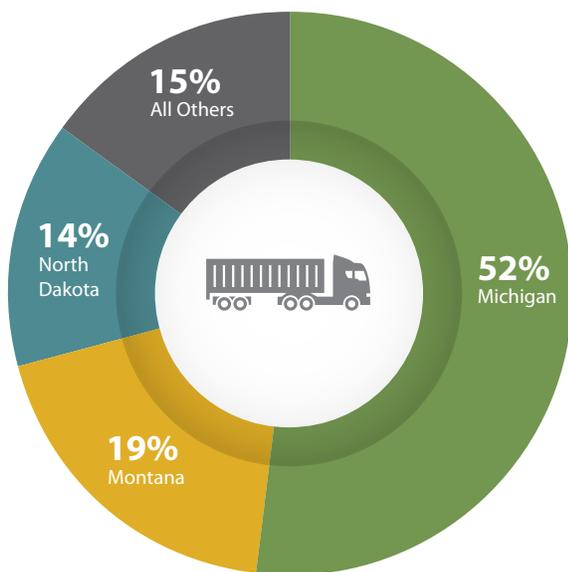


Figure 6. Major Exit States for Texas' Exports by Truck to Canada in 2012.

Figure 7 shows that approximately 57 percent of Texas' exports by rail to Canada exited through gateways in Michigan, 13 percent exited through gateways in Minnesota, 12 percent exited through gateways in Washington, and 11 percent exited through gateways in North Dakota.

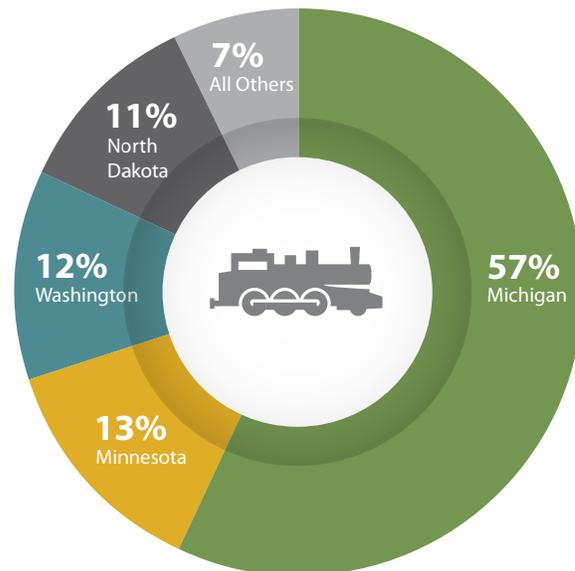


Figure 7. Major Exit States for Texas' Exports by Rail to Canada in 2012.

Texas' Exports to the Rest of the Americas

The FAF4 analysis showed that 98.5 percent of the value of Texas' exports to the rest of the Americas² is shipped by water. Only 1.5 percent of the value of Texas' exports to the rest of the Americas moves by air to the export destination. In the case of Texas exports that move by water, 32.7 percent are delivered by truck to the marine port, 12.5 percent are delivered by train, and 36.1 percent are delivered by pipeline. The remaining 18.7 percent are delivered to the marine port by marine vessel, multiple modes, or an unknown mode.

² The rest of the Americas includes Anguilla, Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands, French Guiana, Greenland, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Martin (French part), St. Pierre and Miquelon, St. Vincent and the Grenadines, Saint-Barthélemy, Suriname, Trinidad and Tobago, Turks and Caicos Islands, Uruguay, Venezuela, and Virgin Islands of the United States. Of all these countries, Brazil is Texas' most important export trading partner.

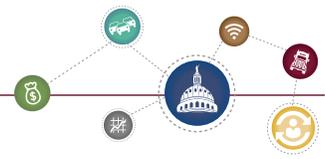


Figure 8 shows that approximately 85 percent of Texas' exports destined for the rest of the Americas are trucked to a Texas port, from where they are transported by marine vessel. In addition, 13 percent of Texas' exports destined for the rest of the Americas are trucked to a port in Louisiana, from where they are exported. All others include ports in California, Florida, Georgia, North Carolina, and South Carolina.

Figure 8. Major Exit States for Texas' Exports to the Rest of the Americas Trucked to a Marine Port in 2012.

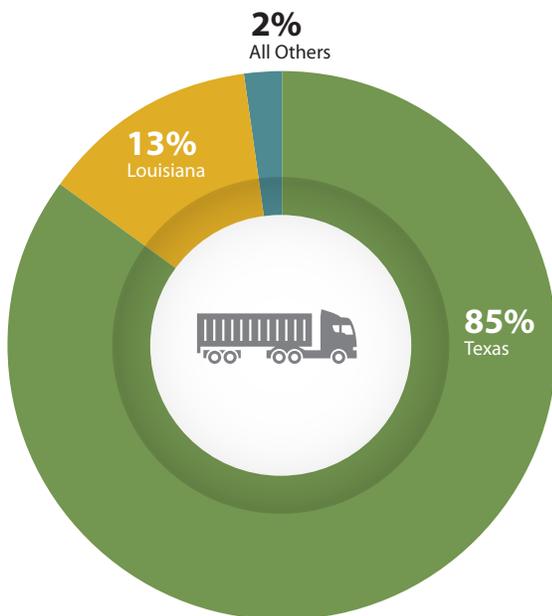
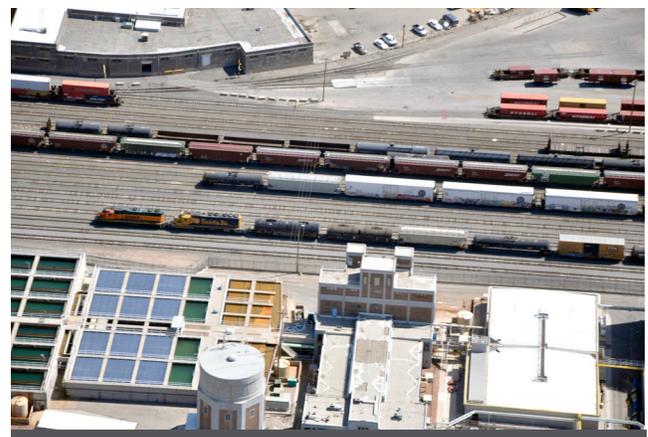
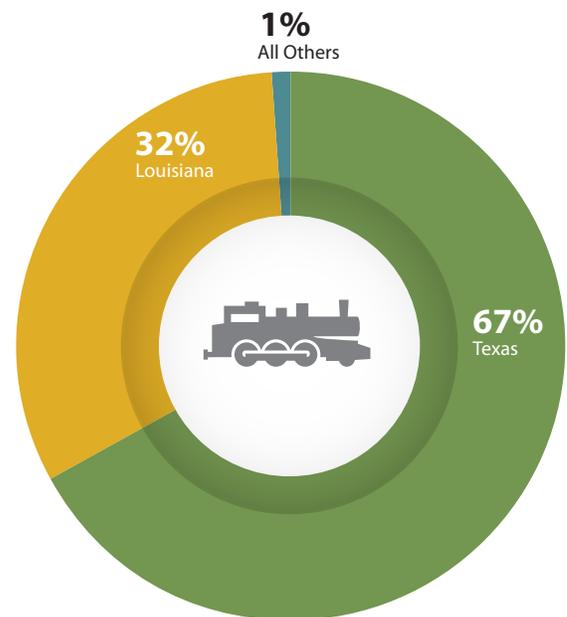


Figure 9 shows that approximately 67 percent of Texas' exports destined for the rest of the Americas are railed to a Texas port, from where they are transported by marine vessel. In addition, 32 percent of Texas' exports destined for the rest of the Americas are railed to a port in Louisiana, from where they are exported. All others include ports in California, Florida, Mississippi, Pennsylvania, South Carolina, and Virginia.

Figure 9. Major Exit States for Texas' Exports to the Rest of the Americas Railed to a Marine Port in 2012.



Texas' Exports to Eastern Asia

The FAF4 analysis showed that 72.3 percent of the value of Texas' exports to Eastern Asia³ is shipped by water. The remaining 27.7 percent of the value of Texas' exports to Eastern Asia moves by air to the export destination. In the case of Texas exports that move by water, 81.5 percent are delivered by truck to the marine port, 7.9 percent are delivered by train, and 5.3 percent are delivered by pipeline. The remaining 5.3 percent are delivered to the marine port by marine vessel or multiple modes. Figure 10 shows that approximately 70 percent of Texas' exports destined for Eastern Asia are trucked to a California port, from where they are transported by marine vessel. In addition, 27 percent of Texas' exports destined for Eastern Asia are trucked to a Texas port, from where they are exported. All others include ports in Florida, Georgia, Louisiana, New Jersey, and Washington.

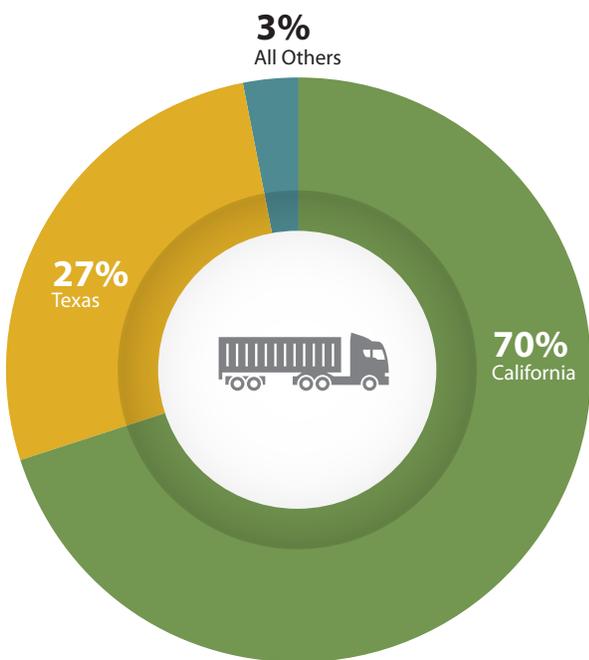


Figure 10. Major Exit States for Texas' Exports to Eastern Asia Trucked to a Marine Port in 2012.

³ Eastern Asia includes China, Hong Kong, Japan, Macao, Mongolia, North Korea, South Korea, and Taiwan. Of these countries, China and South Korea are Texas' fourth and fifth most important export trading partners.

Figure 11 shows that approximately 44 percent of Texas' exports destined for Eastern Asia are railed to a Texas port, from where they are transported by marine vessel. In addition, 41 percent of Texas' exports destined for Eastern Asia are railed to a port in California, and 14 percent are railed to a port in Louisiana, from where they are exported. All others include ports in Alabama, Georgia, New Jersey, and Washington.

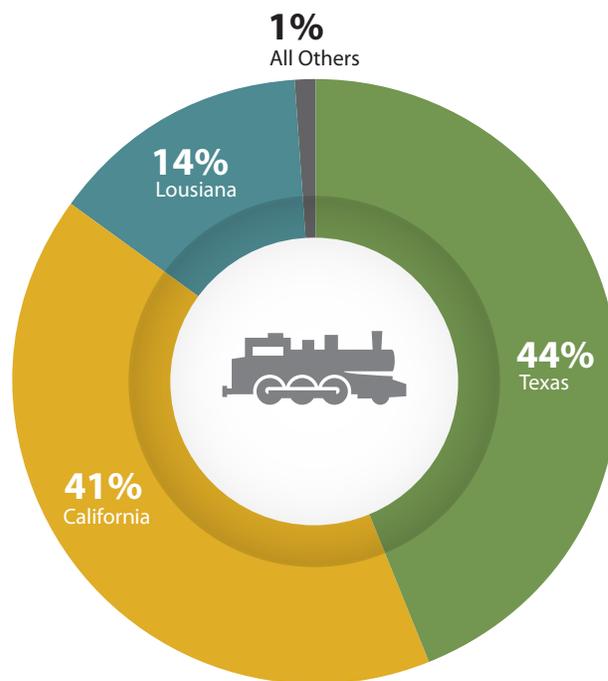
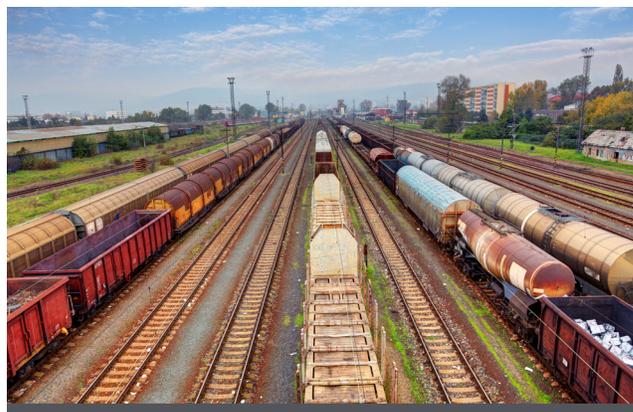
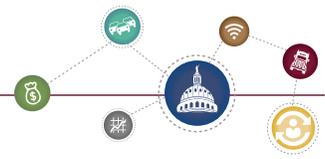


Figure 11. Major Exit States for Texas' Exports to Eastern Asia Railed to a Marine Port in 2012.





Export Supply Chains

The export supply chain has many stakeholders. These stakeholders include different companies/agencies involved in financing, producing, storing, transporting, selling (wholesale and retail), and clearing shipments.

The length and complexity of supply chains are largely a function of:

- The geographic location(s) of the raw materials.
- Intermediate inputs and the manufacturing facilities.
- The number of inputs required.
- The processing required.
- The final destination.

For example, the export supply chain for LNG is much simpler than that for timber, wood, and wood product exports because there are fewer inputs, intermediate steps, and processing required.

Transportation in the Export Supply Chain

Supply chain management seeks to reduce the overall cost of producing and selling a product through maximizing the efficiency of the product's supply chain. The most efficient export supply chains are those that deliver an export product to the importer at the lowest cost while meeting quality-of-service expectations. Transportation is an important component of an export supply chain because transportation adds costs to the final export price—thereby impacting the competitiveness of exporters—and impacts the quality of service provided.

The objective of this series of papers was to describe the supply chains for six of Texas' major export commodities and identify the role of transportation in the export supply chain. The study documented the transportation concerns of industry, transportation policies and regulations affecting the costs of exports, and infrastructure concerns pertaining to the export of:

- Cotton.
- Motor vehicle parts.
- Electronic instruments.
- Plastic resin.
- Timber, wood, and wood products.
- Liquefied natural gas.

The most efficient export supply chains are those that deliver an export product to the importer at the lowest cost while meeting quality-of-service expectations.

Transportation Factors Impacting Export Competitiveness

Texas' transportation system (pipelines, rail, trucks, airports, border crossings, and marine ports) is an important component of export supply chains because it connects all the elements of the export supply chain. For the United States and Texas to remain competitive in the global market, it is important that export shipments be delivered in a timely and cost-effective manner. This section of the document highlights a number of transportation concerns documented in the literature and expressed by industry that may add costs to Texas' export supply chain. The transportation concerns are broadly grouped and discussed under the following four headings:

- Public policies and regulations.
- Gateway efficiencies.
- Transportation system condition and capacity.
- Modal costs.

Public Policies and Regulations

Many of the actions that determine the efficiency of a supply chain fall within the realm of private industry, but many are also influenced by public policy and regulations. Examples include:

- Safety policies and requirements (e.g., driver hour regulations).
- Truck size and weight limits.
- The interaction between public and private agencies.

Texas' transportation system (pipelines, rail, trucks, airports, border crossings, and marine ports) is an important component of export supply chains because it connects all the elements of the export supply chain.

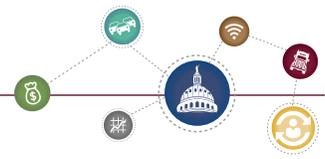


Overweight Regulations

Compliance with overweight regulations by the cotton and timber industry was seen as problematic in the field and the forest. In addition, there was concern that more lenient overweight regulations and lower permit fees in neighboring states (specifically Louisiana) put Texas at a comparative disadvantage in terms of the cost of transporting cotton and timber. Another major concern to the timber industry was the designation of IH 69 in East Texas. This route is currently the main artery for timber movement from East Texas. Unless the state requests an exemption, the timber industry will have to comply with the 80,000-lb federal gross vehicle weight limit for combination vehicles with five axles. Without an exemption, the costs of timber transportation will thus increase, further impacting the competitiveness of Texas' timber exports.

Permit Approvals and Infrastructure for LNG Exports

Receiving permit approvals for LNG exports and the infrastructure required for LNG exports can be a lengthy process because of the complexity and number of federal agencies that can be involved in the approval. As of January 2016, two Federal Energy Regulatory Commission–approved LNG export terminals are under construction in Freeport and Corpus Christi (9). In addition, two LNG export terminals in Sabine Pass and Freeport are pending application, and another six LNG export terminal projects in Texas have been proposed (11).



Gateway Efficiencies

Texas' marine ports, border ports of entry, and airports are critical gateways for the state's exports to global markets.

In addition, a substantial number of the plastic pellets manufactured and cotton harvested in Texas are exported through the Ports of Los Angeles and Long Beach. West Coast port labor issues and port congestion can therefore disrupt these exports to Asia significantly. Labor disputes at West Coast ports also add time (and thus cost) to the electronic instrument export supply chain.

Texas' Marine Ports

Industry noted that Texas' marine ports are at a disadvantage compared to the Ports of Los Angeles and Long Beach, which have more frequently scheduled liner services to China. For example, a lack of scheduled liner services impacts the competitiveness of the export supply chain because exporters must pay for storage at Texas ports (e.g., timber), which adds time and costs. Industry also noted that congestion at terminal gates, last-mile congestion, and port hours affect the number of dray trips a driver can make in a day and ultimately the cost of the drayage operations.



Texas' Border Ports of Entry

A number of factors could result in border delays. These relate to both border infrastructure (e.g., design of the border facilities, inadequate crossing capacity, and inadequate road capacity serving the crossing) and operations (e.g., inadequate staffing to process vehicles). Excessive wait times to cross the border increase the cost of transportation and therefore the cost of trade. For example, cotton exports to Mexico are often delayed due to documentation requirements, the number of agencies involved in the border-crossing process, and the available number of customs and inspection staff.

Similarly, required rail crew changes and safety inspections impose delays on motor vehicle parts crossing the Texas-Mexico border.

Growing border communities are also encroaching on rail corridors, causing conflicts at at-grade crossings and capacity concerns because of limited space for rail terminal expansion.

Existing border-crossing facilities were not designed for southbound commercial vehicle inspections, so recent manual truck inspections on the U.S. side of the border have created congestion at ports of entry and approaching facilities.



Texas' Airports

Industry noted that a lack of direct international flights to and from Austin results in freight forwarders trucking electronic instruments from Austin to Dallas/Fort Worth International Airport (DFW) or Houston George Bush Intercontinental Airport (IAH). Trucking companies do not have many alternatives besides IH 35, US 290, and IH 10 to access DFW and IAH from Austin. All three of these highways are highly congested in the urban areas and near the airports. For example, IH 35 is the most-congested interstate corridor in Texas, with 20 segments appearing on Texas' 100 most-congested roadways in 2015.

Transportation System Condition and Capacity

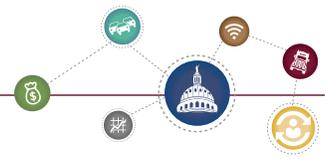
The capacity and condition of the transportation infrastructure serving trade are important in ensuring a reliable and quality transportation service. Inadequate transportation infrastructure capacity (i.e., congested facilities) results in delays and can lead to the perception that an exporter is not reliable. The latter is usually mitigated through stockpiling or warehousing, which adds costs to the export supply chain. Similarly, the condition of the transportation infrastructure is very important because it has a direct impact on the operating costs of the surface modes.

Industry expressed concern about the capacity and condition of a number of elements of Texas' transportation system:

- The deteriorating condition and funding of rural connectors (first mile) are a major concern for timber and cotton exporters (i.e., for moving lumber from the forest to the log storage and merchandizing yard or to a primary processing mill, and for moving cotton from the field to the cotton gin).
- Inadequate rail capacity is a growing concern for timber and plastic resin exporters. For example, rail companies strain to provide the needed storage-in-transit yard capacity to accommodate the increase in resin manufacturing.
- Pipeline capacity to Texas ports is regarded as insufficient.
- The Gulf Intracoastal Waterway is not deep enough to move full barges of plastic pellet containers between the Port of Freeport and the Port of Houston.

Transportation infrastructure concerns are aggravated by concerns about equipment shortages and truck driver shortages due to high driver turnover, low driver retention, and new driver hour regulations. For example, equipment shortages include shortages in the LNG tanker fleet to serve the foreseen increase in LNG exports from Gulf Coast ports; and shortages in trucks, railcars, and containers to transport cotton during the harvest season and when the energy sector is booming.

To comply with current weight regulations, plastic pellet export containers are underloaded and transported to a transloading facility (typically on port property). Additional product is then added to take full advantage of the capacity of the oceangoing containers.



Modal Costs

Industry pointed to a number of factors that impact the cost of transportation and therefore the costs of exports.

Imbalance in Demand

Industry noted that an imbalance in the demand (flow of commodities) to the Panhandle results in empty backhauls that increase the cost of truck transportation to cotton exporters. Similarly, an imbalance between the number of export and import containers results in a shortage of empty ocean containers in Houston, requiring high drayage costs to dray empty containers to the Port of Houston. Chassis availability and maintenance also affect the drayage operations at Texas ports, impacting the last-mile delivery cost of containerized cargo to the port.

Heavy-Weight Corridors

Heavy-weight corridors benefit industry by improving vehicle/container capacity use and removing the need for transloading cargo to capitalize on higher oceangoing container weight limits. This imparts significant cost savings to industry.

Panama Canal Expansion

The Panama Canal expansion will decrease the all-water distance from the Gulf Coast ports to Asia, with associated decreases in ocean liner costs. It is, however, unclear how the expanded Panama Canal will ultimately impact Texas' exports through Gulf Coast ports to Asia because of uncertainty about lock fees and the response from railroads to ensure that the land bridge to Asia (the rail and water option between Gulf Coast ports and Asia) is competitively priced.

An expanded Panama Canal could, however, impact LNG exports. An expanded Panama Canal will be able to handle 80 percent of the world's tanker fleet (as opposed to 8 percent currently), thereby reducing overall LNG shipping costs by approximately 25 percent.

Concluding Remarks

This series of reports documents the characteristics of Texas' export trade and is a first attempt to describe the supply chains for six of Texas' major export commodities—cotton; motor vehicle parts; electronic instruments; plastic resin; timber, wood and wood products; and LNG. The study also identifies the role of transportation in the export supply chains, and examines the transportation concerns of industry that affect the costs of exports and Texas' competitiveness in global markets.

Texas has been the top exporting state in the United States for 13 consecutive years. The major commodities exported from Texas are petroleum and coal products, computers and electronics, chemicals, machinery, and transportation equipment. Texas' top five export trading partners (in terms of value) were Mexico, Canada, Brazil, China, and South Korea in 2014.

An extensive literature review and industry interviews revealed that Texas' transportation system is an important component of Texas' export supply chains because transportation impacts the cost, efficiency, and reliability of moving export products from Texas to global markets. The study revealed a number of transportation concerns that add costs to the final export price—thereby impacting the competitiveness of exporters—and impacts the quality of service provided. These relate to public policies and regulations, gateway efficiencies, the freight transportation system capacity and condition, and modal costs.



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