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16. Abstract

This report describes the major trends in intermodal shipping that are impacting Texas intermodal trade corridors. Key supply and demand forces that underpin intermodal service and routing options are provided. Intermodal development from a technological and shipping industry perspective is described, including the impacts of the global economic recession beginning in late 2007. This is followed by an overview of Texas trade patterns with various trading partners with particular attention paid to those relationships that are in a current state of flux. A review of current and future corridors used for handling international intermodal trade shows the comparative strengths and weaknesses of different routing options for intermodal cargo shipping. Texas ports officials regard the new Panama Canal lock system due to open in 2014 as critical to future demand so a chapter is devoted to examining the system and current status. The inherent economics of different corridor options is enhanced by the development of marine and rail cost models that explore the basic tradeoffs for transportation providers in choosing different corridors. Finally, suggested infrastructure and economic milestones driving changes in trading patterns are given particularly as they relate to the Texas economy and its transportation system.

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Emerging Trade Corridors and Texas Transportation Planning

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Chapter 1. Introduction

The period 1995–2006 was characterized by a strong growth in world trade, averaging 5 to 11% per annum excluding sharp, but brief, declines in 1997 and 2001. The combination of consumer confidence in almost all global markets, easy access to credit and financing in North America and Europe, the emergence of Asia (particularly China) as a manufacturing mega-region, and the ability of multimodal transportation systems to move bulk and consumer products around the world efficiently and cheaply combined to irresistibly drive up trade, whether measured by value or tonnage. In addition, the success of the World Trade Organization in reducing tariffs and promoting trade provided further impetus to long term growth. The term “global trade” tends to be associated with containerized commodities that were the main focus of this study but it should be recognized that bulk and specialized products—including oils, ores, grains, and autos—play significant roles in the commodity types moving across the global transportation corridors and all of these types use elements of the Texas transportation system.

Texas is currently the leading U.S. state for exports and its size also generates substantial import volumes, so multimodal corridors are an integral part of state transportation planning. In addition, the strategic location of Texas means that regional and national corridors, comprising interstate highways, rail corridors, and the Gulf Intracoastal Waterway, lie within or cross its borders. But what constitutes a corridor? The terms “trade corridor” and “transportation corridor” are sometimes used synonymously (McCray, 1998) but for transportation planning it is important that they be treated separately (Boske and Cuttino, 2000), particularly when corridor performance and needs are being evaluated as they are in this study. Essentially, a corridor utilizes a variety of modes to facilitate international flows, and changes in both demand and costs can cause shippers to move business between competing corridors. International trade, including that associated with the North American Free Trade Agreement (NAFTA), uses a variety of corridors to serve Texan destinations, although when this study began in 2007, three systems dominated trade flows.

First, vessels carrying oil, petroleum, chemicals, grains, and containers cross the Gulf to several Texas marine gateways for product processing, re-export, and domestic consumption. Next, NAFTA truck trade uses IH 35, IH 20, US 281, and SH 71 highway segments to move in and across the state. Finally, intermodal Asian containerized trade (with the important exception of some Wal-Mart cargo) was typically routed through Californian marine gateways and then placed on the Union Pacific (UP) or Burlington Northern Santa Fe (BNSF) continental “rail land bridges” for a variety of destinations, including terminals in Texas. In summer 2004, key gateways in Los Angeles and Long Beach became congested and trade flows were severely impacted to the dismay of steamship companies and shippers. Shippers and logisticians concluded that the optimistic forecasts made for Californian port planners, such as the 1998 Mercer San Pedro Bay long term cargo forecast of 36.1 million Twenty-Foot Equivalent Units (TEU) by 2020 (DMJM Harris, 2002), could not be easily reached and so they began to experiment with other routes to U.S. customers, including those serving Texas. There is no single decision maker in corridor selection and a variety of entities impact corridor choice. Manufacturers, producers, and shippers all play major roles and in the last decade companies providing door to door planning—third party logistics providers (or 3PLs)—have entered the market, some linked to rail and truck operators. The success of their efforts should not be underestimated as even during the period of high fuel prices, total logistics costs as a percent of Gross Domestic Product (GDP) rarely rose above 15% and pure transportation costs comprised not more than 10% even for low priced consumer products. The growth of logistics was reflected in sophisticated and dynamic changes in handling containerized goods ranging from larger vessels, faster and less frequent port calls, and transloading from the smaller International Organization for Standardization (ISO) containers to 53 ft domestic containers and trailers.

Global markets received a double setback in the years 2006 to late 2009. The first came with the rapid increase in oil prices and with it the fuel for all transportation modes. The second and more serious impact came with collapse of several key banks, which drove down global consumption and raised prices of the financial services essential to global trading, including letters of credit and similar instruments. These economic difficulties in the consumer and service markets caused global trade to fall, first with containers and autos, followed by raw materials. The percentage fall in volume was substantial as shown in Figure 1.1, although it is noted that a strong rebound was predicted in late 2009 by IHS Global Insight.

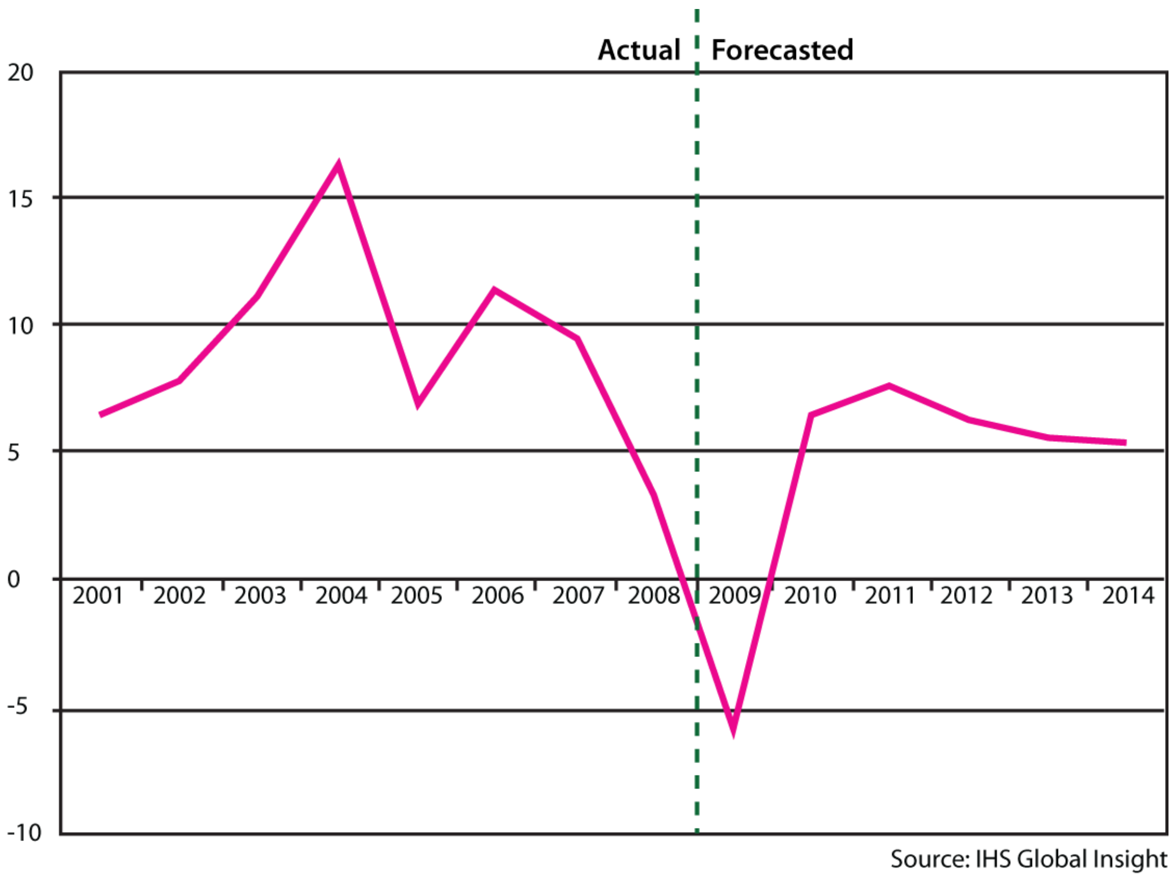

Figure 1.1: Actual Global Trade 2001–2008 and Forecasted Trade 2009–2014

A major unanswered question at the time of writing the report is how long the current recession will last and whether the recovery will be "V" shaped as predicted by IHS Global above or "U" shaped as suggested by Professor Nouriel Roubini, who gained notoriety for predicting the scale of the 2007 global financial troubles. Roubini, of the Stern School of Business at NYU, recently stated that the basic scenario is one of a U-shaped economic recovery where growth is going to be below trend for the advanced economies with a small, but rising, probability that if they do not get the exit strategy right, the global economy could end up with a relapse and a double-dip recession. In any event it is likely that trade volumes, particularly in the Western Hemisphere, will face only a modest recovery and that shippers will have a variety of competing routes and corridors (and very competitive transportation providers) over which to send their business. Southern Californian ports, having enjoyed quasi-monopolistic powers over Asian freight for around a decade, are now encountering diversion to other corridors and were reported in a recent Journal of Commerce article to be looking for more cooperation from railroads on marketing and pricing to win back customers.

The fall in what had been strong merchandise trade growth brought with it a reprieve that, under different circumstances, would be enviable. In early 2009 the United States enjoyed congestion free ports, unclogged rail lines, copious availability of transport worker labor, and modest energy prices. For the logistics community, amidst the gloom of cargo and short term revenue forecasts, has come a realization that this slowdown could be seen as a second chance to rethink trade corridor development and re-emerge with a more balanced, sustainable system of supply chains. Under the earlier paradigm, trade was expected to shift to alternative corridors because of absolute capacity constraints that would leave shippers with no choice. Alternative corridors were thus seen as a last minute bypass to prevent the overburdened veins of trade from bursting. Under the new paradigm, shippers can more fully weigh the current and future attributes of trade corridors to determine which options best suit their long term interests in terms of time in transit, reliability, service level, and connections with related industries.

The conventional wisdom of much of the last decade that containerized seaborne trade with Asia would continue to grow unabated led to projections that U.S. West Coast ports would be overwhelmed by unrelenting import growth. By using linear growth rates these projections showed future U.S. containerized imports rising to unsustainable post-2020 levels that would require multiple new terminals as well as the possible conversion of some existing bulk ports to containerized operations. This phenomenon was illustrated in Texas with proposals to construct five new container terminals slated to operate in the second decade of the 21st century to supplement the single Houston terminal that had served the majority of Texas needs since the 1970s. The logic behind such a rapid expansion of capacity was tied in large part to the possibility that one or more Texas ports would become load centers serving not only the needs of Texas but also the demand in several other states. In 2006, as containerized volumes began to slow, the focus of trade corridor research shifted away from designing systems to meet unrelenting growth. In short, the field has become less about algebra and more about calculus. Rather than projecting what total trade will be in 15 or 20 years through assumed linear growth rates, the trade planner must instead ask "what are the critical demand thresholds? What systemic factors must change for shifts to occur and how are these conditions recognized?"

Central to any economic improvement will be the recovery of the financial system, stable stock and currency markets, and a return to confidence among personal shoppers. Why is this important to transportation? The answer is simple. Transportation is a <u>derived</u> service activity and dependent on levels of economic activity being maintained within certain limits to allow modes to reach financial viability. Steamship companies, and to a lesser extent railroad companies, tend to face difficulties finding a reasonably stable balance between supply and demand. Currently there is overcapacity in the marine sector, and not simply in the container and auto sectors. Figure 1.2 shows vessels laid away at the Port of

Orange in September 2009. Nine vessels, mostly bulk carriers, lie idle including two Harrah gambling ships—demonstrating that no economic sector has escaped the downturn.

Figure 1.2: Idle Vessels at the Port of Orange, September 2009

Initially, the thrust of the study was Asian trade and a task was included that addressed forecasting the magnitude of Asian-Texas containerized trade moving through Texas deep water ports. In the early stages of the work TxDOT enlarged their interest to a global interest – namely which countries in the world trade with Texas and what are the magnitudes of the volumes? This question is sufficiently large to deserve a study of its own and made predicting flows complex. Furthermore, after this decision, the world recession began and added a further complication. A decision was made at that time to use recent container forecasting data to give the reader an idea of Texas port container demand and from that potential handling (terminal) capacity constraints.

A previous CTR[1] report has estimated Texas landed container volumes for the next two decades. The researchers used historic time series data set from the Port of Houston and then used data derived from the 10 largest U.S container handling ports to project likely growth rates over the years between 2005 and 2025. Independent variables used in the estimation included annual population growth rates; Gross State Product and import price index for a basket of commodities. Six separate modeling

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[1] P. Siegesmund, J. Kruse, J. Prozzi, R. Allsup and R. Harrison "An Analysis of the Value of Texas Seaports in an Environment of Increasing Global Trade" TxDOT Report 0-5538-1, October 2008

approaches were used to predict values and further information can be found in the CTR report.[2]. The six models projected container counts (TEUs) for the year 2025 ranging from 2.5 to 4 million TEU. Figure 1.3 depicts the results of the six modeled estimations for container growth from 2005 through 2025. The model with the least sum of squares of errors (Cov2) represents the best statistical model of the six and predicts volumes of near 4 million TEU in 2025. This should be regarded as the lower boundary of predicted volumes since (a) the data did not capture all the pre-2007 recession growth, does not capture the economic attractions of the Bayport terminal at Houston, and (c) does not take into account new services from large vessel passing through the new lock system on the Panama Canal which is due to open in 2014.

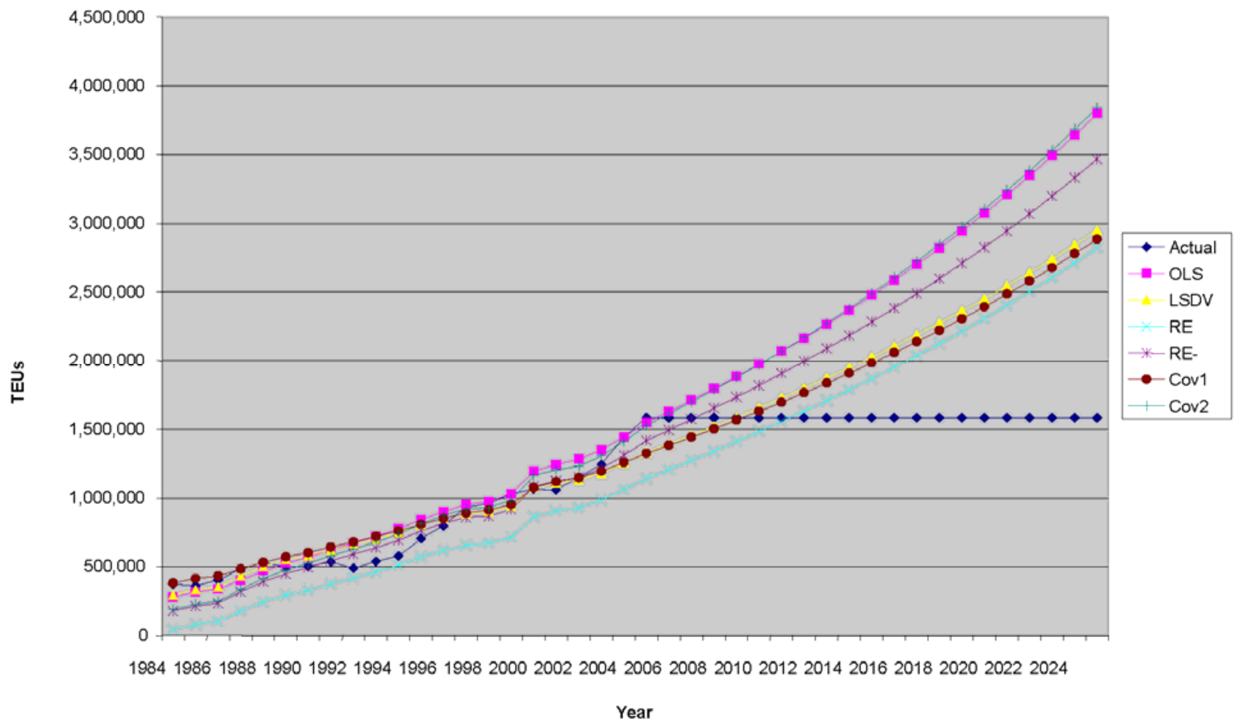


Figure 1.3: Predicted Marine Container Counts for Texas by the Six Models (1984-2025)

[2] Appendix G: www.utexas.edu/research/ctr/pdf_reports/0_5538_1.pdf

The 0-5973 report comprises the following chapters. Chapter 2 examines the current state of global shipping and describes some strategies companies are following to survive the severe downturn in shipping demand. Chapter 3 reports a selection of Texas international trade flows measured in both value and weight for a range of the most critical markets. Chapter 4 describes several key intermodal corridors, some established like those in southern California and newer candidates such as the Prince Rupert terminal in Western Canada. Improvements to the lock capacity of the Panama Canal are seen by many in the Texas Port Association as representing the best chance of gaining significant volumes of containers when the system is due to open in 2014. The impacts of the system are the subject of Chapter 5. The next two sections address the challenge of estimating modal costs so that a comparative cost approach can be used by planners to evaluate competing corridors on the basis of estimated total cost. Chapter 6 provides data on vessel operating costs, which allows calculations on container cost per nautical mile to be derived for a variety of ship sizes. Chapter 7 does the same using an intermodal rail model developed in part from a Southwest University Transportation Center grant. Finally, Chapter 8 summarizes the findings of the study and provides some estimates of likely corridor milestones for planning use. NAFTA remains the largest trading partner with Texas and transportation improvements to the Mexican corridor system are described in Appendix A.

Chapter 2. Current State of Global Shipping

2.1 Background

Global trade for all but the highest value commodities, which are shipped by air, depends on efficient marine transportation systems. The sub-elements of such systems—vessel design, operations, and terminals—have benefited from a period of consistent technological improvement since the 1980s, funded by companies willing to invest in the expectation of higher future demand. Furthermore, post 2001 saw the introduction of electronic systems, termed *e-commerce*, that changed the way steamship companies, shippers, brokers, and customers exchanged information. Separate to this was the parallel need to share information with a variety of government agencies throughout the world, including those tasked with administering security.

Large bulk vessels have been sailing for over 30 years and the largest ever built, the *Knock Nevis*, was built in 1979 at the Sumitomo Heavy Industries Oppama shipyard and then re-fitted and re-named the *Seawise Giant*. After the refit, the ship had a capacity of 564,763 metric tons (DWT), an overall length of 458.45 meters (1,504.1 ft), and a draft of 24.611 meters (80.74 ft). She had 46 tanks, 31,541 square meters (339,500 sq ft) of deck space, and was too large to pass through the English Channel. Figure 2.1 compares this ship with one of the largest current containerships: the *Emma Maersk*, which was launched in 2006 with a capacity of 156,907 metric tons (DWT).

Visual comparisons, using vessel length for these ships are given in Figure 2.1.

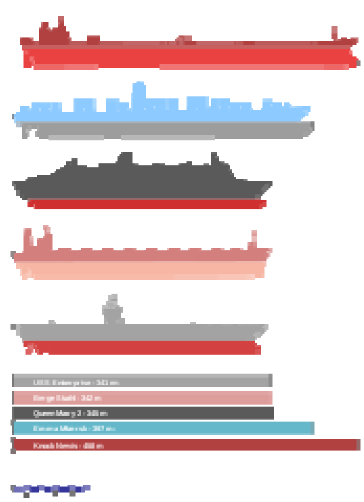


Figure 2.1: Profiles of the Longest Ships. From top to bottom: Knock Nevis, Emma Maersk, Queen Mary 2, Berge Stahl, and USS Enterprise (CVN-65)

Containerships grew steadily after the first ship—a converted World War tanker, the *Ideal X*—sailed in 1956 from Newark, New Jersey to Houston. Unlike bulk vessels that sit low in the water and have inherent stability, containerships carry much of the boxes over the waterline, so raising the center of gravity. It took some time for naval architects to design larger vessels that were stable and encourage diesel engine designers to produce single engines capable of moving the additional mass. Moreover, as ships got larger, the additional capacity came largely from increasing width, which meant that terminal operators had to invest in larger cranes to service the vessels efficiently. In the 1970s, containerships averaged around 3,000 twenty-foot equivalent containers (TEU) and this became the standard vessel for a decade, particularly as its design allowed passage through the Panama Canal locks, dubbing the class *Panamax*. Improvements in ship design and naval architecture and careful analysis of weather patterns while at sea allowed ships to grow in size until around 2000, when the typical large containership capacity was approximately 6,600 TEU. The width of these ships exceeded the lock size on the Panama Canal, so they were termed *Post-Panamax*. In addition, changes to above deck storage designs now allows Panamax vessels to carry around 5,000 TEU. At this time it was thought that any larger ship would need to be powered by two engines and screws, driving up costs substantially. However, Danish architects were able to design the Emma Maersk as a single engine and single screw vessel. The main diesel engine (a Finish Wartsila 14RT-Flex96c) is impressive and its turbo-charged 2-stroke 14-cylinder engine (each cylinder displacing 1,820 liters) produces 114,800 BHP at 102 revs per minute and allows the vessel to cruise at 31 mph (25.5 knots).

The period 2000 to 2007 was one of steamship company mergers, the introduction of larger ships exceeding 6600 TEU capacity, rationalization of routes and ports of call, and large increases in ship orders, particularly for the largest class of vessel. In the *Containerization International Yearbook 2002* (CI), the editor noted "The problem for the ocean carriers is that large containerships which had been ordered in 1999, when post 2000 growth was assumed to be 7–8% were now coming on stream just when they were not needed" (see Box 2.1). Unfortunately, troubles in the shipping industry were only just starting and although CI staff correctly predicted that mergers and failures in the industry were likely post 2001, the scale of the problem was greater than predicted and lasted far longer. The start of the current recession lowered demand far below current and future capacity (the latter based on new ship orders) and prices on all routes fell, so driving down revenues to unprecedented and unsustainable levels. Ship cancellation orders rose but many steamship companies were forced to take delivery of new ships and put them immediately on reserve because cancelation fees were ruinous.

Box 2.1 Gloomy Predictions in 2002

"A combination of slowing trade growth and the massive influx of new, large vessels for the key east/west routes have combined to upset the delicate balance between supply and demand for capacity. What looked like sound business decisions at a time when shipyard prices in Asia were low, lead times for new vessels long and there was a pressing need for economies of scale, especially if your competitors were tooling up with higher tonnage, have now come home to haunt the carriers. These decisions will probably pay off eventually, but in the short to medium term they have been disastrous."

(Boyes, 2002)

Figure 2.2 shows that the relationship between global container demand and containership capacity, where the overcapacity noted by CI staff in the period 2001–2003 can be seen. But this is not what draws the eye. Significant overcapacity in the sector begins around 2005 and becomes huge as the global recession bites in 2007. It is this factor that has put the sector—and many others—into the doldrums, with companies facing clear financial challenges to their commercial survival.

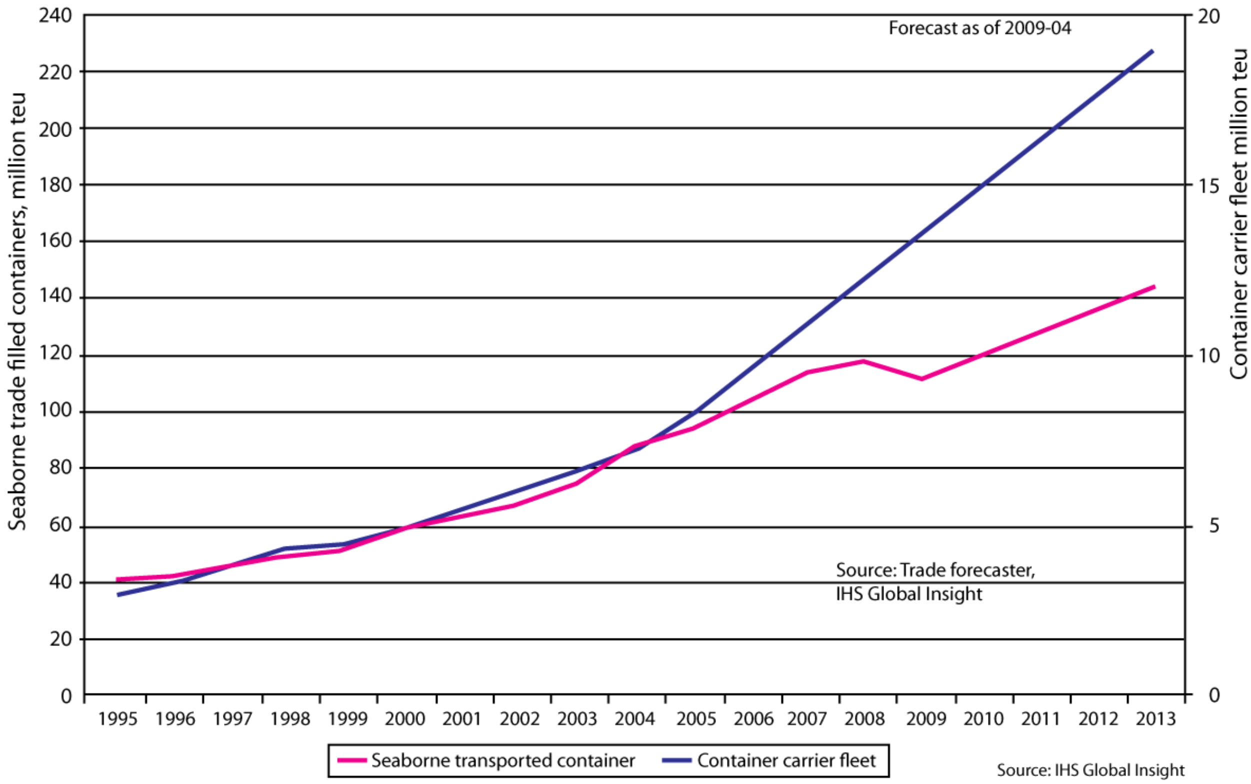


Figure 2.2: Historic Global Demand and Supply (1995–2008) and Predicted Demand and Supply (2009–2013) for the Container Sector

IHS Global Insight recently held a webinar where they showed data on historic, current, and forecasted world fleet tonnage, from 1960 to 2011, broken down by vessel type. This is shown in Figure 2.3 and demonstrates with clarity the magnitude of the new ship orders coming on stream and the composition of the global fleet. Unfortunately, demand for their services depends on an economic recovery, which at the time of writing is far from certain despite the Global Insight global economic forecast that is currently on track for a recovery in late 2009.

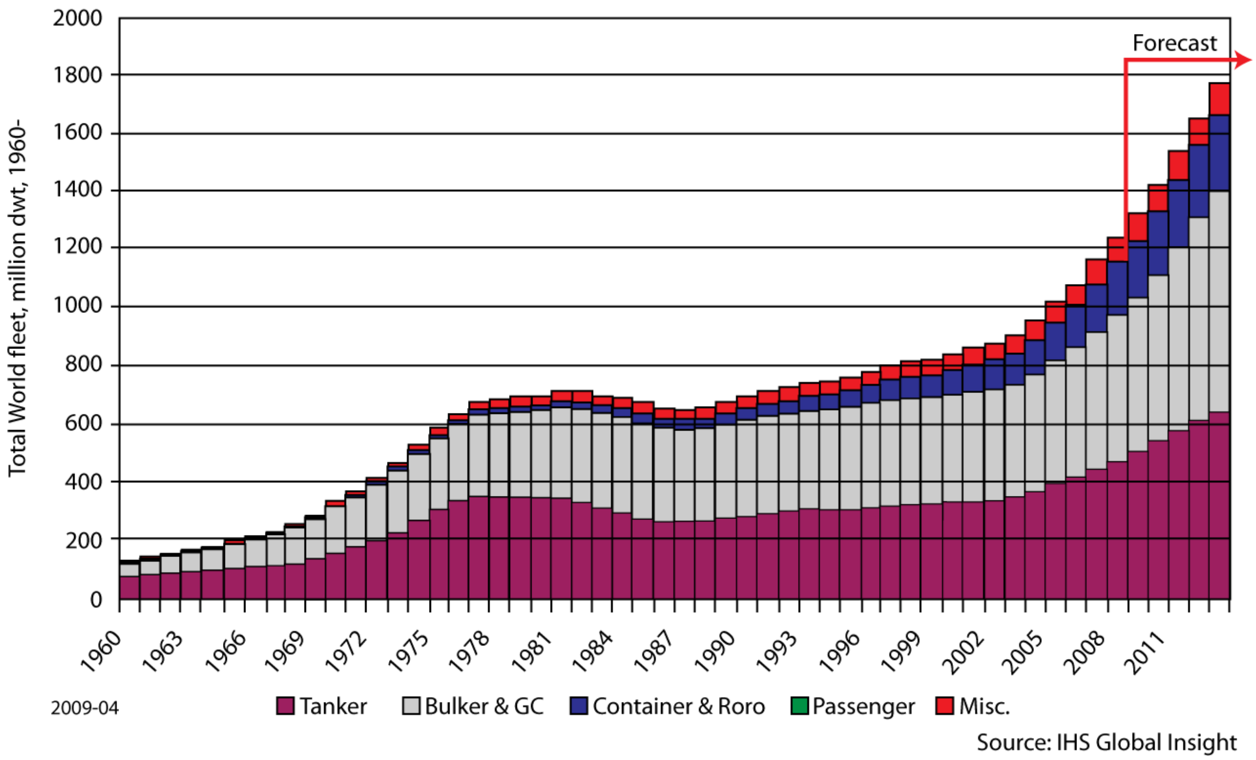


Figure 2.3: The Total World Fleet, by Vessel Type, 1960–2011

International ocean carriers face severe challenges in remaining profitable in the midst of the current economic slowdown. The glut of container carrying capacity, in combination with the rapid fluctuations in energy costs, is severely impacting the pre-existing rate setting structure for liner services. The uncertainty created by the crisis is a risk factor for all liner services but particularly for those routings that are less well established. Thus the future viability of many emerging corridors is partially dependent on the ability of carrier alliances to resolve the structural problems facing the industry. The next section explains some specifics of the problems global ocean carriers now face and strategies that are being considered to address them.

2.2 Transpacific Stabilization Agreement (TSA) Actions

The Transpacific Stabilization Agreement was formed in 1989 and its role became more prominent after the banning of rate setting conference in 2000. Members include American President Lines (APL), China Shipping Container Lines, CMA-CGM, China Ocean Shipping Company (COSCO), Evergreen, Hanjin, Hapag-Lloyd, Hyundai Merchant Marine, K Line, Mediterranean Shipping (MSC), Nippon Yusen Kaisha (NYK) Line, Orient Overseas Container Line (OOCL), Yangming Marine Transport, and Zim.

While the TSA does not have the rate-setting authority that the conference system possessed, it uses a variety of tools to induce major carriers to participate. The logic behind the conference system, which existed for most of the 20th century, was that by self-policing the rate structure, the major ocean carriers could avoid service interruptions during economic downturns. The current downturn is the most severe since the conference system has been dismantled and will test whether the new, decentralized rate-setting structure will be sustainable.

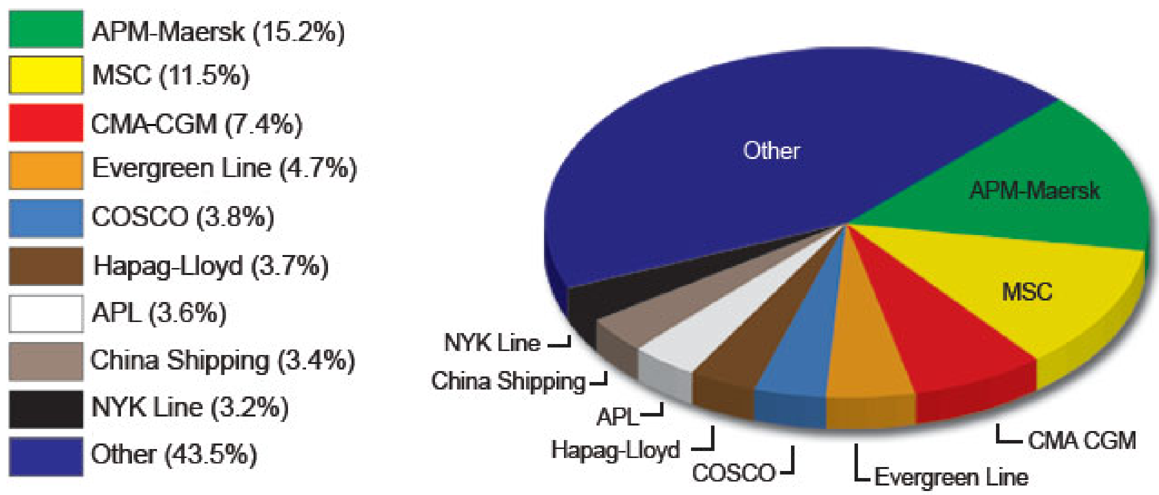
The World Bank estimates that global trade will fall by 5–6% in 2009 while the Organization for Economic Co-operation and Development (OECD) predicted a dramatic 13% drop (Walker et al., 2009). In addition to the real and profound changes in intermodal demand, other factors have caused a marked slowdown in container volumes at major Midwest Gateways such as Los Angeles, Long Beach, Oakland, Portland, Seattle, and Tacoma and have understandably caused rates to come down from the historical highs seen in 2007. The bunker fuel surcharge has dropped precipitously as the price of oil has come down while at the same time base rates have fallen as new capacity has come online at precisely the wrong time (given the drop in demand). Carriers and other rate-setting entities responded by slashing intermodal rates and thereby creating a phenomenon that in some ways mirrors the accumulation of toxic assets in the banking sector. In response to falling demand and overcapacity, logistics providers have been providing remarkably low spot intermodal rates for shipments. In early 2009, some base rates were almost zero plus fuel surcharge and other ancillary charges.

The problem with these types of rate setting is that while the rates may be rational from a narrowly focused supply and demand perspective, if locked in they have the potential to destabilize long term contracts. Given that these rates are not sustainable for the carriers, they have a collective interest in pushing the rates back up. Although some shippers have benefited from discounted rates, in the long term it is also in shippers' interest to ensure that carriers serving their markets are on a sustainable course. For this reason, the Transpacific Stabilization Agreement has used its power and influence with carriers to significantly increase the minimum rates carriers and non-vessel operating common carriers (NVOCCs[3]) charge for future rates, even if this means not filling every vessel in the short term. As the TSA states, they will ensure that "2009–10 service contracts do not result in the kind of non-compensatory, unsustainable rate levels that began to develop principally in the 'spot' rate market during the off-peak this winter." The TSA carriers pledged to "expire" any distorting rates that had been deliberately lowered since the beginning of the crisis by early summer. The TSA had called on individual carriers to not offer distorting rates soon after the crisis started; however, the organization is now taking a more aggressive role. For transpacific trade, the TSA aims to raise transpacific rates by $500–600 over the lowest spot rates that occurred during the winter of 2008. The moves are aimed at preventing carriers from abandoning certain services and continuation of a full blown rate war. OOCL, CMA-CGM, and Maersk have all acted aggressively to hike rates in March of 2009. Carriers such as CMA-CGM have vowed to "firmly follow" the rate guidelines set by the TSA. It is possible that the actions taken by a few major carriers will be sufficient to eliminate unsustainable rate setting, yet with the ocean carrier industry in a state of rapid flux, it is not yet clear whether these actions are sufficient to completely end the practice. Some analysts doubt the potential efficacy of organizations such as the TSA to compel the type of action necessary to support rates. In the words of Raymond P. Ebeling, Chairman and chief executive of American Roll-On Roll-Off Carriers, "the industry is inexorably losing the last vestiges of its global antitrust immunity structure, just when carrier collaborative action could be most helpful" (Ebeling). In

[3] An NVOCC is a person or company (often a forwarding agent) who does not own or operate the carrying ship but who contracts with a shipping line for the carriage of the goods of third parties to whom he normally issues a house bill of lading.

July of 2009, the TSA formalized its revenue improvement strategy by announcing a $500 rate increase for all commodities and to all U.S. destinations. This strong move was explained as necessary by the TSA because of the fact that low rates had permeated not only the spot market but also the 12-month service contracts that run between May 1 and April 30 of the year and cover the substantial majority (approximately 90%) of total U.S. Asia trade (Transpacific Stabilization Agreement 2009).

As the following chart from the *Journal of Commerce* demonstrates (Figure 2.4), there are many small players in the market eager to gain market share. If offering bottomed-out rates proves an effective strategy to gain new customers, it will be tempting for smaller carriers to continue to use it and take advantage of the weakened position of the major carriers who are currently being forced to lay up capacity and cut back service levels.



Source: Journal of Commerce

Figure 2.4: Ocean Carrier Market Share as of March 13, 2009

There is also evidence that efforts by the TSA to hold up rates for east–west trade lanes will not be fully successful in arresting the downward momentum for spot prices, which some analysts expect to settle at between $600–800 (without surcharges) by the end of 2009 (Horowitz 2009). This is compared with average base rates over twice this level in 2008. As long as shippers are struggling to cut any unnecessary costs, there will not be a lot of groundswell amongst the shipping community to work with carriers in setting sustainable rates. Ports are also conflicted as to their position. They take a long term view and do not want carriers to abandon trade lanes serving their facilities; however, they also have the potential to benefit if low rates have a stimulating effect and encourage shippers to increase orders, even if only temporarily, and thereby counteract the sharp drops in volume that major container ports have experienced. If the ports judge that the carriers can survive for a few more months at the low rates, they may not fully support efforts by the TSA and others to sharply raise the average rates and thereby arrest new growth stimulated by the low rates. Container volumes at Los Angeles and Long Beach were down by 33% and 40% respectively in 2009. As grim as these figures are, they would likely be even worse had rates stayed near their 2008 levels.

Rate benchmarks compiled by Drewry and reported in the Journal of Commerce for the representative trade lane of Hong Kong to Los Angeles show substantially less volatility when compared with spot rates (see Table 2.1). This is because these rates are averages and also because they include port handling charges and bunker fuel charges that have not changed as dramatically in 2009 as have base rates. Nevertheless, there has been a steady softening of rates. The average rate for a loaded 40 ft box between Hong Kong and Los Angeles as of February 9, 2009 was $1,425, essentially unchanged from the rates in early January but down 23% from the same week in the previous year. The corresponding bunker fuel price per metric ton in February 2009 was $267.93 and the bunker fuel surcharge was $365 per forty-foot equivalent unit (FEU) container (Transpacific Stabilization Agreement 2009).

Table 2.1: Summary of Base Rates

Source: Drewry

	Rate FEU HK-LA	**Fuel Cost/MT**	**Fuel Surcharge/FEU**
Feb 9 2009	$1425	267	365
Feb 9 2008	$1753	461	905
Feb 9 2007	$1741	325	455

By February 2009, total rates had softened significantly due to a decrease in base rates plus decreased fuel surcharge. Drewry has also published, in the public domain, a document that includes all fuel surcharges and handling charges.

Rates to the Gulf Coast (Houston) throughout the period of time covered in this report were similar to those for the East Coast (New York); however, the average for the Gulf Coast was actually marginally higher when compared with the East Coast and significantly more costly than West Coast shipments (see Table 2.2). The cost structure is a result of distances as well as the fact that deliveries from Asia to the East Coast must be made by smaller vessels limited by the size of the Panama Canal.

Table 2.2: Drewry Historical Base rates for Hong Kong to U.S. Load Centers

	No-06	Jan-07	March 07	May-07	Jul-07	**Average**
Hong Kong–East Coast	3770	3620	3620	3970	4090	**3814**
Hong Kong–West Coast	2570	2570	2570	2270	2290	**2454**
Hong Kong–Gulf Coast	3840	3840	3840	4220	4220	**3992**

The *Journal of Commerce* frequently uses the Hong Kong-to-Los Angeles benchmark rate; however, this rate does not include as many surcharges as are included in the Drewry publication and rates to other destinations are typically proprietary. While the rates have changed in the last 2 years, it can be assumed that the comparative ratio of costs is similar to what it was at the time of the publicly available Drewry publication given that the aforementioned constraints are still present. If anything, the Gulf Coast rates in April of 2009 will be more competitive than they were at the time of the report's publishing, as fuel costs have become lower and therefore the fuel cost penalty of using smaller vessels has become less salient. Therefore, it can be assumed that total all-water costs to the Gulf Coast as of April 2009 were on average 60% higher than deliveries to the West Coast.

2.3 Bunker Fuel Adjustment

The other major effort undertaken by the TSA in the last year has been a restructuring of the formula for calculating bunker fuel surcharge. The TSA committed to reforming the formula for calculating bunker fuel charges during the peak bunker fuel prices that occurred in 2008. The peak recorded price in the summer of 2008 was $767 per metric ton. This is the first time that the TSA had changed its bunker fuel formula in 7 years. Amongst the major changes, the official bunker charge will now be adjusted quarterly instead of monthly—an attempt to respond to the rapid fluctuations in fuel costs that have been occurring over the last 2 years. The average adjustment rates will now be set on January 1, April 1, July 1, and October 1 and will be based on the average prices for the previous 3 months. In addition, there is an attempt to separate the pricing for West Coast traffic as compared with East Coast traffic utilizing the Suez or Panama Canals.

The new formula relies on the following basic correlation: Increasing fuel costs will cause a more significant change in East Coast all-water services than in West Coast services due to the greater distances involved and the need, in the case of Panama services, to use smaller vessels.

> Rounding to the nearest dollar, we see a consistent relationship between bunker fuel price fluctuations fuel cost impacts per sailing, when the basic cost calculation is applied to any fuel price: When the bunker fuel price rises by $20 per ton, container lines see a $20 increase in cost per FEU ($16 per TEU) to the West Coast, and an increase of $38 per FEU ($30 per TEU) to the East Coast (Transpacific Stabilization Agreement 2009).

The TSA Bunker charge guidelines use a simplified formula that does not take into account all origins and destinations in the transpacific trade. Rather, it uses Hong Kong as the representative Asian Port and Los Angeles as the representative West Coast Port with New York serving as the representative East Coast port. Thus, the limited draft/dimensions at the East Coast service are the Panama Canal lock dimensions while the West Coast service is limited to the specifications of berths at the Port of Los Angeles.

Importantly, the TSA differentiates between the nominal capacity of vessels and the effective capacity. This is an important distinction given that the real capacity of vessels is limited by factors such as the mix of container types and load sequencing for priority cargo. The average effective utilization factor for East Coast (EC) shipments is slightly higher (91.7%) than that for West Coast (WC) shipments (88.2%).

TSA Utilization Assumptions

Average Vessel Effective Capacity:[4]

2,744 40-ft containers (FEU) to the WC

1,928 40-ft containers (FEU) to the EC

Utilization:

88.19% to the WC / 91.56% to the EC

Average Vessel Fuel Consumption:

158.45 tons per day to the WC / 127 tons per day to the EC

Average One-Way Steaming Time (excluding time in port):

13.94 days to the WC / 24 days to the EC

Empty Reposition Share of Westbound Vessel Deadweight:[5]

7.714% from WC / 8.84% from EC

It should be noted that because the percentage share of empty container is measured in terms of weight, the number of empty containers on these vessels is far higher than the empty reposition share suggests.

2.4 *Journal of Commerce* (JOC) Sailings summary

Container strings (port calls on routes) change rapidly, particularly in times of sharp economic growth or contraction. Most carriers provide door-to-door service—arranging intermodal rail and truck service along with all water services. Therefore, from the shippers' perspective, it makes little difference whether the shipment has come through a West Coast gateway or has been routed over water directly to the destination port. The only salient distinction is the time in transit and sometimes the reputation regarding the reliability or unreliability of the trade lane. The *Journal of Commerce* has made available to the public general listings of sailings between major ports, allowing users to compare service options and transit times. Before, this information would have only been available from the individual carriers or sometimes the ports. The JOC service is also useful because it displays not only the carrier name but also the names of other Vessel Operating Common Carriers (VOCCs), which share space on the carrier. For example, for the month of April 2009, the fastest service connecting Hong Kong to Houston was to Maersk Transpacific VI (TP6) service, which entails an 11-day ocean transit to the Port of Los Angeles

[4] Vessel capacity allowing for mix of equipment sizes, out-of-scope cargo, heavy and oversize cargo, load-bearing limits on deck and hatches, bridge visibility, load sequencing for priority cargo and port rotation, etc.

[5] Contribution to a ship's total westbound deadweight from empty containers being repositioned to Asia, and subsequent reduction of westbound sailing capacity, allocated to eastbound fuel-related cost.

and arrives in Houston 6 days later. The fastest all water service is the CMA-CGM PEX 3 line, which currently has a transit time of 21 days. China Shipping is currently sharing space on the PEX 3 string. Other options for intermodal service to Houston from Hong Kong include the K Line Calco Y service that is routed through Long Beach and also requires an 18-day transit. Current routing options for Dallas include K Line Calco C or Y strings. K Line has also started offering service from the Port of Qingdao, China to the Port of Prince Rupert, which may be competitive to Dallas in the future. Another feasible option in April 2009 was the Maersk Transpacific 1 (TP1) service, which can connect Hong Kong to Dallas via intermodal routing through Oakland on a vessel sharing agreement with U.S. based Horizon lines (Outsourced Logisitics n.d.). In late 2008, Maersk entered into another vessel-sharing agreement with CMA-CGM to reduce southern California port calls (Cunningham Report 2008). The other principal option is a Maersk connection railed to the Alliance intermodal terminal through the Port of Los Angeles, a service provided by Maersk with its new 9,000 TEU A-Class vessels that were originally launched in the Asia–Europe service but have since been redeployed to transpacific.

2.5 Cargo Tracking

The rapid spread of tracking technology from proprietary systems to the general domain has now encompassed international marine traffic. The Marine Traffic project, sponsored by The University of the Aegean, aims to show the real time position of all vessels in operation around the world. The site depends on a network of tracking equipment set up by volunteers in different countries. The most complete coverage is currently in Europe. However, there are major areas of coverage along the coasts of the United States as well as in Asia. The project is made possible by new international Maritime Association policies. In December 2004, the International Maritime Organization (IMO) requires all vessels over 299 Gross Tons to carry an Automatic Identification System (AIS) transponder on board, which transmits their position, speed, and course as well as the vessel's name, dimensions, and voyage details (Marine Traffic 2009). As of April 2009, the positions and statistics on almost 10,000 vessels were displayed at any one time under the site MarineTraffic.com. The site is useful in quickly understanding the profile of ships calling at a particular terminal along with factors such as the docking positions of different ships or carriers within the port. Because the site relies on information provided for the IMO directly from the ships themselves, there is no filter or interpretation needed for the data. Another function of the database is to show the track of vessels over a period of time. Given that the position recordings are only near shore, only the positions that are in range of the AIS receivers within the Marine Traffic network are displayed. As of 2009, there was no coverage of the Houston area. In fact, the Port of Houston was one of the largest marine areas within the United States that did not have coverage. However, some smaller port areas in the state, such as Corpus Christi and Brownsville, already have coverage. For example, on April 2, 2009, the Marine Traffic project tracked 56 vessels operating in or near the southern stretch of the Gulf Intracoastal Waterway from the Port of Corpus Christi to the Port of Brownsville. Of these, 38 were docked in the immediate vicinity of the Port of Corpus Christi. Of the 56 vessels in this area, 5 were classified as tankers, 3 were cargo vessels, and 31 were tug boats.

One particularly visible trend that can be easily observed is how many vessels are currently moored, particularly in major Asian hubs such as Taiwan. In early 2009, the charter market has been impacted more severely than owned capacity. As of March 2009, there were approximately 485 vessels idled around the world according to AXS Alphaliner, which tracks global container capacity. A disproportionate share of these vessels is chartered. The global liner fleet in 2009 stood at 4,684 active fully cellular vessels. Thus the 485 idled vessels make up approximately 10% of the total both in terms of vessel numbers and TEU capacity.

The idled ships include many less productive and smaller vessels along with stillborn new builds that have never seen service. Another major source of idled ships are feeders that had previously found a lucrative role in moving containers from Asian hub ports to smaller container ports—a service that major carriers were happy to hand over because it allowed the more productive ships to make fewer port calls. Now, as carriers struggle to fully utilize existing capacity, they are lengthening strings as well as repositioning other vessels that had previously provided mainline service to feeder service, often at severely discounted rates, thereby further undermining the feeder's position (Boonzaier 2009).

Some carriers such as Hanjin plan to resume service of these and other vessels in the spring of 2009 (Genoa, Asian Partners Reactivate Laid Up Vessels 2009). Cosco, which had removed several Post-Panamax vessels from its Asia–Europe service, has recently announced that several of these vessels will re-enter service in the spring. The economy of South Korea has been particularly hard hit by the fall in global shipping because it is a major player in ship construction, shipping, and export-oriented manufacturing. In response to falling demand, the South Korean government has launched an effort to buy up idled capacity to prevent carriers from selling ships at fire sale rates (Pierce 2009).

The crisis of overcapacity in the liner industry is made worse by the fact that it was known to be coming significantly in advance of the current global financial crisis. The slowdown in transpacific trade growth in 2007 and 2008, tied partly to the burgeoning recession and partly to the rising energy costs, had already made the slew of new orders placed by carriers in 2004– 2007 seem like irrational exuberance (ASX Marine 2008). When the bottom fell out of the global economy in September of 2008, it made a bad situation even worse. Some carriers were particularly aggressive in placing new orders, many of which were due to be delivered in 2009.

Data from AXS-Alphaliner shows that of the largest carriers, several stand out as having a substantial amount of new capacity still on order compared with their existing capacity that, under current conditions, will have no way to be utilized if and when it is delivered as shown in Table 2.3.

CMA-CGM, for example, has been one of the fastest growing container lines in the world, recently taking delivery of several mega-containerships for use in the Asia–Europe trade lane. AXS-Alphaliner's assessment of global liner capacity warned that the aggressive strategy taken by CMA-CGM and MSC was threatening to challenge Maersk for dominance, particularly as Maersk had "only" 340,000 TEUs of new capacity currently on order (ASX Marine 2008). Despite the fact that Maersk took delivery of 20 new vessels under ownership or long term charter in 2008, it appears that Maersk's strategy of slowing new acquisitions for 2009 was more prudent. In the environment of overcapacity, an ocean carrier's exposure will depend on the percentage of assets it owned versus chartered, the percentage of short versus long term charters, as well as the amount of new building on order relative to total market share. With regard to the first metric, CMA-CGM does not appear to be in as precarious a situation because at present a substantial share of its total capacity is chartered. It had been planning to replace a significant share of its chartered vessels with owned vessels in the next 2 years. Maersk has a lower percentage of charters; in addition, much of its recent chartering activity is for small container vessels, further dampening the total TEU capacity for Maersk charters (ASX Marine 2008). In March of 2009, Standard and Poor's placed CMA-CGM under "credit watch with negative implications" and "highlighted the significant global order book for new boxships, and the prospect supply will continue to increase over the next few years" as systemic issues that could complicate CMA-CGM's ability to effectively respond to the crisis (Genoa, Standard & Poor's 'credit watch' draws howls of protest from CMA-CGM 2009).

Table 2.3: Current and Future Containership Capacity

Source: APX Alphaliner Top 100, Data as of September 2009

		Total		Owned		Chartered			Orderbook		
Rnk	**Operator**	TEU	Ships	TEU	Ships	TEU	Ships	% Chart	TEU	Ships	% existing
1	APM-Maersk	2,034,874	539	1,140,494	212	894,380	327	44.0%	357,941	67	17.6%
2	Mediterranean Shg Co	1,509,130	406	843,412	211	665,718	195	44.1%	598,463	50	39.7%
3	CMA-CGM Group	1,020,730	359	345,440	91	675,290	268	66.2%	505,688	60	49.5%
4	Evergreen Line	588,545	160	329,547	90	258,998	70	44.0%			
5	APL	549,643	139	167,181	44	382,462	95	69.6%	141,894	19	25.8%
6	Hapag-Lloyd	469,369	116	262,151	59	207,218	57	44.1%	122,500	14	26.1%
7	COSCO Container L.	466,477	144	259,493	94	206,984	50	44.4%	425,126	56	91.1%
8	CSCL	461,379	140	287,044	89	174,335	51	37.8%	144,000	16	31.2%
9	NYK	412,563	109	307,798	60	104,765	49	25.4%	109,936	19	26.6%
10	Hanjin Shipping	409,363	92	95,488	18	313,875	74	76.7%	270,448	30	66.1%
11	MOL	343,121	93	151,772	28	191,349	65	55.8%	145,925	28	42.5%
12	K Line	332,537	91	184,921	33	147,616	58	44.4%	178,636	34	53.7%

13	OOCL	328,807	71	209,109	36	119,698	35	36.4%	115,898	17	35.2%
14	Hamburg Süd Group	325,855	108	147,587	39	178,268	69	54.7%	95,305	15	29.2%
15	Yang Ming Line	313,710	78	195,437	46	118,273	32	37.7%	141,402	22	45.1%
16	CSAV Group	294,132	89	34,821	7	259,311	82	88.2%	115,670	19	39.3%
17	Zim	271,318	88	129,394	32	141,924	56	52.3%	244,604	29	90.2%
18	Hyundai M.M.	265,605	52	74,407	12	191,198	40	72.0%	78,160	7	29.4%
19	PIL (Pacific Int. Line)	191,078	107	126,008	77	65,070	30	34.1%	61,762	15	32.3%
20	UASC	171,249	45	113,596	27	57,653	18	33.7%	130,509	12	76.2%

Looking to the secondary carriers, there are other examples of ordering of new capacity that appear overambitious. The Israeli carrier ZIM, for example, which has been a leading proponent of the Asia–Suez–East Coast–Heartland Corridor connection, had new build orders in excess of its current total capacity. On April 1, 2009, ZIM announced that it was cancelling six ship orders placed in 2007 with Taiwan's CSBC shipyards for which the shipyard had not yet started construction. The carrier has laid up 20% of its existing fleet (Dixon 2009). For carriers who still have capital to add charter capacity, they are finding unimaginably low rates. MSC has taken several new charters at rates that are a quarter of what carriers paid last year. Again, the presence of extremely low charter rates complicates the picture for entities such as the TSA who are attempting to eliminate low spot rates. While in general these spot rates do not cover the costs of carriers, in certain instances they may be more justified if the carriers' low rates are in proportion to equally low charter rates.

2.6 Summary

Currently, and over the next 3 years, there is ample vessel capacity to meet the global trade demands in every sector. This means that vessel size and availability will not be constraints to the success of any emerging international trade transportation corridor. The maritime industry as evidenced by this chapter is struggling to become more efficient and capable of addressing the wide variety of customer needs. Ports and terminals around the world that constitute the gateways and load centers so critical for maintaining or improving supply chain efficiencies are re-thinking some policy strategies that would raise shipper costs and possibly divert business to competitive locations. And if they are large enough, ports are fighting declines in market share—like those in the Los Angeles and Long Beach terminals—by putting pressure on supply chain modes (like rail) to lower their prices (see Box 2.2). This is a far cry from the post-2004 shut down in Los Angeles and Long Beach terminals when many forecasters were still largely predicting continuing strong growth rates for these ports, irrespective of their emerging corridor competitors. Texas planners should therefore continue to monitor all corridors serving the state and recognize that, for now, the supply side (vessels and terminals) is not a key problem. Demand for shipping, however, is another story and the next chapter considers what types of commodities flow into and out of the state and which form the demand side of corridor success.

Box 2.2 Ports Plead with Railroads

"West Coast ports are losing container volume to ports in Canada, Mexico and on the East Coast. Executive Directors of all six major West Coast container ports urged the two western railroads to collaborate on developing infrastructure, seek federal aid and market their terminals as the preferred gateways for Asian Trade."

Journal of Commerce

Chapter 3. Trade Data Analysis

The analysis of trade data is driven by data availability. For Texas, trade data related to NAFTA is by far the most comprehensive source of information, yet it is of limited utility in understanding the flows of international containerized shipments from Asia and other trading partners. The first part of this chapter is an analysis of Texas international trade flows to various trading partners. It concentrates on U.S. and Texas trade with key countries. Given the fact there is no single publicly-available data source that fully and comprehensively illustrates containerized freight flows from different origin countries to state-level destinations, an eclectic range of sources is used to describe and approximate these trade volumes. Data availability on exports at the state level is generally superior to that of imports due to the compilation of the State of Origin series by the Census Bureau that has, in recent years, started differentiating between containerized and non-containerized cargoes. Trading volumes are displayed in value and weight in order to better illustrate how these factors may influence transportation decisions.

3.1 Data Sources

The data for this report comes in large part from information compiled by the Bureau of Transportation Statistics and the foreign trade division of the U.S. Census Bureau. Information on exports is taken from copies of Shipper's Export Declarations (SEDs) that qualified exporters, forwarders, or carriers filed at the Port of Departure. The information is transferred directly to the Census Bureau from the Customs and Border Protection (CBP) office and is presented in the USA Trade Online database (Census n.d.). Data is available according to customs value as well as the Customs Insurance and Freight (CIF) valuation. The CIF value will include the cost "import charges," which includes the international portion of the journey, i.e., the cost of "bringing the merchandise from alongside the carrier at the port of exportation in the country of exportation and placing it alongside the carrier at the first port of entry in the United States." While the U.S. government still collects both valuations, the Customs Value is now the official value of goods for balance of trade assessments (Nations 2008). The "USA Trade Online" database provides information on containerized and non-containerized shipments at Port and Port District level. Port districts, as defined by the U.S. Census Bureau foreign trade statistics division, usually contain several physical ports from the same geographic region. The following two tables (3.1 and 3.2) show the breakdown of two trade districts and associated ports for Texas.

Table 3.1: Houston–Galveston Port District

Houston–Galveston, TX	**53**	**District**
Houston, TX	5301	Port
Texas City, TX	5306	Port
Houston Intercontinental	5309	Port
Galveston, TX	5310	Port
Freeport, TX	5311	Port
Corpus Christi, TX	5312	Port
Port Lavaca, TX	5313	Port
Sugar Land Regional Airport, Sugar Land TX	5381	Port

Table 3.2: Laredo Port District

Laredo, TX	**23**	**District**
Brownsville, TX	2301	Port
Del Rio, TX	2302	Port
Eagle Pass, TX	2303	Port
Laredo, TX	2304	Port
Hidalgo, Pharr, TX	2305	Port
Rio Grande City, TX	2307	Port
Progreso, TX	2309	Port
Roma, TX	2310	Port
Edinburg User Fee Airport	2381	Port

The researchers spoke with David Dickerson, Assistant Chief of the Foreign Trade Division, regarding the best strategies for using Census-collected data and for transportation analysis. According to Mr. Dickerson, the data for imports is very precise given the attention paid by customs and border protection. The data for exports is sometimes less precise as it is sometimes reported by third parties; however, the amount of error does not uniformly bias the data in any one direction. Through the use of the state export series, researchers can compare the profile of exports generated in the state with those that merely use the state as a point of departure. CIF values, Mr. Dickerson confirmed, can be used in the aggregate to estimate the role of transportation costs as a percentage of total cost. At the transaction level, a CIF calculation may not be accurate as shippers are sometimes allowed to make a single estimate for their entire shipment even if it includes multiple commodities.

Containerized shipment information became available in the USA Trade Database in February 2007 and is retroactively available to 2004 (US Census Bureau 2007). Data is now segregated into total trade, (ocean-going) vessel trade by weight and value, air trade by weight, and containerized trade (a subset of vessel trade) by weight and value. The weakness of the database in its current form is that overland trade cannot be segregated by mode. Therefore, within the database it is impossible to delineate trade by rail vs. trade by truck for different border ports of entry. For this reason, data from the Bureau of Transportation Statistics (BTS) Transborder database was used to further the understanding of overland trade from Mexico.

3.2 Profile of Merchandise Trade with Key Trading Partners

In the following section, the profile of merchandise trade with some of Texas' top trading partners is described. Also included is a description of trading patterns with certain partners who are currently not as important but may become comparatively more important in the future. In some cases, the value of trade with the United States is depicted for comparison with Texas or due to the fact that Texas volumes are too small to be meaningful at the present time. While value in dollars is the most common method for describing patterns of trade, the researchers have made an effort to give insight into the physical weight and volume of trade as well, as this is often the more critical feature for transportation. The researchers have, in some instances, also sought to compare the value per kilogram of trade by mode so that the role of commodity value in modal choice can be illustrated. In cases where the trade between a particular country and the State of Texas does not give sufficient illustration of the trading relationship, comparisons have been made with other regions of the country or the country as a whole.

3.2.1 Country of Origin and the Role of Liner Strings

Country of origin data does not always tell the full story as to how cargo, in particular containerized cargo, is moved around the world. Because containers can easily be moved overland and can be consolidated and reconsolidated, containerized trade between two countries may involve a maritime transportation leg that does not come into physical contact with either trading nation. The vast majority of U.S. containerized imports and exports are handled directly by U.S. ports. However, for many U.S. trading partners, trade is handled via a third-party country. This is done sometimes in order to create a critical mass of cargo volume. Other rationales for pooling container volumes include the desire to create a faster or less circuitous maritime route or the lack of critical container infrastructure in one of the trading nations which would make direct deliveries by a deep draft container vessel impossible or impractical.

In 2008, U.S. containerized marine imports from the world equaled $580.6 billion or 137 billion kilograms of cargo (137 million metric tons). Despite the slowdown in the economy that occurred in late 2008, the total value of containerized U.S. trade with the rest of the world increased by $30 billion, while the total weight of imports decreased by 8.5 billion kilograms compared with 2007. The average value per unit of weight of imports varies substantially between countries and has been increasing for almost all trading partners in recent years as evidenced by the following graph. Some trading partners, such as Brazil, have been especially successful at increasing the average value per ton of containerized exports to the United States (see Table 3.3).

Table 3.3: Distinctions in Value per Metric Ton of U.S. Imports from Key Trading Partners

	Value per Metric Ton 2004	Value per Metric Ton 2008	Percent Increase
World Total	$3,287.78	$4,234.28	22.35%
Belgium	$2,447.87	$3,098.92	21.01%
Brazil	$1,260.69	$2,025.68	37.76%
China	$3,807.93	$4,682.60	18.68%
Colombia	$483.52	$651.96	25.84%
Germany	$4,925.20	$6,955.40	29.19%
France	$3,519.47	$5,034.10	30.09%
Netherlands	$1,977.27	$2,810.81	29.65%
Singapore	$8,752.11	$11,196.50	21.83%

Source: U.S. Census Data

Although containerized trade is often used as a proxy for trade performance, it is only appropriate in limited cass and should be used with care. It is appropriate for Chinese trade in 2008, 48% of Texas exports to China were sent in containers. But if fails as a measure of trade with Mexico where most non-petroleum trade is transported overland and the value of containerized sea exports makes up only about 1% of total exports, as shown in Table 3.4. Another assumption that is sometimes made is that profiles of containerized exports from the Port of Houston, as the only major container port in Texas, mirror the total containerized exports from Texas. This is also misleading given that for 2008, while China was the top recipient for containerized exports that originated in Texas, the top recipient for containerized exports shipped through the Port of Houston was Brazil. This statistic reflects the fact that Texas shippers tend to use West Coast ports of entry for Asian destinations but rely on the Port of Houston for containerized shipments to South America and Europe. Finally, when assessing the comparative importance of the different trading regions with Texas, it is important to not undervalue the role of Europe simply because trade is still counted under the heading of the European Union's individual member states. In reality these countries function as a trading bloc and share much of their major trading infrastructure. Therefore, if the European export destinations were consolidated into a single category, they would exceed China in terms of total export value and would be similar to China in terms of total containerized export value.

Table 3.4: Share of Texas Exports to Top Trading Partners and Percent Carried in Containerized Form, 2008

Country	Total Value ($US)	Containerized Vessel Value ($US)	Percent Containerized
Mexico	62,088,428,516	400,912,009	1%
Canada	19,248,029,340	-	0%
China	8,446,843,412	4,080,297,665	48%
Netherlands	7,062,732,049	784,371,206	11%
Brazil	5,961,821,484	1,682,078,321	28%
Singapore	5,462,769,430	1,327,517,603	24%
Korea, South	5,162,043,514	1,136,682,755	22%
Taiwan	3,882,744,759	653,632,268	17%
Japan	3,634,730,980	1,088,261,220	30%
Belgium	3,589,256,797	1,089,944,672	30%
United Kingdom	3,541,688,735	594,674,219	17%
Venezuela	3,511,862,332	433,273,172	12%
Colombia	3,023,304,596	582,179,998	19%
Federal Republic of Germany	2,854,232,617	852,614,913	30%
Chile	2,686,417,490	518,721,504	19%
France	2,411,185,291	512,607,439	21%

Source: U.S. Census Data

The availability of data does not allow for a clear comparison of state-level exports and imports given that while exports are tracked via state of origin, imports can only be tracked via customs district. The customs district does not fully account for the destination state given that trade may be cleared in a customs district outside of the state in which the import will be consumed. Another weakness of customs district data is that containerized data cannot be separated from non-containerized. Nevertheless, trade cleared in Texas customs districts is potentially relevant for Texas planning purposes as are recent changes in the volume of imports. In Table 3.5, the top 15 sources of imports to the 5 customs districts located within Texas are compared. Unlike the case with exports, the dominance of petroleum in weighing import totals can be clearly observed.

Table 3.5: Share of Imports from Top Trading Partners Through Texas Customs Districts, 2008

Rank		**2008 ($US)**
	World Total	347,976,368,181
1	Mexico	143,998,421,530
2	China	28,995,688,455
3	Venezuela	21,074,922,318
4	Saudi Arabia	18,636,620,626
5	Nigeria	11,575,523,282
6	Iraq	9,746,481,595
7	Algeria	8,849,430,961
8	Federal Republic of Germany	6,901,601,744
9	Russia	6,684,511,175
10	Korea, South	6,470,820,552
11	United Kingdom	6,293,104,245
12	Japan	5,940,606,404
13	Brazil	4,892,434,444
14	Angola	4,201,085,401
15	Malaysia	3,921,843,555

Source: U.S. Census Bureau

3.3 U.S. Trade with China

There is a great deal that has been written about the unique trading relationship that exists between China and the United States. The most frequently covered areas of discussion are also the most controversial, both from a political and economic sphere. The first major point of controversy is the question of whether or not China's artificial exchange rate with other currencies presents it with a strategic advantage for artificially inflating its export market while holding down domestic consumption of traded or tradable goods. This assertion, which has been the topic of heated discussions between economists and politicians, will not be addressed in the course of this report other than to state that as a general principal, if Chinese monetary policy alone was the secret to its success, more countries would be adopting their own fixed currency rates.

Rather than speculating on the more controversial aspects of what Chinese trade means for American jobs, American indebtedness, etc., this report will focus on the more unambiguous characteristics of the trading relationship. The first point to note is that China's trade with the United States is dominated, both in terms of value and volume, by marine shipments. In 2007, trade by marine vessel constituted $237 of the $321 billion of merchandise imports from China while air constituted $74 billion. By weight, air shipments from China constituted 979 million kg of goods as opposed to 69 billion kg by marine vessel. On average, the customs value of one kilogram of cargo shipped by containerized marine vessel from China to the United States was $4.10 while the average value of air shipments was $75/kg. Trade by district is the broadest delineation as can be seen from Table 3.6.

Table 3.6: Comparisons of Containerized Vessel Shipments by Weight to Different Trade Districts from China, 2007

Source: U.S. Census Bureau

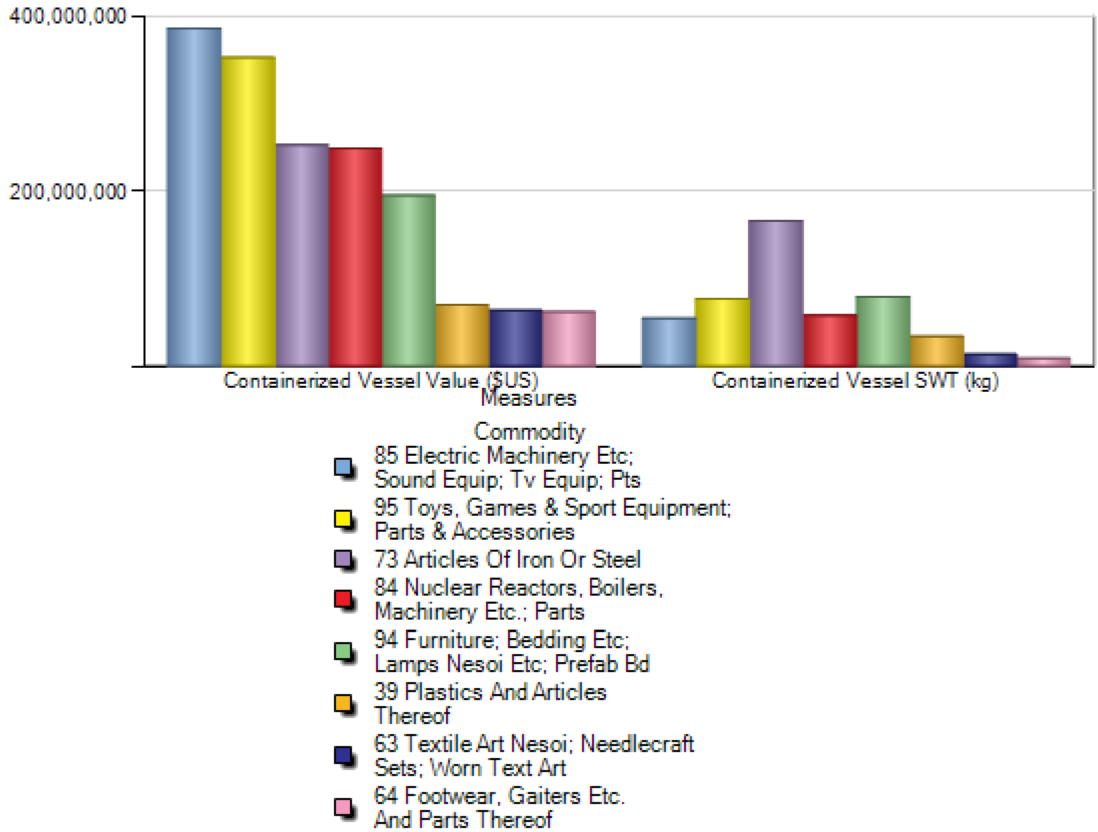
Charleston	971,563,573 kg
Houston	1,442,078,663 kg
Los Angeles	28,600,039,269 kg
New York	5,263,849,614 kg
Seattle	5,240,766,270 kg

3.3.2 Texas Containerized Maritime Trade with China

The decision of whether to evaluate trade based on value or weight has a significant impact on how containerized trade is profiled. Despite the attention that has been paid to China's robust production of consumer goods, in 2007, for example, the containerized commodity of Chinese origin that had the greatest impact on the Port of Houston in terms of weight moved is Fluorite (Fluorspar), a mineral used in the production of steel, aluminum, and hydrofluoric acid. The value of this containerized import is quite low at only $0.16 per kilogram. For comparison, this single commodity weighed almost twice the amount of all imports categorized as furniture (HS Category 94) from China through the port: 135 million kilograms vs. 79 million kilograms for furniture.

In 2008 "Tubes and Pipes" became the top Chinese commodity (4 digit level) import by weight at 130 million kilograms while the total weight of Feldspar fell by more than half, to 66 million kilograms. This change is indicative of the radical shifts in demand that can occur for naturally occurring materials. For consumer goods, 2008 saw the volume of furniture weight fall from 79 to 75 million kilograms.

The distinction between value and weight is even more dramatic when evaluating U.S. containerized exports. The largest single marine containerized export from the United States to the rest of the world is HS category 47 "Wood Pulp," which is primarily scrap paper and cardboard. The low value of this commodity class (averaging only $0.34) per kilogram makes it only number 15 in the ranks of total exports by value. The second most important commodity class, (HS 39) "Plastics" has a value total that is much more closely in line with its weight contribution with an average value of $2.24 per kilogram, making it the number two commodity both in terms of value and weight. Figure 3.1 shows the comparison of value and weight for major commodity categories through Houston in 2007.



Source: U.S. Census Bureau

Figure 3.1: Containerized Imports to Houston from China, 2007

3.4 U.S. and Texas Trade with Japan

The total value of containerized merchandise imports from Japan to all U.S. ports fell slightly in 2007 to $54 billion from $55 billion the previous year. The average value per kilogram is almost $10, more than twice that of Chinese imports. The ratio of sea to air freight is also more favorable to air for Japanese imports when compared with China. In 2007 the U.S. imported 328,870,014 kg of air cargo from Japan at a total value of $35,705,994,282 or $109 per kilogram. Some of Japan's more well-known exports, such as cell phones, are transported principally by air. In 2007, "Phones for Cellular or Wireless

Networks" were equal to $347 million, of which $328 million was transported by air and the rest by containerized vessel.

For the Port of Houston, containerized imports from Japan in 2007 were valued at $79 million, which is a small fraction of the $883 million of total vessel imports. Large volumes of roll-on/roll-off cargoes, such as vehicles, in addition to substantial volumes of steel tubes and pipes are the reasons that the container volume to Houston is low. As an example, steel pipes alone account for over $300 million, which is several times the total containerized trade from the Port of Houston.

Exports to Japan from the Port of Houston equaled $405 million in 2007 of which $186 million was containerized. Organic chemicals were the largest single source of export revenue as well as the largest source of containerized export value.

3.5 U.S. Trade with India

In the last few years, India has seen rates of economic growth that are, aside from China, the highest in the world. The Brookings Institution estimates that the pace of economic expansion in India means that it is, in effect, 10–15 years behind China in terms of growth (Cohen 2006). This does not mean that India will duplicate China's pattern of development or niche as the world's factory, yet it does mean a large middle class of consumers will emerge in India that will increasingly be a factor in determining global patterns of trade.

The United States currently has a trade deficit with India. In 2007, the U.S. exported $17,592,455,000 (assessed at the value of Free Alongside Ship, FAS) of goods to India while we imported goods valued at $24,024,394,000 according to the custom's value[6]. Of general note in assessing trade with India is that the nation is a world leader in the processing of diamonds. The volume of diamonds exported from India skews the total trade figures with several trading partners including the United States, given that their export has little significance from a transportation perspective. In 2007, India's total exports of processed non-industrial diamonds to the United States was $3.69 billion. Specific examples of this effect will be discussed at the trade district level. Commodity groups from India that have seen growth at over 100% since 2004 include organic chemicals (133%), electrical machinery (140%), and iron and steel articles (161%). Particularly notable within this category is the subcategory of steel pipes (commodity category 7305), which accounted for $500 million of trade in 2007 while only accounting for $112 million in 2005.

On the export side, the largest single item for the U.S. trade relationship with India has been the exportation of passenger aircraft. In 2007, the United States exported 41 passenger aircraft to India at cost per item of $138 million or a total value of $5.68 billion. For comparison, 2006 was the first year in which exports of passenger aircraft exceeded $1 billion. Capital goods for heavy and light industry are also key U.S. exports to India, particularly from the dollar value perspective. In the following two charts

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[6] According to the World Customs Organization, which set the internationally accepted standard for customs valuation in 1994, "the basis for valuation of goods for Customs purposes should, to the greatest extent possible, be the transaction value of the goods being valued" (http://www.wcoomd.org).

(Figures 3.2 and 3.3), the impact that exports of aircraft in 2007 had on the total balance of exports year on year can be noted.

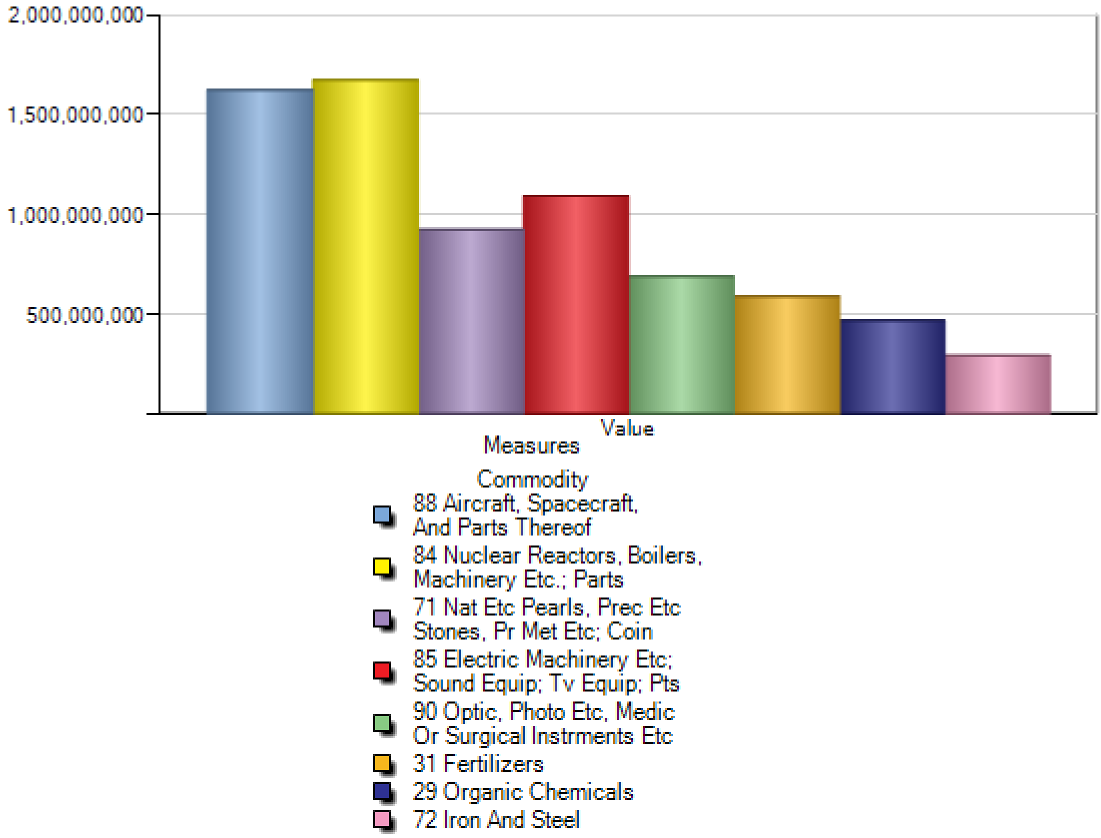
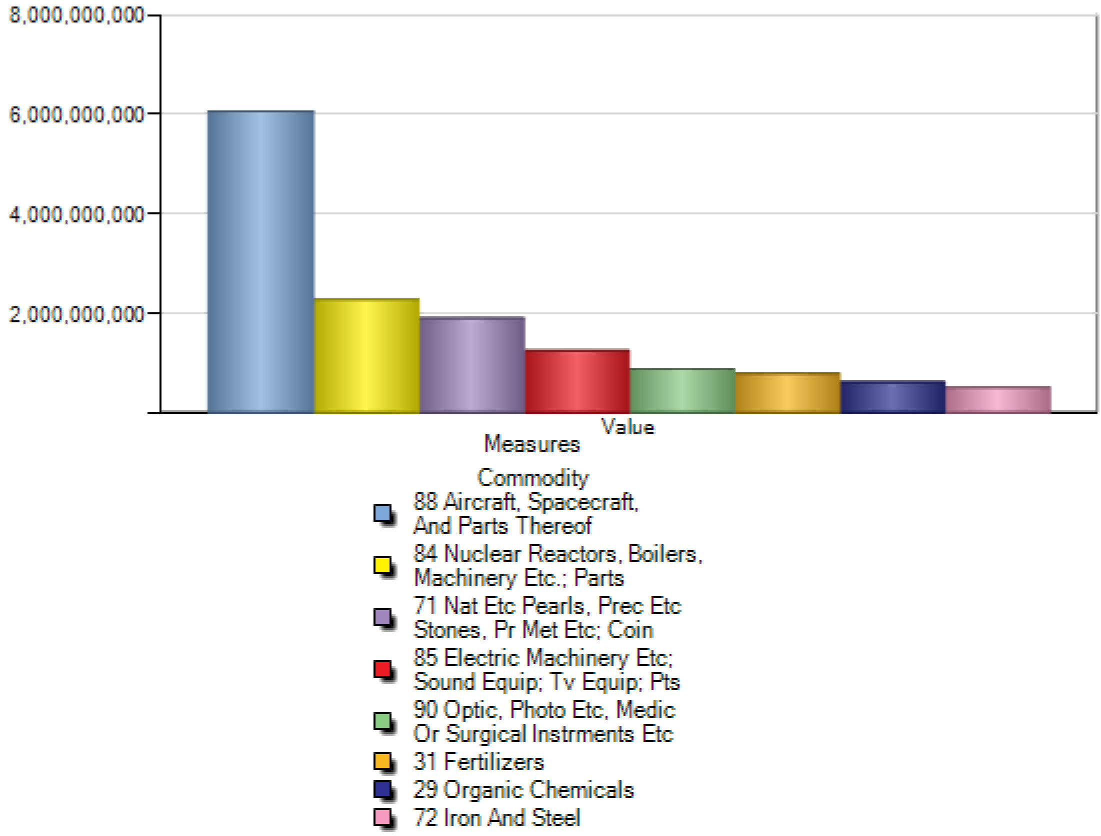


Figure 3.2: U.S. Exports to India 2006 in Dollars



Source: U.S. Census Bureau

Figure 3.3: U.S. Exports to India 2007 in Dollars

3.5.2 Texas Trade with India

Table 3.7 shows that imports with India, while still rather modest when compared with Chinese imports, have been growing substantially for the past few years. Increases in 2004 and 2007 for the Houston customs district were particularly impressive despite the fact that import value through the Port of Houston itself actually fell marginally. A substantial factor in the drop off in cargo value from the Port of Houston came from the loss of wind generator imports, much of which moved to the Port of Freeport. In 2006, wind generators (commodity 850231) were responsible for some $200 million in imports through Houston; however, in 2007 they constituted only $21 million. In 2007 there was a strong surge in granite imports from India through Houston. All of this volume was containerized. It is unclear what impact the downturn in the U.S. residential construction market in 2008 may have on future demand for these and other domestic building materials.

Table 3.7: Imports from India through the Houston Customs District and Port of Houston

Source: U.S. Census Bureau

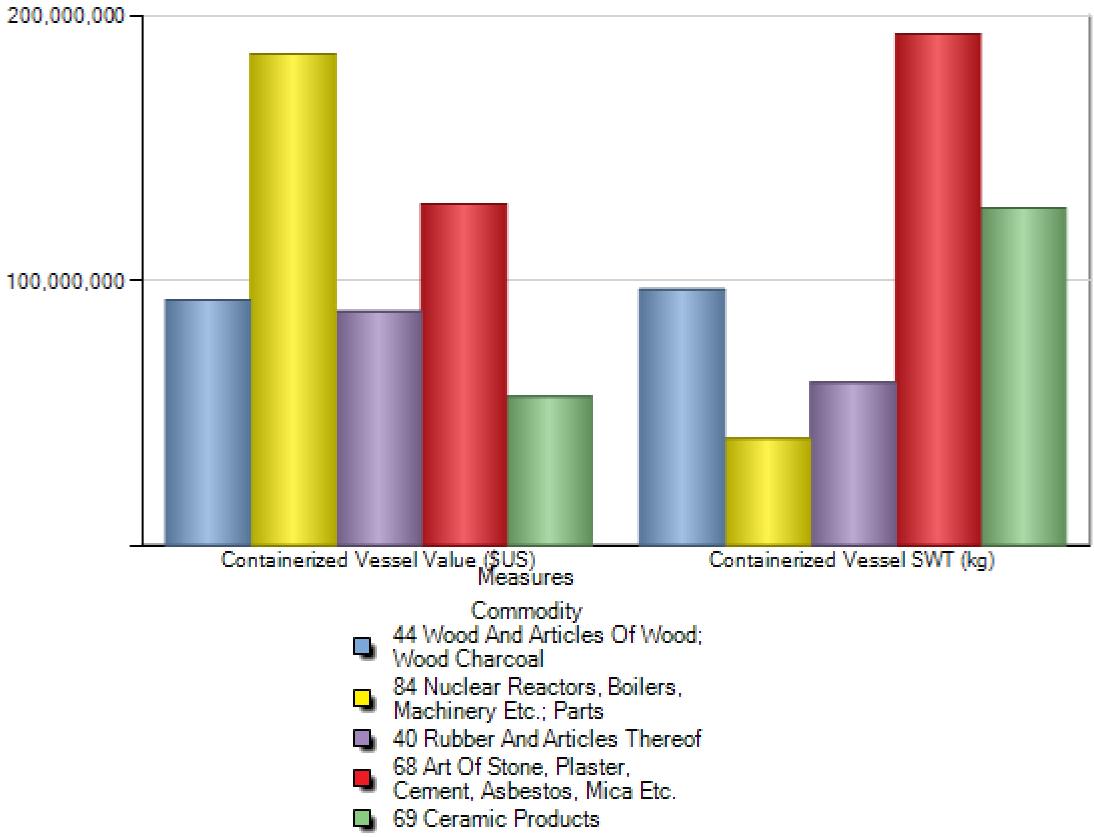
	Houston Customs District	Port of Houston
2003	$ 278,459,209	$251,806,635
2004	$520,660,893	$481,990,864
2005	$676,201,574	$577,291,461
2006	$1,082,308,469	$1,039,039,331
2007	$1,474,941,163	$945,846,508

In examining the data for mode, it is apparent that sea imports to Houston dominate. In 2007, air imports accounted for only $32 million to the Houston Intercontinental Airport. Compared with the 2007 data for all port districts, the Houston District accounted for approximately 5% of the total. Air cargo plays a far more significant role in New York than at either Houston or Los Angeles, making up $6 billion of trade value, higher than the $4.7 billion in total vessel trade.

3.6 Brazil

In 2004, the value of imports from Brazil through all the port districts was $21,627,504,570. Of this total, the value by marine vessel was $16,576,817,999. The total weight of imports by vessel was 35,642,276,113 kg, which means that the average cost per kilogram of cargo was only $0.50. Of this, vessel value through the Houston district was $2,364,362,227, of which $1,122,752,962 was containerized. When compared with other countries, the percentage of cargo that is coming in containerized form is comparatively lower due to substantial amounts of natural resource-based products that ship in bulk. By 2007, the trade picture with Brazil had shifted somewhat. The total value of imports by vessel to all districts had increased to $21 billion, which meant that the average value per kilogram had increased to $.70, still quite low by global standards.

In 2007, Brazil imported 2,116,279,160 kg of cargo through the Port of Houston of which slightly less than half (914,623,248 kg) was in containerized form. The following chart (Figure 3.4) shows the top containerized imports from Brazil by commodity class and compares total value with total weight by commodity.



Source: U.S. Census Bureau

Figure 3.4: 2007 Containerized Imports from Brazil through the Port of Houston

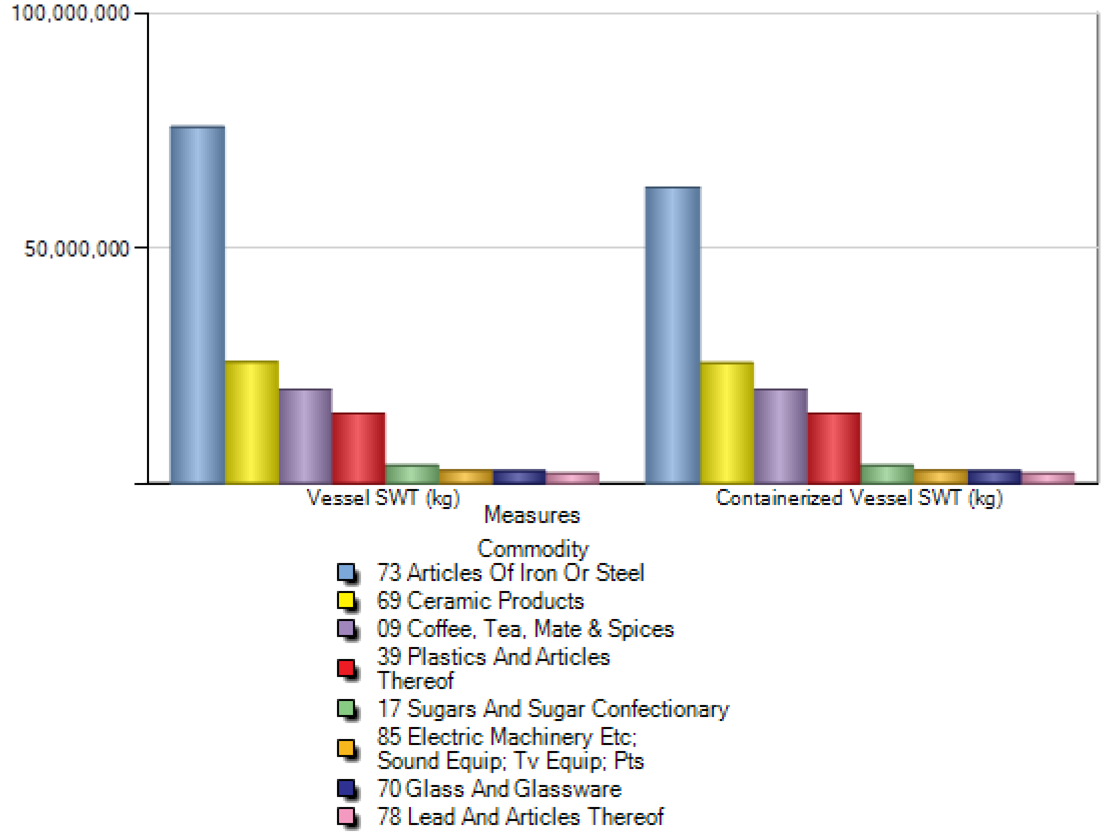
One of the higher-value containerized commodities imported to the Port of Houston through Brazil is rubber soles for shoes. There was a surge in imports for this commodity between 2006 and 2007, increasing from 442,376 kg to 2,565,913 kg respectively. In 2007, the value of these imports was $63,526,096 or $25 per kilogram.

3.7 Imports from Colombia

There has been significant attention paid to U.S. trade with Colombia recently given that the U.S. will soon decide whether to pass a free trade agreement with the South American nation. Oil is the most significant import from Colombia, constituting 1.9 of the 2.6 billion kilograms of cargo transported through the Houston District by vessel from Colombia in 2007. As recently as 2004, sugar was Colombia's top export to the United States through the Houston trade district; however, as of 2006 it has constituted a rather insignificant component of total exports. Containerized commodities constitute a relatively small share of total commodities from Colombia as is illustrated in Figure 3.5.

Other notable characteristics of Colombian trade with Texas include a substantial volume of portland cement at 413,481,774 kg. Houston was the entry point for 20% of the total cement exports from Colombia to the United States. It is therefore conceivable that more favorable trade terms with Colombia may have an impact on the cost of cement. An effort to relax cement duties with Mexico was furthered in the wake of Katrina; however, the process of manufacturing cement in developing countries is a polluting process, so environmental standards will likely have to be addressed to secure a lasting agreement.

Steel pipes are another industrial export from Colombia to the United States. Imports from Colombia have grown from 47 million kilograms in 2004 to 74 million kilograms in 2007. Additionally, this commodity previously was shipped in bulk but has recently been containerized. In 2007, 61 of the 74 million kg of pipes were shipped in containerized form.



Source: U.S. Census Bureau

Figure 3.5: Key Containerized Commodity Imports from Colombia

3.8 Texas Trade Patterns with Mexico

Given the extensive information on Texas–Mexico trade that exists from alternative sources, the researchers have attempted to illustrate some of the variations in trading patterns that can be learned through disaggregation of data. When compared with the other trading relationships discussed above, trade with Mexico is fundamentally different due to the disproportionate role played by ground transport such as truck and rail, the number of direct entry ports, and the unique characteristics of the maquiladora system. As can be seen through the following illustrations, the profile of U.S.–Mexico trade varies significantly by mode and port of entry. The data for this section comes jointly from the USA Trade Online database and the BTS transborder database.

In 2008 there were 3,278,933 total northbound and 2,793,362 southbound crossings at the Texas border. Since 2006, in general terms, truck numbers have not increased at the same rate as has value. Therefore, the average value per truckload was 63% higher in 2006 as it was in 1999 (see Tables 3.8 and 3.9).

Table 3.8: Variation by Port of Entry: Truck Volume vs. Value at Laredo

Source: Bureau of Transportation Statistics, U.S. Census

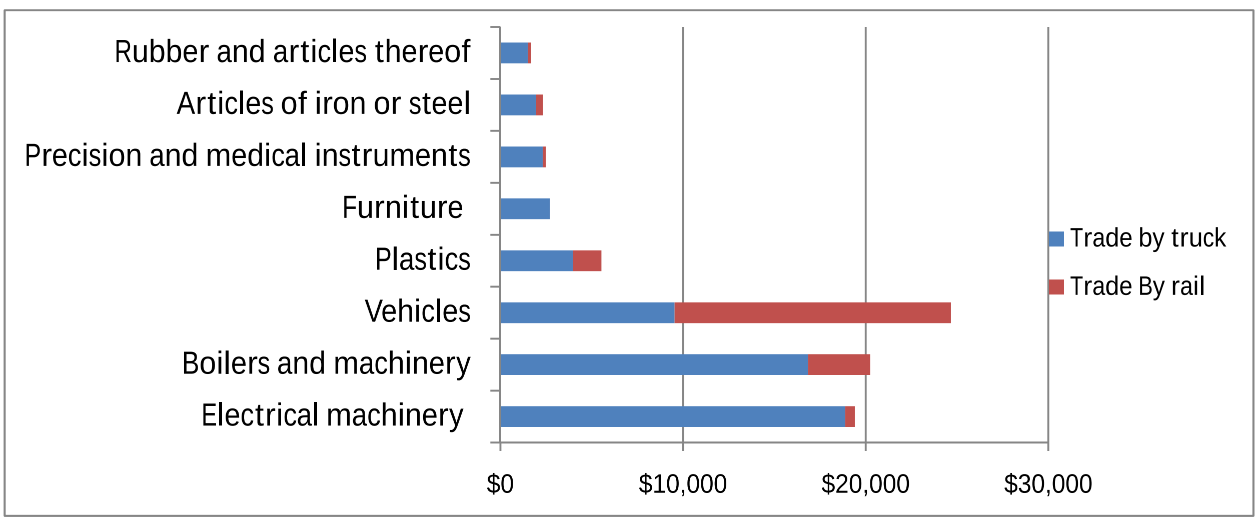
YEAR	TRUCK VOLUME	PERCENT CHANGE	VALUE	PERCENT CHANGE
1999	1,486,489		$50,646,153,715	
2000	1,493,073	0.4%	$60,046,648,803	18.56%
2001	1,403,914	-6.4%	$55,298,351,032	-7.91%
2002	1,441,653	2.6%	$55,801,348,663	0.91%
2003	1,354,229	-6.5%	$54,619,781,165	-2.12%
2004	1,391,850	2.7%	$63,985,424,486	17.15%
2005	1,455,607	4.4%	$66,825,760,275	4.44%
2006	1,518,989	4.2%	$78,502,345,555	17.47%

Table 3.9: El Paso Truck Volume vs. Value

Source: Bureau of Transportation Statistics, U.S. Census

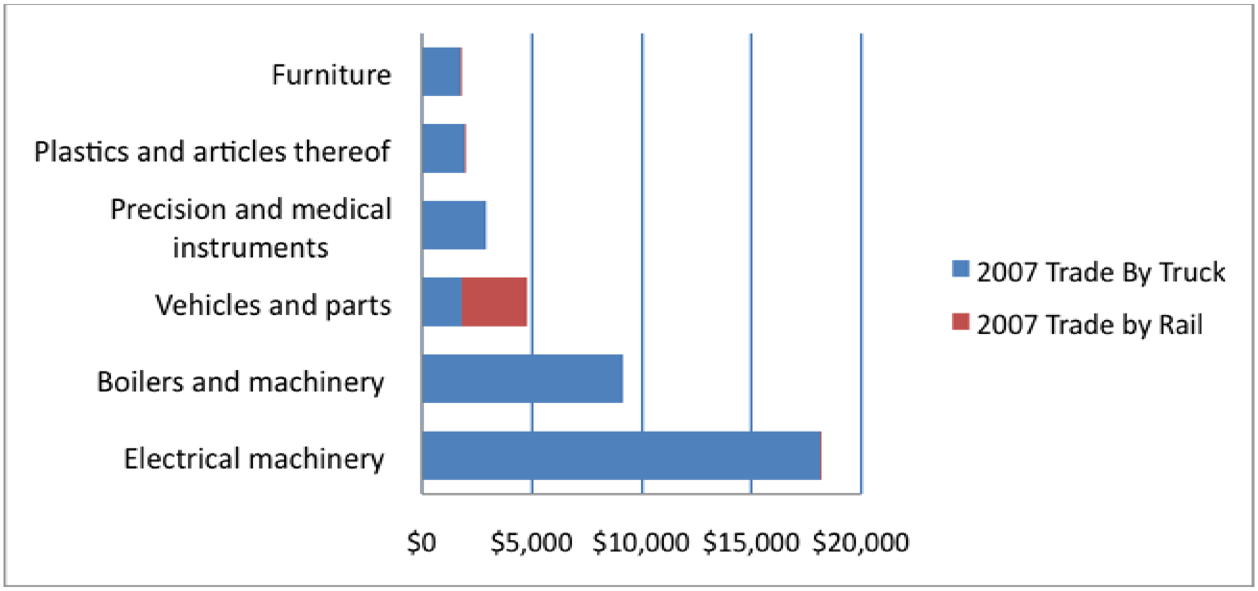
YEAR	TRUCK VOLUME	PERCENT CHANGE	TRADE VALUE	PERCENT CHANGE
1999	673,003		$29,295,508,657	
2000	720,406	7.04%	$36,007,672,923	22.91%
2001	660,583	-8.30%	$34,697,347,987	-3.64%
2002	705,199	6.75%	$35,093,583,193	1.14%
2003	659,614	-6.46%	$35,935,405,055	2.40%
2004	719,545	9.09%	$39,531,128,833	10.01%
2005	740,654	2.93%	$39,523,577,739	-0.02%
2006	744,951	0.58%	$42,237,452,507	6.87%

In 2006, 95% of the loaded rail cars crossing the border crossed at three land ports: Laredo, El Paso, and Eagle Pass. The following figures (3.6, 3.7, and 3.8) illustrate the modal split borne out by commodity class.



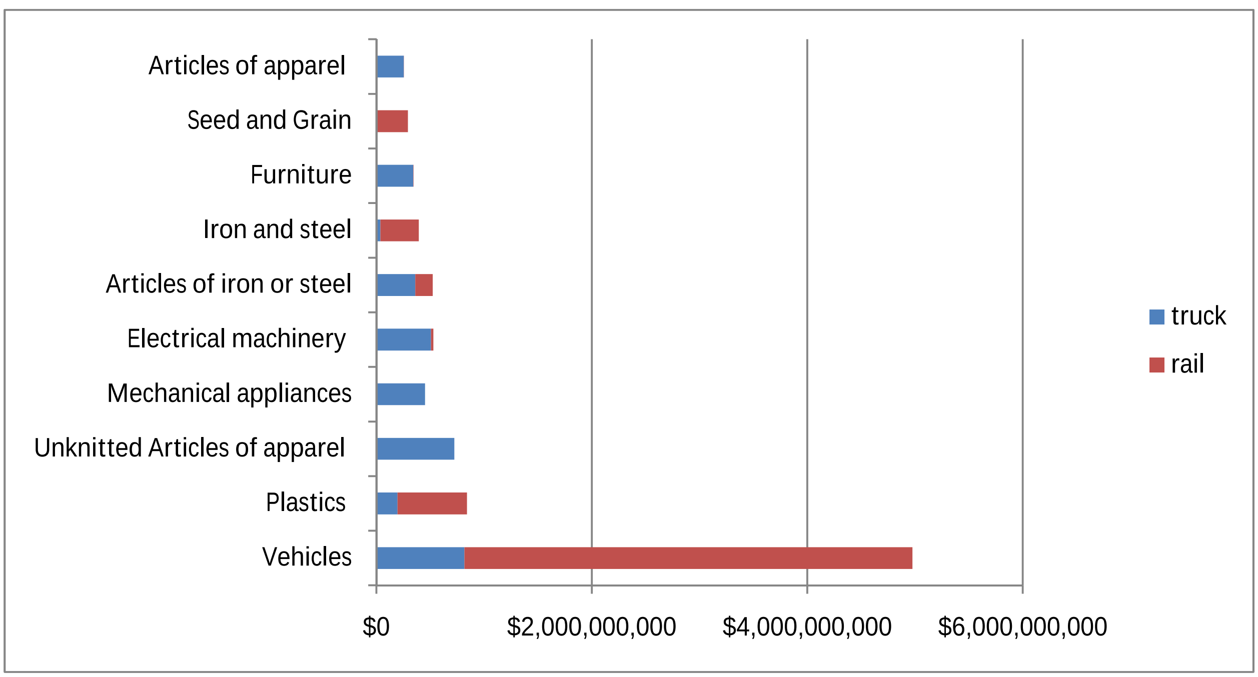
Source: BTS Transborder Database

Figure 3.6: Modal Split for Key Commodities Crossing at Laredo



Source: BTS Transborder Database

Figure 3.7: Modal Split for Key Commodities Crossing at El Paso



Source: BTS Transborder Database

Figure 3.8: Modal Split for Key Commodities Crossing at Eagle Pass

3.8.2 Profile and Sea Imports from Mexico

Marine imports from Mexico are dominated by petroleum. For this reason, the ratio of containerized imports, measured in terms of value and volume, is quite low. In 2007, containerized goods from Mexico constituted 128 million kg (or less than 1%) of the total volume of cargo from Mexico landing at the Port of Houston. Gravel for use in aggregate constituted another key source of imports by weight at 1.3 billion kilograms.

By value, coffee was one of the most significant containerized commodities exported to Houston from Mexico, constituting 12 million kilograms of cargo at an average customs assessed value of $2.8/kg. While the value of containerized commodities to Houston has increased since 2004, the total weight of containerized commodities has actually fallen. While there are many liner strings that call Houston, Altamira, and Veracruz in sequence, services such as the CMA-CGM "Victory Bridge" and "Gulf Express" do not move a substantial number of loaded containers between these ports.

3.9 Conclusion

This chapter identified trading partners with Texas, specifying a variety of commodity types, measured by value and weight. But how is this trade facilitated by transportation modes? Some commodities, high in value and low in weight, are shipped by air in the state through a few major gateways. Others, like oil and petroleum arrive and leave by vessel and are processed in nearby facilities to the major gulf ports. Much of the rest is shipped using containers that use a variety of sea and land corridor segments to move the products, whether these are exports or imports. The next chapter describes the major intermodal corridors used to move products into and out from Texas.

Chapter 4. Major International Trade Corridors Serving Texas

International trade corridors are inherently simple and should be kept simple for planning purposes, though the elements—modes and operations—are dynamic and driven by commodity needs, cost, speed, and reliability. This needs to be recognized by planners and policy makers who should monitor these factors to maintain an understanding of changes in corridor choices being made by shippers serving U.S. import and export markets. This study differentiates corridors running through Mexico from the rest of the world for a number of key reasons. First, the impacts of U.S.–Mexico surface trade flows on the Texas transportation system are largely felt on five highway and three rail corridors in the state. This chapter addresses those corridors—traditional and emerging—that significantly impact Texas and require a maritime segment in the corridor. The term "impact" covers not simply those routes that serve Texas locations but also recognizes that the state, because of its size, supports corridors used by shippers moving trade through the state to other U.S. locations, like Chicago or Kansas City.

The definition of a transportation corridor used for non-NAFTA business should also be kept simple. There are numerous individual port to port links that serve Texas—there are 12 deep-water state ports—but these are best left to the Texas port authorities to decide how they best fit the needs of shippers. The corridor definition chosen for this study is the exporting or importing country or region and the U.S. gateway selected to first process goods into the nation. If that gateway is out of state, the details of the land corridor are also given. The one exception is the new Canadian gateway at Prince Rupert, which is treated as a U.S. transportation corridor because a majority of its traffic is bound for U.S. markets. The order of the country or origin to U.S. port sequence in corridors in the chapter is based on shipping criteria—volume and value—as reported by the Bureau of Transportation Statistics.

All of the corridor options under consideration are for intermodal maritime and rail options. Thus, the cargoes under consideration are all relatively tolerant of long transit times. Furthermore, it has been demonstrated throughout the course of the energy spike and subsequent recession that shipper needs in terms of transit time are rather malleable provided that services are reliable. Of the corridors under consideration only two options, Southern California and the Panama Canal, are currently considered vital to Texas containerized trade from Asia. None of the alternative corridors currently make up a significant percentage of trade volumes. Of the remaining options some, such as Punta Colonet, are not utilized because they have no infrastructure while others, such as Prince Rupert, are not utilized to serve Texas simply because the time of delivery and transportation costs are significantly less favorable when compared with established corridors.

Figure 4.1 shows the variety of intermodal trade corridors serving Texas companies—whether the goods are imports or exports. The subsequent subsections of the chapter describe each corridor in terms of transit time, recent development and state-wide planning considerations.

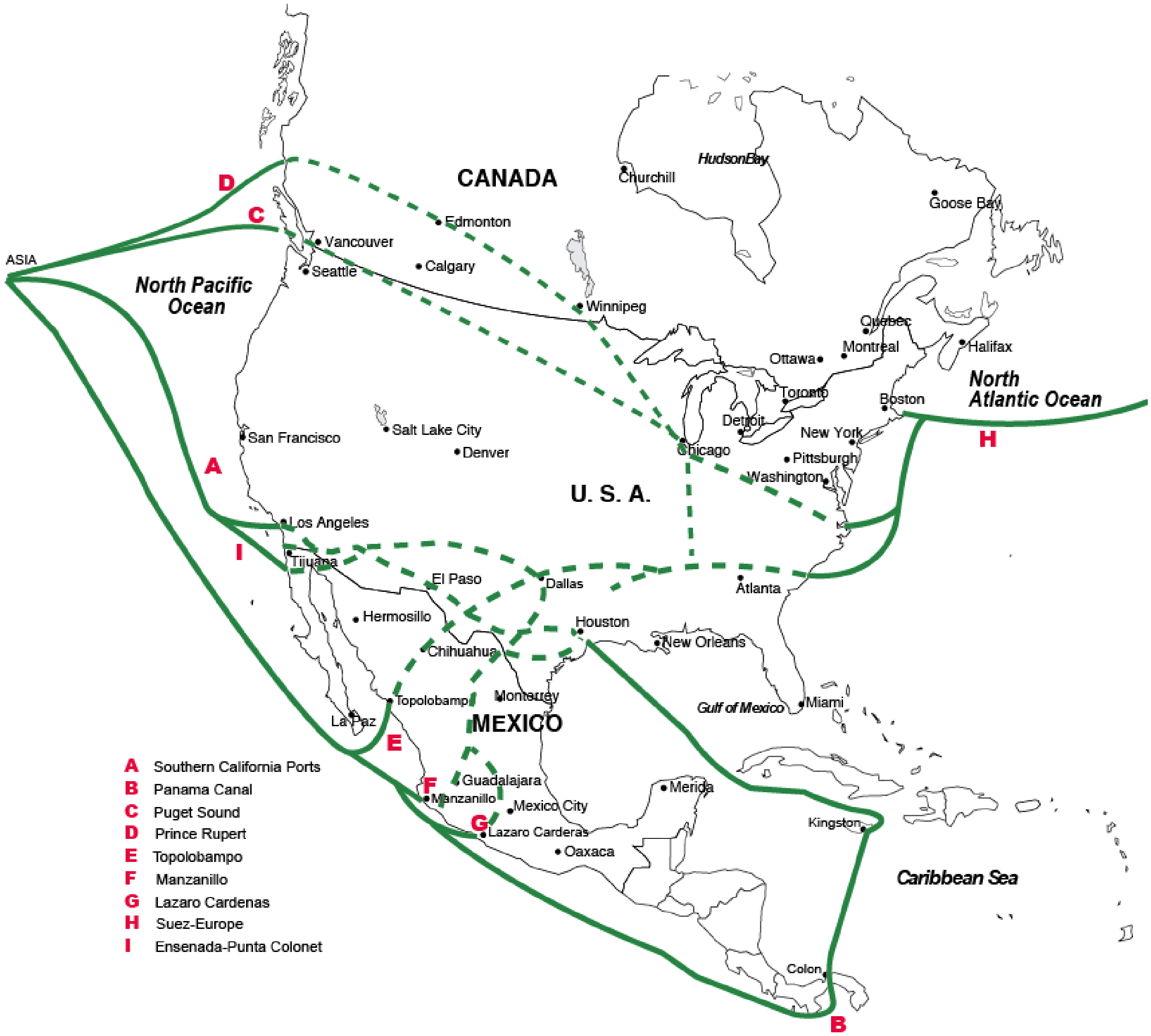


Figure 4.1: Intermodal trading corridors serving Texas

4.1 Asia–West Coast Intermodal Trade Corridor

Corridor Overview: *(see point A in Figure 4.1)* This corridor remains the dominant option for most shippers in transporting containerized cargo from Asia to the Texas market. It offers the greatest flexibility and overall fastest transit times under current conditions. The corridor also offers varying service levels that correspond to different shipper demands including premium rail service and approximately one-third of containers now move via on dock rail. The Port of Los Angeles is in the process of adding additional on dock rail capacity. It is also chosen by many shippers due to the pre-existing location of warehousing in the Southern California region. For simplicity the nearby Ports of Los Angeles and Long Beach, sometimes referred to as the San Pedro Bay Ports, are referenced as a single entity.

Total Transit Time from Hong Kong to Houston: 18–22 days including at least 11 days sailing, 2 days port clearance and rail loading, and 6 days on rail. The Union Pacific advertises an average time of transit of 4.4 days and that 90% of shipments are delivered within 5.7 days. For Dallas, the average time of shipping is 2.9 days and 90% of shipments are delivered within 3.7 days. BNSF currently offers two levels of service for intermodal cargo moving between Los Angeles and Texas destinations. The fastest "E" service quotes delivery to the Alliance intermodal yard in 55 hours (or 2.3 days) in April 2009. This is a Trailer on Flat Car (TOFC) service. The standard service "P" is 79 hours (3.3 days) and deliveries are sent out six days per week. Delivery time to Houston is only available with service level "P" and is 105 hours (4.3 days). Shipments to Houston are sent three times a week.

Key trading Partners: People's Republic of China, South Korea, Japan, Taiwan, Southeast Asia

Key West Coast Ports of Entry: Los Angeles, Long Beach, Oakland

Recent Developments: Heavy landside congestion in the Los Angeles area and lack of sufficient dockside rail complicating traditional truck-rail connections created significant problems in the efficiency of the corridor prior to the falloff in container demand in late 2008. Emerging bottlenecks along the Union Pacific and Burlington Northern Santa Fe transcontinental rail corridors have also been significantly alleviated though not eliminated; the Union Pacific advertises an average time of transit of 4.4 days and that 90% of shipments are delivered within 5.7 days. For Dallas, the average time of shipping is 2.9 days and 90% of shipments are delivered within 3.7 days. BNSF currently offers two levels of service for intermodal cargo moving between Los Angeles and Texas destinations. Delivery time under the fastest service level is for Trailer on Flat Car. Both of these lines are undergoing capacity enhancement. For the BNSF the most critical bottleneck is the Abo Canyon near Belen, New Mexico. BNSF had originally hoped to construct a second main line through the canyon that would allow speeds to be increased from 40 to 50 MPH. After examining the cost and environmental implications, a 40 MPH alignment was chosen. BNSF concluded that "savings and transit time did not justify the construction of a potential 50 mph alignment" (Magistro 2005). Cost implications from a legal battle of the port's controversial implementation of a "Clean Trucks" program to replace older dray trucks and would ban owner-operators has taken on new urgency in the face of the dropoff in cargo.

Statewide TxDOT Planning Considerations: There are currently major inflows of Asian containerized goods to Texas population centers through two transcontinental rail corridors. A substantial amount of through traffic that does not terminate in Texas also passes through the state. Connections with inland ports in Dallas and San Antonio are drivers of growth. In late 2008 and early 2009, the San Pedro Bay ports had the sharpest drop in volume of any port complex in the country. While data from August 2009 showed that container volume was down by 16.5% for the Port of Los Angeles compared with the previous calendar year, the port has yet to generate reliable estimates as to which regions of the country or states have seen the sharpest volume drop (Dijk 2009). The same holds true for the Port of Long Beach, which only tracks the total TEU volume (down 25% as of August) but does not have estimations of where in the country the cargo is headed. The closest approximation of the relative importance to Texas container volumes from the Ports of Los Angeles and Long Beach was a study performed for the Alameda Corridor Authority. The study, which relied on 2005 data, estimated consumption based upon population in different regions of the country. The consultant estimated that Texas directly consumed 11.2% of the ports of Los Angeles and Long Beach total international trade volume. In 2005, this equated to $28.68 billion of which $23.69 billion was imports and $4.99 billion was exports (BST Associates 2007). The Port of Los Angeles uses a proxy container value of $35,000 per TEU. If that assumption is applied, it would mean that the Texas direct consumption share of cargo originating from the Port of Los Angeles or the Port of Long Beach in 2005 was slightly over 800,000 TEU.

The expansion of the Dallas Logistics Hub (DLH) with the addition of a BNSF intermodal terminal located near to the existing Union Pacific Terminal at Wilma has the potential to further improve the attractiveness of Texas as a logistics platform, even for cargoes whose ultimate destination lies outside of the state. In May of 2008, the BNSF purchased 198 acres of land within the DLH for the construction of an intermodal terminal. With the economic slowdown, BNSF has elected not to begin construction on the terminal until economic growth resumes. Should BNSF decide to begin construction, the new terminal could be expected to open within 3–5 years.

4.2 Asia–Panama Canal–Houston

Corridor Overview: *(see point B on Figure 4.1)* The intermodal marine and rail corridor linking Asian hubs with Houston and, by extension, other destinations in Texas is one of the most promising emerging trade routing options for Texas needs. This corridor offers several potential advantages for shippers in that it allows a shipper to move containerized cargo by a single mode from the port of departure to the port of arrival. In most cases, for deliveries to Texas markets, the final delivery from Houston is performed by truck. Thus, for shippers who do not wish to utilize intermodal rail, the all-water Panama Canal route is a realistic option. Under current conditions, there has not been a consistent economic cost advantage in choosing the all-water route, yet the existence of this option is seen as generally favorable for preventing any one provider from gaining undue market power.

The Asia–Panama Canal–Houston corridor can be divided into two classes: 1) direct calls in which the string includes an Asian port of loading or departure along with Houston and 2) transshipment port strings in which the port of transshipment is either in the Panama Canal Zone (Port of Manzanillo or Port of Balboa) or a hub in the Caribbean. Currently an analysis of containership strings shows that Kingston, Jamaica, and Freeport, Bahamas are the most important transshipment hub for cargo moving to and from the Port of Houston. The use of transshipment hubs in lieu of direct calls carries some advantages. For example, in order to justify a direct call from an Asian port to the Port of Houston, a significant volume of containers is required. A far smaller amount of cargo is required to justify a feeder delivery between a Caribbean hub, both due to smaller vessel size and the fact that cargo transshipped from these hubs has been consolidated from multiple origins. The same feeder vessel that delivers containers from Asia, for this reason, can simultaneously deliver cargo from Europe and South America, thereby allowing for more regular shipments than would be possible without the hub and spoke function provided by the Caribbean.

Time of Transit: The time required to deliver a container from Hong Kong to Houston or most other destinations within Texas is 21 days under normal conditions. Potential delays of up to one day can occur at the Panama Canal locks, particularly if the vessel does not secure a reservation slot.

Current Service Providers: CMA-CGM through direct call, other carriers via transshipment

Key Ports of Entry: Barbours Cut, Bayport

Landside Considerations: Most containerized cargo entering Texas via the Port of Houston and bound for termination within Texas is not expected to be rail competitive in the near term. Truck traffic generation from Asian cargo flows will be significant in the Houston area and to a lesser extent on road corridors linking Houston with San Antonio and Dallas.

Statewide Planning Considerations: The Panama Canal showed surprising resiliency in boosting total TEU throughput when transit peaked in 2007 despite projections that the Canal had reached capacity. In the first quarter of FY 08, the Canal actually saw its first decrease in total transits and a subsequent improvement in processing time tied in large part to the weakening U.S. economy (Maritime Global Net 2008) The recent increase in toll rates by the Canal authority may also be a factor in slackening demand for the canal prior to the opening of the new locks.

4.2.1 Recent Developments

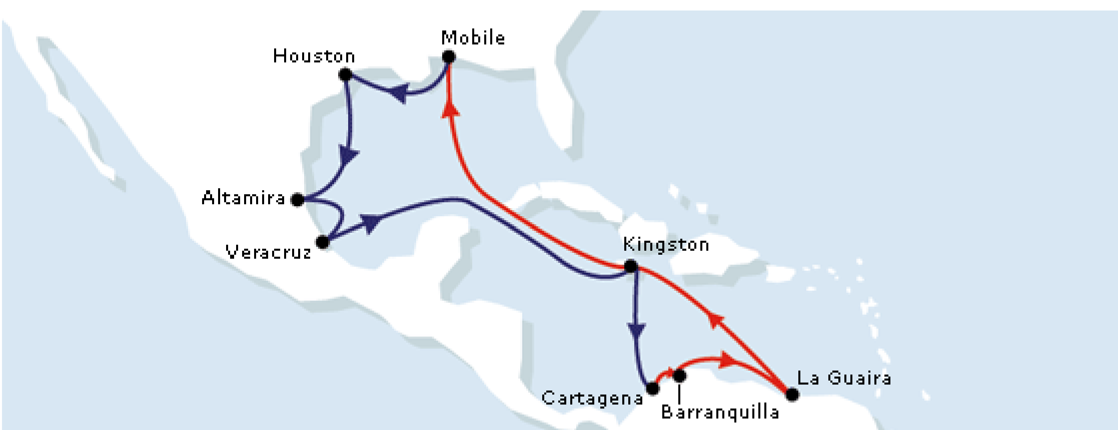
China has been one of the key drivers of growth for the Port of Houston intermodal terminals. Increased growth of trade with Asia was central to the justification to build the Bayport terminal. The need to deliver large volumes of consumer goods to growing markets in central Texas was a central reason for the decision of Wal-Mart and Home Depot to locate major distribution centers near Houston and the decision of a major liner service to call Houston directly from China. Since starting in 2006, the CMA-CGM PEX3 service connecting Hong Kong and Houston has become a mature string using some of the largest vessels currently in operation capable of navigating the Panama Canal.

Aside from the CMA-CGM services, there is currently a lack of services that arrive at Houston after loading directly at Asian ports. Therefore, the role of Asian trade services with the Port of Houston remains essentially the same as it did before Bayport opened—an important component of the total business but still a secondary market to the ports major trading partners of Europe and Latin America. While Houston has a more balanced trading system with ports in East Asia than do ports on the West Coast, the Port still has far greater trade parity with Europe and Latin America. For example in 2007, the most recent year for which data is available, Port of Houston containerized imports from East Asia eclipsed exports by a factor of 3 to 1: 172,164 TEUs of imports and 54,540 TEUs of exports (Port of Houston Authority 2009). In addition, it should be noted that while the Port of Houston imports a wide variety of cargo types from China, the vast majority of its exports are a narrow band of commodity types derived from the petrochemical industry, principally resins. Therefore, if these commodities were removed from the total cargo mix, the balance for containerized trade between the East Asia and the Port of Houston would be similar to that of other containerized ports such as Los Angeles. The fact that many of the ships from Asia that call at the Port of Houston return partially empty means that the export potential for these commodities is limited for the Chinese market. If a new carrier from China were to start calling Houston directly from the same ports of loading called by the PEX3, they would face the same problem of not being able to find sufficient return cargo unless calling at a different market or a port that would transship to other Asian markets, i.e., Hong Kong. Alternatively the transshipment market for Asian destinations to Houston is also subject to uncertainty. In late 2008, Maersk announced that it would abandon its lease at the Kingston container terminal which serves as a transshipment point for Houston cargo, due in large part to unacceptable levels of congestion. The total container volume of Kingston fell by 9% to 1.8 million TEUs in 2007 (Leach 2008). This is important because larger vessels can “load center” at locations such as Kingston and transship containers destined for Houston through a “hub and spoke” system using smaller ships that can serve ports constrained by channel depth.

The lack of available return cargo is problematic because the tolling structure of the Panama Canal is set so that the empty return vessel will pay fees analogous to a loaded vessel. This is an extra cost that container carriers that send large container vessels directly to Houston must bear, in addition to the costs of the extra sailing time. Some carriers have argued that the Panama Canal authority should either cut its rates or at a minimum modify the rate structure so that empty returns are not as costly. So far, the canal authority is resisting these calls and is pressing ahead with planned rate increases in order to continue the funding of the expanded locks.

4.2.2 Impact of the Opening of the Mobile Container Terminal

Despite the additional cost of sending ships through the Panama Canal, carriers are now aided by the fact that they can add the new Mobile container port to their string, thereby lessening the cost penalty of entering the Gulf. The Port started operations on October 2nd and is expected to initially handle 150,000 TEUs per year. In December of 2008, CMA-CGM expanded its PEX 3 string to Mobile, thereby providing two ports of call in the Gulf (CMA-CGM 2008). While the Jones Act bars the transportation of loaded cargo containers between the two ports, Houston has started using the Mobile terminal as a destination for surplus empty containers. Mobile is also a stop on the CMA-CGM's Gulf Bridge express that connects both ports to Altamira, Veracruz, Kingston, Cartagena (COL), Barranquilla, and Colombia (as shown in Figure 4.1). The connection of this string to the transshipment hub of Kingston, Jamaica allows the Port of Houston to send shipments of resin and other products to major Chinese ports including Ningbo and Hong Kong as well as numerous ports not served by strings that directly connect Houston. Also notable, despite the fact that the first two ports of call are in Mexico, almost no loaded containers loaded at Houston are currently unloaded in Altamira or Veracruz.



Source: http://www.cma-cgm.com/en/eBusiness/Schedules/LineServices/Default.aspx

Figure 4.2: CMA-CGM's "Gulf Bridge Express"

4.3 Asia –Puget Sound–Transcontinental Corridor

Key Trading Partners: China, South Korea, Japan, Taiwan, Thailand

Key West Coast Ports of Entry: Seattle, Tacoma, Vancouver, Portland

Corridor Overview: *(see point C in Figure 4.1)* The Pacific Northwest has emerged as a close competitor for the Ports of Southern California in delivering cargo from Asia to Chicago and the East Coast. As a relative newcomer to serving extended hinterland destinations, the Ports in the Pacific Northwest have been judged to have a tenuous hold on cargo market share when compared with the Ports of Los Angeles and Long Beach. A 2008 study on the elasticity of shipments through the Pacific Northwest concluded that even a small $30/TEU increase in container unit cost vis-a-vis alternative ports could cause a loss of market share in favor of Southern California for markets east of the Rockies (Leachman 2007). The corridor is currently not used by a substantial number of shippers for deliveries to Texas due to significantly greater overland distance when compared with Los Angeles and Long Beach. A shipper may choose to utilize the Puget Sound ports; however, if they have pre-existing distribution infrastructure in the region that would counteract higher transportation costs.

Landside Considerations: Heavy use of on-dock rail serving the Midwest and East Coast has meant less community pushback to port expansions. TEU growth since 2000 at Tacoma peaked in 2007. The following year, container volumes fell by 5% (Dibenedetto 2007) and, as with most U.S. terminals, capacity was substantially higher than container demand. Volume declines in late 2008 and early 2009 have not been as severe as at the Ports of Los Angeles and Long Beach. A stronger export profile for Seattle and Tacoma, when compared with that of Los Angeles and Long Beach, has been credited for some of the Ports' resiliency (Cunningham Report 2009).

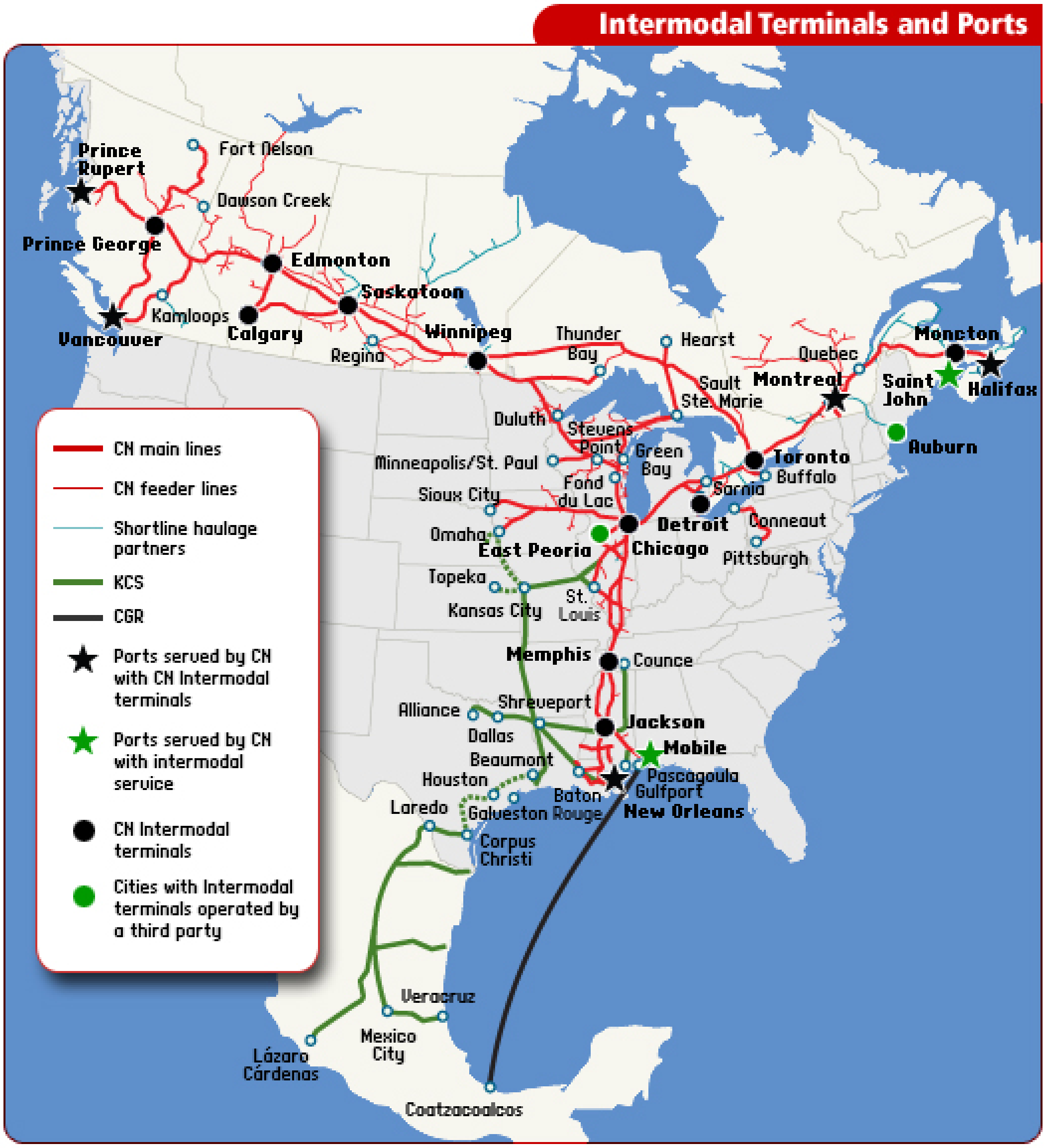
Statewide Planning Considerations: Increased use of Northwest ports headed for Chicago and the northeast would lower the number of through trains from Los Angeles entering Texas. There is a lower chance that cargo entering at Puget Sound ports would directly enter Texas. The conditions under which a temporary shift from Los Angeles/Long Beach to Puget Sound as a port of entry would be an elevation in marine transportation cost combined with a depression in rail cost. There are several potential routing options for Puget Sound to Texas corridors, none of which are posted on the railroads' regular schedule. The most viable possibility would be to route cargo via Kansas City. The rail distance for this shipment is approximately 1,000 miles longer to Dallas than the analogous routing through Los Angeles/Long Beach. Because the rail distance disadvantage is greater than the marine distance advantage, it can be concluded that this corridor will likely remain a secondary option for the majority of shippers to Texas. Yet it is plausible that a combination of favorable rail contracts, dray and distribution arrangements, and maritime contracts could compel a minority of Texas shippers, or national shippers with a Texas branch, to choose a port in the Pacific Northwest as a principal port of entry for Asian imports.

4.4 Asia–Prince Rupert–Chicago Corridor

Key Ports of Entry: Fairview container terminal at Prince Rupert with Canadian National rail connection to Chicago and Memphis.

Key Trading Partners: Korea, Japan, and China

Landside Considerations and Critical Features: *(see point D in Figure 4.1)* The Prince Rupert port of entry is unique among major container terminals in North America due to exclusive reliance on rail; see Figure 4.3. Canadian National retains a monopoly on inland movements from the port. The corridor experiences few inland constraints with the exception of those tied to climate.



Source: Canadian National

Figure 4.3: Canadian National Network Serving Prince Rupert

4.4.2 Prince Rupert–Chicago

Corridor Overview: Prince Rupert provides the fastest port of entry for Northeast Asian strings from the perspective of the ocean carrier. It connects with an underutilized rail line run by the Canadian National (CN). While the rail distance between Prince Rupert and Texas is unlikely to make it a strong option for direct Asia–Texas shipments, it is already taking significant volume away from other West Coast ports of entry, which may ease systemic congestion, particularly if the U.S. economy recovers. Prince Rupert also serves as an important "proof of concept" that a bypass port that does not provide a local truck-dependent market can attract a container string. Another point to be made from the Prince Rupert example is that the provision of service by a single rail carrier has not been a significant impediment. COSCO was the first major container carrier to commit to a weekly call to the Prince Rupert terminal with the first ship arriving on October 31, 2007. A second weekly call was added in the summer of 2008 (Cargo Business News 2009).

Transit Time from Hong Kong to Texas: Under current conditions, a shipper moving product between Prince Rupert and Texas would require a 10-day direct sailing time from Hong Kong to Prince Rupert, 5 days rail transit time to Chicago, 2 days interterminal time, and 6 days transit to Dallas for a total time in transit of 23 days. The CN is also advertising its express service to Memphis, which it estimates at 133 hours (Casey 2009).

Of all of the truly "alternative corridors" to the Port of Los Angeles and Long Beach that were proposed in the first part of the decade and for which new infrastructure was required, the Port of Prince Rupert and its connection to Chicago via the Canadian National Railways is arguably the corridor that has most closely approximated the original vision. The first phase of the Fairview Container terminal opened in late 2007 and has now seen its first full year of operation in which it handled 181,890 TEUs from 78 vessel calls. This works out to 2,331 TEUs per vessel call. The terminal's current capacity is 500,000 TEUs per year. The opening of the terminal was fortuitously timed for the Port as it helped compensate for a drop-off in other mainstay cargo types such as wheat.

Prince Rupert did not suffer the impacts of the economic crisis as immediately as the Ports of Southern California. Despite the fact that container volume is below some expectations held prior to the crisis, the port is still ramping up its services and as a result the nominal total TEU volume for 2009 is still higher than it was in 2008. According to Prince Rupert officials, the TEU volume through August 2009 was 151,554 TEU, which was significantly higher than the 2008 YTD volume. If current trends continue, the Port estimated that its first phase terminal would be operating at 50% of capacity by the end of 2009. Of the current volume, approximately 30% was destined for Canada while 70% was destined for the United States. The majority of the U.S. cargo was to terminate, at least for the rail portion of its journey, in Chicago, where a minority of U.S. shipments are reloaded and sent all the way to Memphis. The Port Authority expects that the rail shipping time to Memphis will be reduced substantially once a new bypass around Chicago is completed.

In January of 2009, the Canadian National completed the acquisition of the Elgin and Joliet short line railroad circling Chicago that will allow the Canadian National to route its trains through the Chicago area at higher speed and with less impact on the urban area. The acquisition was controversial as it will result in greater train activity along the previously underutilized railway that will adversely impact some neighborhoods. Nevertheless, the Surface Transportation Board (STB) approved the acquisition from U.S. Steel (Traffic World 2009). With the Chicago bottleneck greatly alleviated, the Canadian National's corridor from the Port of Prince Rupert to the rest of the country was cleared of a major impediment.

Currently, four double-stack Canadian National train sets serve the Port of Prince Rupert, all of which could theoretically make the 8-day transit time necessary to serve Texas. There are three routing options that can potentially utilize the Prince Rupert Port of entry to Dallas: through Superior, Wisconsin connecting to the Union Pacific; through Jackson, Mississippi handing off to the Kansas City Southern; and through Chicago handing off to the Union Pacific. Canadian National representatives stated that the service through Superior was the fastest and most reliable option for a service to Texas. While this is slower than service through Los Angeles, when the additional sailing time to the Port of Los Angeles from an origin as south as Pusan, South Korea is factored in, the total time in transit becomes comparable.

The comparison may become more favorable, from a time standpoint if a not from a distance standpoint, once the Chicago bypass is complete.

Statewide Planning Considerations: If a shipper chose to use the Port of Prince Rupert for Texas destinations, the cargo could enter Texas by truck from Memphis or Jackson or by rail through interlining with KCS at Chicago. CN intends to use the Pigeon Industrial Park in Memphis as the main distribution hub in the south. Cargo would likely be trucked from Memphis thereby placing truck traffic on I 30.

4.5 Topolobampo–Presidio Corridor (proposed)

Key Ports of Entry: the Ports of Topolobampo, Mazatlan, and Guaymas

Trading Partners: Asia and South America

Corridor Overview: *(see point E in Figure 4.1)* Directly to the east of the Baja Peninsula there are several small cargo ports at Guaymas, Mazatlan, and Topolobampo. None of these ports currently have substantial container handling capability, yet planners have envisioned the possibility of locating a container port at one of these ports and thereby creating a closer point of entry for traffic bound for Texas or, alternatively, Arizona. If container handling ability was established at one of these facilities, a viable landside corridor to Texas would still need to be established. This is made more challenging by the extremely mountainous topography between this section of the Mexican Pacific and the border. Until recently both the rail and highway linkages between this part of the Pacific Coast and the U.S. border were deemed inadequate for large scale cargo movements to the United States (Ochoa 2005). The lack of access for this part of the country to other regions of Mexico as well as the United States was one of the key reasons for the Mexican government's decision to complete the Mazatlan–Durango highway. This project, which has been underway in some form since 1996, involves the modernization of 232 kilometers of highway between Mazatlan and Durango and would represent the last link in a modern highway connection that runs to Monterrey and the U.S. border. The completion of the highway is expected to reduce total transit time between these two cities by more than 50% and make the route more capable of handling truck traffic. Upon completion of this corridor, shippers will be able to more easily transport cargo from the state of Sinaloa and Durango. In addition, cargo arriving at multiple ports along the northern Pacific coast of Mexico will have the option of using this transversal to cross the mountains. The routing would likely be favored by Sinaloa-based shippers of agricultural products. The prioritization by the Mexican federal government for mega-projects such as Punta Colonet and the Mazatlan–Durango highway has curbed enthusiasm for smaller projects such as the Port of Topolobampo. While funding has been approved by the federal government to deepen the channel, there is no concrete proposal for a major container handling terminal under the Mexican National Infrastructure plan through either public or private funding.

Landside Considerations: The rail system linking the port of Topolobampo to Chihuahua is underdeveloped and the rail carrier, Ferromex, has indicated that it does not propose significant capital investment into the line. The rail connection from Guaymas to Tucson would feed the UP transcontinental line. Steep grades leading out of Topolobampo would limit maximum train length. Tunnel restrictions would likely require single stack trains.

Statewide Planning Considerations: Successful corridor utilization would require improvements in the Texas–Pacific line leading to San Angelo via Presidio. Volume would likely be lower than on other corridors due to constraints at various points within Mexico. The impacts on truck traffic would likely be minimal.

4.6 Manzanillo–Ferromex Corridor

Port of entry: The Port of Manzanillo in the State of Colima, Mexico

Trading Partners: Japan, China, Korea, South America, United States

Corridor Overview: *(see point F in Figure 4.1)* The Port of Manzanillo is Mexico's largest container port. For a decade, Manzanillo held a near monopoly on container movements on the Mexican Pacific Coast. This status emerged due to the fact that Lazaro Cardenas, the other port capable of handling significant numbers of containers on the Pacific Coast, had no efficient road linkage to the Mexico City area and the pre-privatization rail service was too inefficient to meet the demands of intermodal carriers. Thus, Manzanillo emerged as the principal gateway for Asian containerized trade moving to Mexico. In 1995, the Port handled only 86,938 TEUs per year. However, after 1995 Stevedore Services of America (SSA) took control of the main container patio through a government-issued concession. They equipped the port with modern container handling equipment, and the volume of the Port has grown every year since then and it has now reached the status of a major container port. In 2007, the Port's volume was roughly equivalent to that of the Port of Oakland, which is the United States' 4th largest container port. Manzanillo's growth since 2005 has been particularly impressive. Volumes grew from 874 thousand TEUs in 2005 to a 2007 level of 1.4 million TEUs. This surge of growth in the last 2 years occurred despite the opening of the first phase of the competing Lazaro Cardenas Hutchinson Port Holdings container terminal in the state of Michoacán, which had been expected to take a substantial amount of cargo away from the Port of Manzanillo.

Landside Considerations: Manzanillo is located in the middle of an urban area; however, convenient on-dock rail at the SSA container terminal has resulted in limited dray impacts in the immediate port area for those containers that are able to be cleared by rail. On the other hand, there has been little attempt to separate the rail corridor from crossings used by the population. As a result, outbound trains have a significant impact on traffic in the urban area and the city has made attempts to limit the number of trains that the port can send out in the course of a day, thereby limiting the overall penetration of intermodal service. The limitations on train throughput leaving the port due to congestion in the city of Manzanillo has led to time restrictions on train movements that hinder overall corridor capacity. The shortest distance for intermodal shipments delivered between the Port of Manzanillo and Texas would be to utilize trackage rights on KCS-Mexico for part of the journey and enter the U.S. at Laredo. The alternative routing, which stays on Ferromex track and crosses at Piedras Negras, is longer and slower.

Statewide Planning Considerations: As the Port of Manzanillo has grown in volume over the last few years, there has been not comparable investment in rail infrastructure. For this reason, while the volume of the containers at the port has increased sharply, the percent of containers cleared from the port by rail has fallen. Without sufficient rail capacity to even meet domestic demand, it is not possible under present conditions for the Port of Manzanillo to serve as a gateway for containerized in-bond shipments to destinations in the United States. The Port of Manzanillo is currently proposing a substantial upgrade to the rail infrastructure serving the Port that would allow rail shipments to bypass the city of Manzanillo. However, this project is in the early planning stages and would require funding, the extent of which is not currently available with the Port's current funding sources.

The underdevelopment of the rail corridor leading from the port to the interior and the lack of planning to improve the corridor by Ferromex currently means that a significant role of this corridor for Texas-bound trade is unlikely. While the Port of Manzanillo has efficient dockside operations and an ambitious expansion program, the landside connection has become the limiting factor. Therefore, it is likely that the hinterland of the Port is being reduced to the greater Guadalajara region. No shippers were identified who were seriously considering the Manzanillo gateway to serve destinations in Texas.

4.7 Lazaro Cardenas –KCSM corridor

Ports of Entry: The Post-Panamax equipped container terminal at the Port of Lazaro Cardenas in the State of Michoacan

Trading Partners: China, South Korea, Japan, Peru and Chile

Corridor Overview: *(see point G in Figure 4.1)* In September 2007, the Port of Lazaro Cardenas opened its long awaited container terminal capable of handling Post-Panamax vessels. Since its opening, the container volume at Lazaro Cardenas has increased substantially; however, most of this growth has come from modestly-sized container vessels, not Post-Panamax. The Port has seen a steady increase in traditional 3,000 to 4,000 TEU vessel strings diverted from the capacity-challenged Port of Manzanillo. In September of 2008, *Lloyd's List* reported that the Chilean line Compañía Sud Americana de Vapores (CSAV) service switch from Manzanillo to Lazaro Cardenas is responsible for a substantial percentage of the change in cargo volume for 2008. It should be noted that the CSAV service switched to the Lazaro Cardenas terminal, which is less efficient than the SSA-operated concession terminal in Manzanillo. The need to handle substantial container volumes at the general use docks at Manzanillo is a phenomenon that emerged following the concession to SSA in order to accommodate shipper demands for additional container handling capacity at the Port of Manzanillo. The principal lines currently serving the Lazaro Cardenas terminal are APL, Maersk Line, Cosco Group, and Hapag-Lloyd. Lazaro Cardenas saw the arrival of a fourth container crane capable of serving Post-Panamax vessels in October of 2008 (Lloyd's List 2008).

An interview with the Port Director of Lazaro Cardenas illustrated the close connection between rail service and the Port's success. According to former Director Palos Najera, approximately two-thirds of the cargo that enters the Port destined for the Mexico City area is currently delivered by rail, with the remaining one-third delivered by truck. This is a particularly relevant statistic given that the truck distance between Mexico City and Lazaro Cardenas, while significant, is not so extreme as to make rail the automatic default choice. A small minority of deliveries are destined for locations north of Mexico City, including San Luis Potosi and Monterrey. These deliveries go almost exclusively by rail. The port does not have specific statistics on cargo that is ultimately destined for Mexico versus cargo that is destined for reassembly and exported to the United States or another country.

Landside Considerations: KCS, under its Mexican division KCS de Mexico, is spending $80 million on developing its rail terminal at the Port of Lazaro Cardenas. This terminal will provide the landside equivalent to complement Hutchinson Port Holdings' investment in a marine container terminal to be supplied with Post-Panamax cranes (El Economista 2008). Unlike KCS, which is fully committed to the Lazaro Cardenas port of entry as its gateway to Asia, Hutchinson is involved in several of the projects along the Mexican Pacific Coast, most notably the delayed Punta Colonet project. The Secretaria de Communicaciones y Transporte (SCT) infrastructure plan for the year 2007–2012 calls for substantial investments in ports of different scenarios. Under the pessimistic scenario, the Mexican Government calls for $4.2 billion in port investments. Under the more optimistic scenario, the government expenditure is expected to be $1.5 billion when compared with $5.1 billion from the private sector or $6.6 billion total. This second scenario is seen as the more likely to reflect reality. Under the final scenario, dubbed very optimistic by the SCT, the public sector would dedicate $2.3 billion to marine enhancements and these investments would be supplemented by $7.8 billion in private dollars in order to create a total of $10 billion over the 5-year period. Kansas City Southern saw earnings rise significantly in 2007 and plans to invest $200 million on its Mexican corridor projects linking the Port of Lazaro Cardenas to the United States in 2008. These investments include the acquisition of 35 modern locomotives. In addition, KCS "plans to construct a new rail bridge at Nuevo Laredo and another at Matamoros" (Cargo News Asia 2008). Despite a recent falloff in volume, the outlook for the Lazaro Cardenas corridor is favorable, especially for shippers who already have a strong presence in Mexico.

4.7.1 Victoria to Rosenberg Connection

On the U.S. side of the border, there has also been a significant infrastructure enhancement with the restoration of the line on which service had previously been discontinued connecting Victoria and Rosenberg. The restoration of the line cost KCS $173.5 million and will save 67 miles of rail distance for trains moving between Laredo and Houston. The attractiveness of the connection is enhanced by the fact that KCS will no longer need to pay trackage rights to use UP track over this corridor and the savings in transit time, estimated at 4 hours, may make the corridor more attractive for shippers of time-sensitive cargoes (Boyd 2009).

4.8 Asia–Panama or Suez Canal–East Coast

Corridor Overview: *(see point H in Figure 4.1)* While the principal focus on alternative on emerging intermodal corridors that could impact Texas transportation patterns in the future have focused on new West Coast options or the potential of direct deliveries from Asia to the Port of Houston through the newly expanded Panama Canal, there is another distinct option that cargo could be routed to an east coast port of entry and subsequently railed to Texas. This option would entail a longer marine distance for most Asian origins, yet it would result in a shorter overland distance on the comparatively underutilized East Coast rail corridors. An intermodal option through the Port of Savannah, for example might be viable for shipments from India via the Suez Canal or even via the Panama Canal for shippers who have an additional justification, such as a distribution center, near the port.

Key Ports of Entry: Hampton Roads (Maersk Terminal), Charleston, Savannah, Jacksonville

Trading Partners: Southeast Asia, India, Taiwan, and Singapore

Landside Considerations: Improvements such as the addition of intermodal yards along the Heartland Corridor route will improve the efficiency of shipment to Chicago on the Norfolk Southern rail network. Although the placement of these intermodal yards has caused opposition from property owners.

Statewide Planning Considerations: The greatest impact will result if a reverse pendulum routing via the Suez Canal is established. If successful, this could lead to additional strings to East Coast ports such as Charleston and Savannah. Cargo could arrive to Texas by means of the CSX or Norfolk Southern rail corridors. The Suez heartland route could lead to some diversion of cargo that would otherwise enter Texas from the West. The Port of Savannah saw a 20% increase in TEU volume in 2007 to 2.6 million TEUs and is poised to become a more important load center for liner services seeking to make deliveries to Gulf Coast States without entering the Gulf (Port of Savannah handles record level of TEUs in 2007 n.d.).

4.9 Punta Colonet (proposed)

Corridor Overview: *(see point I in Figure 4.1)* The proposed port and rail connection at Punta Colonet can be described as a sub-corridor of the broader Asia–West Coast routing option because, if developed as currently envisioned, it will share many of the key characteristics with the existing West Coast intermodal connection. From the perspective of Texas, cargo that comes through Punta Colonet would be similar to cargo emanating from both Los Angeles and Long Beach. Nevertheless, there would be a few key distinctions.

The first distinctive characteristic of cargo emanating from Punta Colonet is that it would be unlikely to use any rail line other than the Union Pacific. The Union Pacific alignment is more conducive to a proposed connection with Punta Colonet than is the BNSF given that the UP line runs closer to the border in the area where the Punta Colonet connection is projected to cross. Another feature of future Colonet traffic that would make it distinct from traffic using the existing southern California gateways is that this corridor would only be a viable option for shippers who intend to deliver containerized cargo, unbroken and unaltered, to a major inland intermodal hub such as Dallas-Ft. Worth or Chicago. While this type of cargo shipment is a very important component of the total cargo profile for the Ports of Los Angeles and Long Beach, it is not the only type or even the dominant type of cargo shipment handled by the port complex. Rather, shipments are divided into those destined for captive markets in and around the Los Angeles Long Beach area, those that are destined for transloading centers but ultimately destined for a market outside of California, and finally cargoes that will be transferred, usually by rail though not exclusively, to interior markets. (Leachman, Port and Modal Elasticity Study 2005)

The market competition between the Ports of Los Angeles/Long Beach and the future Port of Punta Colonet would not be a competition among equals because the Port of Punta Colonet could not effectively serve these first two markets. Thus, despite its close proximity to the Ports of Los Angeles and Long Beach, the Port of Punta Colonet would not truly compete with these two port facilities in the same way that they compete with each other. Rather, Punta Colonet would compete more directly with Prince Rupert and, to a lesser extent, the ports of the Pacific Northwest. In a comparative analysis of the roles played by the different West Coast gateways, Leachman and Associates argued that traffic flows to the ports of the Pacific Northwest were more elastic in the long run than those to the San Pedro bay, in large part due to the scale economies and large captive market offered by the latter (Leachman 2007). Along these same lines, demand at Punta Colonet would be elastic and could only be successful if it could offer distinct advantages over alternative corridors in terms of lessened congestion, and lower land and labor costs compared with other “alternative” corridor options such as Prince Rupert.

Under one estimation, the shippers most likely to use a direct shipping model, in which there’s little to no reconsolidation near the port of arrival, are shippers of low value per unit of weight commercial goods that are nonetheless containerized. For this reason, the analysis showed that the type of shippers most likely to utilize a direct shipment method were “large nationwide shippers of furniture and building materials” such as Home Depot and Lowes (Leachman, Elasticity Analysis of Asian Imports Through the Ports of Seattle and Tacoma 2007). For large shippers of other high value per unit of weight cargo types, an alternative transloading strategy is proposed that would likely not favor new corridor options such as Punta Colonet due to the lack of distribution infrastructure.

As of the publishing of this report, many of the basic facts surrounding the potential development of the Punta Colonet corridor were still uncertain. After suffering what appeared to be a fatal blow with the emergence of the financial crisis in the fall of 2008, Luis Tellez, the Secretary of Communications and Transportation, declared the project all but dead in January of 2009, shortly prior to his leaving this position. In the summer of 2009, the Colonet project again emerged as a priority, yet pronouncements by the SCT have avoided specifics as to when construction may actually begin (Milenio 2009).

Key Ports of Entry: The future port of Punta Colonet in Baja California, the nearby port of Ensenada

Trading Partners: Key trading partners would likely be from Asia and South America.

Landside Considerations: There is a continuing dispute over land rights around the new terminal. The full proposal includes plans for an entire city built in the vicinity of the port that would eventually include significant distribution capability. Distribution and other value-added industries would be added in the years subsequent to the opening of the marine terminal. Thus, the landside impact would grow in complexity as the terminal matures. For the rail connection to the U.S. system, there is opposition on the U.S. side from agriculturalists who object to potential acquisition of land through eminent domain. Another concern is that if Punta Colonet train traffic is added to an already congested UP line in Arizona, it may simply shift the bottleneck east. Presently, the status of the partnership between marine and landside interests is not solidified. A consortium between Hutchinson port holdings and the Union Pacific Railroad broke down in 2007 due to the inability to find agreement with residents of Yuma, Arizona to accommodate the future rail crossing.

Statewide Planning Considerations: If eventually developed, the net impact would be to increase utilization of the UP transcontinental corridor east of California, leading to possible complications for El Paso. There are opportunities to develop partnerships with inland ports along UP corridor such as the Dallas Logistics Hub. Given the significant infrastructure challenges as well as the uncertain economic climate, the potential for Punta Colonet to have a significant impact on cargo flows in the intermediate future is slight. On the other hand if the Mexican government decides to double down on the project, this may divert resources from other infrastructure priorities thereby slowing their timelines for completion.

4.10 Summary

This chapter described the current characteristics of the main trade gateways for goods entering the U.S. and traveling either through or to Texas. The severe economic recession has caused total international trade to fall and resulted in loss of market share at many of the larger U.S. gateways serving transportation land corridors. Prince Rupert is likely to have a modest impact in Texas, although it will be able to serve Memphis with Korean goods very effectively and this may have a "trickle down" effect for those shippers serving Texas. One major gateway that deserves TxDOT vigilance is Norfolk, Virginia because its new terminal is capable of servicing the largest containerships now operating and its landside link with the Heartland corridor can take goods to the Philadelphia region (via Columbus Inland Port) and the Chicago markets using a shorter, faster, and cheaper rail route. If Post-Panamax megaships serve Norfolk as planned, shipping costs from Asia to the Atlantic coast would fall. This in turn may take business away from the trans-continental rail routes (which pass through Texas) now serving West Coast terminals that not only face future competition from emerging corridors but from gateway competitors nearer to home now eying their business. Texas Gulf port authorities are pinning substantial future trade growth on the enlarged Panama Canal, which will be capable of handling containerships around 10,000 TEU when the new locks are opened in 2014—a century after the canal was first opened. This is the subject of the next chapter.

Chapter 5. Panama Canal Impacts

5.1 Canal History

The idea of a waterway able to connect the Atlantic and Pacific Oceans goes back to the 16th century, when the first crossing of the Isthmus of Panama was accomplished by Spanish explorer Vasco Nuñez de Balboa in 1513. A precursor to the conception of the Canal was the construction of the Panama Railway across the Isthmus, which took place from 1850 to 1855, running 47 miles from Colón, on the Atlantic Coast, to Panama City on the Pacific. The existence of the railway was key in the selection of Panama as the site of the Canal.

The French, shortly after the completion of the Suez Canal in 1869, obtained a concession from the Colombian government to undertake the construction across the Isthmus. At the time, Panama was a province of Colombia. Construction of the sea-level canal (without locks) began on January 1, 1882. The land, which is about 50 miles wide at its narrowest point, represented a much tougher challenge that the constructors could envision. The dense jungle vegetation, the mountains, the heavy rains that caused frequent flooding of the Chagres River, the deep swamp, the heat, and the humidity were only part of the difficulties faced by the constructors. The greater hardship, though, was provided by the diseases: malaria and yellow fever were endemic to the Isthmus, and the state of medical knowledge at the time did not include the fact that mosquitoes are the transmitters of such diseases, which resulted in an estimated 22,000 deaths between 1881 and 1889. The first French enterprise folded in 1893, and a second one took over the following year, but ultimately, construction was abandoned altogether, mainly due to disease and financial difficulties in 1899.

The United States, which had been interested in developing a Central American canal, took advantage of the French subsidy at the Isthmus. However, negotiations with Colombia for a concession were unsuccessful. Thus, the U.S., out of their need to construct the Canal, supported Panama's independence movement. Panama declared independence from Colombia on November 3, 1903. A treaty granting the U.S. the Canal's concession in perpetuity was signed, the French equipment and excavations were purchased for US$40 million, and construction was restarted on May 4, 1904. The project called for an elevated canal, with dams and locks, as opposed to the original French concept of a sea-level waterway. This new idea had the advantage of reducing the total excavation volume necessary to accomplish the interoceanic connection. The route from Limón Bay to Panama City was chosen. By that time, it had been discovered that the diseases that had been so detrimental to the workforce of the French venture were transmitted by mosquitoes. Thus, a substantial investment was dedicated to eradicate the insects, and this proved to be a key component of the project that resulted in its eventual success. The Gatun Locks were constructed near the Atlantic Ocean, and the Pedro Miguel Locks and Miraflores Locks close to the Pacific side of the Isthmus. The Canal's construction was completed in 1914, and it formally opened on August 15, 1914.

In 1977, a new treaty was signed between the U.S. and Panama, granting the Panamanians free control of the Canal so long as the Panamanian administration guaranteed the permanent neutrality of the Canal. This led to full Panamanian control effective on December 31, 1999.

5.2 Demand

Since the Canal opened on August 15, 1914, the waterway has provided transit service to more than 815,000 vessels. The Canal has had over 14,000 transits in each of the last 4 fiscal years. In the 2008 fiscal year, there were 14,702 total transits, accounting for $1,317 million in tolls, and for almost 210 million tons of cargo. Currently, about 30% of the total oceangoing transits are by Panamax-size vessels.

5.3 The Canal's Market Segments

The Panama Canal Authority (ACP) classifies its market into eight segments, depending on the type of cargo and the type of vessels used to transport it, namely:

1) Containership segment: all sorts of products, mainly processed and manufactured goods

2) Dry bulk segment, moved in dry bulk vessels used for transporting grains as well as minerals or their derivatives; sugar, salt, cement

3) Vehicle carrier segment

4) Liquid bulk segment: vessels transporting chemical products, fuel, gases and oil derivatives

5) Reefer segment: fruit, meat, dairy

6) Cruise ship segment: passengers on leisure trips, who see the Canal and Panama as a touristic attraction

7) General cargo vessel segment: a variety of products in small lots, serving regional routes

8) Miscellaneous vessel segment: fishing boats, navy and research vessels, and dredges and barges

There has been a steady increase in the tonnage going through the Canal for each segment. Historically, the dry and liquid bulk segments have generated most of the Canal's revenues. However, in recent years the containership segment has seen a dramatic increase, to the point of becoming the main driving force of Canal traffic growth (Figure 5.1). Containers account for the highest number of transits, highest amount of tolls, as well as for the highest number of TEUs.

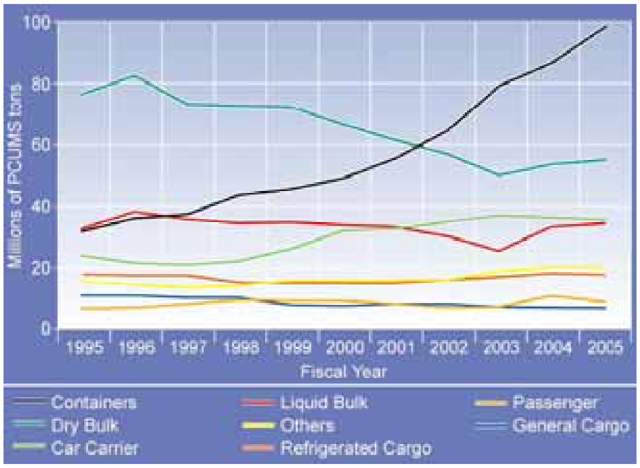


Figure 5.1: Historic Tonnage of Market Segments Through the Canal

The growth of the containership segment is a result of an increase in the number of transits of this type of vessels through the Canal, but mainly it is a consequence of the increasing size of vessels that the segment uses.

Table 5.1 shows the expected growth in traffic through the Panama Canal both with and without the expansion, projected 20 years into the future.

During fiscal year 2005, the containerized segment moved 98 million tons as measured under the Panama Canal/Universal Measurement System (PC/UMS), i.e., 35% of the total PC/UMS volume passing through the Canal, representing 40% of its revenues. That same year, the dry bulk segment represented 55 million PC/UMS tons and 19% of the revenues, while the vehicle carriers segment accounted for 35 million PC/UMS tons and 11% of the income.

Table 5.1: Expected Growth in Tonnage through Panama Canal 2005–2025 *(In Millions)*

Market Segment	**2005 Tons**	**Year 2025 Tons**	
		Without Expansion	**With 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
Other	20	6	8
TOTAL	**279**	**330**	**508**

Source: Panama Canal Authority, 2006

Projections indicate that, in the most probable demand scenario (shown in Table 5.1), the Canal's PC/UMS tonnage volume will almost double in the next 20 years, increasing by an average of 3% per year. This scenario is consistent with a 3.5% annual increase of the Canal's tolls that would result in a doubling of present tolls by 2025. The Canal containerized cargo will increase at an average annual rate of approximately 5.6%, from 98 million PC/UMS tons in 2005 to nearly 296 million in 2025.

Container shipping activities have experienced the highest growth in the larger vessels, especially the ones able to carry 7,000 TEUs or more, which currently do not fit through the Canal.

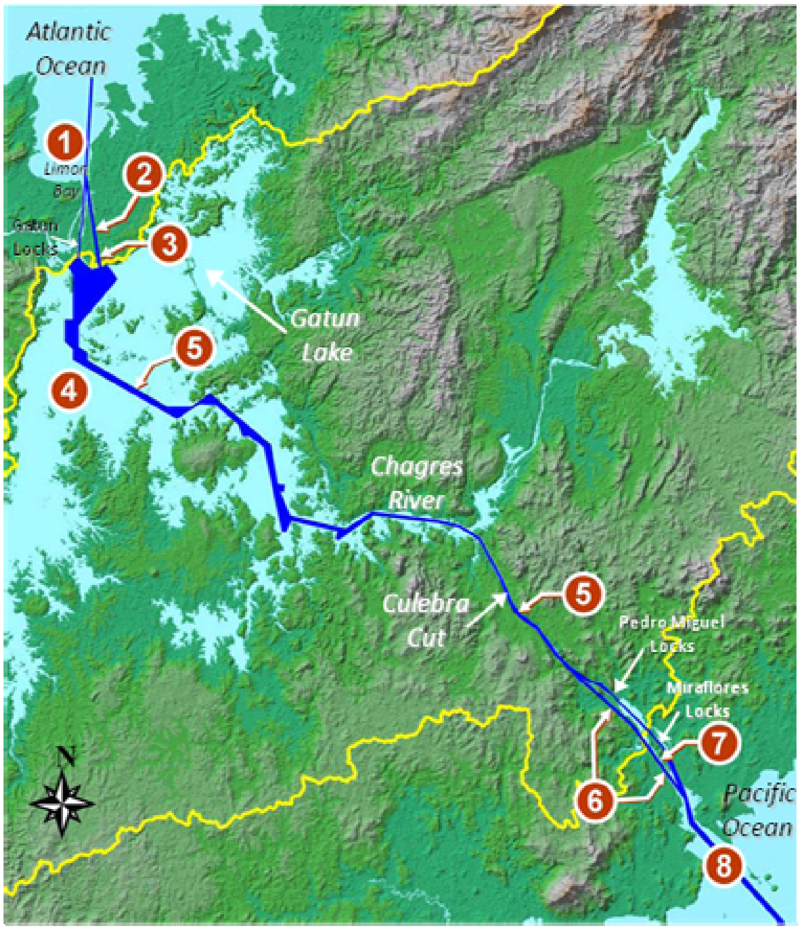
The vehicle carrier and cruise ships segments will have an average annual growth of between 2% and 3% in terms of PC/UMS volume. The dry bulk segment will grow at an average annual rate of approximately 1% during the next 20 years (Table 5.1).

5.4 Expansion Project

After almost a century of successful operation, the Canal faces potential problems, related to its physical limitations and the increasing size of cargo ships. The maximum size of ships that can use the canal is determined by the dimensions of the lock chambers (110 ft. by 1050 ft.). As of 2006, more than 45% of the ships using the Canal matched the lock dimensions; these ships are known as Panamax vessels. Many shippers attempting to satisfy the current worldwide trading demands would need to utilize Post-Panamax (larger than allowed by the Canal's lock dimensions) vessels. The Canal's traffic is soon expected to approach its maximum capacity. Additionally, the number of larger (close to Panamax-sized) ships transiting the canal is increasing steadily. Realizing these issues, the ACP has taken action to increase its capacity, by means of the expansion project. The expansion project consists of three major components:

1. The construction of two new lock facilities, one on the Atlantic side, and one on the Pacific side
2. The excavation of new access channels to the new locks and the widening of existing channels to accommodate larger ships
3. The deepening of navigation channels and the elevation of Gatun Lake's maximum operating level

The project is designed to allow for an anticipated growth in traffic from 280 million PC/UMS tons in 2005 to nearly 510 million PC/UMS tons in 2025; the expanded canal will have a maximum sustainable capacity of approximately 600 million PC/UMS tons per year. Figure 5.2 shows a map of the Panama Canal with expansion elements noted.



1. Deepening and widening of the Atlantic entrance channel

2. New approach channel for the Atlantic Post-Panamax locks

3. Atlantic Post-Panamax locks with three water-saving basins per lock chamber

4. Raising of the maximum Gatun Lake operating water level

5. Widening and deepening of the navigational channel of the Gatun Lake and the Culebra Cut

6. New approach channel for the Pacific Post-Panamax locks

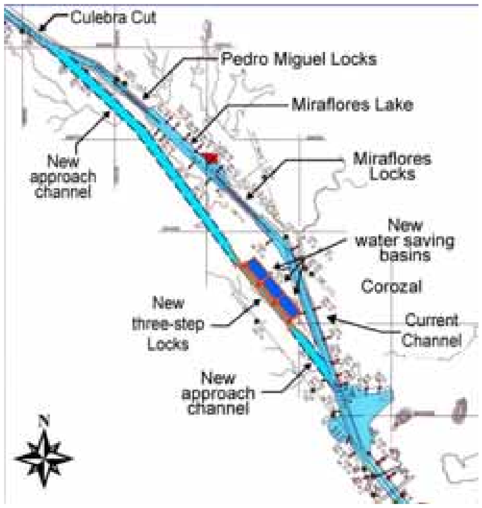
7. Pacific Post-Panamax locks with three water-saving basins per lock chamber

8. Deepening and widening of the Pacific entrance channel

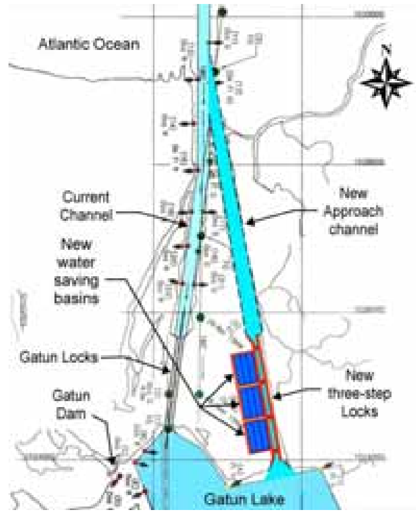
Figure 5.2: Map of the Panama Canal's Expansion Elements

5.5 New Locks

In its current condition, the Canal has two lock lanes. The expansion will add a third lane, by means of the construction of two lock facilities, one at each end of the Canal, i.e., one on the Pacific end, south of the Miraflores Locks (Figure 5.3a), and the other one on the Atlantic end, on the east side of the Gatun locks (Figure 5.3b).



(a)



(b)

Figure 5.3: New Locks Proposed for the (a) Pacific Ocean Side, and (b) Atlantic Ocean Side

Each of the new lock facilities will have three consecutive chambers (Figure 5.4), designed to move vessels from sea level to the level of Gatun Lake and back down again. Each chamber will have three lateral water reutilization basins, for a total of 9 basins per lock and 18 basins in total. The new locks and their basins will be filled and emptied by gravity, without the use of pumps.

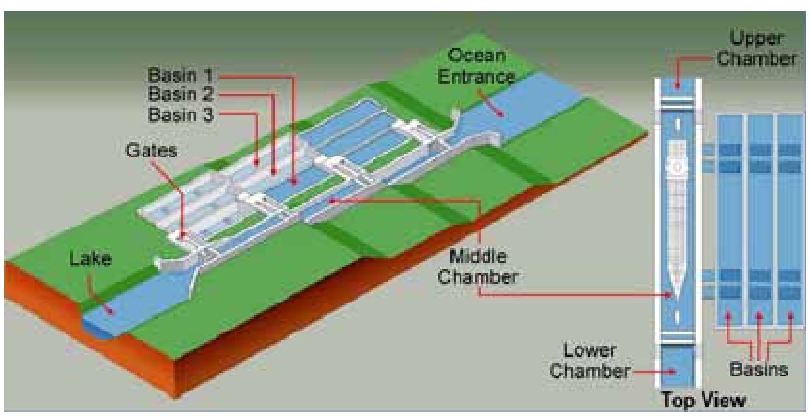


Figure 5.4: Schematic of the New Locks Proposed for the Panama Canal Expansion

The new locks and their channels will form a navigation system that will be integrated into the existing locks and channels system, which will continue to operate. The new lock's chambers will be 1,400 ft (427 m) long, by 180 ft (55 m) wide, and 60 ft (18.3 m) deep, which is large enough to allow the traffic of vessels equivalent in size to a ship carrying around 12,000 TEUs. The new locks will use tugboats to position the vessels instead of locomotives.

5.6 Schedule

It is estimated that the new locks could begin operations between fiscal years 2014 and 2015. The proposal to expand the Canal was approved in a national referendum by approximately 80% on October 22, 2006. Funds availability for the project construction was secured in December 2006. Construction of the project started on September 3, 2007, when the first blast took place to expand the Culebra Cut.

The schedule is divided in two main phases: the preconstruction phase and the construction phase. The preconstruction phase includes the development of final designs, physical models, specifications and contracts, contractor pre-certification, and finally, contractor selection. For the locks component of the project, this phase could last between 2 and 3 years. Dry excavation and the dredging of channels have already started.

The construction phase includes the simultaneous construction of both lock facilities with their water reutilization basins, dry excavation of the new access channels, and dredging of both new lock access channels and Gatun Lake navigational channels, as well as of the sea entrances. Building the locks will take between 5 and 6 years. An illustration of the summarized project schedule is shown in Figure 5.5.

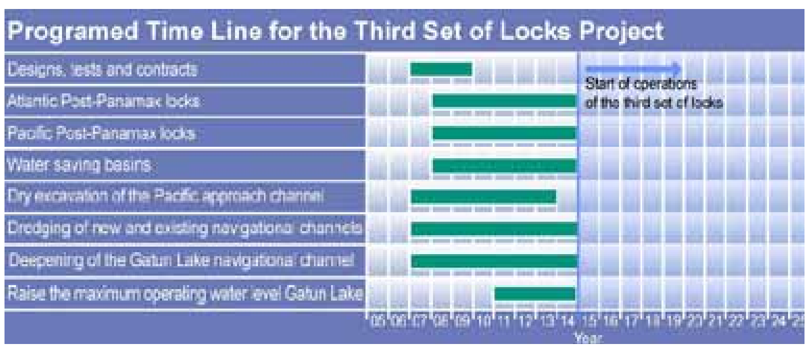


Figure 5.5: Panama Canal Expansion Summarized Project Schedule

5.7 Estimated Cost

The construction cost of the expansion project is estimated at approximately $5,250 million (shown in Figure 5.6, with a breakdown into the main project components).

Project Components	Investment Estimate*
New Locks	
Atlantic Locks	1,110
Pacific Locks	1,030
Contingency for New Locks**	590
Total for New Locks	**2,730**
Water Saving Basins	
Atlantic Water Saving Basins	270
Pacific Water Saving Basins	210
Contingency for Water Saving Basins**	140
Total for Water Saving Basins	**620**
Access Channels for New Locks	
Atlantic Access Channels (Dredging)	70
Pacific Access Channels (Dry Excavation)	400
Pacific Access Channels (Dredging)	180
Contingency for Access Channels**	170
Total for New Locks Access Channels	**820**
Existing Navigational Channel Improvements	
Deepening and Widening of Atlantic Entrance	30
Widening of the Gatun Lake Channels	90
Deepening and Widening of Pacific Entrance	120
Contingency for Existing Channel Improvements**	50
Total for Navigational Channel Improvements	**290**
Water Supply Improvements	
Increase the Maximum Level of Gatun Lake to 27.1m (89') PLD	30
Deepening of the Navigational Channels to 9.1m (30') PLD	150
Contingency for Water Supply Improvements**	80
Total for Water Supply Improvements	**260**
Inflation During the Construction Period* **	**530**
Total Investment	**5,250M***

*Millions of Balboas, rounded to the nearest tenths
**The contingency includes possible variations for each component
***Assumes a general inflation of 2% per year above what is included in the contingency

Figure 5.6: Estimated Cost for Canal Expansion Project

This estimate includes design, administrative, construction, testing, environmental mitigation, and commissioning costs. Additionally, there is a contingency cost element associated to each component, which covers risks and unforeseen events such as accidents, design changes, price increases, and possible delays, among others. The project's estimated cost also includes the effect of inflation during the construction period. The most important item in the estimate is the cost of constructing the two new lock facilities—one on the Atlantic side and the other on the Pacific side—with estimated costs of approximately $1,110 million and $1,030 million each, plus a $590 million provision for possible contingencies during their construction. In total, the estimated cost for the new locks, including their water reutilization basins and contingencies, is $3,350 million. An estimated $530 million has been considered for inflation during the construction period.

5.8 Financing the Locks and Canal Tariffs

The expansion of the Canal is devised as a self-financing program, and will not burden the country's economy. Furthermore, it is expected that the waterway's contribution to the National Treasury will be maintained, given that the expansion will result in additional revenue. Funds for the expansion project will be obtained through tolls increases. Ultimately, tolls will be the source of all funds to be used for the payment of investments related to the third set of locks and for the repayment of its financing. The ACP has not established a toll schedule for the future; its policy is that the time and amount in which the toll increases will take place will be determined by the project's financing requirements, as well as the operating costs and the competitiveness of the market for the Canal.

The financing of the project will come from a combination of ACP's funds, resulting from toll increases, and external financial sources to cover peaks during construction. Revenue obtained from the Canal's operations once the project is completed will allow for the repayment of external financing in 8 years or less, according to ACP's estimations.

The ACP internal resources are capable of financing at least $150 million per year throughout the completion of the project. The new project investment program will require average investments in the amount of $650 million per year. Therefore, the Canal will require approximately $500 million per year in additional funding to cover program requirements, which will be provided by a combination of additional revenues from the toll increase derived from the pricing policy mentioned, and from credit and financial sources that ACP may obtain in the financial markets. Accordingly, the ACP has increased the tolls since 2007 (Table 5.2). As a supplement to the tolls increase, and in order to cover costs during the critical project construction peak in the 2009–2011 period, it is anticipated that the ACP will need to acquire temporary external financing.

Evidently, the toll increases cannot solely be determined by the needs of the construction project. The combination of additional financing from toll increases and external financing will cover the project costs, but the tolls must take into account the maritime transport market conditions as well as the prevailing financial market conditions, such as interest rates, periods and terms, and financing costs. If higher tolls are implemented, there would be less need for external financing; conversely, if the market dictates that tolls cannot be increased to match the demands of the construction project, there will be a greater need for external financing. In this sense, in accordance with the most conservative policy for increasing tolls of 3.5% per year, the amount of external financing required to cover the project's peak construction period will not exceed $2,300 million.

On the other end of the tolls' spectrum, if an 8% yearly increase is applied during the first 5 years of the project, the need for external financing to cover the peak construction period would be of approximately $1,500 million. Table 5.2 presents the tolls increases since 2007.

Table 5.2: Panama Canal Tolls

Market Segment		2007				2008				2009			
		Effective 1st of				Effective 1st of				Effective 1st of			
TEU Toll													
Full Containers	Laden	May	54.00			May	63.00			May	72.00		
	Ballast		43.20				50.40				57.60		
On-Deck Container Toll in other vessels	Laden	May	54.00			May	63.00			May	72.00		
Toll per berth													
Passenger Vessels 1/	Laden	October	100.00			October	115.00			October	120.00		
	Ballast		80.00				92.00				96.00		
Tolls per PC/UMS Ton													
		Effective 1st of	1st 10K	2nd 10K	Rest	Effective 1st of	1st 10K	2nd 10K	Rest	Effective 1st of	1st 10K	2nd 10K	Rest
General Cargo	Laden	Jul	3.26	3.19	3.14	May	3.63	3.56	3.50	May	3.90	3.82	3.76
	Ballast		2.59	2.53	2.49		2.88	2.82	2.77		3.10	3.03	2.98
Refrigerated Cargo	Laden	Oct	3.39	3.32	3.26	Oct	3.80	3.72	3.65	Oct	3.80	3.72	3.65
	Ballast		2.69	2.63	2.59		3.01	2.95	2.90		3.01	2.95	2.90
Dry Bulk	Laden	Jul	3.20	3.13	3.08	May	3.50	3.43	3.37	May	3.73	3.65	3.59
	Ballast		2.54	2.48	2.44		2.78	2.72	2.67		2.96	2.90	2.85
Tankers	Laden	Jul	3.29	3.22	3.16	May	3.70	3.63	3.57	May	3.98	3.92	3.85
	Ballast		2.61	2.55	2.51		2.94	2.88	2.83		3.18	3.11	3.05
Vehicle Carriers	Laden	Jul	3.24	3.18	3.12	May	3.60	3.52	3.46	May	3.87	3.79	3.72
	Ballast		2.57	2.52	2.47		2.86	2.80	2.75		3.07	3.01	2.95
Passenger Vessels 2/	Ladden	Oct	3.39	3.32	3.26	Oct	3.80	3.72	3.65	Oct	3.95	3.87	3.80
	Ballast		2.69	2.63	2.59		3.01	2.95	2.90		3.14	3.07	3.02
Others	Laden	Jul	3.32	3.25	3.19	May	3.78	3.70	3.64	May	4.12	4.04	3.97
	Ballast		2.63	2.58	2.53		3.00	2.94	2.89		3.27	3.20	3.15
Tolls per Displacment Ton													
Displacement		Jul	1.84			May	2.09			May	2.28		

Notes:
1/ Vessels above 30,000 gross tons (GRT) and whose PC/UMS tonnage divided by maximum passenger capacity (PAX-ITC) ratio is less than or equal to 33, shall pay tolls on a per berth basis. If such ratio is greater than 33, tolls shall be paid on the basis of PC/UMS tonnage. Vessels below or equal to 30,000 GRT shall also pay on the basis of PC/UMS tonnage.

Source: Panama Canal Authority

5.9 Progress

The expansion project started in September 2007 and has progressed steadily ever since. According to the latest press release from the ACP, issued on April 23, 2009, the expansion project is on-time and on-budget. In the press release, the ACP acknowledges that the shipping industry is currently experiencing tough times, due to the prevailing global economic uncertainties, but the ACP continues to monitor trends and make adjustments where necessary to ensure that the progress of the construction is maintained.

Since the project started, the ACP has issued quarterly reports detailing the advancement recorded on the various administrative and financial tasks as well as excavation, dredging and construction of the project. The project development, at the beginning, occurred mainly in the administrative, managerial, and legal areas (contracts), as the project was in the preconstruction phase referenced above. However, as the project has moved into the construction phase, work is already underway in the areas of excavation and dredging.

As in every construction project, and especially in endeavors of this magnitude, there have been some unforeseen difficulties that have caused temporary delays, but the ACP has been prompt to request the contractors that have more resources—personnel and/or equipment—are allocated to specific tasks to make up for the lost time and make sure the project gets back on schedule. A considerable number of contractors are participating in this project, many of them being international companies with numerous resources. And in many instances, the expertise and workforce of individual construction companies is not enough to tackle certain tasks, leading to the creation of numerous consortia that are taking part in tasks such as the excavation, design of the locks and construction of dams.

To date, substantial progress has been made on environmental studies, the excavation of the Pacific Access Channel, dredging of the Gatun Lake, relocation of the Borinquen Highway and the divergence of the Cocoli River, the removal and relocation of electrical utilities, telecommunication lines, water lines, sanitation lines, ducts and sewers, archaeological works, construction of the Pacific and Atlantic field offices to be used by ACP personnel and consultants, and the dredging of Culebra Cut.

March 2009 signaled a significant milestone for the project, when the ACP received bids from three world-renowned consortia vying to design and build the new locks. The bids are currently being evaluated and a decision will be made in the coming months.

Nevertheless, there have been some setbacks, which have occurred mainly due to inaccurate estimations of the size of the tasks. In such cases, adjustments have been made to the amount of work, resulting in modifications to schedules and budget. However, these have only happened at the level of individual tasks, as the overall schedule, according to the ACP, has kept the opening date as 2014 and the total cost estimate is still $5.25 billion.

Even though optimism prevails in most of the construction progress reports, the ACP has not been immune to criticism. Most of it pertains to three aspects of the project, namely:

1) Doubts about the bidding process. The ACP chooses the lowest bids. Critics indicate that once the decisions are made, the contracts are awarded. Then profits are increased through add-ons to the contracts. These add-ons can substantially increase the price of the winning bid. A number of instances of this nature have been reported. Also there have been instances of conflicts of interests occurring between ACP officials and companies being awarded contracts.

2) Underestimation of the total cost of the project. Several reviewers reported that the initial budget was a very low estimation of the actual cost, considering the magnitude of the construction endeavor. The purpose of issuing such a widely optimistic figure was to entice the population to approve the project in the 2006 referendum. Furthermore, if the prices of the individual contracts are being adjusted by add-ons as explained in the previous point, such increases will eventually materialize in a higher total project cost.

3) Undertaking the project. Many observers questioned, especially prior to the referendum, whether proceeding with the expansion project was in the best interest of the Panamanian people. The argument was that the expansion project originated from other countries' commercial interests, as it was only necessary to satisfy the demands of the shipping companies from abroad, mainly from the U.S., and that it was not going to necessarily benefit the Panamanians as the owners of the Canal.

5.10 Current Canal Operations

Statistics for the second quarter of fiscal year 2009 were recently released. Herein, some relevant figures are compared to those from the second quarter of 2008. Transits through the Canal have remained fairly constant. Vehicle carriers represent the principal segment mostly affected by the economic crisis, but projections already indicate traffic increases for next year.

Total Canal transits slightly decreased 1.4%, to 3,914 transits from 3,971. Transits of larger ships that require greater time and navigation skills to traverse the Canal declined 2.9%, to 1,815 transits from 1,869.

With regard to market segments, general cargo, dry bulk and tanker transits increased, while refrigerated (reefers), container, vehicle carrier and passenger transits decreased

The Panama Canal/Universal Measurement System (PC/UMS) tonnage remained nearly constant with a slight 3.3% decline to 75.7 million PC/UMS tons from 78.4 million PC/UMS tons.

Utilization of the reservation booking system decreased 15.6%, to 79.56% utilization from 94.31%. Because of this particular statistic, the ACP has announced a temporary modification to the booking system. The temporary measures will take effect on June 1, 2009, and continue through September 30, 2009. These measures consist of two primary components.

- A redefinition of ballast (ships without cargo) for full container vessels transiting the Canal;
- Modifications to the Reservation System to increase flexibility and reduce fees.

5.10.1 Temporary Redefinition of Ballast for Full Containerships

The new definition of ballast for full container vessels will allow a ship that carries 30% or less of its capacity to be charged the ballast rate of $57.60 per TEU, $14.40 less than the $72 laden (ships with cargo) rate.

5.10.2 Temporary Modifications to the Reservation System

- Reservation Fee Reduction: The base reservation price is reduced depending on the vessel size for all segments that use the ACP's Reservation System.
- Late Arrival Fee Reductions: Currently, when vessels fail to arrive on-schedule, they lose their slot, but have the option to pay an additional charge to keep the reservation and transit that same day. The new temporary measure reduces the charges and provides shipping lines with greater flexibility. The percentage reduction varies depending on the vessel's arrival time.
- Flexibility for Slot Substitutions: Canal customers will now have 30 days before the date of a vessel's transit to request slot substitutions without additional costs. Previously, customers could make such requests without an additional charge if that request was made at least 60 days prior to the date of transit.

5.11 Final Thoughts

It is clear that the planned increase in canal lock capacity will stimulate steamship companies with Post-Panamax vessels to determine the viability of developing new routes using the new lock system. The Canal Authorities have shown a recent willingness to modify passage fees to at least partly address the current financial constraints facing the maritime industry. Texas Gulf deep water ports have great expectations riding on the impact of the new canal locks, due to open in 2014. Previous CTR work (Harrison, et al. 2000) concluded that it would be some time before the so-called mega-containership (9000 TEU plus) would directly call at Texas terminals (see Box 5.1). That analysis, conducted a decade ago, still seems relevant since the earliest date such vessels could operate would be mid-2014. Even then, the volumes of containers at Texas ports may not justify the cost of routing the large ships directly to Texas Gulf terminals. Forecasts made in a 2008 CTR/TxDOT report predicted a total container volume at Houston of around 2.4 million TEU, which would not make it a true load center capable of justifying a mega-containership service. At the beginning of this report, we mentioned of the importance of the economies of scale in container shipping. As volumes increase, average TEU per nautical mile falls with ship size. But other costs—which must be combined with the revenue side—increase. Vessel operating costs are a major element in this category and to assist in the economic evaluation of current emerging corridor marine segments, it is necessary to estimate their magnitude. This is addressed in the next chapter.

> **Box 5.1 Mega-containerships in the Gulf?**
>
> "It seems unlikely that such ships will be placed into regular Gulf port liner service any time soon. Load centers at Freeport (Bahamas) and Panama City make more sense given load densities. Texas boxes can then be transshipped to smaller vessels serving a variety of Texas port terminals."
>
> Harrison et al.. 2000

Chapter 6. Marine Cost Model

6.1 Marine Costs

The cost of marine transportation within a given trade lane depends on a number of factors. The marine market is highly dispersed and serviced by a wide variety of vessels that provide connections around the world. The global fleet of container vessels—the primary focus of this analysis—makes up approximately 13% of the world fleet. At the beginning of 2008, there were 4,276 containerships with a total capacity of 10.76 million TEUs, or 144.66 million tons of cargo (Deadweight Tons, or DWT) (United Nations 2008).

While liner companies are required to file tariff rates with the Federal Maritime Commission, they are also allowed to negotiate specific arrangements with individual shippers that may differ from the official rates. Individual arrangements are kept secret. Without access to carrier's proprietary data, it is not usually possible to compare the real rates for more than a few select high-traffic pairs of ports. Given that rates are ultimately determined in relation to the various input costs for marine transportation, a focus on costs was deemed more useful in understanding the factors that drive corridor selection.

Prior to 2002, the U.S. Army Corps of Engineers worked with a private consultant to publish a document every few years that provided physical and costs characteristics for a wide variety of vessels. After 2002, the Corps agreed with the consultant to treat the data as confidential and ceased to make it public. Despite the surge of new building activity that occurred in recent years, in general turnover in the global vessel fleet is a slow process. It is therefore possible to use the physical characteristics of vessels included in the Corps' information regarding dimensions, sailing speed, fuel consumption, and similar items. However, the specific 2002 cost information is no longer valid.

In order to get a reasonable approximation of current marine costs, a source outside of the public domain must be used. For purposes of this analysis, the chosen source was "Ship Operating Costs Annual Review and Forecast—2008/09" by Drewry Shipping Consultants.

It must be recognized that a number of very large containerships (8,000 TEUs or greater) have been delivered in the last 2 years and many more are on order. There has been comparatively little data published on the operating costs of these vessels because there are still comparatively few in existence and they were not in service at the time the U.S. Army Corps of Engineers stopped publishing its publically available cost data. These ships are only used in very high traffic lanes, primarily China–West Coast, and SE Asia–Europe. The data obtained from the Corps only covers the fleet up to about 6,500 TEUs. However, a high percentage of the world fleet is much smaller than these large vessels and carries a very high percentage of the global trade. Furthermore, these ships cannot call on Gulf ports because of draft restrictions, and can call only a few East Coast ports. Therefore, this analysis does not explicitly address the operating costs of very large ships.

Vessel costs fall into two main categories: (1) the costs related to vessel acquisition and financing, and (2) the costs that are associated with operating the vessel. Oceangoing vessels are quite often leased to liner companies, typically on a time charter basis. This means the risk of investment in the asset is borne by the lesser and the liner company (lessee) can limit its risk. Regardless of the actual ownership of the vessel, the cost of the vessel must be recovered. The user of the vessel is going to cover that cost by either purchasing the vessel or paying a charter rate that covers the cost of the vessel.

Operating costs are split between fuel costs and all other operating costs. As with rail services, these costs are route dependent. Costs can vary significantly from region to region. The largest single expense item in recent years is bunkers (marine fuel).

6.1.1 Methodology

Model Assumptions:

- Dedicated container vessels are the only vessels included
- Vessel dimensional characteristics and fuel consumption have not changed significantly since 2002

The model allows the user to input the following parameters:

- Cargo weight per container (the default is 28 tons per FEU not including the tare weight for the container)
- Tare weight per container (the default is 4 tons per FEU)
- Number of containers transported
- Percent of containers that are loaded
- TEU capacity of the ship
- Distance of the voyage
- Price per ton of fuel
- Actual speed of the vessel
- Useful life of vessel
- Salvage value of vessel
- Interest rate for capital investment recovery
- Port charges

Cargo and capacities are entered as TEUs and are converted to tons using the weight per container information. In order to be able to compare the cost of marine shipments and rail or truck shipments, the voyage cost data is converted to a ton-mile basis and a TEU basis. Ton-miles are rarely used in the marine industry, but this is the measure most commonly used in the trucking industry, and in this study the railroad data is also reported on a ton-mile basis.

The cost components analyzed in the model include:

Bunker Fuel: The standard fuel used by marine vessels today is IFO 380cst. This may change in the future as nations begin to enforce a low sulfur requirement, but for now this is the standard.

Manning Costs: The cost of crewing the vessel includes both officers and enlisted personnel (ratings). Because of mandatory days off and limits on the length of work days, a certain number of personnel must be on board at all times, although only a percentage of this crew will actually be on duty at any given point in time. The costs used in the model are for onboard personnel. The number does not vary greatly by size of containership.

Hull & Machinery Insurance: This is insurance on the vessel itself, along with the machinery and appurtenances.

P&I (Protection and Indemnity) Insurance: This insurance covers a ship owner's or operator's liability to others and it generally excludes damage to the insured's own property.

Maintenance and Repairs: This includes costs to keep the vessel in the condition laid down through mandatory standards and the day-to-day routine maintenance costs.

Stores, Spares, and Supplies: The largest single element in this category is lubricants. Other items include paintings and coatings, food, spare equipment parts, and the like.

Management and Administration: This category includes functions related to the vessel itself as well as to the administrative aspects of the business to which the vessel's earnings need to contribute. Management of the vessel includes the financial and administrative aspects of maintaining a profitable income stream along with the aspects involved in keeping the ship's hardware functioning.

Canal Fees: Depending on the specific routing chosen, a vessel may be required to pay fees for using the Panama Canal or the Suez Canal. These fees are based on the capacity and dimensions of the vessel although the methods used to determine the toll rates are different for the two canals.

Keep in mind that these are estimated costs only. In reality, there are a multitude of charges against the vessel and the cargo owner on any given voyage, and many of these charges vary significantly depending on the port of call. The charges included in the model constitute a high percentage of total costs, but are not 100%.

Using the model and these cost factors, it is possible to analyze the influence of the following factors on waterborne shipping costs:

- Fuel price
- Trip length
- Number of TEUs

6.1.2 Fuel Price

In order to analyze the effect of the cost of fuel, a voyage from Hong Kong to Los Angeles was chosen as the base case. Table 6.1 presents the assumed parameters.

Table 6.1: Assumed Parameters

Scenario	
Price of Fuel ($)	Varied
Distance (nautical miles)	6,300
TEU capacity	4,500
TEUs carried	4,000
Percentage TEUs loaded	90
Tons per container (FEU)	28
Speed (knots)	23
Travel Time (days)	11.41

The price of fuel was varied from $350/ton to $700/ton in increments of $50/ton. The effect of the rise in fuel cost on the total cost per ton-mile is shown in Figure 6.1.

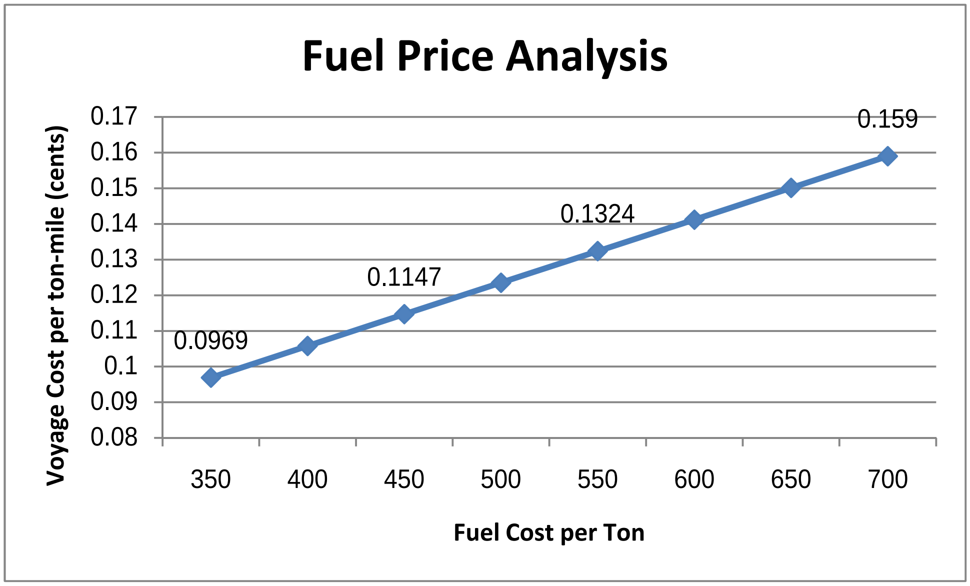


Figure 6.1: Effects of Rising Fuel Costs on Total Cost per Ton-mile

It can be inferred from Figure 6.1 that for each $50 per ton increase in the cost of fuel, the voyage cost per ton-mile increases slightly less than 0.0089 cents. Total cost (not shown) increases at a constant rate of $74,000 per voyage.

When fuel costs as a percentage of total costs are compared to other cost elements, the slope of the curve is no longer constant. Figure 6.2 shows that fuel cost as as percentage of total cost increases at a decreasing rate as the price of fuel rises. This is due to the fixed nature of some of the cost elements associated with marine shipping. These costs do not vary with increasing fuel prices and therefore limit the effect of rising fuel prices on total voyage costs.

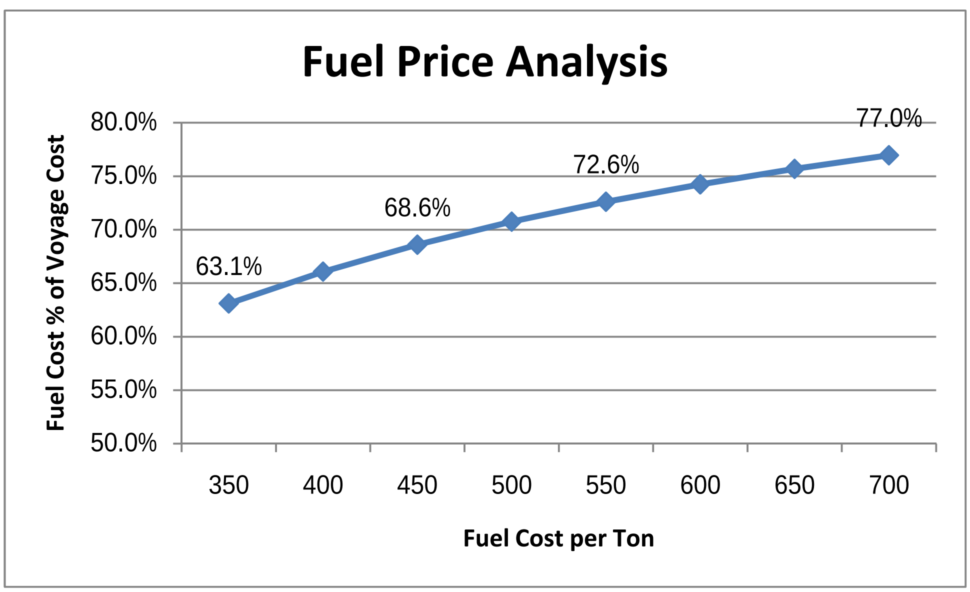
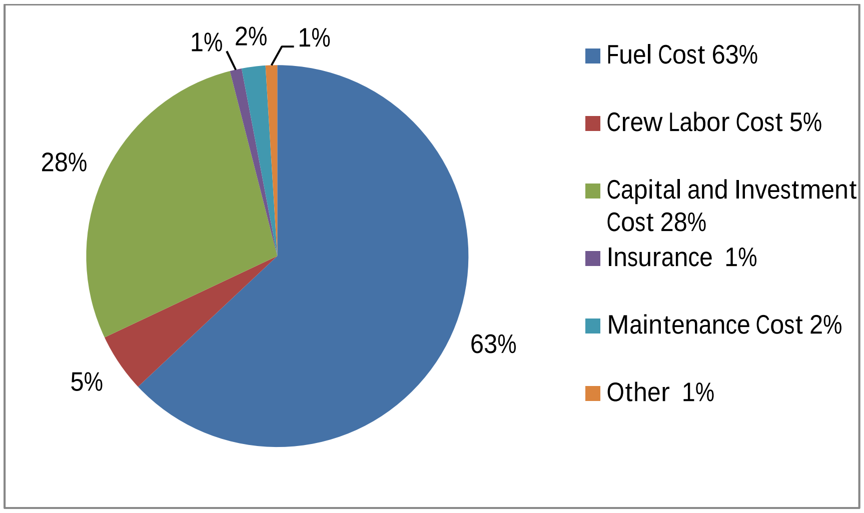


Figure 6.2: Fuel Cost as Percentage of Total Cost

Figure 6.3 shows the cost breakdown in percentages.

Fuel Price at $350/ton



Fuel Price at $700/ton

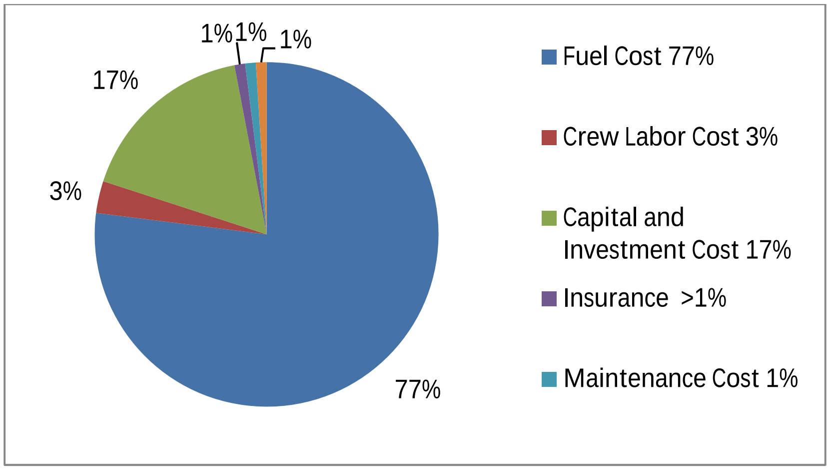


Figure 6.3: Fuel Price Breakdowns

The dominance of fuel costs compared to other inputs that occurred in the summer of 2008 shows why carriers began to adopt “slow-steaming” as a strategy to lower the fuel impact of total costs. The net effect of slow steaming is that the carrier usually must add an additional vessel to the string. For example, the standard Asia–Europe string that required eight ships prior to the beginning of slow steaming now requires nine vessels in order to keep the same schedule frequency. The vessels consequently drop their cruising speed from 25 knots to 19 or 20 where fuel consumption is optimized. By August of 2008, 75% of Asia–Europe strings had added a ninth vessel to utilize this strategy (Journal of Commerce 2008). Unlike earlier generations of Economy ships that were designed to sail at these slow speeds, the vessel that is voluntarily limiting its speed always has the option to speed up if it is running behind schedule or is attempting to keep a pre-designated slot in the Panama or Suez Canal. While slow steaming was widely adopted to counteract high fuel costs, it likely could not have been widely adopted nor sustained had not the issue of overcapacity in the liner industry already been looming (Marston 2008). While it may be economically justified to idle capacity, a line that idles too much capacity can be viewed with suspicion by investors and rating agencies. Slow steaming allowed some lines to find a way to keep their capacity occupied while at the same time saving fuel. For this reason, when the economy declined and led to a subsequent fall in oil prices, the practice of slow steaming did not end. Over the long run, there are concerns that slow steaming may have unforseen implications for engine maintenance because the vessels were designed to operate at 85% of their maximum capacity and slow steamers operate at approximately 70% (Marston 2008).

6.1.3 Trip Length

Trip length was varied from 5,500 nautical miles to 7,500 nautical miles in 200-mile increments. The justification for this variance is to approximate the sailing fuel cost impact of diverting to alternative ports of entry such as Seattle/Tacoma or Oakland, which would be a shorter option or to quantify the fuel cost penalty from a longer marine journey to use Punta Colonet or Lazaro Cardenas as a Port of entry. The results, shown in Table 6.2, demonstrate the influence of increased trip length on fuel consumption and per ton-mile costs.

Table 6.2: Results of Increased Trip Length

Scenario	
Price of Fuel ($)	$350/ton
Distance (nautical miles)	Varied
TEU capacity	4,500
TEUs carried	4,000
Percentage TEUs loaded	90
Tons per container (FEU)	28
Speed (knots)	23
Travel Time (days)	11.41

The results of the analysis showed that the cost of the shipment per ton-mile or TEU varies directly with distance on a straight-line basis (the change in cost varies negligibly with each increment in distance). This is due to two primary factors:

1. Marine shipments are over very long distances with very high tonnages. Therefore, a breakdown of costs by ton-mile or TEU results in extremely small fractions of the total cost.

2. A high percentage of costs incurred by vessel operators are variable costs. Since fixed costs are a relatively small percentage, they do not influence the curve to a noticeable degree.

6.1.4 Number of Loaded TEUs

The analysis of loaded TEUs is slightly more complicated than the previous analyses. Vessel operators make every attempt to match the size of their vessel to the amount of cargo they expect to carry on a given route, yet precisely matching the vessel size to the amount of cargo to be carried on every voyage is not always possible. Therefore, as the amount of cargo increases, so does the vessel size, in many cases the number of loaded containers being carried is significantly less than the vessels' rated capacity. Therefore, the degree to which the vessel is loaded varies and this greatly influences the cost curve on a per loaded TEU basis. For purposes of this analysis, it is assumed that the number of TEUs will be 90% of the total vessel capacity in TEUs. The number of TEUs is varied from 2,000 to 5,500 in increments of 500. Results are shown in Table 6.3.

Table 6.3: Results of TEU Variation

Scenario	
Price of Fuel ($)	$350/ton
Distance (nautical miles)	6,300
TEU capacity	Varied
TEUs carried	Varied
Percentage TEUs loaded	90
Tons per container (FEU)	28
Speed (knots)	23
Travel Time (days)	11.49

Figure 6.4 shows that the cost per TEU transported decreases as the number of TEUs carried increases (and therefore the vessel size) due to economies of scale. The slight upward blip at the end of the chart results from the fact that as vessel sizes go beyond the 5,500 to 6,000 TEU range, the data on operating costs become less comprehensive and the size ranges for which data are reported increase. The literature indicates that due to savings in energy costs and labor costs, even up to sizes beyond 10,000

TEUs the cost per TEU should continue to drop yet the marginal gain from the increase in scale clearly higher between 2,000–4,000 TEU. Thus, the difference between Post-Panamax and Panamax is not as compelling as the difference in operating efficiency between small container vessels and Panamax.

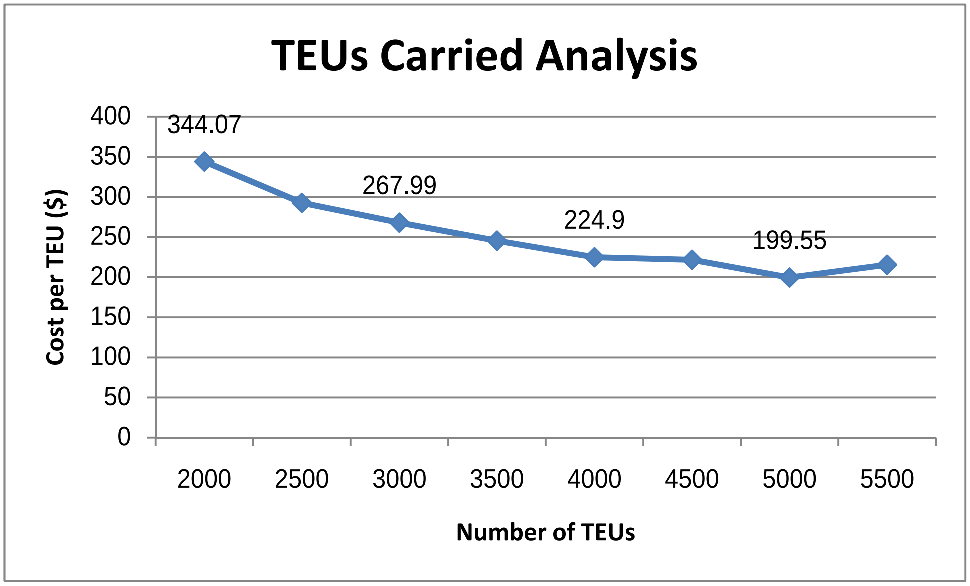


Figure 6.4: Analysis of TEUs Carried

For railroads, the required motive power is determined by the total weight to be transported. However, for marine shipments, the size of the vessel is determined by the number of containers to be shipped, regardless of the weight in each container. The only point at which weight becomes a factor is when the total cargo weight exceeds the load carrying capacity of the vessel. However, this rarely occurs except in such shipments as wastepaper and other very dense products. The cost per TEU will not significantly vary with the tons per TEU so long as the box is of standard dimensions. In the pricing of maritime transportation, therefore less attention is paid to the type of commodity being transported than is the case for either truck or rail.

6.1.5 Port Charges

The cost of physically transporting cargo across the ocean is the most important single component of marine transportation cost for long voyages, yet charges on ships and cargo handling by ports for their services can also be significant. In examining the full supply chain, port charges will occur at the port of departure and the port of arrival. For the purposes of this study, only port charges associated with North American ports of arrival are considered. As is evident from Tables 6.4 and 6.5, the amounts charged and methods for collected fees vary substantially between ports.

Table 6.4: Port TEU Tariff Summary

Charge	Port	Amount Loaded	Amount Empty	Notes
Wharfage	Houston (Bayport)	-0-	-0-	No charge if vessel is involved & not transshipment
	Lazaro Cardenas	100 Pesos	100 Pesos	98 for 20 ft
	Long Beach			Only assessed on transfers (transshipment)
	Los Angeles			Only assessed on transfers (transshipment)
	Savannah	$4.20/ton	-0-	
Security	Houston (Bayport)	$2.30	-0-	
	Lazaro Cardenas	100 Pesos	-0-	
	Long Beach	N/A	N/A	
	Los Angeles	$2	N/A	Per APM Tariff
	Savannah	$5.75	$5.75	
Container Throughput	Houston (Bayport)	$85.50	$29.05	Discounts available (Note 1)
	Lazaro Cardenas	933.82 Pesos + IVA (value added tax) + 568.76 + IVA for trucks or 986.42 + IVA for rail	933.82 Pesos + IVA + 568.76 + IVA for trucks or 986.42 + IVA for rail	
	Long Beach	Not Published	Not Published	
	Los Angeles	$600	$600	Per Maersk Tariff
	Savannah	$115	$115	Vessel movement in/out of GPA Terminal

Gate Fee	Houston (Bayport)	-0-	$5.15	
Infrastructure Fee	Los Angeles	$30/FEU	-0-	$15/TEU
	Long Beach	$30/FEU	-0-	$15/TEU
Clean Truck Fee	Los Angeles	$70/ FEU for non-compliant trucks	-0-	$35/TEU—Isn't necessarily paid
	Long Beach	$70/FEU for non-compliant trucks	-0-	$35/TEU
Pier Pass	Long Beach	$80 per FEU	-0-	$40/TEU—Peak hour moves
	Los Angeles	$80 per FEU	-0-	$40/TEU—Peak hour moves

Note 1: Houston Volume Discount

Table 6.5: Fees for Loaded and Empty Vessels

Annual Loaded Container Volume	Loaded Throughput	Empty Handling Charge
0 to 10,000 Units	$85.50	$29.05
10,001 to 15,000 Units	$80.50	$27.05
15,001 to 25,000 Units	$75.50	$25.05
25,001 to 35,000 Units	$70.50	$23.05
35,001 to 50,000 Units	$66.50	$21.45
50,001 to 75,000 Units	$61.00	$19.25
75,001 to 110,000 Units	$56.50	$17.45
110,001 to 150,000 Units	$55.00	$16.85
150,001 to 175,000 Units	$53.00	$16.05
175,001 to 200,000 Units	$51.00	$15.25
200,001 +	$49.00	$14.45

6.2 Final Thoughts

It should be recognized that data derived from calculating operational costs in a time of a severe economic recession is unlikely to be corroborated by using the rates (prices) charged by the steamship company. Over the past 18 months, wide swings in container rates were noted in Chapter 2, almost all in a downward cycle. It appears that this may now be over, but if prices can vary so much, is there any virtue in estimating vessel costs? The main reason for undertaking costs analysis using a vessel or rail model is that it allows a consistent way of measuring the cost differentials between several corridors rather than estimating the prices charged. It allows a planner to compare a large containership segment to Los Angeles, with the box moved onward by rail to Texas, with a smaller ship using the Panama Canal and taking the boxes directly to Houston. Both methods are used by shippers but for different reasons because commodity types have different speed, costs, and reliability characteristics. Given that global corridors require ships, a marine cost model is critical in making good cost comparisons. The second mode that is currently necessary to estimate international container landside movement is rail, and the next chapter describes a model for that purpose.

Chapter 7. Rail Cost Model

Along with estimations of per mile marine cost, a model to estimate per mile rail cost for intermodal shipments was developed. Estimating private costs of freight rail service is inherently complex. As stated by Forkenbrock, factors that contribute to its complexity include joint production among rail companies (e.g., sharing trackage or rolling stock), economies of scale and density, and lack of data on specific expenditures pertaining to individual freight movements (Forkenbrock, 2001). The high capital cost required to construct and maintain rail service obscures the ability of outside analysts to determine how much it actually costs the railroad to send any given shipment. Nevertheless, an understanding and ability to approximate rail line-haul costs is essential in understanding the likelihood that a rail company will choose to pursue new types of business such as the support of a new corridor for international trade. A railroad will not pursue all avenues for new business. Rather, it will select those that make the best and most profitable use of the network. Thus, policymakers can never know for certain which types of business a railroad will choose to pursue. While a full and comprehensive cost analysis of rail operations is difficult to achieve, it is also in the public interest to know the variable cost elements involved in rail shipments as these factors allow planners to determine how various proposals would impact rail operations such as relocation or corridor enhancement.

Over the years, economists and government organizations have tried developing models to estimate the internal costs of freight rail services. Many of these models are either too case specific to be used for purposes of comparison or alternatively are too general to be useful. Econometric models such as those of Caves, Christensen, and Swanson (1980, 1981a, 1981b), Bereskin (1996), Spady and Freidlaender (1976, 1979, 1980), Barbera et al. (1987), and Lee et al. (1987), as listed by Bereskin (1998) and Forkenbrock (2001), tend to concentrate on the shape of the cost function and its implications for productivity growth and economies of scale, scope, and density (Bereskin, 1998). A reoccurring finding of these studies has been that the railroad industry is achieving productivity gains over time and through mergers, and that rail costs are non-linear in nature (Bereskin, 1998 and Forkenbrock, 2001).

While economists such as Bereskin have developed highly refined econometric models of rail cost that take into account factors such as track capacity, government agencies such as the Surface Transportation Board (STB) are more limited in the types of tools they can utilize in determining the impacts of a change in rail service or whether rates charged are in line with variable cost. For two decades, the STB has used a model called the Uniform Rail Costing System (URCS). While the model has significant limitations, it is still the official tool used by the STB and as such served as the first point of reference for this rail cost study. The URCS model can be used for costing specific traffic with less concern for economic characteristics (Bereskin, 1998). URCS is the STB's railroad general purpose costing system that is used to estimate variable and total unit costs for Class I U.S. railroads. URCS uses system average based on cost relationships and collected system data for Class I railroads. The data is updated annually by the STB. However, the basic structure of the models remains as it was when it was developed decades ago and does not reflect modern railroad operations. For example, there is no clear way to delineate double stack intermodal as this technology was not widespread at the time of the model’s development. For several reasons, the cost estimation method used by URCS is not entirely accurate. Three primary problems have been identified by researchers. First, the model uses linear “percent variable” equations to allocate expenses to specific operating activities based on a cross-sectional regression of cost data against traffic data for the Class I railroads of the 1980s, using a several-year time series. The equations therefore did not account for the recent changes in the industry (e.g., mergers, increasing size, and traffic carried) that affected operational costs of railroads (Bereskin, 2001). Furthermore, the linear nature of the model is contrary to the earlier stated findings that rail costs are non-linear in nature.

Secondly, URCS uses system averages based on data collected from Class I railroads. This system

> "uses an accounting based approach to costing, relying on annual operating expenses and traffic data reported by the railroads. This approach provides cost estimates on the average cost structure of individual railroads or regionalized groups of railroads. Average data on average railroad moves may not, in all cases, be appropriate for estimating a cost for a given railroad movement" (URCS Manual).

System averages may not reflect the actual railroad rates charged by carriers, and may not reflect geographical location, technological improvements, and system performance (AECOM, 2007). However, URCS gives users the flexibility of substituting cost data developed by the STB with user-generated cost.

Thirdly, URCS does not account for changes in fuel prices, which is a major concern in this study. The model does not have an input for fuel cost, which we believe has a major influence in freight rail service rates. Recently the STB announced its intention to begin the process of replacing the URCS model due to its well known limitations. This initiative, taken under new chairman Mulvey, was started with a hearing at the STB on April 30, 2009. Dr. Gregory Bereskin, who aided the researchers in the development of this model, provided testimony to the STB.

Because of the above stated limitations of URCS, the researchers deemed it necessary to develop a transparent line-haul rail cost model to illustrate the contribution of different elements that make up rail variable cost in a way that is relevant for corridor comparisons.

The new spreadsheet model is limited to the line-haul movement operation and therefore does not account for terminal operations that include arrival operation, inspection operation, classification operation, assembly and disassembly operations, and the labor involved in the above operations. Terminal operations are a substantial part of railroad operations and the cost involved in running terminal operations cannot be ignored in railroad cost analysis. However, for purposes of this research, we assume that terminal operations and costs are the same for all origins and destinations, and the primary concern is to determine how cargo weight, number of cars, type of loading (single or double stack), rail track, car and locomotive maintenance, distance, travel time, delays, and capital investments influence line-haul movement operation cost. Also of significant interest is to determine how varying fuel costs influence the rail industry. Loading and unloading operational costs are included to account for economies of scale in line-haul operation.

Capital investments such as road construction, right-of-way acquisition, grading, signal and interlocks installation, stations and office buildings, and all other infrastructural investment cost are not included. These costs do have a significant influence in the overall rail operation costs but are ignored because of lack of sufficient supporting data and variability amongst the various rail companies. Other expenses ignored include equipment rentals, purchased services, and other indirect expenses (AECOM, 2007). Because this paper focuses on comparing rail corridors, it can be assumed that expenses are the same for all rail companies.

Excluding operational costs to the line-haul portion of the rail service might result in an underestimation of overall costs in certain cases.

Line-Haul Cost Model Assumptions:

- Rail cars are assumed to be intermodal cars and can therefore be single or double stacked
- Fuel consumption is calculated as a function of horsepower, thermal efficiency of engine units, and the energy content of the fuel (DeSalvo, 1969). A formula for predicting train fuel consumption per hour is used and the thermal efficiency can be specified for the user for different locomotive types.
- Changes in fuel consumption during acceleration, deceleration, and idling are not accounted for.

Line-Haul cost model allows users to input the following parameters:

- Distance
- Number of freight cars
- Tons per car
- Maintenance of railroad estimate
- Maintenance of equipment
- Labor wages
- Fuel price per gallon
- Travel time

The unit of measurement generally used is the ton-mile but this unit comes under scrutiny by authors like Ivaldi and McCullough who argue that ton-mile data, though readily available, force the assumption that rail freight services are homogeneous and rail operations, whether unit coal trains, high-speed intermodal, or local boxcars, generate similar costs. This assumption, Ivaldi and McCullough argue, is troublesome from an economic standpoint since freight railroads are multiproduct firms operating in diverse geographic and product markets (Ivaldi and McCullough, 2001). For intermodal shipments, given the close competition with trucking, it is valuable to compare the operations based upon similar metrics that would be used to measure trucking productivity and cost. Based on AECOM classifications, railroad operating cost consist of the following:

- **Labor:** Labor costs are directly influenced by baseline wage rates, the strength of union representation among the workforce, and work rules. It is therefore a significant fraction of the operating cost for freight railroads.
- **Fuel and Power:** This category includes both diesel fuel and the electric power generated by the locomotive.
- **Maintenance of Equipment:** This category covers the repair and maintenance of locomotive, freight cars, and other support equipment
- **ROW Maintenance and Structures:** The repair and maintenance of track, signals, communication systems, buildings, and other structures (AECOM, 2007).

This study sought to measure the influence of the following factors on freight rail cost:

- Fuel price
- Trip length
- Number of wells (sometimes interchanged with cars)
- Tonnage
- Utilization ratio (ratio of empty to full containers)

7.1 Scenarios

Scenario #1: Double-stack container train to simulate WEST railroad

This scenario approximates a shipment between Los Angeles and Dallas. It estimates the *per mile* costs which can be applied to other O-D pairs with similar characteristics.

Container: 23.50 tons (average based on composite of rail sources)

Tare weight of 40ft container: 4 tons

Tare weight of well: 17 tons

Configuration: Double Stack

Gross weight of one well: 72.00 tons

Number of wells: 140

Number of containers: 280

Fuel Price: $1.80 a gallon

Speed: 35 mph

Utilization ratio: 100%

Distance: 1,466 miles

Table 7.1 presents a comparison of the model with URCS.

Table 7.1: Comparison of Model with URCS

Cost	Model	URCS
Total Cost (Variable or Average Cost)	$187,353.14	$228,923.13
Cost per ton-mile	1.15 cents	1.41 cents

7.1.2 Estimates

In order to ensure that the outputs of the model were logical based upon established alternative approaches, Dr. Gregory Bereskin used inputs provided by CTR and TTI to provide an estimate of rail line-haul cost using his own proprietary econometric model. Dr. Bereskin used a percent empty return ratio of 50%. Using this assumption in our model and the URCS model yielded the results in Table 7.2:

Table 7.2: Comparison of Per-Mile Costs

Cost	Model	URCS	Bereskin
Total Cost (Variable or Average Cost)	$208,636.54	$232,151.35	$231.959.00
Marginal Cost			$208.152.00
Cost per ton-mile	1.88 cents	2.09 cents	2.05 cents 1.84 cents (MC)

The new model is not 100% accurate in predicting line-haul cost. The above estimates, however, are encouraging and suggest that the model is useful in predicting the influence of fuel cost, trip length, number of containers, and utilization ratio on overall line-haul operational cost.

Scenario #2: Double-stack container train to simulate EAST railroad

This scenario approximates a shipment between Savannah and Dallas. It estimates the *per mile* costs which can be applied to other O-D pairs with similar characteristics.

Container weight : 23.50 tons

Tare weight of 40ft container: 4 tons

Tare weight of well: 17 tons

Configuration: Double Stack

Gross weight of one well: 72.00 tons

Number of wells: 90

Number of containers: 180

Fuel Price: $2.00 a gallon

Speed: 35 mph

Utilization ratio: 100%

Distance: 1,015 miles

Table 7.3 presents a comparison of the line-haul model with URCS for the East railroad.

Table 7.3: Comparison of EAST Railroad Model vs URCS

Cost	Line-haul Model	URCS
Total Cost (Variable or Average Cost)	$187,353.14	164,116.48
Cost per ton-mile	1.15 cents	1.41 cents

Table 7.4 gives the output from the preliminary line-haul cost model and URCS models using the same percent empty return rate of 50% that was used by Dr. Bereskin. The cost of the return is not included in the calculation however the availability of return cargo is implicit in rate setting.

Table 7.4: Model Comparisons with 50% Empty Return

Cost	Line-Haul Cost Model	URCS	Bereskin
Total Cost (Variable or Average Cost)	$208,636.54	$232,151.35	$231.959.00
Marginal Cost			$208.152.00
Cost per ton-mile	1.88 cents	2.09 cents	2.05 cents 1.84 cents (MC)

7.2 Examining the Cost Components

7.2.1 Fuel Price

The fuel price was varied from $1.00 a gallon to $4.00 a gallon at 25-cent increments. The percentage of fuel cost on total cost was then measured. Table 7.5 presents the results of the analysis, illustrated in Figure 7.1.

Table 7.5: Fuel Price Sensitivity

Price of Fuel ($)	Varied
Distance (miles)	1,466.00
No. of Cars	140.00
Ton per container	23.50
Travel Time (hr)	41.89
Speed (mph)	35.00
Utilization Ratio	100%

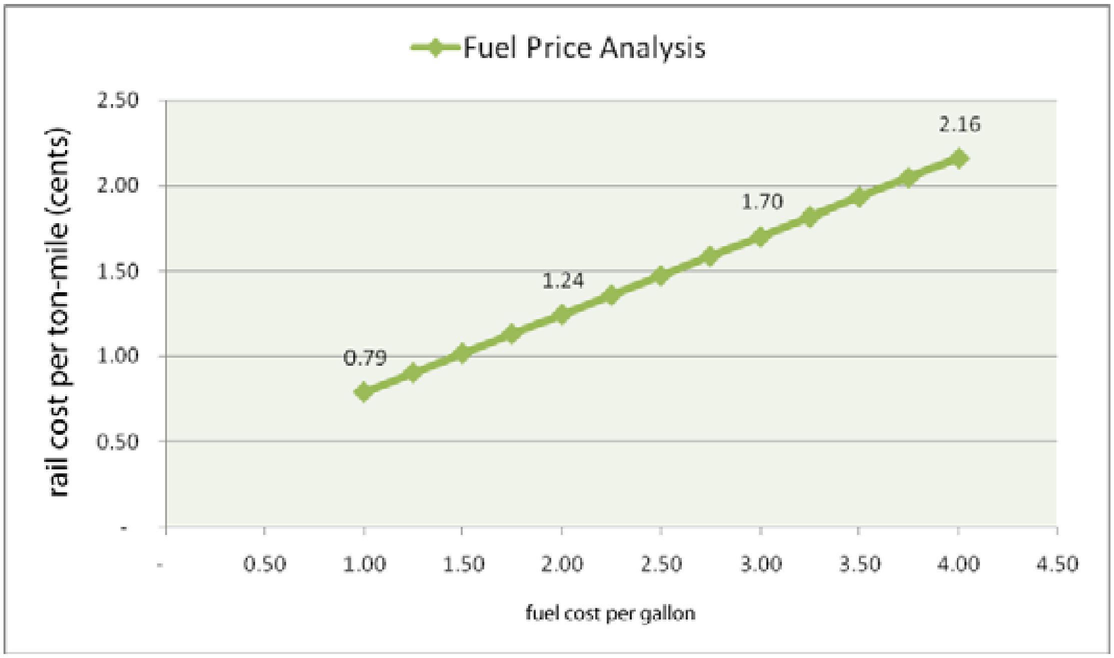


Figure 7.1: Variation in Per-mile Cost with Increase in Fuel Price per gallon

As expected, Table 7.5 shows the increase in per ton-mile cost with increasing fuel prices. It can be inferred from Figure 7.1 that for each 25-cent increase in fuel price, per ton-mile cost increased by 11 cents. Total cost (not shown) also increased at a constant rate of $18,543 dollars for each 25-cent increase in fuel cost (Figure 7.2).

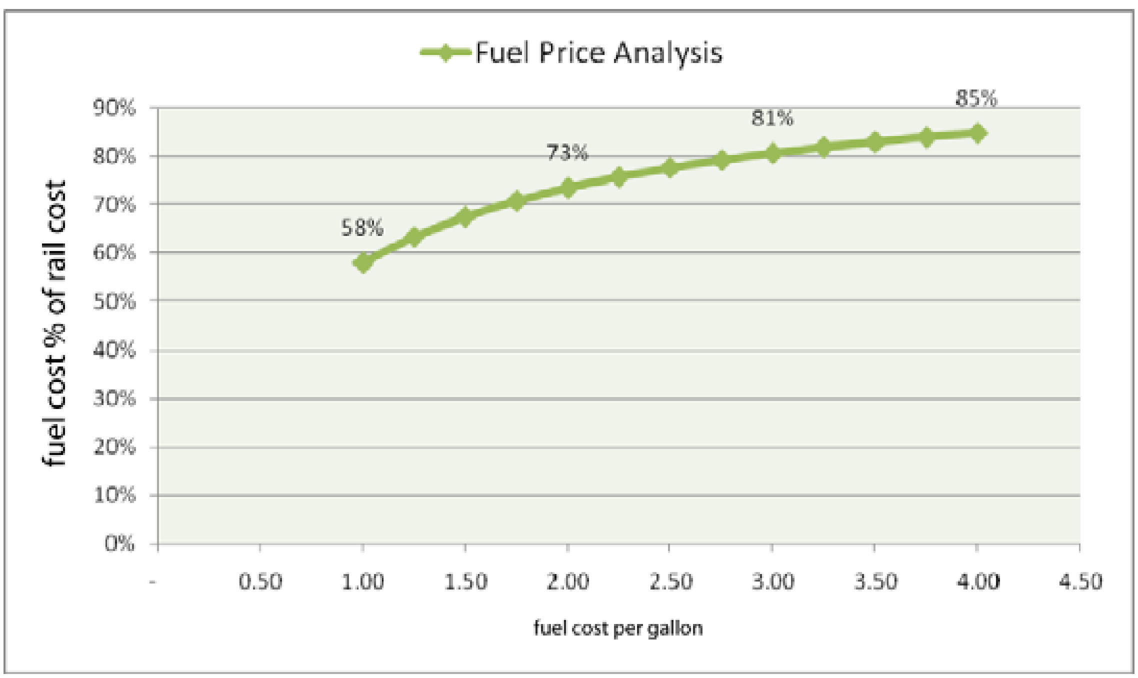
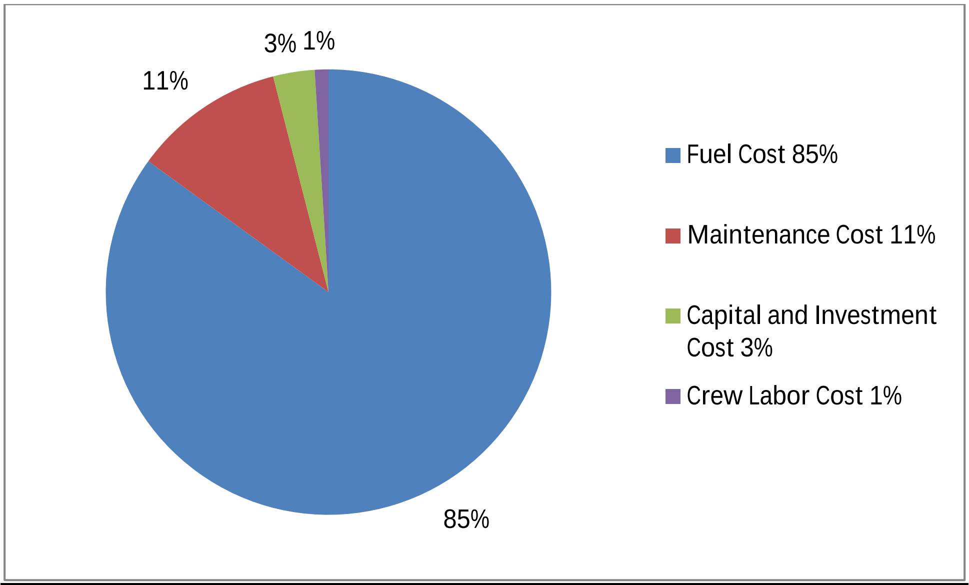


Figure 7.2: Variation of Fuel Price in Gallons as a Percentage of Total Cost with Percent Increase in Fuel

Figure 7.2 shows fuel cost as a percentage of total cost increasing for increasing price per gallon of fuel. At $1.00/gallon, fuel price made up 58% of total cost and at $4.00/gallon fuel price made up 85% of total cost. The observed curvature in the graph can be attributed fixed maintenance, labor, and capital costs. These fixed costs do not vary with increasing fuel prices and therefore limits changes of fuel prices on total cost. Figure 7.3 shows the cost breakdown in percentages:

<u>Price of fuel at $4.00/gallon</u>



<u>Price of fuel at $1.00/gallon</u>

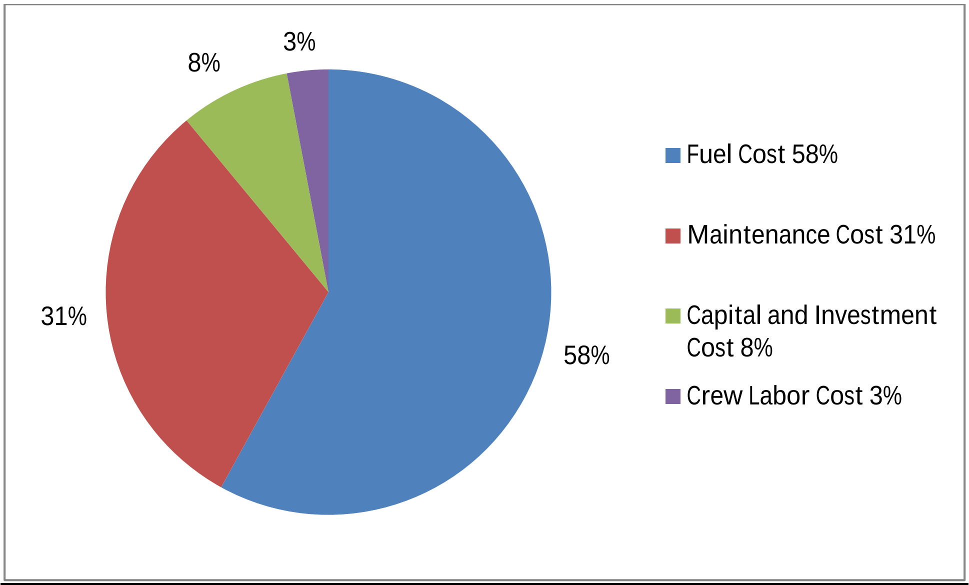


Figure 7.3: Cost Breakdown in Percentage

7.2.2 Trip Length

Trip length was varied from 100 to 1,300 miles at 100-mile increments. This analysis was performed to determine the influence of trip length on fuel consumption and per ton-mile cost. A loading and unloading cost of $25.00 a container was included in the analysis to account of economies of scale and demonstrate that the model was functioning as intended. Results are shown in Table 7.6 and Figure 7.4.

Table 7.6: Inputs for Variation of Per-mile Cost with Distance

Price of Fuel ($)	1.80
Distance (miles)	Varied
No. of Cars	140.00
Ton per container	23.50
Travel Time (hr)	Varies
Speed (mph)	35.00
Utilization Ratio	100%

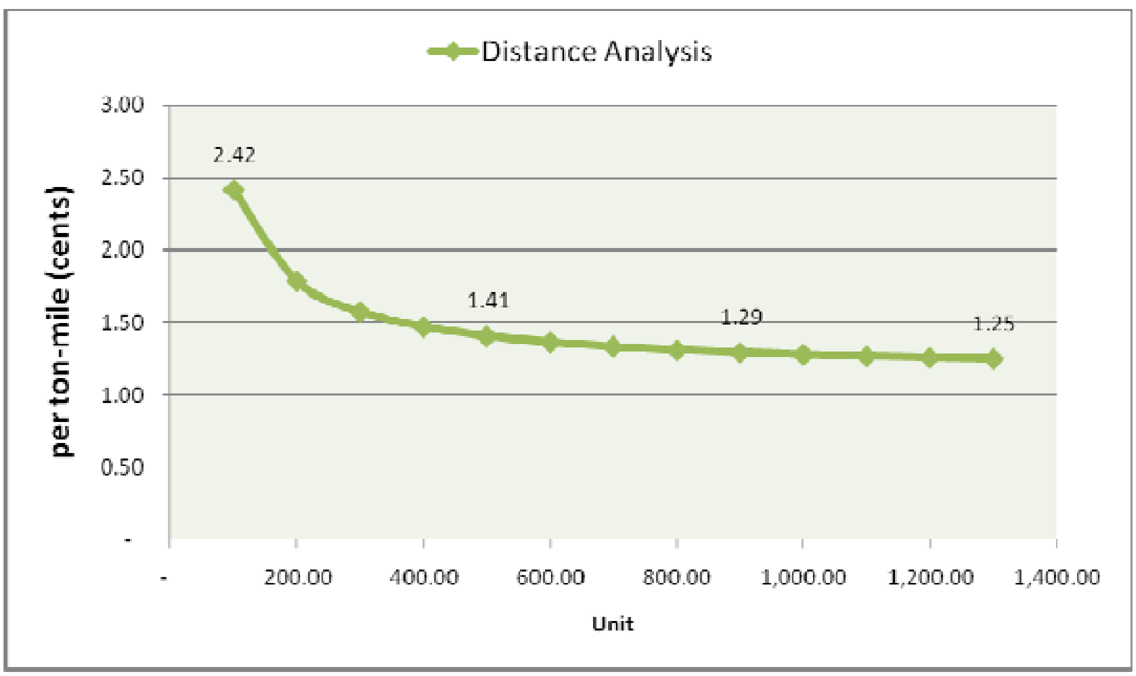


Figure 7.4: Variation of Per-mile Cost with Distance

As expected per ton-mile cost over distance varies because of economies of scale. Fixed cost components like loading and unloading cost account for a change in slope of ton-mile cost. At short distances (between 100 and 400 miles) ton-mile cost is high because fixed costs remain the same despite the distance travelled by the train. As the distance travelled increases ton-mile cost reduces. This explains the reason why it is cheaper to use rail when transporting goods at long distances compared to shorter distances.

7.2.3 Number of Cars

Table 7.7 presents the baseline criteria vis-à-vis number of cars.

Table 7.7: Number of Cars Analysis Baseline Criteria

Price of Fuel ($)	1.80
Distance (miles)	1466
No. of Cars	Varied
Ton per container	23.50
Travel Time (hr)	41.89
Speed (mph)	35.00
Utilization Ratio	100%

Figure 7.5 shows changes in ton-mile cost with increasing number of wells. As the number of cars is increased, per-ton mile cost decreases because of economies of scale. However, after a certain threshold, an additional locomotive is needed to move the specified number of cars. Inclusion of an additional locomotive results in an increase in fuel and locomotive operational costs. This cost, however, decreases again as the number of wells increase because of economies of scale.

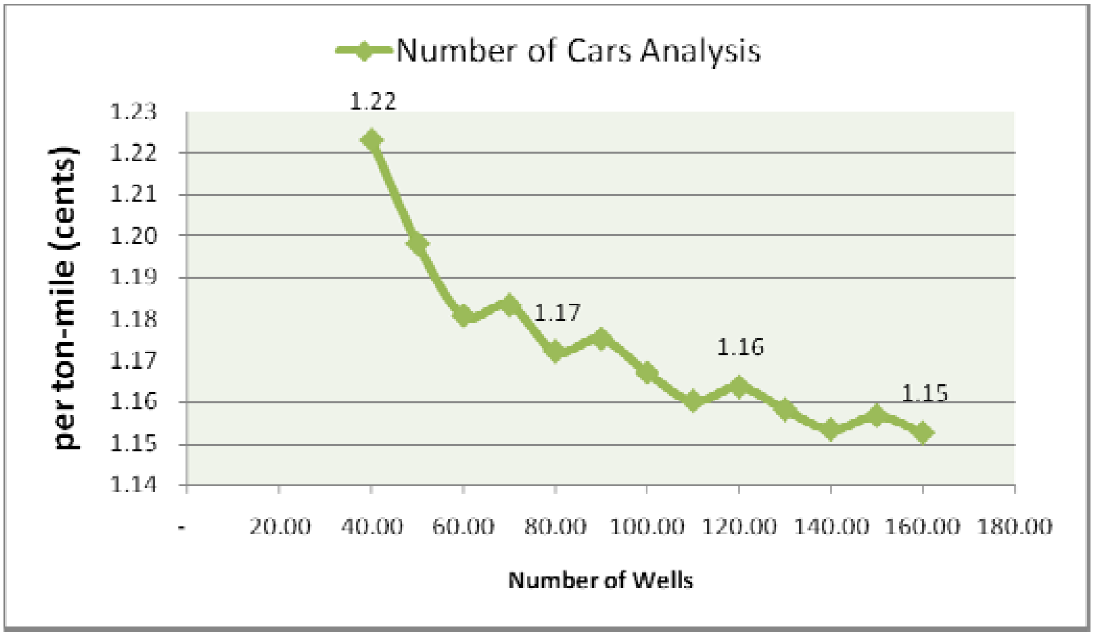


Figure 7.5: Variation of Per-mile Cost with Number of Wells

The claim of fuel cost increasing as number of locomotives increased can be observed in Figures 7.6 and 7.7. Ton-mile costs increase because of the need for an additional locomotive when the threshold for a certain number of cars is reached. It should, however, be noted that the threshold is determined by the cargo weight of each car, i.e., cars with a gross weight of 72 tons will reach the threshold much quicker than cars with a gross weight of 50 tons.

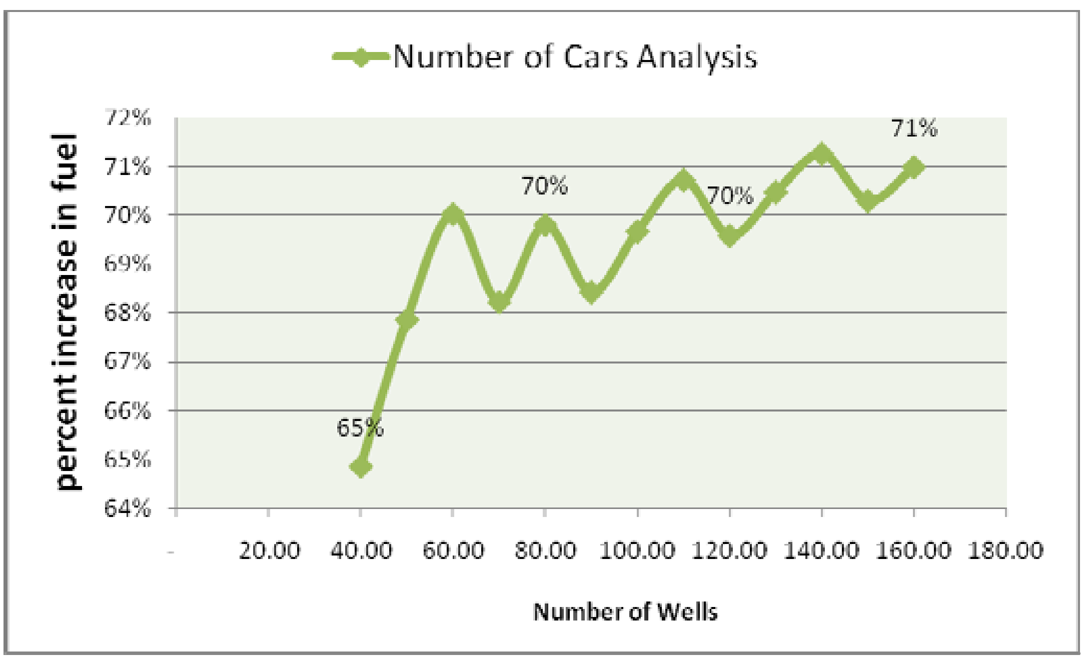


Figure 7.6: Fuel as a Percentage of Total Cost with Number of Cars

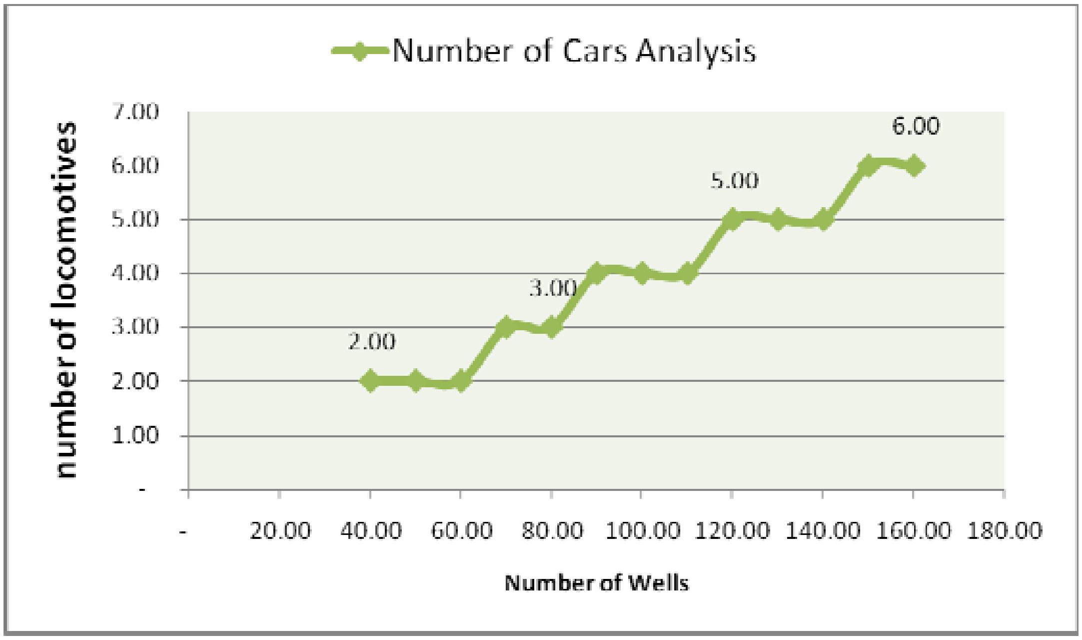


Figure 7.7: Required Number of Locomotives with Number of Wells

7.2.4 Tonnage

Ton per container was varied to determine the influence of cargo weight on total cost (see Table 7.8 for baseline inputs). The containers are double-stacked so each specified ton per container will have to be multiplied by two to determine overall cargo weight per well.

Table 7.8: Baseline Inputs for Correlation of Cost with Cargo Weight

Price of Fuel ($)	1.80
Distance (miles)	1466
No. of Cars	140
Ton per container	Varied
Travel Time (hr)	41.89
Speed (mph)	35.00
Utilization Ratio	100%

It can be observed from Figure 7.8 that as the number of tons increased for each container, ton-mile cost decreased. This is as a result of economies of scale whereby it is cheaper to move more tonnage over longer distances. Fuel cost, however, increases because of the need for additional locomotives. Figure 7.9 graphs the number of locomotives needed for each increase in tons per container.

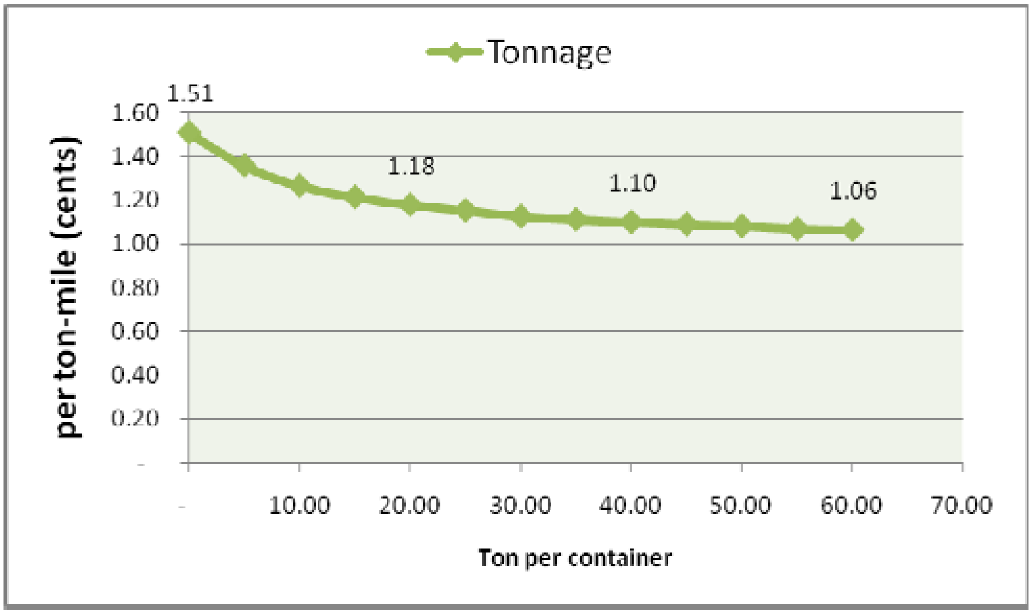


Figure 7.8: Correlation of Cost with Container Weight

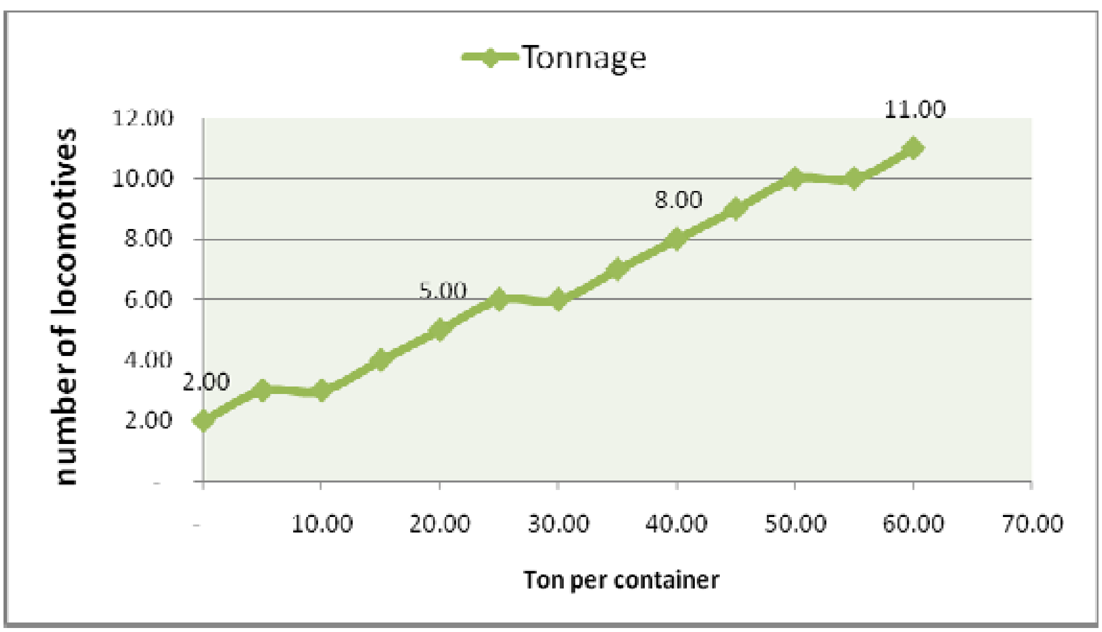


Figure 7.9: Number of Locomotives Needed for Each Increase in Tons per Container

7.2.5 Utilization Ratio

The final observation was how changing loaded vs. empty ratios could influence rail costs (see Table 7.9 for baseline inputs). This test is necessary to determine how moving empty containers influence the overall operational cost. This analysis will help support the need for efficient movement of goods.

Table 7.9: Baseline Inputs

Price of Fuel ($)	1.80
Distance (miles)	1466
No. of Cars	140
Ton per container	23.50
Travel Time (hr)	41.89
Speed (mph)	35.00
Utilization Ratio	Varied

From Figure 7.10 it can be observed that ton-mile cost decreases with fewer empty containers. The gradual change is comparable to change in tonnage per well but on a much larger scale (i.e., the entire train). There is a need for an efficient movement of goods as the analysis shows significant cost decreases when trains are fully utilized.

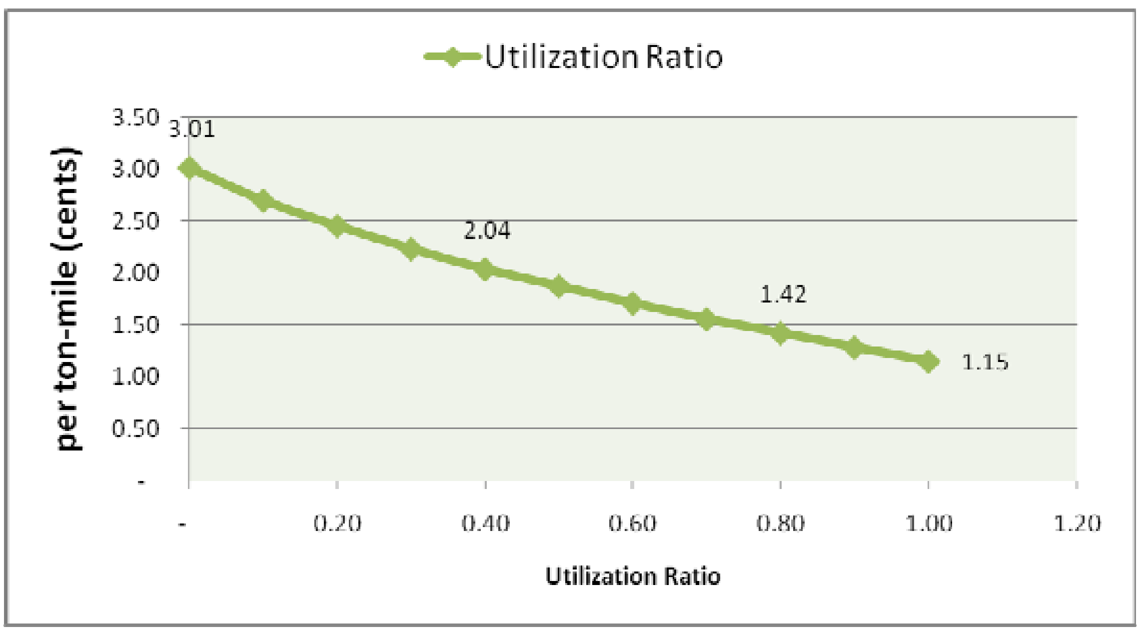


Figure 7.10: Correlation of Per-mile Cost and Utilization Ratio

Figure 7.11 presents an observation of interest regarding total cost.

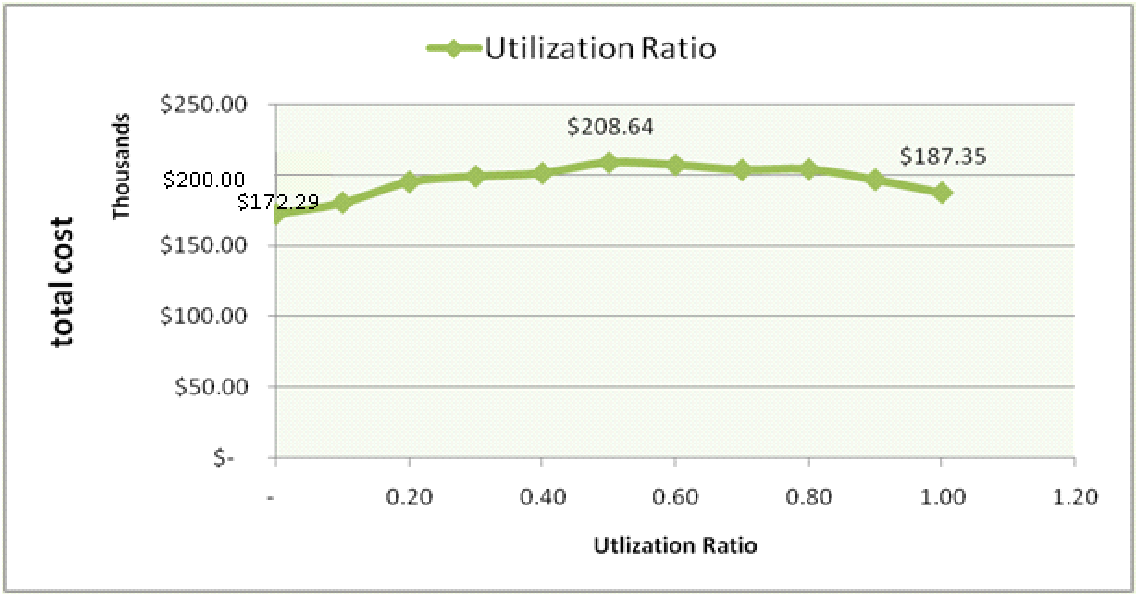


Figure 7.11: Correlation of Train Per-mile Cost and Utilization Ratio

7.3 Analysis of Scenario Comparisons

As developed, the rail cost model cannot predict which corridor a shipper might choose; however, it can illuminate the underlying advantages or disadvantages of a particular corridor strategy based solely on transportation costs. For example, in Table 7.10 two rail corridor options were tested for cargo travelling between the West Coast and Alliance, Texas. The dominant corridor for these shipments has historically been to enter at Southern California; however, some shippers who have a distribution hub in the Pacific Northwest may choose to send imports through the Port of Seattle instead. What is the cost differential per container for choosing this option? As can be seen in the example, using the northwest ports adds approximately 1000 rail miles to the trip. Assuming that both trains have the same length and operating characteristics, this would add approximately $350 in cost per TEU. The actual price differential offered by the railroad to the customer may be greater or less than this amount.

For a point of comparison, how does choosing the alternative corridor compare if it is assumed that the shipper must cover the cost of PierPass, the peak period pricing mechanism in Los Angeles? According to the OffPeak program, each TEU moved under peak period shifts is assessed an additional $50 fee. Thus, according to the model the additional cost of choosing the Port of Seattle as a port of entry as opposed to the Port of Los Angeles is seven times more costly to the shipper that would be the comparative cost of PierPass. Another way to view the cost comparisons between the two simulations would be to say that the Seattle-to-Alliance rail option is 65% higher in terms of cost than the LA-to-Alliance option. In addition to not having a charge for peak drayage delivery, the Port of Seattle has generally had better on-dock rail options, yet with a higher base rail delivery cost, a shipper would have to realize several additional advantages, including possible savings on the marine side. Because both Los Angeles and Seattle have regular established intermodal rail service and the characteristics of trains operating on both of these corridors is roughly similar, the comparison of the Pacific Northwest with Southern California comparison is relatively straightforward. Comparing either of these options to corridors through Mexico, for example, would present additional variables.

Table 7.10: Cost Differential between Two Route Options

Scenario	Distance (BNSF)	Total Cost	Per Ton-Mile	Per Mile	Per TEU	Per FEU	% Fuel	Travel Time (Hr)
Los Angeles,CA to Alliance, TX	1,545.00	253,346.49	2.91	163.98	527.81	1,055.61	0.44	44.14
Seattle,WA to Alliance, TX via Kansas City, MO	2,548.00	417,816.74	2.91	163.98	870.45	1,740.90	0.44	72.80

7.4 Final Thoughts

The models described in this and the previous chapter can be combined to provide a valuable insight into the cost differentials that when used with route modal segment lengths can give estimates of the time to traverse the corridor. Those wishing to estimate corridor costs with further precision can do so in the following way. First the corridor is identified, together with the relevant beginning and end points and intermediate modes. A typical corridor would comprise a) landside mode to export gateway, gateway transfer costs, export terminal to import gateway (marine), gateway transfer costs, then either landside truck delivery (dray) or over the highway truck (single or team drivers) or truck to rail (dray), rail to regional terminal (like Alliance Texas), then truck delivery (dray). The options can be simplified by noting where corridors being compared have similar activities—such as both using dray trucks over the same distance. In this instance, the planner should regard these as constants that have no impact on differentials and drop them from the calculations. If a gateway has additional but unique costs (like PierPass) they should be retained. Truck costs can be derived from two CTR studies, 0-5684 “Drayage Activity in Texas” (Harrison et al., 2007) or the forthcoming 0-5974 study report on “Estimating Texas Motor Vehicle Operating Costs” (Harrison et al., 2009). Conclusions and recommendations of this study are now presented, with a matrix identifying likely milestones of use in state transportation planning.

Chapter 8. Summary of Findings and Milestones for TxDOT Planning

This report has traced the underpinnings of intermodal trade corridor development as it relates to Texas. The report provides insight as to why the intermodal corridors that currently dominate trading patterns between Asia and Texas currently hold this status and the necessary developments that would be required to diversify trade from these corridors. The report has described the demand side of trade and the various factors that drive trading relationships. It has also examined how these factors have been shaken by recent economic events and to what extent the situation may differ under a new post-recession equilibrium.

8.1 Location decisions and trade corridor selection

Most international trade is the movement of goods or components for finished goods between different industrial concentrations. The geographical concentration of industrial activities within certain regions is a key feature of the modern global economy. A key insight is that industrial concentrations do not just determine where goods are made but also how they are shipped. Access to efficient freight transportation has historically been a reason driving the concentration of industries in particular locations. There are also many instances in which transportation providers have altered their networks or service level in order to better serve pre-existing or growing industrial aggregations. The features of the industrial/freight agglomeration tend to be self reinforcing, which means that once a concentration and its trade network have been established, it attains a degree of inertia. The economic literature on aggregations helps in understanding the continued relevance of dominant intermodal trade corridors such as the Los Angeles to Chicago trade corridor, which forms the backbone of the U.S. intermodal system. Many shippers who utilize this corridor do so not only for the access to advanced port facilities and intermodal connections but also for the vast network of distribution facilities.

8.2 Aftermath of energy crunch on sourcing decisions

While the role of major corridors and their linkages to key industries is relatively secure in the short term, in the long term a change in inputs could eventually convince shippers to seek alternatives. One criticism of the U.S. intermodal system is that, despite being energy efficient in comparison with trucking, it is also energy intensive due to long overland distances required for intermodal cargoes from Asia to reach their ultimate destination and also due to the emphasis on speed and just-in-time delivery that has undercut slower yet more energy efficient alternatives. When energy costs started to increase, a variety of broad proposals were suggested to improve energy usage. These included shortening supply chains through near sourcing; using secondary ports to land cargo closer to its destination; reducing the speed of ships, trains, and trucks to reduce fuel consumption; public investment in freight rail alternatives to steer shippers away from over-reliance on trucking; and new investment into energy efficient transportation technologies. The energy crisis can be seen in retrospect as a time of experimentation in which many strategies were attempted with varying degrees of success. It became clear during the course of the energy crisis that the existing paradigm of routes, infrastructure, and procedures was built on the assumption that energy prices would be low and that a full conversion to an energy-efficient system would take years if not decades to implement.

8.3 Impact of 2009 crisis

The impact of the financial crisis on international trade was severe and multifaceted. A downward trend in global trade was already emerging by the time the collapse of the banking sector occurred. As a result, shippers and carriers were already in a weakened position before the crisis officially “started.” Aside from the systematic problems of attracting customers and investors that impacted all industries, the intermodal system faced a few additional problems tied to overcapacity in the liner industry. Intermodal trade relies on long term planning and predictions that were made highly problematic due to the rapid fluctuations that occurred in demand. Orders for new vessel capacity, for example, had been made long in advance of the crisis. Furthermore, rates negotiated during the initial falloff were often unsustainably low and threatened to undermine the pricing structure of carriers and delay the return to profitability even longer.

8.4 Resiliency of existing trade corridors

Despite the almost unimaginable drop-offs in cargo volumes for ports and trucking and rail lines throughout the first half of 2009, by the summer of 2009 there had been a rationalization of services that was beginning to show a path back to sustainability. Several carriers imposed rate hikes in the late summer of 2009 that were intended to counteract the effects of the low spot rates that had been offered earlier in the year. The surge in rates was as dramatic as the falloff had been in months previous. For example, Drewry reported that spot rates on the benchmark Hong Kong-to-Los Angeles trade lane grew 57% in the first 2 weeks of August 2009 in response to the coordinated rate restoration drive (Journal of Commerce 2009).

8.5 Trade Data Analysis: Overview of sources and reliability

Many sources of trade data were utilized at different stages of the study. One priority in the data collection was to use sources that would be attainable for future investigators. Another goal was to use sources that allowed sufficient disaggregation of commodity data so that the specific handling characteristics of the commodities could be understood. The use of official trade statistics collected by the U.S. Census and reported through the database of USA Trade Online fulfilled these criteria. Studies of corridor sensitivity by Leachman and others had concluded that the price of a containerized commodity per unit of weight is an important determinant of shipper strategy. Again, the U.S. Census data proved valuable for this purpose because both the assessed value and the weight of shipments broken down by commodity could be matched.

8.6 Highlights of trading relationships

The analysis of trading patterns demonstrated the difference that containerization makes with respect to some Texas trading partners as opposed to others. While virtually all trade between Texas and China is containerized, a very small percentage of trade with Mexico comes in containerized form. Containerized shipments also play a relatively modest role for Texas in its trade with other key partners. In some cases, this is because the principal trade in commodities is in natural resources that are not containerized. In other cases, the trade in high value commodities that are transported by air reduces the total share transported by intermodal container. The data show that Texas has several underutilized trading relationships that were only beginning to emerge when the financial crisis hit including promising relationships with India, Vietnam, and Colombia among others.

8.7 Corridor profiles

In summarizing the key features of the major corridors currently used to transport intermodal cargo to Texas, the researchers focused on key questions such as these: for existing corridors, what are the advantages and disadvantages of shipping to Texas destination through competing gateways and, for the case of proposed corridors, what would be some of the principal obstacles to be overcome in order for the corridor's full potential to be realized? Given the lack of severe congestion tied to the economic slowdown, it was concluded that the principal force driving corridor diversification would be long term economic benefits and market access and not, as had been suggested under high growth forecasts, the crowding out of shippers from existing corridors due to capacity constraints. While each shipper will have different preferences based upon the needs of their cargo, the researchers determined that several principal routing options for Asian cargo would be potentially viable. The Southern California option is reasonable for shippers of most commodity types. Entry through the Pacific Northwest would be a reasonable option if pre-existing distribution centers in the region compensated for additional landside transportation costs. Entry through the Mexican Pacific is potentially viable if distribution infrastructure is shared with Mexico or if the cargo is destined for the Maquiladora region in northern Mexico or southern Texas. The Panama Canal, which had been assumed to be at or near capacity prior to the economic crisis, appears to have sufficient capacity to absorb new growth for several years due in part to a natural falloff in demand and in part due to a simultaneous increase in toll rates by the Panama Canal Authority. All water service is particularly attractive to shippers whose cargo is destined for the Houston area given that trucking costs for delivery to the rest of the state will be higher. There is comparatively less potential for reverse pendulum Asia–Suez–East Coast services under the present conditions. Finally, the Prince Rupert option, while not attractive for Texas shippers in the intermediate future, may be a long term solution once the Elgin–Joliet bypass is completed.

8.8 Cost modeling

Another contribution of the study and the report was to develop an easy-to-use marine and rail cost model that can be used to illustrate corridor comparisons. The model is intended to translate the metrics used by ocean carriers and rail providers into a metric that can be compared against trucking. The model estimates line-haul cost so that these inputs can be combined with other associated costs such as port or canal fees to determine a total cost of shipping through a particular routing option. The model can be used to show the tradeoffs, for example, from a routing option in which sailing distance and associated cost for a container is reduced but landside distribution costs are increased.

An example of the rail model's utility, comparing the rail cost of cargo bound for Dallas entering through the Port of Los Angeles and then Port of Seattle, is presented. The model demonstrates how a change in rail distance impacts total intermodal costs and how changing a key input, such as the cost of fuel may alter the dynamics of the tradeoff.

8.9 Milestones

8.9.1 Political Milestones

There are many ways in which political developments can significantly impact trading relationships. This can occur through political agreements that strengthen existing trading relationships and those that open up new markets that had originally been closed off. Texas has a very good track record in establishing active trading relationships with countries that have emerged from closed off markets. This is partly due to the fact that Texas exports many products that have utility as inputs for a wide range of industrial products, such as resins, plastics, and cotton. The importance of these trading relationships can be seen in the example of Venezuela where exports of manufactured goods from Texas *tripled* between 2001 and 2008 despite the increasing hostility between the Venezuelan and U.S. administrations (TradeStats Express 2009). A restoration of normal trade ties with Iran, for example, given the large size of the market and the need in Iran for specialized equipment tied to the oil industry, bodes well for the potential of Texas goods in that market.

A second category of countries and markets that could open up in the near future are those for which a new bilateral trade agreement has been executed, or those which are experiencing rapid growth in the middle class. Recent bilateral trade agreements include the Peru Trade Promotion Agreement that entered into force in February 2009 (United States Trade Representative n.d.). The agreement eliminated tariffs on many U.S. goods immediately and created a schedule to eliminate tariffs on the rest of the goods in the near future. The impacts of this recently executed agreement are still working their way through the system. In addition, the Free Trade Agreements (FTAs) that have been signed and agreed to in principal but have not yet come into force, such as the Colombia Free Trade Agreement. Panama and Korea could be approved in the near future and would each create expanded markets for goods. For the BRIC countries (Brazil, Russia, India, and China), the impact of the growth in middle class consumer-oriented populations will likely be the most salient feature in growing opportunities to trade with these countries. While Texas has relatively well developed trading relations with Brazil, for example, Texas exports to Brazil are still only equivalent to exports to South Korea—a country that has less than a quarter of Brazil's population and is almost twice as far in nautical miles from the Port of Houston. When it comes to trade, it is perhaps India that emerges most clearly as a future market. Recent reports have speculated that U.S.–India trade could increase as much as eight times by 2018 (Field 2009). While this estimate is likely overly optimistic, there is no question that the impact of U.S.–India trade, which is estimated at 1.3% of U.S. trade, is not representative of India's contribution to the world's economy or workforce.

A systemic lowering of tariffs by the World Trade Organization (WTO) through the formal multilateral trade negotiations is also a possibility that could impact trade flows to and from Texas. As of summer 2009, the current Doha Development Round of WTO negotiations had been declared all but dead and it was unlikely that major agreements would be reached in the near future. Nevertheless, the Obama administration is quietly examining alternatives for bringing the round to an acceptable conclusion. The current head of the WTO has projected that the round will end sometime in 2010 (Coates 2009). The U.S. administration views even a partial solution as preferable to endless stagnation given that a partial removal of trade barriers could provide global economic stimulus to aid recovery from the recession. While the conventional wisdom may be that negotiating free trade agreements in the midst of a global downturn is a difficult proposition, the counterargument is that the recession has had the effect of deflating, the economic dominance of the world's richest countries and thereby leveled the playing field for negotiations between rich and poor countries, all of whom are in agreement that the status quo is not acceptable.

8.9.2 Infrastructure Development Milestones

In order to successfully trade, a country needs the critical infrastructure. Unfortunately, many countries have limited access to trade infrastructure. There is little disagreement about what infrastructure is required for a country to successfully participate in the global trading system; however, the cost to provide this infrastructure can be prohibitively high. Almost without exception, low and middle income countries seeking to improve their trade infrastructure require outside investment either from the private sector or from international aid agencies such as the World Bank. For this reason, poor countries who are seeking to develop their trade infrastructure are only successful if they are first able to establish a degree of trust with the lender. If it is a private sector lender, this means the probability that the lender will receive a return consistent with the degree of risk the lender incurs. Public sector lenders similarly require assurance against graft and other misuse of funds. This lack of certainty can have the effect of holding back needed trade infrastructure investment.

The most critical infrastructure investments are those that fundamentally change the trade options available to a country. It is these investments that can truly lead to permanent changes in trade lanes. A recent example is the opening of two new deepwater container facilities in Vietnam—a country that had poor container port infrastructure despite its strong comparative advantage in manufacturing—which will significantly shorten the time and cost needed to ship Vietnamese goods across the Pacific. While Vietnam had previously relied on small feeder vessels and barges to deliver its goods to transshipment hubs such as Singapore, the country can now export directly from its own ports and container carriers have been quick to commit to new direct services, reflecting what was clearly a pent-up latent demand. Even prior to the opening of these facilities, Vietnam was seen as one of the emerging exporters most likely to take market share away from China. The realization of modern trade infrastructure seems likely to speed this process and will undoubtedly impact Asian trade corridors serving Texas in the future.

8.9.3 Mexico: Method of Shipment Milestones

In the analysis of Mexico and the impacts of infrastructure spending on Texas trade patterns, there are several trends underway. In some cases, existing corridors are being upgraded, which will lower the average cost of shipping goods from Mexico City to Texas by rail. In other instances, the completion of new trade corridors within Mexico such as the imminent completion of the Mazatlan–Durango highway will open regions of Mexico to international trade, such as the State of Sinaloa, that had previously been barred from efficiently trading even with other parts of Mexico. A final trend to be noted is that Mexico appears to be rapidly approaching a level when containerized transport becomes the norm not only for international cargo movements but also for internal domestic movements over a certain distance. This process, which has been underway in the country for some time, has the potential to become a virtuous circle in which domestic transportation efficiencies encourage greater participation in international trade.

8.10 Economic milestones

Finally, there is the question of when "normal" trade growth and corridor development will resume. It is clear that neither the double digit growth of the early 2000's nor the doldrums of post September of 2008 are likely to be the new model. Trade will likely resume growth, yet at a lower average rate than before and under an environment of uncertainty and relatively high energy costs. While the most severe shocks have likely passed, small booms and busts in trade patterns may continue for the intermediate future. As milestones to indicate that benchmarks in the resumption of growth has been reached, the researchers suggest that global GDP growth will have been positive for three consecutive quarters. Given the interconnectedness of the world economy, tracking the GDP performance of any one country or region is not sufficient.

Another key metric will be a restoration in new ship orders as opposed to the current environment in which many ship orders have been cancelled and carriers who have taken delivery have often simultaneously idled existing capacity. It will take a significant period of time, perhaps years, for the glut of shipbuilding to fully work its way through the system. When idle capacity is under 10% of the global fleet, the industry may again be regarded as healthy. Another marker of the health of the trade industry will be bond ratings for major carriers. Nevertheless, while the search for alternative corridors to relieve congestion at Los Angeles and Long Beach has been redirected, corridor diversification remains a long term goal for many shippers irrespective of congestion. As shippers seek out lower cost alternatives, and more countries seek a part of the global intermodal trade industry, new corridors can and will continue to emerge.

8.11 Final Recommendations

Transportation corridors are rarely entirely new. Typically trade uses well defined paths and modes as it moves across the global transportation system. Moreover, changes—even improvements—come at a cost that must be borne by several beneficiaries and not a single provider. Improvements to ship design, port infrastructure, landside links, rail systems, and information technology require careful analysis, planning, and funding that all take time. This favors state-level transportation planning because it provides reasonable time "windows" in which to evaluate the issues and decide whether further appropriate actions need to be taken, such as joining the debate (as a public-private-partner) or incorporating data into current state plans to address future potential impacts.

Monitoring corridors is not technically challenging but it requires a consistent commitment, ensuring that the dynamic nature of the international transportation business is captured. A multi-level information system should be followed, based on inexpensive data sources. These comprise weekly and monthly trade journals, weekly review of web sites and upcoming webinars, together with subscriptions to annual modal compendia such as *Containerization International*. A suggested list is provided at the end of this report.

This report identified the predominant trade corridors carrying global trade to, and through, Texas in containerized form, as specified in the study objectives. In addition, there are proposals for other corridors termed "emerging" that also should be monitored. The basic monitoring technique could be rather simple. A spreadsheet for each corridor should be used to record data on trade volumes, plans, funding sources, implementation strategies for improvements, and the key strategic points that would trigger a new TxDOT planning activity. These are termed “milestones” and work in the following way.

Data and information are collected to monitor the corridor and so allow time series analyses to be undertaken, and issues identified where a major change in direction is noted. As an example, proponents of an emerging corridor wish to alert TxDOT to the need for new investments in Texas needed to support the predicted trade flows. If the proposed corridor data and information system were in place, planners could access it to confirm the relevance and impact of the corridor. They would note a) steamship liner frequencies to the import gateway, b) terminal capacity at port, c) volumes of TEU, d) if served by rail, frequency of double-stack service, and e) the location of entry into the state (in this case, border gateway), and f) subsequent modal state routes used. Very quickly a pattern of “needs” would arise, many of them lying outside state jurisdiction and some within agency responsibility. As an example, many import gateways are limited by capacity constraints that must be addressed before impacts are felt on the corridor. Typically, terminal investment proceeds in building increments of around a third of a million TEU, which can take years from conception to operation—Bayport, for example, took around a decade. This gives time for TxDOT planners to review their options and make changes, if necessary, to their planning and programming schedules. Some potential monitoring and tracking activities are provided in Table 8.1 for each major group of corridors serving Texas global containerized trade.

Texas transportation planning will greatly benefit from multiple corridors—actual and emerging—capable of handling international trade to and from the state. First, the state will not be faced with the investment programs needed to mitigate congestion from concentrated trade flows on a single corridor, like IH 710 in Long Beach. In addition, the equally important social costs associated with congested corridor like IH 710 will be reduced. Marine international trade will benefit from accessing a wide variety of foreign port to Texas corridor options capable of alleviating future congestion on the current east-west rail corridors. And even with NAFTA, other highway corridors will complement the IH 35 corridor; some rail based, using containerized systems. Finally, providing transportation services to the predicted centers of state population growth and the likely development of one or two mega-regions in the state over the next 30 years is greatly enhanced by the variety of modal corridors available to shippers. It is essential, however, that TxDOT continually monitors activities on all corridors so that its planners are in the best position to make a timely contribution to enhance their effectiveness.

Table 8.1: Suggested Milestones for Key Texas International Container Corridors

Routing Option	**Future Monitoring Strategies**
Asia–California–Texas	• Create and monitor a TEU spreadsheet by Port. Note significant changes—up and down. • Record new agreements with railroad companies on current operations (prices) and any new rail investment proposals. • Note the introduction of, or changes to, local transfer fees linked to container moves. • Record new terminal and near-terminal infrastructure investments.
Asia–Panama Canal–Texas	• Monitor construction of the new lock system – costs and schedule. • Examine the Panama Canal web site and note business trends and issues such as pricing. Corroborate with trade journals and web market intelligence. • As 2014 nears, note all steamship companies planning to route large ships through the new system and identify the ports of call, especially if they include Texas Gulf ports.
Asia–Mexico–Texas	• Monitor TEU growth at Mexican ports and note any new destinations that are given for the next five years. • Note all investment programs being implemented at port terminals to raise capacity and efficiency. • Monitor KCS de Mexico operations and note changes (improvements) to service levels. • Monitor plans for new ports/terminals like Punta Colonet
Asia–Northwest–Texas	• Monitor TEU changes at terminals on Puget Sound and Prince Rupert and link volumes to enhanced rail services to load centers (like Memphis) that could facilitate modal transfers to serve Texas.
Europe–North Atlantic–Texas	• Monitor changing patterns of trade (value, weight, or TEU) between EU and U.S. ports. • Note any new large containership services on the EU–North Atlantic corridor. • Note any changes in vessel size on all Maersk EU–Gulf services • Note all off shore load center hubs impacting Gulf container business.

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Appendix A: Analysis of Mexican Rail and Port Expansion Plans

Infrastructure expansion is now a key priority of the Mexican government. The new President of Mexico prioritized accelerating the development of infrastructure in order to reverse the historical trend in which the poor quality of Mexico's infrastructure has held back the country's overall economic development. The World Economic Forum (WEF) recently released a report detailing the competiveness of the Mexican economy in a multitude of areas. The assessment shows that Mexico has made significant progress in many fundamental areas in creating a healthy and sustainable economy. Public debt has been brought under control. The economy has diversified as have foreign trading partners. Yet Mexico still suffers from a legacy of infrastructure underinvestment that is systemic and impacts all areas of the economy. The overall infrastructure rating in Mexico is lower than the economy's overall rating. Furthermore, the ratings for Mexico's port and rail infrastructure are lower than its cumulative infrastructure rating. For example, Mexico's port rating is 91st in the world, substantially below its rating for highways of 59th[7] (World Economic Forum 2008).

The WEF report describes the inter-relationship of the various components of the economy including institutions, infrastructure, macro-economic stability, health, and primary and higher education. The authors argue that all of these essential goals are interrelated and that at some point the excessive development or underdevelopment of one of these areas begins to impact other areas. One of the sharpest insights of this approach is the recognition that not all countries have the same goals in advancing their economies at any particular stage. Developing countries are classed as "factor-driven" economies. In these economies, the most important elements are basic institutions, basic infrastructure, macroeconomics stability, and decent health and primary education. These are the factors that allow all countries to participate in the global economy and isolate areas of comparative advantage. Countries like Mexico are defined as "efficiency-driven" economies, which is the middle-tier of economic development. Countries in this range have all the necessary tools to compete in the global markets; however, they succeed against other middle income countries by improving their labor market efficiency, their goods market efficiency, their financial markets sophistication, technological readiness, market size, and workforce training. Economies such as the United States are characterized as innovation-driven economies in that they have previously mastered the efficiency stage and are now growing in a postindustrial phase.

The most important point is that while all economies benefit through transportation improvements, economies in the efficiency-driven stage such as Mexico have the most to gain by prioritizing transportation infrastructure improvements. The quality of transportation infrastructure is important to many of the efficiency enhancers that are illustrated in the WEF report in that they improve the market size, the access to markets, the goods market efficiency, and the labor market efficiency. In short, transportation infrastructure is one of the key components for Mexico to be able to effectively compete with other developing countries that have lower labor rates but are not as strategically positioned next to the world's largest consumer market. Remarkably, only now under the Calderon administration has transportation infrastructure improvement assumed a central role in the government's national

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[7] Assessing the Foundations of Mexico's Competitiveness: Findings from the Global Competitiveness Index 2007-2008, World Economic Forum, http://www.weforum.org/pdf/Latin_America/Mexico2008.pdf

economic strategy. Yet it is clear that building new roads, enhancing rail connections, constructing new ports and airports and is not merely a job creation strategy, rather, it is an attempt to fundamentally reposition Mexico for the 21st century.

Financing

Until recently, Mexico lacked the basic financial tools needed to raise sufficient capital to rapidly increase the competitiveness of infrastructure. Tax revenues were insufficient and funding for infrastructure was incredibly uneven. There were also strict barriers on private investment in the Mexican economy that prevented the private sector from augmenting the insufficient public sources of revenue. As recently as 1993, foreign indirect investment into Mexico was a paltry $5 billion per year. Since 1993, foreign direct investment has increased by approximately 400% as of 2006.

The detailed ranking of competitiveness segregates infrastructure into eight components. Then, each component is classified a positive or a negative to the country's overall economic performance. For all eight subcategories Mexico's infrastructure impedes its overall economic performance. The overall quality of infrastructure is poor and rates 69th in the world. The quality of roads are ranked 59th, railroad infrastructure is ranked 74th, port infrastructure is ranked 91st, and air transport infrastructure is ranked 60th. Therefore Mexico's air transport and road network are seen as low performing, yet in line with Mexico's overall economic rating. However, the quality of its port infrastructure and its railroad infrastructure is seen as far below that of its overall economic performance.

Within the broader category of transportation infrastructure, ports and railroads are the areas in which Mexico can improve the most compared with other countries. The ranking for ports and rail infrastructure in Mexico is particularly striking given that the country has had almost a decade of experience in the privatization and reform for these sectors of the economy. It has been well documented that the privatizations of major terminals and rail lines in Mexico has been largely successful and have improved Mexico’s status compared to pre-privatization. The modernization of ports and intermodalism within Mexico has been improving at a rapid pace. Yet even with all of these improvements, systemically Mexico's intermodal system is not yet where it needs to be in order to serve as a net advantage in the development of the economy. Statistics such as these illustrate how dilapidated the Mexican Port and rail infrastructure was prior to privatization. The WEF index is an aggregate summary that assesses the total quality of all assets. As such it may understate the presence of some assets that are high quality. As is common when a country shifts from a publicly financed and publicly managed infrastructure system to a hybrid public-private system, the development of infrastructure will be uneven given that private investors will place their money in those projects that have the highest probability of producing financial returns. This dichotomy is illustrated in the example of Mexican ports in which certain facilities within Mexico have been developed to U.S. or European standards, and when examined independently indicate that they are making great strides in port development. Yet the aggregate numbers indicate despite showing marked improvement at some facilities, Mexico still has a long way to go. Until a few years ago, Mexico had one modestly sized container port on its West Coast in order to handle all containerized imports from Asia and its Pacific South American trading partners. Thus, in describing the truly impressive improvements that have occurred in Mexico’s development over the past decade, it is important to recognize that most of these improvements have been about bringing Mexico infrastructure up to the point that it no longer critically undermines Mexico’s own economic development.

Geography is important in understanding the constraints and inherent logic driving multimodal improvements within Mexico. Mexico's difficult topography is one contributing factor to the high cost of transportation that has hindered the development of internal and interregional trade. The mountainous terrain is a challenge and an opportunity for the development of intermodal rail within Mexico. David Eaton of the Kansas City Southern, a railroad that has significant intermodal experience in both countries, estimates that the breakeven distance where rail becomes competitive with trucking in Mexico is significantly shorter than the comparative distance within the United States, under optimal conditions. This is partially due to the fact that moving cargo over significant grades requires far more energy per ton than moving cargo over low grades. The technological challenges for designing a double stack railway over difficult topography are significant, yet in certain key corridors in Mexico these technological challenges have been overcome. Thus the comparative fuel savings from moving containerized cargo particularly from the Mexican Pacific Coast to central or Northern Mexico when compared with the trucks is significant.

One advantageous feature of the Mexican intermodal rail system is the ability to handle 53-foot boxes. The U.S. domestic 53-foot container, which has several productivity advantages over 40-foot containers, is becoming far more common as a unit of commerce. The grade and curvature of many of the roadways within Mexico are not designed to handle long trailers easily. Short trucks with heavy axle loads are appropriate for Mexican trucking so long as cargo is stuffed and unloaded internally. However, when trucking operates internationally, this is no longer a viable option.

In the past, the government has subsidized the price of diesel fuel, which has held down the price of trucking domestically. However, in its attempt to limit the distortions currently caused by federal control of the petroleum sector, the Mexican government has recently announced that it will reduce diesel subsidization. As a response, the Mexican Trucking union, La Cámara Nacional del Autotransporte de Carga (CANACAR), instituted increases in fuel surcharges that would push the target cost of trucking in Mexico to approximately $3.00 per kilometer (Camara National del Autotransporte de Carga 2008). This figure is higher when truckers must use toll roads. The market share of trucking in Mexico, when compared with rail, is dominant enough that in most cases the truckers can make rate increases without seriously considering the impact of diversion to rail.

The restoration of rail service in Mexico has assisted in the development of several key sectors of the economy, particularly the auto industry. Intermodal rail in Mexico was pursued, even prior to privatization, as an automotive connection linking Chicago and Detroit to Mexico City. In recent years, rail connections for intermodal cargo from the Pacific or Atlantic coasts to central Mexico have emerged as a priority area. The minor role that marine ports played in the Mexican economy for manufactured commodities meant that there was not enough rail competitive cargo to justify rail corridors linking the ports to central Mexico. The growth in marine intermodal cargo at the Ports of Veracruz, Manzanillo, and recently Lazaro Cardenas has meant that the full development of a transcontinental rail system that would compete with trucking in Mexico is now possible, though it would require a substantial expansion from the current situation. As an example, the total number of rail cars in the Mexican system stood at 34,591 at the beginning of 2008. This compares with 1.4 million cars in the United States. Recently, the Association of American Railroads started tracking and reporting carload volumes for the two major Mexican railroads along with their reporting of U.S. and Canadian Class I rail activity. Through the first 46 weeks of 2008, Mexico’s rail volume has not seen the amount of decrease that has been seen by

American Railroads. While KCS-Mexico's (KCS-M) total volume for all cargo types is down 6.5% through early November, their intermodal volume has increased by 8.1% compared to the same period in 2007 (Progressive Railroading 2008). KCS-M's total intermodal volume stood at 234,000 units through the first half of November 2008. Ferromex intermodal volumes for the first 10.5 months of 2008 were virtually unchanged from 2007 at 133,000 units. According to rail officials in Mexico, the investments made in infrastructure are now bearing fruit and will increase the total volumes of cargo, thereby delaying the visible onset of a slowdown in demand.[8] As of July 2009, the cargo profile for Mexican railroads remained decidedly more mixed than the comparative situation for U.S. railroads. While U.S. railroads in the summer of showed dramatic declines in every major commodity category, Mexican railroads saw increases in three commodity classes: chemicals, petroleum, and farmed products excluding grain (AAR 2009).

Response to the Current Budget Crisis

The basic funding mechanisms of Mexico's infrastructure plan are currently under stress from a number of sources. The projected growth rate for the Mexican economy for the year 2009 has been reduced to 1.8% from a projected growth of 3% at the beginning of the year.[9] The rapidly declining price of oil—which is reducing projections of federal revenues along with the collapse of major financial institutions that were expected to play a large part in financing rapid infrastructure expansion—threatens to undermine the plan. In October, the Mexican federal government downgraded the projected price of oil for 2009 and determined that it would be necessary to run a significant deficit, of up to 1.8% of Gross Domestic Product (GDP) in order to continue to fund the infrastructure program as well as other national spending priorities. This deficit would be the largest such deficit in Mexico since 1990 and a bitter pill for an administration that had sought to improve the perception of Mexico as a financially stable market and continue the progress that was made during the Fox administration in terms of enhancing Mexico's reputation. The trend lines for the Mexican economy are worrying. Mexican manufacturing has been strongly tied to the "Big 3" auto makers in the United States, each of whom has outsourced significant production to Mexico in order to reduce costs. The collapse of the auto industry in the United States threatens to undermine Mexican manufacturing given that factories in central and northern Mexico are key suppliers of parts for the U.S. auto industry. While not wedded exclusively to the Big 3, Mexican firms retain a strong symbiotic relationship with Detroit. Furthermore, a decline in demand from the Michigan-based companies has the potential to substantially undermine the base of intermodal cargo currently moving through gateway ports such as Laredo. Detroit auto manufacturers, for all practical purposes, started intermodalism within Mexico. While the intermodal profile of cargo moving between Mexico and the United States has diversified in recent years, auto parts still form the backbone and most of these are headed to Chicago and on to the Midwest manufacturing centers. Rail is becoming competitive for Texas-based auto manufacturers such as Toyota in San Antonio, but it is the Michigan market that has locked up a substantial share of Mexico's cross border intermodal volume for the last 10

[8] "Tráfico ferroviario de mercancías aumentará pese a la crisis: ALAF," http://www.t21.biz/Snoticias/titulo_1/titulo_1.php

[9] "Mexico's Economy Justifies Lower Rate, Werner Says," http://www.bloomberg.com/apps/news?pid=20601087&sid=agILi2vO8ZJk&refer=home

years. This role was illustrated in Technical Memo 1. If this market were to suddenly disappear, it is doubtful that in the short term sufficient diversification to other potentially rail competitive cargoes could occur to compensate. In short, the reduction in rail revenues could curtail other expansions in the rail network currently envisioned.

The credit crisis and collapse of investment banks has the potential to have other, potentially unforeseen impacts on the Mexican economy and Mexico's intermodal ambitions. Cities in Mexico already have far fewer options in terms of availability of credit when compared with their U.S. counterparts. It is possible that part of the role of Banco Nacional de Obras y Servicios Publicos (BANOBRAS), the Mexican state-supported infrastructure bank, will be strengthened in the coming months and years to compensate for a fall-off of private investment banks. BANOBRAS played a critical role in infrastructure funding during Mexico's previous economic downturns. In the last few years, its total participation in infrastructure projects has waned and its lending has become more specialized towards functions that could not be adequately addressed by private financiers, such as loans to states or municipalities that did not have investment grade rating. Increased participation by BANOBRAS or demand for BANOBRAS-backed loans in areas that have seen recent participation by pure private banks may be an indication that the private system is insufficient to provide needed funds.

Another action that is currently being proposed by Mexican officials in order to shore up the short term economic crisis is a lowering of interest rates. Again, this is a policy that is common practice in the United States but has been used with great reluctance in Mexico given the interest in keeping the Peso strong. Still, Mexico's deputy finance minister, Alejandro Werner, has called for a reduction in interest rates in the near future. Mr. Werner argues that falling commodity prices, such as food and energy, which make up an even greater share of the average Mexican's family budget than is the case in the United States, will serve as a deflationary force that would serve to counteract inflationary pressure created by falling interest rates. This step, along with the groundbreaking decision to voluntarily run a deficit and use infrastructure spending as economic stimulus, indicate a degree of sophistication in Mexican economic policy. It is a credit to the Mexican efforts of the past decade to improve their macro-economic condition and reputation that they can now afford to take steps such as running temporary deficits and lowering interest rates that 5–10 years ago would not have been a viable option.

In November of 2008, the Congress did pass a budget that expanded domestic spending on infrastructure. The version of the budget that was passed by the House of Deputies actually raised the total amount of infrastructure spending when compared with the amount proposed by the Calderon administration.[10] The Finance Minister, Augustin Carstens, took the unusual step of hedging the price of oil at $70 barrel for 80% of its oil exports for the remainder of the year, thereby preventing further erosion in Mexico's ability to cover its budget. The new budget will represent a 13% increase in spending in real terms compared with last year.[11] It is believed that without the decision to hedge oil prices, expanding

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[10] "Mexico lawmakers clear '08 budget for final vote," http://www.reuters.com/article/marketsNews/idUSN1232371820081112

[11] "Mexico's Congress passes budget increase," Adam Thomson in Mexico City, November 13 2008, http://www.ft.com/cms/s/0/b807f7b6-b1b5-11dd-b97a-0000779fd18c.html

infrastructure spending would not have been possible or at least would have been seen as far riskier for Mexico’s long term macroeconomic stability.

Specific Developments at Mexican Ports and Rail Facilities

The following section illustrates recent notable developments that have occurred at Port and rail projects in Mexico that may impact Texas–Mexico trade patterns. The projects described in the following section all have an intermodal focus. Some are multimodal, such as the described inland port development projects and the port developments whose success will depend in large part on parallel improvements in the rail system.

Developments at the Port of Lazaro Cardenas

Location: Pacific Coast State of Michoacán

Status: Container terminal partially completed. Access to KCS rail system

In September 2007, the Port of Lazaro Cardenas opened its long awaited container terminal capable of handling Post-Panamax vessels. Since its opening, the container volume at Lazaro Cardenas has increased substantially; however, most of this growth has come from modestly sized container vessels, not Post-Panamax. The Port has seen a steady increase in traditional 3,000 to 4,000 TEU vessel strings diverted from the capacity-challenged Port of Manzanillo. In September of 2008, *Lloyd’s List* reported that the Chilean line Compañía Sud Americana de Vapores (CSAV) service switch from Manzanillo to Lazaro Cardenas is responsible for a substantial percentage of the change in cargo volume for 2008. It should be noted that the CSAV service switched to the Lazaro Cardenas terminal, which is less efficient than the SSA-operated concession terminal in Manzanillo. The need to handle substantial container volumes at the general use docks at Manzanillo is a phenomenon that emerged after the concession in order to accommodate shipper demands. The principal lines currently serving the Lazaro Cardenas terminal are APL, Maersk Line, Cosco Group, and Hapag-Lloyd. Lazaro Cardenas saw the arrival of a fourth container crane capable of serving Post-Panamax vessels in October of 2008 (Lloyd's List 2008).

Maersk has stated that it is interested in building its own terminal in Lazaro Cardenas as opposed to using the terminal currently constructed. The concession tender for this terminal is expected to be released in November.

An interview with the Port Director of Lazaro Cardenas illustrated the close connection between rail service and the Port’s success. According to former Director Palos Najera, approximately two-thirds of the cargo that enters the Port destined for the Mexico City area is currently delivered by rail, with the remaining one-third delivered by truck. This is a particularly relevant statistic given that the truck distance between Mexico City and Lazaro Cardenas, while significant, is not so extreme as to make rail the automatic default choice. A small minority of deliveries are destined for locations north of Mexico City, including San Luis Potosi and Monterrey. These deliveries go almost exclusively by rail. The port does not have specific statistics on cargo that is ultimately destined for Mexico versus cargo that is destined for reassembly and exported to the United States or another country. [12]

Quality of Road Access

The Port of Lazaro Cardenas is accessible by means of a newly constructed toll road that connects the city of Lazaro Cardenas to Morelia. After having been delayed for over a decade, the Siglo XXI highway was inaugurated by Vicente Fox in mid-2005 and reduced the travel time between Lazaro Cardenas and Morelia from approximately 8 hours to only 4 hours. The actual construction of the road took 8 years.[13] The road was principally designed around freight but was also of key importance in connecting communities. One of the key reasons for the delay was a cost overrun that raised the total for constructing the road from 2.5 to 4.8 billion pesos.[14] Delays also were generated from conflicts with fishermen and farmers on commonly owned *ejido* land.[15] One of the goals of the new terminal construction was to improve the access by trucks and to lessen the required interaction with city traffic. The new terminal facility is built to the east of the city. The new arrangement allows trucks and trains to exit the urban area heading east and eventually north without interfering with urban traffic. Some traffic will pass through the town of Petacalco, which is a suburb of Lazaro Cardenas, en route to the main Lazaro Cardenas-Uruapan Highway.

There are indications that the Port of Lazaro Cardenas is already having some impact on Texas commerce and the maquiladora sector. Keith Patridge of the McAllen Economic Development Corporation states that his organization is coordinating with maquiladoras in the Reynosa area to use the Lazaro Cardenas gateway for shipments that had previously come through Los Angeles and Long Beach. As of October 2008, maquiladoras with which the McAllen Economic development corporation has a direct relationship with were moving approximately 10 containers per week from the Port of Lazaro Cardenas to the Reynosa area. Industries that have taken advantage of this option include electronics and appliance maquiladoras. Textile manufacturers have yet to divert from traditional trade routes. The McAllen development foundation states that at least through this early experimental phase, shippers have been able to reduce their total logistics cost by an average of $1000 per container for imports and $1500 for exports by utilizing the Mexican trade corridor when compared with their previous routing through the West Coast intermodal system. This option also produces a time savings of approximately 3 days when compared to landing cargo at the Port of Los Angeles, railing to San Antonio, and draying it across to the Reynosa area. While the volume of cargo handled by Reynosa maquiladoras through the Lazaro Cardenas gateway is still modest, more important is the type of cargo that has crossed at this gateway. Specifically, the gateway is being utilized for cargo that will end up in the maquila assembly plants on the Mexican

[12] "Top carriers flock to Lazaro Cardenas," Lloyd's List, September 30, 2008, Tuesday, Special Report—Mexico; Pg. 15, 542 words

[13] Estrena al fin su 'Siglo 21' El Norte, 19 March 2005, Adán García

[14] "INAUGURACION TOTAL-AUTOPISTA" Servicio Universal de Noticias, 21 March 2005

[15] *"...debido en parte a los conflictos sociales que se generaron por parte de ejidatarios y pescadores de la region,"* INAUGURACION TOTAL-AUTOPISTA Servicio Universal de Noticias, 21 March 2005

side of the border and will then be exported, in finished form, across to the U.S. side. In its 2005 study on Asian trade corridors, CTR proposed that the shifting pattern of maquiladora input sourcing away from the United States and towards Asian suppliers would be a potential opportunity for Mexican Pacific coast container ports. The rationale is that it saves not only total overland distance, but also eliminates a redundant border crossing. While the southbound crossing of maquila input cargo is less onerous than crossing the other direction, it can add cost, unpredictability, and time with associated inventory cost to any transaction. Instead, cargo must only cross the U.S.–Mexico once as a finished product.

Port of Manzanillo

Location: State of Colima, Pacific Coast

Status: Undergoing expansion

Background: The Port of Manzanillo is Mexico's largest container port. For a decade, Manzanillo held a near monopoly on container movements on the Mexican Pacific Coast. This status emerged due to the fact that Lazaro Cardenas, the other port capable of handling significant numbers of containers on the Pacific Coast, had no efficient road linkage to the Mexico City area and the pre-privatization rail service was too inefficient to meet the demands of intermodal carriers. Thus, Manzanillo emerged as the principal gateway for Asian containerized trade moving to Mexico. In 1995, the Port handled only 86,938 TEUs per year. However, after 1995 Stevedore Services of America (SSA) took control of the main container patio through a government issued concession. They equipped the port with modern container handling equipment, and the volume of the Port has grown every year since then and it has now reached the status of a major container port. In 2007, the Port's volume was roughly equivalent to that of the Port of Oakland, which is the United States' 4th largest container port. Manzanillo's growth since 2005 has been particularly impressive. Volumes grew from 874 thousand TEUs in 2005 to a 2007 level of 1.4 million TEUs. This surge of growth in the last two years occurred despite the opening of the first phase of the competing Lazaro Cardenas Hutchinson Port Holdings container terminal in the state of Michoacán, which had been expected to take a substantial amount of cargo away from the Port of Manzanillo.

Manzanillo's success has been driven by a number of factors. SSA has invested substantial resources into the port over the course of the last decade, acquiring modern container cranes and rubber tired gantries (RTGs) that allow the port to attain a high volume of throughput per acre despite a location that is hemmed in by the surrounding urban area.

The initial concession to operate the container terminal at Manzanillo was issued in the summer of 1995 to a joint venture of SSA and Transportacion Maritima Mexicana (TMM), which was Mexico's biggest shipping line. Under the initial agreement, TMM and SSA offered 211.33 million (July 1995 exchange rate) pesos for the concession and promised an additional 82.22 million pesos for terminal equipment. The Mexican partner, TMM, originally held an 80% stake in the deal while SSA held only 20%[16] (Reuters News 1995). It is important to note that the Mexican National Railway company still controlled the rail access to the Port of Manzanillo at the time of this tender. It has since been tendered to Ferromex, which is Mexico's largest rail carrier measured in track miles. The rail connection from the

[16] "Mexico awards concessions at three key ports," 12 July 1995, Reuters News

Port of Manzanillo to the United States runs through Guadalajara and crosses the border at Piedras Negras.

In addition to direct investment from SSA, Manzanillo also benefits greatly from its location within the state of Colima, which has one of the highest GDP and quality of life measures within Mexico. Balancing the industrial activities associated with the port with Colima's touristic and service-based economy has been a challenge but one that the Port has so far successfully navigated. It should be noted that SSA only directly moves approximately half of the TEUs that are serviced by SSA, which is operating its dock through a 50-year concession. The rest are handled by private stevedores, including Hutchinson port holdings and several Mexican stevedores who lease part of the general use cargo docks and unload boxes with mobile harbor cranes. In Manzanillo the Hutchinson operation is referred to as Operado Portuaria de Manzanillo.

Even with the efficiencies that SSA brought to the Port's overall operation, it has still encountered capacity constraints in the last 3 years and its potential to further expand operations is limited with its current footprint. When researchers from CTR toured the Port of Manzanillo in 2005, SSA cited figures of over 40 container moves per crane hour—a rating of port efficiency that placed it in line with some of the most efficient U.S. ports. Yet since the surge of growth that occurred in the last 2 years, a lack of dock space has forced the port to make more redundant lifts to accommodate each box and has consequently seen its moves per crane hour fall into the low 30s (Interview with Mauricio Flores Diaz, SSA Mexico n.d.). Containers are now routinely stacked five-high in the main SSA yard. Furthermore, a substantial share of the port's new growth in recent years has been transshipment cargo, which does not put additional strain on the landside network. The growing role of transshipment cargo has significantly altered the Port's overall cargo profile. Until a few years ago, transshipment cargo made up a relatively small share of the port's total volume. However, it is now the single largest source of port traffic measured in annual TEUs. Some of the lines that use Manzanillo for transshipment are Hapag-Lloyd and Hamburg Sud. From there, feeder ships take cargo to South America, Los Angeles/Long Beach, or through the Panama Canal to the East Coast. In this way, the TEUs handled at the Port of Manzanillo are already impacting container flows of Asian containers to the United States despite the fact that no inbound container trains are currently moving directly between the Port of Manzanillo and the U.S.–Mexico border.

Some officials at SSA expressed disappointment at the level of investment made by Ferromex in the rail facilities serving the port. Manzanillo has an efficient on-dock rail system. However, there is often a shortage of equipment such as rail cars and locomotives that makes rail service from the port less efficient than it could be and has driven away some customers who were attracted to using rail to send cargo to Mexico City but are dissuaded by the uncertainty of having equipment available. In 2008, Ferromex only handled about 70,000 containers a year from the Port of Manzanillo.[17] The majority of the cargo was destined for Mexico City, as is 70% of the total inbound cargo.

[17] Interview with Mauricio Flores Diaz, SSA Mexico, February 28, 2008

Need for New Space

It is clear that SSA de Mexico cannot sustain its current rate of growth without expanding its container patio footprint. While it is true that the Port of Manzanillo is geographically constrained, it would be possible to transfer a greater share of the total dock and patio from the publicly owned port authority to the control of the comparatively more efficient SSA and thereby boost the total TEU capacity of the port. For several years, SSA has been in negotiations with the SCT to acquire a portion of patio located adjacent to the main SSA dock that would allow the stevedore to add an additional berth and shipside crane and would also allow for a more flexible stacking system resulting in fewer rehandles. Under the agreement, the SSA patio would be expanded from 16 to 26 hectares.[18] While this move would not substantially impact the throughput density per hectare, it would likely return the port to its previous attainment for crane moves per hour and, given that the port will likely retain its current market share for transshipments, would likely not have a substantial impact on landside congestion.

In addition to the negotiations with SCT for additional space, SSA was working with API as well. Through interviews with SSA personnel, CTR gained insight into the process of acquiring the additional dock from the publicly controlled API. While on the surface a relatively minor change, this shift was highly problematic due to concerns expressed by SCT of further monopolization by SSA over the West Coast market given the lack of a competing container facility. While SSA made the appeal to acquire the dock to SCT in 2000, final approval did not come until 2007. SSA has speculated that the delay may have been tied to the completion of the Lazaro Cardenas terminal, which the government did not want to see undermined before it got off the ground. Originally, TMM and SSA were planning to fill in the Tapeixtles Lagoon in order to expand their patio space. However, when the lagoon was declared an ecological reserve, the API attempted to compensate by offering TMM and SSA additional dockage space.[19]

Negotiations to approve the deal were conducted directly between the head of SCT and the President of SSA, based in Seattle, Washington. Once approval was issued, SSA immediately began the process of repaving and improving the dock to make it suitable for use as a berth. While there are additional expansions envisioned by the Port's master plan, this expansion is the most near term. The U.S. Trade and Development agency estimates that the total cost of this initial expansion will be $170 million that will come from a combination of public and private sources.[20] While future expansions are possible within the Port's existing area, SSA has begun to favor the construction of a new terminal that would be further from the city center and would not face the restrictions on truck and rail movements that the current terminal faces. The new terminal, which would be built near the Laguna de Cuyutlan, faces significant environmental hurdles if it is to be realized. Protests are already occurring to prevent the threat to the native turtle population. The Manzanillo API is still interested in the possibility of expanding the port on its existing territory through the "Zona Norte" expansion that would add, theoretically, an additional 2 million TEU of capacity and would likely continue the port's current orientation as a

[18] "Bids on Manzanillo port Zona Norte work to start mid-08," 26 September 2007, *Business News Americas*

[19] "Land granted to TMM in Manzanillo was included in concession contract," 1 July 2002 *Corporate Mexico*

[20] "US and Mexico: Building Partnerships in Infrastructure Conference Guide," US Trade and Development Agency, Feb, 2008

transshipment hub.[21] If Manzanillo were to improve its landside connectivity, this would require the construction of two landside overpasses and/or a tunnel to connect to the Ferromex system. For this Ferromex's active participation would likely be a prerequisite.

Rail Issues

Ferromex is Mexico's largest rail carrier in track mileage. They are in the process of expanding intermodal cargo capacity.

Ferromex estimates that rail in Mexico currently constitutes about 6% of the total intermodal volume moving within the country. There is a significant opportunity to shift cargo internally from the road network to intermodal corridors. Presently, 12 principal intermodal corridors are under consideration for development as part of the Calderon Plan in order to shift a greater share of the cargo to the rail network. In 2009, Ferromex plans to invest $200 million and expand the number of intermodal terminals from 7 to 10, thereby providing greater interconnectivity for rail shipments.[22]

Major ocean carriers have recently suggested that while the rail network in Mexico is improving, it is still not good enough to surpass the trucking industry. A few of the rail corridors have seen substantial investment, such as the route connecting Mexico City to Laredo. However, much of the network requires modernization. *Lloyd's List* states that, despite all the attention paid to international intermodal services, "Domestic cargoes are driving the growth today." In one sense, the relative success of domestic intermodal service within Mexico is a positive sign given the historical dominance of trucking. Shippers of international intermodal cargo, should they proliferate within Mexico, would likely not have as strong of a modal bias towards trucking, given that intermodal rail is well known in the world of international freight forwarding. *Lloyd's List* also argues that the initial enthusiasm from shippers for using Mexican ports of entry to bypass the U.S. west coast has faded considerably. It appears that Ferromex is taking a less pro-active strategy when compared with KCS-M in targeting the U.S. market. While the $200 million of investment cited above is an impressive sum, it is spread over an expansive rail network, much of which requires substantial upgrading. Without a substantial capital injection from an outside source, Ferromex can likely not afford to simultaneously improve the network as a whole and upgrade a principal intermodal corridor such as the corridor linking the Port of Manzanillo with the border crossing at Piedras Negras. This would involve upgrading some 1,700 km of the track to ensure that it could compete on a cost and time reliability basis with the more direct Lazaro Cárdenas to Laredo Routing. KCS-M has long stated that the international corridor running from Lazaro Cardenas to Laredo would be its first priority and account for a substantial share of total investment. Ferromex has no such corridor of equivalent centrality. It is partially for this reason that intermodal rail traffic on the Manzanillo to Guadalajara corridor is still lagging. While rail traffic on this corridor has improved, it has not managed to keep pace with growth at the Port of Manzanillo. As a result trucking from Manzanillo, even as far as to Mexico City, is still prevalent. This is an area of concern for shippers who continue to prefer the efficiency of the Port of Manzanillo but cannot rely on using rail service for the majority of their

[21] "Bids on Manzanillo Port Zona Norte work to start mid-08", Business News Americas, 26 September 2007

[22] "Intermodal corridors have 'big potential'," *Lloyd's List*, September 30, 2008 Tuesday, Special Report—Mexico; Pg. 14, 755 words

cargo shipments. Ferromex has stated that their shippers have shown little interest in cross border shipments: "Today, there is no demand for cross-border cargoes," according to Terry McDermott, the commercial director for Ferromex.[23] Nevertheless, Ferromex has promised that it will invest in new capacity commensurate with planned capacity expansions at Manzanillo in the next 2 years. These expansions include not only higher projected throughput at the recently enlarged SSA terminal but also expansions of the Hutchinson general use dock, which will see $14 million of investment in the near future. In addition, the Mexican stevedoring firm Operadora d la Cuenca del Pacifico (OCUPA) has invested $5 million in container infrastructure and handles containers on the general use dock.[24] OCUPA is currently negotiating with CMA-CGM to handle up to 60% of the containers arriving at Manzanillo.[25] CMA-CGM is the same shipping company that carries containers through the Panama Canal from Asia to Houston.

Resolving Trackage Rights Disputes

SCT is strongly pushing to end disputes over trackage rights that have limited the growth of rail since privatization. The use of track by other railroad companies is still a rare occurrence in Mexico despite the fact that shared track would lower the total rail distance for key routes such as the connection between the Port of Manzanillo and the border. Major markets that currently are hosted solely by one rail provider. For example, KCS-M has sole access to the Guadalajara market since it owns the rail line to Guadalajara. Creating competitive access to this market is one of the current goals of the Mexican government.

Guanajuato Inland Port

Location: State of Guanajuato, Central Mexico

Status: Early development, access by Ferromex rail

Several inland ports that have been proposed or constructed in Mexico thus far have revolved around the KCS system. However, the new inland port under construction at Guanajuato would be exclusively accessible by Ferromex and newly improved highway corridors. A conference hosted by NASCO in June of 2008 highlighted the potential role of the Inland Port of Guanajuato in Mexico's future transportation system. The inland Port at Guanajuato entered into the discussion in 2004, when the site was envisioned to handle overflow cargo from the rapidly growing Port of Manzanillo. The Port Director of Manzanillo, Hector Mora, stated that the Inland Port was pursued by the port due to rapid

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[23] "Intermodal corridors have 'big potential'," *Lloyd's List*, September 30, 2008 Tuesday, Special Report—Mexico; Pg. 14, 755 words

[24] "Growth," *Lloyd's List*, September 30, 2008

[25] "OCUPA looks to consolidate operations at Manzanillo through contract with CMA-CGM," *Business News Americas*, 6 November 2008

growth that could not be easily accommodated in the immediate port area. In 2004, the newspaper *Reforma* stated that the Inland Port was to “serve as an extension of Manzanillo.”[26]

A company named the Guanajuato Puerto Interior (GPI) signed a memorandum of understanding with Dallas in 2007 to pursue connections between the two inland Port facilities—Alliance and GPI. The two ports pledged to study rail investments that could improve the linkage between Guanajuato state and Dallas. Like Alliance, the Guanajuato facility was initially planned around air freight. It is accessible by the Ferromex rail-line, which connects to the Port of Manzanillo, but could also receive truck shipments from the Port of Lazaro Cardenas.[27] The port facility has established a free trade zone.

Interpuerto Monterrey

Location: Monterrey, Nuevo Leon

Status: Early development accessed by KSC-M (near their intermodal terminal)

The development of a major inland port in Monterrey has the potential to substantially alter freight patterns to Texas for both rail and trucks. The Mexican federal government has dedicated $50 million to the construction of this facility. In addition, an expert estimated that the federal government will invest approximately $250 million in the construction of the SR1 connecting the inland port to the bridge at Colombia.[28] This project is a part of the Calderon Infrastructure plan. The state of Nuevo Leon has facilitated the construction of the facility by approving the environmental permits, certifying the facility as a free trade zone, and constructing the supporting landside infrastructure. The bulk of the financing, however, will come from private investors. One key function of the inland port will be to join together the Ferromex and KCS rail lines with a central terminal that may or may not be controlled by a third party. This would allow shippers to make decisions on shipments from or to Monterrey without worrying about the exclusive arrangement with one rail carrier or the other, thereby potentially improving the total market share for rail.

There are several organizations that are stakeholders in the Interpuerto project including the INVITE organization, which is tied to the state government of Nuevo Leon. This organization has been responsible for publishing multiple studies on the economic situation of the Nuevo Leon economy, often in concert with the prestigious Tech de Monterrey University. INVITE also works with the private group SADCV (Servicios Inter-Puerto SA DE CV), who are developing the inland port. In Texas, the interest of establishing the inland port has been repeatedly advocated by the NEMEX-Tex organization, which was created by an agreement between Governor Perry and the governors of the states of Northeastern Mexico to advocate for common issues. Of the two major railroads that would be impacted by this development, neither has played a large financial role in its development. KCS-M already has a fully functional intermodal terminal in Monterrey. In one sense it has less to gain, at least in the short run, from the

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[26] “Manzanillo Port to Build Guanajuato Warehouses,” *Business News America*, April 6, 2004, Roberto Martinez Perez

[27] “GPI signs cooperation agreement with Dallas,” August 31, 2007, *Business News Americas*

[28] Interview with Hugo Gonzalez, INVITE, 05/07/08

development of a general use inland port near its own terminal than would Ferromex. However, Ferromex is also taking a passive role towards the project at the moment and has not directly contributed to its completion.

Figure A1 shows the location of the terminal, which is sandwiched between the Ferromex and KCS-M rail lines. The project would build upon KCS-M intermodal rail terminal with industrial development to the west. There is some confusion in terminology given that the term “Interpuerto” was first largely used to refer to the inland port in San Luis Potosi.[29] This term is now being used in Monterrey and other inland ports as a generic term. Certain officials have suggested that the term Interpuerto only be used in reference to intermodal facilities that have access by more than one major railroad. Such a designation would apply to Monterrey but not to San Luis Potosi or the new inland ports at Guanajuato or Oriental (Puebla).

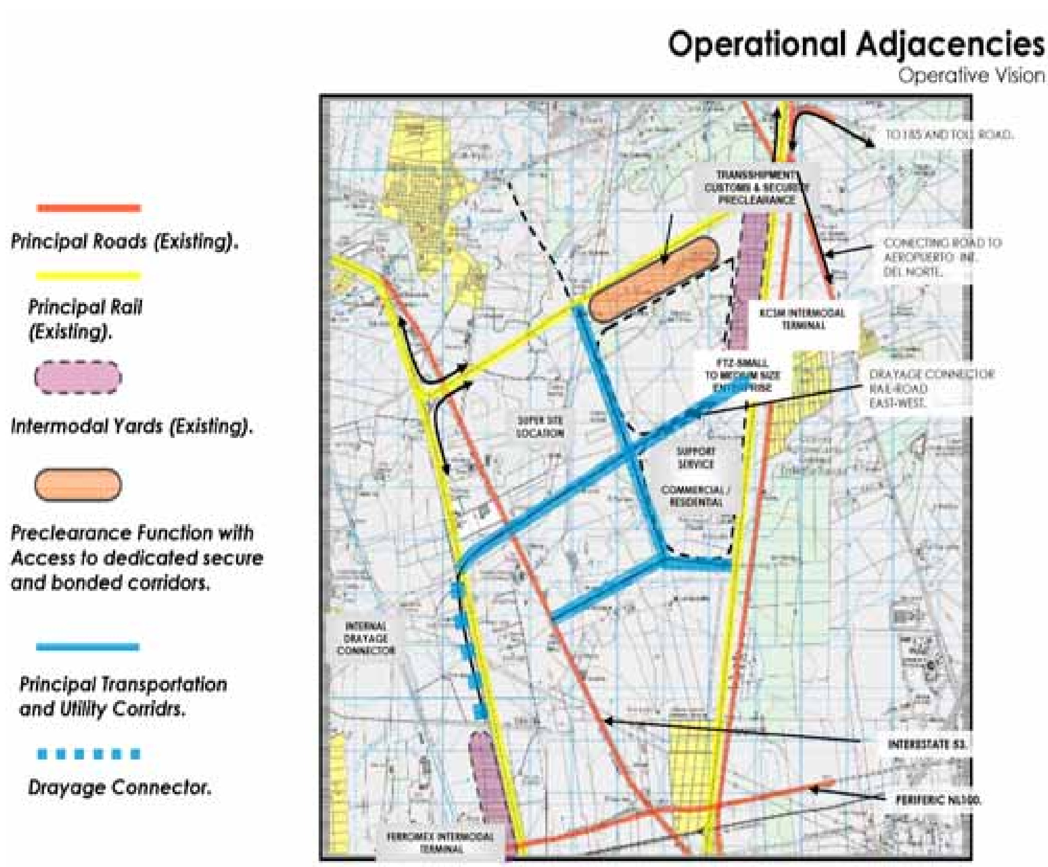

Figure A1. Monterrey Inland Port

[29] KCS-M “Interpuerto: Terminal Intermodal del Carga, About us.” http://www.interpuerto.com.mx/Pages_Main/info/info.asp

El Paso/Juarez Rail Corridor

Location: Ciudad Juarez and surrounding area

Status: Advanced planning access with Ferromex and Burlington Northern and Santa Fe Railroad.

In recent years, the Burlington Northern and Santa Fe (BSNF) has championed the concept of performing a significant upgrade of the rail line connecting Ciudad Juarez and El Paso. This rail line is a critical connection for the BSNF in handling both intermodal and bulk cargo. The rail line passes through the middle of Ciudad Juarez and causes major disruptions to traffic as well as safety. Video footage compiled by Ferromex train operators over the last few years has painted a picture of intolerable train/pedestrian interaction. In the most recent infrastructure plan sponsored by President Calderon, funding was provided to provide grade separations throughout Ciudad Juarez. This plan was viewed by several parties as a workable near to medium-term solution that could rapidly improve the safety conditions of rail traffic while at the same time removing the justification for restrictions on north south train traffic currently placed by the city government of Ciudad Juarez that produces significant conflicts between local government and the railroad company. The mayor's office has regularly placed restrictions on the number of trains that can pass through the city during daylight hours. A grade separation project would not completely solve the problem, but it would greatly alleviate it. The project is competing with a more wide ranging proposal to completely bypass the Cities of Ciudad Juarez and El Paso and cross trains to the west of the City, at the proposed Santa Teresa rail crossing in New Mexico. This solution, which is strongly supported by the Mayor of Ciudad Juarez, as well as the State of New Mexico, among others, would be a more permanent and lasting solution, but would also come at a much higher cost. BNSF and the Mexican Federal government, including officials in the rail division of the SCT, believe that the Santa Teresa proposal shall be Phase 2 of a two-step process, given the severity of the current problem and current economic conditions. The first step being the grade separations in Ciudad Juarez. New Mexico Governor Bill Richardson, who recently met with the Governor of Sonora regarding the project, has stated that he hoped to accelerate the clearance process for the presidential permit to construct the crossing.[30] The Mexican administration fully supports the realization of the crossing clearance and permit issuance. It does not, however, believe that the construction of a grade separation project in Ciudad Juarez would necessarily prevent the Santa Teresa crossing from moving forward. Rather, the SCT suggests that the new grade-separated system could be converted to serve commuter rail if the Santa Teresa crossing was built. The Mexican government has allocated funding in the national infrastructure plan. It is believed that the Santa Teresa Crossing would potentially benefit the Union Pacific to a greater extent than the BNSF given that it corresponds with the UP's efforts to create a new intermodal yard and refueling station in the Santa Teresa Area. The UP plan depends on negotiating a land swap between the state land office and the U.S. Bureau of Land Management in order to create a 1,600 acre site for the yard.[31]

The BSNF has seen a far higher rate of growth at the Ciudad Juarez/El Paso point of entry than at other points of entry such as Laredo and Piedras Negras. BNSF has seen a doubling in rail car unit volumes through El Paso since 2003, increasing from 80,000 in 2003 to over 160,000 in 2006. In 2007,

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[30] "Officials Pledge to Help Railroad Bridge Move Forward," *Albuquerque Journal*, October 1, 2008.

[31] "Officials Pledge to Help Railroad Bridge Move Forward," *Albuquerque Journal*, October 1, 2008.

the El Paso Gateway was responsible for 37% of BNSF's total unit traffic with Mexico. This growth in volume is what prompted the incoming Calderon administration to seriously consider an infrastructure upgrade to the corridor.

The estimate for the cost of the Santa Teresa Crossing (shown in Figure A2) is $515 million. The Mexican side has promised funding of $148 million, plus $69 million from Juarez. The U.S. side would be responsible for $297 million.[32]

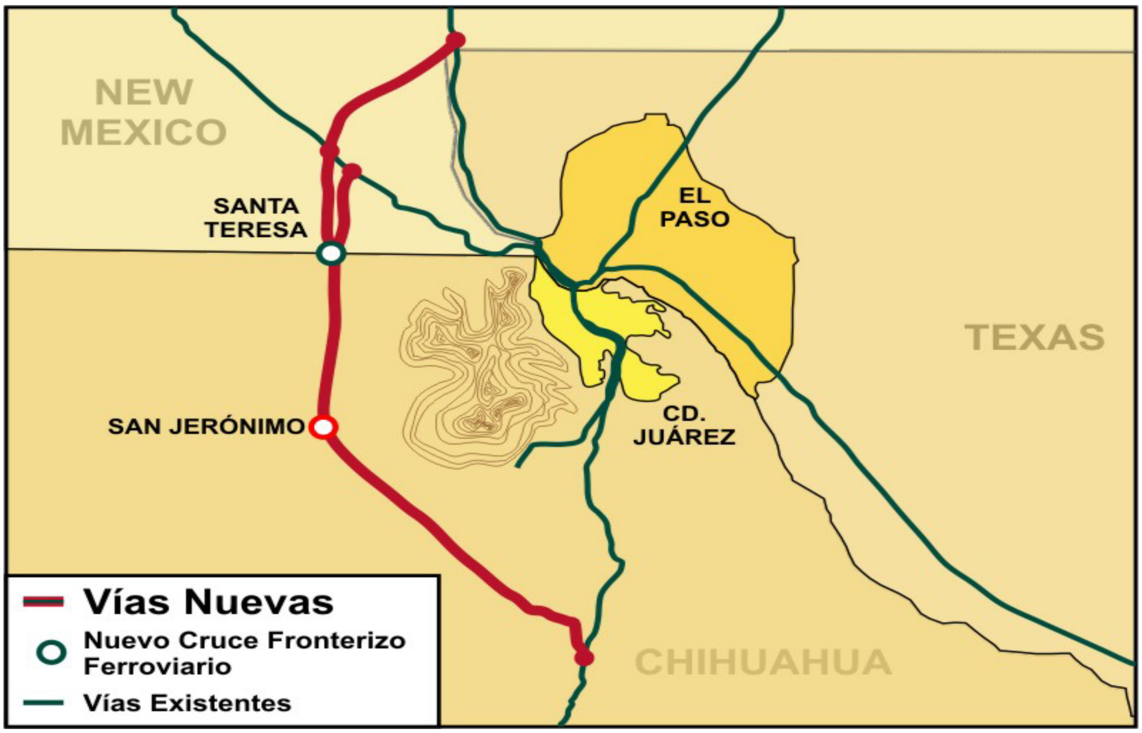

Figure A2. Map of Proposed Santa Teresa Bypass

The grade separation through Ciudad Juarez would be much less expensive. It is estimated to cost $70 million and be completed over the course of 3 years. It should be noted that in this presentation, construction was assumed to begin in 2008; however, this will now likely be delayed until 2009 at the earliest.

In conversations with BNSF, it was learned that the city government of Ciudad Juarez has come to oppose the grade separation project advocated by SCT because they feel that if developed, this will likely mean that the Santa Teresa crossing project will never materialize. This would mean that, while north-south freight rail traffic would be less intrusive than it is currently for civilian life within Ciudad Juarez, it would significantly delay, if not eliminate, the possibility that a full north-south bypass of the

[32] "Proyecto Integral Paso Del Norte (PIPN)," Powerpoint presentation by SCT, Ferromex, and BNSF

city would be completed in the near future. In October 2008, the Mayor of Ciudad Juarez attempted to block the implementation of the grade separation plan.

Safety concerns in Ciudad Juarez are amplified by several factors: one of the most significant is that not even passive restraints for rail safety currently exist, meaning cars and passengers casually pass over the rail tracks over dimly lit streets. According to BNSF officials, one of the greatest safety concerns occur when trains are stopped, inducing pedestrians to cross in between the rail cars. There is no way for the engineer to know, when the train is restarted, whether people are crossing in between the rail cars. Likewise, it is impossible for individuals crossing to know when a stationary train is about to start moving.

Appendix B: 0-5973 IRO Workshops

The attached CD contains three, four-hour presentations made for the TxDOT International Relations Office during the summer of 2009 covering a variety of trade-related issues impacting global transportation and TxDOT planning. It is based on material collected and used by research staff for the various aspects of the 0-5973 reports, and comprises PowerPoint presentations – together with speaker notes of introductions where appropriate.