

1. Report No. SWUTC/11/161121-1		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle U.S. and Texas International Trade and Transportation				5. Report Date July 2011	
				6. Performing Organization Code	
7. Author(s) Dr. Leigh B. Boske and Larry K. Anazia				8. Performing Organization Report No. Report 161121-1	
9. Performing Organization Name and Address Center for Transportation Research University of Texas at Austin 1616 Guadalupe, Suite 4.202 Austin, Texas 78701				10. Work Unit No. (TRAIS)	
				11. Contract or Grant No. 10727	
12. Sponsoring Agency Name and Address Southwest Region University Transportation Center Texas Transportation Institute Texas A&M University System College Station, Texas 77843-3135				13. Type of Report and Period Covered	
				14. Sponsoring Agency Code	
15. Supplementary Notes Supported by general revenues from the State of Texas.					
16. Abstract This report, funded by the Southwest Region University Transportation Center, examines various aspects of international trade, transportation, and foreign practices implemented facilitate and fund transport-related infrastructure. The report is composed of six chapters. The first chapter provides an overview of the U.S. international trade outlook. The second chapter describes the roles played by air cargo transport, ports and ocean carriers, railroads, and the motor carrier industry in U.S. international trade. The third and fourth chapters focus on Texas-specific international trade and modal gateways. The fifth chapter reviews various transport funding mechanisms, Intelligent Transportation System (ITS) applications, and forms of public-private partnerships adopted in various foreign countries. The final chapter describes the expansion of the Panama Canal and its likely Texas impacts.					
17. Key Words International Transportation, Trade Patterns and Forecasts, Modal Outlooks, Foreign Country Profiles and Best Practices, Air Cargo and Oceanborne Freight			18. Distribution Statement No restrictions. This document is available to the public through NTIS: National Technical Information Service 5285 Port Royal Road Springfield, Virginia 22161		
19. Security Classif.(of this report) Unclassified		20. Security Classif.(of this page) Unclassified		21. No. of Pages 69	22. Price

U.S. and Texas International Trade and Transportation

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July 2011

Sponsored by:

Southwest Region University Transportation Center

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ACKNOWLEDGMENTS

The authors wish to acknowledge that support for this research was provided by a grant from the U.S. Department of Transportation, University Transportation Centers Program to the Southwest Region University Transportation Center which is funded, in part, with general revenue funds from the State of Texas. The authors also would like to thank the International Relations Office of the Texas Department of Transportation, as well as the following persons for their contributions in providing background information for this report: Jacob Cottingham, Eric Faulk, David Hardy, Wenjie Luo, Jaime McAllister, Brian Miller, Scott Polasek, Lauryn Radice, and Sait Sozumert.

EXECUTIVE SUMMARY

Annual growth in global trade had been above 5% since the 1970s and above 7% throughout the 1990s. The growth rate then fell to 3.6% in the early 2000s, followed by an absolute decline as a result of the 2008-2009 global economic downturn. During this period, the United States experienced a decline of \$200 billion in the value of its exports. Correspondingly, the value of imported goods declined approximately \$600 billion. The process of economic recovery has been slow and uneven.

The above-mentioned pattern of events and impacts were reflected in varying ways in the operations of the four modes of transportation involved in U.S. international trade.

Air Cargo	Rail Freight
Experienced high growth for many decades Industry instability due to volatile oil prices Growing share of high-tech goods Trade started declining as 2008/2009 recession occurred Partial shift of retail goods to ocean shipping due to recession Increase in trade experienced in 2010 Will not fully recover until 2013-14 High-growth markets will be key to speed of recovery	Stronger performance in 2010 vs. 2008/2009 Many rail carriers are investing to expand capacity Experienced record levels of traffic even during recession Challenge is keep costs low Biggest competition is trucking
Ocean Freight	Trucking Freight
Declines in worldwide trade led to excess capacity and falling rates in ocean shipping Key industries served are housing, automotive, consumer goods and industrial equipment/machinery Imports fell close to 6% in U.S. in 2008 Exports fell close to 7%	Canada accounts for close to 60% of truck trade with U.S., while Mexico makes up the remainder. (in \$ value) It is believed that trucking will see additional growth But this growth likely will be slower than for other modes

Texas has the 3rd-largest state economy, but it ranked first in the nation in generating export revenues (15% of U.S. total export revenues). The economic downturn also had an adverse effect on the state's economy. But Texas appears to be well-positioned in terms of its geographical location, industrial structure, and natural resources to recover quickly.

Salient characteristics of Texas modes of transportation involved in international trade are shown below.

Air Cargo	Rail Freight
Texas has 55 air cargo operators Expected to see growth after 2013 Most future growth to take place in Austin, El Paso, and Houston Laredo International will be completing an expansion soon	Texas has more miles of track than any other state 91% of Mexico-U.S. trade passed through Texas (2003) Panama Canal expansion and the future of carbon caps could really impact this industry
Ocean Freight	Trucking Freight
Texas ports handle over 50% of U.S. foreign imports and exports by tonnage Texas ports account for more than 17% of Gross State Product Panama Canal expansion will increase port usage, but state ports will need adequate harbor depths and landside infrastructure to take advantage of future opportunities	Largest gateway for truck bound trade Largest inland ports are Laredo, El Paso and Hidalgo Issues of concern are new regulations for commercial vehicles, new registration fee schedule and changes in DMV

The expansion of the Panama Canal, scheduled for completion in 2014, will enable the passage of significantly larger ocean vessels (called post-Panamax ships) and reduced transit times. The canal will become an increasingly important route for trade between the U.S. East and Gulf coasts and Asia. The canal expansion likely will benefit Texas ports at the expense of West Coast ports. Currently, 14% of container traffic through the Port of Houston passes through the Panama Canal and port officials hope the percentage will grow to 25% by 2020. Already, the Port of Houston is planning a new terminal at Bayport that will triple the port's container capacity and accommodate post-Panamax ships. The Port of Corpus Christi is also expanding its capacity. However, failure to provide adequate channel/harbor depths and adequate landside transport infrastructure to accommodate larger ocean vessels could well limit future growth in maritime traffic at Texas ports.

Finally, a number of exemplary practices relating to transport funding, intelligent transportation system (ITS) technologies, and different forms of public-private partnerships (PPPs) have been implemented worldwide. These practices are worth considering in the U.S. context as possible mechanisms for facilitating and improving the movement of both domestic and international freight.

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Chapter 1. U.S. International Trade

Global Trade Outlook

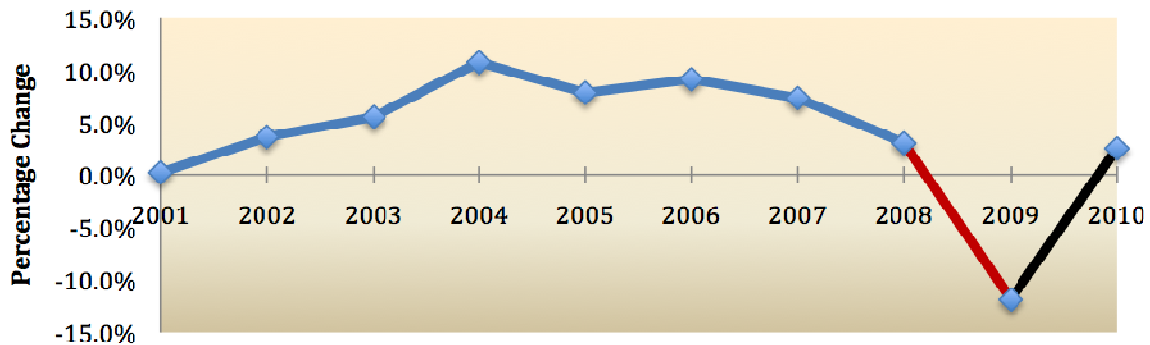
Global trade has increased almost without interruption since the end of World War II. Before the first oil shock in 1970s, the annual growth rate of world trade volume in goods and services remained above 5%. Sustained by the “New Economy,” global trade posted an annual growth rate of 7.1% from 1991 to 2000. Entering the 21st century, global trade continued to grow, but at a slower annual growth rate of 3.6%.¹

In 2008, the world economy suffered a deep recession due to the economic and financial crisis. Global trade has been affected heavily by the economic recession. The International Monetary Fund (IMF) estimated that the world volume of trade in goods and services would decline by 11.9% in 2009 compared to the previous year.²

U.S. total exports in the first three quarters of 2009 declined by 23.8% on a year-on-year basis.³ China’s total imports and exports in 2009 amounted to \$2.21 trillion, down by 13.9% compared to that of 2008.⁴ And total trade between the European Union (EU) and the U.S. in the first eleven months of 2009 decreased by 22.8% on a year-on-year basis.⁵

Although the impacts of financial crisis have not yet ended, the IMF believes that the global economy is expanding again, and that financial conditions had improved markedly. The change in the global marketplace is attributable to the strong performance of Asian economies and stabilization or modest recovery elsewhere. The IMF predicted that the world volume of trade in goods and services will increase slightly by 2.5% in 2010 on a year-on-year basis.

Figure 1. World Volume of Trade in Goods and Services, 2001–2010



Source: IMF

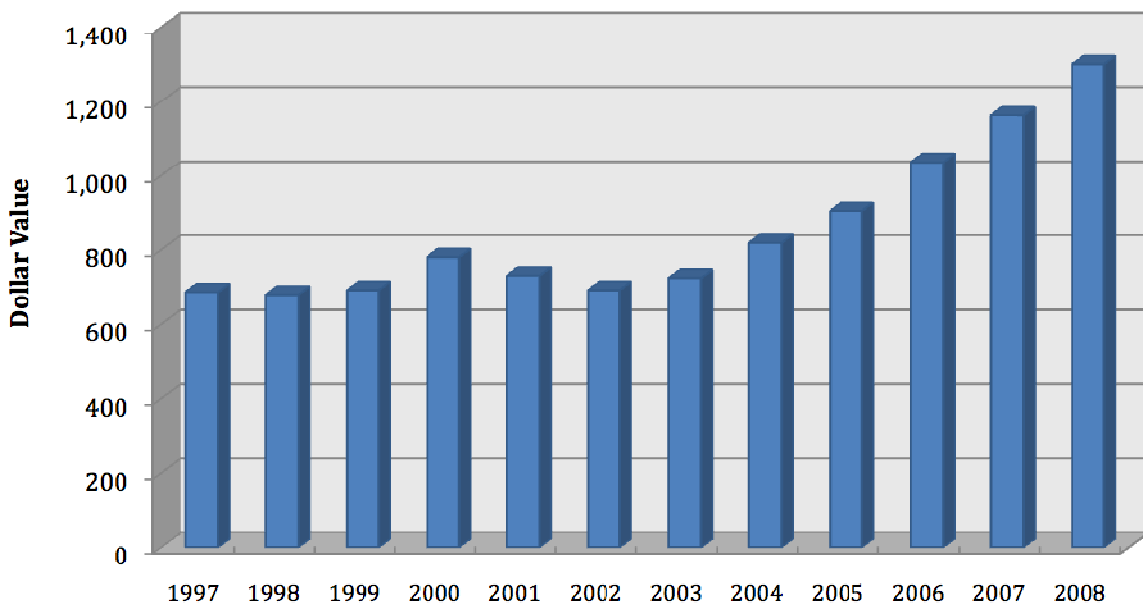
U.S. International Trade Outlook

The United States is a leading country in world trade, ranking as the fourth-largest exporting and second-largest importing nation in 2009. U.S. exports reached \$1.277 trillion in 2008 and \$994.7 billion in 2009; its imports amounted to \$2.117 trillion in 2008 and \$1.445 trillion in 2009.⁶

U.S. foreign trade experienced rapid growth period in the recent past. Although the 9/11 New York City terrorist attack hurt U.S. economic performance, U.S. exports grew at an average annual rate of about 11% from 2002 to 2008. Trade within the NAFTA countries and with China increased significantly due to economic growth and mutual market-opening efforts.

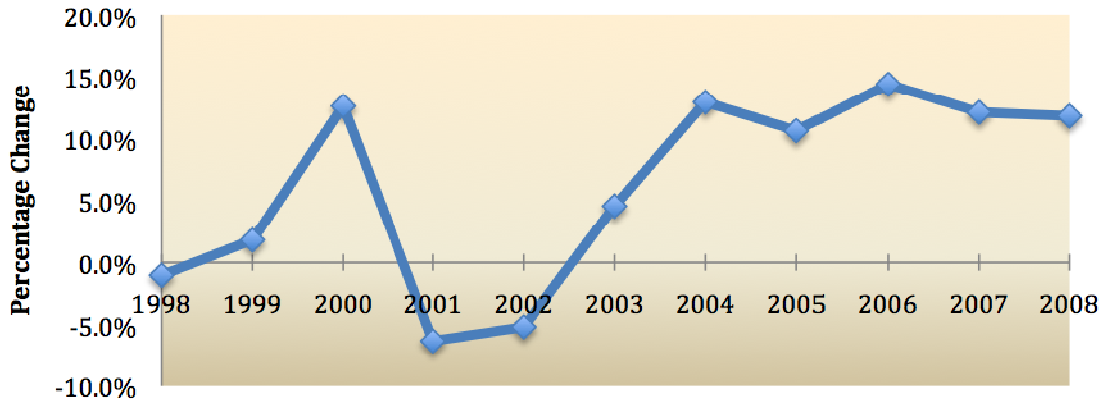
U.S. trade was inevitably influenced by current economic and financial crisis. Both exports and imports have shrunk. U.S. exports in the first three quarters of 2009 declined by 23.8% compared to that of 2008; and U.S. imports in 3rd quarter of 2009 declined by 28% on a year-on-year basis.⁷

**Figure 2. U.S. Total Exports, 1997–2008
(Billions of Dollars)**



Source: WISER Trade

Figure 3. U.S. Exports Annual Percentage Change, 1998–2008



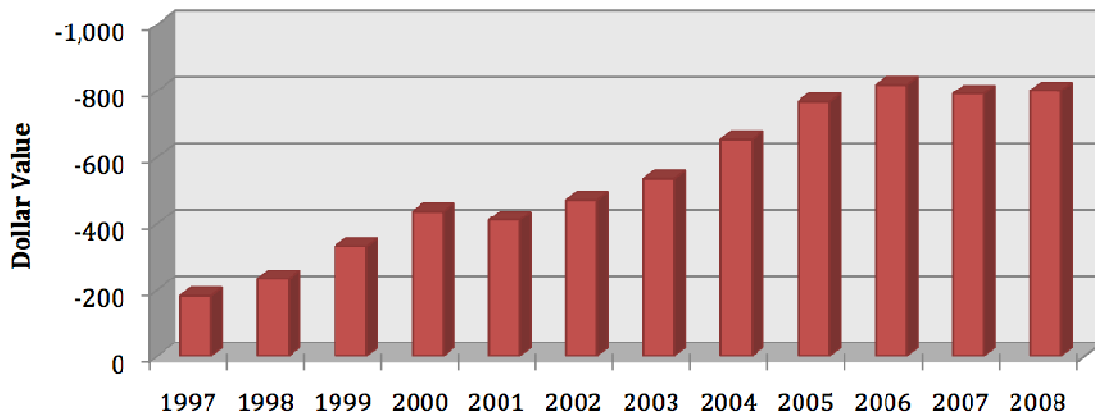
Source: WISER Trade

Trade Balance

The U.S. trade deficit has been a major issue since the 1980s. Until the late 1990s, U.S. annual trade deficit ranged between \$100 billion to \$200 billion. In 1998, the trade deficit reached \$200 billion for the first time. Afterwards, the trade deficit continued to grow, reaching an annual growth rate of more than 30% in some years.

The year 2006 represented the peak for the U.S. trade deficit when it reached \$818 billion. The 2007 and 2008 trade deficit decreased slightly. The 2009 trade deficit then declined by 39.5% on a year-on-year basis, mainly due to sharply shrinking domestic demand. Due to the weakness of the U.S. dollar, the U.S. trade balance should remain relatively stable around the current levels for some time.

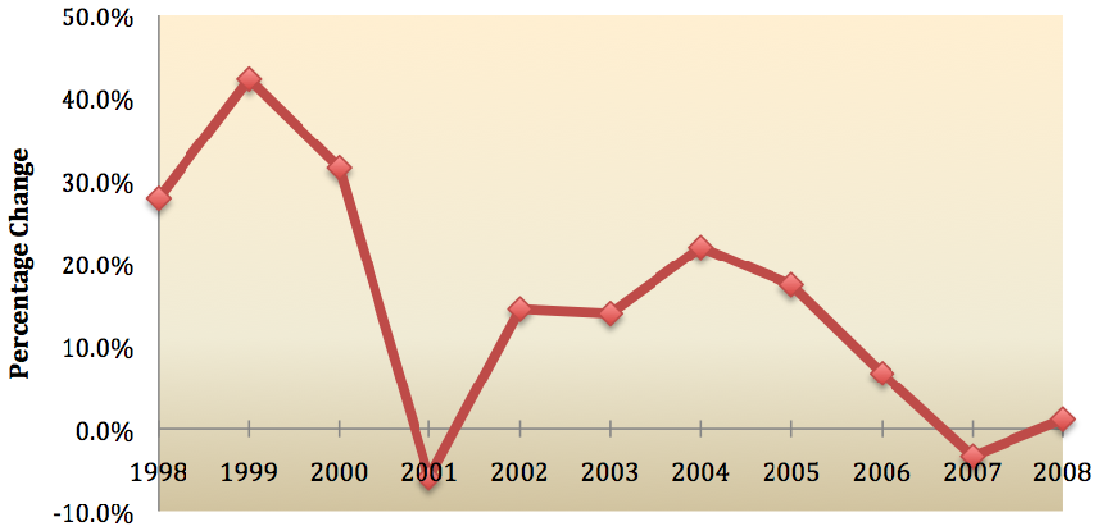
**Figure 4. U.S. Trade Balance, 1997–2008
(Billions of Dollars)**



Source:

WISER Trade

Figure 5. U.S. Trade Balance Percentage Change from Previous Year, 1998–2008

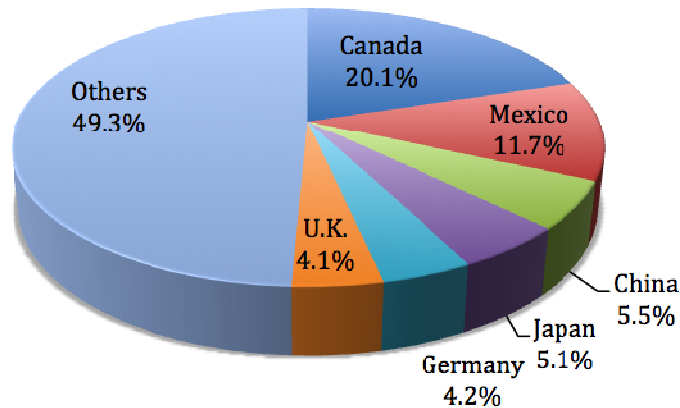


Source: USITC

Breakdown of Exports and Imports

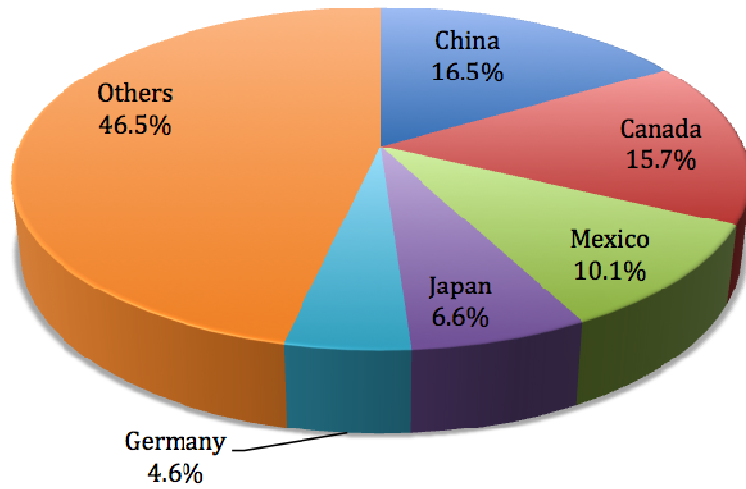
In 2008, 49% of U.S. commodity exports were capital goods such as transistors and computers. Some 26.8% were industrial supplies such as organic chemicals and 15% were consumer goods such as automobiles and medicines. Meanwhile, U.S. commodity imports included industrial supplies with a share of 32.9%, consumer goods of 31.8%, capital goods of 30.4%, and agricultural products of 4.9%. Top export destinations in 2008 included Canada, Mexico, China, Japan, Germany, and U.K. Top import sources in the same year were China, Canada, Mexico, Japan, and Germany.⁸

Figure 6. U.S. Top Exports Destinations, 2008



Source: CIA Factbook

Figure 7. U.S. Top Imports Sources, 2008



Source: CIA Factbook

U.S. International Trade Outlook

Both anticipated global economic recovery and a weak U.S. dollar on foreign exchange markets should stimulate U.S. exports and imports by raising domestic consumption of commodities and energy.

In 2010, U.S. international trade may still shrink slightly or stop declining, depending on domestic and global economic conditions. These economic conditions include domestic industry performance, the unemployment rate, the U.S. dollar exchange rate, and global trade policies. To make a more reasonable prediction about trade, it is necessary to consider national tendencies for trade protectionism.

Chapter 2. U.S. International Modal Outlook

Air Cargo

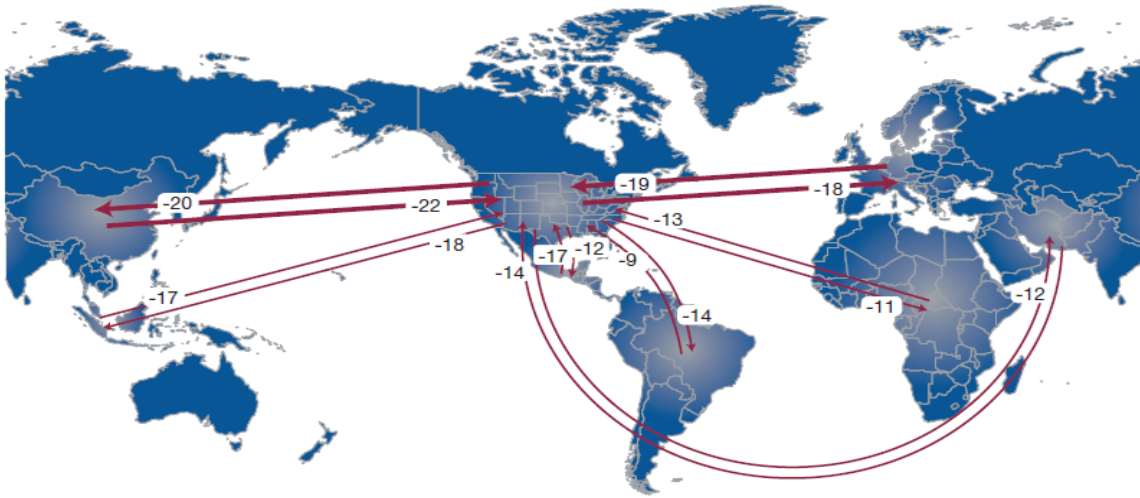
Air cargo has experienced high-growth rates for several decades. However, the recent economic crisis caused growth to slow down. Air cargo demand was hit hard in 2008, and did not make a significant improvement in 2009. Seabury's 2009 Trade Forecast projected 18% losses in both air cargo imports and exports. Another problem is instability. There have been changes in regulation, as well as unpredictability in the oil markets. On the regulatory level, import tariffs and "Buy American" provisions have a negative impact on air cargo. Additionally, the push to encourage U.S. consumers to increase savings may also have a negative impact on long-term air cargo trends. Tighter security measures and initiatives to reduce carbon emissions are negatively impacting air cargo as well. The instability in oil prices makes it difficult for air cargo executives to manage costs.

According to Seabury's projections, U.S. air trade will continue to decline until 2010. Growth is expected to resume in the 2010-2013 period, but air trade will not fully recover until 2013 or 2014. China's slowdown in export growth has affected air trade routes: "From 2000 to 2005, China's exports grew at a 17.8 percent compound annual growth rate, easing back to 9.1 percent for the 2005-2007" (Seabury Aviation Aerospace). Another troubling trend is the significant decline in U.S. consumer imports. Four of the top-five consumer import commodities are below their levels of nine years ago. Seabury forecasts that U.S. air imports for consumer goods will continue to decline, estimating a 13% drop from 2008 to 2009. The final troubling trend is the modal shift from air cargo to ocean shipping.

Air cargo's share of high-technology products had been growing despite this modal shift. In 2008, high technology made up 40% of U.S. imports from Asia Pacific Rim nations. However, the modal shift becomes more pronounced in challenging economic times because of the decrease in demand for high-value products and the shift in less time-sensitive goods to sea transport.⁹

Figure 8. U.S. International Air Trade Growth, 2008-09 (%)

U.S. faces double digit declines on all major trade lanes in 2009, imports from South America being the only exception, with around 20 percent decline on Pacific and Atlantic.

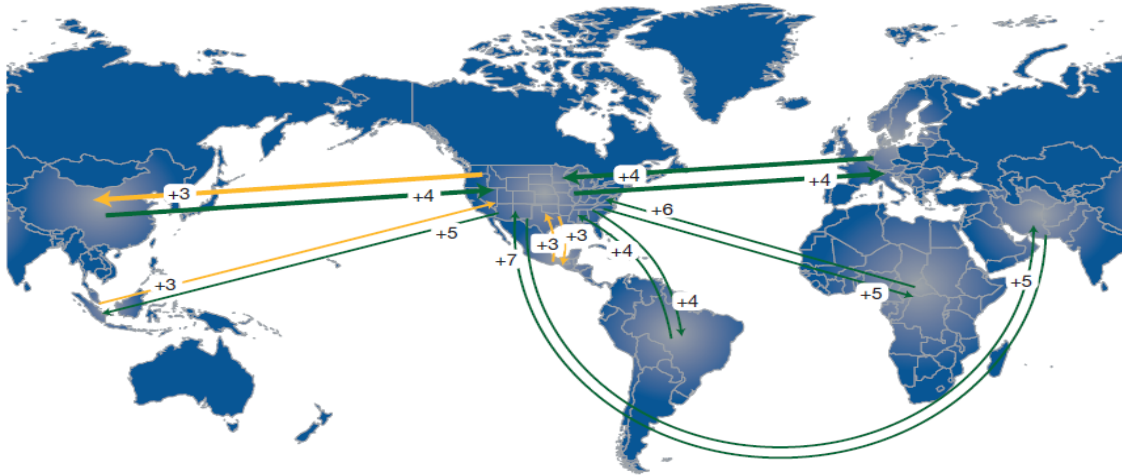


Source: Seabury Air Trade Forecast Database

That said, the future of air cargo is not as dire as the current situation would suggest. The strengths of air cargo exist in niche markets and niche sectors. While many trans-Pacific and trans-Atlantic trade routes are mature, there are opportunities for above-average growth in other regions. Some of these regions are Vietnam, Central Europe, Russia, and the Balkans. Additional areas of high growth, according to Seabury, are trade between the U.S. and the Middle East/South Asia (MESA) and between the U.S. and Africa. Trade between MESA and the U.S. is predicted to grow around 7% while U.S.-Africa trade is estimated to grow by 5.9% annually. Exports in these regions are also expected to grow at 5.4% and 4.7% in the next four years. Another positive feature for the future of air cargo is the anticipated growth in climate-controlled air cargo. Perishables and raw materials are anticipated to be growth drivers for Latin America. The anticipated annual growth rates for these perishables and raw materials are 4% and 8.1%, respectively, from 2009-2013.¹⁰

Figure 9. Projected U.S. International Air Trade Growth, 2009-13 (%)

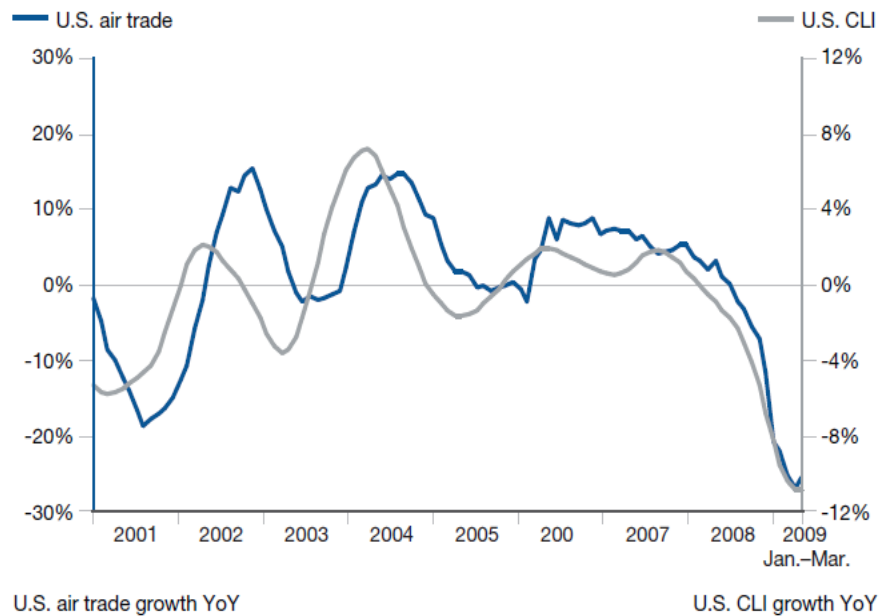
All U.S. air trade flows are expected to show recovery from 2010 on, but recovery will be weak compared to years before crisis.



Source: Seabury Air Trade Forecast Database

Another sign of recovery for the industry can be seen when looking at the Composite Leading Indicator (CLI), an indicator used by the Organization for Economic Co-operation and Development (OECD) to help predict turning points in trade and transport. The CLI typically correlates closely with the air freight market. The latest indications of the CLI suggest that declines in the U.S. market are beginning to taper off. This could indicate that the air cargo market could be stabilizing. Air cargo typically lags behind CLI about four months.¹¹

Figure 10. U.S. CLI & Air Trade Growth, 2001-09

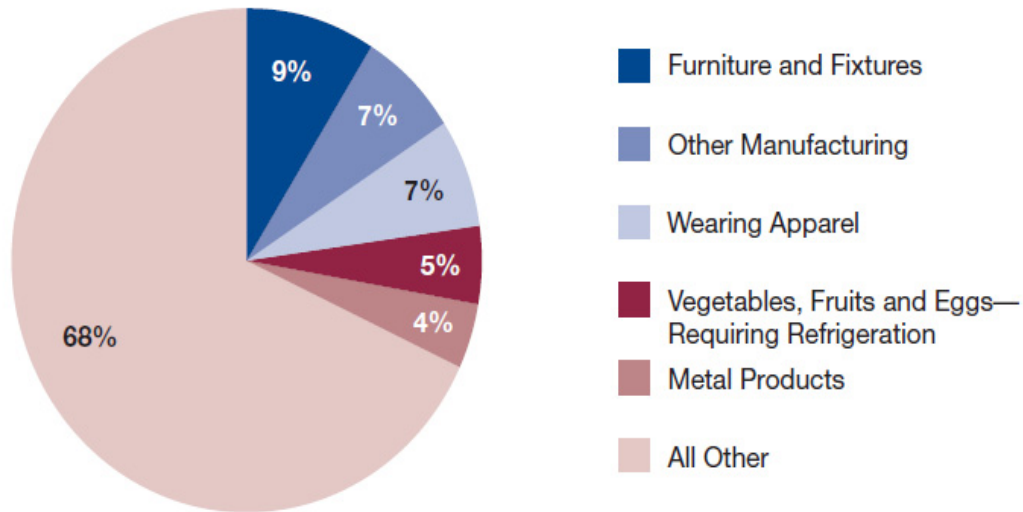


Source: OECD; U.S. Census Bureau; Institute for Supply Management; Seabury Analysis

Ocean Freight

Because of the economic downturn, shippers began to decrease their inventories and imports as global demand fell. “Buy America” provisions have been put into place in response to the economic downturn, but experts do not believe this will cause a “collapse in global trade” (IHS Global Insight). U.S. ocean container imports fell 5.8% in 2008 and were projected to shrink 12% in 2009. Imports from many northeast Asian countries are anticipated to fall the most, according to the IHS Global Insight’s Trade Forecast for 2009. U.S. containerized imports and exports have suffered significantly during the economic recession.¹²

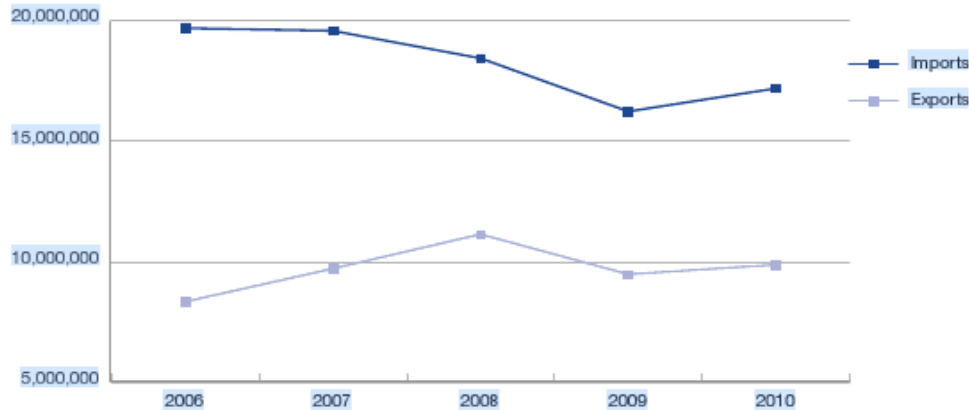
Figure 11. U.S. Containerized Imports, 2009



Source: IHS Global Insight

The recovery for sea trade is predicted to be slow in the U.S. Seaborne metric imports that shrank 7% in 2009 were projected to recover to 3% growth in 2010. Fully loaded TEU imports were expected to recover 5.9% growth in 2010. The container trade imbalance was projected to increase to 8.3% or 7.3 million TEUs, with imports exceeding exports by those amounts. There was not a sector or region that was not affected by the financial crisis; but recovery in almost all regions is anticipated for 2010.¹³

Figure 12. Total U.S. Containerized Trade, 2006-10



Source: IHS Global Insight

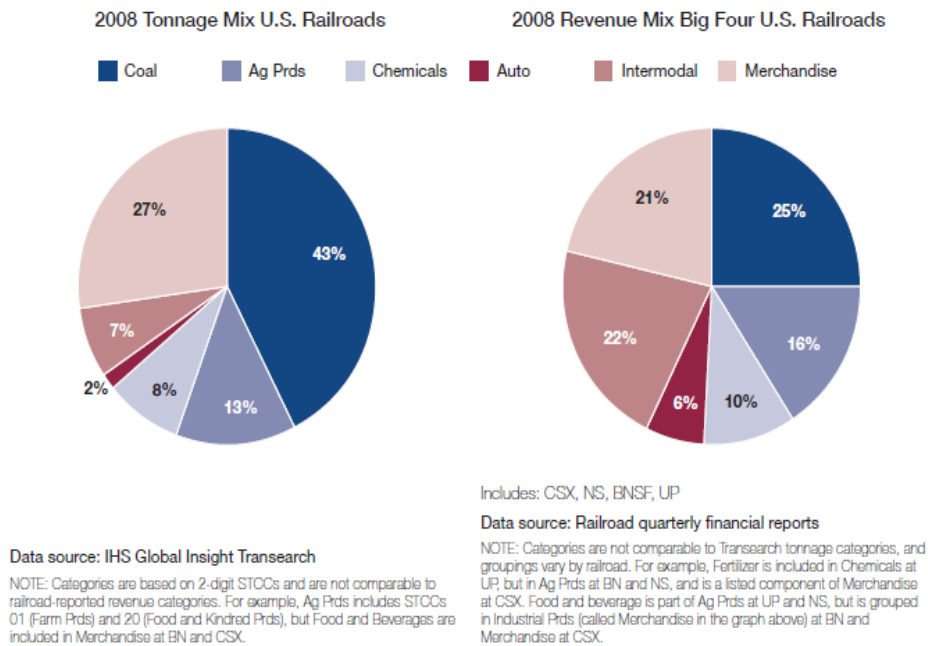
Key U.S. trade partners for container imports are China, Japan, Germany, Brazil, and Taiwan. Key export partners are China, Japan, Taiwan, South Korea, and Brazil. China is the U.S.'s largest containerized ocean trade partner. Exports to China are anticipated to fall 8.3% in 2009; but, as the economy recovers, exports are anticipated to grow 7.9%, according to IHS Global Insight. Chinese exports to the U.S. are also expected to grow 6.99% in 2010, up from an estimated 16.7% decrease in 2009. Brazil is also one of the U.S.' largest containerized trade partners and the most important trade partner in South America. Exports from the U.S. to Brazil are expected to rebound 11.5% in 2010, from a 2009 decrease of 15.9%. Imports from Brazil have been decreasing since 2007, but are expected to 6.09% growth in 2010. Some of the most important imports from Brazil are motor vehicle parts, iron, steel, and rubber goods. The last country is Japan. Of all the U.S.' key trade partners, Japan has been affected the most because of the export-focused nature of its economy. U.S. imports from Japan are anticipated to only recover .3% after a 22% decline in 2009. U.S. exports to Japan are also weak and are anticipated to remain flat in 2010 at best, after an anticipated 18.3% drop in 2009.¹⁴

Some key sectors that are influential in containerized trade are housing, automotive, consumer goods, industrial machinery, and equipment. The recovery in trade in the housing sector is important to the U.S. economy. This sector contained some of the highest volumes of trade in recent years. Residential construction is anticipated to be down 11.3% for most of 2009 and is expected to bottom out sometime before the end of the year. The automotive sector is also important to U.S. imports and exports. Auto exports from the U.S. fell from the 48% growth witnessed in 2009, to a 21% decline. Auto exports are not expected to rebound until 2010 (8% growth). Imports of autos have also fallen because of decreased sales. Imports are anticipated to be down 17.1% for 2009, and won't see recovery until 2010, with a 6.5% growth. When it comes to consumer goods, the outlook is slightly more positive. Consumer spending looks to be up at approximately 2.2% in 2009. However, U.S. exports of consumer goods are estimated to drop 16.5% this year and will have a mild recovery of 4.7% in 2010. These goods include apparel, chemical products, and furniture. Imports are expected to be down 11.9% in 2009 with an anticipated recovery of 5.9%.¹⁵

Rail Freight

Rail performed stronger than anticipated in 2008. Gains in coal, agriculture, and chemical exports offset the losses in forest products, metals and metal ores, motor vehicles, non-metal materials, and incoming containers. According to American Trucking Associations' (ATA's) forecasts, U.S. railroads are seeking to improve their capacity. Even in the economic downturn, rail use is still pretty close to record levels. The most important challenge for this industry will be to keep operating costs down because of low traffic margins.¹⁶

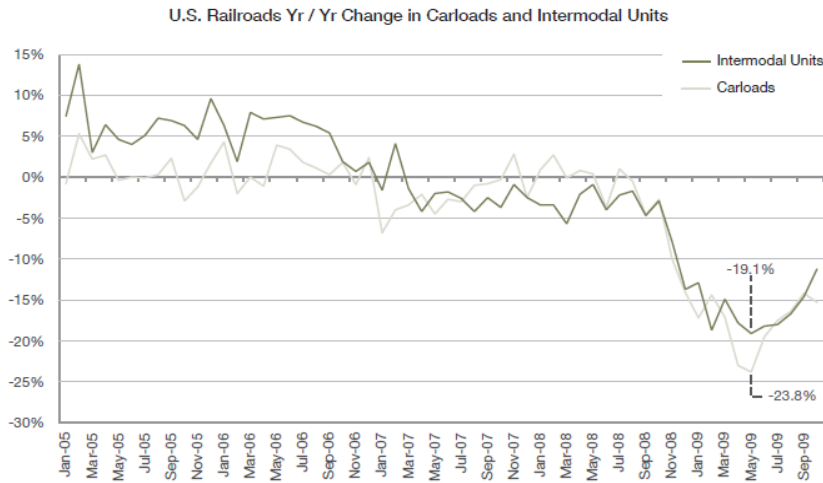
Figure 13. U.S. Rail Tons and Revenue by Commodity, 2008



Source: American Trucking Associations

The industry is anticipated to see a slow and steady recovery. Because of concerns about the carbon footprint of trucks vs. rail, it is expected that the rail industry's competitive position will increase vis-a-vis trucks. The tonnage share of rail freight is estimated to remain relatively stable through 2014. There will be a small decrease between 2008 and 2014 of 0.1%, but, in 2020, it is anticipated to remain stable at 14.7%.¹⁷

Figure 14. U.S. Railroads Volume Trend



Source: American Trucking Associations

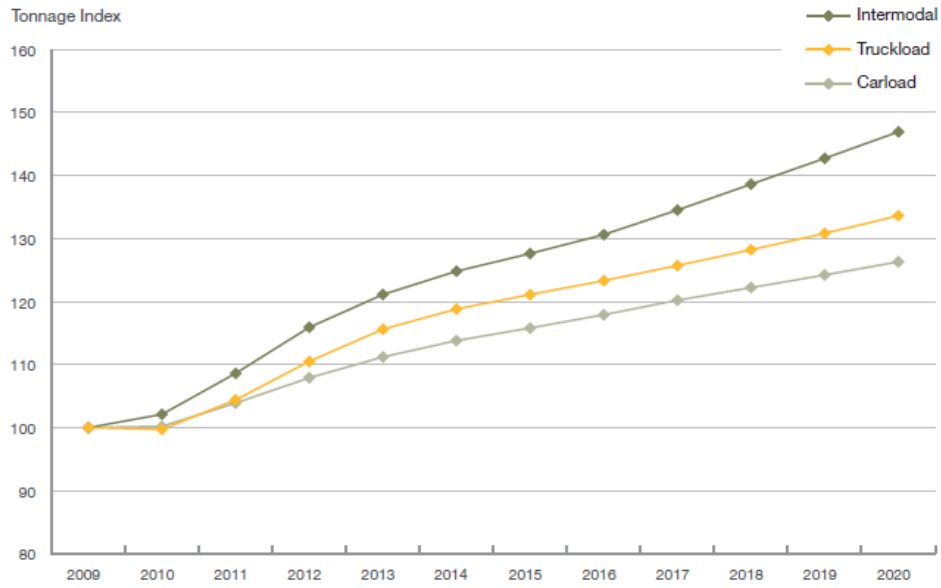
Trucking Freight

When it comes to trucking international freight, Canada dominates the percentage value of trade between the NAFTA countries. In 2007, Canada made up 58.5% of the dollar value in trade by truck, while Mexico made up the remainder, according to the U.S. Bureau of Transportation. The top-10 traded imports from Mexico by truck in 2007 were: electrical machinery, nuclear reactors, vehicles, plastics, optical and photographic medical instruments, furniture, clothing, vegetables, and steel and iron. In 2007, these items made up 82% of the trade value from Mexico to the U.S. In turn, the top-10 goods from the U.S. to Mexico in 2007 were: electrical machinery, nuclear reactor materials, plastics, vehicles, optical and photographic medical instruments, steel and iron, paper and paper board, aluminum, meat, and copper. These goods made up 73% of the dollar value of trade by truck in 2007 from U.S. to Mexico. Goods traded from Canada to the U.S. are much of the same except that optical medical equipment is replaced by wood and wood articles. These goods made up 65.5% of the trade by truck from Canada to the U.S. in 2007. For the goods going from the U.S. to Canada, these products are similar to those the U.S. transports by truck to Mexico, except meat is replaced by articles of iron and steel, and copper is replaced by furniture.¹⁸

The ATA believes that trucks will gain additional percentage share of transported freight. But, it is also anticipated that the rate of growth will be slower than other modes. The trucking sector's share of total tonnage is estimated to be 69.8% in 2014 and will reach 70.9% by 2020. The percentage growth in revenue streams for trucks over the time period is anticipated to remain relatively stable.¹⁹

Figure 15. U.S. Freight Tonnage Forecast

Forecast Tonnage Index for U.S. Rail and Truckload Freight (2009=100)



Source: IHS Global Insight Transearch

Chapter 3. Texas Trade Outlook

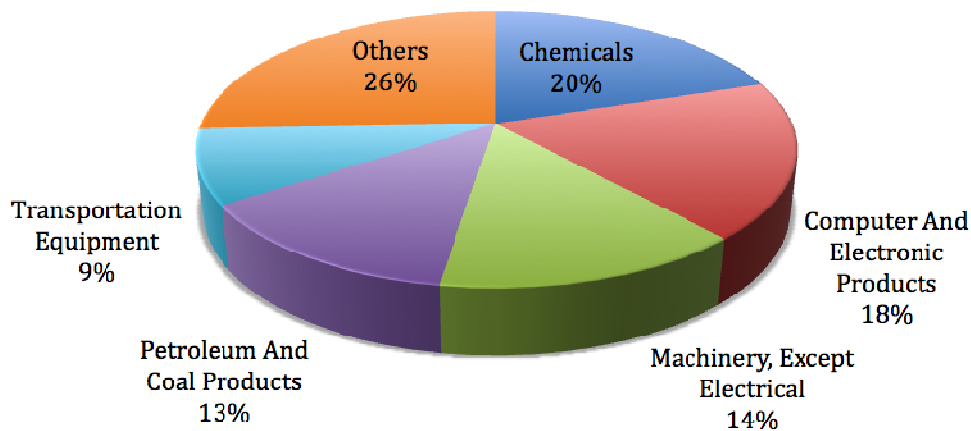
Texas Trade Patterns

The Texas economy is supported by both the domestic and global markets. Texas was the third-largest economy among the states in 2008. For the seventh year in a row, the state ranked first in terms of export revenues which totaled \$192.14 billion, or 14.9% of total U.S. exports. Overall, Texas oceanborne imports totaled approximately \$329.06 billion, an increase of 8.7% compared to that of 2007.

Texas Exports

Although the state's Gross State Product (GSP) was 33.7% lower than that of California, Texas exported 32.6% more than California did in 2008. One fifth of Texas exports in 2008 were chemicals, 18% were computer and electronic products, 14% were machinery, 13% were petroleum and coal products, and 9% were transportation equipment.

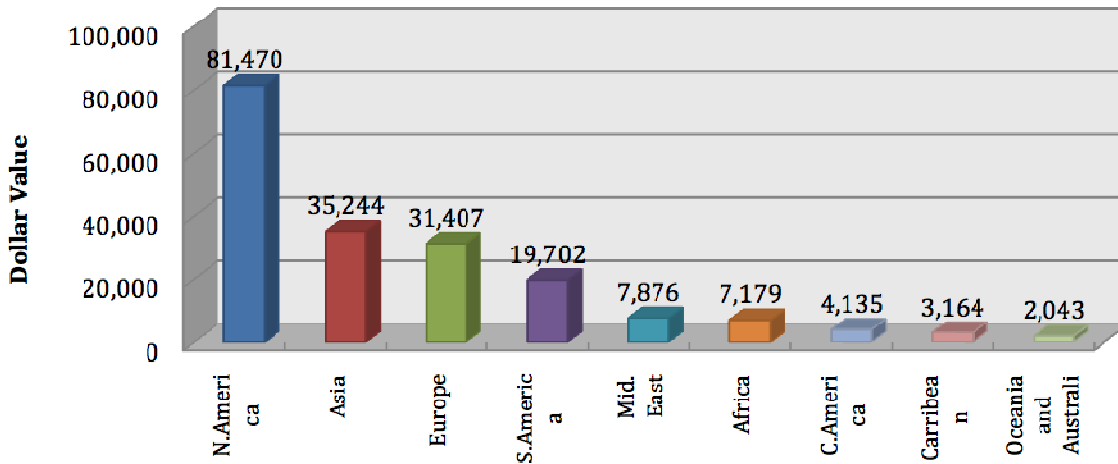
Figure 16. Texas Top Exports by Commodity, 2008



Source: WISER Trade

In 2008, North America was the largest market of Texas exports, reaching \$81 billion. Asia was the second-largest market, but was less than one-half of North America trade.

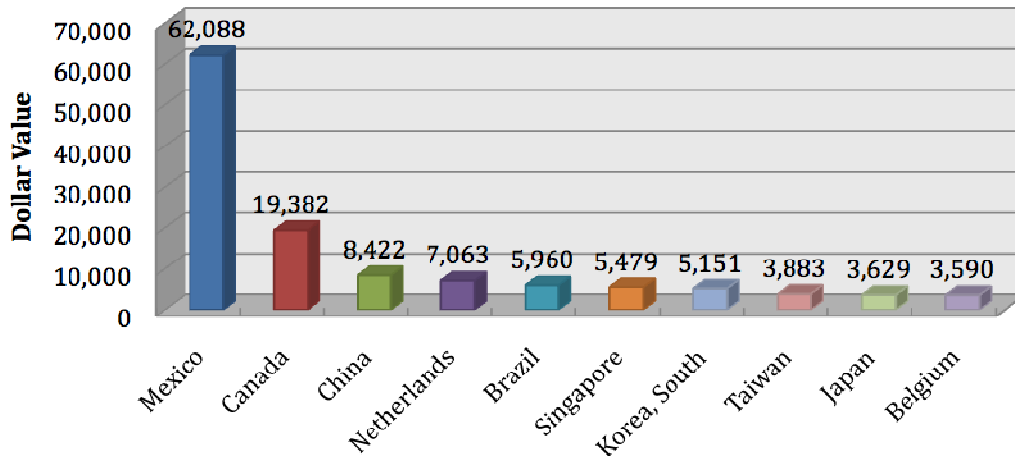
**Figure 17. Texas Exports Destinations by Region, 2008
(in millions)**



Source: WISER Trade

Mexico and Canada, both NAFTA countries, are the state's most-important export destinations. In 2008, Mexico imported \$62 billion in goods from Texas; and Canada imported \$19 billion. China has become the third-largest market for Texas exports, but only amounting to one-half that of Canada. Asian countries also are becoming increasingly important. In fact, five of the state's top-ten export destinations are Asian countries.

**Figure 18. Texas Top Exports Destinations by Country, 2008
(in millions)**

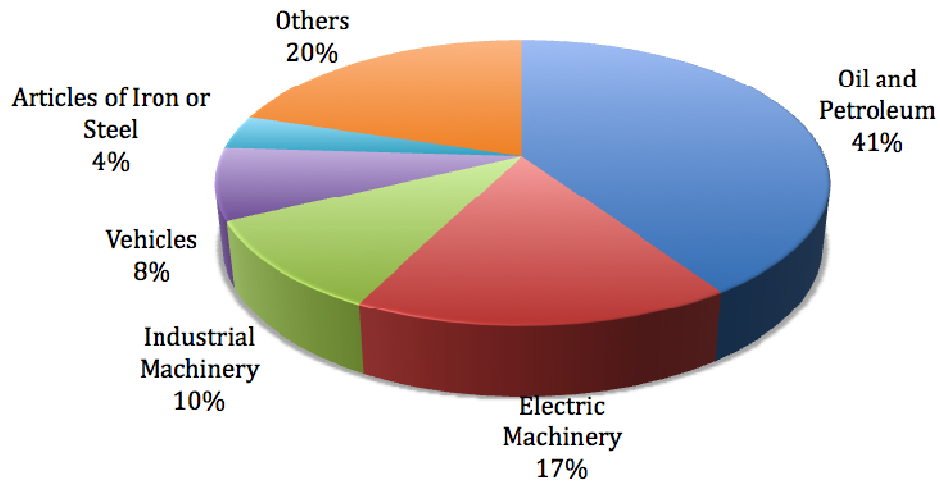


Source: WISER Trade

Texas Port Level Imports

Texas ports imported a total of \$329.06 billion in goods in 2008, mainly through the Port of Houston. These imports consisted of oil and petroleum (accounting for 41%), electric machinery (17%), industrial machinery (10%), vehicles (8%) and iron and steel (4%). Consumer goods were imported mainly from China and brought to Texas by highways and rail from California ports; thus, they were not calculated as Texas port level imports.

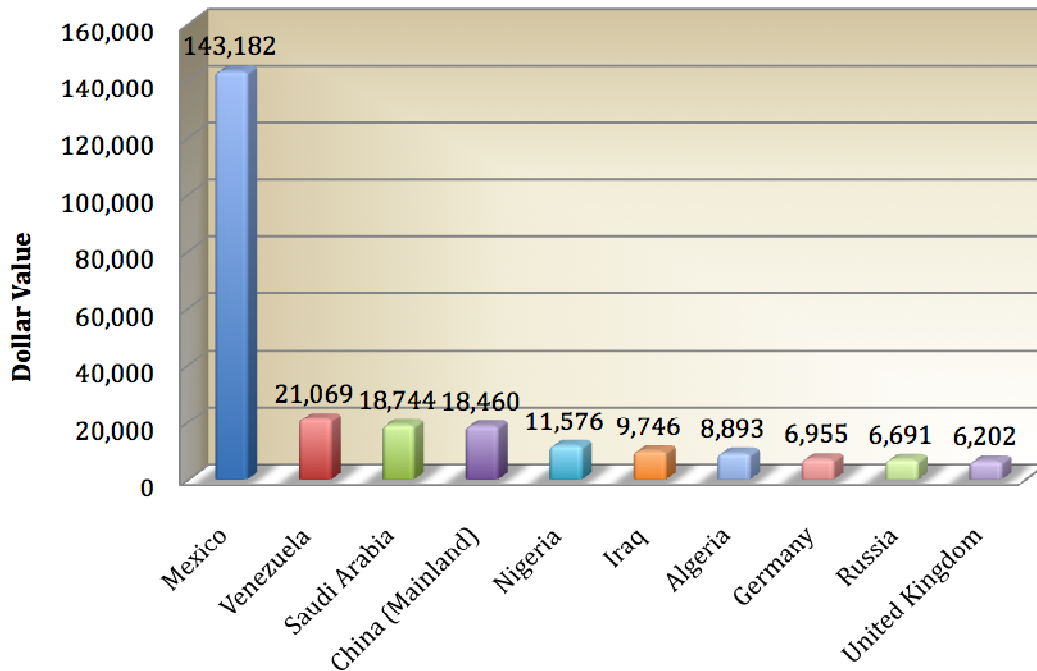
Figure 19. Texas Top Port Level Imports by Commodity, 2008



Source: Office of the Governor- Economic Development & Tourism

Because of NAFTA and the country's nearby location, Mexico's exports dominated Texas port level imports. In 2008, 43.5% of Texas port level imports were from Mexico, which accounted for 56.9% of top-10 Texas port level imports. Venezuela, Saudi Arabia, Nigeria, Iraq, and Algeria were among top-seven import sources, mainly involving exported oil and petroleum products to Texas.

Figure 20. Texas Top Port Level Imports Sources by Country, 2008 (in millions)



Source: Office of the Governor- Economic Development & Tourism

Texas Metro-Area Trade Patterns

In the first half of 2008, two metropolitan areas in Texas were ranked as top-20 metropolitan area exporters in the United States, based on the Origin of Movement (OM) ZIP-code-based series. One is the Houston-Sugar Land-Baytown (HSB) Metropolitan Area, ranked as the second-largest exporter after the New York-Northern New Jersey-Long Island Metropolitan Area; the other is the Dallas-Fort Worth-Arlington (DFA) Metropolitan Area, ranked as the ninth-largest exporter.

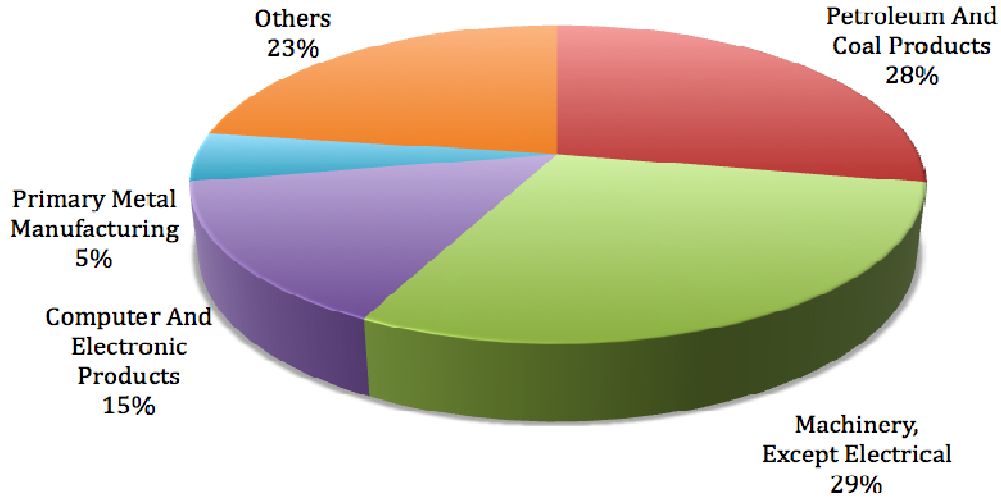
Houston-Sugar Land-Baytown (HSB) Metropolitan Area Trade Pattern

In 2007, the Houston-Sugar Land-Baytown Metropolitan Area accounted for merchandise export sales of \$62.8 billion. The Houston metropolitan area accounted for 48.1% of total Texas merchandise exports in 2007. About 24.5% of Houston's merchandise exports went to NAFTA countries in the same year.

20

Petroleum, coal products, and machinery, when combined, made up more than one-half of Houston's exports. Computer and electronic products accounted for 15% of the total exports. Primary metal manufacturing then followed with 5% share of the total. These four categories constitute nearly three-quarters of Houston's exports in 2007.

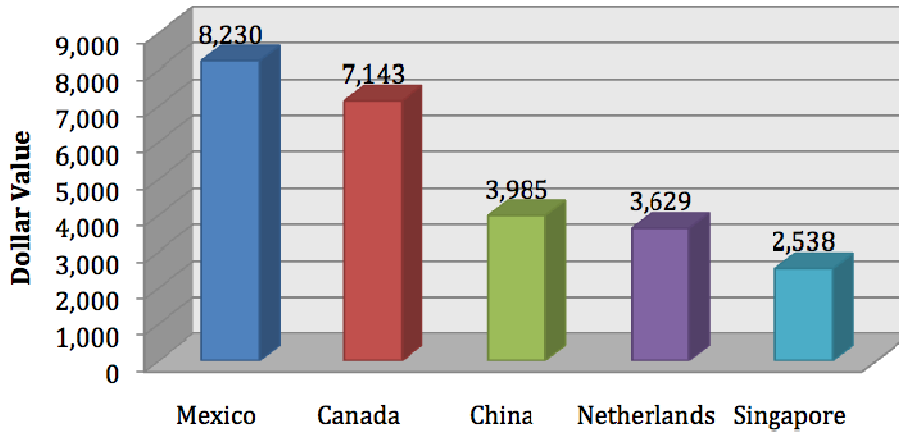
Figure 21. Houston Metro Area Top Exports by Commodity, 2007



Source: International Trade Administration, U.S. Department of Commerce

Mexico and Canada were Houston’s main trade partners. In 2007, Houston exported \$8.2 billion in goods to Mexico and \$7.1 billion to Canada. Sino-Houston trade is becoming increasingly important. The value of goods that Houston exported to China in 2007 was \$4.0 billion, which was only one-half of that to Mexico. But, Sino-Houston trade is expected to accelerate in the future, especially with the 2014 opening of the expanded Panama Canal.

Figure 22. Houston Metro Area Top 5 Exports by Country, 2007 (in millions)

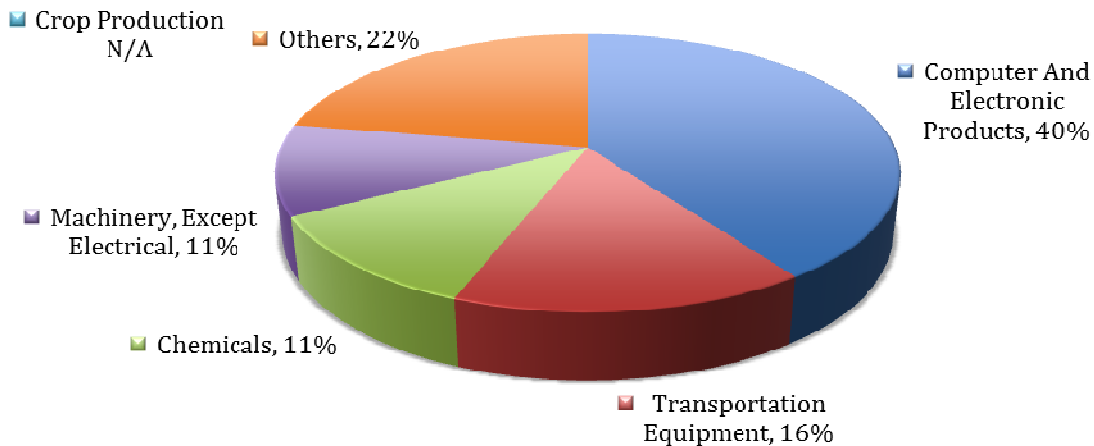


Source: International Trade Administration, U.S. Department of Commerce

Dallas-Fort Worth-Arlington (DFA) Metropolitan Area Trade Pattern

In 2007, the Dallas-Fort Worth-Arlington Metropolitan Area was the ninth-largest export market in the United States, with merchandise sales totaling \$22.8 billion. The Dallas metropolitan area accounted for 16.9% of Texas merchandise exports. About 29% of Dallas merchandise exports went to NAFTA countries.²¹ Some 40% of Dallas exports were computer and electronic products, illustrating the city's importance to the nation's IT industry. Transportation equipment, chemicals and machinery, respectively, accounted for more than 10% of the total exports from the Dallas metropolitan area.

Figure 23. DFW Metro Area Top 5 Exports by Commodity, 2007



Source: International Trade Administration, U.S. Department of Commerce

Similar to the Houston metropolitan area, the main export destinations of Dallas are Canada and Mexico. Canada imported \$3.5 billion of goods from Dallas and Mexico imported \$2.9 billion of goods in 2007. China is becoming an important trade partner of Dallas. China imported more than \$1 billion of goods directly from Dallas, showing a strong connection with Texas. Malaysia and Taiwan were among the top-5 importers of Dallas exports, which demonstrated that Asian market had strong demand of Dallas' goods.

Texas Trade Outlook

The Texas state economy leads the nation in international trade. Although the state's GSP ranks behind those of California and New York State, it has remained largest exporter for eight-consecutive years. In 2008, Texas exports accounted for 14.9% of total U.S exports, while second-place California accounted for 11.2%.

For the 3rd quarter of 2009, Texas exports totaled \$117 billion, representing a 21% year-on-year decrease. But this rate of decline is still lower than the 23.8% decline in overall U.S. exports. From a historical view, in the past decade, Texas exports grew at annual rates almost always above the national growth rates.

Many experts believe that Texas will lead the nation's economic recovery, which, in turn, will continue to spur growth in international trade.

Chapter 4. Texas Modal and Gateway Outlook

Air Cargo in Texas

Air cargo is a niche transportation mode for low-weight, high-value and time-sensitive shipments like packages, alcohol, electronics, and medicines. It accounts for 2% of international trade by weight but 40% by value.²² Most air cargo goes through passenger airports, but requires additional facilities including warehouses, apron space, and road linkages.²³ Beyond courier services like FedEx and UPS that carry packages to consumers, air cargo volumes depend on what industries Texas has. Electronics, aerospace, and pharmaceutical industries are large users of air cargo.

Texas has 50+ air cargo operators. Many of these combine passengers and freight on the same aircraft flights. Texas also has many charter air cargo operators. Many of these charter operators are based in Addison, a suburb just north of Dallas with one of the busiest general aviation airports in the country. In addition to smaller airports like McAllen, and Del Rio, all major airports have an air cargo terminal.

Table 1. General Information on Texas Cargo Airports

	Total carriers	Foreign Trade Zone	Warehouse space (sq. ft.)
Austin-Bergstrom Int'l Airport	12	No	229,000
Brownsville/South Padre Island Int'l Airport	1	Yes	2,000,000
Dallas/Fort Worth Int'l Airport	35	Yes	41,375
El Paso Int'l Airport	11	Yes	250,000
Fort Worth Alliance Int'l Airport	2	Yes	unavailable
George Bush Int'l Airport	33	No	600,000
Laredo Int'l Airport	3	Yes	387,000
San Antonio Int'l Airport	10	Yes	65,280

Source: Air Cargo World

Table 2. Distance to Connecting Modes (Miles)

	Rail terminal	Ocean port	Interstate highway
Austin-Bergstrom Int'l Airport	50	200	5
Brownsville/South Padre Island Int'l Airport	2	2	4
Dallas/Fort Worth Int'l Airport	30	225	1
El Paso Int'l Airport	6	unavailable	2
Fort Worth Alliance Int'l Airport	3	unavailable	2
George Bush Int'l Airport	25	35	3
Laredo Int'l Airport	5	150	4
San Antonio Int'l Airport	unavailable	unavailable	unavailable
	Truck terminal	Inland waterway port	Intermodal center
Austin-Bergstrom Int'l Airport	2	200	250
Brownsville/South Padre Island Int'l Airport	2	2	unavailable
Dallas/Fort Worth Int'l Airport	0	unavailable	30
El Paso Int'l Airport	unavailable	unavailable	unavailable
Fort Worth Alliance Int'l Airport	unavailable	unavailable	2
George Bush Int'l Airport	1	35	unavailable
Laredo Int'l Airport	3	150	5
San Antonio Int'l Airport	unavailable	unavailable	unavailable

Source: Air Cargo World

Projections: 2008-2035

Air cargo in Texas tracked the decline in international trade for 2008-2009. Looking beyond, Texas air cargo is expected to grow rapidly. A 2001 study from the Southeastern Trade Alliance projected air cargo tonnage tripling by 2020; even so, international air cargo is expected to decline as a percentage of total air cargo to 11.1%, indicating domestic air cargo will grow faster than international air cargo. It further projected \$487 million in additional air cargo infrastructure by 2020, comprising 5,076,812 sq. ft. of building area and 8,122,896 sq. ft. of runway apron to support more planes.²⁴

A 2008 study by the Texas Transportation Institute at Texas A&M University projected Texas air cargo to grow over 526% from 2002 to 2035, with Austin, El Paso, and Houston growing the most. Houston's outbound air cargo is expected to surge a staggering 6,451%, necessitating massive investment in air cargo facilities. Houston and Dallas will comprise 90% of air cargo tonnage in 2035, up from 85% in 2002.²⁵ Although air cargo gateways have traditionally been at large commercial airports, there is a trend toward smaller regional airports for time-sensitive goods to avoid highway congestion. These general aviation and ex-military airports offer substantial expansion capability.²⁶ Below is a chart of the deciding factors for air cargo carriers on locating their operations.

Table 3. Deciding Factors for Air Cargo Location of Operations

Pull Factors	Push Factors
Origin-destination demand	Bilateral restrictions
Freight forwarder presence	Night operations capability
Passenger Freight Operations	Noise regulation
Presence of partner airlines	Infrastructure availability
Flying time/cost	Congestion
Location of competitors	
Airport charges	
Incentives	
Airport reputation	
Airport advertising	

Source: Gardiner, Ison, Sperry, et al.

Established airports have to contend not only with limited space, but also the expanding city limits that eventually envelops outlying airports. This prevents further expansion, and increases the pressure to curtail night flights, and address noise pollution and road congestion. Therefore, the trend over time is for established airports to become less attractive on the basis of those factors than further outlying airports, while increasing their attractiveness in locations closer to a large population center.

Other factors that affect air cargo operations in general are the price of fuel, new aviation technology, and competing modes of transportation. Because air cargo is more expensive than truck, rail, or ship, it must make up the difference by means of faster flights. Companies are always weighing time vs. price when picking a shipping option. In an emergency like the Toyota recall of accelerator pedals, air cargo might be used to transport a part that otherwise would come by rail. Natural disaster relief also relies heavily on air cargo.

Current expansion projects

Laredo International Airport: This airport is undergoing expansion projects to be completed in 2011. One new runway has been completed, and new cargo facilities are scheduled to be completed in 2011. The expansion will create 300,000 sq. ft. of ramp and apron space for cargo operations and 30,000 sq. ft. of warehouse space.²⁷

Ocean Freight in Texas

Texas is home to 27 Gulf Coast ports. Of these 27 ports, 12 are classified as deep-draft and 15 as shallow-draft. Texas ports handle over 50% of U.S. foreign imports and exports by tonnage.²⁸ Annually, ports bring in almost \$5 billion in local and state tax revenues and \$9 billion in federal tax revenues. The ports of Beaumont, Corpus Christi, Freeport, Houston, and Texas City are among the nation’s top-25 ports in terms of tonnage handled.²⁹ Some 423 miles of intra-coastal waterways connect these ports and provide easy transportation of goods along the Gulf Coast. Over 70 million tons of cargo is transported through these ports and channels each year.³⁰ These international gateways account for more than 17 percent of Texas GSP.³¹ Texas ports handle crude oil, lumber and paper, steel, agricultural products, consumer goods, chemicals, aggregate, automobiles, construction equipment, and strategic military cargo. In 2004, Texas ports handled 18.5% of the nation’s total deep-sea vessel calls.³²

Table 4. Value of Texas Trade for Selected Ports

Port Name	2008 Imports by Value (\$US)	2008 Exports by Value (\$US)
Beaumont	\$18,490,359,652	\$2,847,202,426
Brownsville	\$899,553,222	\$72,856,893
Corpus Christi	\$24,720,910,917	\$4,964,545,034
Freeport	\$13,795,886,954	\$1,989,339,755
Galveston	\$4,037,168,801	\$2,021,547,435
Houston	\$78,873,335,900	\$68,821,466,068
Orange	\$36,130	\$14,060,755
Comfort	\$992,145,733	\$243,787,159
Port Arthur	\$14,907,522,110	\$2,444,784,981
Sabine Pass	\$35,094	\$95,541
Texas City	\$19,461,905,436	\$3,263,767,682

Source: World Port Source

Table 5. Top Import and Export Countries by Port

Port Name	Top 5 Countries By Import	Top 5 Countries by Export
Beaumont	1. Saudi Arabia, 2. Mexico, 3. Algeria, 4. Venezuela, 5. Angola	1. Mexico, 2. Iraq, 3. Venezuela, 4. Chile, 5. Nigeria
Brownsville	1. Netherlands, 2. Argentina, 3. Spain, 4. France, 5. China	1. Mexico, 2. Gibraltar, 3. Ecuador, 4. China, 5. Nigeria
Corpus Christi	1. Venezuela, 2. Nigeria, 3. Russia, 4. Algeria, 5. Kuwait	1. Mexico, 2. Nigeria, 3. Netherlands, 4. Gibraltar, 5. Chile
Freeport	1. Venezuela, 2. Algeria, 3. Angola, 4. Nigeria, 5. Brazil	1. Brazil, 2. Colombia, 3. South Korea, 4. Netherlands, 5. Costa Rica
Galveston	1. Saudi Arabia, 2. Japan, 3. Kuwait, 4. Germany, 5. Iraq	1. Iraq, 2. Brazil, 3. Mexico, 4. Australia, 5. Algeria
Houston	1. Mexico, 2. Saudi Arabia, 3. China, 4. Germany, 5. Venezuela	1. Mexico, 2. Brazil, 3. Netherlands, 4. Venezuela, 5. Belgium
Orange	1. Gabon	1. Mexico, 2. Indonesia, 3. Sri Lanka, 4. China, 5. Honduras
Comfort	1. Mexico, 2. Trinidad and Tobago, 3. Taiwan, 4. Guinea, 5. Brazil	1. China, 2. South Korea, 3. Chile, 4. Japan, 5. Mexico
Port Arthur	1. Mexico, 2. Iraq, 3. Saudi Arabia, 4. Venezuela, 5. Colombia	1. Netherlands, 2. Brazil, 3. France, 4. Mexico, 5. Belgium
Sabine Pass	1. Japan	1. France, 2. Australia, 3. Venezuela
Texas City	1. Nigeria, 2. Mexico, 3. Venezuela, 4. Saudi Arabia, 5. Iraq	1. Mexico, 2. Netherlands, 3. China, 4. United Kingdom, 5. Panama

Source: World Port Source

Projections 2008-2035

The scheduled expansion of the Panama Canal, to be completed in 2014, will have a significant impact on the amount of cargo brought to Texas ports. The Port of Houston, the state's largest container port, will experience by far the most growth in Panama Canal-related trade. The port already has prepared for the expansion of trade by constructing its new Bayport container facility. A detailed report on this subject was completed by Cambridge Systematics, Inc. for the Texas Department of Transportation (TxDOT), and serves as an excellent source for the planning strategies currently being implemented to help handle the anticipated expansion in tonnage of goods passing through the Panama Canal. However, there is growing concern that unless landside rail improvements are implemented, Texas may squander this great opportunity for economic growth. More details on the expansion can be found in the final chapter.

Table 6. Expected Growth in Panama Canal, 2005 to 2025 (in millions)

Market Segment	2005 Tons	Year 2025 Tons (With Expansion)
Containers	98	296
Dry Bulk	55	73
Liquid Bulk	34	28
Passenger	10	19
Car Carrier	36	58
Refrigerated Cargo	19	22
General Cargo	7	4
Other	20	8
Total	279	508

Source: Panama Canal Authority

Current Projects at Selected Texas Ports

Port Freeport: Wind energy equipment has grown to be one of the port's leading imports; in 2008, the port handled 28,000 tons of wind energy equipment and the number of calls of vessels carrying equipment was expected to double from 21 to 42 in 2009. India's Suzlon Energy is the 5th-largest supplier of wind turbines and is a long-term customer of Freeport. The port is well-suited to handle the large cargo with 7,723 acres of undeveloped land, 14 operating berths, a 45-foot-deep harbor channel, and a 70-foot-deep berthing area. Future expansion projects include the construction of a 1,300-acre multi-modal facility, two multi-purpose 1,200-foot berths with 50-foot-deep water, and two 120,000-square-foot transit shed. The port is nearing completion on the construction of a new berth which will allow the port to handle another one to two container ships a day, and expectations are to accommodate 730 additional container ships annually. The port was recently given permission by the U.S. Army Corps of Engineers to widen the shipping channel and a \$37 million project has been undertaken to allow for two-way traffic and 1,000-foot-long vessels. This project is expected to be completed in 2011.³³

Port of Galveston: Wind energy equipment is also boosting shipments to the Port of Galveston. The Gulf Wind project has brought hundreds of wind turbines to this region.³⁴

Port of Corpus Christi: In 2008, the port paved an additional 25 acres of land to accommodate wind turbines, military cargo, and cargo destined for nearby power plants. Another 20 acres were targeted to be paved in 2009. The port recently enjoyed the expansion of business brought by the opening of the Joe Fulton International Trade Corridor, which gave the port additional road and rail links, and access to over 2,000 acres of land on the north side of the channel for future development.³⁵

Port of Houston: In 2008, general cargo to the Port of Houston grew 20% from 6.6 million tons to 8 million tons. These imports consisted mainly of steel imports for the oil and gas industries located nearby. Containerized cargo also rose 1% to 1,794,309 TEUs. The Port of Houston receives calls for containerized cargo from Maersk Line, Mediterranean Shipping Company, Hapag-Lloyd, and CMA CGM. The port handles 69% of the Gulf region's containerized cargo, and the recent completion of the Bayport Container Terminal, a \$1.4 billion project, is expected to accommodate additional growth associated with the expected expansion of the Panama Canal. The port is also experiencing a growth in wind energy equipment imported from Europe, India, and Brazil.³⁶

Port of Brownsville: Steel is the largest breakbulk commodity arriving at the Port of Brownsville, the majority of which comes from Mexico, the port's biggest source of business. About 75% of the steel goes to Mexico for additional processing, and about 25% is shipped back to Brownsville. In 2008, the port partnered and launched a new operation serviced by SeaBridge Freight with Port Manatee in Tampa Bay to promote containerized trade between Texas, Mexico, and Florida.³⁷

Port of Beaumont: The port is currently continuing its \$58 million capital improvement program. Some aspects of the program include a new \$5.3 million mobile crane, a 650-foot cargo wharf with new rail and road access along the Sabine-Neches Waterway, a \$5.4 million office building to serve as headquarters for the U.S. Surface Deployment and Distribution Command's 842nd Transportation Battalion, and a \$16 million rail storage yard expansion. The Port of Beaumont continues to be a critical exporter of military supplies to U.S. troops stationed abroad.³⁸

Railroad Freight in Texas

The United States has the largest freight rail network in the world, with more than 140,000 miles of track spanning across the continent. Forty-three percent of intercity freight volume is transported by rail, the largest share of any mode of transportation.³⁹

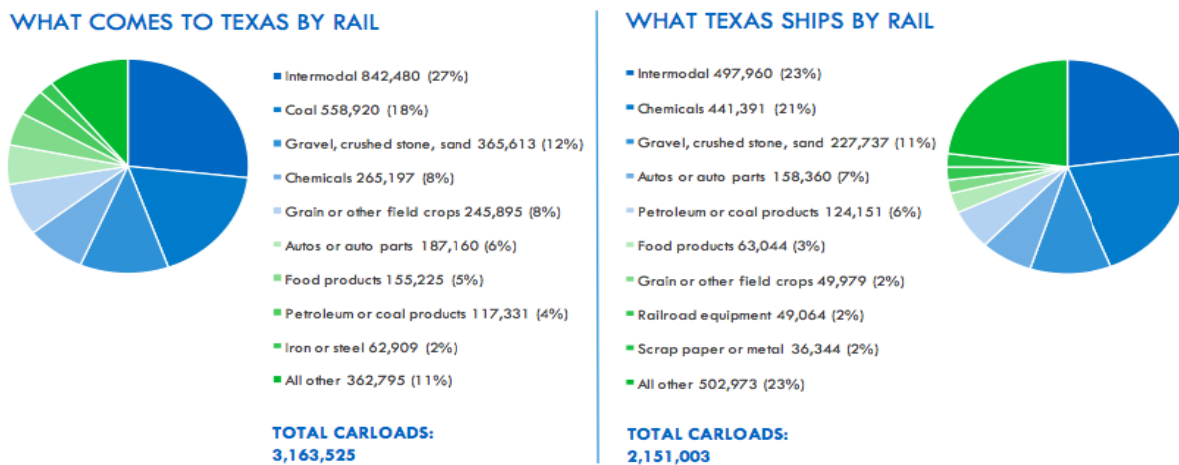
Texas has 10,804 miles of track, over 3,000 more miles than any other state. There are 43 rail carriers in the state, of which three are Class 1 carriers--Union Pacific, BNSF, and the Kansas City Southern (KCS).

Railroads in Texas carried 9,272,731 carloads of freight in 2007, and 17,554 freight railroad employees live in the state. Additionally, Texas has the second-largest number of railroad companies, the most rail tons terminated in a state, the third-most rail tons originated, and the second-most rail carloads hauled.

International trade is a crucial to freight transport in Texas, and Mexico figures prominently into

that equation. For example, in 2003, 67 percent of U.S.-Mexico truck freight traveled through Texas and 91 percent of U.S.-Mexico rail trade went through the Lone Star State.⁴⁰

Figure 24. Texas Rail Movements



Source: 2007 STB Waybill Sample

Rail concerns in Texas are similar to those in many other states--how to accommodate increasing amounts of global trade, while maintaining a safe operations and speedy service. According to TxDOT’s Houston Rail Study Executive Summary, “An improved rail system can promote continued growth in the local economy as well as support the shifting of truck cargo to rail cars...can strengthen the region’s global competitiveness in goods movement, and help citizens reap the benefits associated with economic growth and vitality.”

Projections 2008-2035

Although the rail freight industry was negatively impacted by the recession, most forecasts predict increased growth in intermodal traffic as global trade expands. Over the past 20 years, intermodal containers have been the fastest-growing segment of rail freight, increasing from 3 million trailers and containers in 1980 to around 12 million in 2009. According to the Association of American Railroads (AAR), approximately 60 percent of that traffic consists of imports or exports, reflecting the vital role railroads play in international trade.⁴¹

The continuation and expansion of free trade agreements will also increase rail freight traffic. After NAFTA passed, rail car traffic in Texas doubled, and is estimated to increase another 65 to 85 percent in the next 20 years². Freight tonnage moved by rail is expected to triple in the Houston region alone by 2025.

Current Projects and Issues of Concern

Positive Train Control: In 2008, a train engineer, engaged in text messaging, caused a head-on collision with a passenger train, leading Congress to require freight lines to institute what is known as Positive Train Control (PTC). This technology is capable of preventing train-to-train collisions, over-speed-limit derailments, and casualties or injuries to rail employees. PTC is also capable of preventing train movements if a switch is left in the wrong position. This unfunded mandate has made it difficult to institute PTC on trains. Other countries with more advanced

integrated rail networks have already developed several different variations of PTC.

Carbon Caps: Global climate change is a contentious, complex issue. Although the U.S. Senate failed to introduce mandatory carbon limits or create a new comprehensive energy policy, it is still an issue firmly in the collective mind of the nation's rail freight industry. This is because hauling coal accounts for nearly 45 percent of tonnage and 23 percent of revenue for U.S. Class I railroads.⁴²

Panama Canal Expansion: The \$5.25 billion expansion of the Panama Canal, set for completion in 2014, will increase cargo destined to Texas ports. However, Bruce Todd, executive director of the Texas Rail Relocation and Improvement Association, warns that moving extra freight could be difficult if the freight rail lines serving those ports are not upgraded. "Texas is in jeopardy of letting millions of dollars of economic opportunity simply sail away if rail infrastructure improvements aren't made to ensure that goods can move efficiently to and from our ports," Todd said.⁴³

Projects

Houston: Due to the expected growth of intermodal traffic through the Port of Houston, regional rail facilities need substantial improvements. "Outdated rail yards and inadequate infrastructure, together with the demands of the petrochemical industry and growing volumes of containers, are clogging Houston's rail system, potentially diminishing the competitive position of this region," Mark Ellis, board chairman of the Gulf Coast Freight Rail District, told the Texas 2030 Committee last year. The Houston Freight Rail Study, issued in 2007 by TxDOT, identifies numerous freight rail improvements needed in the eight-county Houston region. These include new bridges to separate rail lines from streets; closure of certain rail grade crossings; upgrades of capacity and connectivity on existing rail lines; and new rail corridors. Over the next 20 years, growth rates for vehicle and train traffic could trigger delays costing more than \$2.6 billion. The TxDOT report also recommends \$1.4 billion spent on "Improvements to Existing Railroad Infrastructure" to improve capacity and connectivity on existing lines and another 1.1 billion spent on new railroad corridors. Just at the Houston Rail Terminal, capacity additions have been projected due to increased intermodal trade in Houston and to accommodate passenger service. Three capacity additions totaling \$126 million are proposed.⁴⁴

Seminole/Gaines County Corridor: With the growth in foreign apparel making markets, West Texas is experiencing increased demand for its cotton. This has spurred a project to bring rail service to the Seminole/Western Gaines County area, specifically a proposal to connect Hobbs, New Mexico with the Lubbock and Western Railway at Seagraves, Texas via the city of Seminole. Currently, their agricultural products are trucked to Brownsville or Fort Worth, and then loaded on a train.

Trucking Freight in Texas

Texas is the nation's largest gateway for truck-hauled trade. In 2009, over 1.6 million trucks entered the United States through Texas' overland ports, representing over 30% of all truck-hauled trade in the nation.⁴⁵ The largest inland ports are Laredo (48% of truck traffic) El Paso (22%) and Hidalgo [McAllen/Pharr] (15%).⁴⁶ Trucking accounted for \$83 billion in international

trade with Mexico, or 64% of Texas' trade by value with Mexico, and 16% of Texas' total trade with all countries. The principal commodities transported by truck between the U.S. and Mexico are electrical machinery (35%), boilers and mechanical machinery (17%), vehicles (7%), plastics (5%) and optical, photographic, and medical equipment (4%).

Table 7. Truck Trade in Texas, by Port of Entry

Port	# trucks (2008)	% of Truck Crossing
Laredo	771,054	48.1%
El Paso	351,036	21.9%
Hidalgo	245,509	15.3%
Brownsville	107,818	6.7%
Eagle Pass	46,562	2.9%
Progreso	28,560	1.8%
Del Rio	27,933	1.7%
Rio Grande City	17,467	1.1%
Presidio	3,550	0.2%
Roma	3,511	0.2%
Grand Total	1,603,000	100%

Source: Bureau of Transportation Statistics, "North American Transborder Freight Data"

Table 8. International Truck Trade in Texas, by Commodity

Commodity	Dollar Value	Share of Texas truck trade
Electrical machinery and equipment and parts thereof; Sound recorders and reproducers	29,211,518,963	35.2%
Nuclear reactors; boilers; machinery and mechanical appliances; parts thereof	14,346,654,240	17.3%
Vehicles; other than railway or tramway rolling stock; and parts and accessories thereof	5,386,366,530	6.5%
Plastics and articles thereof	3,747,183,981	4.5%
Optical; photographic; cinematographic; measuring; checking; precision; medical instruments	3,459,808,294	4.2%
Articles of iron or steel	2,442,153,315	2.9%
Mineral fuels; mineral oils and products of their distillation; Bituminous substances; Mineral waxes	2,127,225,025	2.6%
Toys; games and sports equipment; Parts and accessories thereof	1,367,965,345	1.6%
Special classification provisions	1,300,004,982	1.6%
Furniture; Bedding; mattress supports; cushions and similar stuffed furnishings; Lighting fittings	1,227,653,861	1.5%
Iron and steel	1,196,470,356	1.4%
Copper and articles thereof	1,190,981,622	1.4%
Meat and edible meat offal	1,015,933,949	1.2%
Paper and paperboard; Articles of paper pulp; of paper or of paperboard	1,014,410,008	1.2%
Aluminum and articles thereof	918,792,913	1.1%
Rubber and articles thereof	768,028,542	0.9%
Edible fruit and nuts; Peel of citrus fruit or melons	718,992,533	0.9%
Other	11,598,307,896	14.0%

Source: Bureau of Transportation Statistics, "North American Transborder Freight Data"

Trucking Corridors

The U.S. Congress has designated seven routes, originating or passing through Texas land ports of entry as high priority corridors.⁴⁷ These include:

- Cd. Juarez, MEX/El Paso – Albuquerque – Denver (I-10/I-25)
- Cd. Juarez, MEX/El Paso – Wichita (US-54)
- Ojinaga, MEX/Presidio – Odessa – Midland (US-67/US-385)
- Nuevo Laredo, MEX/Laredo – Piedras Negras, MEX/Eagle Pass – Cd. Acuña, MEX/Del Rio – Amarillo – Denver (US-277, inter al.)
- Nuevo Laredo, MEX/Laredo – Dallas – Kansas City – Minneapolis – Des Moines – Duluth (I-35)
- Laredo – Houston – Texarkana (US-59)

- Reynosa, MEX/McAllen; Matamoros, MEX/Brownsville – Houston – Memphis – Detroit – Sarina, CAN(US 281/77, US-59, I-69 [proposed])

Issues of Concern

*New Texas laws affecting truckers*⁴⁸

- Changes to structure of Department of Motor Vehicles
- New Registration Fee schedule
- New regulations for commercial motor vehicle operators

*National Concerns*⁴⁹

- Drawing down/suspend filling the Strategic Petroleum Reserve to alleviate high diesel costs
- Investment in improvements to domestic refining and extraction capacities.
- National fuel standards to simplify diesel distribution
- Tax credits to encourage idling reduction
- National Clearinghouse for positive drug/alcohol tests of commercial vehicle drivers.

New Developments

The Anzalduas International Bridge opened in December 2009, providing another connection between McAllen/Mission and Reynosa. The bridge is expected to cut travel times between the Lower Rio Grande Valley and Monterrey by as much as 45 minutes.⁵⁰ Another bridge is under construction connecting Donna (12 miles east of McAllen) to Rio Bravo. When these routes operate at full capacity, they will increase freight traffic between the Lower Rio Grande Valley and the I-35 / US-77 corridors.

Mexican Trucks in US

In March 2009, the U.S. Congress ended a pilot program that allowed a small number of Mexican trucks to operate within the United States. Since allowing Mexican trucks to operate within the United States was a provision of NAFTA, Mexico responded with retaliatory tariffs against the United States. The Obama administration reinstated the pilot program mid-2011.⁵¹

Chapter 5. International Best Practices

Developing and Funding Transportation Infrastructure in the European Union

In the U.S., states finance highway construction and maintenance primarily through a combination of state revenues and federal aid. States have funded their share by taxing motor fuels and charging user fees – for example, motor vehicle registration and driver’s licenses and, to a lesser extent, tolls. The federal aid program to the states is also financed through motor fuel taxes and other levies on highway users. Federal aid for highways is entirely on a cash basis from the Highway Trust Fund. At the state level, most highway spending is in the form of cash raised from taxes and user fees that are accumulated in designated highway accounts. Debt financing constitutes only about 6 percent of the revenues states use for highways. Transport officials at all levels of government recognize in recent years that funding from traditional sources is not keeping pace with demands for new, expanded, or improved highways. As a result, they have begun to explore new sources of financing. This section of the chapter will focus on European financing structures because of the many governmental, economic, and geographic similarities between our two continents.

The European Union’s Role

The European Commission of the European Union (EU) takes lead role in developing major infrastructure projects that benefit trade throughout the EU zone. The organizational structure exists so that the 27 different countries within this free trade zone can adopt similar regulations, procedural controls, and transportation networks than can successfully interact with one another. The interoperability of systems allows the entire continent to realize the maximum benefit from their current economic free trade zone. To help achieve this interoperability, the European Commission has outlined several priorities designed to highlight the future goals of Europe’s transportation system. The EU transport policy priorities for the next several years include:

- European single sky
- Clean urban transport
- Sustainability
- Interoperability and intermodality
- Intelligent transport systems
- Maritime safety⁵²

The European Union’s primary transportation goal from its very beginning was the development of an integrated and interoperable continental transport network. The multimodal trans-European transport network is comprised of transportation infrastructure, traffic management systems, and positioning/navigation systems. Prior to the creation of a free trade zone throughout the European community, each nation developed its own unique transportation infrastructure system made up of independent networks with differing standards. Interestingly, many of the previous inconsistencies between countries were intentionally incorporated (designed) into each transportation network as defense mechanism in the event of future wars. The EU is now

attempting to mesh these separate networks by encouraging future transportation infrastructure decisions of nations and private companies through both micro and macroeconomic incentives.

To help achieve their policy objectives, the EU identified the following as priorities for the development of the Trans-European Transport Network (TEN-T):

- Establishment and development of connections, key links, and interconnections needed to eliminate bottlenecks, fill in missing sections and complete major routes;
- Establishment and development of infrastructure for access to the network, making it possible to link island, landlocked and peripheral regions with the central regions of the community;
- The optimum combination and integration of the various modes of transportation;
- Integration of environmental concerns into the design and development of the network;
- Gradual achievement of interoperability of network components;
- Optimization of the capacity and efficiency of existing infrastructure;
- Establishment and improvement of interconnection points and intermodal platforms
- Improved safety and network reliability;
- The development and establishment of systems for the management and control of network traffic and user information with a view to optimizing use of the infrastructure; and
- Studies contributing to improved design and better implementation of the trans-European transport network⁵³

In order to help achieve these priorities, the EU offers financial incentives for member nations to research and develop projects that will benefit the greater good of the community. The EU provides up to 50% of funding for feasibility studies and 10-20% for the construction of TEN-T priority projects. Moreover, the EU has designated that up to 75% of its transportation funding will go towards the above-mentioned priority projects allocated as follows: 45% (of the designated 75%) towards projects developing public-private partnerships (PPPs), 20% towards developing a continent-wide GPS container tracking system, and 35% towards other projects that focus on issues such as air traffic control, ITS, and rail bottlenecks.⁵⁴ In addition to these EU-based incentives, several individual countries, such as Germany and the Netherlands, make available subsidies for inland ports that offer open access to users. Combined, these national and transnational monetary rewards for developing mutually beneficial infrastructure projects helps provide the necessary financing and incentives to develop many of Europe's major transportation projects.

European Funding Sources

The four primary funding mechanisms through which the European Union distributes transportation financing include: Structural Funds; the Cohesion Fund; the European Investment Bank (EIB); and the European Investment Fund (EIF). For the period of 2007-2013, the EU's

Structural Funds and Cohesion Fund account for €348 billion (€278 billion for Structural Funds and €70 billion for the Cohesion Fund) and represent 35% of the total EU budget⁵⁵. Structural funds are set aside specifically for less-developed regions of the EU, which in addition to other objectives, help provide capital for major infrastructure investments and help less-developed regions. The European Regional Development Fund (ERDF) represents that largest portion of these Structural Funds which directly invests in transportation projects. The Cohesion Fund is designed to help less-developed areas achieve EU transportation standards and is available for countries whose GDP is less than 90% of the EU average.⁵⁶ Whereas the Structural and Cohesion funds provide grants to improve transportation networks in lower income areas, loans to provide the remainder of the capital for major projects come from the EIB and EIF. These two funding sources also attempt to draw private investors into major projects through the selling of municipal bonds.

The EU receives revenue from member countries to finance the previously mentioned projects from three main sources: 14% from levies on agriculture products of non-member countries; 35% from a Value Added Tax (VAT) levied on all goods and services; and the remainder coming from contributions of member countries determined as a function of their GDP.⁵⁷ The agricultural “tariff” is fairly self-explanatory and not the focus of this paper. Membership dues of member countries come from general revenue funds and we will discuss several sources of these funds later in this paper. However, the Value Added Tax is an interesting revenue source that deserves further discussion.

Value Added Tax (VAT)

Similar to sales tax in the United States, the VAT is a tax that is placed on all goods and services used for domestic consumption within the EU (i.e., non-exports). However, unlike sales tax, the VAT is applied at every stage of the production, transport, and consumption supply chain. Total tax expenses are tracked throughout this chain so that consumers are not additionally taxed, paying more than the total VAT rates on a given good.¹ The system of tracking tax expenses makes the VAT a neutral tax, occurring at the same rate despite the number of transactions involved. This system of continual taxation ensures that all economic activity is taxed and, therefore, generates far more revenue than a simple sales tax on the final consumption goods or services as used in the U.S. This tax is initially paid by the seller or the “taxable person,” yet the consumer eventually bears the tax burden when he or she pays the producer at the time of sale.

Presently the minimum mandatory VAT rate established by the EU is 15% through 2010. EU countries are free to set higher rates and most maintain a tax rate between 15% and 25%⁵⁸. Every few years, the VAT Authority re-exams minimum tax rates and makes adjustments as necessary. To ensure that European companies are not at a disadvantage to non-EU states, the VAT is also levied on all imports into the EU region. The fact that exports are not taxed at VAT rates ensures European goods will remain competitive within the global market against competitors where similar fees do not exist.

¹ The VAT is collected fractionally meaning that all taxable members along the supply chain deduct the amount they have already paid other parties (i.e. suppliers) from the total amount that is due. This taxation method ensures that it remains neutral regardless of number of transaction made.

Road Use Taxes

One of the many issues that the EU presently shares in common with the U.S. is the gradual shift in freight moved by rail and inland waterways towards trucking. This trend, when combined with the increase in passenger car traffic, poses significant congestion problems as road systems designed for much lower volumes of traffic become crowded. Moreover, the increase in freight movement on the national highways places greater wear on roads causing more frequent repairs. Because of the open border agreements between nations, European countries use a unique method of financial compensation to ensure every state receives payment for the use of their individual road networks.

To help offset the higher maintenance costs from the added burden on roads, individual nations within the EU levy road taxes on vehicles mostly in the form of road registration stickers called vignettes. This is unlike the United States where individual states register vehicles (solely benefiting from the fees) while the vehicle is free to use all local, state and federal roads throughout the country. Instead, EU countries sell individual (or block) vignettes for their country for a defined period of time (weekly, monthly, annually) and for a specific size, type, and weight of vehicle. This allows every country to generate revenue from both domestic and transient vehicles using their infrastructure and helps offset maintenance costs. This also helps eliminate some of the maintenance funding difficulties that would occur from the combination of a pure fuel surcharge and unrestricted open borders.

Automatic Road Tolling

One nation that is a very notable exception to the vignette practice is Germany. Germany abandoned the use of traditional vignette road tolling in 2005 for a modernized system of GPS-based mileage tolling on all trucks greater than 12 metric tons.⁵⁹ This system is administered by the private German company named Toll Collect. Vehicles required to pay a road toll generally have an onboard GPS system installed that tracks user miles from any road, lane, or vehicle speed. This preferred automatic method does not impede traffic flow like traditional tolling systems and can be paid through numerous billing options. Alternatively, vehicles that do not frequent Germany roads can choose the manual option which requires trucks to stop at traditional toll booths to pay user fees. An added benefit of this system over traditional tolling systems is that it does not encourage alterations in traffic flow that often occur in other areas containing both free and toll roads. Under most other tolling systems, alternate roads simply absorb the additional traffic from toll roads effectively offsetting revenue. In Germany, all roads are billed the same according to distance traveled. This German tolling policy allows private vehicular traffic to operate freely along the nation's roads and forces commercial traffic, which generate the bulk of wear, to finance repairs. Moreover, it creates an added incentive for freight to move along railways and inland waterways to help reduce congestion along the nation's roads.

Germany currently charges between 9 cents and 14 cents per vehicle kilometer depending on the weight and number of axels on a given vehicle. This equates to higher road fees than either those of US or other EU countries using vignettes. By regulation 50% of revenue must be spent on federal highways, 38% on federal railways, and 12% on inland waterways⁶⁰. In 2007, Germany generated \$5.3 billion in revenue from commercial vehicle tolling⁶¹ In addition to Germany, Austria has also adopted a method of electronic tolling in 2003 using microwave technology.

Their current system levies fees on all trucks greater than 3.5 metric tons.² Both countries are presently working to make both systems interoperable.

Fuel Taxes

Fuel surcharges are another important component of European revenue generation. Unlike in the U.S., where the primary purpose of a fuel tax is to generate highway revenue, EU nations levy much higher fees that help generate funding for their general budgets³. Looking at the U.S. as a basis for comparison, the average cost of diesel fuel was \$2.85 per gallon and \$2.13 per gallon for gasoline as of November 2008.⁶² This equates to approximately 38 cents per gallon in fuel taxes as a national average.⁴ During the same time period, fuel prices in the least expensive EU nation, Spain, was \$4.86 and \$4.67 per gallon of diesel and unleaded gasoline respectively. Average fuel prices in the most expensive EU nation, the Netherlands, were \$5.58 and \$6.38 per gallon of diesel and unleaded gasoline respectively.⁶³ Virtually all of this 200% to 300% price differential between the U.S. and Europe is from national gas taxes. Again, this tax revenue is not dedicated to infrastructure projects and transportation maintenance; however, it represents a large portion of the general funds and offsets other forms of taxation that indirectly applies towards transportation expenditures. The high fuel cost encourages the use of mass transit, more efficient freight movement techniques, and reduces the overall volume of traffic on roadways. In addition, high fuel taxation rates helps the EU achieve many of its environmental goals outlined in the before mentioned TEN-T priorities.

The EU has a uniquely different system of funding and influencing infrastructure development projects than does the U.S. These alternate solutions are generated by a unique set of challenges that this community must solve as a result of their free trade and open borders policies. In addition to interoperability and expense sharing issues between countries, European governments place a higher price on the true cost of transportation than the United States. Because of this different method of valuing the total social and economic costs of transportation, the government levies larger fees on certain aspects of freight movement and fuel use that helps shaped the economic decisions of businesses and individuals. While some of these practices may not be ideal for adoption in the United States, it is important to observe what the EU is implementing, and evaluate these techniques for future use.

Intelligent Transportation Systems

Summary of ITS Technologies

The future of transportation over the next several decades, to the dismay of many science fiction readers, lies not in the invention of flying cars, but instead in the development and

² As a result of extensive truck tolling in Germany, Austria, and other European nations, the freight movement industry has adapted so that fewer empty vehicles are hauled across roads networks and more containers are being moved by railway, inland waterway, and short sea modes.

³ As of 2004, the US generated 64% of highway revenue from fuel surcharges, 8% from tolls, and 28% from other forms of taxes and fees such as vehicle registration. More than half of the nation's toll revenue comes from New York and New Jersey. Texas is one of several states that generate more than half of its revenue from registration and administrative fees.

⁴ Revenue generated from fuel taxes has dropped over the past several decades as vehicle fuel efficiencies become better and rates have failed to increase as road construction has become more expensive.

implementation of Intelligent Transportation Systems (ITS). These systems, made possible due to recent breakthroughs in GPS and wireless technology, will play a crucial role in the advancement of our nation's infrastructure. In places where they have been successfully implemented, ITS have improved both traffic congestion and safety for drivers, and also reduced vehicle gas usage, pollution, and greenhouse gas emissions. This section will offer a basic summary of the current technology, provide a research guide to find further information, discuss some successful ITS projects that have been performed around the world, and outline the types of systems the United States needs in order to implement and operate a new 21st Century infrastructure.

“ITS is likely to emerge as the major tool to solve surface transportation challenges over the next several decades, as an ‘infostructure’ gets built alongside countries’ physical transportation infrastructure.”⁶⁴ The potential of ITS cannot be stressed enough. Imagine if your car could warn you if you are approaching an intersection and another vehicle is not slowing down, causing you to avoid a potentially fatal accident. Imagine that your car will instantly update your navigation route based on real-time traffic and weather conditions, road hazards, and construction obstructions. Imagine if your car could “talk” to a traffic signal causing it to instantly change green when it recognizes it is the only car in the intersection. These measures do much more than alleviate driver frustration and enhance roadway safety; they serve an important social purpose by reducing driving time and pollution.

Overview of Four major types of Intelligent Transportation Systems:

1) Advanced Traveler Information Systems (ATIS)

These types of systems directly emerge from GPS devices are familiar, like GMs OnStar and the TomTom. However, by expanding on this technology, GPS systems will be able to provide drivers with real-time travel information, receive updates about upcoming delays/conditions, and communicate with other vehicles to form a network of devices that provides continuously updated information. In 2009, 28% of vehicles were equipped with these types of devices, and by 2012 that figure is expected to jump to 40%.⁶⁵ Investing in a uniform network, where these devices can communicate with each other and with roadways (traffic signals, operations centers, etc.) would greatly improve traffic congestion and efficiency.

2) Advanced Transportation Management Systems (ATMS)

These are systems that work to improve overall transportation management by improving the way traffic control devices function. Many cities and states, as well as countries around the world, use Traffic Operation Centers (TOCs) to supervise and manage traffic flow. ATMS would connect roadside sensors, cameras, and other equipment to observe traffic patterns and detect accidents and roadway hazards.

One example of an ATMS is the Adaptive Traffic Signal Control. This is a traffic signal that is more technically sophisticated than the current “static” and “outdated” traffic signal that in many cities is based on traffic data from years or even decades before.⁶⁶ This type of signal is able to “sense” if a vehicle is stopped at the intersection or allows the vehicle itself to send a message to the traffic signal. It is estimated that 5 to 10% of congestion on major roadways

in the United States is due to bad signal timing. Implementation of “smart” traffic sensors, combined with other ATMS projects could significantly reduce traffic congestion.

Another form of an ATMS that is currently used in many places is the Ramp Meter. Ramp meters are signals on entrance ramps that break up the amount of cars waiting to enter the interstate or freeway, which results in better traffic flow during peak hours, as well as making merging safer for drivers. A study of ramp meters was recently performed in Minneapolis, Minnesota where there was a 15-20% reduction in total crashes on roadways.⁶⁷

Congestion Pricing Schemes, another ATMS, were implemented in Stockholm, Sweden over the past several years. A congestion pricing scheme charges a fee for entry into urban areas during peak hours. The idea is that it will encourage more travelers to opt for public transportation due to the added expense. The data from the year 2007, the first full year of the program, show that the program reduced both traffic congestion and carbon emission by 15 percent, and generated \$120 million dollars in net revenue.

Vehicle Miles Traveled (VMT) Fee System is currently being explored as the next way to finance transportation infrastructure. The National Surface Transportation Infrastructure Financing Commission recommended in 2009 that within a decade, states should adopt a VMT fee system. This system would replace fuel taxes and other fees, and drivers would be charged according to the amount they used the roads. Holland is the first country to implement a nationwide VMT; its system is called the Kilometerprijs (“Price per Kilometer” Program) and will begin for passenger vehicles in 2016. By 2012, the Kilometerprijs will be charging freight transport, and will use satellite technology and an on-board vehicle system to charge based on mileage driven. Oregon, Washington, and Hawaii are currently considering this transition.

3) Advanced Public Transportation Systems (ATPS)

These systems help improve the efficiency and use of public transportation. One major system that is currently being implemented worldwide is the Automatic Vehicle Location (AVL) Device. This device provides real-time information to travelers about when a scheduled bus/train/metro should arrive and where it was located. Also, there are currently Electronic Fare Payment Systems implemented in Japan and South Korea that allow a rider to use a “smart card” or a mobile device to pay fares effortlessly.

4) Vehicle to Infrastructure (VII) and Vehicle to Vehicle (V2V) Integration

This is the most important and advanced ITS system. In the United States, this system is being called IntelliDrive, and it will cause important changes to update our current infrastructure. IntelliDrive combines both VII and V2V systems, and will allow vehicles to communicate with road infrastructure and other vehicles. IntelliDrive will work with several ITS technologies to adapt traffic signals, detect road hazards, and change traffic flow by updating/changing traffic signs and directions, and display important warnings to drivers.

This technology could potentially allow for the integration of Cooperative Intersection Collision Avoidance Systems (CICAS). CICAS would enable vehicles to communicate with each other and with roadside sensors/devices to alert each driver about an upcoming, imminent collision. These alarms would be based on travelling speed and vehicle trajectories.

This technology can also allow the two vehicles to be automatically slowed down when an alarm goes off.

Another version of this technology is the Vehicle to Infrastructure Intelligent Speed Adaptation (ISA). This technology would be able to use GPS position data, and a digital speed map of the United States that would alert the driver if they are exceeding the posted speed limit. France is testing a version of ISA that would automatically slow speeding vehicles in extreme weather conditions.

ITS Leaders Around the World

Japan

Japan has been designated by the *Intelligent Transport Systems International Magazine* as the world leader of developing and implementing ITS technology for its roadway network. The Japanese government has placed a high priority on integrating ITS systems. It has implemented a two-pronged system in order to provide travelers with real-time traffic information data. Japan has built sensors in and alongside of the roadway and “mobile probes” which are made up of taxis, mobile devices, and other specified vehicles that report on traffic flow as they travel around. This system, called the Vehicle Information and Communications System (VICS), began in 1996. VICS is also updated with information from Japan’s Road Traffic Information Center and provides up to date knowledge of accidents, congestion, road closures, and weather conditions; which is then sent to in-vehicle navigation systems and the appropriate route is then suggested.

Japan is continuing to be a leader in ITS technology as it is developing its second version of VICS technology, called “Smartway.” Smartway will not only provide road and traffic information, but also internet connectivity and a cashless, wireless payment feature for toll booths, parking lots, gas stations, and convenience stores. It will also feature a new technology called Advanced Cruise-Assist Highway System (AHS) and Advanced Safety Vehicle (ASV) which will enable vehicle-to-vehicle communication to reduce accidents. Smartway will be able to warn drivers when they are approaching slower traffic or congestion, as well as alert them when they are travelling on more dangerous roads or going too fast for the road ahead. Japan is planning to implement this technology nationally this year.

South Korea

South Korea is recognized as a leader in ITS due to the availability of real-time traffic information, advanced public transportation information system, and electronic fare and toll payment. In 2000, South Korea released its National ITS Master Plan for the 21st Century which outlined the next 20 years of ITS development and deployment, with a planned budget of \$3.2 billion to be spent from 2007 to 2020. South Korea began its process by creating “model cities” which would test the ITS technology. These test cities recognized an increase in travel speed and a reduction in delays. The program is now being implemented in 29 cities in South Korea. The South Korean program features an Expressway Traffic Management System which collects travel information that is then sent to South Korea’s National Transport Information Center, which monitors and distributes traffic information.

Singapore

Singapore has created a Land Transport Authority (TLA) to oversee all forms of transportation in the country. Singapore uses over 5,000 taxis to collect traffic information, which is fed back to the Traffic Operations Management Center. The country then displays traffic information alongside its roadways on message signs and over the radio. Singapore also makes use of electronic road pricing, and has special congestion pricing for busy roadways. An in-vehicle unit is installed in every car which accepts a “Cashcard.” The price of using a certain road is automatically deducted from the balance of the Cashcard when it is being driven on. Singapore also changes the speed limits on its major roads to help with congestion during peak times. Another innovative system currently being implemented in Singapore is the Parking Guidance System which is a system of signs that display the location and number of available parking spots around the city.

International Best Practices in Public-Private Partnerships

Each year, the Federal Highway Administration (FHWA) publishes a series of research reports. In collaboration with the American Association of State Highway Transportation Officials (AASHTO) and the National Cooperative Highway Research Program (NCHRP), the FHWA conducts research on international best practices and distributes these reports through its International Technology Scanning Program. For 2008 and 2009, the FHWA focused some of its research examining international best practices relating to public-private partnerships (PPPs), defined as a partnership between a government agency and a private company in which the private company is responsible for the majority of costs associated with a project.⁶⁸ Research began in 2008 when a group of transportation professionals visited Portugal, Spain, the United Kingdom, and Australia. The following abstract contains a summary of best practices reviewed by the FHWA in 2008 and 2009. The final report was issued in March 2009 by the Office of International Programs within the FHWA Office of Policy and Governmental Affairs.⁶⁹

Some of the findings of the program that are noteworthy include the following:

1. PPP contract details in the countries visited rely primarily on feasibility studies to determine the highest value for related costs;
2. The funding mechanism for highways is not exclusively tolls: a variety of funding options are utilized by each of the countries visited;
3. PPP arrangements are regarded as long-term partnerships, instead of a short-term contract, between the public and private sector firms;
4. Most countries conduct a rigorous risk allocation assessment, determine key performance measures, and use an independent third party to act as a monitor for PPP contracts; and
5. Most PPP contracts in the countries visited ranged from 30 to 40 years.⁷⁰

Funding Mechanisms

Countries visited for this study used a variety of different funding mechanisms which include up front or real tolling, shadow tolling, and direct-payment methods. In Portugal, for highways in which traffic volume exceeds 15,000 vehicles per day, real tolls are used and, in some cases, congestion pricing is also implemented. For traffic volume under that amount, shadow tolls in

the form of service fees paid by the public agency to the private company are often assessed on a traffic volume basis. These shadow tolls allow the government to step in when there is not sufficient market incentives associated with a project and are thus able to mitigate the issue that some highway projects, although valuable to the public, cannot be profitable from a business perspective.

It is interesting to explore Portugal's model for financing moderately congested roadways. With roadways that have a moderate amount of traffic congestion, a combination of real and shadow tolls is used. Real tolls pay for a portion of operational costs while the rest is provided as a service fee from the public to the private entity. As traffic volume increases, the real toll increases in the form of a congestion price and the amount paid by the public entity in service fees proportionally decreases. All highways in Portugal currently run on this system; however, for highways that have enough traffic volume to cover the costs of operations, the Portuguese government is considering removing shadow tolls.⁷¹

Projects Suitable for Public-Private Partnership

In both Spain and Portugal, the governments prepare a risk analysis to determine whether a PPP is necessary. If the majority of risk can be transferred to the private entity, then the PPP will proceed. Spain also conducts an economic viability analysis to determine private-sector interest in a particular project based on the capital costs over time and estimated revenue generation. In the United Kingdom (UK) and Australia, the governments start with the assumption that public funding is better. They establish a hypothetical model for the project to remain entirely public and assesses whether or not involving private funding will be the lowest cost for value option. This assessment method, used to determine if a PPP is the best option for a specific highway project, is referred to as a value-for-money (VfM) analysis.⁷²

Risk Allocation

Allocating risk or shifting risk from the public to the private sector is a primary reason for developing a PPP. Of the four countries visited for this study, each country had a slightly different diagram for risk allocation in PPP contracts. In Portugal, for example, almost the entire burden of risk is held by the private-sector agency with a small portion of risk held by the public sector for environmental compliance and shadow tolling market/demand. The exception is for Force Majeure in which a majority of risk is held by the public sector.

In Spain, Australia, and the UK, the public sector takes on significantly more risk than in Portugal. In these countries, all risk for land acquisition and Force Majeure is assumed by the public sector. Spain and Australia also assume the burden of risk for issues of changes in law whereas Portugal and the UK do not. In summary, the areas of greatest difference in risk allocation relate to changes in conditions that may occur over the life of the project including environmental compliance, traffic demand, Force Majeure, and changes in public policy.

As stated above, risk allocation in these countries is not shifted to the private-sector agency in all cases. In fact, there are certain provisions for "rebalancing" risk according to the rate of return for a project. If the rate of return or profit for a given project is low, the private sector will not have as much incentive to bid on the project; therefore, risk allocation will shift to the public entity or offer the private company a subsidy to ensure that the project will be attractive enough

to the private sector to bid on the project. On the other hand, if rate of return is high, a considerable amount of burden can be pushed forward to the private sector which will be willing to take on the majority of the risk in return for the anticipated high rate of return associated with the project.

Of the countries surveyed, Australia exhibited the most variance its methods of allocating project risk. With Australia, the public entity rarely takes the burden of risk. Instead, the private sector bears the risk of market shifts and long-term changes. Australian private sector agencies have grown accustomed to assuming this risk and, by and large, are willing to do so.⁷³ As mentioned above, the UK and Australia conduct a rigorous value-for-money analysis that helps determine if a project is truly suitable for a PPP contract which may help reduce the risk overall for a particular project.

Procurement, Contract Periods, and Standards

When procuring a contract with a private entity, each country studied has a formal, competitive bidding process, which allows for a variety of private-sector agencies to compete for a bid. The differences between countries are in the amount of negotiation that occurs during the bidding process. For example, Spain does not allow for much negotiation over the contract and the bidder must adhere to the terms of the contract as initially stated. On the other hand, the United Kingdom has a rigorous negotiation process that occurs with the bidders and contracts may be altered multiple times before a suitable agreement is reached. Portugal and Australia fall in the middle on the spectrum of pure bid versus pure negotiation which can be used to receive the optimal contract for a project.⁷⁴

Spain essentially uses an open competition model. Each bidder is allowed to submit up to three alternative proposals for a project, and the Spanish government chooses the bidder with the most merit. This process is said to reduce costs associated with a more open negotiation model; however, if the number of bidders is high, the cost savings may not be realized and some qualified bidders may be discouraged from applying due to the low likelihood that their bid will be successful. The United Kingdom, on the other hand, has a much more involved and multi-layer bidding process which includes: prequalification; tender guidance and dissemination of information; negotiation; and contract award.⁷⁵

Contract periods can last from 25 to 40 years or more in all of the countries surveyed. Generally, contracts are more flexible at the beginning of the contract period and become more standardized as construction begins. The UK has put into place a two-tiered mechanism for modifying contracts. Over the long-term, if significant changes are needed when circumstances change, a new contract can be developed. In the case of small modifications, there is a provision in the contract for making incremental modifications as needed through the life of the contract. Furthermore, for each country studied, the contract documents have a common basic framework which includes an agreement, a similar set of provisions and requirements, contract-specific requirements, and a schedule for the contract.⁷⁶

Management and Operations

Once the PPP contract begins, certain operations standards and performance measures are put in place to ensure project success. In the countries studied, performance measures, also known as

key performance indicators, can focus on a number of areas of project implementation and operations depending on the nature of the project. Certainly, there are a few performance measures that are most widely used by these countries to determine if a project is meeting standards and achieving goals such as safety, environmental compliance, route performance, and overall project management.

During the construction and design process, all countries studied had an independent third-party review the project for compliance and quality. During the operations phase, each country has a person-in-charge in government that served as the coordinator for performance, financial monitoring, and contract administration. In the UK, this person-in-charge is called the department's representative (DR) and in Spain is often called the government delegate. The importance of this position is recognized across the board as the person-in-charge is responsible for maintaining a balanced relationship between public interests and the private contractor's revenue goals throughout the project period.⁷⁷

Program Performance and Lessons Learned

All of the countries studied agree that PPPs have allowed them to begin projects that may otherwise have not moved forward. Indeed, the ability for private agencies to access capital markets is much more expedient than for public agencies to access public funding for highway construction due to rigorous public approval processes. In many cases, these countries were able to save money and bring down costs to the public through this expedited access to capital markets through PPPs.

Since 2000, Portugal has vigorously pursued PPP contracts to upgrade its highway system as the country has a tremendous need to support the increase in vehicles on the roadway. The result has been a significantly upgraded highway network. Spain has also built more than half of its highway networks through PPP contracts and the UK has recently shifted to using more PPP contracts and away from its role as the operator of the highway networks. Both Spain and Australia, through the PPP process, have fostered growth in their private sectors involved in the development, operation, and financing of these contracts. A residual effect of having private firms operate highway projects is that these firms have developed expertise and competitiveness in the global market.⁷⁸

Three general conclusions can be gleaned from these country case studies. First, the countries have learned the importance of incorporating the public interest in a PPP contract, instead of solely focusing on cost-savings and/or profit generation. This lesson is manifested in the rigorous evaluation process in which each country studied determines if a project is suitable for a PPP. Second, the PPP should be seen as an exercise that needs to carefully assess business conditions and technical requirements, and to determine project costs. In a PPP contract, it is imperative that the private firm is able to visualize its return-on-investment. Third, all the countries studied have realized that the internal capacity of the public agency to conduct these assessments is of utmost importance; it should not rely too heavily on consultants to act as a coordinator between the public agency and the private company operating the project. Without adequate understanding of the methods of operations of a PPP, the public agency may develop a substandard contract which will lead to substandard outcomes for the public.⁷⁹

Summary of Findings

The FHWA highlighted a variety of interesting findings from their analysis of PPPs in Spain, Portugal, Australia, and the UK. The following is the list of the top-10 findings for the report.

1. PPPs make up a small percentage of the overall highway network, but projects administered through these agreements are often critical infrastructure developments that greatly improve the nation's mobility.
2. Public agencies in the host countries face the same limits in public funding and aging infrastructure that is faced by the United States.
3. The learning curve for both public and private agencies on PPP administration has greatly improved the PPP development process in the last decade.
4. Determining if a project is a good fit for a PPP is complex, and financing a project is not the sole consideration for implementing a PPP contract.
5. There are a variety of funding options for highway projects, and real tolling/ user fees are not always required. Shadow tolling is another popular choice.
6. Contract periods for PPPs are long term ranging from 30 to 40 years and can be as long as 50 years.
7. In many cases, PPP contracts are able to deliver a project sooner than a public agency due to the ability for private companies to access capital markets.
8. There is no standardized method for defining a PPP and acronyms and methods vary. Each contract must be unique according to the needs of public.
9. The public-sector agency administering PPPs needs to alter the way it thinks about a project and develop its skill set for contracts with private sector companies. A capable government is needed to properly negotiate contracts and provide oversight through the life of the contract.
10. In PPP contracts, innovation in providing services to the public is evident in all of the countries studied.⁸⁰

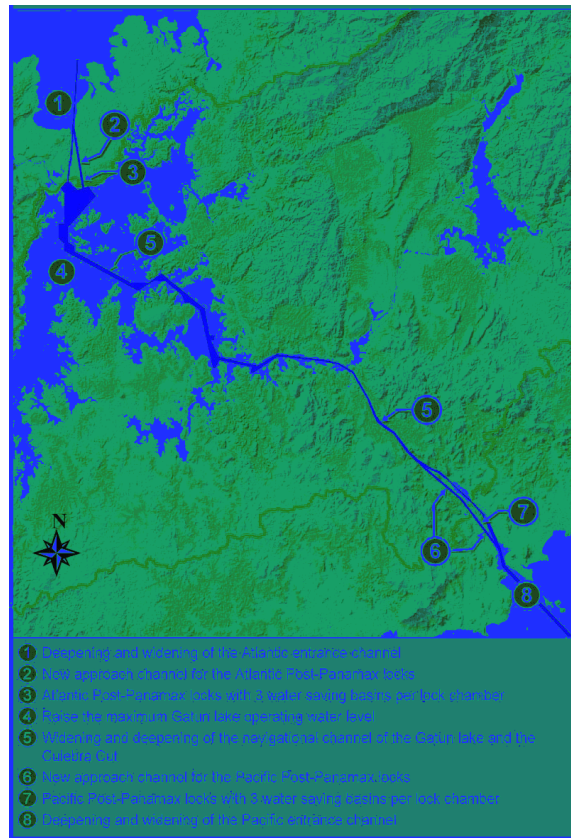
More details on project findings can be found in the body of the FHWA report. A number of charts, graphs, and case studies are embedded throughout the report and provide substantial detail into the PPP process for the countries surveyed. Furthermore, the final pages of the report provide recommendations for short-term, mid-term, and long-term actions. These recommended actions include building agency capacity for PPP implementation, continuing research on foreign PPPs, and developing guidelines for facilitating PPP contracts from the initial feasibility study to the bidding process to performance measurement.⁸¹

Chapter 6. Panama Canal Expansion & Texas Impacts

Expansion Overview

In 2006, the citizens of Panama approved a referendum to expand the Panama Canal by adding a third lane of locks to accommodate larger ocean vessels and to enable those vessels to pass through the canal more quickly. The project is scheduled for completion in 2014, at a cost of \$5.25 billion.⁸²

Figure 25. Components of Third Set of Locks Project



Source: Panama Canal Authority 2006

The expanded canal will include new lock complexes on the Atlantic and Pacific coasts, both creating new channel locks and widening existing channels, to nearly double the canal's existing tonnage capacity. Overall, traffic is expected to grow 82% from 2005-2025 with the number container boxes growing at more than 200%.⁸³ The maximum dimensions of vessels transiting the Panama Canal, known as Panamax, will grow roughly 45%, and the number of container boxes these new larger ships can carry will grow 140%.

Competing Routes

While builders are confident that the expanded canal will be a competitive route between Asia and the Central/Eastern United States, alternative routes are also of interest to policymakers. These alternatives include overland routes via rail through Mexico and Canada to markets in the United States, and, longer-term, possibly a ‘dry canal’ through some other part of Central America (either Nicaragua or Mexico’s Isthmus of Tehuantepec), or a route through the arctic region should polar ice continue its retreat.⁸⁴ Planners in Panama do not, however, expect any of these alternative routes to threaten the canal’s profitability in the foreseeable future.

Table 9. Panamax Pre- and Post-Expansion

	Panamax (feet)	Panamax post-2014
Length	965	1,400
Width (Beam)	106	180
Draft	39.5	60
TEUs	5000	12000

Source: Panama Canal Authority 2006, p. 45, accessed March 2010

The Panama Canal has been an increasingly important route for trade between the U.S. and Asia. According to TxDOT, the Panama Canal’s “share of total container shipments between Asia and the United States has increased from 11 percent in 1999 to over 38 percent in 2004 and container volumes through the Canal are expected to grow by nearly 6 percent annually over the next several years.”⁸⁵

Counteracting this trend, however, is the growth in exceedingly large “post-Panamax” ships that are forced to unload on the West Coast ports or traverse the Suez Canal and Atlantic Ocean. Ships between China, Korea, and Japan rarely take this route. Currently, about 50% of all ships from East Asia unload at West Coast ports. But only 30% of the unloaded cargo remains on the West Coast; the rest is sent eastward by truck or rail.⁸⁶

Impact on Texas

Expansion in 2014 will accommodate most of these post-Panamax ships and likely will benefit Texas ports. It will initially make the largest impact on the Port of Houston, the closest major U.S. port to the Panama Canal and which handles 80% of Texas’ container traffic. It is a major conduit for manufactured goods between the U.S. and Asia coming through the canal.⁸⁷ Currently, 14% of container traffic passing through the Port of Houston also passes through the Panama Canal. Houston port officials hope that the percentage will grow to 25% by 2020. Forecasters believe the Port of Houston could attract 20% of the ocean vessels docking on the West Coast.⁸⁸ This will increase road and rail traffic out of Houston and possibly necessitate further investment in inter-modal networks around the region.

For Texas, this means a surge not only in the volume of maritime traffic passing through the state’s ports, but also a significant increase in the number of the largest ocean vessels. Already the Port of Houston is planning a new terminal in Bayport that will triple the port’s container

capacity and accommodate post-Panamax ships. The Port of Corpus Christi is also expanding its container capacity.

The existing depth of ship channels and port harbors is a concern. The Port of Houston’s 45-foot-deep channel is the deepest in Texas; even so, it will be unable to accommodate post-Panamax ships, which will require a draft of 50 feet, the emerging standard. Competing East Coast ports, such as New York/New Jersey and Hampton Roads (Virginia), already have 50-foot-deep channels.⁸⁹ Dredging channels is expensive, so Texas should look to federal and private partners in its efforts to prepare its ports for larger, post-Panamax ships. Ports that fail to do so will lose market share to more modern, efficient ports.⁹⁰

Figure 26. Comparison of Tonnage Growth/Segment

Comparison of Tonnage Growth per Segment			
PCUMS Tons Per Market Segment*	Year 2005	Year 2025	
		Canal without an expansion	Canal with an expansion
Containers	98	185	296
Dry Bulk	55	49	73
Liquid Bulk	34	19	28
Passenger	10	13	19
Car Carrier	36	40	58
Refrigerated Cargo	19	15	22
General Cargo	7	3	4
Others	20	6	8
Total PCUMS Tons	279	330	508
*Millions of PCUMS tons			

Source: Panama Canal Authority 2006, p. 26, accessed March 2010.

Texas infrastructure planners must also prepare to face environmental and land-use challenges as they expand ports to accommodate larger, post-Panamax ships. Dredged materials are costly to dispose of, and different community groups often have varying visions as to the preferred use of waterfront land.⁹¹ Policy planners should be prepared to cooperate with stakeholders to advance a port-expansion agenda that meets the state’s transportation needs, while maintaining environmental standards and cultivating community support.⁹²

Even if Texas ports are upgraded to accommodate these new mega-ships, the state’s highway and rail networks may not be able to adequately cope with the anticipated growth in traffic. The Texas Rail Relocation and Improvement Association (TRRIA), a statewide advocacy coalition, predicts that Houston area freight tonnage traffic will triple by 2025. Significant investment will be needed to upgrade or reroute railways around the Houston metropolitan area. Without infrastructure improvements, the Texas transportation system will be unable to handle increased traffic even if the port capacity is expanded. Ocean carriers may well choose to dock and unload their shipments at other competing ports located along the Gulf and Atlantic coasts. This would lead to lost jobs and more expensive products being delivered to Texas. The TRRIA estimates that 35,000 to 40,000 jobs are generated for each \$1 billion in new trade.

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