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Chapter 1. Study Purpose and Scope

This concept study has developed a preliminary assessment of the potential of developing a new rail connection from Port Freeport along the SH 36A Corridor to serve the inland markets of Texas and Middle America. This hinterland could stretch as far north as Chicago, as far west as Denver, and as far east as Birmingham, Alabama.

If the Port Freeport develops as a major container port, the proposed SH 36A Development Corridor that would serve Freeport is expected to develop into a major trade corridor connecting the rail yards, intermodal centers, and retail distribution centers of central, northern and west Texas. Due to geography it is expected that Port Freeport will need to rely heavily on intermodal connections, so the ability to effectively develop the needed inland rail connectivity is the major focus of this study.

1.1 Introduction

Given the proposed changes to the Panama Canal, and the potential development of Port Freeport as a major container port, the purpose of this concept study is to evaluate the potential for developing a Freeport/SH 36A Development Corridor as a major rail trade corridor serving the intermodal centers of northern Texas and mid-America. The corridor will also provide a bypass and reliever to the ports of Galveston and Houston, which are being “choked off” by bottlenecks and congestion. Furthermore, the Houston ship channel is not able to be dredged to the 50+ feet depth needed by fully-loaded Post-Panamax containerships. However, if Port Freeport can dredge to the planned 56 feet and provide the required facilities, it could become a major port of call for such ships.

1.2 Study Objectives

Transportation Economics & Management System, Inc. (TEMS) has been asked to develop a Concept Level Analysis that will answer the following questions:

- Is there a Business Case for investing in rail along the SH 36A Corridor and developing a trade corridor?
- How will the Port Freeport and the communities along the SH 36A Corridor benefit?
- Can the private sector play a role in developing the corridor, and can the freight railroads become a partner in the process?
- What are the potential sources of public and private funding (revenue, loans, grants, bonds, letters of credit, etc.) that can be obtained to support and develop the project?
1.3 Study Approach

The purpose of the concept study is to assess the market opportunities, physical facility needs, financial and economic returns, business arrangements and implementation timeline for developing rail service along the SH 36A Corridor to and from Port Freeport.

In undertaking this analysis TEMS will use its six step Business Planning process. The process is shown in Exhibit 1-1. For concept studies TEMS uses a more aggregate level of analysis that can be refined to a more detailed analysis as work proceeds from Concept to Feasibility to Investment Grade. The fundamental methodologies are similar, but feasibility and investment grade studies develop much more detailed and refined data bases than do early concept studies. At the Investment Grade Level the study database will need to be considerably refined so the work reflects the ± 20 percent error level agreed with Wall Street as necessary for both general and revenue bonds.
Exhibit 1-1: Steps for Development of the Business Plan

**Step 1**
- Study Design
- Prepare Market Database
- Set up the Database System

**Step 2**
- Define Port and Railroad Development Scenarios

**Step 3**
- Develop Traffic and Revenue Estimates

**Step 4**
- Forecast Traffic and Revenues for Scenarios, Landuse Development
- Estimate Annual Operating, Capital and Maintenance Costs
- Determine the Financial and Economic Feasibility of Service Scenarios

**Step 5**
- Public-Private Financing for the Proposed Scenario Development
- Determine the Funding Framework

**Step 6**
- Implementation Plan
- Produce a Business Plan

- Baseline Trip Tables
- Presentation & Review Meeting
- Service Scenarios
- Presentation & Review
- Service and Tariff Structure
- Presentation & Review
- Summary Capital, Operating Costs and Revenue for Initial Scenarios – Financial Feasibility
- Presentation & Review
- Assessment of Potential Private and Funding Support
- Presentation & Review Meeting
- Critical Path & Work Plan
- Business Plan
- PowerPoint Presentation
**Step 1 – Overall Market Assessment**

In Chapters 2, 3, and 5 using the market data developed by TEMS from the Panama Canal, Gulf Coast Port Study, West Coast Port Study, and National Ports Model a market analysis for the Port Freeport and SH 36A Development Corridor will be developed using the TEMS GOODS™ multimodal freight model. The existing database of socioeconomic data, marine markets, and competitive inland transport networks will be updated using the latest Port statistics, updated inland transportation data, and changes in mode competition due to oil prices, congestion and fuel efficiency. The GOODS™ model allocates traffic to modes using a “Generalized Cost” metric that reflects shipper and carrier behavior in the face of different mode and service options. It provides a mechanism for estimating market share traffic volumes and revenue potential for each element of the traffic movement.

Medium and Long Term forecasts will be prepared using both economic growth forecasts and changes in transport infrastructure in the Port Freeport and the other Gulf Ports, and the market shares of the Gulf versus both West and East coast ports. The market analysis will be used to identify truck and rail traffic potential from Port Freeport along the SH 36A corridor for horizon years 2020, 2030, 2040, and 2050. The traffic analysis will be summarized in terms of short, medium and long term opportunities.

**Step 2 – Service Scenario Definition**

In Chapter 4, the Business Plan will seek to define the most appropriate form of port, and rail infrastructure and development strategies that might be developed for the Port Freeport and the SH 36A corridor. Using specific market data on the potential market pairs, service needs, and the potential types of water and rail operations in terms of performance and cost, an Interactive Analysis will be completed that assesses the relationship between market volumes, and service development options for the Port Freeport and Inland distribution networks. From the evaluation of these options the analysis will identify the rail traffic potential, intermodal interface needs, port to port services, and potential schedules and tariffs.

Port and rail Infrastructure needs to service Port Freeport and the SH 36A Corridor will be identified and their operating and capital costs estimated. This includes the ability to support on-dock, near dock, and conventional rail intermodal services. Furthermore, the timing of rail infrastructure needs will be assessed to ensure that it is timed to relate to changing traffic conditions, which could well occur in the next five to ten years due to the Panama Canal and increasing congestion in the Houston region. The impact of the proposed improvements in Port Freeport services and SH 36A Corridor for rail will then be compared to other major Gulf ports and used in estimating the potential market that the Port can capture.

Exhibit 1-2 shows the Interactive Analysis process. It can be seen that data on the marine and inland transport distribution systems and on the market is required to identify the character of the transport operations that can be provided in the Freeport/SH 36A Development Corridor.
Finally, the analysis will define the most effective way to develop both water services and inland distribution services, by assessing their performance in both financial and economic terms. In developing the service plan, the analysis will also recognize and consider existing and potential institutional, fiscal, and policy issues that are fundamental to the success of the project.

A key element of the next phase of this assessment will be that the study teams work closely with important stakeholders such as the shippers to ensure they are comfortable with the basic concepts, market forecasts, and Port Freeport service proposals. It is important to achieve “buy-in” from the freight shippers, railroads and carriers, and to identify their needs in meeting the Port Freeport proposals. This includes both line and yard capacity issues for rail, which will be identified using the MISS-IT™ and Switch-It™ models. As required, capacity needs and potential funding will be addressed. The service plan as finally developed will include contingencies to manage issues affecting its implementation.

**Step 3 – Traffic and Revenue Assessment for the Preferred Option**

For the preferred option as identified in Step 2 above, a traffic and revenue yield assessment will be completed in Chapters 5 and 6 to optimize the tariff systems and estimate cash flows for funding the preferred intermodal service plan. For each level of service, the market data and the service plan will be used to derive revenue estimates that reflect supply and demand conditions. By providing an analysis of tariffs in relation to the supply and demand conditions, a final set of traffic volumes and revenues can be derived. These tariffs, when applied to the market, will optimize revenues and provide the key input to the financial model used to assess the potential of Port Freeport, and SH 36A Corridor.
Step 4 – Implementation Plan Analysis

In the fourth step, the market analysis, service plan and tariff structures developed in Steps 1 through 3 will be used to define the specific infrastructure, land uses, and development proposals for the Freeport/SH 36A Development Corridor. The service scenario definition in Chapter 5 identifies these critical inputs/costs:

- Rail infrastructure,
- Port infrastructure,
- Inland port potential,
- Terminal facilities, parking and access,
- Bulk and car load rail yard traffic,
- Maintenance facilities,
- Interface access systems for truck and rail traffic,

A financial and economic evaluation in Chapter 6 will assess financial return and economic benefits including net present value, internal rate of return, payback period, debt coverage and financial risk. As the process develops, specific recommendations for Port Freeport and the SH 36A Corridor will be examined to maximize the economic success of the project.

At the end of Step 4, a preliminary Implementation Plan will be developed, defining the milestones and components for implementing the Freeport/SH 36A Development Corridor.

Step 5 – Financing and Funding Plan

In Step 5 a potential financing framework and funding plan will be defined to include potential public-private partnerships, franchise potentials and others. This will be presented in Chapter 6. The role of funding sources in terms of both the public and private sector will be assessed and a variety of creative financing and funding programs will be considered. Specific consideration will be given to the appropriate institutional structures for the operation and the needs of stakeholders. As required, specific cost sharing arrangements will be developed between federal, state, ports, shippers and the freight railroads and cost allocation procedures proposed.

During this step, Institutional arrangements agreements will be discussed, developed, and delivered to the partners for their acceptance. A preliminary Risk Analysis will identify key factors and issues associated with the different strategic options.

Step 6 – Business Plan

In Step 6, a preliminary Business Plan will be finalized that will bring together the various sub-plans and agreements that have been developed as part of Steps 1 through 5. This plan will set out a development plan and investment program to support as necessary the development of a rail corridor and operation to support the updated Port Freeport infrastructure, and a full multimodal “Inland Port” facility to facilitate traffic movement by rail, truck and water out of and into the Port Freeport hinterland. This development will require full financial and economic justification and an understanding of the
contribution the rail facility can make to the Texas economy in terms of jobs, income and transfer payments like tax base expansion and additional rents and fees. The preliminary Business Plan will include:

- Market Analysis
- Operating and Service Plans
- Land use Requirements
- Preliminary Financial Plan
- Preliminary Funding Plan
- Preliminary Implementation plan

The Business Plan will guide and support the key stakeholders throughout the implementation and financing activities of the incremental rail project. Capital needs, operating costs and potential revenues will be identified.
Chapter 2. The Need for a Deep Water Port in Texas

*With its planned 56’ channel depth Port Freeport will be able to accept any container ship operating in the world today. Thus, Freeport can fully exploit the market opportunity afforded by enlargement of the Panama Canal, as well as even larger ships that might transit the expanded Suez Canal.*

### 2.1 Impact of Panama Canal Expansion on Vessel Sizes and Costs

The shipping industry is moving towards larger container ships in both Pacific and Atlantic lanes. As shown in Exhibit 2-1 the new Panama Canal locks could potentially permit more than a doubling of containership vessel size in terms of TEU capacity. To accommodate larger vessels, ports need at least 50 feet of water. On the Gulf coast only Freeport and Corpus Christi will have this water depth.

Previous studies\(^1\)\(^,\)\(^2\) have found costs in the range of approximately $0.04 per TEU-mile for a 2,000 TEU ship and $0.02 per TEU-mile for a 6,000 TEU ship. Larger ships cost even less. By comparison, a double stack rail move costs $0.12 per TEU-mile (plus terminal handling) and truck $0.95 per TEU-mile (one typical trailer load equals two TEU) for a one-way loaded movement.\(^3\) Though the precise numbers will vary, the magnitudes of cost differentials for larger ships, *by cutting line-haul costs approximately in half*, explains the rapid growth of Post-Panamax container ships in the world fleet. *A mile of sea costs between six and thirty times less than a mile of rail or truck*, respectively.\(^4\) This is why it is cheaper to bring goods by water through the Panama or Suez Canals even overcoming the longer distance of the ocean routes. As shown in Exhibit 2-1:

- The type “D” ship is largest that will be able to transit the expanded Panama Canal locks. Such a ship could carry 12,500 TEU and needs a channel depth of 15.2 meters or 50’ fully loaded, which exceeds the depth of the Houston Ship Channel, but could be comfortably accommodated by Freeport’s proposed 56’ channel.\(^5\)

- The type “E” ship is largest container ship in the world.\(^6\) It is too wide to fit through the Panama Canal locks, but can come through the Suez Canal.\(^7\) However, it does not need much more depth than the type “D” ship. It could carry 18,000 TEU and needs a depth of 15.5 meters or 51’ fully loaded. The proposed 56’ channel at Freeport also could accommodate this, or any container ship in the world.

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1. Texas Gulf Ports Study, Figure 4.3. See: [http://www.utexas.edu/research/ctr/pdf_reports/1833_3.pdf](http://www.utexas.edu/research/ctr/pdf_reports/1833_3.pdf)
2. Vessel cost functions that were measured by TEMS and the RAND Corporation for the Great Lakes and St. Lawrence Seaway independently confirmed vessel operating costs in the same range. See: [http://www.marad.dot.gov/documents/NCNV_Report-Part_1.pdf](http://www.marad.dot.gov/documents/NCNV_Report-Part_1.pdf)
3. Rail costs were modeled as $125 lift costs per TEU for loading and unloading, or $62.50 at each end, plus 12¢ per mile for the rail line-haul. These values were derived from published truck and rail operating costs, in particular rail Intermodal costs developed using the U.S. Surface Transportation Board’s Uniform Rail Costing System (URCS) methodology, as summarized and used in the previous TEMS/RAND GLSLS study, and from the U.S. Federal Railroad Administration’s Intermodal Transportation and Inventory Cost model. See: [http://trb.org/news/blurb_detail.asp?id=4801](http://trb.org/news/blurb_detail.asp?id=4801)
4. This finding is from the Texas Gulf Ports Study, page 47: [http://www.utexas.edu/research/ctr/pdf_reports/1833_3.pdf](http://www.utexas.edu/research/ctr/pdf_reports/1833_3.pdf), but it was independently corroborated by the other sources cited in this analysis.
Exhibit 2-1: Panama Canal Ship Capacity vs. Dimensions

<table>
<thead>
<tr>
<th>Exhibit 2-1: Panama Canal Ship Capacity vs. Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> Early Containerships (1956-1974) 500 - 800 TEU</td>
</tr>
<tr>
<td><strong>B</strong> Fully Cellular (1974-1978) 1,000 - 2,500 TEU</td>
</tr>
<tr>
<td><strong>C</strong> 4,000 - 5,000 TEU</td>
</tr>
<tr>
<td><strong>D</strong> Past Panamax (1988-1996) 6,000 - 6,000 TEU</td>
</tr>
<tr>
<td><strong>E</strong> New Panamax (2014) 12,500 TEU</td>
</tr>
<tr>
<td><strong>F</strong> Past New Panamax (2006) 16,000 TEU</td>
</tr>
<tr>
<td><strong>G</strong> Triple E (2013) 16,000 TEU</td>
</tr>
</tbody>
</table>

However, the main competition for Texas ports today relies on neither the Panama nor Suez Canals. Instead, most Asian traffic to the U.S. today comes via direct vessel service across the Pacific Ocean into a West Coast port, then by rail to mid-America or the East Coast. Railroads have (up until now) been able to arbitrage the water cost differential all the way across the Pacific Ocean, due to big ships on the West coast versus small ships on the Gulf and East Coasts.

The reality is that, in spite of all the marketing “hype” about West Coast ports being “Big Ship Ready”10,11, the trans-Pacific lanes from Asia to the West Coast are actually too short to support the economics of the very largest ships. Since vessels only generate savings when they are moving, Prince12 claims that vessels in the 7,000-8,000 TEU size range are near-optimal for the West Coast trans-Pacific lanes.13 KFW-IPEX Bank14,15 agrees, saying that once East Coast port improvements (e.g. dredging) are implemented, this 7,000-8,000 TEU size (Type “C” ships in Exhibit 2-1) will become the new standard in trans-Atlantic lanes as well.16,17 There is no physical constraint preventing larger ships on the West Coast so the industry consensus seems to be that “what you see is what you get.”

For service to the East and Gulf Coasts however, the clear trend has been towards larger ships as ports are able to complete dredging projects that are prerequisites to handling them. It is clearly possible that even larger ships could be used, particularly in long haul lanes that transit the Suez or Panama canals, where big ships produce the best line-haul economics. In the future, a serious disadvantage of vessels in the 7,000-8,000 TEU range is that they would waste a significant share of the Panama Canal’s added capacity -- such vessels are too large for the existing locks, but won’t nearly utilize the full capacity of the expanded locks. As a result, vessel sizes will likely continue to grow as the Texas market continues to develop over the next 20-30 years.

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10 See: http://www.polb.com/about/bigshipready.asp
12 Ted Prince, Panama Canal expansion: game changer, or more of the same? Supply Chain Quarterly, 1st Quarter 2012 issue: http://www.supplychainquarterly.com/topics/Logistics/201201panama/
13 AECOM, Port Capacity Analysis in Long Beach, slide 14, Mercator 2006 data, see http://onlinepubs.trb.org/onlinepubs/mb/MTS/Govil.pdf. A more detailed but older study of the same issue can be found at http://www.polb.com/cvica/file/86068a.pdf. Note that all of the ships in the Long Beach distribution could transit the expanded Panama Canal. (12,500 TEU limitation.) Since West Coast ports could handle larger ships all along, it is not port capability that limits deployment of larger vessels. Rather one must assume that this vessel size distribution reflects an economic tradeoff that currently optimizes vessel size in the 7,000-8,000 TEU range for the trans-Pacific lanes.
16 Unfortunately, the 5,000 TEU Panamax ship is about the largest that the 45’ Houston Ship Channel can take fully loaded. This poses a serious quandary for the shipping lines – not being deep enough to allow direct vessel calls using the types of container ships that the major shipping lines will find most economical to operate -- there is a chance that Houston may lose some of its direct Asian vessel services and be relegated once again to the role of a feeder port. Once as expected large 7,000-8,000 TEU ships are also fully deployed in the European trade lanes, Houston’s European traffic would similarly be at risk. See: http://www.porttechnology.org/news/panama_canal_container_trades_past_present_future Issued by dynamar bv #U9eU6U0y71
17 Existing Panamax-sized ships will likely become obsolescent as shipping lines continue migrating towards larger vessels, including in trans-Atlantic lanes that are not directly related to Panama Canal. Many of those smaller ships will likely end up being scrapped because they will no longer be able to economically compete against the larger ships.
Although initially vessels in the 7,000-8,000 TEU size range are likely, Port Freeport should anticipate 12,500 TEU via Panama or even larger ships arriving via the Suez Canal. Rising tolls on both Panama and Suez Canals may further accelerate the trend towards larger ships, so Freeport should be prepared to accept larger vessels sooner rather than later.

2.2 Demand Forecasting Assumptions

A critical issue in the forecasting of Gulf Coast port and vessel costs is the role of Panama and Suez Canal tolls. Both canals are committed to increasing their capacity and the size of ships they can handle. While the average size of ships using the Suez Canal has grown from 6,911 TEUs to 7,756 TEUs over the past year, the size of Panama Canal ships remains constrained by the lock sizes. It’s “just a question of time” before all services passing through the Suez Canal will deploy vessels of more than 8,000 TEUs, Drewry predicts and it’s also likely that a similar distribution of vessel sizes will operate through the Panama Canal.

Recent toll increases by the Panama Canal have resulted in some loss of share as for example Maersk withdrew its vessels from the Panama Canal, so Panama now holds only a 48% share of U.S. East Coast traffic as compared to Suez’s 52%. Clearly, large ships are changing the distribution of traffic by offering lower and lower costs as ships sizes continue to go up.

Clearly assuming that toll levels for the Panama and Suez Canals remain reasonably stable, the trend is to longer water movements in larger ships. Whether container movements come to the U.S. East and Gulf Coast via the Panama or Suez Canals, the future level of cost will be lower and highly competitive.

For the purpose of this study it is conservatively assumed that the Gulf Ports will continue to be served by the Panama Canal routing and that vessel sizes will increase to the 7,000-8,000 TEU range. This is conservative because it will only equalize Port Freeport’s competitive position relative to the West Coast ports, which have historically held a cost advantage based on their ability to use big ships, as compared to Houston’s current limitation to small ships. Although this assumption would equalize Freeport’s position it would not give Freeport any competitive advantage over the West Coast based on vessel size.

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18 According to Drewry, in June 2014 the average size of vessel from Asia for East Coast of North America ports passing through the Panama Canal was just 4,630 TEU, as compared to 7,510 TEU via the Suez. Even though a few vessels transiting the Suez are much larger, this current average 7,510 TEU vessel size for the Suez Canal is consistent with what KFW-IPEX Bank has projected is most likely to be expected on the East and Gulf Coasts after expansion of the Panama Canal, see: http://www.tradewindsnews.com/weekly/342068/Suez-overakes-Panama-Canal-on-key-container-route

19 According to http://www.bloomberg.com/news/2013-03-11/maersk-line-to-dump-panama-canal-for-suez-as-ships-get-bigger.html Fees for ships to go through the Panama Canal have tripled in the past five years to $450,000 per passage for a vessel carrying 4,500 containers, Skou said. In February, the Suez Canal Authority announced toll increases that would be effective from May, according to the Asian Shipowners’ Forum. This is $100 per TEU each direction. According to http://www.joc.com/port-news/panama-canal-news/suez-canal-lure-more-traffic-panama-canal_20131111.html The Suez Canal Authority currently charges about $1 million for a combined northbound and southbound transit by ships of between 8,000 TEUs and 9,000 TEUs. This is $62.50 per TEU each direction. At the current time the Suez Canal tolls are substantially cheaper than Panama Canal tolls on a TEU basis, which along with the economics of larger ships, has helped in the short term to accelerate the trend away from use of the Panama Canal toward the Suez Canal for traffic from Asia to the east coast of North America.

20 See http://www.joc.com/port-news/panama-canal-news/suez-canal-lure-more-traffic-panama-canal_20131111.html However, Drewry says the damage caused by the overdue opening of the Panama Canal’s new locks is not irreparable. “Everything currently being lost through Suez could easily be switched back to the Panama Canal depending on the level of its new tariffs” Drewry explained.
If it turns out that the steamship lines operate larger type “D” and “E” vessels through both the Panama and Suez Canals, then this forecasting assumption will turn out to be conservative. In this event TEMS would expect to see water costs fall even farther than predicted, which would give Port Freeport an actual competitive advantage over the West Coast based on vessel size. That would make this study very conservative in terms of the potential for Container traffic on the Gulf Coast. This assumption will have to be reexamined in more detail in the next phase of study.

Another area where this study makes a conservative assumption is on connectivity back to the Houston Ship Channel area. While there are a number of options for getting Asian containers into Houston, including maintaining the current practice of shipping on small Panamax vessels, Freeport unlike Corpus Christi is close enough to the Houston market to be an effective coastal port for trucking and shipping access. Trucking to Houston from Freeport would be cheaper than transloading from big ships to small ships at a Caribbean port such as Freeport Grand Bahama, Kingston Jamaica, or Colon Port in Panama; and would also be less expensive than shipping all the way across the Pacific Ocean in a smaller Panamax vessel.

The market assessment for this study conservatively assumes (because it’s more expensive than other intermodal connectivity options) that ships will be completely unloaded at Freeport, and containers trucked back to the Houston Ship Channel area. A more cost-effective solution would be to develop an intermodal connection to Houston that does not rely on trucking. For example, it might be possible to have Port Freeport “top off” a large ship and then take the partially unloaded large ship into Houston as a second port of call. This is similar to how Savannah works today. New York takes most of the loaded containers off the big ship, which can then access Savannah. Alternatively, similarly to what is done at Rotterdam today, containers could be unloaded at Freeport and Houston’s containers forwarded via a Container-on-Barge (COB) shuttle.21.22

In the next phase of work, this requires further discussions with the Ports of Houston and Freeport, as well as the steamship lines to find out which intermodal connectivity options they will prefer. As a result, it is clear that developing an alliance between the Houston and Freeport ports would enhance the market position of both ports. It is recommended that this be explored during the feasibility-level study to further clarify how the ports of Houston and Freeport, can work together.

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21 It is even possible that a whole network of connecting water services might be developed linking Freeport to neighboring ports such as Corpus Christi, Brownsville, and Beaumont as well as to the Houston ship channel area. This COB service could utilize either open water sailing or the GIWW. It would be similar in length to the Norfolk-Richmond COB service sponsored by the Virginia Ports Authority, see http://hamptonroads.com/2009/12/container-barge-service-norfolk-richmond-still-business and http://blog.portofvirginia.com/my-blog/2012/10/richmond-barge-service-adds-third-sailing-tuesday-thursday-and-saturday.html
22 While a COB technology may be suitable for connecting nearby coastal ports, extended connections to New Orleans, Mobile and Tampa using oceangoing feeder ships might also be possible. This would avoid the need for large ships to make an extra stop at a Caribbean Hub port since the containers for New Orleans, Mobile and Tampa could be transferred at Freeport, TX. However, since the Jones Acts may require use of U.S. flag feeder vessels this may put Freeport, TX at a competitive disadvantage compared to the use of foreign hubs. The U.S. Ports of Miami and Ponce Puerto Rico http://latintrade.com/2009/06/port-of-the-americas-puerto-rico would suffer the same problem. This has the effect of actually forcing these container volumes offshore to foreign ports, whereas U.S. ports might actually have been able to compete on a level playing field. Clearly the ability to develop a competitive Caribbean Hub on U.S. soil could further enhance the prospects for Port Freeport, TX. If desired the impact of possible regulatory changes could be considered in a future phase of work.
Chapter 3. Market Assessment

This section assesses the existing markets and Texas transportation system identifying strengths on which to build, potential weaknesses or bottlenecks, markets opportunities and competitive threats that may impact Port Freeport’s ability to grow and develop.

3.1 The Current Market in Texas

In anticipation of Panama Canal expansion, some traffic has already shifted from the West Coast to East and Gulf Coast ports. This was driven both by the knowledge that expansion of the Panama Canal would happen, as well as by a desire of shippers to diversify their options. Both port congestion and a West Coast strike in 2002 demonstrated supply chain vulnerabilities associated with over reliance on only a single port, and encouraged shippers to begin to look for new options. However, since the Panama Canal expanded locks won’t open until 2016, the forecasted major shifts driven by vessel economics have yet to occur. Until then, ports on the Gulf and East Coast have been advancing their plans to get ready.

Expansion of the Panama Canal offers a key opportunity for Texas ports, but also a challenge to handle the larger ships that will be transiting the canal in the near future. This has been perceived as benefiting mostly the US East Coast and not the Gulf, except for heavy bulk shipments like coal, grain, oil and LNG, which could all move more cost effectively from the Gulf in larger ships. However, this view belies the fact that Houston, since the Los Angeles port strike of 2002 has been able to successfully attract container vessel calls from Asia through the Panama Canal. Feeder service from Panama started by 2004 but by 2006 Houston already attracted direct CMA CGM vessel service. As shown in Exhibit 3-1, COSCO added a second direct vessel service in 2012. In contrast, other Gulf coast ports including Corpus Christi, New Orleans, Mobile and Tampa are all still dependent on feeder services from Caribbean Hubs. So Houston is as of now the only Gulf port that has been able to attract direct vessel

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29 Port of Houston teams up with Panama to draw a piece of Asia’s massive trade away from West Coast, http://www.freerepublic.com/focus/news/1273495/posts
32 See: http://www.logisticsmgmt.com/article/ocean_shipping_cma_cgm_csav_expand_service_at_port_of_new_orleans
calls from Asia. In fact as shown in Exhibit 3-2, the level of trade with China has grown to the point that China is now Houston’s single largest import trading partner for containerized goods.

Exhibit 3-1: PHA All-Water Asia Container Services Volumes (Loaded TEUs)

Exhibit 3-2: PHA Container Trade Partners: Imports (Percent of 2013 TEU Total)\(^{34}\)

Houston’s success in Asian trade over the past 10 years has been in spite of current vessel size limitations of the Panama Canal. When the new locks open in 2016\(^{35}\), larger vessels will be able to lower shipping costs even more. This is projected to increase East Coast share of trade relative to West Coast ports; but there is no reason to believe that Gulf ports cannot share in this growth if they can accept the


\(^{35}\) [Deal signed to end row over Panama Canal expansion, March 2014](http://www.bbc.com/news/world-latin-america-26587046)
larger ships. Nonetheless, although Houston has been able to gain some market share, because it is currently limited to Panamax ships, its competitive position in Asian trade is marginal relative to using rail from the West Coast. The West Coast has the advantage of being able to use larger ships on the trans-Pacific lanes which gives it a natural cost advantage. Houston’s shippers today use the port mainly as a back-up to protect against disruptions on the West Coast, not for significant cost savings, since the rail vs. water economic tradeoff today is very close.

As Exhibit 3-3 shows, West Coast ports dominate the whole country today; this effectively limits Houston’s service area to the immediate port hinterlands (truck market only, very little penetration even to Dallas, Fort Worth or interior points) but the same thing can also be said of most of the East Coast ports, which are also effectively limited to their local port hinterlands. Although Houston today has up to a 75% share of its truck hinterland container market36, it has only about a 15% share of all Asian imports37 coming into Texas; 80% of Asian imports still come into Texas via the West Coast and 5% via East Coast.

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36 This is an unusually high market share for water given the relatively tight spread that exists between rail and all-water rates at Houston. However, it might not be unexpected since a number of the major importers, like Wal-Mart, opened distribution centers in Houston for the express purpose of diversifying their supply chain options. This creates a strong “bias” towards water use since the distribution centers were located near the port for the specific purpose of being able to use water, rather than relying on rail shipping from the West Coast.

37 This 15% consists primarily of Houston-area imports from China and Korea where direct container services operate. However, Texas is not connected to all Asian origins by a direct vessel service. For example, Houston’s has no direct vessel connection to Japan, so Houston’s share of Japanese imports to Texas is only about 2% -- almost all container imports from Japan arrive via West Coast ports.

38 Large Ships (2¢/TEU mile) to West Coast, Small Ships (4¢/TEU mile) to Houston and East Coast due to Panama Canal and Port constraints, Rail Intermodal (12¢/TEU mile). This costing framework is consistent with the Texas Gulf Ports Study, Figure 4.3. See Exhibit 1-3 in this report. Web link: http://www.utexas.edu/research/ctr/pdf_reports/1833_3.pdf
By comparison, Houston’s position in European trade today is quite strong (Exhibit 3-4.) Houston attracts direct vessel services from Europe, which also connect to Suez routes that add containers from India and Southeast Asia. For European traffic, Houston competes with East Coast ports, primarily Charleston, SC and Savannah, GA. As a result, Houston has an 80-90% share of European and Suez (e.g. India) containers within a large port service area extending north and west from Houston across the whole Great Plains, east of the Rocky Mountains.

Exhibit 3-4: Current Small Ship Houston Port Hinterland\(^{39}\) from Europe and Suez

Comparing Exhibits 3-3 and 3-4, it can be seen that the Houston port hinterland area for European goods is geographically much larger than it is for Asian goods. In large part, this reflects the fact that for European (and Suez) trade today, East Coast ports are limited to smaller ships by their channel depths; European traffic to the West Coast is limited to small ships because of current Panama Canal limitations. As a result, all three coasts: East, West and Gulf are limited to small ships in European trade today. This competitive parity allows the Houston port to remain competitive over a much larger area for European than for Asian goods, where it is disadvantaged by the West Coast’s sole ability to take big ships.

It is important to note that the result of the GOODS™ model port Hinterland area modeling validates closely the Port of Houston’s current trade statistics shown in Exhibit 3-5. Today, because the European hinterlands are large while Asian\(^{40}\) hinterlands are very small, the Houston port actually handles more European import containers than it does Asian. (The total market size shows 317k / 235k or 35% more

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\(^{39}\) Small Ships (2¢/TEU mile) to West Coast due to Panama Canal and Port constraints, Small Ships (4¢/TEU mile) to Houston and East Coast due to Port constraints, Rail Intermodal (12¢/TEU mile).

\(^{40}\) China is the ports largest single trade partner but all European countries exceed all Asian countries.
European containers than Asian, are available to the Port of Houston in Exhibits 3-3 and 3-4.) TEU’s handled at Houston in 2013 was 274k / 176k for Europe vs. Asia – 57% more European import containers than Asian. Exhibit 3-6 shows that Houston’s 72% share of Asian containers within the immediate environs of the port (primarily the Baytown area) is still lower than Houston’s 78% market share for European containers – because of the economics of big ships at the West Coast ports. West Coast ports dominate the flow of containers to Dallas/Ft. Worth and even compete with the Port of Houston for the Houston market.

Exhibit 3-5: PHA Container Trading Lanes: Imports (Percent of 2013 TEU Total)\(^{41}\)

Exhibit 3-6: Houston Port Actuals vs. Hinterland Validation: Europe vs Asia

(Thousands of TEUs)

\(^{41}\) As compared to Exhibit 3-2, this graph shows Imports by Trading Lane rather than by Country. Although China remains the largest single import trading partner, collectively imports from all European countries are currently larger than Asian trade at Houston. See: [http://www.portofhouston.com/static/gen/business-development/Origination/2-Container_Volume_by_Trade_Lanes_stats_2013.pdf](http://www.portofhouston.com/static/gen/business-development/Origination/2-Container_Volume_by_Trade_Lanes_stats_2013.pdf)
A third market as shown in Exhibit 3-5 that is very important to Houston is the Caribbean and South American trade. Due to volume and port limitations, as well as the relatively short lengths of haul, very small ships are mostly used in these trade lanes. Feeder vessels also connect to Caribbean hub ports where they can pick up containers from European or Asian origins – anywhere in the world. “Catch all” services from Caribbean hubs provide basic connectivity to other Gulf ports that don’t have enough volume to support dedicated vessel services. But since Houston has been able to attract direct vessel calls from Europe and Asia, most traffic comes directly into Houston without needing to transfer at a Caribbean hub. Even so, some residual European and Asian volumes occasionally do arrive into Houston on these feeder vessels.

Both Houston and Freeport have a strong position today in the Caribbean and South American markets, but since small feeder vessels are used in these lanes, New Orleans and other smaller Gulf ports have been able to compete strongly as well. In competition with Houston, New Orleans also has a very strong position in Caribbean and South American trade – which naturally flows on a north/south axis -- because its on-dock rail connections with CN at Napoleon Avenue provide fast and efficient connections to Memphis, Chicago and Canada. At the same time, this CN rail connection doesn’t help New Orleans very much for east/west European or Asian traffic, since the East and West coast ports are much more competitive than New Orleans for this traffic at Memphis and Chicago. This prevents New Orleans gaining much share in the European or Asian markets, in spite of its excellent rail connectivity. This is not likely to change because of New Orleans 45’ channel depth limitation and the small size of the local New Orleans hinterland container markets, both of which are problematical for the deployment of large ships and will make it difficult for New Orleans to reduce its costs.

In contrast to New Orleans’ weak hinterland container market, the Texas market is very large and growing rapidly. This is why Houston and not New Orleans has emerged as the primary Gulf coast container port. In Texas even beyond Houston, Exhibit 3-7 shows that Dallas and Fort Worth have also emerged as important logistics hubs. Even though Houston and Dallas/Fort Worth are similarly sized by population, Dallas/Fort Worth has almost twice Houston’s warehousing employment.

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42 As a result, shipping rates to South America, but especially in the Caribbean region, tend to be very high compared to the major trade lanes. This reflects high costs for the small ships used, low volumes and resulting port inefficiencies. See for example, Harding et al. (page 21) at http://www.cepal.org/publicaciones/xml/2/12812/Lcl1899e.pdf


44 In 2013, Great White Fleet moved 21,894 TEUs through Port Freeport, making it the port’s top container cargo tenant. Its second-largest tenant, Dole Ocean Cargo Express, moved 21,312 TEUs. Most of their ships are coming from Central America, specifically Guatemala and Costa Rica. See: http://www.joc.com/port-news/us-ports/port-freeport-texas/port-freeport-ties-crane-investment-rising-demand_20140520.html

45 Some other ports like Corpus Christi, Mobile and Tampa also participate in these trades although they serve mostly local port markets. These same feeder vessels also serve the major Caribbean Hubs where they are able to pick up some Asian and European traffic, which accounts for the relatively small share of Asian and European traffic that is captured by the New Orleans, Corpus Christi, Mobile and Tampa ports.


47 See: http://portno.com/napoleon-avenue-interop-modal-terminal


49 Development of the New Orleans port is hampered by its small hinterland population: New Orleans population of 1,227,096 (devastated by Hurricane Katrina in 2005 and actually reduced since then) as compared to Houston’s rapidly growing 6,313,158 and Dallas/Fort Worth’s 6,526,548. (http://en.wikipedia.org/wiki/Greater_Houston and http://en.wikipedia.org/wiki/Dallas%2280%3FFort_Worth_metropolitan) This tends to drive container ships to Houston rather than New Orleans. New Orleans has difficulty attaining enough “critical mass” to develop into a major container port. Although it aspires to a greater role and plans to aggressively compete for Asian imports (http://portno.com/CMS/Resources/brochure_panama.pdf) economics will likely continue to limit its ability to attract Asian and European direct vessel calls, so it will continue to be confined to a niche role in the Caribbean trade.
Data downloaded from U.S. Census Bureau in June 2014 from [http://www.census.gov/econ/cbp/download/](http://www.census.gov/econ/cbp/download/). NAICS 493 (Warehousing and Storage Employment) totals were cross checked by comparing to [www.tracer2.com/admin/uploadedPublications/2047_TLMR-Feb12.pdf](http://www.tracer2.com/admin/uploadedPublications/2047_TLMR-Feb12.pdf). This exhibit shows that:

- Dallas/Fort Worth area is the main logistics hub of Texas having twice the warehousing employment of Houston.
- After Houston itself, the next most important area to reach in Texas is San Antonio.
- Next is the Brownsville/Laredo area which could be a candidate for a COB connection, but either KCS or UP could provide rail options for reaching these markets.
- Fifth is El Paso, but since for Asian traffic west coast ports are likely to dominate this market (see Exhibit 2-10) this is outside the Houston port service area. As a result, it should not be a high priority for developing a Houston inland port. UP’s new Santa Teresa facility could be used for any European containers that are headed to El Paso.
While Houston has the greater concentration of heavy industry, Dallas/Fort Worth is Texas’ main logistics center.\(^{51}\) Collectively, the “Texas Triangle” (Houston, Dallas/Fort Worth and San Antonio) account for 84% of all distribution employment in Texas. Clearly, development of effective linkages from Freeport to Dallas/Fort Worth as well as to San Antonio will be essential to expand the port market area. This supports the high container volumes that will be needed to bring large ships to Port Freeport.

Currently, containers to and from Europe, India\(^ {52}\), South America and the Caribbean are routinely trucked from Houston to Dallas/Fort Worth as well as to San Antonio. The distance from Houston to Dallas/Fort Worth is approximately 250 miles and to San Antonio is 200 miles. This is far enough to make trucking expensive, but too short for conventional intermodal service which needs a minimum of 500-600 miles length of haul to be profitable (primarily, to offset high terminal and drayage costs at both ends of the move).\(^ {53}\) However, with an on-dock rail connection and sufficient volumes, an intermodal connection can work.

Union Pacific is already operating a twice a week “Texas Shuttle” from Barbour’s Cut to its South Dallas intermodal ramp at Wilmer, TX.\(^ {54}\) The train times are coordinated with the arrival times of the two weekly vessels that arrive from Asia (CMA CGM and COSCO). The Panama Canal Authority has promoted this link to Dallas as a major growth opportunity for the Houston port\(^ {55}\). In October 2013 this service was reportedly handling about 30 containers per train.\(^ {56}\) UP’s goal is to increase that to 100 containers per train, but this may be difficult since it appears that the rail service has already captured most of the available Asian traffic. Additional containers may be available at Houston, but capturing significant volumes will be difficult since this traffic is higher valued (thus worth trucking) and the infrequent rail service isn’t timed well to connect with ships from Europe, India, South America and the Caribbean. Unfortunately, Panamax-sized ships can’t deliver Asian containers to Houston at a low enough cost (in competition with West Coast ports) to significantly penetrate the Dallas/Fort Worth market. Given the 45’ depth of the Houston Ship Channel which prevents using larger ships, this seems unlikely to change so long as the rail service stays at Barbour’s Cut.

By comparison, Exhibit 3-8 shows the distribution of Houston port-related container traffic within Texas from the Panama Canal model’s 2006 database. Houston itself absorbs about 2/3 of the containers that come into the port today, while the balance is distributed to other cities within Texas and to other states, mostly by truck. It can be seen that the largest single destination for containers beyond Houston (besides the port area itself) is Dallas, but most of these are European, South American and Caribbean containers. The reported 30 (FEU) containers per train (twice as week) on UP’s rail service squares nicely with the Asian container data in Exhibit 3-8, which suggests Dallas is receiving an average of 64

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\(^{51}\) See: [http://dallaslogisticshub.com/?p=592](http://dallaslogisticshub.com/?p=592)

\(^{52}\) Any Far East destinations, generally south and west of Singapore, that are reached via the Suez Canal.


import containers (128 TEU) per week from Asia via Houston\textsuperscript{57}.

**Exhibit 3-8: Current Distribution of Houston Port Containers within Texas\textsuperscript{58}**

![Bar chart showing the distribution of Houston Port containers within Texas.](image)

Houston itself absorbs approx 2/3 of all import containers from the Port.

Elevated Asian Houston Port market share at Corpus Christi due to lack of effective rail competition there. It could be vulnerable to Caribbean Hub competition with big ships, however.

Exhibit 3-8 however, also shows another interesting opportunity, which is the significant number of containers moving from Houston to Corpus Christi\textsuperscript{59} today, with additional containers to Brownsville and Laredo\textsuperscript{60}. In total, this shows that the south Texas coastal market today (287 containers/week from Houston) is comparable to Houston’s current Dallas/Fort Worth (288 containers/week) market.

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\textsuperscript{57} This is only the blue shaded area at the bottom of the bar, about 6,500 TEU total for the year.

\textsuperscript{58} 2006 USITM data. In the key, WCSA = West Coast of South America, ECSA = East Coast of South America and Caribbean

\textsuperscript{59} 164 Containers/week, 116 from Asia

\textsuperscript{60} 123 Containers/week, 46 from Asia
This comparison provides some important insights into the competitive structure of shipping and rail intermodal services in south Texas. While there are rail ramps in Houston, there are none in Corpus Christi. As such, the only way to get a container from Houston to Corpus Christi is to truck it. Due to the lack of direct rail competition at Corpus Christi, it is cost effective for ocean carriers to bring containers into Houston on a vessel service and then truck to Corpus Christi. Corpus Christi is also close enough to Houston (220 miles) so trucking can compete with direct water service using feeder vessels from a Caribbean hub. As a result, trucking from Houston to Corpus Christi is cost competitive both with rail from Houston-area ramps as well as with vessel service from the Caribbean hubs.

However, farther south (at Brownsville, 350 miles from Houston) trucking costs are higher, and there is also a Union Pacific rail ramp at Brownsville. Houston’s reduced market share into Laredo and Brownsville reflects the impact of direct rail competition as well as use of feeder vessels from Caribbean hubs.

However, if an effective rail or COB intermodal link could be established from Freeport along the southern Texas coast, this might prove to be more cost effective than trucking. Linking Freeport with Corpus Christi and Brownsville could certainly help grow Freeport’s volumes, by better enabling it to compete both with rail from the West Coast and with the Caribbean hub ports in these markets. The possibility of establishing a COB service along the GIWW to distribute containers from Freeport along the Gulf coast may be assessed in a future study.

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61 Currently Corpus Christi does not have intermodal service by any railroad; UP has a ramp at Brownsville, and both UP and KCS have ramps at Laredo. see http://www.corpuschristi-mpo.org/04_studies/04_studies_fr/ccmffis_fr_021010.pdf
62 Notwithstanding previous negative assessments of COB potential, see: Bomba and Harrison, Feasibility of a Container-on-Barge Network Along the Texas Gulf Coast at http://uts.cc.utexas.edu/~harrison/pdf_other/02_4007.pdf
Chapter 4. Service Scenario Definition

This section will identify the market opportunities, required services and related infrastructure needs for the Port Freeport to fully realize its potential. Specific strategies for linking Freeport to its potential markets will be identified. From this, the need for specific supporting infrastructure will be developed.

4.1 Assumed Facilities at Port Freeport

It is clear that the need for inland transportation improvements depends on the development of Port Freeport. A critical step for Port Freeport is the dredging of its channel to 56 feet, and developing appropriate berths for large container ships.

For development of rail operating plans and estimation of related rail infrastructure needs, some assumptions must be made about the character and capabilities of Port Freeport. To begin with, it will be essential for Port Freeport to have enough berths, cranes, dockside space and loading tracks to accommodate forecasted demand. Although Freeport, TX with its deepened channel could in theory handle any container ship in the world, this is not expected to be a regular occurrence. Ships in the 7,000-8,000 TEU range are more likely in the short term. Larger ships will however, probably be used for expanding capacity in the future as demand continues to grow. Port Freeport therefore, should be designed for 12,500 TEU ships although these are not likely in the short term.

For an acceptable loading and unloading rate (competitive to what other ports offer) a 7,000-8,000 TEU ship will need a minimum of 4 Post-Panamax cranes. Larger ships will need more cranes. In the future to handle a 12,500 TEU ship, Freeport should be able to assign six to seven cranes to each ship to be able to unload and reload the ship within an acceptable time frame. Exhibit 4-1 is a Google satellite image showing six cranes working on a ship in the Los Angeles harbor.

Exhibit 4-1:
Six Cranes Working a Ship at Los Angeles Port

63 The reference Intermodal Transportation and Containerization at https://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c6en.html suggests that each crane can handle roughly 30 movements (loading or unloading) per hour. This reference suggests that 5 to 6 cranes can service a 5,000 TEU containership. However, this many cranes are not commonly used in practice. The Port of Long Beach claims to run 16 hours a day on two shifts, five cranes to a ship: http://articles.latimes.com/2011/may/14/business/la-fi-cranes-20110514. But the very large 16,000 TEU CMA/CGM containership is seen to have only four cranes working on it: http://www.dailymail.co.uk/news/article-2245394/Worlds-largest-container-ship-396m-long-arrives-Britain-maiden-carrying-thousands-Christmas-presents.html. A minimum of 4 cranes should be assigned to each ship although a fifth crane could be added if available. However, only two cranes are currently coming to Freeport: http://www.houstonnewcomerguides.com/news/freeport-tx-%E2%80%93-post-panamax-crane-heading-to-port-freeport-tx so Freeport is going to need to order more cranes if it wants to develop into a major container port.
Currently, the Barbours Cut terminal in Houston has nine small (50’ gauge) cranes but four large (100’ gauge) Post-Panamax cranes have been ordered to expand its capacity. Houston’s Bayport terminal already has nine Post-Panamax ZPMC cranes with twin-pick capabilities. As such, either Barbours Cut or Bayport are already positioned to offer competitive turn-around times for big ships, although neither facility has the channel depth needed to take a fully loaded Post-Panamax ship.

By comparison, Freeport currently has only two Post-Panamax cranes. While this is probably adequate for the needs of the Great White Fleet and its small vessels, Freeport does not yet have enough cranes to be able to load and unload a large ship in a time frame that is competitive to other ports. In the short term, this will likely be a negative factor in terms of the port’s ability to attract vessel calls beyond the current Chiquita banana business.

As a result, Freeport needs at least four cranes and 1000 feet of dock to be able to work one 7,000-8,000 TEU ship at a time and should expand to this capability as soon as possible. As business starts to develop, because of the challenges associated with scheduling multiple vessel calls, Port Freeport will need at least eight cranes to be able to work two ships simultaneously (one loading, the other unloading.) Over time this will be need to be further expanded to 12-18 cranes to either work more ships or larger 12,500 TEU ships as volumes continue to grow. In terms of the projected volume forecasted, the Freeport Master plan needs to provide this level of capacity improvement over time.

Cranes can typically make about 30 moves per hour, and most containers are in fact 40’ units, so if each crane handles 2 TEUs per lift:

- 1,000 TEU / 2 TEU per 40’ container / 30 moves per hour = 16.7 hours for 1,000 TEU per crane.

For complete unloading, a 12,500 TEU Post-Panamax ship would need 35-52 hours, then another 35-52 hours for reloading, depending whether the ship arrives fully loaded and how many cranes are assigned:

- 12,500 TEU * 16.7 hours / 1,000 TEU / 4 cranes = 52 hours
- 12,500 TEU * 16.7 hours / 1,000 TEU / 6 cranes = 35 hours

The more typical case would be an 8,000 TEU ship with 4 cranes assigned to work it. This ship would need 33 hours for complete unloading and another 33 hours for reloading.

- 8,000 TEU * 16.7 hours / 1,000 TEU / 4 cranes = 33 hours

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64 See: http://www.portofhouston.com/container-terminals/barbours-cut/barbours-cut-specifications/
66 See: http://www.portsamerica.com/portofbayport-texas.html
68 See: http://www.portsamerica.com/portofbayport-texas.html
69 By comparison, the Long Beach has 15 container cranes: 9 cranes reach 24 containers across, and 6 cranes reach 20 containers across. http://www.polb.com/economics/cargotenant/containerized/pierj.asp There are 16 Post-Panamax cranes at Savannah, GA: http://www.joc.com/port-news/us-ports/port-savannah/new-super-post-panamax-cranes-operational-port-savannah_20131024.html The Velasco Terminal at Freeport, TX will only have two cranes which is not enough to unload a large ship in a competitive time. http://www.yourhoustonnews.com/pearland/news/new-port-freeport-cranes-on-the-way/article_8762a3ee-9100-584a-ac48-56d754875b17.html
As a result, it can be seen that each ship will need about 1½ days in port to unload, and then another 1½
days to reload assuming all cranes are working on a 24 hours + 7 day a week basis. If Freeport can
attract two vessel calls per week, then four cranes could (in theory) suffice provided the vessel
schedules can be coordinated.\textsuperscript{70} If the ships only partially load or unload (assuming they take Houston
containers to Barbours Cut) then the dwell time at Freeport will be reduced, lessening pressure on dock
space and crane capacity at Freeport. If Freeport has just four cranes for each 8,000 TEU ship and if the
port handles two ships per week, then the throughput of the Port would be:

- 8,000 TEU * 2 ships/week * 52 weeks/per year = 832,000 TEU per direction\textsuperscript{71}, or 1.6 million TEU
for the port annually (both loaded and empty containers) This design capacity would represent a
4½ times increase over today’s Asian trade resulting from the expanded port hinterland area,
enskapping the added large cities of San Antonio, Dallas and Fort Worth as well as areas to
the north. This volume can be seen as roughly comparable to the Port of Houston’s current total
throughput and is consistent with the result of Chapter 3.\textsuperscript{72}

- If, however, European vessel calls were also added to port according to the analysis of Chapter
3, this would generate roughly 0.3 million TEU’s per direction, or 0.6 million TEUs for the port
annually (both import and exports, assuming these remain in balance) requiring one additional
vessel call per week. Port Freeport would not have enough capacity to handle this third vessel
call without another set of 4 cranes, so 8 cranes would be needed to support volumes above 1
million TEUS’s annually.

- If ships only partially load/unload at Port Freeport (assuming they take ½ to ⅔ of their containers
on to Barbours Cut to finish unloading) then four cranes might be sufficient for 3 vessel calls — if
schedules can be tightly coordinated. This requires further analysis in the next phase of work.

If each ship carries 4,000 containers (8,000 TEU) for the purpose of developing the rail operating plan, if
½ the containers are forwarded by rail, then 4,000 TEU or 2,000 containers will come off each ship. Each
double stack train can haul 250 40' containers at a time\textsuperscript{73} so each ship generates 8 trains in and out of
the port, twice a week: 3-4 trains each to Dallas and Fort Worth, and 1-2 trains to San Antonio per ship.
This would be 16 trains in a week, an average of 2-3 trains per day each way, to start. A single track rail
link to Rosenberg would be sufficient for handling this volume of train traffic.

\textsuperscript{70} However, it would be more efficient to have eight cranes and four vessel calls per week so that one vessel is loading and the other is
simultaneously unloading. This will create a smooth flow of containers both on and off the dock, which would promote the most effective
utilization of the port and inland distribution infrastructure. At this level of utilization, the cranes, docks, and inland port facilities can be kept
running on a practically continuous basis. To the extent it possible to smooth demand and even out the traffic flows, this will result in the most
effective utilization of both port and inland distribution facilities.

\textsuperscript{71} This is consistent with forecast range of 0.6 to 0.9 million Asian import TEU’s per year, from Chapter 2 which is a three to fivefold increase
over Houston’s current traffic levels.

\textsuperscript{72} By comparison, the Port of Houston handled approximately 2 million TEU’s in 2013, roughly 350,000 TEU’s are estimated to have come from
Asia: 175,765 import loads; 90,360 export loads; 85,405 export empties (estimated)

\textsuperscript{73} The largest double stack trains carry up to 400 containers at a time (800 TEU) but a train size of 250 containers (500 TEU) is more typical. (see
https://people.hofstra.edu/geotrans/eng/ch3en/conc3en/ch3c6en.html)
4.2 Import Container Transloading at Freeport

Ancillary services, such as distribution warehousing and trans-loading capabilities, are needed near the port, since some shippers will want to transload import containers, particularly for destinations beyond Texas, into larger domestic boxes.74,75

Transloading benefits ocean carriers by keeping containers close to the port, as well as shippers by allowing them to move goods inland utilizing more efficient domestic containers.76 For example: at Los Angeles, after goods are reloaded into a 53’ domestic box, some shipments reappear in downtown Los Angeles as “domestic” loads. Unfortunately, this means that these containers do not take advantage of the Alameda Corridor investment, nor do they pay the Alameda Corridor toll. Rather, trucks travel on city streets adding to congestion in downtown Los Angeles.77 However, since the existing rail ramps are all so far away, long distance drayage from Port Freeport is not going to be economical for avoiding the anticipated tolls or port fees. (UP facilities are at Settegast and Englewood yards near the center of Houston; BNSF has an intermodal yard at Pearland, and KCS has intermodal yards at Rosenberg78 and Port Arthur.79)

However to accommodate this need, the Port needs either to offer transloading services itself, or else to allow transloaded goods to reenter the Port for riding the rail shuttle trains. If this cannot be accommodated on-dock then a separate near-dock rail loading facility should be provided80 for integrating domestic containers flows into the proposed shuttle train operations at or near the Port. Further study is needed to determine the most effective way to do this.

4.3 Export Container Transloading at Freeport

A related issue is how exports are to be handled. Houston is unusual for a United States port, since it actually exports more containers than it imports. As shown in Exhibit 4-2, containerized exports are mostly industrial commodities rather than consumer goods. As a result, maintaining connectivity to industrial shippers (for export) may be as important as connectivity to distribution centers (for imports).

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74 Because a 53’ US standard truck trailer holds up to 60% more freight than a 40’ ocean container, drayage of ocean containers is significantly less productive than conventional trucking. See: http://exportlogisticsguide.com/apl-introduces-53-foot-ocean-containers/

75 If goods are intended to move inland for any significant distance, it is often beneficial to transload goods into domestic trailers or containers. These transloads are typically done close to the port. See: http://www.idstransportation.com/news/transloading-benefits-driving-growth

76 It easy to find a backhaul for a domestic container in Chicago, but ocean containers are not wanted for domestic loads so most of them end up being sent back to the ports empty.


78 Currently the Kendleton, TX facility (just southwest of Rosenberg) is used primarily for Mexico-bound traffic although presumably northbound traffic could use it as needed, See: http://www.centerpointenergy.com/staticfiles/CNP/Common/SiteAssets/doc/Rosenberg%20-%20-%2010%20Rosenberg%20Intermoda%20Center%20gaining%20speed.pdf

79 Currently the Port Arthur facility is used primarily for traffic to Atlanta and the northeastern U.S., See: http://www.thefreelibrary.com/Kansas+C+City+Southern+and+Norfolk+Southern+Open+Joint+Intermodal...-a020504362

80 An open port policy would allow Brazoria and Fort Bend Counties to share the economic growth potential that will result from development of Port Freeport, by developing their own value-added logistics industry. If would allow Freeport logistics to compete with Dallas, Fort Worth and San Antonio on a level playing field. It would also help build volume on the rail shuttle services since goods could ride the trains whether they are transloaded into domestic containers, or come directly off the docks.
The ability to transload exports (such as resins, plastics, chemicals and minerals) into ocean containers will be a critical adjunct to development of Port Freeport.

### Exhibit 4-2: Houston Export Commodities

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Percent of TEU Total based on 2013 Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resins &amp; Plastics</td>
<td></td>
</tr>
<tr>
<td>Chemicals &amp; Minerals</td>
<td></td>
</tr>
<tr>
<td>Machinery, Appliances &amp; Electronics</td>
<td></td>
</tr>
<tr>
<td>Food &amp; Drink</td>
<td></td>
</tr>
<tr>
<td>Automotive</td>
<td></td>
</tr>
<tr>
<td>Steel &amp; Metals</td>
<td></td>
</tr>
<tr>
<td>Fabrics Incl. Raw Cotton</td>
<td></td>
</tr>
<tr>
<td>Retail Consumer Goods</td>
<td></td>
</tr>
<tr>
<td>Hardware &amp; Construction Materials</td>
<td></td>
</tr>
<tr>
<td>Apparel &amp; Accessories</td>
<td></td>
</tr>
<tr>
<td>Furniture</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

Source: PHA Market Development, Journal of Commerce/PIERS data
Notes: Values include all Houston Ship Channel Terminals. Totals are estimated, not exact. Commodity categories based on custom PHA Market Development definitions.

While the opportunity to backhaul ocean containers may seem like an obvious benefit to steamship lines, it adds cost if the goods are not available in exactly the same place where containers were made empty. Then, the need for repositioning empty containers usually involves a complex triangulation of movements. It takes time and adds cost compared to the economics of returning empty containers directly to the ship. Since backhaul rates are typically low, this may not be an effective use of the container asset from the shipping line’s perspective, especially during the peak season.

An alternative – which avoids costs associated with repositioning empty containers – is an innovative approach that *brings loads to the empty containers, rather than trying to take empty containers to the loads*. For example, unit trains of agricultural products are today being brought into Yermo, CA and into Tacoma, WA in covered hoppers where they are transloaded *near the port* into ocean containers. Port Freeport should anticipate the need for bringing industrial commodities into the port on railcars, trucks and barges, and should provide facilities for efficiently transloading these exports into empty containers.

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82 See: [http://www.tc.gc.ca/pol/EN/Report/Containers2006/C7.htm](http://www.tc.gc.ca/pol/EN/Report/Containers2006/C7.htm) This describes the situation in Canada where front-haul business generates 80% of the steamship line revenues leaving backhaul traffic to generate only 20%. The fronthaul versus backhaul rate is heavily influenced by container utilization. At times when plenty of containers are available, backhaul rates fall, but in the peak season, the incentive is to get empty containers back to Asia as quickly as possible for reloading. Because of this, backhaul rates tend to be extremely volatile. Nonetheless, many backhaul commodities (such as grain) can be stored and shipped off peak when plenty of container capacity is available. According to an example in: [http://infratrans.gov.ab.ca/INFTRA_Content/docType56/Production/UseofContainersinCanadaFinalReport_0.pdf](http://infratrans.gov.ab.ca/INFTRA_Content/docType56/Production/UseofContainersinCanadaFinalReport_0.pdf) page viii a steamship line needs at least $800 per box to make the backhaul “interesting” as compared to the front haul rate of $3,000-$3,800 per box, so the backhaul rate even during the peak season was cited as just 27% of the front haul rate. The assumed 40% of front haul factor would be sufficient to cover some added surface transportation cost while still making a contribution towards fixed costs, especially during the off peak season when the opportunity cost of container utilization does not exceed the actual cost of leasing or owning the equipment.
4.4 Linking Back to the Houston Ship Channel Area

A challenge to shifting Asian and European big ship calls to Freeport will be how to maintain connectivity to the existing industrial base in the Houston Ship Channel. As shown in Exhibit 4-3 from Freeport to Barbours Cut is 81 miles by truck or 117 miles by water. Currently the analysis assumes that this linkage will be maintained by trucking. But because of the distance and high traffic volumes involved, it is logical to plan to develop some sort of intermodal connection from Freeport back to the Barbour’s Cut area. This requires further discussion with both Ports and steamship lines to determine the best approach.

Exhibit 4-3: Distances from Freeport and Barbours Cut to Houston-Area Rail Ramps

Warehousing employment data (Exhibit 4-4) makes it clear that distribution activity in Houston is today heavily concentrated in Harris County (Exhibit 3-3). Within Harris County, the University of Texas identifies many of the large distribution centers as being located in the immediate vicinity of the Port, south and east of the city center. Wal-Mart’s national distribution center, for example, is located in Baytown, TX right across the Fred Hartman Bridge just 5 miles away from Barbour’s Cut marine terminal. In 2005, Wal-Mart signed a 30-year lease on its 4-million square feet facility so it is committed to stay there for another 20 years at least.

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84 This exhibit also shows the distances to existing UP, BNSF and KCS intermodal ramps. However, not much port traffic uses these ramps today since Barbour’s Cut is mostly a truck port today, and will likely remain so in the future due to its channel depth limitation.
85 Data downloaded from U.S. Census Bureau in June 2014 from http://www.census.gov/econ/cbp/download/. NAICS 493 (Warehousing and Storage Employment) totals were cross checked by comparing to www.tracer2.com/admin/uploadedPublications/2047_TLMR-Feb12.pdf
86 According to http://www.bayareahoustonmag.com/trucks-road-sign-positive-economic-times/ over 70% of the goods imported through the Port of Houston container terminals are consumed by the 7 million people located within a single day’s drive.
88 See: http://en.wikipedia.org/wiki/Fred_Hartman_Bridge

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Exhibit 4-4: Distribution Activity within the Houston Area

It has been assumed for this study that local Houston market connectivity can affordably be established by trucking. For reaching Wal-Mart’s Baytown warehouse, for example:

- The highway distance from Freeport to Baytown is 82 miles; from Barbours Cut to Baytown the distance is only 7 miles. This is an increase of 75 miles. Based on a one-way trucking cost of $0.95 per TEU-mile\(^90\) this would add $71 to the cost of each TEU delivered from Freeport to Wal-Mart’s warehouse in Baytown.

- Based on a distance of 11,647 miles\(^91\) from Shanghai to Houston a savings of 2\(\text{¢}\) per TEU-mile in vessel line haul operating cost would save $233 per TEU.

- As a result, trucking is economically justified, given the length of ocean haul from China it and the use of the bigger ship, since the ocean line haul savings exceeds the added drayage cost from Freeport.

This suggests that Houston Ship Channel shippers could save $162 per TEU on Asian containers by trucking from Freeport to take advantage of the ocean transportation costs savings, compared to using a small ship at Barbour’s Cut. Even taking into account the need for returning empty containers and “bob tailing” typically associated with drayage, Houston-area shippers would still likely be better off with big ships at Freeport than with small ships at Houston. Nonetheless if an intermodal linkage could be developed, then Houston Ship Channel shippers would have the “best of both worlds” by being able to enjoy the benefits of cost-effective vessel service in spite of Houston’s 45’ channel depth limitation.

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\(^90\) Source: Texas Gulf Ports Study, Figure 4.3. See: [http://www.utexas.edu/research/ctr/pdf_reports/1833_3.pdf](http://www.utexas.edu/research/ctr/pdf_reports/1833_3.pdf)

\(^91\) Based on 10,121 NM or 11,647 statute miles from Shanghai to Houston via the Panama Canal, [http://www.sea-distances.org/](http://www.sea-distances.org/) and [http://e-ships.net/dist.htm](http://e-ships.net/dist.htm)
4.5 Intermodal Rail Loading Facilities and a Freeport Terminal Railroad

To develop into a competitive ocean port, Freeport will need efficient rail links to key inland markets, and competitive access by more than one railroad. North Carolina’s Maritime Strategy\textsuperscript{92} explains why competitive rail service is important for developing a world-class container port:

> CSX and Norfolk Southern agree that the shipping lines desire access to two railroads. When a shipping line has the option for two railroads at a given port, it can offer a competitive advantage in attracting vessel calls and shipper demand. . . . NC Ports and in-state shippers contend that the lack of dual rail service contributes to high quotes for rail transport to the state’s port facilities. Dual rail service would introduce rail freight competition by offering service of two railroads to each port location. . . . NCSPA also cites lack of dual rail service as a challenge in trying to attract new container vessel calls to Wilmington. This is particularly problematic because NC Ports are the only port facilities among the regional peer ports that do not benefit from dual freight rail service into the port facility. Because shippers and shipping lines often have agreements with specific railroads, waterborne cargo may be directed to a specific railroad and the actual advantage of dual rail service may be less than perceived. Still, the railroads agree that it would benefit both companies to have access into each port.

At Houston, UP and BNSF both seem to understand the need for competitive port access, since both railroads serve the Barbour’s Cut Marine Terminal\textsuperscript{93,94} and the railroads have also been cooperative on the need for developing competitive rail access to Bayport\textsuperscript{95} in the future. It is hoped that the railroads would extend the same consideration to Port Freeport.

As an alternative to duplicating Union Pacific’s rail access into Freeport, Port Freeport might choose to negotiate with Union Pacific for purchasing the existing Angleton-Freeport branch line. This rail line links Freeport with Union Pacific’s Angleton Subdivision – over which BNSF has trackage rights. Thus, by gaining Port ownership of this rail line, both BNSF and UP could immediately access Freeport via...
Angleton over existing tracks. Freeport could then establish a neutral terminal switching railroad (similar to the PTRA in Houston.)

This type of port transaction is very similar to what was done on the west coast, where the Pacific Harbor Line\(^96\) (PHL) serves the Ports of Los Angeles and Long Beach. PHL operates 75 miles of track mostly owned by the two ports\(^97\) although it also leases some industrial track from Union Pacific.\(^98\) PHL serves nine on-dock intermodal terminals and numerous carload customers. It was developed by the ports in conjunction with the Alameda Corridor project to provide a neutral switching carrier for both BNSF and UP, and began operations in 1998.

*The ports bought all of the physical rail assets from the railroads to level the playing field for shippers. Prior to this, Harbor Belt Line was owned and run by the Southern Pacific, the Santa Fe Railway and the Union Pacific. In the past, a shipper could have problems getting their goods to or from the port depending on where an individual railroad’s track ended. With the inception of PHL, shippers now had a neutral switching railroad that could dispense reliable service at the largest port complex in the western hemisphere which handles 14 million TEU annually. In other words, the PHL leveled the playing field between the ports and the railroads.*\(^99\)

Once Port Freeport has established a competitive rail link to the outside world, rail shuttle trains could be started over existing rail lines linking Freeport to proposed inland ports at San Antonio, Dallas and Fort Worth allowing direct connections to the national intermodal rail network. At these hubs, efficient connections can be made to anywhere else in North America or the world. It is assumed that costs for developing these port, rail and inland terminal facilities will be recovered by the port’s own fees.\(^100\) While this should be sufficient to recover costs at Port Freeport, more study is needed to confirm the actual fees that Freeport will need to charge to recover its operating and capital costs.

### 4.6 The Need for Inland Ports

The development of a network of inland port facilities would complement the capabilities of on-dock rail loading, and can also support the goals for establishing competitive rail services that shippers want. As a rule, inland ports are justified when there is a concentrated volume of sufficient container traffic moving to or towards a particular location, beyond a comfortable truck drayage distance from the ocean port.

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100 Water costs are modeled as approximately $400 lift costs per TEU for loading and unloading ($200 at each end of the water movement) plus line-haul of 2c per TEU-mile in large ships, or 4c per mile in small ships. For the port operation, the assumed $200 per TEU fee ($400 for a 40-foot container) is based on a competitive level of costs at Los Angeles and other ports. Port charges at Los Angeles are $325-425 per 40 foot container, see [http://www.polb.com/civica/filebank/blobload.asp?BlobID=6866](http://www.polb.com/civica/filebank/blobload.asp?BlobID=6866) In addition to this, rail containers would be charged $125 per TEU ($62.50 at each end) for rail loading and unloading. Rail costs are modeled as $125 lift costs per TEU for loading and unloading, or $62.50 at each end of the rail movement, plus 12¢ per TEU-mile for the rail line-haul. These costs are based on double stack trains, and were developed from "Rail Short Haul Intermodal Corridor Case Studies", Table 6.3.3 on page 32. See: [https://www.fra.dot.gov/Elib/Document/1649](https://www.fra.dot.gov/Elib/Document/1649)
Inland ports could lower shipping costs at key competitive points as Dallas, Fort Worth and San Antonio that will have enough traffic volume to justify running direct train services.  

For example, the Virginia Port Authority has been running an Inland Port at Front Royal 220 miles from Norfolk with a dedicated double stack rail service since 1989. In 2013, the port of Charleston, SC also opened an inland port at Greer, SC, halfway between Greenville and Spartanburg, 215 miles from Charleston. The distances to Dallas/Fort Worth and San Antonio are very similar so a concept similar to Virginia’s and South Carolina’s would likely work in Texas as well. It can be seen that inland ports are increasingly becoming standard adjuncts to ports, as more and more ports start to develop these kinds of facilities.

Co-locating inland ports as close as possible to existing rail ramps would facilitate opportunities for long-distance moves connecting onto the national rail system beyond these points. As a result, the proposed inland ports could serve not only as destinations for Texas-bound traffic, but also as transshipment hubs (like CSX’s Northwest Ohio facility) for shipments beyond Texas. Given the distance from Freeport to any existing Houston area intermodal ramp, it will certainly be more efficient to make a direct connection to the national rail network at a Dallas, Fort Worth or San Antonio hub than to rely on truck drayage to any of the existing Houston area rail ramps. This will also support Texas DOT’s objectives for avoiding the congested rail and highway networks of downtown Houston.

Exhibit 4-5 shows the distribution of Warehousing and Storage Employment by county within the Dallas/Fort Worth area - showing that distribution activity there is divided almost evenly between the two cities, with three other counties also sharing significant employment. With such a large and geographically dispersed market, it will be difficult for any single facility to effectively serve both Dallas and Fort Worth. Also, BNSF has its main intermodal facility at Alliance, TX north of Fort Worth, whereas UP’s is in Wilmer, TX south of Dallas. Thus there is an opportunity to develop an effective inland port facility in both cities by working cooperatively with both railroads. As a result, three inland port facilities are proposed, at or adjacent to:

- UP’s Dallas facility in Wilmer, TX which also could support a KCS connection;
- BNSF’s Fort Worth facility in Alliance, TX
- UP’s San Antonio ramp

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101 See the discussion related to Exhibit 2-5, where these locations were identified earlier
102 See: [http://en.wikipedia.org/wiki/Virginia_Port_Authority](http://en.wikipedia.org/wiki/Virginia_Port_Authority)
104 This is a highway distance via I-64. The rail distance via Roanoke is almost 400 miles.
106 Dallas has an existing inland port Initiative, but Virginia’s concept is a little different since the Front Royal facility is operated under the direct control of the Port Authority as a dedicated facility. However, either a dedicated or a shared facility could work with the appropriate institutional arrangements. See: [http://www.ipod-texas.org/](http://www.ipod-texas.org/)
108 UP is partnered with KCS and NS on developing the Meridian Speedway connection to Atlanta. This is UP’s new transcontinental route from Los Angeles to Atlanta, which is now goes through Dallas and Meridian rather than through Houston and New Orleans. BNSF is working with CSX, it has its own Atlanta ramp which it reaches by using trackage rights over CSX from Birmingham.
109 UP is the only railroad that owns infrastructure in San Antonio, although BNSF has trackage rights. See: [http://www.txtransportationnmuseum.org/history-r-n-burlington-northern-santa-fe.php](http://www.txtransportationnmuseum.org/history-r-n-burlington-northern-santa-fe.php)
The proposed three-ramp inland port strategy for Freeport would have the advantages of:

- Promoting competitive access by both UP and BNSF into Port Freeport, while also taking full advantage of KCS’s Meridian Speedway from Dallas to Atlanta.

- Repurposing the capacity of existing rail ramps to reflect the new reality of Post-Panamax shipping economics -- and the fact that, in the short term at least, much of Freeport’s container traffic would be existing demand that is shifted from West coast ports to Freeport. Port Freeport could “buy in” to the capacity of these existing ramps or finance expansion as needed.

- Only three on-dock sorts would be required at Freeport, since the container sorting capabilities of the inland hubs could be used for reaching all other destinations. This would build economies of scale on the shuttle trains by consolidating volumes of connecting national containers, along with local traffic moving to the Inland Ports.

- Keeping Freeport container traffic out of the congested Houston highways and rail networks.

### 4.7 Development of Rail Connections to Dallas, Fort Worth and San Antonio

By working with both BNSF and UP, the proposed three-ramp strategy supports the goal of competitive rail access, promotes competitive equity and also would link to KCS’s Meridian Speedway via UP’s Dallas Inland Port. Connecting to KCS in Dallas may be more advantageous than connecting with them in Houston, since KCS runs all of its trains east from Rosenberg over UP trackage rights through the heart of downtown Houston. Even if KCS does not serve Freeport directly, in cooperation with Union Pacific, Freeport containers that go up to Dallas on UP could still access the Meridian Speedway using the connecting UP “Blue Streak” intermodal connection towards Atlanta. This may in fact turn out to be a more advantageous strategy since containers given to KCS locally would route east through downtown Houston. If instead UP takes the containers to Dallas, Freeport containers would bypass Houston.
from Freeport to San Antonio, Dallas and Fort Worth, the railroads would likely use existing rail lines as shown in the “Base Case” scenario in Exhibit 4-6.

**Exhibit 4-6: “Base Case” Scenario for Linking Freeport to San Antonio, Dallas and Fort Worth**

Currently, no rail line connects directly to Rosenberg through Brazoria and Fort Bend Counties. Instead, at Angleton all trains must first head northeast towards Houston to enter the BNSF (former Santa Fe) Galveston Subdivision\(^{112}\) at Algoa. UP has trackage rights over BNSF’s Galveston Subdivision from Algoa to Sealy (northwest of Rosenberg) and over BNSF’s Mykawa subdivision from Alvin into downtown Houston, which it uses to access the Angleton Subdivision and Port Freeport.

While BNSF’s Galveston Subdivision bypasses Houston, UP’s network strongly focuses on Houston since its two main terminals, Englewood and Settegast are located downtown. Also, UP’s alternative routes tend to be very circuitous. As a result, UP’s tendency today is to take everything through downtown Houston. This can be seen in Exhibit 4-6 which shows UP’s two alternative routes for connecting Freeport to its Wilmer Intermodal hub, south of Dallas:

- UP’s most likely route would head through the heart of downtown Houston, following BNSF’s Mykawa Subdivision to UP’s own Palestine and Navasota Subdivisions. North of Hearne the route would follow UP’s Ennis Subdivision to Wilmer. This route is 321 miles long.

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\(^{112}\) The Galveston Subdivision acts as a western bypass of the city of Houston. It skirts the west edge of the city rather than going through downtown Houston. BNSF trains headed to the Pearland intermodal facility follow the Galveston Subdivision to Alvin, then turn left and head north of the Mykawa Subdivision. Thus these BNSF trains are actually able to enter Houston from the south rather than trying to navigate the downtown Houston rail network.
- UP does have a secondary route that could avoid downtown Houston. Trains would stay on the BNSF Galveston Subdivision through Rosenberg to Sealy, where they would enter the Smithville Subdivision, the former Katy main line to West Point. From there, trains would follow the Giddings Subdivision to Hearne. The route north of Hearne would follow the Ennis Subdivision, same as before. This route is 376 miles long, 55 miles longer than UP’s direct route through downtown Houston and relies even more heavily on BNSF trackage rights. UP is unlikely to want to use this alternative for Dallas-bound traffic.

However, as shown in Exhibit 4-6, BNSF’s Alliance (Fort Worth) and UP’s San Antonio routings are straightforward. From Algoa, trains heading to Fort Worth or San Antonio would stay on the BNSF Galveston Subdivision to Rosenberg and would not come into downtown Houston. From Rosenberg, UP trains would follow the Glidden Subdivision to San Antonio, while BNSF trains would continue north on the Galveston Subdivision to Temple, TX, where they would enter the BNSF Fort Worth subdivision that will take them to Alliance.

For development of new rail options, Texas DOT has suggested that “bypass” strategies to get traffic around, rather than through Houston would have important public benefits. Implementation of a new port at Freeport can support this objective by providing an alternative gateway for container imports. Freeport is close enough to be able to develop a cooperative and synergistic relationship with Houston’s port; but far enough away so traffic bound to Dallas, Fort Worth and San Antonio will neither be delayed by nor contribute to Houston’s congestion problems.

Clearly the UP route to Dallas (Wilmer) is the most challenging in terms of keeping Freeport containers out of downtown Houston. As shown in Exhibit 4-7, a two-part solution is proposed to develop a Houston bypass that might be attractive to UP:

- A direct greenfield link from Freeport to Rosenberg would shorten the distance by up to 30 miles. This eliminates the “dog leg” via Alvin, but this improvement by itself is not quite sufficient to close the gap associated with use of route through Houston.

- Staying on the BNSF’s Galveston Subdivision to Caldwell instead of following the MKT line to West Point would save an additional 39 miles. Eliminating the second “dog leg” via West Point would produce an effective UP western bypass of Houston. The new route would be only 307 miles long, as compared to the 321 miles of the existing route through downtown Houston. As a result, this Houston bypass would become UP’s shortest and most effective route for moving trains north from Freeport to Dallas.
Developing this Houston bypass for Port Freeport traffic (Exhibit 4-7) would require:

- Development of a new greenfield rail link from Angleton (or Freeport) linking to both the BNSF Galveston Subdivision and the UP Glidden Subdivision north and west of Rosenberg.\footnote{Rosenburg is a major rail junction where all three railroads (UP, BNSF and KCS) cross. The proposed connection point would not be in downtown Rosenberg, but in the open countryside about 6 miles west of Rosenberg where the proposed Fort Bend rail bypass would have connected to the BNSF Galveston Subdivision. If the new rail line does not meet the existing UP Freeport line at Angleton but rather follows the existing SH36 alignment directly from Rosenberg to Freeport, then it would need to be 58 miles rather than 42 miles long.}
- Capacity improvements and the development of a UP/BNSF joint rail facility north from Rosenberg to Sealy to Caldwell over the BNSF Galveston Subdivision.
- A new northeast quadrant connection at Caldwell to link the BNSF Galveston Subdivision to UP’s Giddings Subdivision. This would connect both to UP’s proposed new freight yard at Hearne, TX and to the Wilmer, TX intermodal facility south of Dallas.

**Exhibit 4-7: “Proposed” New Routes for Linking Freeport to San Antonio, Dallas and Fort Worth**

\footnote{For KCS, Rosenberg is the eastern end of the line from Victoria that was recently rebuilt to support NAFTA trade. KCS has an intermodal ramp at Kendleton, TX just south of Rosenberg. UP purchased 2,000 acres of land comprising a triangle beginning at the intersection of U.S. 90A and State Highway 36 in west Rosenberg. UP may use this for a new intermodal facility. [http://www.instantnewsfortbend.com/2007/07/23/30112](http://www.instantnewsfortbend.com/2007/07/23/30112)}
4.8 Relationship to the SH 36A Corridor Improvement Project

Detailed engineering and environmental studies will be needed for developing rail improvements north of Freeport. At least one segment of greenfield\textsuperscript{115} alignment has been proposed to shorten the distance, so preparation of a full Environmental Impact Statement will likely be required including "No Build\textsuperscript{116}" and identification of a number of possible route alternatives.\textsuperscript{117} The proposed Environmental study would result in a full assessment of environmental benefits (e.g. Houston congestion, safety, energy savings, emissions reduction) as well as costs (e.g. farmland and property takings, wetlands impacts) and would identify appropriate mitigations for any negative impacts.

Since the SH 36A highway project might include a rail element, environmental studies could be conducted in conjunction with the SH 36A highway, although studies might be pursued separately if it is determined that the two projects will not share the same right of way. In conjunction with the proposed SH 36A highway, there are two possible segments of independent utility, rail links south and north of Rosenberg as shown in Exhibit 4-8:

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\textsuperscript{115} A new rail line on new right of way, linking Freeport to Rosenberg would not only add capacity, but would also shorten the distance. This would generate operating cost savings and environmental benefits that could make this a better alternative than adding capacity to the existing rail route. For this reason it is reasonable to pursue further development of this option.

\textsuperscript{116} Even in the "No Build" alternative some rail infrastructure will likely need to be developed, at a minimum, to add capacity to the existing rail lines. For a "No Build" alternative the existing rail line from Angleton to Rosenberg could be used. This existing rail route segment is 71 miles from Angleton to West Rosenberg. It consists of a combination of UP-owned (23 miles) and BNSF-owned (48 miles) track, so the route could not be developed as an effective alternative without the cooperation of both railroads. It consists of three segments: (1) The single-tracked UP Angleton Subdivision from Angleton to Algoa, over which BNSF has trackage right; 23 miles. (2) The double-tracked BNSF Galveston Subdivision from Algoa to Alvin, over which UP has trackage rights; 5 miles. (3) The single-tracked BNSF Galveston Subdivision from Alvin through Rosenberg to West Rosenberg, over which UP has trackage rights; 43 miles.

\textsuperscript{117} A key decision will be whether to build an all-new 58-mile long rail line all the way from Freeport, close to the existing SH36 Highway corridor; or to utilize any portion of the existing UP rail line from Angleton to Freeport as part of the new alignment. The Angleton alternative is shorter, only extending 42-miles across open countryside, but it would lie somewhat to the east of the proposed SH 36A Highway corridor. As a result, it might be developed separately from the highway. Also, a parallel abandoned rail right of way exists from Guy into Rosenberg, parts of which might be considered for restoration.
• **Segment 1** corresponds to the proposed Freeport to Rosenberg connection. *All three rail shuttle services would use it and would save up to 30-miles compared to the existing rail route through Algoa.* As a result this section of proposed greenfield alignment is a key component of a Houston rail bypass that the freight railroads would likely want to use.

• **Segment 2** would link Rosenberg north to the UP Eureka Subdivision near Hempstead. *Only UP’s Dallas trains would use this segment, and it offers little if any mileage savings compared to the existing BNSF Galveston Subdivision.* Adding capacity to the BNSF Galveston Subdivision would likely be a more effective approach. As a result development of this segment does not appear to be essential for effective rail access to Freeport.

As such, a clear case only exists to pursue development of greenfield Segment 1 between Freeport and Rosenberg. Instead of developing Segment 2 from Rosenberg to Hempstead, it is recommended to work with the railroads to develop an efficient joint facility from all the way from Freeport to Rosenberg to Caldwell. This could serve as an effective route for both UP and BNSF railroads that would also keep the Freeport traffic out of downtown Houston.

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118 As compared to the alternative for upgrading the existing BNSF Galveston Subdivision north of Rosenberg:

- Both Greenfield Segment 2 and BNSF Galveston Subdivision alternatives are about the same distance from Rosenberg to Hearne. Depending on the SH 36A alignment finally selected for SH 36A, the existing rail route may even turn out to be shorter.
- The Rosenberg to Hempstead greenfield may be environmentally problematical if it crosses the Katy Prairie (See: http://www.houstonchronicle.com/news/science-environment/article/Proposed-highway-could-cut-path-through-prized-5166714.php)
- The UP Eureka Subdivision at Hempstead up to Navasota (and College Station) is one of the few Houston rail corridors where the railroads have indicated a willingness to work with public authorities on passenger rail development. To preserve the ability to use this corridor in the future for passenger rail it may be better to focus freight on the BNSF Galveston Subdivision, so the Eureka Subdivision may be preserved for future passenger use. (See: http://www.gcfrd.org/docs/Final%20Report%20February%202012.pdf, ftp://ftp.dot.state.tx.us/pub/txdot-info/rail/austin_houston_final.pdf)
Chapter 5. Traffic and Revenue Assessment for the Preferred Option

Based on the target market area, preliminary market assessment and infrastructure strategies proposed in previous Chapters a quantitative assessment of the market and forecast traffic potential will be developed. This will form the basis of the financial and economic assessment to be conducted for the proposed rail improvements.

5.1 Definition of the Preferred Option

After the expansion of the Panama Canal, Port Freeport will be able to attract a substantial volume of Asian/Panama Canal and European/Suez Canal traffic. This is due to the global shipping industry’s move towards larger ships. As a result, because of its deep 56’ shipping channel, Port Freeport will have an opportunity for developing world-class facilities. This includes:

1. Docks, cranes, gates, storage yards, and on-dock rail facilities at Port Freeport, who will be responsible for developing these facilities.
2. Dedicated intermodal yards at inland points, particularly Dallas, Fort Worth and San Antonio, which are presumed to operate under the direct control of the Port, in an integrated and coordinated manner for supporting the needs of the Port. Port Freeport will be responsible for developing these facilities either as new infrastructure, or by contracting with the freight railroads to provide ramp capacity.
3. An efficient inland rail connection for linking Freeport to Dallas, Fort Worth and San Antonio that will also support the goal of avoiding the congested downtown Houston rail network. This is the primary focus of the current study for the SH 36A Coalition.
4. Improvements to highway intermodal connector links and SH 36A corridor for supporting truck distribution not only from the port, but also from major new intermodal rail terminals that are likely to be developed in the Rosenberg area. The needs for highway freight distribution in the SH 36A corridor will be addressed by a future study.

The traffic and revenue forecasts developed here assume, that inland ports have been set up in Dallas, Fort Worth and San Antonio which also provide rail connectivity to the national intermodal rail network. Based on this, the focus of this chapter will be on developing a specific traffic and revenue assessment for the proposed intermodal rail system. The GOODS™ model and a generalized cost framework will be used to develop an assessment that is more focused and specific than the target market assessment that was developed by the previous chapter.
5.2 Network Modifications and Updates

This study will develop a concept-level assessment based on models that TEMS developed for previous USDOT MARAD, Army Corps and Panama Canal studies. These will be sufficient for a preliminary assessment of market potential, but a more detailed feasibility and investment grade study will need to be completed to develop a more accurate estimate.

TEMS GOODS™ modeling framework, which is designed to support the analysis of freight traffic flows at the regional and urban level, will be used. The GOODS™ model uses data on current traffic flows, regional economic growth potentials, and specific industrial development proposals to develop total freight traffic flows and forecasts. The evaluation processes of the GOODS™ model includes both financial and economic analyses that identify the commercial potential of new transportation infrastructure, as well as the economic benefits to users and surrounding communities, as shown in Exhibit 5-1.

US Inland Trade Monitor (USITM) and Freight Analysis Framework (FAF) data collected for previous studies was used as the basis of this Concept Level evaluation. Some of this data is pre-recession (dating back as far as 2006) but it has been validated against more current Port statistics (e.g. Figure 3-6) and since the economy “went to sleep” for about 6 years, the data was found to be still relevant and reasonably descriptive of the current situation. However, these data and networks will need to be updated for a more precise evaluation as in a Feasibility-level update.
The traffic database for containerized traffic has been disaggregated for differentiating the Value of Time characteristics of six commodity different groups — shippers of these goods behave differently in making route choice tradeoffs. For example, computers are the highest value commodity and also the most likely to stay on its current West Coast port routing. Raw Materials tend to be heavier and less time sensitive, so they are more likely to flow over more cost effective but slower routes, such as the Panama Canal. To clarify, these breakdowns are only for containerized commodities -- bulk goods and Ro/Ro traffic is treated by completely separate models which have not been used in this study. The current study focuses only on containerized traffic at Freeport. See Exhibit 5-2.

Exhibit 5-2: Containerized Commodity Disaggregation

In addition to a network of vessel strings and services from the previous studies, the TEMS database also includes a comprehensive network of rail lines and services upon which the rail intermodal analysis is based. See Exhibit 5-3.
In line with Discrete Choice Theory, Generalized Costs are used in GOODS™ to estimate the impact of changes in the transportation system.

$$GC_{ijmp} = TT_{ijm} + \frac{TC_{ijmp}}{VOT_{mp}} + Other\ Factors$$

Where:

- \( TT_{ijm} \) = Travel Time (in minutes) between zones i and j for mode m
- \( TC_{ijmp} \) = Travel Cost between zones i and j for mode m and commodity p
- \( VOT_{mp} \) = Value of Time for mode m and commodity p

GOODS™ also includes a Total Demand model that forecasts the growth in traffic in future years, reflecting the impacts both of changing demographics as well as transportation supply and demand conditions.

$$T_{ijp} = e^{\beta_0p} (SE_{ijp})^{\beta_1p} e^{\beta_2p U_{ijp}}$$

Where:

- \( T_{ijp} \) = Number of trips between zones i and j for commodity p

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119 M. Ben-Akira and S. Lerman: Discrete Choice Analysis: Theory and Applications to Travel Demand, MIT Press, 1985
SE_{ijp} = Socioeconomic variables for zones i and j for trip commodity p
\( U_{ijp} \) = Total utility of the transportation system zones i to j for commodity p
\( \beta_{0p}, \beta_{1p}, \beta_{2p} \) = Coefficients for commodity p

The GOODS™ decision-choice framework utilizes a hierarchical structure which is intended to model the process by which shippers and carriers actually make routing decisions. Exhibit 5-4 shows the structure of the model that was used in this study for routing Asian traffic. Similar models were used for European and South American traffic.

**Exhibit 5-4: Asia Decision Choice Model**

To model decision choices, the equations are individually calibrated at each layer of the model based on the transportation network and observed (actual) modal split behavior associated with each of the six commodity groups. Each market uses a hierarchical structure appropriate to the decisions being made. For example, the Europe model treats the Suez and Panama Canals differently, and the South American models both include New Orleans as well as Houston as a competitive choice.

### 5.3 Growth Rates

A concept-level assessment has been performed based on models that TEMS developed for previous USDOT MARAD, Army Corps and Panama Canal studies. These are sufficient for this preliminary assessment of market potential, but a more detailed feasibility and investment grade study will need to be completed to develop a more accurate estimate as project planning moves forward from this point.

To forecast container traffic into the future, the GOODS™ model used GDP as a key factor. It is important to note that the Texas GDP growth rate is significantly higher than US growth rate. As shown in Exhibit 5-5, Texas has sustained a 6-7% growth every year for the past 20 years, with the exception of a couple of years as a result of the recent economic downtown. However, this high rate of growth has...
since resumed, increasing the pressure on the need for significant infrastructure development in Texas for supporting it. To evaluate the growth of demand in the hinterland of Texas Ports for container, goods, forecast years assume a growth in Texas of 7%, Grain Belt region of 6%, and in the Midwest region of 4% growth per year. Overall this gave a 5.6% average growth rate for the whole of the Texas port hinterland area. This high growth rate is a key financial assumption that should be further assessed in future studies.

Exhibit 5-5: Texas GDP Growth

Source: Bureau of Economic Analysis, 2014
5.4 The Freeport “Full-Build” Case

This considers what is likely to happen if Port Freeport is fully developed as a coastal container terminal. Developing the port will require inland rail and highway transportation infrastructure to efficiently distribute the containers that would be coming into and out of the port. The resulting expanded port service areas are shown in Exhibits 5-6 and 5-7.

- This analysis assumes that cost effective intermodal links will be developed in conjunction with the port wherever traffic volumes warrant: most particularly, rail links and inland ports serving the key market areas of Dallas, Fort Worth, and San Antonio.

- Additionally, intermodal linkages to maintain connectivity between Freeport and the traditional Houston Ship Channel area (e.g. Barbour’s Cut) should be considered along with links to Texas coastal ports (Corpus Christi, Brownsville, and Beaumont.)

Because of the ability to handle large ships at Freeport, Exhibits 5-6 and 5-7 show that Houston and Freeport by working together can successfully push back against both east and west coast port competition. What emerges is a large core hinterland area in the heart of the North American continent where Freeport will have a clear cost advantage and should be able to capture significant market share. Beyond this core lies an expanded service area (dashed outline) where Freeport will have close cost parity with other ports and should therefore be able to capture some market share. Particularly in the expanded cost parity zone it is currently difficult to predict the level of market penetration that Freeport will be able to achieve, but the value of supply chain diversification is a solid marketing argument that Freeport most likely would be able to sell to many shippers and consignees within this expanded area. The potential impact of this on Freeport volumes should be assessed in a future more detailed study.

The hinterland analysis shows that with a deeper channel, Port Freeport has a huge potential to attract Asian container volumes. As shown in Exhibit 5-6, the Asian hinterland market potential in 2016 is between 1.6 and 3.4 million annual TEU’s, of which it reasonable on a cost competitive basis to conclude that Freeport is actually likely to capture something like a 30% market share. This results in a forecast range of 0.6 to 0.9 million Asian import TEU’s per year.

It is also assumed that Freeport would be able to capture in the neighborhood of 0.3 million TEU’s per year from the European market once larger ships are deployed in those lanes. As a result Freeport would be handling approximately 1.0 million loaded import TEUS’s per year. Because of the rapid demographic growth in the State of Texas, these volumes will grow rapidly over time and support the economics of even larger ships.

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121 For example, Kansas City and St Louis today are almost solely dependent on West Coast ports for their Asian imports, so that places those key gateways in the unfortunate position of vulnerability to supply chain disruptions. With large vessel service, however a routing to Kansas City or St. Louis via Freeport would be cost competitive even though it may take a day or two longer than coming via a West Coast port. This however, may be an acceptable tradeoff for shippers who would be asked to route a certain percentage of their traffic via Freeport in order to maintain a competitive shipping alternative. See: http://www.inboundlogistics.com/cms/article/panama-canal-more-questions-than-answers/ Many shippers would likely accept this argument.

122 By comparison to Exhibit 5-7, the Asian container market potential is seen to dwarf the European container traffic, which has been historically the main focus of the Houston port.
Exhibit 5-6: “Full Build” 2016 Large Ship Freeport Hinterland from Asia

Exhibit 5-7: “Full Build” 2016 Large Ship Freeport Hinterland from Europe and Suez

123 Large Ships (2¢/TEU mile) to West Coast, Large Ships (2¢/TEU mile) to Freeport, Large Ships (2¢/TEU mile) to East Coast, Rail Intermodal (12¢/TEU mile). “Core” Houston area shows cost advantage. “Buffer” area (dashed line) shows expanded region of approximate cost parity.

124 Same assumptions as before: Large Ships (2¢/TEU mile) to West Coast, Large Ships (2¢/TEU mile) to Freeport, Large Ships (2¢/TEU mile) to East Coast, Rail Intermodal (12¢/TEU mile). “Core” Houston area shows cost advantage. “Buffer” area (dashed line) shows expanded region of approximate cost parity. Note that Freeport has an even stronger position in Asian Suez traffic than it does in Asian traffic that is routed via the Panama Canal. Assuming the use of Panama therefore results in a more conservative forecast for Freeport potential traffic volumes.
For Asian traffic via the Panama Canal (Exhibit 5-6) the port service area will expand to include San Antonio, Dallas and Fort Worth (but not El Paso) -- and also north to include large areas of Oklahoma, Arkansas and Missouri. Based on the economics of large ships via the Panama Canal, Port Freeport will have cost dominance for distribution into this area. Beyond this into the expanded “potential” market area where Freeport will have cost parity with other ports, it is possible that Freeport could capture some market share as far north as Chicago and as far east as Atlanta.

For European and Asian Suez Canal traffic (Exhibit 5-7) the port service area is even larger, and shifted slightly towards the west. Although the market area for European goods covers the whole State of Texas as well several neighboring states the overall size of the European market today is much smaller compared to the amount of traffic that is potentially available from Asia and these goods tend to be higher valued. To the extent that more traffic develops from Asia via the Suez Canal, this will only improve Texas ports market position.

Exhibit 5-8 summarizes the results of the GOODS™ model forecasts for the transportation system of Chapter 4. This includes Port Freeport itself plus three inland ports, along with the connecting rail links. Note that Houston traffic is growing faster than the overall Freeport forecast, reflecting the very high growth rate occurring in the local Texas market which is faster than that for the Freeport hinterland as a whole.

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**Exhibit 5-8: Asia + Europe Import Container Forecast for Freeport, TX**

![Diagram showing container forecasts for 2016 and 2035](image)

- **2016**
  - FPT: 1,048K TEUs
  - DFW: 343K TEUs
  - HOU: 613K TEUs
  - SAN: 92K TEUs

- **2035**
  - FPT: 3,527K TEUs
  - DFW: 1,805K TEUs
  - HOU: 1,421K TEUs
  - SAN: 301K TEUs

**Tripling of Rail TEUs in 20 years “Fills Up” a Single Track Railroad**

- **Water**
- **Rail**
- **TBD**

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125 Rail intermodal connectivity to the State of Colorado poses some concern although rail lines do go from Houston to Denver, no intermodal trains run directly that way today. Although Colorado is shown as part of Freeport’s service area, this is minor concern since only a small number of European TEUs are headed that way. The port service areas may be further refined in a future stage of work.
As can be seen in Exhibit 5-8 after the expansion of the Panama Canal, large ships from Europe and Asia will call at Freeport initially bringing around 1.0 Million TEU annually into the port. This will grow to 3.5 Million TEU by 2035. At Freeport, the ships will discharge between half and two-thirds of their containers headed for a large rail hinterland shown in Exhibits 5-6 and 5-7. The balance of cargoes that are headed to the Ship Channel area are assumed to go to Port Houston, which will continue to serve its current markets. If Port Houston is able to further expand into the Freeport hinterland by improving its rail service beyond the existing connectivity that was assumed in the GOODS™ model, it is considered that this will be achieved by further increasing the market share taken from West Coast ports.

Because of the vast geographic extent of the market areas served, Freeport will need to rely heavily on rail connections for inland movement of containers. In fact, many of the Freeport containers will be destined for markets beyond Texas which will be reached from the San Antonio, Fort Worth and Dallas rail hubs. **This is why it is important to co-locate the Inland Ports at or near existing rail ramps.** As shown in Exhibit 5-9:

- An approximate 50/50 traffic split between UP Dallas and BNSF Fort Worth hubs is assumed.
- About half the traffic to San Antonio will hub via a rail connection farther west (mostly European containers to El Paso). The other half will go out the gate to local markets.
- About three quarters of traffic to Dallas and Fort Worth will hub via a rail connection farther north and east. The other quarter will go out the gate to local markets.

**Exhibit 5-9: 2016 Freeport Forecast Detail**
Please note that the projected 67% rail share of Freeport import container volumes also assumes that rail will recapture any container volumes that are transloaded into domestic boxes in the vicinity of the Port. By comparison to West Coast ports:

- In 2006, California State GDP was $1.87 Billion so California residents are estimated to actually consume 2.24 Million TEU. During that same time period, the port of Los Angeles/Long Beach imported 8.10 million TEUS, so local consumption can account at most for 28% of the port’s throughput. The Alameda Corridor itself captures fewer than half the Port’s containers, but many containers go out the gate by truck for transloading. Many transloaded goods reappear at the downtown Los Angeles rail ramps as domestic loads. Including these volumes (that are in fact transloaded but not locally produced), it is not unreasonable to suggest that as much as 72% of the Los Angeles/Long Beach port traffic ultimately moves beyond California, mostly by rail.

- The situation is even more pronounced in the Pacific Northwest and Canadian ports that are gateways for major population centers in the Midwest and eastern Canada, but don’t have large local populations that generate cargo the way Los Angeles-Long Beach or Oakland do. It has been estimated that at least 50 to 70 percent of their inbound cargo moves on to eastern destinations.

- Speed and reliability are the advantages Prince Rupert builds on to keep its existing customers and attract new services, said Shaun Stevenson, vice president of marketing and business development. Prince Rupert is located 500 miles north of Vancouver. Virtually all of its inbound cargo leaves the port by rail, so the efficient transfer of intermodal containers from vessels to trains at the port’s on-dock rail yard is crucial to its success.

As such, the projected 67% rail share of traffic at Freeport is in-line with West Coast port experience. The rail share at Los Angeles only appears to be lower because of the high share of ocean containers that are being transloaded to domestic boxes. At Freeport however, it is expected to recapture the transloaded containers so they also will be able to ride the shuttle trains to Dallas, Fort Worth and San Antonio, thus benefit from the economics of rail shipping.

Asian and European service will provide enough “base volume” at Freeport to support development of dedicated rail connections to Dallas, Fort Worth and San Antonio. While Caribbean or South American services do not bring enough traffic to support a dedicated rail service, they could ride as incremental volume. For example, Chiquita’s Great White Fleet already brings about 60,000 containers a year into Freeport from the Caribbean and South America. As a very time sensitive and perishable cargo, bananas and other fruits are currently trucked from Freeport – no bananas move by rail today in the

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126 The regression relationship between 1997-2007 US national Imports and GDPs is Imports (millions)=1.200386*GDP (billions).
United States. Refrigerated containers can and do move by double-stack trains using self-contained diesel power units but Chiquita’s refrigerated ocean containers need external electric power supply, which is not available on board standard double stack rail equipment. However even without any special equipment these containers could move single stacked on Chiquita’s chassis which provide the needed power supply. Chiquita has in the past expressed interest in shipping bananas by rail so possibly they may be interested in utilizing the proposed rail intermodal services out of Freeport as well.

While it is expected that Houston will hold onto most of its current Caribbean and South American traffic, Freeport’s proposed on-dock intermodal connections would be directly competitive to New Orleans in the Caribbean and South American trades. This can be assessed in a future study.

5.5 Carload Traffic Forecasts

In addition to intermodal container traffic, Freeport also has a base of existing carload traffic. Most of this is related to petrochemical industrial customers in the Freeport area. Although we do not have exact figures on the number of carloadings at Freeport, Exhibits 5-10 and 5-11 allow a rough estimation of this level of traffic based on the Gross Tonnage and train count reported for the Angleton Subdivision and the branch line to Freeport.

Exhibit 5-10: 2007 Gross Tonnage of Texas Rail Lines

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132 See: http://www.google.com/patents/US3692100
134 Source: Figure 3-3 on page 3-4 of the Texas State Rail Plan, based on 2007 data. See: ftp://ftp.dot.state.tx.us/pub/txdot-info/rail/plan/ch3.pdf
In Exhibit 5-10, the Freeport branch is seen to carry traffic in the 5-10 million gross ton range. But since the rail line segment north of Angleton carries 40-50 million tons, and the segment south of Angleton carries 20-30 million tons, the loading of the Freeport branch that feeds into it must be close to the high end of the range, e.g. 10 million tons. Since most railcars carry 100 tons and weigh 30 tons empty, assuming 100% empty return factor and 10% locomotive tonnage, the loaded carloads at Freeport can be converted from gross tonnage as follows:

\[
\frac{10,000,000 \text{ Gross Tons}}{(100 + 30 + 30) \text{ tons per car}} / 1.1 \text{ loco-tons factor} = 56,800 \text{ loaded cars}
\]

This would be matched with an equal number of empty railcars moving in the opposite direction. If there are 312 operating days per year, this would be an average of:

\[
56,800 \text{ cars per direction} * 2 \text{ directions} / 312 \text{ days per year} = 364 \text{ cars per day}
\]

The FRA grade crossing database (Exhibit 5-11) shows 8 trains daily to and from Freeport; this is 4 trains in each direction. This would be an average of:

\[
364 \text{ cars per day} / 8 \text{ trains} = 46 \text{ loaded and empty cars per train}
\]

This is reasonable considering that a number of these trains are local freights operating out of the Angleton freight yard, which directly serve Freeport industrial customers. As a result, the revenues associated with this carload traffic could carry much of the infrastructure cost burden of the proposed Freeport Terminal Railroad.

In terms of what carload traffic might potentially contribute to the cost of a greenfield north of Angleton, it would appear that the rail line continuing past Angleton south towards Brazonia carries about three times the traffic of the Freeport branch: about 364 * 3 = 1,092 cars per day, or 341,000 cars...
per year south of Angleton. North of Angleton the volume would be the combined total of 364 * 4 = 1,456 cars per day or 454,000 cars per year. This is the best that can be estimated using publicly available data and needs to be confirmed by a future more detailed study.

The proposed export container transload activity will likely increase the level of carload traffic coming into Freeport. It is difficult to forecast the exact potential for added carload rail traffic due to a number of variables. For example, since Freeport would be expected to handle a large share of Asian traffic (largely import containers from China) the first challenge is in forecasting how many exports China will buy. At present China is not buying much from the United States, even raw materials – ships are departing from Houston to China 80% empty. However, to get a rough order of magnitude estimate of the traffic volume potential, if we assume that 50% of 1 million annual TEU’s were to be reloaded for export, that would be 500,000 TEUs to be filled with plastics, resins and other raw materials for exports. At an average of 15 tons per TEU this would correspond to 7.5 million tons of export freight. At 100 tons (net) per railcar this would generate an inbound traffic of 75,000 loaded railcars, generating another 75,000 empty return trips, which would more than double the current rail carload traffic base at Freeport. Assuming 312 working days per year this would be the equivalent of approximately 240 railcars (or two trains in and out of Freeport) per day over and above current traffic levels. By 2035 expected growth in railcar traffic may necessitate three or four daily trains, both in and out of Freeport.

The resulting Freeport carload estimate is summarized in Exhibit 5-12: as 113K annual cars from Freeport (loads + empties) plus 341K coming into Angleton from south Texas. As a result it is estimated that 454K cars are moving on the Angleton Subdivision north of Angleton. This carload traffic will significantly contribute to the cost and operations of a Freeport Terminal Railroad and some of the cars may also be able to use the proposed new Freeport greenfield to bypass downtown Houston. This could also help contribute to the financial case for improving the rail system.

Exhibit 5-12: Existing Freeport Carload Traffic Estimate
5.6 West Coast Ports: Competitive Response

To refine Freeport’s container demand forecasts in future feasibility or investment-grade studies, it will be necessary to consider a range of potential competitive responses at the West Coast Ports. To do this, it is important to note that shipping lines (and not ports) establish vessel services, and together with shippers they (and not ports) determine the most advantageous container routings.

As a possible competitive response to Panama Canal expansion, it has been suggested that vessel sizes at the West Coast ports are likely to continue to grow: although this is a reasonable (and conservative) assumption for demand modeling, it has already been argued (in Chapter 1) that the trans-Pacific lanes are too short to make the economics of the largest vessels work. Rather, it has been suggested that the current vessel size in the 7,000–8,000 TEU range provides the optimal tradeoff between port and line haul economics on the West Coast. The recent collapse of the proposed P3 Shipping Alliance\[135\] and forecasted reduction in West Coast port TEU volumes after the Panama Canal expands, would seem to make the widespread adoption of extremely large vessels on the West Coast even less likely, at least in the short term. However, if larger ships are going to be used anywhere, they are likely to be used (first) in the Suez Canal lanes and (second) in the Panama Canal lanes which are both longer than the trans-Pacific lanes, which will optimize the ocean carriers’ length of haul.

Also, the suggestion that West Coast ports will be able to mount a competitive response neglects the simple fact that the same shipping lines serve both West Coast ports and Panama Canal routes. While shipping lines do compete against one other, they have no need to price competitively against their own routes. Rather it is more likely that the shipping lines will simply allow traffic to flow over the most naturally cost effective routes. If anything, the shipping lines will likely have a bias towards the Panama Canal routes that gives them a greater length of haul, and thus more profitability.

Because of the economics of double stack rail coupled with the large-ship advantage of the West Coast ports, as shown in Exhibit 3-3, West Coast ports have until now actually held the cost advantage for shipping from Asia to most of the United States -- except for the immediate port hinterlands of Gulf and East coast ports. Together with the railroads, West Coast ports have pursued a “Cost Leadership” business model based on the economics of large ships, high volumes generating economies of scale and heavy, slow double stack trains that maximize the railroads’ line haul efficiency.

Railroads have in fact been competing with Panama Canal ships rather than with trucks for the West Coast container business. Even so, it is not clear, why stack trains need to take 5 days to get from Los Angeles to Houston (1,632 miles average 14-mph\[136\]) when Amtrak does the same run in 37 hours (average 44-mph).\[137\] This narrow existing service differential actually increases the railroads’ competitive vulnerability since as shown in Exhibit 5-13, transit times via the Panama Canal are almost as fast as rail schedules via West Coast ports. This gives shippers very little reason to pay a higher price for using rail as compared to direct water service.


\[136\] This is about the same as the 12-knots that Maersk ships sail when slow-steaming, so rail loses its speed advantage over ocean shipping

Exhibit 5-13: Rail vs. Panama Canal Transit Times

Source: Parsons Brinckerhoff, Panama Canal Expansion Study, June 2012

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138 Exhibit source: MARAD 2013 Panama Canal Expansion Study, See http://www.marad.dot.gov/documents/Panama_Canal_Phase_I_Report_-_20Nov2013.pdf Figure 15 on page 57. The 5-day transit time from Los Angeles to Houston was re-confirmed by a current schedule inquiry to the Union Pacific website on July 17, 2013 at http://c02.my.uprr.com/pic/jas/intermodalSchedulePage.jas although it should be noted that Union Pacific does offer faster 79-hour schedules on domestic traffic.
For example, according to Exhibit 5-13, shipping from Asia to Houston via the West Coast takes 19 days, whereas direct shipping via the Panama Canal takes 21 days. At New York, the time differential is even tighter at 21 days via rail versus 22 days via water. This is a practically insignificant differential given the nature of supply chain logistics from Asia and the typically long required shipment lead times of 70-80 days. These small differences are well within the error term of the measurement. As a result, shippers are likely to select the lower cost alternative, which will be the all-water service. Since these rail transit times are insufficiently differentiated against water, this puts a substantial share of West Coast rail traffic at risk even for higher valued, service sensitive commodities.

Given this reality, the West Coast Ports and railroads have two choices: either improve their services or drop prices. Dropping prices may be risky for the railroads, since water, not rail will have the low cost advantage. Therefore the water carriers will likely win any straight-out price war. Water carriers also have the advantage of having a simpler logistics chain with fewer handlings than the railroads, thus all-water service is perceived by shippers as more reliable, even though it may take longer.

Improving service may be a better option for the railroads. Perhaps the West Coast ports and railroads will choose to move away from their current cost leadership strategy and instead pursue a service differentiation strategy, improving services to hold onto the higher valued goods (e.g., electronics) that offer the most natural advantage to the west coast ports. However it will be difficult for the railroads to implement this strategy by themselves. A coordinated service improvement strategy will likely also need to have a port and vessel component as well, so that the overall service offering via the West Coast becomes a clearly differentiated, albeit higher cost transportation product that is of distinctly higher quality than what the main steamship lines are able to offer via their all-water, slow-steaming routes.

Matson Navigation, for example, already offers a “guaranteed expedited service” from China to Long Beach with a money-back guarantee. Using the motto, “Smaller, Faster, Better,” Matson’s new U.S.-flag service is shaving two to five days off standard Transpacific shipping times at comparable rates to international carriers by using small 2,000-3,000 TEU ships. Matson explains:

> Most of the bigger vessels – up to 9,000 TEUs – sailing the Pacific have to stop at additional Asian ports to fill the ships before sailing to the West Coast. Matson’s 2,600 TEU ships do not. In addition, unloading larger ships requires three or four days in port, which can be hampered further by congestion at large multi-user terminals. In contrast, Matson sails direct from Ningbo and Shanghai to Long Beach, arriving every Sunday at Matson’s dedicated facility, with cargo availability the next day. For added convenience, Matson drays all local cargo to an off dock container yard four miles from the harbor, allowing large retailers 24/7 cargo availability and the ability to avoid the congestion of bigger ships.

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139 Exhibit 3-14 shows a 22 day transit time to New York, Norfolk or Savannah. While this may be theoretically possible, in actual practice it depends on the construction of the vessel strings. Since New York is usually the first port of call and Savannah is served on the way back to Asia, the actual transit time to Savannah may take a week longer.


141 See: http://www.matson.com/china/ges.html


143 See: custommedia.bnpmedia.com/Custom/Home/Files/PDFs/Matson_adv.pdf
This market refocusing may occur as a direct result of competitive pressure and likely traffic realignments that the Panama Canal expansion will place on West Coast ports and the railroads. If this occurs, it will give shippers in Texas as well as across the country a much broader range of differentiated options than they have today. This concept for having a very cost effective all-water option available at a nearby port as compared to much faster albeit more expensive rail alternative from West Coast ports – which may be triggered by the Panama Canal expansion -- has strong implications for the improved competitiveness of rail service in truck competitive domestic lanes as well. If it occurs, this would serve to further reinforce the commodity-oriented differentiation that most demand models have predicted where the Panama Canal would focus on the heavier, lower valued goods whereas the lighter, higher valued goods would stay at west coast ports. The only question is where exactly is the dividing line going to be, that drives mode choice by commodity? This should be assessed in a future more detailed study.

Modeling developed for the current study has assumed that competition from West Coast ports will remain very strong. Even if Freeport is able to take a 30% share of its hinterland market, West Coast port traffic will continue to grow. Even though West Coast container volumes may dip temporarily as some traffic diverts to East and Gulf coast ports, those volumes are forecasted to rapidly recover. Exhibit 5-14 shows the current situation with small ships at Houston, as compared to the 2035 forecast. Given the magnitude of traffic growth that the West Coast ports will be called upon to handle based on this forecast, the question arises whether the West Coast can even support their 70% market share forecast of 5.4 million TEU for the Port Freeport hinterland area. To meet this need, the West Coast ports will need to more than double the amount of traffic they are handling, which in an environment of more competitive rates may be difficult to do.

**Exhibit 5-14: Asian Container Volume Forecast for Texas vs. West Coast Ports (1000’s of TEUs)**

<table>
<thead>
<tr>
<th></th>
<th>Current (2013)</th>
<th>Future (2035)</th>
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</thead>
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<td>Small Ships</td>
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<td>5,403</td>
</tr>
<tr>
<td>Texas</td>
<td>176</td>
<td>2,315</td>
</tr>
<tr>
<td>LA/LB</td>
<td>2,315</td>
<td>5,403</td>
</tr>
</tbody>
</table>
5.7 East Coast Ports: Competitive Response

This considers what is likely to happen if Texas maintains the “Status Quo.” It develops a hypothetical “Worst Case” scenario based on Texas ports “doing nothing” while East Coast ports proceed with planned improvements. As a result, competitive East Coast ports will see their costs go down due to their ability to accept larger ships. West Coast ports will also see costs go down for direct service from Europe, due to the ability of large ships to transit the Panama Canal. These improvements will trigger some market shifts regardless of what Texas does.

With respect to East Coast ports, it should be noted that in 2005 Norfolk Southern Railway (NS) invested over $300 million to acquire a joint interest from Kansas City Southern (KCS) in the Meridian to Dallas rail line. As shown in Exhibit 5-15 the “Meridian Speedway” was developed as a high quality, high capacity rail line directly linking Atlanta, GA to Dallas/Fort Worth, bypassing the congested gateways of Memphis and New Orleans. Union Pacific partners with KCS and NS, using the Meridian Speedway for its transcontinental Los Angeles-Dallas-Shreveport-Atlanta “Blue Streak” intermodal service. The Meridian Speedway provides a direct rail link between Texas and the east.

Exhibit 5-15: The KCS/NS “Meridian Speedway” Rail Line

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144 This is a hypothetical scenario, not a forecast of what is actually likely to happen, since port improvements are actually being made in Houston, Freeport as well as other Texas ports in preparation for the expansion of the Panama Canal. Rather, it presents a base line for comparative purposes simply identifying the major risk factors to Texas ports. While a “do nothing” scenario may not seem realistic, it is in fact is what MARAD assumed in their November 2013 Panama Canal Expansion Study – which explains why that study suggested that Texas ports had no growth potential. For example, Table 13 on page 48 of that report clarifies there are “No Immediate Plans” for dredging Houston’s Ship Channel any deeper than its current 45 feet, and nowhere in the report is the new Velasco Container Terminal at Freeport, TX even mentioned at all. See http://www.marad.dot.gov/documents/Panama_Canal_Phase_I_Report_-20Nov2013.pdf
146 It is assumed that all of these ports will complete their own dredging programs.
For Texas ports, this rail line poses both an opportunity and a competitive threat:

- **Opportunity**: By taking advantage of Savannah’s vulnerabilities in Asian traffic via the Panama Canal, the Meridian Speedway could possibly allow Texas ports to compete with East Coast ports as far east as Atlanta. For example, a container routing from Asia to Atlanta via Freeport would be faster than coming through Savannah, and less expensive than from a west coast port.

- **Threat**: On the other hand, by directly connecting the Ports of Savannah and/or Norfolk to Union Pacific’s Blue Streak intermodal service, European and Asian traffic via the Suez Canal could use the Meridian Speedway to penetrate as far west as El Paso against West Coast port competition. This threat however, would likely be neutralized if large ships could directly serve Texas markets via Freeport.

Either way, it is clear the Meridian Speedway is likely to play an increased role. The outcome depends on whether Texas chooses to develop Port Freeport to its full potential.

Up until now, as shown in Exhibit 3-3, East and Gulf coast ports were mostly limited to their local hinterlands. This will change dramatically after the Panama Canal expands. At that time the East Coast port hinterlands for Asian traffic could well expand as far west as the Mississippi River. This matches nicely with the market territories of the CSX and NS eastern railroads -- but East Coast port influence for Asian traffic via the Panama Canal will not likely extend as far west as Texas. As a result, the main competitor for Asian traffic to Houston will likely remain the West Coast ports, as it is today.

However, since Houston has such a limited share of Asian traffic today, the impact of the “No Build” case on Houston’s Asian traffic is expected to be minimal since essentially nothing has changed in regards to West Coast port competition. Houston was serving its own truck hinterlands before and will likely continue doing so after Panama Canal expansion. There will likely be some marginal traffic shifts to competitive Gulf ports that now depend on feeder services from Caribbean Hubs such as Corpus Christi. These will immediately see their costs go down, due to the ability to use larger vessels on the trans-Pacific line haul.

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149 Particularly the fact that Savannah is only dredging its channel to 47’ will prevent fully loaded ships from calling there. The MARAD November 2013 Panama Canal Expansion Study says on page 49 that Post-Panamax ships could only call on Savannah at periods “when tides are favorable.” As a practical matter, this will lock in the current vessel rotation pattern where ships sail first to New York, then call at Savannah on their return trips to Asia (mostly empty) from New York adding at least a week additional sailing time. By comparison, Freeport will have a deep channel for large ships and be the first U.S. port of call. This makes Savannah more vulnerable to competition.

150 Up until now, West Coast ports have held a natural cost advantage since they alone could benefit from the ability to use large ships on the trans-Pacific lanes. The cost differential for being able to use a large ship on the short trans-Pacific lane versus a Panamax ship from China to the east coast opened enough cost differential to not only for rail to compete on the transcontinental container movement, but actually to dominate the market. As shown in Exhibit 3-3 this is true everywhere except for the local truck hinterlands of East and Gulf coast ports. This small truck hinterland based on Panamax shipping economics was just sufficient to allow Houston and East Coast ports to establish a foothold in their local markets, but everywhere else, rail double stack competition from the west coast dominates.

151 Some Corpus Christi, Laredo, Brownsville and Beaumont cargoes may divert to direct feeder vessels resulting in some loss of Asian traffic at Houston. New Orleans and Mobile may also gain some market share at Houston’s expense. However, further study would be needed to positively confirm the magnitude of these potential adverse impacts.

152 Most likely cargoes that are now trucked from Houston to Corpus Christi, Laredo, Brownsville and Beaumont would divert to feeder vessels resulting in a minor loss of Asian traffic at Houston. If Houston service were converted to a feeder vessel, then New Orleans and Mobile might gain even more significant market share at Houston’s expense. However, the competitive threat posed by Caribbean Hubs would likely be neutralized by the ability of large ships to call directly at Freeport, especially if COB or rail intermodal links were also developed from Freeport.
By comparison, the expansion of the Panama Canal (allowing big ships to reach the West Coast) along with dredging of East Coast ports would force Houston to simultaneously face increased competition from both the East and West coast ports, both of whose economics will be bolstered by large ships. Against such an increase in competition, Houston’s service area for European and Suez Canal traffic would likely contract to just the local truck hinterlands.

Because of this, MARAD and the Texas working group both concluded that “Texas ports likely would not see many more container ships after the Panama Canal project is done (emphasis added).” However, this only reflects Houston port’s inability to dredge, which undermines the economic advantage potentially afforded by Panama Canal expansion, because Houston would not be able to accept any larger ships than it can today. MARAD’s negative appraisal of Houston’s potential does not, however, take into account the new opportunity presented at Freeport.

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154 As shown in Exhibit 5-7, the Pacific Northwest ports would take over the northern part of Houston’s territory, while southern California ports could compete as far east as El Paso. Savannah would capture the most lucrative parts of Texas trade including the Dallas and Fort Worth markets via the Meridian speedway. Again, further study would be needed to positively confirm the magnitude of these potential adverse impacts if port improvements at Freeport are not fully developed.


156 Port Authority gets green light for major dredging projects, See: http://www.houstonchronicle.com/news/transportation/article/Port-Authority-gets-green-light-for-major-5484906.php

157 Freeport however, has already developed a plan to dredge its channel to 56' for LNG tanker ships. For no additional dredging cost, this creates an opportunity for large container ships to serve Texas markets as well.
Chapter 6. Implementation, Financing and Funding Plan

This section will lay out a preliminary implementation plan and assumed capital costs for development of infrastructure, a terminal railroad for Port Freeport, and rail connections to the interior of the U.S.

6.1 Implementation Plan

Conceptually it is assumed that port and rail improvements will be developed in three stages:

1) **Develop the Ocean Port Itself:** From the perspective of the ocean shipping lines, Port Freeport needs to offer competitive rail access by at least two railroads if it wants to be a credible market player. The first step is to develop the necessary terminal capacity at the Port itself and then negotiate to acquire the UP track from Angleton into Freeport, including the Angleton freight yard for establishing a neutral terminal railroad.

2) **Develop Inland Ports:** The second step is to develop Inland Ports in Dallas, Fort Worth and San Antonio. This should be done concurrently with development of facilities at Freeport. While expansion of the Panama Canal will likely result in some short term cargo losses at West Coast ports, it is likely that these losses will be quickly recovered as the US economy continues to grow.\(^{158}\) And since the Texas economy is growing even faster than the US as a whole, it is clear there will be a need for expanding intermodal terminal capacity in Texas. This offers Freeport a clear opportunity to build Inland Ports. However, as shown in Exhibit 5-9, much of the traffic projected coming through Freeport will be heading for destinations even **beyond** the rail hubs. As a result, any new inland ports should be developed as close as possible to, or preferably colocated with existing rail ramps to optimize rail-to-rail connectivity.

Since Houston today is primarily a truck port, Freeport’s traffic will largely **not** compete with Houston’s; rather, it will largely be headed to interior locations, and diverted from west coast ports. As such, although the traffic will be new to Freeport, it will not be new traffic to the railroads. As an expedient way to gain the needed inland terminal capacity in the short term, Freeport should consider contracting with the railroads for needed capacity in Dallas, Fort Worth and San Antonio. However, a future study\(^{159}\) should develop both long and short term terminal strategies so Freeport can fully understand the implications both of sharing a ramp with a major railroad, as well as those associated with developing its own dedicated Inland Port facilities.

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\(^{158}\) See for example, [http://www.dailynews.com/general-news/20130222/panama-canal-expansion-impact-on-ports-discussed-at-california-senate-panel-session](http://www.dailynews.com/general-news/20130222/panama-canal-expansion-impact-on-ports-discussed-at-california-senate-panel-session) even at this late date there is a lot of uncertainty regarding what will be the actual short and long term impact of the Panama Canal expansion. See also [http://www.supplychainquarterly.com/topics/Logistics/201201 Panama_Canal_Phase_I_Report - 20Nov2013.pdf](http://www.supplychainquarterly.com/topics/Logistics/201201 Panama_Canal_Phase_I_Report - 20Nov2013.pdf), page xvi) says that it expects that a **significant amount of transportation cost savings associated with the use of larger vessels is expected to be absorbed by providers of transportation services**. If the steamship line don’t pass along the savings in reduced rates, then the impact of canal expansion will truly be minimal, but if the potential savings are passed on to shippers, then the expansion could have a much larger impact in shifting traffic.

\(^{159}\) This study assumes that costs of these Inland Ports will be fully recovered through allowances that are already built into the freight rates. But since the $62.50 per TEU allowance is based on nationally competitive standards that are not specific to Dallas, Fort Worth or San Antonio, the adequacy of this level of fees needs to be confirmed by a future more detailed study.
3) **Develop Rail Connections for Linking Freeport to the Inland Hubs:** The third step is to develop a joint rail corridor as proposed by constructing a new shorter alignment from Freeport (or Angleton) to Rosenberg, then improving the existing BNSF rail line up to Caldwell, TX where UP trains would diverge towards Hearne and Dallas onto their own line.

While different institutional models could be used to facilitate the development of this corridor, the current analysis assumes that a Public Private Partnership following the example of the Alameda Corridor\(^ {160}\) would be used to develop a high quality, publicly owned rail line for providing common access for all railroads into Port Freeport. This would enable development of infrastructure while using cost effective revenue bond financing – or even lower cost RRIF financing – to reduce the interest cost burden associated with financing the project.

It is proposed that debts would be serviced by tolls collected from the railroads on a TEU-basis, using the same type of financial and administrative structure that was pioneered by the Alameda Corridor. Operationally, the Alameda Corridor\(^ {161}\) is managed by a joint UP/BNSF dispatching center in San Bernardino. However, BNSF and UP have together created a joint regional center for the Houston area as well, located in Spring, TX\(^ {162}\), which controls the whole Houston area rail network. It would seem logical that the proposed Freeport corridor up to Caldwell could be managed out of this existing Spring dispatch center.

The Alameda Corridor pioneered a new Public/Private approach for finance, ownership, administration and rail corridor operations that could be used as a model for Freeport as well. As shown in Exhibit 6-1, this analysis will be conducted from the point of view of a public infrastructure authority modeled after the Alameda Corridor Transportation Authority (ACTA)\(^ {163}\). It is assumed that this Authority would be separate and distinct from Port Freeport.

![Exhibit 6-1: Structure of the Financial and Economic Assessment](image-url)

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\(^{160}\) See: [https://www.aar.org/keyissues/Documents/Background-Papers/Public%20Private%20Partnerships.pdf](https://www.aar.org/keyissues/Documents/Background-Papers/Public%20Private%20Partnerships.pdf)

\(^{161}\) See: [http://www.acta.org/agendas/Operating_Committee/Special_Rail_Operation_Com_9-5-07_Agenda.pdf](http://www.acta.org/agendas/Operating_Committee/Special_Rail_Operation_Com_9-5-07_Agenda.pdf)

\(^{162}\) See: [http://www.grainnet.com/articles/BNSF__UP_Sign_Historic_Dispatching_Agreement-3073.html](http://www.grainnet.com/articles/BNSF__UP_Sign_Historic_Dispatching_Agreement-3073.html)

\(^{163}\) See: [http://www.acta.org/](http://www.acta.org/)
6.2 Revenues of the Freeport Rail Authority

The Toll Authority would derive revenues from tolls collected from the freight railroads as usage fees, plus other contractual commitments such as to annual track maintenance. It is assumed that the financial structure would be modeled after ACTA’s and that the toll structures would be similar. For the Alameda Corridor the railroads have agreed to pay:164,165

- A fixed charge per TEU for every ocean container using rail that originates from Los Angeles/Long Beach -- whether that container uses the Alameda Corridor or not. Since the railroads agreed to this “Take or Pay” fee for all ocean containers, this maximizes the railroads incentive to actually use the corridor. Under law and also by contract, the railroads are required to pay this fee for every ocean container, even those that are trucked to the downtown rail ramps. This is possible to audit since the Port Authority maintains records of all containers that originated at the Port.166

- A much reduced charge per TEU for loaded containers that are not port related, for empty containers and for railcars, which lowered fees are intended to encourage the railroads to use the corridor for discretionary traffic. Fees on these discretionary units generate some small incremental revenues for ACTA since the fees are intended to encourage the railroads to use the Alameda Corridor rather than their own lines (which pass at grade through congested areas of the city) but which both BNSF and UP railroads continue to maintain for local traffic.

At Freeport, the proposed new rail line could provide a direct route for Union Pacific carload traffic to go straight to the new classification yard which they plan at Hearne. However, to encourage Union Pacific to voluntarily use this bypass rather than taking trains through downtown Houston, fees for carload and non-port-related containers must be kept low. As such, for this Concept-level evaluation, we have adopted the Alameda Corridor structure but have simplified it somewhat, ignoring the marginal impact of discretionary carload and non-port-related traffic, and by pricing all loaded containers on a round trip basis (assuming 100% empty return). These refinements will be added in a full Feasibility-level study.

Even for port-related container traffic it is desirable to keep the level of toll as low as possible, and in any case to be able to demonstrate an economic advantage to the freight railroads for using the route. Therefore, a preliminary view has been taken of the project (a Freeport to Rosenberg greenfield) from a freight railroad perspective to identify the level of potential benefits, as shown in Exhibit 6-2. This suggests a railroad savings on the order of $18 per Loaded TEU for a round trip on the Rosenberg greenfield.

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166 Shippers can avoid this charge, however, by transloading the goods to a domestic container and reconsigning the goods as domestic freight.
By comparison, the proposed rate structure would be:

- 64% of Alameda Corridor rate per TEU ($10 less expensive per TEU)
- 29% of Alameda Corridor rate per TEU-mile

Exhibit 6-2: Prospective Freight Railroad Benefits of New Rail Line

In terms of benefits to the railroads, firstly the proposed new greenfield route would be 25-30 miles shorter than the existing rail route through Algoa, as shown in Exhibit 6-3. A line-haul cost of 12¢ per TEU-mile\(^\text{\textsuperscript{167}}\) has been developed from STB data. The railroads would save 12¢ per TEU-mile in \textit{both directions} (loaded and empty) by using the new, shorter greenfield route. Applying this to the assumed 28-mile shorter greenfield route in both directions results in a direct railroad cost savings of $6.72 per loaded TEU. The railroads should be willing to pay at least this level of fees for using the new shorter rail route since it would be less expensive than using their own but longer tracks.

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\(^\text{167}\) Rail costs are modeled as $125 lift costs per TEU for loading and unloading, or $62.50 at each end of the rail movement, plus 12¢ per TEU-mile for the rail line-haul. These costs are based on double stack trains, and were developed from "Rail Short Haul Intermodal Corridor Case Studies", Table 6.3.3 on page 32. See: https://www.fra.dot.gov/Elib/Document/1649. It should be noted that the rail line haul cost of 12¢ per TEU-mile includes a 40% markup (the ratio of direct to long term variable cost) which includes an allowance for amortizing the capital cost of the railroads' infrastructure. Underlying cost development was based on STB URCS http://www.stb.dot.gov/stb/industry/urcs.html and the railroads' annual R-1 reports http://www.stb.dot.gov/stb/industry/econ_reports.html.
Unlike Los Angeles/Long Beach where each railroad has its own line to the Port, neither railroad has its own line to Freeport, since as shown in Exhibit 6-4 each railroad must rely on trackage rights over the other. In terms of avoided trackage rights payments, this has been estimated to contribute $3.41 per TEU.\(^{169}\) It also disadvantages Port Freeport by inhibiting the railroads’ willingness to invest\(^ {170}\) in the Houston area rail network, since:

- Railroads don’t like making trackage rights payments to direct competitors
- Railroads don’t like investing in their own lines that benefit competitors without cost sharing
- Railroads don’t like investing in their competitor’s rail lines

\(^{168}\) As shown in Exhibit 6-3, there are a number of conceptual options for developing this route: some starting from Angleton (e.g. Segment 1) and others all the way from Freeport (e.g. Segment 1a) as would be required if the Freeport Terminal Railroad is not developed. The financial analysis here is based on the longer of the two options (Segment 1a to Freeport) and the mileage savings are similar, so the current analysis is conservative if the shorter Segment 1 were able to be constructed.

\(^{169}\) See Page 140 of the SP/UP Merger Decision at: [https://www.uprr.com/aboutup/history/decision.pdf](https://www.uprr.com/aboutup/history/decision.pdf) reported trackage rights fees at 3 mills per Gross Ton mile (in 1996) = $0.003 per GTM with 130 ton is 39¢ per Loaded car mile. Inflated by 28.5% increase over 11 ½ years using AAR’s Rail Cost inflation index [https://www.aar.org/StatisticsAndPublications/Rail-Cost-Indexes/Documents/RCAF%20History%202014Q3.pdf](https://www.aar.org/StatisticsAndPublications/Rail-Cost-Indexes/Documents/RCAF%20History%202014Q3.pdf) yields a current equivalent rate of 50¢ per Loaded car mile and 12¢ per Loaded car mile.

\(^{170}\) Angleton Subdivision study, [http://d2dtl5nnlpfr0r.cloudfront.net/swutc.tamu.edu/publications/technicalreports/473700-00011-1.pdf](http://d2dtl5nnlpfr0r.cloudfront.net/swutc.tamu.edu/publications/technicalreports/473700-00011-1.pdf)
Finally, it is noted that the significant volume of trains added by Port Freeport would likely necessitate adding track to the existing rail corridor from Angleton to Alvin, a distance of 28 miles. Assuming a phased development of double track along this segment (over a 20 year time frame) this avoided investment is conservatively\(^{171}\) worth the equivalent of $7.90 per TEU.

In summary, revenues are assessed at $18 per loaded TEU based on an assessment of potential savings to the freight railroads. Further analysis is needed in the next phase of work to confirm and further refine this assumption.

### 6.3 Capital Costs for Constructing the Line

At this early stage of project development, a preliminary capital cost has been estimated by benchmarking to similar projects, rather than based on any detailed engineering assessment. At a concept level the capital costs for rail development have been estimated at an average of $7.3 million/mile\(^{172}\) in 2014 dollars based on benchmarking to the recent Colorado R2C2 and Texas Houston

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\(^{171}\) Based in part on STB’s 11.32% railroad cost of capital in 2013, which is known to be less than the hurdle rate that railroads use for funding discretionary capital investments. Also the cost of double tracking north of Alvin was not included since it is likely that capacity improvements there will be needed regardless. See: [http://www.railwayage.com/index.php/regulatory/stb-sets-2013-railroad-cost-of-capital-at-1132.html?channel=40&utm_source=WhatCounts+Publicaster+Edition&utm_medium=email&utm_campaign=RGN+8.1.14&utm_content=Full+Article](http://www.railwayage.com/index.php/regulatory/stb-sets-2013-railroad-cost-of-capital-at-1132.html?channel=40&utm_source=WhatCounts+Publicaster+Edition&utm_medium=email&utm_campaign=RGN+8.1.14&utm_content=Full+Article)

\(^{172}\) R2C2 Study alignment “B” is a pure greenfield, therefore it provides a comparable basis for the development of costs for a new, single track greenfield rail alignment with a 2-mile passing siding every 10 miles. It is 180 miles long (Fig 3-3) costing $1,188 million in 2008 dollars: $6.6 million per mile. See: [http://www.coloradodot.info/projects/railroadstudy/documents/finalreport-2009/r2c2_final_report-full020609.pdf/view](http://www.coloradodot.info/projects/railroadstudy/documents/finalreport-2009/r2c2_final_report-full020609.pdf/view)

In the Houston area, the Dayton-Cleveland bypass was estimated at a slightly lower cost of $6.2 million per mile ($212 million for 34 miles, see Executive Summary page 11 [https://ftp.dot.state.tx.us/pub/txdot-info/rail/freight/houston_study.pdf](https://ftp.dot.state.tx.us/pub/txdot-info/rail/freight/houston_study.pdf)) As of July 2014, the ENR Construction Cost Index was 9835; in 2008 the average index value was 8310 giving an inflation cost factor of 18.4% [http://enr.construction.com/economics/](http://enr.construction.com/economics/)

Applying this factor to the local cost for the Dayton-Cleveland project the current 2014 cost for greenfield rail development is estimated as $7.3 million per mile.
For the 56-mile “full build” option from northwest Rosenberg to Freeport, this comes to $409 million, or $136 million per year over a three year construction period.

### 6.4 Operating and Maintenance Costs

Once the rail line has been built the Rail Authority will need to maintain it and periodically replace components (cyclic maintenance). In addition the Rail Authority will itself have some administrative overhead including management, legal and financial fees for collecting revenues, servicing the debt, and maintaining the required financial reporting.

Administrative fees have been tentatively estimated at 4.2% of revenue based on the overhead rate of the Alameda Corridor Transportation Authority. This will be subject to refinement once more is known about the actual financing approach that will be utilized for this project.

Once the new rail line is built, it will have to be maintained. Exhibit 6-5 shows the relationship between track maintenance cost and total tonnage that was calibrated from a 2004 Zeta-Tech study. It shows a strong relationship between tonnage, FRA track class (4 through 6, corresponding to a 79-mph, 90-mph and 110-mph track speed) and track maintenance cost.

Exhibit 6-5: Zeta-Tech Track Maintenance Costs (in $2002)

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<thead>
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<table>
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In Exhibit 6-5, Zeta-Tech gives Total and Operating cost components; the difference is in Capital cost. For example, the mid-line Cost functions (in $2002) for Class 4 track is broken down as follows:

- $12,082 + $1,067 * MGT = Operating Cost per Mile Class IV track
- $19,805 + $743 * MGT = Capital Cost per Mile Class IV track
- $31,887 + $1,810 * MGT = Total Cost per Mile Class IV track

Capital costs for periodic infrastructure renewal, are not incurred all at once but rather are subject to a ramp-up as specified by Zeta-Tech in Exhibit 6-6

### Exhibit 6-6: Zeta-Tech Track Capital Cost Ramp-Up Factors

<table>
<thead>
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<th>Year</th>
<th>% of Capital Maintenance</th>
<th>Year</th>
<th>% of Capital Maintenance</th>
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</thead>
<tbody>
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</tr>
</tbody>
</table>

Inflated to $2014 (an approximate 52% increase, a higher rate of inflation than CPI, reflecting the energy-intensity of construction materials) these cost functions become:

- $18,365 + $1,621 \times \text{MGT} = \text{Operating Cost per Mile Class IV track}
- $29,784 + $1,112 \times \text{MGT} = \text{Capital Cost per Mile Class IV track}
- $48,149 + $2,733 \times \text{MGT} = \text{Total Cost per Mile Class IV track}

It is estimated that Port Freeport will generate approximately 15 Million Gross Tons (MGT) annually of intermodal traffic\(^{174}\) on the proposed new rail line at first so:

- Operating maintenance of the proposed new rail line would cost $45,000 per mile eventually rising to over $125,000 per mile (in current dollars) as volumes grow to 65 MGT by 2045.
- Capital maintenance would eventually reach $100,000 per mile per year (in current dollars) but as a result of both ramp-up factors and traffic growth would take 30 years to reach this level.

### 6.5 Financial Analysis

The analysis assumes a Greenfield rail alignment: 56 Miles Freeport to NW Rosenberg (full-build Segment 1 independent of existing UP Freeport branch) costing $409 million in operation by 2020.

A key assumption for any financial analysis is the interest rate. According to the Bond Buyer website\(^ {175}\) the weighted average 2014 rate for Revenue Bonds is 4.4%.\(^ {176}\) This was assumed along with 1.4\% annual inflation so that effectively a 3\% real discounting rate is used. The forecasted TEU container rail volumes were used along with the assumed $18 per TEU revenue yield to develop a very preliminary,

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\(^{174}\) A 500 TEU double stack train will weigh on average (loaded + empty) around 9,000 tons. 9,000 tons/train * 16 trains/week * 52 week/year * 2 directions = 14.976 MGT (practically 15 MGT) for 832,000 TEU - an average of 18 tons per TEU including the weight of container and train.

\(^{175}\) See: The Bond Buyer website, at: http://www.bondbuyer.com/apps/custom/msa_search.php?product=bbi_history&co1=1&start_date=01%2F01%2F2014&end_date=08%2F01%2F2014&submit=GO&csv=1

\(^{176}\) If a RRIF loan could be obtained, this financing will likely be even less expensive than Revenue Bonds.
conceptual analysis from the point of view of the Freeport Railroad Authority. Since inflation was assumed along with a nominal interest rate, the analysis reflects year of expenditure dollars. It yields a strongly positive Net Present Value for the Freeport Rail Authority, as shown in Exhibit 6-7 suggesting that the project could generate sufficient cash flow to service the revenue bonds without needing subsidy or grant assistance. More study however, is needed to positively confirm both costs and revenues, to confirm the financial feasibility of the project.

Exhibit 6-7: Projected Cash Flows for the Freeport Rail Authority

<table>
<thead>
<tr>
<th>discounted over 30-year life</th>
<th>NPV ($thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Revenues</td>
<td>$670,648</td>
</tr>
<tr>
<td><strong>Total Revenue</strong></td>
<td><strong>$670,648</strong></td>
</tr>
<tr>
<td>GF Capital Cost</td>
<td>$375,300</td>
</tr>
<tr>
<td>Track Mtce Cost Oper</td>
<td>$77,522</td>
</tr>
<tr>
<td>Track Mtce Cost Cap</td>
<td>$42,389</td>
</tr>
<tr>
<td>Admin Cost</td>
<td>$28,167</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$523,378</strong></td>
</tr>
<tr>
<td><strong>NET</strong></td>
<td><strong>$147,271</strong></td>
</tr>
</tbody>
</table>

This gives a Return on Investment of 6.38 percent. This shows that there is a good case for a public investment.
### 6.6 Economic Impacts

An analysis of potential job creation, income and tax impacts associated with logistics opportunities within the SH 36A corridor has been undertaken. As shown in Exhibit 6-8, two major opportunities for the corridor have been identified resulting in significant job creation potential. These are development of Port Freeport for ocean shipping, as well as a new rail intermodal facility in the Rosenberg area, for which Union Pacific has already purchased land.

**Exhibit 6-8: Projected Logistics Opportunities in the SH 36A Corridor**

- **Rosenberg Rail Intermodal 2035:**
  - Up to 1 Million TEUs on the Highway;
  - Houston Distribution Growth 25% Share of Rail TEUs
  - 5,000-10,000 jobs

- **Port of Freeport 2035:**
  - Up to 1.4 Million TEUs on the Highway; 2.1 Million going out by Rail.
  - Port Operations, Import and Export Transload, Houston Distribution Growth Share of Water TEUs
  - 10,000-20,000 jobs

The overall magnitude of the potential economic impacts is estimated at between 15-30 thousand full time jobs by 2035. Exhibit 6-9 shows the likely sources of this job creation: the vast majority of employment impact will be in warehousing, logistics, trucking and industrial jobs, while port and railroad operations themselves are so efficient that they have only a relatively minor impact on overall employment levels.
Under the “Direct Job Creation” scenario it is assumed that:

- In Rosenberg, 6,250 industrial, warehousing and trucking jobs\(^\text{177}\) would be created by development of a new rail intermodal ramp.
- At Freeport 7,000 jobs would be created, as follows: 176 at Port Freeport, 761 on the railroad and 620 jobs for transloading bulk exports\(^\text{178}\) at the Port. In addition, 5,454 distribution warehousing jobs would be created for transloading long-distance containers\(^\text{179}\) bound for out of state destinations into larger domestic boxes.

The “Direct and Indirect Job Creation” scenario assumes that the SH 36A corridor is additionally able to capture a small share (25%) of the forecasted growth of container logistics that is currently focused on Dallas, Fort Worth and San Antonio. Since the total volume of freight will be increasing dramatically, it will be necessary to substantially expand existing distribution capacity. While the vast majority of growth would likely be focused in the existing distribution areas, since the containers will be passing through the corridor (at both Freeport and Rosenberg) it is likely that the SH 36A corridor may be able to capture some of the related value-added distribution activity. Rosenberg, for example could be a good place from which to distribute into Houston’s rapidly growing western and northern suburbs.

If Rosenberg and Freeport could together capture 25% of the growth of Texas logistics, as shown in Exhibit 6-9, this would result an additional 10-11 thousand jobs in the SH 36A corridor resulting in a total impact of around 24,000 jobs which we take as the base line estimate for likely impact to the corridor. Translating these jobs into likely income and tax revenues the result, as shown in Exhibit 6-10 shows the likelihood of substantial economic impacts in the SH 36A corridor.

It should be noted, however, that the two initiatives (Port Freeport and Rosenberg rail ramps) are not independent, but rather will tend to strongly reinforce one another. That is, if both developments were undertaken together, it is apparent that the Rosenberg distribution industry would also likely induce a strong demand for trucking containers up SH 36A from Port Freeport. In this case the local job creation impact would be further amplified boosting employment impact closer to the 30,000 range that was cited in Exhibit 6-8. This needs further study to assess the likely degree of synergy that may exist between the two projects (port and rail ramp) and to determine the probable level of interaction between them.

\(^{177}\) See: http://www.thefutureneedsus.com/images/uploads/cc-book_1.pdf This is also consistent with the level of economic impacts that were estimated by CSX for their recently-opened Winter Haven, Florida intermodal facility (8,500 annual jobs with a total annual payroll of $282.2 million; over a 10 year period, more than $10 billion in economic development and $900 million in state and federal tax revenue.) See: http://www.flgov.com/2012/11/08/governor-scott-breaks-ground-on-winter-haven-intermodal-rail-terminal/

\(^{178}\) See: http://www.midwestshippers.com/news_detail.php?article=844

\(^{179}\) This 2/7 factor is based on the observed transloading rate at Los Angeles/Long Beach where it has been estimated that 50% of the containers move directly off the dock, while 20% go out the gate for transloading to domestic containers and subsequently reappear as domestic loads at the downtown intermodal ramps. This factor is applied only to the share of long-distance containers that would be moving beyond Dallas, Fort Worth or San Antonio not to local containers that terminate in those cities, or in Houston.
Exhibit 6-9: Sources of Jobs Increase by 2035 in the SH 36A Corridor

Exhibit 6-10: SH 36A Economic Impacts by 2035

Total Income Increase (million $ per Year )

$768

Direct Job Creation

Direct and Indirect Job Creation

Total State Sales Tax Increase (million $ per Year )

$44

Direct Job Creation

Direct and Indirect Job Creation

It is estimated that the increase in Income due to Direct and Indirect jobs in the SH 36A corridor will be $768 million in 2035, and this will expand the sales tax base by over $44 million per year in 2035. The SH 36A counties could therefore expect an increased sales tax payments of $660 million over the life of the project. This creates a very good case for the counties of the corridor to both support the development of Port Freeport, as well as the rail and highway infrastructure of the SH 36A Corridor.
Chapter 7. Summary and Conclusion

Based on the finding and results outlined in the previous chapter, the following next steps are recommended for pursuing further development of freight logistics in the SH 36A corridor.

The Panama Canal will open in 2016. The opportunity for Port Freeport to develop as the major container port on the gulf needs to be realized within the next 5 years, and this needs to include dredging the port to 56 feet as currently proposed, and building facilities for berthing large container ships. Without this investment other competitive ports will establish Market Share, and this will tend to lock in distribution patterns of major retailers and industrial consumers, and make it harder to shift traffic after that.

This places some urgency on the task of completing the planning for both development of Port Freeport, as well as associated infrastructure, including both the rail link between Freeport and Rosenberg and the proposed SH 36A highway. As a result, this study assumes a 2020 implementation date. This reflects the urgency of capitalizing on the current market opportunity for Texas ports to gain control of their own hinterlands -- including the major cities of Dallas, Fort Worth and San Antonio -- rather than ceding control of these areas to LA/LB and Miami/Savannah. Moving promptly is necessary to send a clear signal to the marketplace of Freeport’s intention, in conjunction with Houston, to fully develop its Port.

This study has focused primarily on the development of a rail link in conjunction with development of the SH 36A highway, although rail and highway could be developed on separate alignments, it is also possible that the two projects could be developed together. A key decision of the Texas DOT in cooperation with the SH 36A coalition will be whether to separate the rail and highway projects or to advance them together.

Key goals for development of the rail project are:

- Port Freeport should dredge and develop the Container Port facilities for large ships.
- Work with the railroads to provide rail access to Port Freeport by two or more railroads.
- Development of the rail system should follow Port Freeport development by 6 to 18 months to avoid unnecessary risk.
- Seek 100% Cost Recovery From Tolls, to minimize Capital Grants
  - Base tolls on railroad operating savings and alternative capital cost avoidance
  - Rail bypass should be more economical than going through downtown Houston
  - Keep tolls lower than Alameda Corridor charges

While this study has not been able to fully develop all the alternatives, at the current time it appears feasible that all the project goals could be achievable within the scope of subsequent planning efforts.
7.1 Next Steps

For further development of the system, the following next steps are recommended:

- Rail development is dependent on Port development, so further discussions with Port Freeport and freight railroads are needed to advance the project. Coordinate all aspects of project development with Houston GCRD and Texas DOT rail planning.

- Develop coordinating organization with:
  - The three counties of SH 36A Coalition.
  - Port of Houston and Freeport
  - Freight Railroads

- Further refine Port Freeport and Port Houston freight forecasts to feasibility and ultimately the investment grade level. These forecasts drive everything else.

- Develop Freeport Port Infrastructure and proposed Terminal Railroad feasibility planning from institutional, engineering, environmental, economic and operational perspectives. Assess the feasibility of developing Transload and coastal COB container distribution services in conjunction with Port Freeport and Port Houston.

- Develop strategies for Inland Ports whether by sharing existing rail ramps, or by developing new dedicated capacity.

- Environmental and Engineering (NEPA) studies of new rail alignment options are needed, including discussions with Texas DOT, GCRD, freight railroads and ultimately the public regarding the utility of such routes.

- Assess potential for developing large UP and BNSF Railroad intermodal facilities in the vicinity of Rosenberg and assess the role that SH 36A highway development could play in supporting the development of such facilities.

- Refine and further develop the financial and economic impact analysis for evaluating both port and rail intermodal facilities on the need for developing the SH 36A corridor.