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A Review of Asian Trade Corridors Serving Texas

Authors:

Robert Harrison

Nathan Hutson

John McCray

**Project 50-5XXIA006: Impacts of U.S.-China Trade on the Texas Transportation System**

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**Performing Organization:**

Center for Transportation Research  
The University of Texas at Austin  
3208 Red River, Suite 200  
Austin, Texas 78705-2650

**Sponsoring Organization:**

Texas Department of Transportation  
Research and Technology Implementation Office  
P.O. Box 5080  
Austin, Texas 78763-5080

Performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.

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## **Background and Introduction**

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This report summarizes an evaluation of transportation routes for Asian container shipments to Texas, as performed by researchers at the Center for Transportation Research and the University of Texas at San Antonio. Sponsored by the Texas Department of Transportation (TxDOT), the work's main focus was the impact on the Texas transportation system from continued Asian containerized trade growth, particularly the cargo from China likely to move through Mexican Pacific ports rather than through southern Californian terminals. Total U.S.–Asia trade includes bulk and project cargoes but the corridor analysis in this report concentrates principally on containerized trade moving across intermodal systems.

Since this study began in January 2005, concerns about the ability of the U.S. transportation system to handle the imminent increase of Asian containerized trade have grown more widespread, garnering significant attention in both the industry and mainstream press. Most of this attention has focused on capacity constraints at the Ports of Los Angeles and Long Beach and the rail trans-continental routes serving their container terminals. Ironically, the 2004 late-summer levels of congestion at these ports stimulated a variety of adjustments by shippers, steamship companies, and terminal operations that subsequently allowed the southern California ports to avoid congestion and set new records for container throughput in 2005 and 2006. Still, an overall consensus remains among the logistics community that, without a major change in the global economy, at some future point the volume of Asian cargo will exceed existing and planned U.S. West Coast port capacity. Already, shippers are seeking alternative ports of entry outside the borders of the United States. An array of alternative corridors are being used, tested, or proposed to offer corridor routes that can compete with the Los Angeles and Long Beach terminal routes. This report addresses some of the key corridor alternatives that could impact Texas transportation systems in the next decade.

China is now America's dominant trading partner for containerized goods. The unprecedented rate of growth in international trade with China has put stress on several of the major container ports on the West Coast, namely Los Angeles, Long Beach, Seattle, Tacoma, and Oakland. In most cases, containers not destined within the state hinterland travel on double-stack rail to reach inland state destinations, such as those in Texas. Therefore, to be a viable point of entry for Texas-bound Asian cargo, a container port must have sufficient channel and dockside capacity and an efficient double-stack rail connection. The exception to this condition is an all-water service through the Panama Canal serving a Texas port like Houston. Until 2004, this required set of conditions meant that almost all Asian containerized trade bound for Texas was processed through Los Angeles or Long Beach terminals.

Researchers analyzed those competitive substitutes for Los Angeles and Long Beach terminals that would adequately serve the specific needs of Texas in a variety of ways. First, they categorized the alternates into (a) new and existing port terminals in Mexico, (b) new services through the Panama Canal, and (c) potential service through the Suez Canal. The team developed three technical memos exploring different aspects of these issues. The first memo examined Asia–U.S and NAFTA trade, the latter because

NAFTA trade is already impacting Texas transportation systems, and containerized commodities moving through Mexico might place additional strains on network efficiency. The second memo reported on a field trip to examine two of the most important Mexican Pacific ports, Lazaro Cardenas and Manzanillo, and their links where Asian trade destined for Texas might be handled. The third and final memo compared all corridors using a basic pre-feasibility screening cost tool. The objective of this model was not to predict actual container prices—as prices vary significantly with volume, type and service levels—but to estimate cost differentials between the corridors and so anticipate the impact of cost on shipper choice. The three memos were drafted for TxDOT use when planning staff were considering corridor proposals developed outside the department; this report summarizes those memos.

## **Technical Memo 1: International Trade and Texas: Asian-U.S, China, and NAFTA Growth**

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The purpose of the first technical memo was to explore the evolution of U.S. trade with China and Mexico and record the current trade patterns. The growth of U.S.–Pacific Region trade has three important characteristics for Texas transportation planners. First, trade with Asia is far more unidirectional than trade with Mexico with imports dominating exports. Second, the trade corridors that carry Pacific Region trade are currently east-west rather than north-south, and third, a substantial part of the U.S.–Pacific region trade is containerized and can be moved across the North American intermodal network. This is in marked contrast to NAFTA trade, which is predominantly moved in truck-trailers across well-established Texas highway routes<sup>1</sup>. Global trade is dynamic and shifts in trade impact both the international corridors selected by shippers and the states through which they pass.

### **Shifting U.S. Trade Impacts**

There has been increasing TxDOT interest, since NAFTA was implemented in December 1993, regarding the impact of cross-border NAFTA trade on transportation infrastructure. Several research projects, including bridge, corridor, and port processing studies, have been conducted to ensure that the transportation infrastructure was adequate or that deficiencies could be included into future planning. The increase in U.S. trade with Asia has now turned attention of transportation planners in Texas to the impact this trade will have on transportation infrastructure. Accommodating a growth in Asian trade at a time when cross border trade with Mexico remains robust may present a new set of challenges to Texas transportation planners.

TxDOT sponsored research projects addressing trade issues quantified U.S.-Mexico trade impacts on Texas interstate and other corridors, but generally did not consider Asian trade. This section will summarize total U.S. regional trade, compare

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<sup>1</sup> See McCray, J.P. *The Rivers of Trade: U.S.-Mexico Trade Truck Transportation Corridors*. *Proc.*, 37<sup>th</sup> Annual Meeting of the Transportation Research Forum, Chicago, Ill., 1995 and Figliozzi, M.A., R. Harrison and J.P. McCray. *Estimating Texas-Mexico North American Free Trade Agreement Truck Volumes*. Transportation Research Record No 1763, National Academy Press, Washington, D.C. 2001.

Asian trade with more familiar U.S.-Mexico trade, identify the factors driving the growth of Asian trade, and discuss the movement, peak periods, and potential congestion caused by this trade.

### **Total U.S. International Trade by Regional Trading Partner**

International trade in the U.S. has grown faster than Gross Domestic Product (GDP), making trade increasingly important in the national economy. Total U.S. trade with the world has grown in current dollars from \$827 billion in 1989 to \$2.5 trillion in 2005, as shown in Table 1. U.S. trade grew with all regions of the world during this period. For the purpose of this study, Canada and Mexico are viewed as separate trade regions because each has unique and exclusive trade lanes to the United States. Growth with Asia increased at the sharpest rate from \$306 billion in 1989, to \$841 billion in 2005.

**Table 1. Total U.S. Regional Trade Billions of U.S. Dollars**

	<b>1989</b>	<b>Pct</b>	<b>1994</b>	<b>Pct</b>	<b>1999</b>	<b>Pct</b>	<b>2005</b>	<b>Pct</b>
Asia	306	37%	437	37%	575	33%	841	33%
Europe, Mid East, Africa	258	31%	315	27%	469	27%	728	29%
Canada	156	19%	243	21%	362	21%	491	19%
Mexico	52	6%	100	9%	197	11%	287	11%
South America & Caribbean	54	7%	80	7%	114	7%	191	8%
Total	827	100	1,176	100	1,717	100	2,538	100

*Source: U.S. Dept of Commerce, Foreign Trade Division, Annual CD ROM (various years), Washington D.C.*

The Europe/Mid East/Africa region has seen the second highest growth rate with the United States during this period, growing in dollar terms from \$258 billion in 1989 to \$728 billion in 2005. Although the dollar amount has grown substantially, the percentage of U.S. trade with this region has decreased from 31% in 1989 to 29% in 2005.

Canada has been the U.S.'s single largest trading partner in value terms for several years. In 1989, U.S.-Canada trade reached \$156 billion. The amount increased to \$243 billion in 1994, \$362 billion in 1999, and \$491 billion in 2005. The Canadian percentage of U.S. trade increased from 19% in 1989 to 21% in 1994 and 1999 but fell back to 19% in 2005. U.S.-Mexico trade was \$52 billion in 1989, which was 6% of U.S. trade. In 1994, the first full year NAFTA after was implemented, U.S. trade with Mexico was \$100 billion and the percent of U.S. trade increased to 9%. U.S.-Mexico trade has continued to increase in value from \$197 billion in 1999 to \$287 billion in 2005. However, the portion of U.S. world trade that this represents has remained stable at 11%.

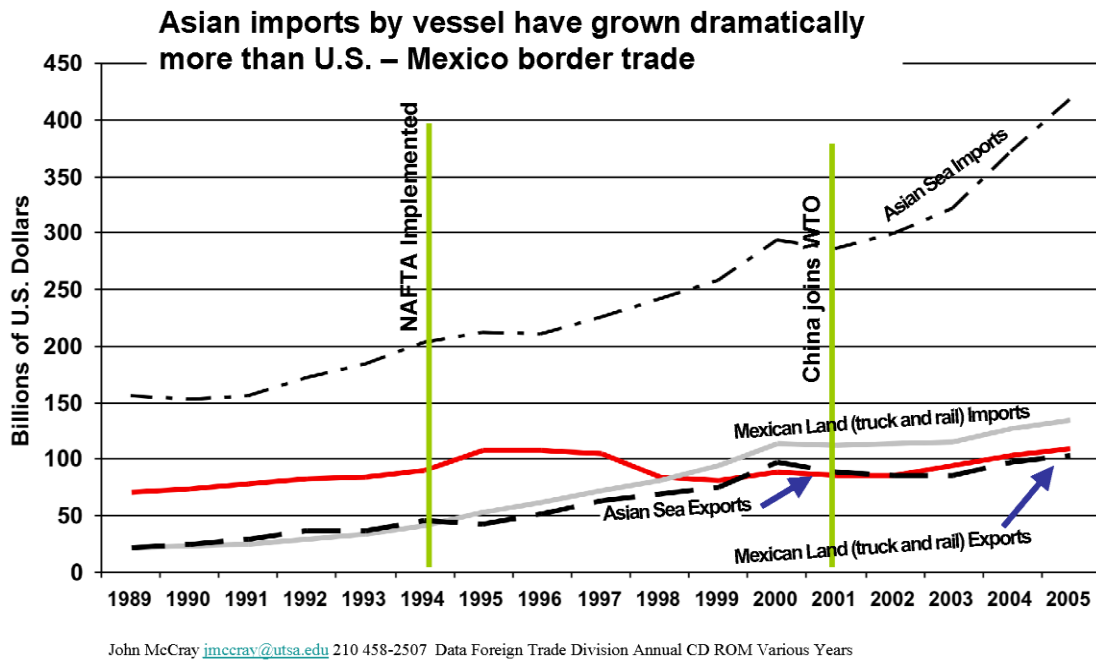
U.S. trade with South America and the Caribbean was \$54 billion in 1989 and 7% of U.S. trade, which remained constant through 1999. The value of U.S. trade with South America and the Caribbean increased to \$80 billion in 1994, \$114 billion in 1999 and \$191 billion in 2005.

While the value and percentage of U.S. regional trade represents the most important relationships underlying the direction of trade flow, the type of trade is also a consideration. U.S. trade with Asia is primarily made up of exports of raw materials in bulk and imports of finished products shipped by container. About one-fifth of U.S. trade with Europe, the Mid-East and Africa is imports of mineral fuels like oil and gas. A substantial percentage of U.S. trade with Europe, Canada, and Mexico is intra-industry. The dominant form of intra-industry trade with Mexico is under the *maquiladora model* in which U.S. exports components to Mexico and then re-imports from Mexico the finished products. Since NAFTA was implemented in 1993, U.S. trade with Mexico has been greater than with all South American and Caribbean countries combined.

### **U.S.-Mexico Trade and Asian Trade**

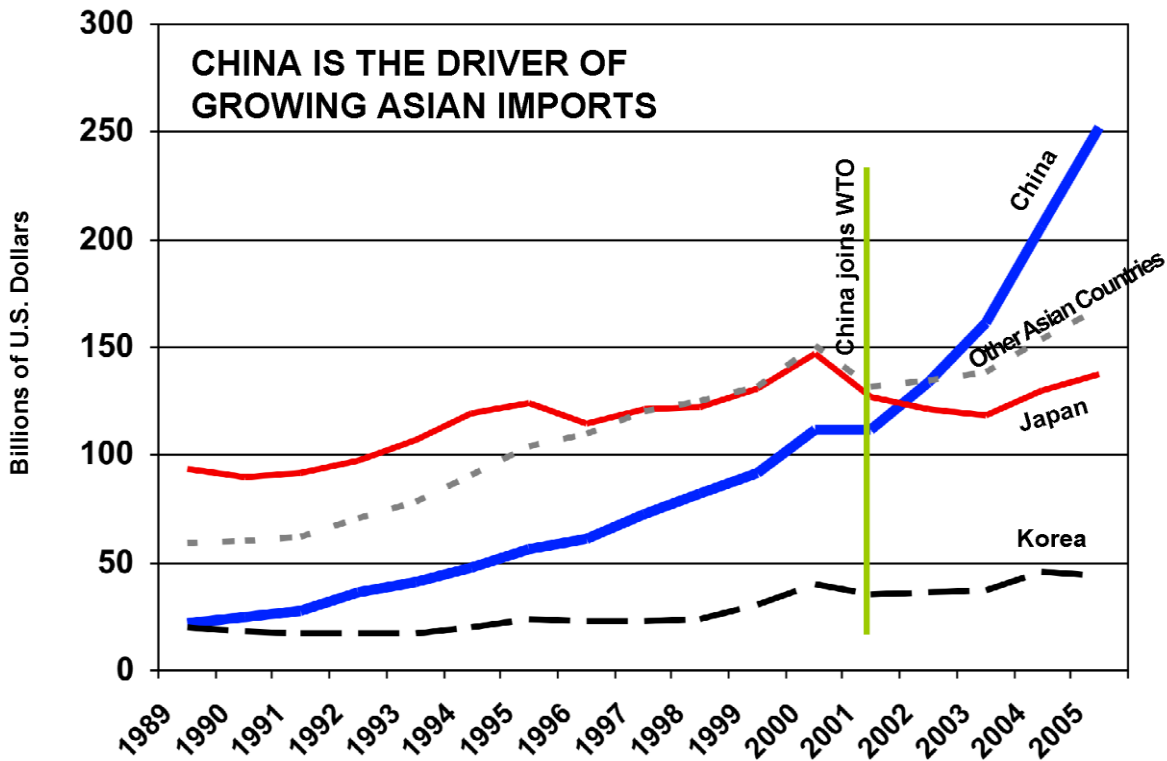
As shown in Figure 1, U.S.-Mexico trade grew from \$100 billion and 9% of total U.S. trade in 1994 to \$287 billion and 11% of total U.S. trade in 2005. Much of this moves by truck. The direct impact (and high visibility) of truck congestion and the importance of U.S.-Mexico trade to the Texas economy are reasons why trends in U.S.-Mexico trade are emphasized and studied in Texas. With respect to the transportation of U.S.-Mexico trade in Texas, the land (truck and rail) transported trade that crosses the border is most important. Unlike U.S.-Mexico trade, Asian trade is transported by air to airports in major metropolitan centers or by sea, primarily by containers to U.S. west coast seaports, which are first processed in the port and then further transported to metropolitan centers by rail. It is important therefore to compare Asian trade with U.S.-Mexico NAFTA ground trade in terms of both imports and exports to gain insight about possible impacts.





*Figure 1. U.S. Asian Sea and Mexican Ground Trade*

After the NAFTA implementation, U.S. imports from Asia were flat from 1995 to 1996 but then rose through 2000. U.S. imports from Asia increased after 2001, when China became a member of the World Trade Organization (WTO). Since China’s ascension to the WTO, the Asian U.S. imports have grown at a faster rate than U.S. exports to Asia. In 1989 U.S. imports from China played a relatively minor role in the U.S. total trade picture, roughly on par with U.S. imports from South Korea. China represented only one quarter of the imports as Japan, as shown in Figure 2. U.S. imports from South Korea increased moderately until 2000, fell through 2002, and then increased to slightly less than \$50 billion in 2005. Conversely, U.S. imports from China grew at a far faster rate until 2000, slowed briefly during the U.S. economic slowdown of 2000 and 2001 and then increased at an even faster rate after China joined the WTO and the U.S. economy began to rebound. Chinese imports surpassed U.S. imports from Japan and all other Asian countries combined in 2002.



John McCray [jmccray@utsa.edu](mailto:jmccray@utsa.edu) 210 458-2507 Data Foreign Trade Division Annual CD ROM Various Years

Figure 2. 1989–2005 U.S. Imports from Asia

U.S. maritime imports from major Asian trading partners have risen in almost every year since 1989. The rise of U.S. imports from China, however, far exceeds growth from all other Asian countries combined. Clearly, China is the driver of growing U.S. imports from Asia in terms of value. Value, however, is not the only consideration. A container may have high priced products, low value products, or be empty. If two U.S. trading partners have similar values of trade, but one sends primarily high value products and the other low value products, the low value exporter will likely place far more containers onto the U.S. transportation network. This is important for TxDOT and railroad planning because a container needs the same space on the infrastructure whether it is loaded or not. As shown in Figure 2, the dominance of China in U.S. container imports is unmistakable. U.S. containerized imports from China have risen from about 2.1 million TEU in 1997 to over 8.2 million by 2005. China sends more containers to the U.S. than all other countries in Asia combined. From Figure 2, it is apparent that there is comparatively little growth in the numbers of containers from South Korea or Japan and that the growth of containers from all other Asian countries is about 6.5% per year. The growth of U.S. container imports from Asia is dominated by China and shown in Figure 3.

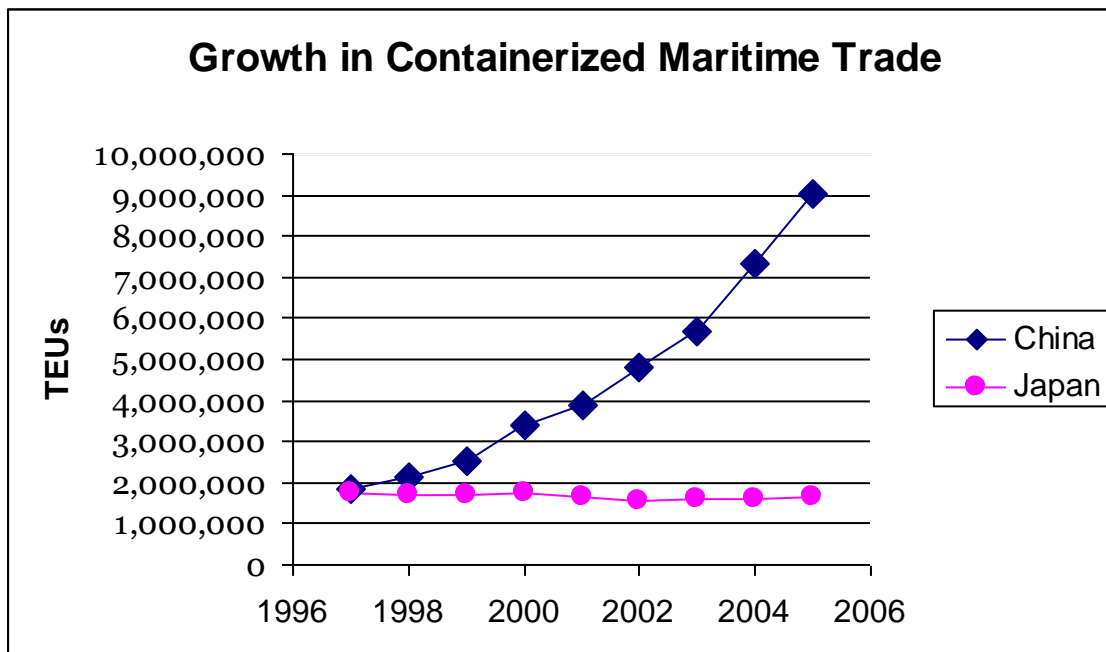


Figure 3. Chinese and Japanese Containerized Maritime Trade with the United States 1997–2005

Source: MARAD 2006

### How Does a Chinese Container Get to Texas?

Containers with Chinese products bound for the U.S. begin their journey when the empty container is delivered to the Chinese factory. Once the container is filled at the factory, the container is moved to a secure Chinese customs holding area for at least 24 hours prior to loading to allow entry into the U.S. DHS security database. The ports of Shanghai and Hong Kong are now designated Container Security Initiative (CSI) ports, and containers are often scanned at the port of departure before being loaded onto a ship. This speeds the DHS process at the U.S. port of entry because it helps insure the maintenance of container integrity. Movement of the container after the 24-hour holding period will depend upon on the availability of a container slot on a ship bound for the U.S. destination port. The additional wait time may be as much as a week, but more likely will be two or three days, because the ports at both Shanghai and Hong Kong are served by several container ships a day bound for U.S. ports and many ports do not accept containers that are being “stored” by shippers prior to loading.

The container will then be moved to shipside and loaded in a slot on the container ship. Ship transit time from either Shanghai or Hong Kong, the two dominant Chinese origins of containers to the U.S., will depend on the speed of the ship, route of travel, number of stops at intermediate ports and the U.S. or Mexican port of destination. In the case of containers bound for Los Angeles/Long, Beach, the direct pacific transit will take from 10 to 14 days. If the destination is Manzanillo or Lazaro

Cardenas in Mexico, the direct transit time will be from 12 to 14 days. However, it is highly unlikely that there will be a direct service to Mexican ports—initially at least—so routes will include other port calls that will lengthen the Pacific leg of the supply chain. Chinese originating vessels that transit through the Panama Canal to Houston will take 17 to 19 days.

Although there is a large volume of containers bound from China to the U.S. and the number is increasing each year, these containers do not arrive at a constant rate. Using the monthly value of U.S. imports from China, Figure 4 was developed to show when high concentrations of containers can be expected in the U.S. and Texas. U.S. imports from China tend to be lowest in March or February and then increase to a peak in October or November. At the low point in the cycle there are approximately 30% fewer containers than at the high point of the cycle in each year. Understanding this cycle of container movements will help in the planning and construction of intermodal facilities in Texas. Congestion in Ports and Distribution Centers due to U.S. imports from China peak in October or November and is lowest in February or March.

In summary, while the impacts of U.S. trade with Mexico may still be more visible at the border and along major highway and rail corridors than that of U.S.-Asia trade, the importance of Asian trade to the Texas economy now and in the future should not be understated. Tables and figures in this section show that U.S. trade with Asia is growing rapidly. The volume of this trade, which is dominated by imports, dwarfs U.S.-Mexico cross-border trade. Clearly, whether measured by value in dollars or numbers of containers, China is the “engine” growing Asian imports into the United States.

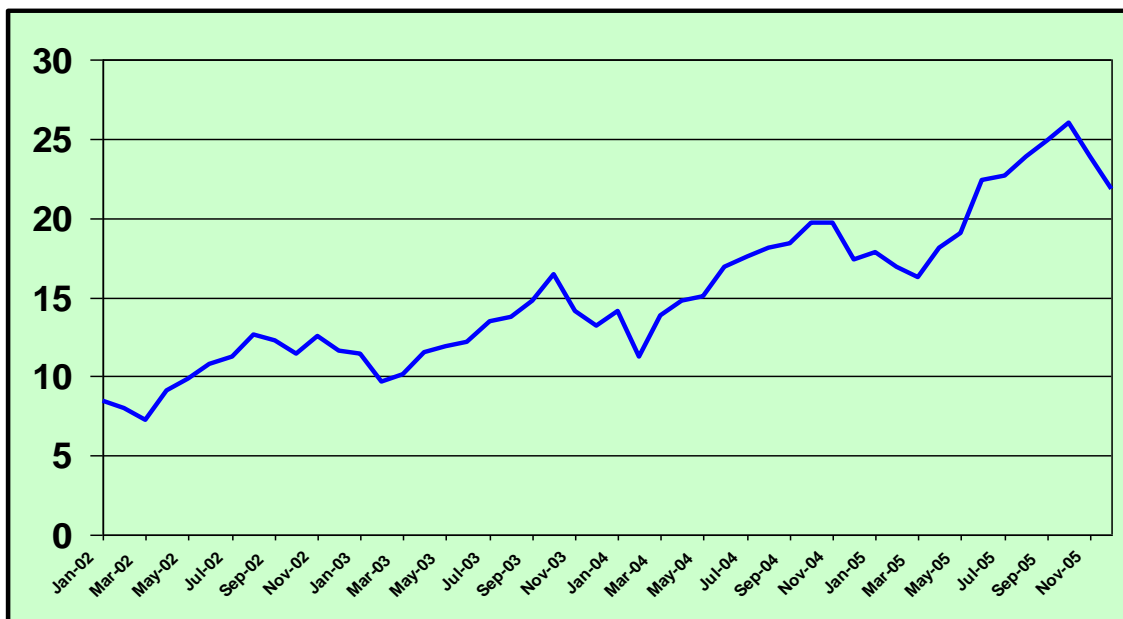


Figure 4. Seasonal Variation in U.S. Imports from China, 2002–2005 (Billions of Dollars)

## **Infrastructure in China: Will it Constrain Economic Growth?**

China's ambitious attempt to serve as the world's factory is straining its own transportation system and natural environment. While the Chinese economy has become very efficient in certain areas, in other areas such as logistics its efficiency remains far below that of western countries. One of the first questions to be addressed, therefore, is whether the current rate of Chinese industrialization can continue, or whether China's growth in exports will become constrained in the future.

China must take steps to increase the productivity of non-coastal provinces if it is to continue to maintain current growth rates. At present the provinces on the eastern coast that have nearby port facilities are far more economically productive when compared with interior provinces. The deteriorated state of China's inland transportation network, in particular the freight rail network, is one of the largest reasons for this sharp divide and a possible constraint on future growth. Freight railways in China remain fully state controlled.<sup>2</sup> While the rail network has seen significant state investment in the past two decades, the use of the rail system for intermodal containers in China is still underdeveloped so highways and waterways play more critical roles. Rail currently makes up only 10% of international freight movements in China while only 3% of rail movements are intermodal. The government plans to greatly enhance the role that intermodal rail will play in the economy in the near future with the planned construction of 18 major intermodal logistics parks and 48 major intermodal facilities.<sup>3</sup> In addition, working is proceeding on over 70 new container berths at an astonishing rate for those used to negotiating the U.S and European planning and environmental processes. At present, the traffic density on Chinese railways is about three times that of American railways.<sup>4</sup> Chinese logistics costs, as a percentage of total costs, have been on average twice as high as in the United States. This has contributed to the marked concentration of exporting industries within China near the coast and has led some analysts to predict that China's productive capacity is nearing a peak.

The Chinese government has shown an awareness of the negative impact that poor inland transportation networks, further strained by geography, are having on the country's potential for future growth. The government is now actively trying to improve connectivity from the coastal region to the poorer interior provinces. Given the level of investment China is devoting to increasing the percentage of the country's population able to work in export oriented industries, and the lack of evidence of any imminent political crisis, the researchers conclude that supply side constraints are unlikely to limit the expansion of the Chinese export economy in the near future.

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<sup>2</sup> "Bullet train plan ready to roll with no foreign role aboard"  
10 April 2006, South China Morning Post

<sup>3</sup> "Intermodal Transformers," Ted Prince, Containerisation International, June 2006

<sup>4</sup> The Location Decisions of Foreign Logistics Firms in China: Does Transport Network Capacity Matter?, 2006 TRB Conference Paper, Anthony Chin and Chong Junjie

China's growth is beginning to affect the U.S. economy in new ways. The demand for oil and its effects on world prices is now well documented. Less well publicized is the demand for heavy industrial inputs such as steel and cement along with high tech inputs like silicon, which is creating global shortages and driving up costs. In order to make the best projections and investment decisions, U.S. planners must understand the full extent of Chinese economic development on the U.S. economy. The memo concludes that Texas planners need to devote at least the same level of focus to Asian cargo in the next ten years that they have devoted to NAFTA trade in the last ten years. This is especially important now that the line between Asian trade and Mexican trade is beginning to blur. Many of the products thought of as Mexican exports are actually Asian in origin and assembled in Mexico, as was the case in the 1990s with Japanese products.

## **Technical Memo 2: The Mexican Port and Rail Infrastructure**

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The purpose of the second technical memo was to more closely examine the Mexican port and rail infrastructure to assess its capability to handle transshipments of Asian cargo bound for the United States. The researchers began with a literature search examining the different attempts to use Mexico as a land bridge in the past and determine why, with limited exceptions, none of these attempts had been successful. The researchers determined that transshipments had indeed become more feasible under the current environment due to a) the privatization of the Mexican port and rail system and b) the copious investment made by foreign firms in this infrastructure combined with c) the presence of congestion at the competing Pacific ports in the United States.

Three different strategies were examined for utilizing Mexico as a transnational trade corridor. The first strategy was to divert cargo to a Mexican port near the California-Mexico border and then transfer that cargo to the U.S. rail system for delivery to customers. In this option, the cargo would make a minimal diversion from the ports of Los Angeles and Long Beach. In the second option, the cargo would travel farther along the Mexican coastline and the cargo would be transported over a considerable distance on Mexican rail until it crossed the U.S. border into Texas. The third option was to discharge cargo at the narrowest point on the Mexican isthmus and rail or truck it to a second port on the Atlantic side. While this third option had been heavily promoted by President Fox, it was not deemed feasible in the near term and was eliminated from further study.

Options one and two were designated as potentially feasible for the near- to medium-term. However, only option two (utilizing the Mexican port and rail network) could be expected to have a noticeable impact on the Texas transportation system. To examine the feasibility of this option in greater detail, CTR researchers traveled to Mexico in July of 2005 to examine the Ports of Lazaro Cardenas and Manzanillo and meet with transportation planners at the Instituto Mexicano del Transporte (IMT).

## The Lazaro Cardenas–KCS Option

Both studied ports have an efficient pre-existing rail corridor capable of transporting double-stack trains. The port of Lazaro Cardenas, in the state of Michoacan, relies on the KCS railroad to transport cargo to the United States.<sup>5</sup> The KCS route, which runs through the major industrial centers of Mexico such as San Luis Potosi is considered the most direct and efficient route between the Texas-Mexican border and the Mexican Pacific. The distance from Lazaro Cardenas and Laredo in the KCS Mexico network is slightly less than 1000 miles. Since being acquired by Kansas City Southern in the mid 1990s, over a billion dollars has been invested in infrastructure and operational enhancements. These improvements allowed KCS to sharply reduce transit time from Mexico City to the border and slash the number of total employees. In 2005 KCS completed its acquisition of TFM by buying out its Mexican partner TMM. KCS currently runs 2,300 carloads per day in Mexico, accounting for more than 540 million dollars in revenues.<sup>6</sup>

While traveling from Morelia to Lazaro Cardenas, the researchers examined the state of the rail in terms of grade and alignment and sought to determine whether some of the improvements made by TFM since privatization could be documented. Highway connectivity to the Port of Lazaro Cardenas has also been enhanced by a new toll road which reduces travel time from the port to the regional capital of Morelia from 8 hours to 3 ½. Several improvements to the rail line were observed near the port.



*Figure 5. Grade-separated Rail Crossing near Lazaro Cardenas, July 17, 2005*

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<sup>5</sup> Prior to 2005, KCSM was known as TFM

<sup>6</sup> “The China-Kansas Express; Michael Haverty believes the future of international trade hangs on a dusty Mexican Port town.” Dorothy Pomerantz and Evan Hessel  
19 June 2006, Forbes Asia

The Port of Lazaro Cardenas is primarily a steel and bulk port. In the 1990s, container operations at the Port were halted and the Port of Manzanillo gained a virtual monopoly on container handling on the Mexican Pacific. The collapse of rail subsidies due to privatization and the lack of adequate road infrastructure within Michoacan were factors in the drop-off of container traffic. Nevertheless, in terms of total tons of cargo moved, Lazaro Cardenas grew steadily from 5 million tons in 1992 to over 15 million tons in 2000 thanks in large part to steel related traffic.

Hutchinson Port Holdings has committed to spend approximately \$400 million to construct a major container terminal at the Port of Lazaro Cardenas that will supplement and eventually replace the Port's existing modest container facility. The port has a deep channel and copious room for expansion. This expansion effort is strongly supported by the KCS railroad as well as the regional and national Mexican government. At the time of the CTR visit in July 2005, the port was in the process of dredging the channel for the new container terminal but active construction had not yet begun. The terminal is planned have an eventual capacity of 2 million TEUs at full build-out.

On April 26, 2006, Hutchinson announced that it had begun the active construction of the new container terminal and hoped to open the first phase in July of 2007.<sup>7</sup> The new terminal, which will cost \$200 million, will have three post-Panamax cranes along with 12 yard gantries.

Despite the interest from American shippers in using the port as a transshipment hub for Los Angeles-Long Beach overflow cargo, clearly the primary impetus for the port's construction is to serve the domestic market. The development of Mexico's trade relationship with Asia has been hindered by the fact that no Pacific port, up until this point, has had convenient road or rail access to Mexico City. The opening of the new container terminal at Lazaro Cardenas along with the newly opened toll road should greatly reduce the transportation costs for importing containers from Asia to the Mexico City area. Mexican imports from China have surged from under \$2 billion in 1999 to over \$14 billion in 2004 and Lazaro Cárdenas is well positioned to take a share of this market.

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<sup>7</sup> "New US\$200mn Lázaro Cárdenas container terminal ready in June 2007 – Mexico" <http://www.bnamericas.com/story.jsp?sector=5&noticia=351735&idioma=I>





Figure 6. Site of Future Container Terminal in July 2005



Figure 7. The Lazaro Cardenas to Laredo Corridor

Source: KCS

The successful realization of the Lazaro/KCS corridor as a viable alternative to American port and rail connections will require the coordinated improvement of infrastructure by Hutchinson, the Port Authority and the KCSM railroad. KCS is currently in the process of lengthening sidings to accommodate longer container trains and constructing a rail terminal within the port. The speed of the projects completion may also be influenced by demand should the rate of growth with Asia unexpectedly increase or decrease or if internal Mexican political considerations arise. One key infrastructure component to be provided by the port is a new truck bridge that will connect the emerging container facility with the existing port yards. This truck bridge is currently under construction with estimated completion in summer of 2007.

Since the CTR visit, the Port has experienced some internal and external challenges. The port director, Juan Paratore, was replaced in March 2006 by Armando Palos Nájera. In addition, the city of Lazaro Cardenas has been affected by massive protests connected to union disputes at Mittal Steel, the city's largest employer. These disruptions did not significantly affect business at the port. The election of Felipe Calderon as the new president of Mexico can be expected to further the country's focus on encouraging trade growth with both Asia and the United States. All of the major candidates in the recent campaign argued that Mexico needed to improve its transportation assets. Furthermore, private sector involvement has increased during this period.

In April of 2006, a delegation of representatives from the Port of San Antonio, the Port of Lazaro Cardenas and the San Antonio Free Trade Alliance held a series of seminars in Southern China to promote the China-Lazaro Cardenas-San Antonio corridor. This shows that those parties supporting the corridor are working diligently to build a broad base of corridor support and awareness among potential users.

In summary, there is substantial interest in using the Port of Lazaro Cardenas as a gateway for Asian cargo bound for the United States; however, the port is not being constructed specifically for this purpose. Rather, its strongest long-term potential is likely to serve Central Mexico and the Mexico City area with U.S. transshipments playing a lucrative but secondary role. KCS officials believe that between one-half to two-thirds of the containers coming into Lazaro Cardenas after the new terminal is completed will terminate in Mexico with the remainder going to the United States.<sup>8</sup> In June 2006, KCS began running one train per day from the Port of Lazaro Cardenas to Jackson, Mississippi with a stop in San Luis Potosi. The route currently takes five days to reach Jackson. This regular service was started prior to the completion of the phase one Hutchinson terminal and will function as a proof of concept to demonstrate that the corridor is ready to handle more substantial regular services once the phase I terminal is completed.

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<sup>8</sup> Presentation to Investors, Arthur Schoener, Executive Vice President and COO, June 15, 2006.

## The Manzanillo–Ferromex Option

The Port of Manzanillo is Mexico’s dominant pacific container port. It is operated by the Seattle-based Stevedore Services of America (SSA) on a 50-year lease. In 2005, the port handled 872,000 TEUs split almost evenly between imports and exports. Port TEU volumes have almost doubled since 2001. At 5%, the rate of TEU increase in 2005 was the slowest annual growth rate since 2001. This slowdown in growth is tied primarily to the growth at Lazaro Cardenas. The port operations are modern and efficient and in most areas are equivalent to a U.S. port of equivalent size.



*Figure 8. Manzanillo Main Container Yard*

The current port area devoted to containers is approaching capacity. The port is attempting to manage congestion and improve throughput per acre in a number of ways. For example, it is attempting to institute a new assignment system for truckers wishing to enter the port in order to smooth peak demand. It is also helping provide Mexican customs officials with the resources they need to speed the clearance of containers so that this does not become a bottleneck in the system. With the right efficiency improvements, the port estimates it could increase its total capacity by up to 50%.

Manzanillo also has significant space for adding capacity when necessary. In the first phase of its expansion plan, SSA will occupy an underutilized general use dock and

convert it to a container dock. In the next phase, the port may develop port owned land on the opposite side of the channel or an adjacent lagoon. The port is currently in the process of obtaining environmental clearance for its full master plan.

While the dockside infrastructure for container handling is currently more developed than at Lazaro Cardenas, the rail connection is less direct. Given that very few rail shipments from either port currently go all the way to the U.S. border, it is difficult to directly compare their speed. However, the KCS route is significantly shorter. The Ferromex route has also not seen the level of investment in capital improvement that the KCS network has seen since the late 1990s. Still, the Ferromex route from Manzanillo to Piedras Negras at the U.S. border can accommodate 130 metric ton 4 axle units and is certified for double-stack container trains. Ferromex officials estimated transit time from the port to the border at 60 hours; however, this cannot yet be confirmed with real world tests. A recent test train from Lazaro Cardenas to Nuevo Laredo took significantly longer despite its shorter distance.

In short, the Port of Manzanillo offers a facility that would already be capable of taking a significant number of overflow containers from Asian shippers and transport them to the United States should the need arise. It is too soon to say whether such an arrangement would be cost effective without severe congestion at U.S. west coast ports. Furthermore, it is logical to assume that the 2007 opening of the new Lazaro Cardenas terminal will cause a potential shift for those Asian shippers currently importing products to Mexico City via Manzanillo. This may produce significant surplus capacity at Manzanillo that could be filled by U.S. transshipments.

### **Technical Memo 3: Cost Model**

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Technical Memo 3 built on the foundation of the first two memos by estimating differential costs for different the chosen corridors including the traditional Los Angeles-Long Beach corridor, the two Mexican corridors examined in Technical Memo two, an alternative all water service through the Panama Canal, two other future corridors in Mexico, and finally a China-Europe-North Atlantic route transiting the Suez Canal.

There are a number of factors which could lead a shipper to choose one route over the other. The decision on route choice could change depending on a number of factors such as a change in the commodity type or a change in congestion conditions. It should be recognized that transportation companies, as a rule, are inherently conservative and also risk averse. Transportation requires large capital investments in, at times, risky and competitive environments where margins are thin (consider the recent impact fuel prices had on trucking, for example) so change within the sector as a whole is often slow and always carefully considered.

Class One railroad company profitability is now intimately linked to intermodal service and the recent realization that shippers are willing to pay premiums for specific types of intermodal service has been a contributing factor in raising industry return-on-investment figures to the point where covering cost of capital is now a reality—

something not possible for over two decades. Railroad companies are now re-investing in a variety of programs to raise productivity, including inter-continental network capacity and service improvements. It is an opportune moment, therefore, for those proposing new corridors served by rail.



Figure 9. Potential Routes for Asian Cargo Delivery to Texas

Figure 9 identifies two all-water services that were examined in the memorandum. The first is through the Panama Canal while the other is an Asian service traversing the Suez Canal. With Los Angeles/Long Beach forming the benchmark, all seven corridors were subjected to more detailed—but still preliminary—analysis, comprising a modal cost model and policy evaluation technique which, when taken in conjunction provide an insight into the relevance and timing of potential impacts. If the projected increases in Asian container flows (TEU) are even only half what has been forecasted, new corridors will be needed and possibly all of those identified in this study will have a role to play.

Following are the per-mile variable costs (in January 2006 prices) per 40-foot container (FTE) for each mode used in this memorandum<sup>9</sup>:

Containership (4000 TEU):	8 cents
Rail Intermodal Double-stack:	22 cents
Rail Intermodal Flat Car:	58 cents
Truck, Single Driver:	92 cents

**The Benchmark Corridor: Los Angeles/Long Beach to Texas**

Any corridor group wishing to attract shippers moving Asian cargo to Texas must compare the performance and cost of the proposed alternative with that corridor currently dominating the transfer of such traffic, namely the Los Angeles/Long Beach ports, served by UP and BNSF railway double stack service on their premier trans-continental routes.

**Table 2. Union Pacific Intermodal Service from ICTF to Texas Destinations<sup>10</sup>**

<b>Destination</b>	<b>Frequency</b>	<b>Adjusted Running Time (hours)</b>
Barbours Cut	Daily	98
Dallas Intermodal Yard (DIT)	Daily	64
Houston - Englewood	Daily	95
San Antonio TOFC	Weekdays & Sunday	107

BNSF provides two intermodal train services: Expedited and Premium. Schedule information for expedited service to Alliance and Houston is not available online. The only schedule information available is for premium.

<sup>9</sup> Estimates provided to CTR by Zeta Tech rail consultants

<sup>10</sup> "Intermodal Schedule." Union Pacific Website.

<[http://co2.my.uprr.com/cdm/intermodal/intermodal\\_schedule.jas?industryaffiliation=intermodal&CMD=showsearch](http://co2.my.uprr.com/cdm/intermodal/intermodal_schedule.jas?industryaffiliation=intermodal&CMD=showsearch)>. 16 Feb 2005.

**Table 3. BNSF Intermodal Service from Los Angeles to Texas Destinations<sup>11</sup>**

<b>Destination</b>	<b>Frequency</b>	<b>Adjusted Running Time (hours)</b>
Fort Worth (Alliance)	Daily except Wednesday	80
Houston	Tue, Thurs, Sat, & Sun	88

**Table 4. BNSF Intermodal Service from Long Beach to Texas Destinations<sup>11</sup>**

<b>Destination</b>	<b>Frequency</b>	<b>Adjusted Running Time (hours)</b>
Fort Worth (Alliance)	Daily	105
Houston	Daily	107

The mileages for these corridors are as follows.

UP to Houston (Barbours Cut): 1654  
UP to Dallas (Miller Yard): 1487  
BNSF to Fort Worth (Alliance): 1587  
BNSF to Houston: 1787

The Ports of Los Angeles and Long Beach have embarked on a major program to improve terminal efficiency. This centered on a substantial rise in the number of longshoremen hired and related equipment to operate more shifts with higher productivity. In 2005, there were no reported delays and the port volumes grew strongly without much reported congestion on the seaside. Landside issues continued to create challenges, first from an inability of UP and BNSF from time to time to synchronize equipment with container flows from the terminals and second with the introduction of Pier Pass, a congestion charge levied on truckers picking up containers during designated hours associated with urban highway congestion. In short, the congestion experienced 2004 was not a sign of collapse. It was, however, an early warning to shippers to start looking at alternatives, some of which could be viable in the short term, others only over a longer period.

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<sup>11</sup> "Intermodal Service Schedules" BNSF Website. <<http://www.bnsf.com/bnsf.was5/siisweb/cntrl>>



**Table 5: Corridor Cost Estimates per TEU to Houston**

Corridor	Maritime	Rail	Trucking	Border	Canal	Total
LA – UP	0	364	225 <sup>1</sup>	0	0	589
Ensenada/Punta Colonet	16	334	80 <sup>2</sup>	100 <sup>3</sup>	0	530
Topolobampo/Presidio	72	271 <sup>4</sup>	120 <sup>2</sup>	100 <sup>3</sup>	0	563
Manzanillo	96	354	100 <sup>5</sup>	100 <sup>3</sup>	0	650
Lazaro Cardenas	112	295	80 <sup>2</sup>	100 <sup>3</sup>	0	587
Panama Canal	281	0	0 <sup>6</sup>	0	42 <sup>7</sup>	323
Suez-North Atlantic	540	150	0	0	60 <sup>8</sup>	750

## NOTES:

1. Reflects Pier Pass, fuel surcharge.
2. Estimated dray cost, new facility w/rail adjacent.
3. Estimated administrative (broker) costs.
4. Does not reflect grade and tunnel limitations.
5. Estimated dray cost, rail further away from new facility.
6. Houston destination, no drayage.
7. Implemented May 1, 2005 rising to \$49 May 1, 2006.
8. February 2006 <http://www.gacegypt.com/suez-canal/suezcalculate.htm>

The results are given in the preceding table where it is noted that several corridors have similar total variable costs and comprise Los Angeles/Long Beach, Topolobampo, Lazaro Cardenas, and Punta Colonet ports-of-entry. Note that the costs for Topolobampo are underestimated because the rail element is based on a double stack service currently not available through the Copper Canyon. These costs, therefore, relate only to the service that would be available once the line was upgraded to double stack standards. Running the cargo on a single stack rail would likely add approximately \$200 per TEU to the total cost. It must also be pointed out that Punta Colonet is currently a green field site with no port facilities or landside access—all must be built, so that is also an estimate of what the corridor use might cost shippers if the infrastructure was in place. That leaves Lazaro Cardenas as the corridor most nearly equivalent to the base case in 2006. Additional rail costs, together with trucking costs drive up inbound U.S. flows from Manzanillo. The Panama Canal appears to offer the lowest price for Asia container delivery to Houston, while the Suez-North Atlantic is the most expensive. These cost estimates, however, are very sensitive to two major factors. The first is the potential economies derived from operation of the large S class container ships (6600-9000 TEU) which could drive down the costs over much of the Asia-Suez-Atlantic portion of the route. In addition, there may be more efficient double stack service offered to Texas destinations from ports served by the Suez service such as Charleston or Savannah. At the moment, however, the Suez corridor appears to be the most expensive in dollar costs per TEU to move Asian containerized cargo to Texas.



## **Key Characteristics and Planning Milestones of Each Corridor**

### Los Angeles/Long Beach with BNSF and UP Intermodal: The Benchmark

The Southern California routes will continue to be the primary double stack rail service for much of the Asian traffic with destinations in Texas. However, the share of Asian/Texas trade will diminish over the next 10 years as capacity and environmental issues constrain the growth on this corridor. If costs continue to rise at a faster rate than other ports, due to direct costs and the imposition of societal costs, then it is likely that the lower cost, less time-sensitive containerized commodities will switch to other corridors and slow growth on this corridor at a faster rate.

### The Panama Canal: The Most Direct All-Water Service to Texas

The Canal has already begun to carry significant numbers of Asian containers to Houston and the development of the first phase of Bayport will, it is believed, accelerate the market share of this corridor. The Panama Canal Authority is raising passage charges over the next several years, so higher user fees could be a feature constraining growth of this corridor. Operating an all water service through the canal to the eastern United States requires an average of eight vessels for a rotation as opposed to five for a West Coast intermodal service.

In April, the President of Panama announced a master plan for expanding the canal to accommodate post-Panamax ships. Polls show that the \$5.25 billion venture, to be paid for out of current and future canal revenues, is likely to pass in a national referendum which has been scheduled for October 22, 2006. The expansion, if completed on schedule, would open for new business in 2014.

One question for planners is how effectively the Canal will hold its market share in the interim period after the Canal reaches capacity but before the completion of the third set of locks is completed. The researchers believe that although the Canal is fast approaching capacity, container traffic as a percentage of total traffic will continue to increase as containers displace other lower valued cargo such as some dry bulk commodities. As a percentage of total canal traffic, containers have surged in recent years, and it is likely that higher value containerized goods will continue to displace lower valued shipments as canal charges increase.

The recommended TxDOT planning milestones for this project are as follows:

- a. Development of additional Asian container Panama Canal services to Houston. This will be most evident when Bayport comes into operation later this year, because it will increase the capacity by 400,000 TEU per annum and so providing space for new services.
- b. The Panama Canal Authority is incrementally increasing passage fees over the next 3 years and it will be critical to see how those providing container services are able to absorb, or pass on, some or all of such increases to shippers.
- c. There is the possibility of routing large post-Panamax vessels to the Pacific entrance to the canal and then moving containers by the Panama Canal railroad on a double stack service and then interlining at the Gulf side with a Houston gulf liner service. This system will be driven by the economics of the system and the prices charged by the port authorities on both sides of the canal and the rail service provider.
- d. In the longer term, plans are afoot to provide new super-large locks supplementing the existing system and capable of handling the mega containerships now being brought into service.

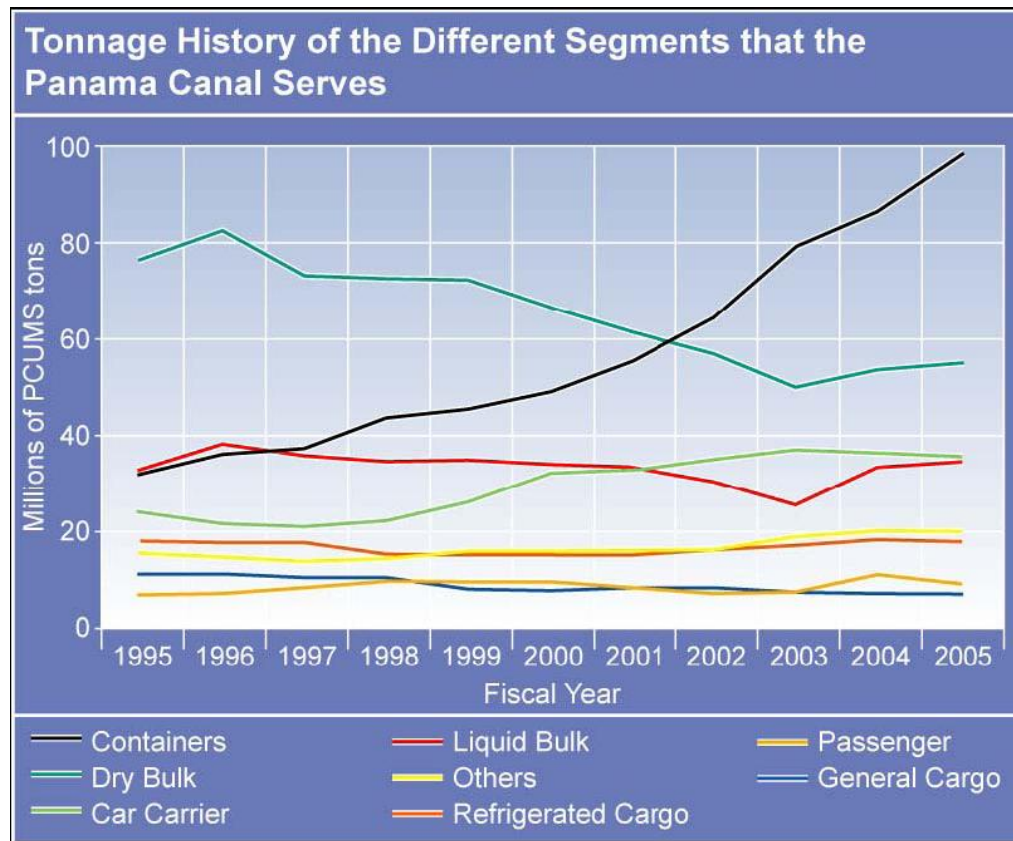


Figure 10. Tonnage History of the Different Segments that the Panama Canal Serves

Source: Panama Canal Authority

## Lazaro Cardenas: The Leading Mexican Contender to Serve Texas

The major reasons for highly ranking this corridor are first, its deepwater location and second, the KCS rail link into the U.S Class One systems. KCS has investigated substantial amounts of resources in rehabilitating this corridor after purchasing it in the mid 1990s. The railway is now capable of operating an efficient intermodal service to Laredo and currently offers a daily intermodal service to Jackson, Mississippi. As noted earlier, the problems beyond Laredo are a constraining feature of service over KCS tracks in Texas, limited first by restrictions on the TexMex portion of the route between Laredo and Corpus Christi and secondly by the growing rail congestion in the Houston area. Active construction on the new container terminal, which will supplement the existing container terminal, began in March 2006 and is slated for completion in July of 2007. On time completion will require the delivery of cranes and the extension of the port rail network.

As the closest container port to Mexico City, there is little doubt that Lazaro Cardenas will grow by handling Mexican containers destined for the Mexico City area. At present, 60% of the port's containerized imports are destined for Mexico City. The majority of these containers now travel by intermodal rail. In-bond service to the U.S. is another, perhaps secondary, strategy for port success. During the first four months of 2006, the port of Lazaro Cardenas saw an 80% increase in container volume compared with their 2005 year to date volume. The Asian services to Lazaro are dominated by Maersk. CP Ships and APL also regularly called the port from Asia in 2006.

Intermodal services are still being developed in Mexico as the American Association of Railroad data given in the box show. The first 37 weeks of 2006 showed as 4.2 percent decrease in trailers and containers compared with the similar period in 2005. But the 37<sup>th</sup> week showed a 22 percent rise for the same week in 2005. KCS recently hired a senior manager to address intermodal market opportunities and this includes operations in Mexico. It is therefore likely that a further push to grow both the domestic and in-bond U.S containerized traffic will take place in the immediate future.

### Box 1. KCSM Traffic Data 2005/6

The AAR also said that during the week ending September 16 Mexican railroad Kansas City Southern de Mexico (KCSM) reported total carload volume of 12,037 cars, up 4.5 percent from last year. KCSM reported total intermodal volume of 4,339 trailers or containers, up 21.9 percent from the 37<sup>th</sup> week of 2005.

For the first 37 weeks of 2006, KCSM reported total cumulative volume of 418,713 cars, down 4.2 percent from last year, and 146,075 trailers or containers, down 4.2 percent.

Source: AAR Insider, Vol. 4, Issue 22, 9/25/06

The recommended TxDOT planning milestones for this project are as follows:

- a. Growth to 500,000 TEU and then 1 million TEU, proving port successes.
- b. Regular double-stack service, first within Mexico to key terminals like Monterrey, and then finally to Laredo. Regular double-stack services will be of interest to TxDOT because loads maybe de-ramped at the Laredo/KCS terminal and moved onto highway routes, such as I-35.

- c. Regular double-stack daily services (10+) to Texas and U.S. inland ports like Kansas City.

#### Manzanillo: The Largest Container Port on the Mexican Pacific Coast

Although the rail link to Texas is less direct when compared with the KCSM link connecting Lazaro Cardenas to Laredo, it could be upgraded and could start to serve Texas destinations once it has established regular double stack services with key Mexican intermodal ramps. Finally, if the Laredo rail transfer system—the yard and a single bridge—becomes congested, the Manzanillo-Ferromex route entry point could provide alternative routes through Eagle Pass or El Paso.

The recommended TxDOT planning milestones for this project are as follows:

- a. Container volumes exceed 1.5 million TEU, creating opportunities for moving in-bond traffic to Texas.
- b. Post-Panamax liner services established.
- c. Regular double-stack service from the port to the border.
- d. Rail improvements at the El Paso terminal.

#### Suez-Mid Atlantic: Economies of Scale

Cargo from South Asia already moves to the U.S. East Coast by means of the Suez Canal. The distances from Northeast Asia have thus far prohibited the adoption of the Suez-Atlantic route for Chinese cargo to the East Coast. However, the economies the scale offered by mega-containerships are changing this equation. Container service from northeast Asia to the U.S. East coast ports container service will grow over the period to 2012 prior to the opening of the Panama Canal expansion. Much of this growth is likely to center on destinations in the northeast. Texas markets could be served by the Ports of Savannah or Charleston paired with double-stack service on the CSX or Norfolk Southern railroad. Shippers have accepted all water services because of their reliability and cost, which should be considered against the slower maritime speeds. For commodities where reliability, rather than speed, is the critical factor, all water service offers important benefits.

The recommended TxDOT planning milestones for this project are as follows:

- a. The first regular designated mega-containership ship liner service from Europe to a U.S. port, possibly as an extension of an Asian route.
- b. In terms of the importance to Texas, the links to south Atlantic ports, such as Savannah are important because Norfolk Southern can interline with either BNSF or UP to bring boxes into Texas.
- c. Finally, containers may stay on an Atlantic-Gulf service and enter Texas Gulf ports. Again, it is a matter of monitoring the development of liner services to the Texas ports.

#### Punta Colonet: A Greenfield Site in Baja California

If constructed as currently envisioned, this new port/rail connection will have a large impact on Asian-U.S. cargo. At present, planners envision a state-of-the-art new port facility served by a new double-stack rail route interlining with the UP Sunset Limited route. According to the latest estimates, construction on the port is scheduled to begin in 2008.

The port costs are likely to be higher than Manzanillo and Lazaro Cardenas because the new facility costs - estimated at over 100 million for the port alone have to be recouped, but it is also the best port complex to complement (and compete with) the Los Angeles and Long Beach ports. The first region served by the port is likely to be California while other U.S. markets will be secondary. Nevertheless, this is a critical development and the milestones suggested in this memo will allow TxDOT planners to track the development of this port as it is built.

The recommended TxDOT planning milestones for this project are as follows:

- a. The port breaks ground on its phase I activities at Punta Colonet.<sup>12</sup>
- b. Landside link improvements are completed on the highway side and later the new rail route is completed or “staged” so allowing double-stack service to connect with U.S. railways.
- c. Successful growth in liner service operations (more ship calls) at the facility.

#### Topolobampo: The Closest Mexican Port to the Texas Border

Topolobampo location is tempting to shippers because it is by far the closest Mexican port to Texas. However, there are also disadvantages as the Port has a shallower channel than the other ports studied, an absence of container handling equipment, and a rail line incapable of taking double-stack trains. The Port is pursuing several options including taking on cruise ships and grains. In June 2006, the Port entered into negotiations with the Chief Container Terminal Operator at the Port of Barcelona (TCB). TCB will be performing a market analysis for the port examining potential commodities and trading partners for a container facility. With the right enhancements, the Port would be able to accept smaller or light loaded container ships and transport them to Texas through the Ferromex and the Texas Pacifico railway. Its most likely role in the short term would be as a second port of call for a container ship with shipboard cranes needing to deliver goods to Chihuahua or Hermosillo.

The recommended TxDOT planning milestones for this project are as follows:

- a. The enlarging of tunnels along the Ferromex rail route to accommodate double-stack trains.
- b. The improvement of maximum rail capacity along the route from 120 to 130 tons.
- c. The delivery of Panamax or post Panamax container cranes to the port of Topolobampo.

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<sup>12</sup> The completion of the Colonet facility may allow the southern California

- d. Improvements in the Southern Orient route connecting Presidio to the main UP trans-continental route.

## **Associated Impacts on the Texas Transportation System**

The contract required the team to address some elements of the Texas Transportation System that might be impacted by the growth of the various corridors carrying Asian trade. Specifically, impacts on the Trans-Texas Corridor, rail network (particularly potential congestion) and also on highways and associated congestion. Comments on these areas are now presented.

### The Trans-Texas Corridor

The first element of the Trans-Texas Corridor mirrors Interstate 35 (TTC-35) and thus would be clearly impacted by NAFTA trade growth or decline. In addition, some of the Mexican corridors might create additional highway and rail demand through the development of the alternative ports in Mexico, particularly Lazaro-Cardenas. In theory, it would be expected that Asian containers would stay on rail as long as possible but it is also likely that containers for destinations within the southern part of the Texas Triangle, particularly around San Antonio, would be de-ramped at Laredo and trucked to final destination. The alignment for TTC-35 was not made public during the course of this project, so most remarks are speculative and of limited value at this time.

### Rail Network and Congestion

In 2005, Texas border crossings saw an average of 600 northbound trains per month, far more than all the other border states combined.<sup>13</sup> The busiest crossing is Laredo, which takes around 65 incoming trains per week. The longest train that can be accommodated on KCSM track from Lazaro Cardenas to Laredo holds 240 containers. Therefore, a theoretical liner service that would discharge a fully laden Panamax vessel at Lazaro Cardenas once a week with all cargo Texas-bound could generate 8 to 10 northbound trains through Laredo per week, though it is unlikely that all of the cargo on any given week would be moved in-bond to the U.S. The southbound return traffic could re-enter Mexico through Laredo or a less congested crossing. Empty return cars would be particularly likely to use other underutilized rail crossings where possible.

The in-bond cargo shipments on Asian cargo crossing at Laredo would likely be destined for an inland port such as the Port of San Antonio or Alliance in the Dallas-Fort Worth region. Note that almost all of the excess traffic would be located on Union Pacific and Kansas City Southern tracks.

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<sup>13</sup> [www.nascocorridor.com](http://www.nascocorridor.com)

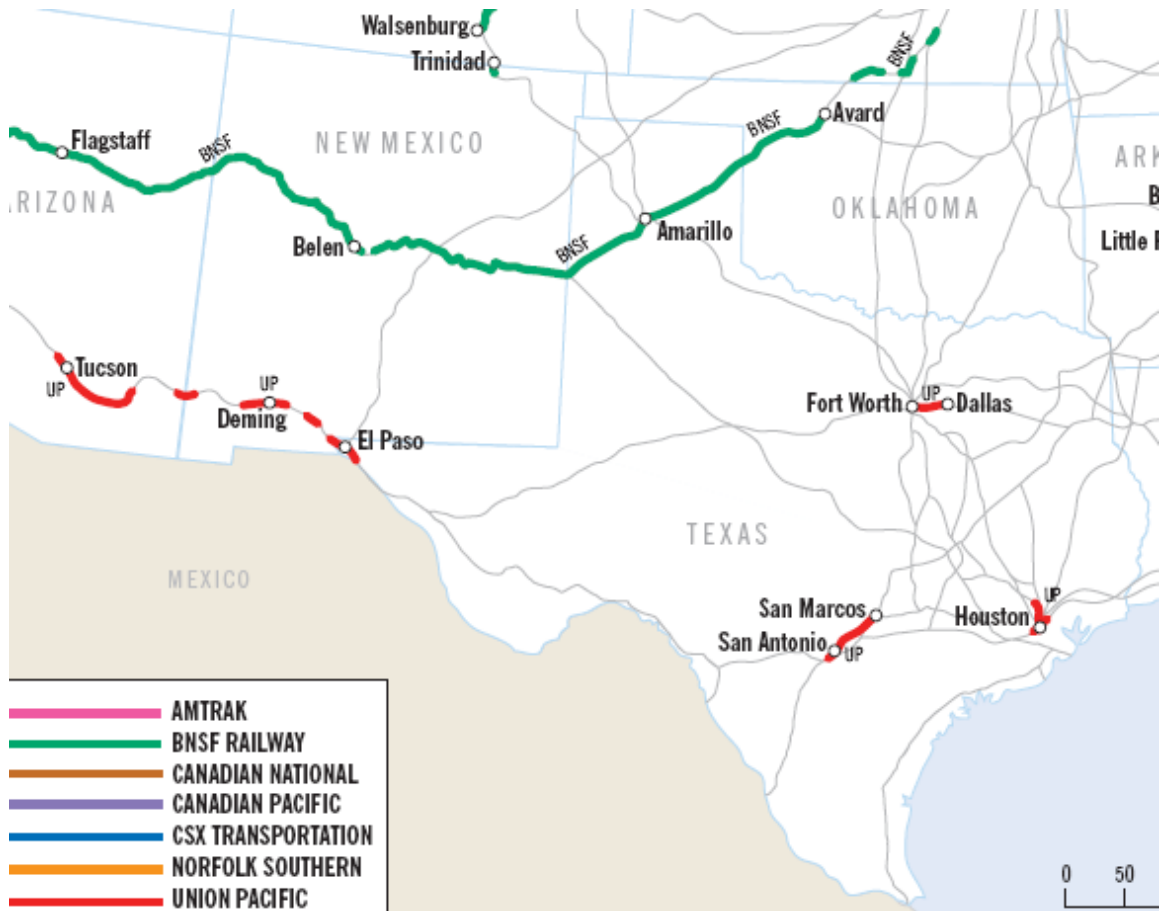


Figure 11. Double-Track Segments of the Texas Rail Network

Source: *Trains Magazine*, January 2006

In March of 2006, a private sector proposal was put forward to construct a new freight rail line connecting the DFW area with San Antonio and possibly to the Texas border. If constructed, this line could be expected to be fully double-tracked and fully grade-separated; allowing a level of service that is an order of magnitude higher than what is currently available for rail shipments in Texas. Such an arrangement would greatly enhance the advantages of a north-south corridor for Asian deliveries to Texas. The new line may also diminish some of the track access problems that have developed in the early planning stages of this corridor. For example, KCS has indicated its preference to use its own Tex-Mex tracks for Texas deliveries, yet the Port of San Antonio (Kelly USA) has an interest in taking shipments from Mexico that would currently need to use the UP line from Laredo to San Antonio. A neutral party may therefore make such arrangements more flexible.

Further development of the Panama Canal to allow larger container ships would enhance rail movements at several Texas ports, such as Houston and Corpus Christi. Additional Asian cargo to Houston provides an added incentive to improve the rail network through grade-separation projects, as these investments would allow the port to more readily serve as a transshipment hub for other states. The current rail study by HNTB is evaluating these issues and should identify several areas where targeted

investment will bring high benefits, including improvements to rail containerized services. Interstate rail movements of Asian containers could play a role for the Corpus Christi container terminal—when built—as the city of Corpus Christi itself is not large enough to justify its own container terminal.

These north-south rail movements can be expected to remove rail traffic that would otherwise go on the UP and BNSF trans-continental lines from California through Texas. The researchers do not, however, believe that traffic on these corridors will decrease. Even at full build-out, the port developments in Mexico can hope to take only a modest percentage of cargo away from southern California in the short to medium term. Furthermore, Class One investment in the trans-continental routes are adding capacity and becoming more efficient. Therefore, the growth prospects for both the north-south and east-west rail options remain strong.

### Impacts on Road Congestion

There is concern that without substantial improvements to the freight rail network in Texas, rail will be unable to hold its current market-share, and cargo currently using rail will migrate to the highway network. A diversification of rail traffic away from the most congested east-west corridors to the somewhat less congested north-south corridors may mitigate this impact and railroad company investment could build market share in critical areas. Obviously, substantial new capacity improvements, together with advanced train control, would be appropriate longer term solutions. It is a misconception that containerized cargo entering the state by train does not produce road congestion. If the cargo is destined for Texas, it must eventually be transferred to a truck for delivery to customers. Therefore, growth in total containerized cargo volumes to Texas will result in additional road congestion somewhere in the state even when these containers enter the state by rail. The difference is that containers are taken off corridors but show as metropolitan or urban highway traffic. The same holds true for containers that enter through maritime ports, as would be the case for Asian containers that reach Texas through Panama or Suez. Major investment studies for landside improvements connecting container ports to the highway network must take into account the added effect of Asian cargo that until a few of years ago would not have been a factor in these calculations. Containers entering the state, regardless of mode or corridor, will appear as a component of urban freight demand.