Republic of Panama

The Panama Canal Impact on the Liner Container Shipping Industry

Final Report

Submitted to:

The Panama Canal Authority

Submitted by:

THE Louis Berger Group, INC.
Washington, D.C.

in association with:

The National Ports & Waterways Institute / UNO
The Tioga Group
PIERS

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The Panama Canal Impact on the Liner Container Shipping Industry

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The Panama Canal Impact on the Liner Container Shipping Industry

FINAL REPORT

The Louis Berger Group, Inc.
Washington, D.C.

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EXECUTIVE SUMMARY

The Louis Berger Group has carried out a market analysis of the present and future demand for container vessel transit services provided by the Panama Canal. This study focuses on one of the most important segments of the shipping market that the Panama Canal serves and is one of six studies of individual market segments the ACP is undertaking to assess the potential overall demand for the Canal. The other five segments (dry bulks, liquid bulks, refrigerated cargo, vehicle carriers and cruise ships) are the subject of other studies. This approach recognizes the unique characteristics of the major market segments and the desirability of employing different analytical tools that best model the variables and decision-making processes that affect the use of the Canal. The results of all of the studies, as well as additional work on pricing and market strategies, will be integrated into an overall market demand study, anticipated to be finalized in mid-2004.

Among the different market segments, the liner container shipping segment appears to offer the greatest potential for future growth. Its significance goes beyond its contribution to Canal traffic in that it is the key driver of cargo movement at Panama's ports. The liner container shipping market is of strategic importance not only to the future of the Panama Canal, but also to the country's ports and its position as a regional hub.

This study of the demand for Liner Shipping Services through the Canal differs from prior studies in that it is not solely based on historical trends. The study forecasts result from a model based on an analysis of each market segment, the alternatives available to shippers, and various scenarios regarding changes in production, distribution, and logistics that affect the Canal markets. It should be noted, however, that the forecasts are made without any recognition of possible capacity constraints or pricing sensitivities, and should be considered as unfettered demand projections.

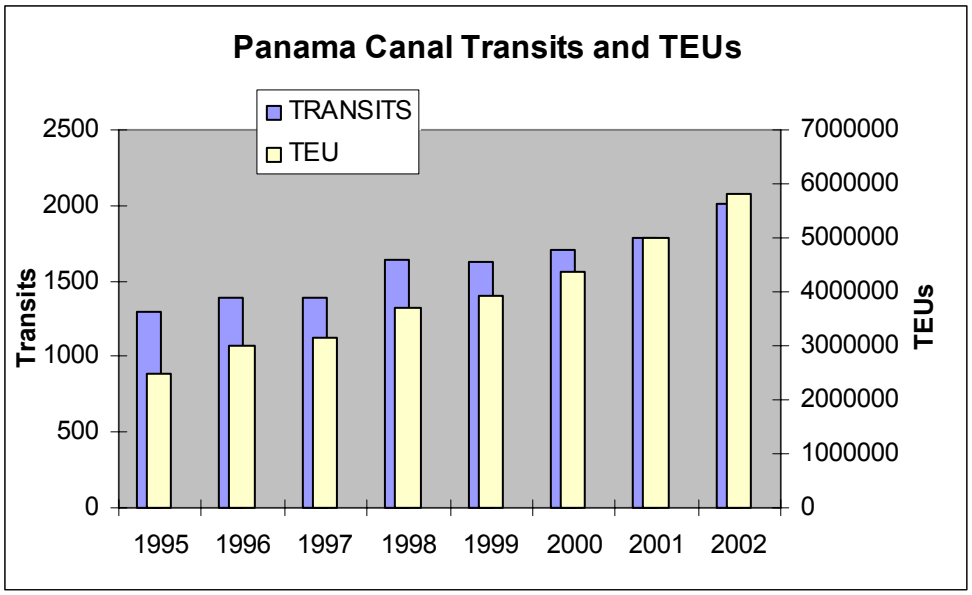
Market Analysis

Container traffic continues to grow as a component of the Panama Canal's business, both in terms of number of vessel transits and in the TEU capacity of the vessels using the Canal. Over the period from 1995 to 2002, ACP data indicates that the number of container vessel transits across the Panama Canal increased at an average annual growth rate of 6.4% while at the same time TEU capacity of these specialized vessels transiting the Canal grew by 12.9% (see Figure ES-1).[1] Consistent with worldwide trade

[1] Historical cargo in TEU transiting the Canal is not available, but TEU capacity is used as an indicator of actual TEU transiting the Canal assuming TEU/vessel remain the same. We believe that the larger increase in transits and TEU since 1998 is the combination of several factors: introduction of new buildings made Panamax vessels available for all-water deployment; growth of alliances created incentives for all such groupings to have at least one all-water service, passage of the Ocean Shipping

trends, the liner container shipping segment is likely to experience continuing growth for the foreseeable future.[2]

Figure ES-1: Transits and TEU capacity growth (1995 – 2002)



The containerized cargo moving through the Canal does so primarily along 12 trade routes, with flows between Northeast Asia and the United States being by far the largest. Table ES-1 illustrates the 2001 composition of the container markets served by the Canal for each trade route. An origin and destination region is shown to indicate the dominant trade direction between the two regions (exports or imports). The relevant trade flows are based on data obtained from PIERS container worldwide trade flows and includes cargos that are shipped not only through the Canal route, but by alternative routes as well.

The total relevant trade in 2001 was approximately 5.2 million TEU, or slightly less than half of the total of 10.7 million TEU for the twelve segments. The relative competitiveness of the Canal for US shippers or consignees depends on the region within the US to which cargo is destined, or in the case of US exports, from which it originates. For the largest single segment, NE Asia – US, the Canal captured about 30% of trade to the East US region, only 3% to the Gulf region and none of the West region. Other trade flows, such as US East – Oceania, can be considered captive, with the Canal the only route used. The inverse is true on still other routes, with little or none

Reform Act (OSRA) served as a catalyst that allowed all-water pricing to be market-driven, and the increased number of distribution centers by large retailers in the USEC (e.g. Wal-Mart).

[2] Although some containerized cargo is carried on other vessel types, this analysis focuses only on that handled by the liner container vessels.

of the flow coming though the Canal. Overall, the Canal captured 36.5% of the total volume of relevant trade in 2001.

Table ES-1: Relevant Trade Flows and Canal Shares for 2001 ('000s TEU)

Trade Flow				2001 Trade Volume ('000s TEU)			Percent
No.	Origin	Destination	US Region	Total	Relevant	Canal Share	Share
US Based Trade Routes							
1	NE Asia	US	East	2.183	2.183	647	29,7%
			Gulf	807	807	24	3,0%
			West	2.942			
2	SE Asia	US	East	407	407	72	17,8%
			Gulf	151	151	0	0,0%
			West	528			
3	US	Oceania	East	134	134	134	100,0%
			West	36	36	0	0,0%
4	US	NC/EC SA	East	326			
			West	87	87	44	50.0%
5	WC SA	US	East	192	192	192	100,0%
			West	51	51	0	0,0%
6	Europe	US	East	1,790			
			West	476	476	476	100.0%
Non-US Based Trade Routes							
7	WC SA	Caribbean		6	6	6	100,0%
8	NE Asia	EC SA		144	144	0	0,0%
9	Europe	WC SA		169	169	169	100,0%
10	NC/EC SA	WC SA		94	94	47	50,0%
11	Asia	NC SA		42	42	42	100,0%
12	Asia	WC SA[3]		171	171	27	15,6%
Total				10.736	5.150	1.880	36,5%

Note: All figures are one-way, in the dominant direction.

Source: PIERS, ACP data, consultant analysis.
Legend: WC= West Coast; NC= North Coast; EC= East Coast; SA= South America

[3] Based on industry interviews and capacity deployed in the trade route, it is assumed that 30% of the trade from Asia to WCSA is transshipped in Panama. For the cargo transshipped in Panama, it is assumed that Balboa's share is 74% and Colon 26% (specifically in CCT, Evergreen Terminal). These shares are based on the capacity of feeders calling at Balboa and Colon terminals serving WCSA (Maersk and Evergreen feeder services). The cargo that is transshipped in Colon has to transit the Canal twice, once in the eastbound direction on the mainline vessel and then again westbound on the regional feeder. This results in 15.6% of total trade from Asia to WCSA transiting the Canal.

Of these 12 routes presently served by the Canal, 6 are US based and the remaining 6 are Latin American based. The US trades account for almost 95% in the total relevant trade flows. Asia – US flows alone, the first two relevant flows (NE and SE Asia to the US East and Gulf regions), account for over two thirds of the total relevant market. That same Asia-US cargo comprises approximately 40% of the total Canal volume. Conversely, while the total Europe trade flows with the US and West Coast of South America are a relatively small share of the total relevant market -- just over 12% combined -- they account for over a third of the total Canal volume. Other notable shares of Canal traffic are US – Oceania at 7.1% and WC South America – US at 10.2%.

Competitor Routes

The alternative routes that are deemed competitive to the Canal vary by trade flow. The Canal's competitiveness is directly related to savings in cost and/or time offered by a route and the steamship line operating strategies for the various trade flows.

The major alternative route options that shippers have for their cargo movements instead of using the Panama Canal for their container shipping traffic can be classified as follows:

- All-Water Routes (AW) that do not include the Panama Canal
    - via the Suez Canal
    - around Cape Horn
    - around the Cape of Good Hope
- Intermodal Routes (IM)
    - From Asia to the West Coast of the US connecting to the US Rail System

Clearly, the most important competitor to the Canal is the US intermodal system. The vast majority of the traffic moving through the intermodal system tends to be higher-value, time-sensitive traffic. Lower-value, less time-sensitive traffic continues to move in all-water service across the Panama Canal. The choice between the intermodal system and all-water service continues to be customer-specific and/or shipment-specific.

Main Drivers of Panama Canal Traffic Growth

The Panama Canal demand is mainly derived from economic activity. As the world's economy grows, the trends affecting manufacturing and distribution, and the shifts in location of economic activity are the main determinants of demand. The main drivers of future Panama Canal traffic are therefore:

1. Economic and trade growth, trends toward globalization and shifts of manufacturing to the lowest-cost locations around the world far away from the consuming areas of the world;

2. Shipper logistics requirements for this trade; and

3. Steamship lines' strategies to serve the shippers and improve their profitability.

The market share of the Panama Canal (defined as the cargo handled out of the total trade and related vessel transits) have been analyzed under many scenarios that reflect the various factors that influence these key demand drivers. The scenarios have been combined into alternative futures that reflect the uncertainty as to future economic growth, trade, shipper logistics, as well as shipping industry technology and infrastructure

Scenarios

Scenarios covering three sets of factors were considered:

1) Economic and Trade Growth[4]

Essentially, the key factors that affect trade flows (e.g., income growth) are assumed across a range as follows:

1. Worst Case – slowest economic growth and trade assumptions;
2. Best Case – fastest growth assumptions; and
3. Base Case – reflecting moderate growth assumptions.

2) Shipper Logistics and Operations

The alternative futures for shipper logistics and operations consider three basic drivers of demand for those US trades in which there is significant competition between the all-water route and the intermodal route:

a. Cargo Type and Value
b. Types of Shippers and their Supply Chains (including sourcing, the roles of retailers and manufacturers, distribution centers networks and logistics, and order cycle time and reliability)
c. Quality of Service Offered on Alternative Routes (including US port development and efficiency)

A total of 3 alternative futures have been defined as follows:

[4] Economic and Trade Growth Scenarios were provided by PIERS and verified with other sources such as Global Insight.

1. Increased Intermodal Competition (Pessimistic) future in which improved performance of the services in the competing intermodal route would attract cargo away from the all-water route, the mix of cargo favors speed over cost and shippers focus on reducing order cycle times.

2. Resurgence of All-Water Route (Optimistic) future in which the performance and quality of the all-water services improve relative to the competing intermodal route, the mix of cargo shipped is on the margin more sensitive to cost than to time and large sophisticated retailers that can manage longer order times are increasingly important.

3. Competitive Balance Status Quo (Moderate) future in which improvements in the performance and quality of the all-water route are comparable to those for the competing intermodal route, the mix of cargo and its average value remains relatively unchanged, while shippers improve the quality of their distribution networks to take advantage of modern supply chain management techniques to improve order times gradually.

3) Shipping Technology (including vessel size)

Two scenarios are considered for the future size of the vessels (measured in TEU) based on the assumption of **slow** and **accelerated** change in the introduction of Post-Panamax vessels on the Panama Canal services.

For captive trade flows, shippers have no reasonable choice, so the forecast is only based on economic trade/growth and shipping technology scenarios.

A final scenario has been considered to analyze what might happen if there were no expansion of the Canal. The Base Case economic scenario is combined with the Pessimistic operating scenario and a No Deployment of Post-Panamax vessel scenario to model this situation. The analysis conducted under this study does not consider capacity constraints, which would be a key factor in any No-Expansion analysis. Therefore, the analysis of this scenario is limited to consequences of the inability to accommodate the Post-Panamax fleet.

Forecasting Approach

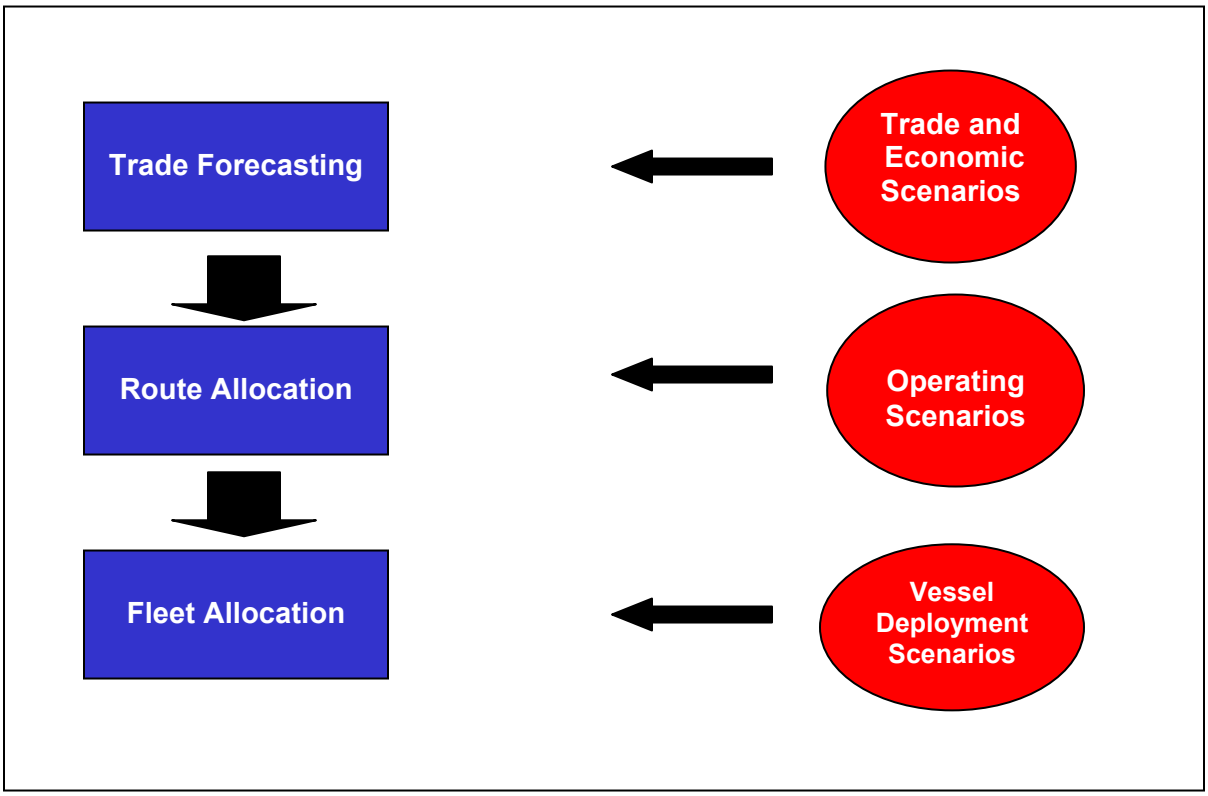
A three-stage approach to forecasting the future container shipping traffic through the Panama Canal was employed. This approach is characterized in the graphic in Figure ES-2.

In the first stage, a Trade Forecasting Model based on PIERS and Journal of Commerce data was used to estimate the total potential demand for the Panama Canal by relevant trade route through the year 2025. As indicated in the graphic, this model is influenced by trade and economic scenarios that produce a range of outcomes that have been reduced to three discrete views of the future: Worst Case, Base Case and

Best Case, reflecting future economic and trade growth. For US trade, the forecasting statistical model applied is country-specific, specifying US imports as a function of aggregated income, import price indices and exchange rates. The analysis of the non-US trades is based on similar statistical models, adjusted to reflect trade-specific assumptions.

In the second stage of the modeling approach, for the divertible trades, the potential demand for the Canal is input into a series of integrated Route Allocation Models. Different modeling approaches have been developed to capture the distinct competitive dynamics that characterize the various relevant trade flows. All modeling is based on determining a market share of the trade flow allocated to, and thus captured by, the Panama Canal in competition with the alternative route choices. As shown in the graphic, route allocation is influenced by operating scenarios, which combine the range of critical factors that affect route choice decisions. For captive trade routes, the Panama Canal is assigned all the projected trade for that trade flow.

Figure ES-2: Modeling Framework



For this second stage, the route allocation, or econometric, model considers the following variables.

- Time differential between AW and IM routes.
- Cost differential between AW and IM routes.
- Share of distribution center (DC) space in the Eastern US.
- Value of cargo transported.
- Cargo type.

The data for the development of the route allocation model comes from a series of interviews of shippers, shipping lines and other industry representatives conducted during the course of the study.

Finally, the share of the total container shipping traffic, measured in TEU, is input into a Fleet Allocation Model to arrive at forecasts of vessel crossings through the Panama Canal. This is influenced by the future vessel deployment scenarios.

Forecast Results

Forecasts of future demand for the Panama Canal by liner container shipping services have been developed based on the market analysis, extensive interviews with key industry stakeholders and rigorous modeling for several future scenarios as described above – **assuming no capacity constraints**. The results are container, vessel and revenue forecasts under scenarios that consider a wide range of economic growth, operating and vessel deployment scenarios.

The forecasts of Panama Canal container and vessel traffic as well as toll revenues are presented in Table ES-2 by 5 year increments up to 2025 assuming the present toll structure for Canal transits. Total Canal traffic and revenues for the liner market segment is projected to grow as follows:

- **TEU** are estimated to increase by at least 250% (over 4% annually) under the pessimistic scenarios. Traffic in TEU is expected to increase from 3.7 million TEU in the year 2001 to between 10.0 million and 22.4 million TEU by 2025. Under the optimistic scenarios, traffic is projected to grow by over 7% annually to a level over 6 times greater than present traffic levels.

- **Vessel crossings** are estimated to increase at a lower rate – at least by 37% - increasing from 1970 vessel crossings in the year 2001 to between 2,712 and 5,824 vessel transits by the year 2025.

- **Toll revenues** in this period are projected to at least triple from $142 million in 2001 to approximately $433 annually by the year 2025, with the most optimistic revenues reaching close to $1 billion.

Table ES-2: Panama Canal Traffic under Alternative Trade Growth, Operating and Vessel Deployment Scenarios – 2001-2025

				2001	2005	2010	2015	2020	2025
Operating Scenario	Economic Scenario	Vessel Allocation							
Pessimistic	Base	Slow Deployment Post Panamax	TEU	3,711,241	4,981,209	6,788,553	8,498,170	10,207,787	11,917,405
			Transits	1,970	2,407	2,878	2,900	3,118	3,209
			Toll	$142,755,226	$214,844,583	$290,133,236	$363,365,629	$438,538,662	$514,254,196
		Rapid Deployment Post Panamax	TEU	3,711,241	4,981,209	6,788,553	8,498,170	10,207,787	11,917,405
			Transits	1,970	2,407	2,878	2,497	2,875	3,209
			Toll	$142,755,226	$214,844,583	$290,133,236	$364,713,181	$439,318,143	$514,254,196
	Worse	Slow Deployment Post Panamax	TEU	3,711,241	4,716,264	6,082,032	7,399,138	8,716,243	10,033,349
			Transits	1,970	2,281	2,579	2,525	2,668	2,712
			Toll	$142,755,226	$203,435,933	$259,909,818	$316,387,143	$374,647,516	$433,137,586
		Rapid Deployment Post Panamax	TEU	3,711,241	4,716,264	6,082,032	7,399,138	8,716,243	10,033,349
			Transits	1,970	2,281	2,579	2,176	2,461	2,712
			Toll	$142,755,226	$203,435,933	$259,909,818	$317,493,532	$375,132,627	$433,137,586
	Best	Slow Deployment Post Panamax	TEU	3,711,241	5,658,908	8,595,750	11,309,367	14,022,983	16,736,599
			Transits	1,970	2,746	3,667	3,865	4,291	4,520
			Toll	$142,755,226	$244,055,080	$367,473,218	$483,483,071	$602,082,922	$722,102,431
		Rapid Deployment Post Panamax	TEU	3,711,241	5,658,908	8,595,750	11,309,367	14,022,983	16,736,599
			Transits	1,970	2,746	3,667	3,330	3,960	4,520
			Toll	$142,755,226	$244,055,080	$367,473,218	$485,210,076	$603,397,811	$722,102,431
Moderate	Base	Slow Deployment Post Panamax	TEU	3,711,241	5,387,864	7,872,965	10,185,033	12,497,102	14,809,170
			Transits	1,970	2,577	3,290	3,456	3,760	3,875
			Toll	$142,755,226	$232,236,153	$335,972,715	$435,132,235	$536,756,429	$639,187,104
		Rapid Deployment Post Panamax	TEU	3,711,241	5,387,864	7,872,965	10,185,033	12,497,102	14,809,170
			Transits	1,970	2,577	3,290	2,938	3,436	3,875
			Toll	$142,755,226	$232,236,153	$335,972,715	$436,822,262	$537,433,862	$639,187,104
	Worse	Slow Deployment Post Panamax	TEU	3,711,241	5,055,233	6,985,949	8,805,231	10,624,513	12,443,795
			Transits	1,970	2,423	2,923	2,989	3,201	3,266
			Toll	$142,755,226	$217,994,403	$298,157,983	$376,223,499	$456,257,186	$537,120,926
		Rapid Deployment Post Panamax	TEU	3,711,241	5,055,233	6,985,949	8,805,231	10,624,513	12,443,795
			Transits	1,970	2,423	2,923	2,542	2,929	3,266
			Toll	$142,755,226	$217,994,403	$298,157,983	$377,360,958	$456,969,596	$537,120,926
	Best	Slow Deployment Post Panamax	TEU	3,711,241	6,255,081	10,185,545	13,782,381	17,379,216	20,976,052
			Transits	1,970	2,995	4,270	4,682	5,231	5,494
			Toll	$142,755,226	$269,556,254	$434,592,139	$588,919,588	$746,024,858	$904,851,502
		Rapid Deployment Post Panamax	TEU	3,711,241	6,255,081	10,185,545	13,782,381	17,379,216	20,976,052
			Transits	1,970	2,995	4,270	4,682	5,231	5,494
			Toll	$142,755,226	$269,556,254	$434,592,139	$588,919,588	$746,024,858	$904,851,502
Optimistic	Base	Slow Deployment Post Panamax	TEU	3,711,241	5,525,152	8,239,066	10,754,524	13,269,982	15,785,440
			Transits	1,970	2,635	3,429	3,643	3,976	4,100
			Toll	$142,755,226	$238,180,328	$351,463,838	$459,216,407	$569,756,207	$681,404,025
		Rapid Deployment Post Panamax	TEU	3,711,241	5,525,152	8,239,066	10,754,524	13,269,982	15,785,440
			Transits	1,970	2,635	3,429	3,086	3,628	4,100
			Toll	$142,755,226	$238,180,328	$351,463,838	$461,056,389	$570,933,814	$681,404,025
	Worse	Slow Deployment Post Panamax	TEU	3,711,241	5,169,670	7,291,114	9,279,933	11,268,751	13,257,570
			Transits	1,970	2,470	3,039	3,146	3,383	3,453
			Toll	$142,755,226	$222,789,634	$311,083,603	$396,504,707	$484,060,097	$572,178,668
		Rapid Deployment Post Panamax	TEU	3,711,241	5,169,670	7,291,114	9,279,933	11,268,751	13,257,570
			Transits	1,970	2,470	3,039	2,667	3,089	3,453
			Toll	$142,755,226	$222,789,634	$311,083,603	$397,735,442	$484,910,184	$572,178,668
	Best	Slow Deployment Post Panamax	TEU	3,711,241	6,456,351	10,722,265	14,617,278	18,512,292	22,407,305
			Transits	1,970	3,079	4,474	4,956	5,548	5,824
			Toll	$142,755,226	$278,197,810	$457,298,502	$624,251,188	$794,573,191	$966,761,905
		Rapid Deployment Post Panamax	TEU	3,711,241	6,456,351	10,722,265	14,617,278	18,512,292	22,407,305
			Transits	1,970	3,079	4,474	4,193	5,064	5,824
			Toll	$142,755,226	$278,197,810	$457,298,502	$626,328,061	$796,334,837	$966,761,905
No Canal Expansion	Base	No Deployment Post Panamax	TEU	3,711,241	4,981,209	6,788,553	8,498,170	10,207,787	11,917,405
			Transits	1,970	2,407	2,878	3,719	4,478	5,237
			Toll	$142,755,226	$214,844,583	$290,133,236	$363,258,927	$436,254,812	$509,230,539

Cost Competitive Analysis

For each of the 12 relevant trade flows, a comparison was made of the Panama Canal route to an alternative intermodal and/or all-water route. This analysis provides an estimate of the cost difference between the alternative routes (i.e. the cost savings that results from using the Canal route instead of the next-best alternative), which can be viewed as the perceived *economic value* of the Canal to a given user. Major findings are:

- The trade flows that compete with the US intermodal system, NE Asia-USEC and Europe-USWC, account for over 60% of total current Canal traffic and are expected to grow to over 65% by 2025. These market segments (particularly the NE Asia – USEC trade flows) are the most intensely competitive and the actions taken by the ACP to improve its price-service offering will be important in determining the share of the market it captures and the revenues it generates. Consequently, special attention should be focused on these market segments.

- The trade flows that compete with the all-water alternative routes are generally captive to the Canal route and at current toll levels bring substantial benefits to the Canal's users. If the ACP were to consider a tolls policy based on price differentiation, there is significant opportunity for raising tolls for these trades to increase revenues.

- This analysis supports the findings in previous studies and through Canal experience that demand for the Canal is highly inelastic to toll increases in the short term yet, the impacts of such increases on traffic will vary by route. This inelasticity is a function of the inherent cost advantages that the Canal route offers to certain shippers in certain trades. While there clearly are opportunities to raise revenues by increasing tolls, this should be based on further consideration of the implications on various trade flows, as longer term it can lead to a loss of traffic and market share. Any revised pricing strategy should be based on commercial considerations as well as conformance with the Canal Treaty. The ACP should explore pricing changes and toll strategies in conjunction with a broader marketing strategy that builds around alliances and close coordination with partners in the US ports and large shippers and steamship lines that should commit to the growth of the Panama Canal route and the utilization of Post-Panamax size vessels on that route.

Marketing Strategy

The Canal's marketing strategy to attract expanded all-water services should involve the following program elements:

- **Data gathering and market understanding** - Follow up on the insights gained through the interviews conducted as part of this study to gather

information on actual traffic routings, changing shipper requirements and industry trends so as to gain a better understanding of the Canal's increasingly important role in the supply chain that manufacturers and retailers use to move their products;

- **Maximize existing capacity utilization and orchestrate successful transition to Post-Panamax operations** - Work with the steamship line industry to consider how to best use the Canal's limited capacity and further improve the reliability of all-water services until the time that the expansion is completed, and how to assure a successful transition to Post-Panamax vessels from the present Panamax vessel fleet;

- **Promote increased use of Asia – US East Coast all-water services** - Jointly with steamship lines and ports, promote the increased use of all-water services and the Canal route;

- **Monitor competitor initiatives** – Consider appropriate market response to any competitive threats and use the Canal's market position and Panama's strategic location at the crossroads of major trade routes to further increase the Canal's market share of divertible cargo;

- **Consider innovative and commercially sound pricing strategies.** New pricing strategies should include volume discounts, special promotional periods for new services, incentives for bundled rates that result in increased traffic and/or use of Panama ports, and other incentives aimed at attracting increased Canal traffic and increased transshipment in Panama; and

- **Forging alliances with selected key industry partners** – As part of its marketing strategy to assure success of the Canal expansion, the Canal should seek partnerships with selected steamship lines and ports, including:

  i. partnerships with steamship lines and/or alliances that commit to long term Canal services
  ii. alliances with a limited number of US East Coast ports to present a coordinated and attractive "product" to compete with the intermodal system, including coordinating plans for Canal improvements with port improvements that will be necessary to accommodate the Post-Panamax vessels that are increasingly being used in the east-west trades worldwide. The main candidate port for such a port-canal alliance is New York, followed by Norfolk and Savannah.
  iii. agreements with all Panamanian ports that commit to having adequate infrastructure ready by the time of the opening of the Canal expansion to handle the largest vessels that will be able to use the expanded Canal.

Conclusions

The ACP should concentrate its efforts on competing most effectively against the US intermodal system for the Asia – US trades. This effort should include:

- Forging alliances with US East Coast ports to present a coordinated and attractive "product" to compete with the intermodal system, including coordinating plans for Canal improvements with port improvements that will be necessary to accommodate the Post-Panamax vessels that are increasingly being used in the east-west trades worldwide; and

- Continue working closely with shippers, shipping lines and the shipbuilding industry to understand changing shipper logistics and other customer requirements, and assure that the Canal "product" is properly positioned in the competitive market place.

The unfettered demand for the Canal by the liner container shipping market that has been analyzed in this study should be studied in greater depth in conjunction with consideration of capacity constraints, demand for other market segments, alternative pricing strategies and the costs and schedule associated with the Canal expansion program. This will be necessary to develop a unified strategy for undertaking the expansion program and marketing the Canal throughout and beyond this period of transition.

A comprehensive communications program is already underway and should be implemented in close coordination with the Canal's marketing strategy to inform users and industry groups regarding the plans and proposed policies for the future expansion of the Canal and to assure positive reception by the market. The cost and schedule of the expansion, the toll implications of the programmed investments, and the improved capability, service level and reliability of the expanded Canal will be of particular interest to the Canal's users and other stakeholders (steamship lines, shippers, ports, railroads), lending institutions and governments of countries with strategic interest in the Canal, such as the US, China and Latin American countries that rely on the Canal for significant shares of their foreign trade.

CHAPTER I

1. Introduction

Background

This study focuses on one of the most important segments of the shipping market that the Panama Canal serves and is one of six studies of individual market segments the ACP is undertaking to assess the potential overall demand for the Canal. The other five segments (dry bulks, liquid bulks, refrigerated cargo, vehicle carriers and cruise ships) are the subject of other studies. This approach recognizes the unique characteristics of the major market segments and the desirability of employing different analytical tools that best model the variables and decision-making processes that affect the use of the Canal. The results of all of the studies, as well as additional work on pricing and market strategies, will be integrated into an overall market demand study, anticipated to be finalized in mid-2004.

The market segment studies are being carried out at an historic time for the Panama Canal. Since its opening in 1914, the Canal has experienced few physical changes. It is now reaching full throughput capacity for the original locks and operates at close to maximum vessel transit capacity. The recently completed expansion and modernization program eliminated remaining operational bottlenecks, resulting in an increase in vessel throughput. Latest projections anticipate that traffic demand will fill this additional capacity in the near future.

In spite of the operational improvements and capacity increases, the Canal's pre-eminent role has been challenged by other routes featuring intermodal services with faster transit and/or all-water services using increased vessel sizes that provide cost savings due to economies of scale. The competing all-water routes enable the use of increasingly larger vessels that reduce unit shipping costs. The intermodal routes using the inland rail systems from West-Coast ports in the United States are able to offer significant time savings.

Considering that the Canal is close to its capacity, that an increasing number of vessels are being built with dimensions larger than the current Canal locks, and to take advantage of potential new markets, the ACP is studying the possibility of further expanding the Canal's capacity in the near future to allow the transit of larger vessels. The program of studies that includes this study of the liner container shipping segment is intended to provide the needed information to support the decisions to be made on the expansion of the Canal.

Among the different market segments, the liner container shipping segment appears to offer the greatest potential for future growth. Its significance goes beyond its contribution to Canal traffic in that it is the key driver of cargo movement at Panama's

ports. The liner container shipping market is of strategic importance not only to the future of the Panama Canal, but also to the country´s ports and its position as a regional hub.

This study of the demand for Liner Shipping Services through the Canal differs from prior studies in that it is not solely based on historical trends. The study forecasts result from a model based on an analysis of each market segment, the alternatives available to shippers, and various scenarios regarding changes in production, distribution, and logistics that affect the Canal markets. It should be noted, however, that the forecasts are made without any recognition of possible capacity constraints or pricing sensitivities, and should be considered as unfettered demand projections.

Objectives

The objectives of the present study as defined in the Terms of Reference can be summarized as follows:

- Identification of the potential market through the Panama Canal for the liner container shipping segment;

- A cost analysis of the Panama Canal route compared to alternative routes from the perspective of Canal users;

- Recommendation of a marketing strategy that will optimize the use of the Panama Canal and that will best influence the development of Panamanian transshipment operations, allowing that both the waterway and the country become more relevant players for world containerized cargo distribution;

- Determination of traffic flow through the Panama Canal for the liner container shipping, which includes, among other aspects, the analysis and projections of current and future service patterns and the study of intermodal services as significant competitors for the waterway; and

- Identification of the potential container-transshipment volume for the Republic of Panama, congruent with the Canal expansion decision.

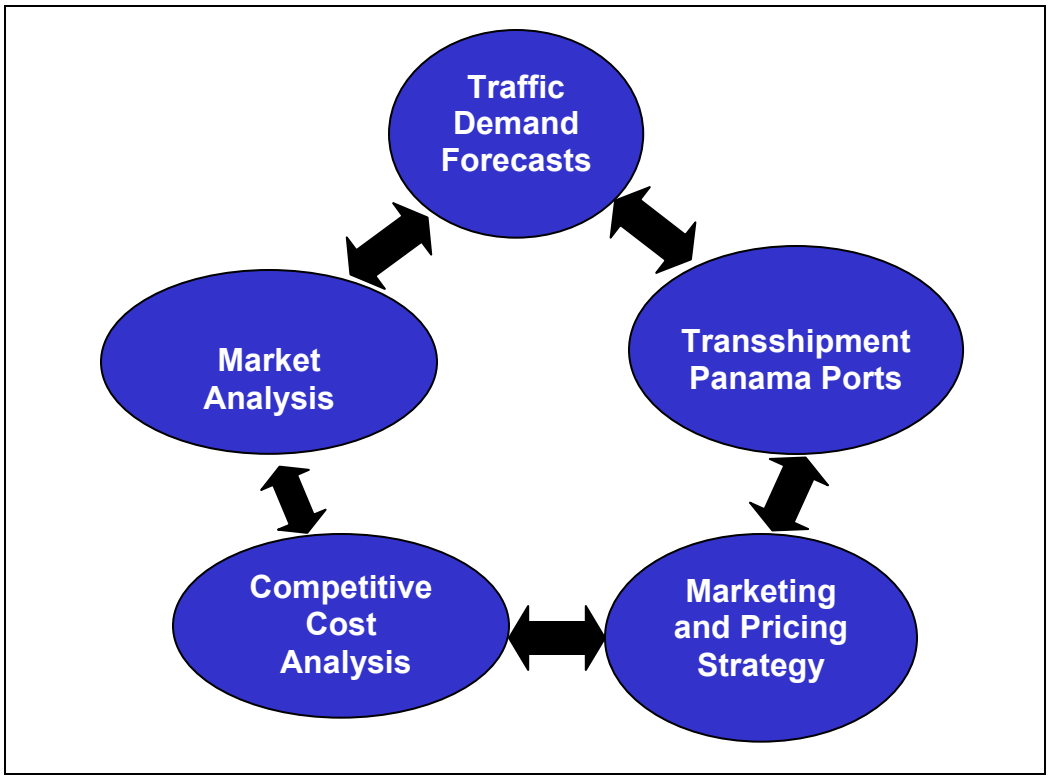
It is important to note that these objectives, and the tasks required to achieve them, are not completely independent of each other. In fact, there is a high degree of interaction among the different areas of study, as characterized by Figure 1-1 below.

Figure 1-1 depicts each of the five major study objectives as an oval. The arrows connecting the objectives represent the relationship among them in a simplified manner. For example, market analysis is required as part of the effort to develop traffic forecasts. Similarly, the market analysis is helpful in analyzing competitive costs or assessing the economic value of the Canal to users, which in turn establishes parameters that influence the amount shippers or shipping lines will be willing to pay to transit the Canal. The competitive cost analysis should be a critical factor in developing marketing and

pricing policies for the Canal. Marketing and pricing strategies and policies will in turn influence the share of the market captured by the Canal for certain segments, which has an impact on traffic forecasts. There is also an obvious analytical connection between the market analysis and marketing strategies for container traffic through the Canal and the potential for container traffic through Panama's ports.

The graphic is intended to simplify and show how the study comprises a number of important interrelated elements which are very complex but is not intended to show every functional relationship. These relationships have been taken into consideration throughout the development of the study.

Figure 1-1: Interaction among study objectives



Report Organization

This report is organized as follows:

This initial Chapter I contains a brief introduction that summarizes the background and objectives of the study.

Chapter II presents the results of the market analysis that has been conducted, with a focus on existing service patterns. It includes a review of current and historical Canal traffic and trade flows, an analysis of competing routes, and present and changing

service patterns. This Chapter also defines the relevant trade routes to the Panama Canal and the relative magnitude of each.

Chapter III covers the analysis of industry trends and factors that affect future changes in market conditions and user requirements. It includes the results of interviews with key industry participants – shipping lines, shippers and ports – and a synthesis of their perspectives and concerns. The range of alternative scenarios that frame the traffic demand forecasts is also addressed in this Chapter. The wide range of exogenous variables that affect demand are combined into a discrete set of scenarios that help to scope out the range of demand forecasts that can be expected in the future.

In Chapter IV, the analytical approach and forecasting methodology for the study are described. This Chapter discusses the models that have been developed and applied for the study.

Chapter V summarizes the results of the forecasting effort, presenting forecasts of Canal traffic and revenue under the range of alternative futures and related scenarios. It includes analysis of the sensitivity of the results to variation in key variables.

Chapter VI addresses the competitive cost analysis, i.e. the economic value of the Canal from the perspective of Canal users.

In Chapter VII, marketing and pricing strategies are discussed, based on the results of other components of the study.

Chapter VIII covers transshipment and rail activity in Panama and the relationship to liner container shipping traffic through the Canal.

Finally, in Chapter IX, the study conclusions are presented.

The main body of the report is by design concise, with the goal of presenting the study's approach, key results and conclusions in a coherent and easy-to-grasp format. Following the report's main text are a series of appendices that provide data and the technical analysis of the various components of the study in greater detail.

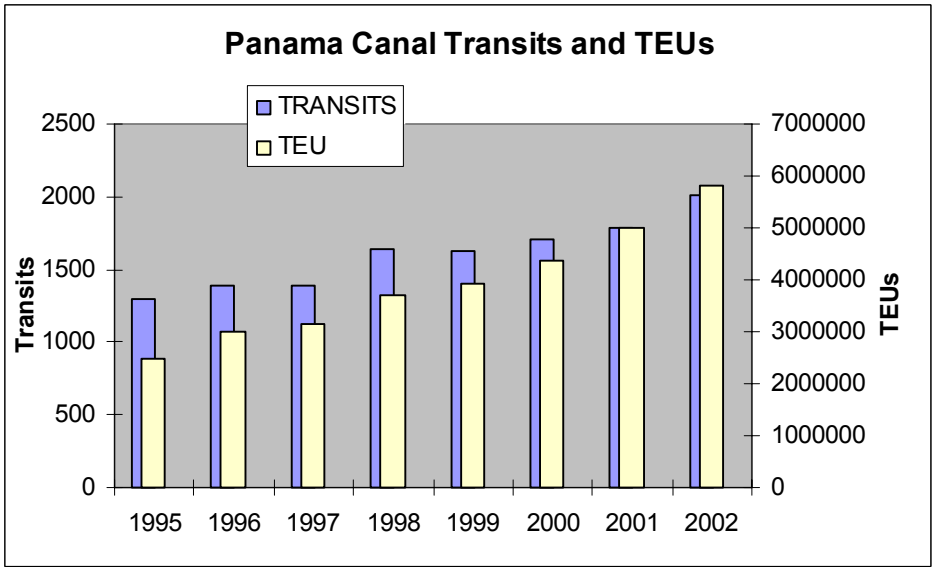
CHAPTER II

2. Market Analysis – Existing Service Patterns

2.1 Panama Canal Traffic and Historical Trade Flows

Container traffic continues to grow as a component of the Panama Canal's business, both in terms of number of vessel transits and in the TEU capacity of the vessels using the Canal. Over the period from 1995 to 2002, ACP data indicates that the number of container vessel transits across the Panama Canal increased at an average annual growth rate of 6.4% while at the same time TEU capacity of these specialized vessels transiting the Canal grew by 12.9% (see Figure 2-1).[1] . Consistent with worldwide trade trends, the liner container shipping segment is likely to experience continuing growth for the foreseeable future.[2]

Figure 2-1: Transits and TEU capacity growth (1995 – 2002)



The containerized cargo moving through the Canal does so primarily along 12 trade routes, with flows between Northeast Asia and the United States being by far the

[1] Historical cargo in TEU transiting the Canal is not available, but TEU capacity is used as an indicator of actual TEU transiting the Canal assuming TEU/vessel remain the same. We believe that the larger increase in transits and TEU since 1998 is the combination of several factors: introduction of new buildings made Panamax vessels available for all-water deployment; growth of alliances created incentives for all such groupings to have at least one all-water service, passage of the Ocean Shipping Reform Act (OSRA) served as a catalyst that allowed all-water pricing to be market-driven; and the increased number of distribution centers by large retailers in the USEC (e.g. Wal-Mart).

[2] Although some containerized cargo is carried on other vessel types, this analysis focuses only on that handled by the liner container vessels.

largest. Table 2-1 illustrates the current composition of the container markets served by the Canal broken down by trade route for the year 2001, the most recent full year for which data was available at the time of this analysis. It is based on data obtained from PIERS container worldwide trade flows and includes cargos that are shipped not only through the Canal route, but by alternative routes as well.

Table 2-1: Relevant Trade Flows and Canal Shares for 2001 ('000s TEU)

Trade Flow				2001 Trade Volume ('000s TEU)			Percent
No.	Origin	Destination	US Region	Total	Relevant	Canal Share	Share
US Based Trade Routes							
1	NE Asia	US	East	2.183	2.183	647	29,7%
			Gulf	807	807	24	3,0%
			West	2.942			
2	SE Asia	US	East	407	407	72	17,8%
			Gulf	151	151	0	0,0%
			West	528			
3	US	Oceania	East	134	134	134	100,0%
			West	36	36	0	0,0%
4	US	NC/EC SA	East	326			
			West	87	87	44	50.0%
5	WC SA	US	East	192	192	192	100,0%
			West	51	51	0	0,0%
6	Europe	US	East	1,790			
			West	476	476	476	100.0%
Non-US Based Trade Routes							
7	WC SA	Caribbean		6	6	6	100,0%
8	NE Asia	EC SA		144	144	0	0,0%
9	Europe	WC SA		169	169	169	100,0%
10	NC/EC SA	WC SA		94	94	47	50,0%
11	Asia	NC SA		42	42	42	100,0%
12	Asia	WC SA[3]		171	171	27	15,6%
Total				10.736	5.150	1.880	36,5%

Note: All figures are one-way, in the dominant direction.

Source: PIERS, ACP data, consultant analysis.
Legend: WC= West Coast; NC= North Coast; EC= East Coast; SA= South America

[3] Based on industry interviews and capacity deployed in the trade route, it is assumed that 30% of the trade from Asia to WCSA is transshipped in Panama. For the cargo transshipped in Panama, it is assumed that Balboa's share is 74% and Colon 26% (specifically in CCT, Evergreen Terminal). These shares are based on the capacity of feeders calling at Balboa and Colon terminals serving WCSA (Maersk and Evergreen feeder services). The cargo that is transshipped in Colon has to transit the Canal twice, once in the eastbound direction on the mainline vessel and then again westbound on the regional feeder. This results in 15.6% of total trade from Asia to WCSA transiting the Canal.

The data represent total one-way cargo between two regions (N.B. empty containers are not included), and uses the convention of assigning an origin and destination to indicate the dominant direction of trade. For example, while trade flow 1 represents all trade between NE Asia and the US, it delineates NE Asia as the origin since the US imports more from this region than it exports. It further subdivides the flows by region within the US, where appropriate, in order to reflect proximity of other points within the US to the three coasts.

Relevant trade is defined as that which might logically be moved through the Canal, even if it actually moves by other routes. The relative competitiveness of the Canal for US shippers or consignees depends on the region within the US to which cargo is destined, or in the case of US exports, from which it originates. For example, a shipment to a facility located close to Pacific ports would not consider the all-water route via the Canal as a viable option, since it is possible to ship faster and cheaper directly to a Pacific port. On the other hand, a facility close to the East Coast will consider the tradeoffs between entering the US on the Pacific side and then shipping by land, or using an Atlantic port with a much shorter land segment, which would involve a routing that includes a Panama Canal crossing. The competitive dynamic will be examined in detail in subsequent Chapters in this report; however, it is important to discuss it briefly in order to characterize the current market for the Canal.

As shown above, the total relevant trade in 2001 was approximately 5.2 million TEU, or slightly less than half of the total of 10.7 million TEU for the twelve segments. The market share of the relevant flows captured by the Canal can then be calculated. For the largest single segment, NE Asia – US, the Canal captured about 30% of trade to the East US region, only 3% to the Gulf region and none of the West region. Other trade flows, such as US East – Oceania, can be considered captive, with the Canal the only route used. The inverse is true on still other routes, with little or none of the flow coming though the Canal. Overall, the Canal captured 36.5% of the total volume of relevant trade in 2001.

It is quite clear from the analysis that US trades dominate the relevant trade flows, accounting for more than 95%, with flows between Asia and the US accounting for over two thirds of the total relevant market.

That same Asia-US cargo comprises approximately 40% of the total Canal volume, as shown below in Table 2-2. Conversely, while the total Europe trade flows with the US and West Coast of South America are a relatively small share of the total relevant market -- just over 12% combined -- they account for over a third of the total Canal volume.

2.2 Competing Routes

2.2.1 Route Options by Trade

Container shipping traffic through the Panama Canal is now and has historically been dominated by a relatively small number of trade flows. For purposes of this study, the

market that is relevant to the Panama Canal has been divided into twelve trade flows, further regionally subdivided as appropriate. The share of the total market for each of these trade flows that is captured by the Panama Canal is a function of many factors, but preeminent among them is the competition the Canal faces from alternatives routes. The alternative routes that are deemed competitive to the Canal vary by trade flow. The geography of the origin-destination pair and the alternative routes that connect them lead to tradeoffs in transport cost, time, and level of service. But it stands to reason that the Canal's competitiveness is directly related to shippers' and shipping lines' perspectives about those tradeoffs.

Table 2-2: Composition of Relevant Trade Flows and Canal Shares for 2001

Trade Flow				2001 Trade Volume (000's TEU)		Composition	
No.	Origin	Destination	US Region	Relevant	Canal Share	Relevant	Canal
US Based Trade Routes							
1	NE Asia	US	East	2.183	647	42,4%	34,4%
			Gulf	807	24	15,7%	1,3%
2	SE Asia	US	East	407	72	7,9%	3,9%
			Gulf	151	0	2,9%	0,0%
3	US	Oceania	East	134	134	2,6%	7,1%
			West	36	0	0,7%	0,0%
4	US	NC/EC SA	West	87	44	1,7%	2,3%
5	WC SA	US	East	192	192	3,7%	10,2%
			West	51	0	1,0%	0,0%
6	Europe	US	West	476	476	9,2%	25,3%
Non-US Based Trade Routes							
7	WC SA	Caribbean		6	6	0,1%	0,3%
8	NE Asia	EC SA		144	0	2,8%	0,0%
9	Europe	WC SA		169	169	3,3%	9,0%
10	NC/EC SA	WC SA		94	47	1,8%	2,5%
11	Asia	NC SA		42	42	0,8%	2,2%
12	Asia	WC SA		171	27	3,3%	1,4%
Total				5.150	1.880	100,0%	100,0%

Note: All figures are one-way, in the dominant direction.

Source: PIERS, ACP data, consultant analysis.
Legend: WC= West Coast; NC= North Coast; EC= East Coast; SA= South America.

The major route alternatives to the Panama Canal can be classified as follows:

- All-water Routes (AW)
    - via the Suez Canal
    - around Cape Horn
    - around the Cape of Good Hope
    - Pacific direct
- Intermodal Routes (IM)
    - From Asia to the West Coast of the US connecting to the US Rail System

Figure 2-2 graphically illustrates the routes available for cargo relevant to the Canal, while Table 2-3 lists the route options for each of the twelve major trade flows.

Figure 2-2 Relevant Panama Canal and Alternative Trade Routes

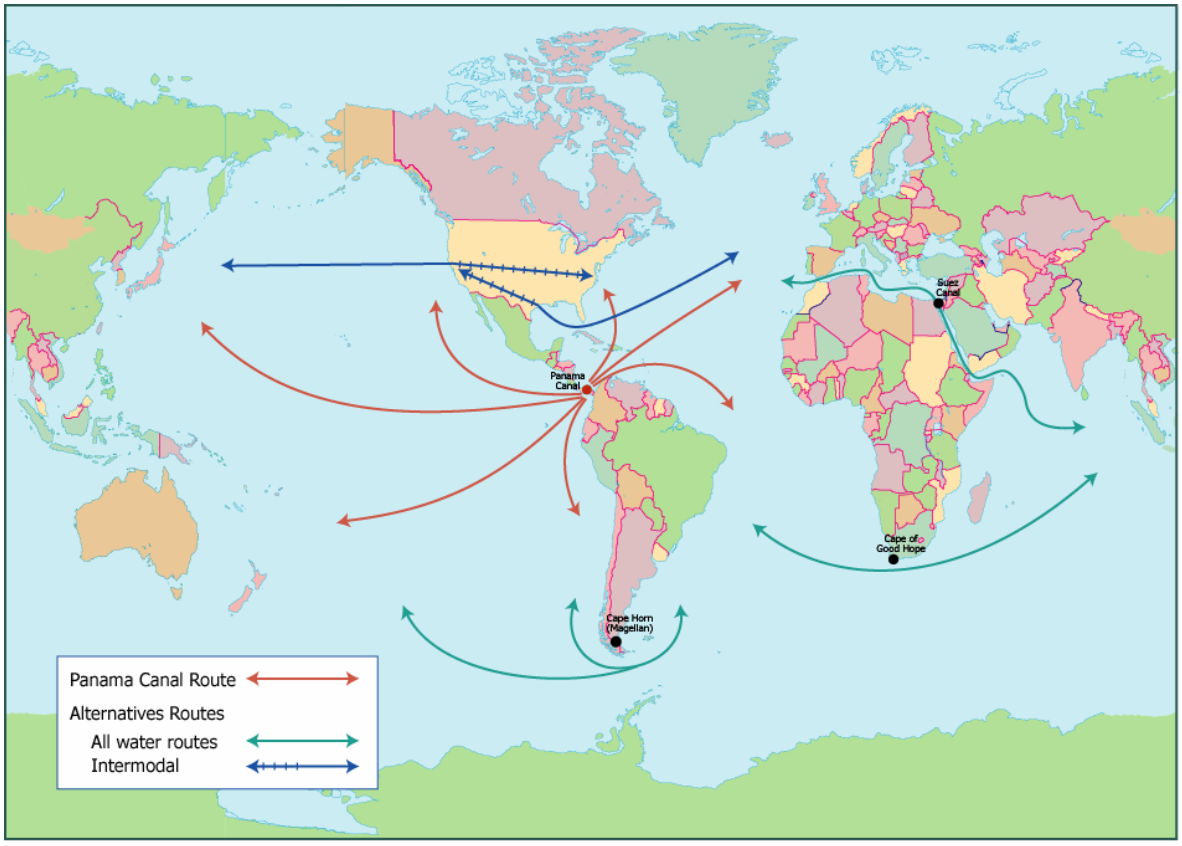


Table 2-3: Route Choices for Relevant Trade Flows

Trade	US Region	Relevant to Canal	Route Choices
US Based Trade Routes			
1. NE Asia – US	East Coast	Yes	AW / IM / Suez
	Gulf Coast	Yes	AW / IM / Suez
	West Coast	No	
2. SE Asia – US	East Coast	Yes	AW / IM / Suez
	Gulf Coast	Yes	AW / IM / Suez
	West Coast	No	
3. USA - Oceania	East Coast	Yes	Canal only
	West Coast	Yes	Direct / Trans-shipment
4. USA - NC/EC SA	West Coast	Yes	AW / IM
	East Coast	No	
5. WC SA – USA	East Coast	Yes	Canal only
	West Coast	Yes	Direct / Trans-shipment
6. Europe – USA	West Coast	Yes	AW / IM
	East Coast	No	
Non-US Based Trade Routes			
7. WC SA	Caribbean	Yes	Canal only
8. NE Asia	EC SA	Yes	Canal / Cape of Good Hope
9. Europe	WC SA	Yes	Canal only
10. NC/EC SA	WC SA	Yes	Canal / Cape Horn
11. Asia	NC SA	Yes	Canal only
12. Asia	WC SA	Yes	Direct / Trans-shipment

Note: AW: All-water route through Panama Canal; IM: Intermodal route.

2.2.2 Captive and Divertible Traffic

The route options identified for each of the twelve trades represent varying degrees of competition to the Panama Canal. In Table 2-4, the relevant trades are categorized according to whether they are considered to be *captive* to the Panama Canal, meaning there is no reasonable alternative to the Canal route, or *divertible*, meaning the Canal route must actively compete against alternative routes. Categorization of relevant trade flows in this manner is useful to analyze current and future demand and the development of appropriate marketing strategies and tactics to capture the highest possible share of potential future demand.

Table 2-4: Captive and Divertible Trade

Trade (Origin – Destination)	US Region	Relevant to Canal	Divertible, Captive or Not Relevant
US Trade Flows			
1. NE Asia – US	East, Gulf	Yes	Divertible
	West	No	Not Relevant
2. SE Asia – US	East, Gulf	Yes	Divertible
	West	No	Not Relevant
3. USA - Oceania	East	Yes	Captive
	Wes	Yes	Divertible
4. USA - NC/EC SA	West	Yes	Divertible
	East	No	Not Relevant
5. WC SA – USA	East	Yes	Captive
	West	Yes	Divertible
6. Europe – USA	Wes	Yes	Divertible
	East	No	Not Relevant
Latin America Trade Flows			
7. WC SA	Caribbean	Yes	Captive
8. NE Asia	EC SA	Yes	Divertible
9. Europe	WC SA	Yes	Captive
10. NC/EC SA	WC SA	Yes	Divertible
11. Asia	NC SA	Yes	Captive
12. Asia	WC SA	Yes	Divertible

Among the twelve relevant trade flows, three South American based are deemed to be captive to the Panama Canal: West Coast of South America to the Caribbean, Europe to the West Coast of South America and Asia to the North Coast of South America. Trade between both coasts of South America and trade destined for South America from Asia represents flows which could be diverted to the Canal route from competing, predominantly all-water services. Interestingly, the seemingly least logical move, from Asia to the West Coast of South America through the Canal, is competitive not because of any true route advantage, but because of transshipment through ports in the Caribbean side of Panama.

The remaining six trades include the US as either an origin or destination, with the region within the US a key factor in determining the competitiveness of route options that involve a Canal crossing. These six trade flows have accordingly been subcategorized by US region.

The most significant trade segment, measured in terms of total volume currently transiting the Canal, is NE Asia to the US, specifically to the East Coast.[4] The Canal share of the relevant trade flows in 2001 was just under 30%, but the volume of 647,000 TEU was the largest single segment of the Canal's container traffic. Similarly, SE Asia to US trade captures over 17% of the East region trade, but with volumes of only 72,000 TEU. For both of these flows, the prime competitors to the Canal route are the intermodal routes, combining Pacific shipping routes with rail service inland from West Coast US ports.

The US intermodal system also is the prime competitor for the second largest flows through the Canal, that between Europe and the US, which at 476,000 TEU represented 25.3 percent of total volume in 2001. While trade to East Coast destinations is not relevant, the Canal competes with the intermodal routes for West Coast trade. The Canal captured 100% of the US West region trade in 2001, and 21% of total Europe trade to all of the US.

The US – Oceania trade is divided among captive and divertible flows, depending on the origin/destination region within the US; flows to and from the East Coast are captive to the Canal, while those to and from the West Coast have the choice of a direct all-water route or transshipment through Panama or Caribbean ports. Additionally, transshipment allows the Canal to compete for trade between the West Coasts of the US and South America against the direct all-water route, augmenting the captive flows to and from the East Coast of the US. Flows from the West Coast of the US destined for the North and East Coast of South America move either through the Canal or intermodally.

2.3 The US Intermodal System

This analysis of trade flows clearly points out that the most important competitor to the Canal is the US intermodal system.

2.3.1 Railroads and Containerization

Modern containerization was "invented" in 1956 by Malcolm McLean, whose company became SeaLand. Container service expanded over the next ten years from the United States to and from Alaska, Hawaii, Europe and Asia.

Container movement by rail followed. A North American "land-bridge" was explored in the 1970s as a means to serve Asia-Europe when the Suez Canal was closed -- with trans-Pacific and trans-Atlantic vessels joined by a trans-continental rail movement. It was never economically viable, and the reopening of the Suez Canal mooted the idea. Mini-land-bridge service used substituted rail linehaul to a port destination (i.e., Houston served over Long Beach). Movement to inland terminals ("micro-landbridge") became

[4] In 2001, the Canal attracted 1.3% of the NE Asia - US trade flow with origin/destination near the Gulf Coast, but new services have been started since, and there is potential for increased market share in the future.

more common and eventually door-delivery (IPI -- inland point intermodal) became the norm. Rail was also attractive because of liberal (i.e. free) internal repositioning of empty containers for export reloading

Rail intermodal traffic was deregulated in 1976. All rail traffic was deregulated in 1979 and ocean shipping was partially deregulated in 1984. The Plaza Accords of 1985 set off an import boom in the US at the same time that railroads were looking for ways to grow business volume. International traffic was very attractive because it was growing rapidly and its service requirements generally fit rail transit.

Double-stack trains accelerated rail movement of containers. In 1978, Sea-Land and the SP developed double-stack cars to serve LA and Houston, but it was APL's widespread deployment in 1984-1986 that made doublestack mainstream. Beyond technology, APL revolutionized inland transportation by their recognition that imports were predominantly eastbound while domestic traffic was overwhelmingly westbound. Rather than move empties westbound, they could be filled with domestic cargo. The widespread introduction of double-stack rail services in the mid-1980's accelerated with the introduction of Post-Panamax vessels in the late 1980's. Many lines followed APL's example and discontinued their all-water service to totally commit to intermodal.

By the early 1990s, the all-water route looked positively threatened, and east coast ports were considering how to attract Suez services. Some lines (e.g., Mitsui O.S.K.) maintained their services more out of historical tradition than pure economics. However, by the mid 1990s, all-water service began to be reconsidered. Before the passage of the Ocean Shipping Reform Act (OSRA) in 1998, liner pricing had almost no price-service differentiation. There was no discount for all-water, nor premium for intermodal. Cargo moving over the US west coast from Asia with 16-day transit time maintained a similar price as all-water cargo with a 30-day transit between the same origin and destination. OSRA boosted the all-water routing option because it introduced confidentiality into the dealings between lines and customers. All-water is now a rate/service alternative to intermodal.

As the services have matured and customers have gained in sophistication, their use of intermodal has been segmented accordingly along customer-specific and/or shipment-specific lines. Today, most import intermodal traffic tends to be higher-value, time-sensitive traffic that can justify higher rate levels. Lower-value, less time-sensitive traffic moves in all-water service across the Panama Canal.

2.3.2 Growth of Domestic Containerization and Transloading

With international traffic serving as critical mass, domestic containerization began to grow. By the late 1980s, 48-foot, then 53-foot and 57-foot domestic containers were being introduced. Containers are now the predominant form of rail intermodal because of the significant linehaul cost economics of double-stack. The traffic balance has remained unchanged -- eastbound is international and westbound is domestic.

Ocean transportation has historically been a transload operation. Break-bulk ensured that cargo was rehandled at least at origin and destination. Containerization changed that. As containers grew in size, source loading in Asia was not always possible. Port consolidation terminals developed to load containers. This was especially true in Hong Kong where lines like APL (ACS) SeaLand (Buyers) and Maersk (Mercantile) developed subsidiaries to perform this work.

Through the mid 1990s, port and inland distribution in China was not sufficiently robust, so freight continued to flow through Hong Kong. Cargo was sorted for the ultimate inland destination, solid containers were loaded, and containers moved intact through west coast ports, onto trains, to their intended destination. Direct vessel calls from Hong Kong to San Pedro reduced ocean transit to 12 days. Rail service required an additional 5 days, so the total transit time from Hong Kong to New York was 17 days. Once emptied, the container could be reloaded with westbound domestic traffic. Once devanned on the west coast, the empty would be loaded with export cargo – or just returned empty.

There was more standing in the way of US transloading besides equipment logistics. West coast port rates were the basis for all conference pricing – and were thus kept artificially high. That is why – when measured against west coast rates -- intermodal marginal revenue was always less than the marginal [rail] cost for steamship lines. It was impossible to put together a competitive transloading price and service package prior to OSRA's confidential contracting. By then, South China factories were manufacturing in sufficient volume to load without intervening consolidation – and China had developed ports that could handle direct Trans-Pacific vessels. By transloading in the US, pipeline inventory could be reduced by deferring routing decisions – which reduced safety stock requirements – and inventory carrying costs. Lines could retain their equipment on the west coast and eliminate intermodal headaches. Newer entrants such as TPL and Wan Hai found this very successful as a niche strategy.

Because southern California domestic traffic is inbound imbalanced, carriers are looking for outbound cargo. Distribution facilities that handle imports have become a major source of this traffic. As 53-foot containers became the domestic standard, the eastbound import traffic balanced the westbound domestic nicely. It is now estimated that cost per-cubic meter of cargo delivered by transloading is now less than direct intermodal in many markets.

2.3.3 The North American International Intermodal System Today

The North American rail network for international traffic is a composite of the individual rail systems as well as being tied to the development of the west coast ports.

<u>San Pedro Bay Ports</u>

A generation ago, Oakland was the predominant west coast port; however, its preeminent position has been replaced by the San Pedro ports of Los Angeles and

Long Beach that offered lines large tracts of land to build dedicated terminals. In turn, the lines guaranteed large volumes of cargo – including most of their discretionary (i.e., intermodal) cargo. The need for such large terminals was driven by the lines' desire to utilize larger vessels and develop on-dock rail.

The LA Basin also contains the major population center on the US West Coast that absorbs great amounts of local import cargo. It is also a producer of waste paper – the major export commodity by weight. Because three railroads served this market (UP, SP and ATSF) there was much greater competition for intermodal business than in the other port markets – which only had two railroads competing. The SP was also a notorious price leader. The rail route from LA to Chicago is shorter, less steep and is much less single-tracked than the other corridors. All of these factors make it easier to run intermodal trains.

San Pedro has several rail capacity issues. While UP has three routes from LA to Chicago, BNSF only has one – and there is a definite capacity threshold. The Alameda Corridor eliminated grade crossings for the connection between the downtown rail yards and the port terminals, but there remain capacity problems. Because traffic is not evenly distributed through the week, there are peak periods that can cause congestion concerns. Bunching of vessel arrivals over the weekend can exacerbate this problem.

Other West Coast Ports

Although the percentage of US imports handled through west coast ports has remained fairly steady over the past two decades, the San Pedro share has grown to almost two-thirds of the US west coast share. As a result, even though the total market has been increasing, the market share of other ports has been coming down.

Oakland, the market leader a generation ago was unable to grow due, primarily, to lack of land. Given the requirements for a first-port-of-call Panamax vessel in terms of berth, terminal space, cranes and the like, Oakland is unlikely to become an alternative to San Pedro, and has become mainly a port for local cargo. A large reason is the export of perishable commodities. Fruits and vegetables are grown locally and chilled meat is trucked in from the Midwest. From an intermodal perspective, Oakland is further from Chicago (as measured by rail miles) and has more sections with steeper grades.[5]
In the Pacific Northwest, Seattle and Tacoma have a long history of trans-Pacific trade. However, Seattle is space constrained like Oakland.[6] Tacoma has available land and has used it to attract lines to dedicated facilities. PNW ports grew around two imbalanced trades. Import cargo was at least 80% intermodal – the local markets are

[5] Oakland has an interesting historical highlight. In the late 1980s, when Oakland still was competing for intermodal business, it realized that it was at a competitive disadvantage because stack trains could not carry two high cube containers through the Sierras. A three-way agreement was reached between the Port of Oakland, Union Pacific and APL to finance the tunnel improvements. The work was completed, but Oakland continued to lose market share – although domestic containerization grew in the Bay area.

[6] It is located near the downtown area with many competing claims on use of real estate.

very small. However, the export market was 80% local – mainly forest products and agricultural exports. This imbalance required moving empty containers back to the area for local vanning. As the dollar increases in strength, these exports decline.

Chicago

When more than one railroad is involved, it is necessary to interchange this traffic. Whereas rail carload traffic can only be interchanged by terminal switching, this method ("steel-wheel" interchange) is not always the norm for intermodal traffic. Very often, intermodal traffic arriving at the destination terminal of the first railroad is unloaded, trucked to the next railroad, and reloaded for further movement. While there are a number of other connection points or gateways (i.e., Kansas City, St. Louis, Memphis, New Orleans, Birmingham, Dallas), Chicago is the major one. In fact, it is estimated that Chicago is the third largest "port" in the world since over 11 million annual TEU transit through its terminals. Moving traffic through Chicago is a real challenge. Terminal capacity is limited and the two newest terminals were built 70-80 miles west of the city.

Chicago is the natural rail gateway to the Northeast -- and many locations in the Southeast too. Most international traffic in Chicago is merely transiting between railroads. Currently a $1.2 billion plan is under consideration to significantly improve intermodal rail connections in the Chicago area, which would reduce transit time and costs for intercontinental rail traffic. Should a trans-continental railroad be formed by merger, a second would likely follow shortly thereafter, and intermodal traffic would be a major driver,[7] and railroads would seek to run coast-to-coast trains that bypassed Chicago.

East Coast Railroads

Today there are two railroads east of Chicago. The CSX and NS purchase of Conrail accomplished two things. First, the $10 billion transaction caused severe financial strain on the acquirers. That is why some observers believe that US trans-continental railroads are inevitable. Second, it largely degraded service to and from New York.[8] Both railroads expected the merger to generate increased intermodal traffic, however, that growth has been slow to develop. Whereas railroads carry about 80% of inland traffic from west coast ports, that figure is only about 35% from east coast ports.

Canada

Canada has become an active corridor in container trade. The Ports of Halifax and Montreal have always been competitive threats for Atlantic cargo moving to the Midwest. The Port of Vancouver has become an equal threat from the west coast as Canadian railroads offered competitive rate and service packages to Chicago. The

[7] Intermodal and automotive are really the only transcontinental rail markets.
[8] Conrail had three possible routes from New York to Chicago, but NS and CSX have only two. This reduction in redundancy impacts reliability and operational cost.

weakness of the Canadian dollar, questions about the US Harbor Maintenance Fee and the expansion of Vancouver in a four-way partnership between port, terminal and railroads also helped.

It is impossible to categorize CN and CP as only Canadian railroads because they both have extensive US operations. Both compete from Vancouver to Chicago and CN offers a single line transcontinental service from Vancouver into New England (Auburn, Maine.)

Ports and Railroads

There is an interesting dichotomy in the relationship of railroads and ports between the US east and west coast ports. Western railroads have generally treated ports equally. In the early 1980s, the BN (Seattle) and SP (Long Beach) tried to market port generic trains, but the market did not accept the product. Today, there are no favorites played. Rate differentials between ports can be clearly understood by cost-driven factors such as distance, fuel consumption and balance.

Eastern ports developed differently. Railroads and ports tried to jointly induce steamship lines to use specific port/railroad combination. (e.g., Guilford and Boston; Conrail and New York/New Jersey; CP and Philadelphia; CSX and Baltimore; NS and Norfolk, etc.) Some of the most ill-fated initiatives (e.g., Front Royal, VA) came about as a result of these arrangements. The Canadian example is a little different because CN owns the terminal at Halifax and CP views Montreal as its Midwest lifeline. Both CN and CP each own 25% of Delta Port in Vancouver.

Rail consolidation and financial urgency have forced the railroads to abandon these favored arrangements for more equal treatment. The east coast now looks like the west – two railroads serve most ports. It does not appear that the ports understand this changed dynamic and they continue to unsuccessfully seek some form of advantage from the railroads – which refuse to cannibalize revenue they will ultimately get – regardless of port.

International Intermodal and Labor

In October 2002, the west coast ports were shut down as a result of labor deadlock between labor (ILWU) and management (PMA.) Although the shutdown was less than two weeks, it took months to recover. This added uncertainty has caused shippers -- even of high value items -- to reassess their total reliance on intermodal. A balanced portfolio approach, where there is some all-water, seems to be evolving although the long-term impact is unknown.

It is interesting to note the dichotomy between the east and west coast when it comes to organized labor's approach to intermodal. On the west coast, on-dock rail is beset with onerous work rule restrictions. Although the new contract allows the PMA to automate, vessel operations will probably be addressed first.

The west coast labor deadlock is in marked contrast to the east coast, where the ILA has taken the position that intermodal cargo is highly desirable. They have taken steps in certain ports (e.g., New York/New Jersey) to reduce assessments on intermodal cargo.

2.3.4 International Intermodal Rail Capacity Outlook

According to a recent AAR study, intermodal is now the largest rail commodity by revenue. Continued growth is dependent upon adequate capacity. This is a big change from the era of regulation, when the government protected industry and consumers by granting the former a monopoly license and protecting the charges assessed against the latter. This also assured adequate capacity in times of national emergency – as was clearly demonstrated during both world wars.

Following deregulation, the railroads worked very hard to increase demand and reduce supply. Steamship line business was the only rail commodity that was growing rapidly, so it was pursued aggressively. Rates fell and lines continued to grow volume as trade grew. By 1998, things had changed. Railroads finally managed to bring supply and demand into equilibrium. “Free” excess capacity was consumed, and steamship lines found that they could no longer assume that rail rates would keep declining on real dollar terms.

Rail duopolies developed through mergers just as capacity became constrained. Steamship line customer issues (i.e., vessel performance, volume surges, equipment imbalances and terminal dwell of containers and chassis.) that had previously been overlooked became less tolerated. Also, a series of troubled mergers and spot capacity shortages caused service disruptions that caused many steamship lines to reconsider intermodal

Railroads also became increasingly sophisticated about international trade. They came to understand that it wasn’t necessary to “buy” business. Business cycles basically affect all lines the same and it isn’t possible for one railroad to take all the business because they don’t have sufficient capacity. More and more, railroads seem to be presenting a “take it or leave it” approach to steamship lines.

Railroads have not been earning their cost of capital, so they will need to continue to improve their financial performance if they are going to continue to invest in the product. They will seek higher paying intermodal freight from motor carriers and will seek to improve yields on international traffic. Railroads will also change the commercial terms to reduce capacity and cost. (i.e., less free storage, generic chassis pools, etc.).

Steamship lines can’t get out of intermodal entirely because of long-term contracts with the railroads (3-5 years generally) and San Pedro ports (20-25 years) that are an effective barrier to exit. However, it is possible that east coast intermodal destinations will decline as an overall percentage of intermodal movement as all-water becomes more economical.

2.4 Present and Changing Vessel Service Patterns

2.4.1 Definition of Terms

The following terms and concepts are used in the market analysis. Specifically, *trade, service* and *service pattern* are defined as follows in this study.

- A *trade* is defined as the flow of cargo (measured in TEU/year) between two world regions. The study concentrates on the twelve relevant trades previously identified that are either already using the Canal or may do so in the future. The trades are carried by various shipping line services.

- Liner *service* is defined as a string of ships, usually of similar capacity and speed, following the same route or rotation, which means that they call at a series of ports in the same order and at the same, fixed frequency.[9] A service's *rotation time* is simply the time required for a ship to complete a full rotation (round-trip voyage), arriving again at its initial port of departure. *Transit time* is the time between two ports of call on the ships' rotation. Most services have fixed day of the week frequency, so vessel rotations are usually a multiple of 7 days and the number of vessels required is the number of weeks in the rotation.

- A *service pattern* is defined as a specific type of route (or rotation). Each service has its own name, often based on three letters denoting the trades served by this service. It should be noted that the same ports could be served by several service patterns, each following a different route. Likewise, a service pattern can either serve a single trade flow or several trade flows, in which case it is defined as a *multi-trade service*.

2.4.2 Current Asia – US Service Patterns

As previously noted, the Asia – US trades have been steadily growing over the past seven years, to a point where they now collectively account for over 40% of total container traffic through the Canal, and give every evidence of continuing to grow in both overall volume and as a proportional share of traffic. While this trade is served by many specific service patterns, four generic service patterns have been identified for analytical purposes. They are defined as follows:

- ***TPD*** – Transpacific Direct, a rotation that includes direct calls in ports in NE Asia[10] and USWC (may also include Canada, Mexico, and/or South America).

[9] With the creation of alliances in the past decade, not all vessels on a liner service may be operated by a single line – although they usually are.
[10] Sometimes TPD also combines ports in South East Asia, mainly Singapore and Laem Chabang.

- ***AW*** – All-water, a cross-Panama rotation that includes direct calls in ports in NE Asia and USEC, with or without an intermediate call in the USWC. A service that avoids calling USWC is defined as "express".
- ***Pendulum*** – The combination of two loops at a common point, can include all-water services, For example, the Asia-US-Europe Pendulum includes an AW route from Asia to USEC that combines with a Transatlantic service, continuing from the USEC to North Europe; another version is a combination of an AW service from Asia that continues to the Mediterranean instead of North Europe; and a third version would be Europe-Asia-USEC, which would involve a combination of Europe-Asia service (through Suez) that continues with an AW service through Panama to the USEC.
- ***SZ*** – A Suez transit that includes direct calls in ports in SE Asia and USEC, with an intermediate call in the Mediterranean. A service that avoids calling Mediterranean ports is defined as "express."

It is worth noting that the four generic service patterns identified include two that imply a Panama Canal crossing (the AW and the different types of Pendulum services) and two that avoid the Canal (TPD and SZ).

2.4.2.1 Service Pattern Variations and Combinations

While the four service patterns have been defined as generic, each has several variations, mainly related to specific regional ports of call and the order in which they are called, with special importance placed on the First In and Last Out. In fact, except for a rare occasion, there are no two identical services. The only noteworthy variations relate to the TPD. This pattern has three variations in terms of USWC destination: (a) PSW – Pacific Southwest, calling only at California ports; (b) PNW – Pacific Northwest, calling only Washington, Oregon and Vancouver BC ports; and (c) a combination PSW-PNW.

Another kind of variation is based on creating service patterns by combining two of the above generic patterns. These, for example, could include a TPD with either an Asia – Europe; or with a SZ. The latter is a unique service pattern that calls the two coasts of United States, completing almost a round-the-world (RTW) route. The TPD + SZX pattern is in use now only by one group, the Grand Alliance, which operates fifteen 3,900 TEU ships on express routes linking Europe, the US and Asia. The "full" round-the-world rotation would combine all the three major east / west trades, and has all but disappeared, following the decision of Evergreen to terminate their eastbound and westbound loops. Still there is at least one "quasi" RTW rotation, focusing on Oceania, created by Hapag-Lloyd, CMA/CGM, Hamburg Sud, Marfret and PON, and consists of an eastbound loop of ten 4,100 TEU vessels and a westbound loop of twelve 2,200 TEU ships.

2.4.2.2 Asia – US Service Pattern Distribution

As of May 2002, there were at least 59 fixed-day services that handled the NE Asia – US trade. Hong Kong to Long Beach / Los Angeles and Hong Kong to New York are the pivotal links for this trade today and have been assumed to retain this dominance in the future.

As of May 2002, the port pair Hong Kong – Long Beach was served directly by at least 33 weekly services, or more than four per day; the fastest transit time between the two was 11 days, the typical average 13. The Hong Kong – New York pair is served by 12 direct services; the fastest is 25 days and the more typical is 27 days.

The shortest Asia – US crossing time is 8 days, between the Japanese ports and the US Pacific Northwest (PNW) ports.

A summary of the Asia-North America services as of May 2002 is presented in Table 2-5, which aggregates services by pattern, alliance or line grouping, and then divides them into cross-Panama and non-Panama service patterns.[11] Sixteen services out of the total of 59 include a routing through the Panama Canal.[12]

Table 2-5: Summary of all Asia-North America Services by Pattern (May 2002)

	Pacific						*Atlantic*	
	Non-Panama		*Cross-Panama*					
Alliance / Line	**TPD**	**TPD+Eur**	**AW**	**AWX**	**Pend-Pan**	**Pend-Med**	**SZX**	**Total**
United	3	1		1	1			6
CKY	6	1		1				8
Grand	6			2	1		1	10
MSL	3		1		1			5
New World	8	1		2	1			12
Evergreen	4	1		1	1			7
Zim		1				1		2
CMA / China Shipping	1	1		1				3
MSC			1					1
Others	5							5
Total	**36**	**6**	**2**	**8**	**5**	**1**	**1**	**59**
Grand Total	**42**		**16**				**1**	

TPD = Transpacific Direct; TPD+EUR = TPD linked to Asia/Europe (called also USWC-Asia-Eur Pendulum by the industry).
AW = All Water (USWC+USEC); AWX = All Water Express (USEC only).
SuezX = Suez Express

[11] This table summarizes major services but it does not include other relatively minor services. It is a snapshot of services as of May 2002.
[12] Since May 2002, other all-water services have been added.

2.5 Current Vessel Technology and Trends

2.5.1 Background

A brief overview of the history and current situation regarding vessel technology and fleet deployment, along with future forecasts and vessels on order, is presented here as part of the characterization of current market conditions.

2.5.2 Panamax Ships

Since its modest beginning in 1956, the containership has undergone tremendous changes in both configuration and size. The specialized configuration of the containership, defined as Fully Cellular Containership (FCC), was first introduced in the mid 1960s. FCC is based on flash-open hatches with holding cells and flat hatchcovers with lashing bridges; most vessels are gearless. FCC usually carries about half of its containers inside hatches and the rest above deck. While the size of the containership has increased dramatically, its basic configuration has remained unchanged.

The rate of growth in overall vessel size has been quite impressive: 1,700 TEU in 1965; 2,300 TEU in 1975; 3,200 in 1985, and 4,500 TEU in 1986. The 4,500-TEU Econoships are considered the first so-called genuine Panamax. Their dimensions, 294 x 32.2 x 12 m (LOA x Beam x Draft), tightly match the existing Panama locks dimensions. These locks pose two important limitations on ship size: beam and draft. In terms of beam, the maximum number of rows of containers that can be stacked across deck is 13 (13-wide). In terms of draft, the maximum is 12.04 m., usually with a pattern of 8 rows of containers below deck and 5 above, or altogether 13 rows. However, the Canal has no air draft limitation, so this number can be increased, assuming sufficient ship stability.[13] Altogether, the so-called basic *arrangement* of a Panamax is 8 – 5 – 13 rows, under – above – across deck.

2.5.3 Early Post-Panamax

Because of the importance of the Canal to liner shipping, lines operating containerships refrained for many years from building larger, Post-Panamax containerships. At the same time, Post-Panamax vessels were introduced in other, non-liner trades, notably liquid bulk.

The Panamax barrier was eventually shattered in the 1980's, with the rise of the US Intermodal route. During the prior decade, APL had eliminated all-water services across the Canal to the US East Coast and decided instead to serve the entire Asia/US trade through the USWC. In the mid-1980's APL, initiated their own double stack rail intermodal services. It followed this decision with the introduction of the first Post-Panamax containership in 1988. APL constructed 5 ships of the C-10 series, sufficient to establish a Transpacific Direct service, with dimensions of 275 x 39.4 x 12.5 m and

[13] Draft has not been as important a restriction as beam. The maximum length overall is approximately 294.13 m.

nominal capacity of 4,340 TEU (54,665 dwt). Interestingly, these early Post-Panamax had the same draft and overall capacity as Panamax. The main changes were the wider beam, allowing for a 15-wide vs. 13-wide arrangement, and shorter length, 275 vs. 294 m.

The deployment of shorter and wider Post-Panamax was intended to eliminate a major flaw in Panamax design, namely instability. Panama's original lock dimensions were defined according to the US inland system, which is geared to handle articulated tows of flat-bottom barges, designed for sailing in protected waters. Hence, the LOA / beam ratio of Panamax, a common ratio for measuring the slenderness of hulls, is over 9 vs. the more economically desirable 6.5. Slender ships have smaller hydrodynamic resistance, but they are inherently unstable. Indeed, for the purpose of stability, Panamax has to carry 5,000 tons or even more of ballast water. Likewise, the relatively narrow beam creates problems in terms of ships' stowage plans, mandating excessive segregation of containers by weight. For these reasons, Panamax are widely considered as economically inefficient ships. Hence, the tendency to go Post-Panamax is not only due to the natural economies that may come with size, but also because of the desire to avoid inherent design problems of Panamax.

Once APL shattered the psychological barrier of Panamax, other lines followed. The next early Post-Panamax ships were built in 1991 by CGM (now part of CMA / CGM), with 4,688 TEU, followed, in 1992, by Hyundai's 4,411 TEU and MSC's 4,469 TEU. All were 15-wide, 275 x 37 x 14 m and 62,000 dwt.

Early Post-Panamax ships had a similar capacity or were slightly larger than Panamax. This suggests that their introduction was not driven by a desire to increase capacity but to overcome the inefficiency of Panamax vessels.

2.5.4 Recent Post-Panamax

The next notable development of Post-Panamax ships came in 1996, when Maersk, now Maersk-Sealand (MSL), introduced its 17-wide K-class ships with the dimensions of 318 x 42.8 x 14 m and capacity of 6,418 TEU (84,900 dwt).[14] In parallel APL introduced its 16-wide C-11 class, with 276 x 40 x 14 m, 4,832 TEU (66,520 dwt).

MSL's K-class design was later extended with the addition of two mid-ship bays, and its name changed to S-class, with 347 x 42.8 x 14.5 m, 7,060 TEU (104,696 dwt). MSL has 19 S-class ships, with the total expected to reach 25 in the near future. By then, MSL's fleet of Post-Panamax will be about the size held by all other lines combined. In parallel, P&O Nedlloyd (PON) introduced its equivalent to the K-class but with a shorter design, with 299 x 42.8 x 14 m and 6,690 TEU (88,669 dwt), of which eight ships have

[14] Maersk's original 1993 announcement was for a series of 4,800 TEU ships, increasing it later to 5,500 TEU and upon inauguration in 1996 to 6,000 TEU. The actual capacity of these ships depends on the cargo composition, empty/full ratio, and may reach up to 7,000 TEU. Likewise, the S-class capacity may reach 8,000 TEU.

been built thus far; subsequently, MSC ordered eight 6,750 TEU Maxi-class and Evergreen eight 6,700-TEU E-type.

Construction of Post-Panamax vessels proceeded rapidly in the late 1990's and early 2000's. Some recent new orders include four 7,500 TEU by Hapag Lloyd, four 7,700 by OOCL, eight 7,700 TEU by PON, and, most recently, five 7,455 by COSCO. These orders suggest that the 17-wide, 7,500-TEU ship is going to be the workhorse of major east / west trade, at least in the near future.

However, it would be unwise to assume a standard from this order pattern. There is a wide range of operating Post-Panamax ships, with even larger ones under discussion, ranging from about 4,400 to 18,000 TEU (See Table 2-6). There is general agreement in the industry that the size of containerships will continue to increase, although there is no agreement as to what will be the largest size. The new Canal locks will become a new Panamax size which will likely be the maximum containership dimensions for some time.

The various sizes of Post-Panamax vessels can be categorized according to the relationship of their width to the Panama Canal's locks. The most restricting dimension of the current locks is their width, equivalent to 13 rows of containers. Accordingly, Post-Panamax ships can be classified along three categories as follows:

- ***Post I*** -- containerships with 14 – 15 rows across deck, typically having a carrying capacity ranging from 4000 to 5,500 TEU. An early example of this type is APL's 15-wide C-10 with 4,340 TEU.

- ***Post II*** -- Containerships with 16 – 18 rows across deck, which typically have a carrying capacity ranging from 6000 to 10,000 TEU. The prime example is the Maersk's S-class, which is similar to that of Hapag Llyod's Hamburg Express and those recently ordered by PON and OOCL, all of which are 17-wide and with capacity of about 7,500 TEU.

- ***Post III*** – Containerships with 19 rows or larger across deck (over 10,000 TEU). No containership of this category is in existence or on order at this time.

Table 2-6: Capacity and Dimensions of Panamax and Post-Panamax Ships

Design	Capacity (TEU)	Dimensions (Length x Beam x Draft m)	Arrangement (rows) Under – Above - Across
Panamax	4,500	294 x 32.3 x 12	8 – 5 – 13
Post I – APL C-10	4,340	275 x 39.4 x 12.5	8-5-15
Post II - MSL S-Class	7,000-8,000	347 x 42.8 x 14.5	9 – 6 – 17
Post II - Samsung	9,200	340 x 45.6 x 14.5	10 - 6 - 18
Post III - MSL "Rumor"	10,500	404 x 51 x 14.5	10 – 6 - 20

2.5.5 Present Fleet and Order Book of Containerships

2.5.5.1 Present Fleet of Containerships

Worldwide, about 13 percent of ships by number and 27 percent of the total liner capacity (TEU) are currently Post-Panamax, with significantly higher percentages among the newer ships (27 and 47 percent, respectively). Table 2-7 presents the composition of the world's fleet of containerships by size and age, based on statistics compiled by Clarkson Research, as of July 2003. Table 2-7 only includes ships with 1,000 or more TEU, assuming this is the minimum size of ships involved in inter-regional trades, which are of interest here.

2.5.5.2 Order Book of Containerships

The order book for new Post-Panamax containerships of over 4000 TEU, as depicted in Table 2-8, reflects a similar fleet composition to that of Table 2-7, indicating sustained growth in the number and size of Post-Panamax ships, reaching more than 75%-85% of the total cargo volume of new ships by 2004-2005, according to Containerization International. For lack of detailed information, the assumption in Table 2-8 is that all ships in the 4,000 – 4,999 TEU category are Panamax, although, there is a recent tendency to construct Post-Panamax vessels with capacity in this range.

Table 2-7: Containership Size and Age Profile (July 2003)

I. Number of Ships

		Age (years)							
	TEU Range	**25+**	**20-24**	**15-19**	**10-14**	**5-9**	**0-4**	**Total**	**Share**
Panamax	1000-1999	46	95	90	133	324	215	903	42.8%
	2000-2999	23	52	72	52	129	162	490	23.2%
	3000-4000+	3	8	67	79	161	129	447	21.2%
	Subtotal	**72**	**155**	**229**	**264**	**614**	**506**	**1,840**	**87.2%**
Post-Panamax	3700+	0	0	5	7	73	186	271	12.8%
Total		**72**	**155**	**234**	**271**	**687**	**692**	**2,111**	100.0%
Post-Panamax Share		0.0%	0.0%	2.1%	2.6%	10.6%	26.9%	12.8%	

II. Number of TEUs (000)

		Age (years)							
	TEU Range	**25+**	**20-24**	**15-19**	**10-14**	**5-9**	**0-4**	**Total**	**Share**
Panamax	1000-1999	63.3	135.1	129.3	179.7	457.7	310.2	1,275.3	22.1%
	2000-2999	55.0	127.0	182.7	134.3	313.5	402.0	1,214.5	21.1%
	3000-4000+	9.3	26.6	231.8	289.4	623.3	525.6	1,706.0	29.6%
	Subtotal	**127.6**	**288.7**	**543.8**	**603.4**	**1,394.5**	**1,237.8**	**4,195.8**	**72.9%**
Post-Panamax	3700+	**0.0**	**0.0**	**21.7**	31.2	394.6	1,115.4	1,562.9	27.1%
Total		**128**	**289**	**566**	**635**	**1,789**	**2,353**	**5,759**	272.8%
Post-Panamax Share		0.0%	0.0%	3.8%	4.9%	22.1%	47.4%	27.1%	

Source: Clarkson Research, manipulated by Berger/NPWI

Table 2-8 Containership Orderbook

		2003		2004		2005	
	TEU Range	No	TEU	No	TEU	No	TEU
Panamax	4000-4999	36	157,850	19	83,507	1	4,370
Post-Panamax	5000-5999	15	83,872	16	87,197	0	0
	6000+	20	133,773	25	181,572	4	31,662
	Subtotal	**71**	**375,495**	**60**	**352,276**	**5**	**36,032**
Post-Panamax Share		49.3%	58.0%	68.3%	76.3%	80.0%	87.9%

Source: Containerization International, March 2003

2.6 Market Analysis Summary

The main conclusions from the analysis of the current service patterns and competitive position of the Canal can be summarized as follows:

1. The Canal competes for liner vessel transits that handle containerized cargo moving along 12 relevant trade flows. Currently, the Canal handles 36.5% of the total relevant flows. US trades represent nearly 85% of the Canal container volumes and the rest is mainly South American cargo
2. The Asia to US East Coast trade is the most significant segment currently transiting the Canal and the most competitive. The Canal competes mainly with the US intermodal system for this cargo trade. The Canal's market share is nearly 30% for NE Asia – US East Coast (which represents close to 35% of total Canal container volume) and nearly 18% for SE Asia – US East Coast flows (close to 4% of total Canal volume).
3. The US intermodal system has grown rapidly in the past 20 years, with import cargo distribution centered along the San Pedro Bay ports of LA and Long Beach, and double stack rail services moving cargo inland and to the East Coast through Chicago. More recently, though transloading of import cargo into domestic containers, intermodal import cargo is taking advantage of the import (mostly outbound) and domestic (mostly inbound) rail cargo imbalance in the LA area.
4. Until the passage of the Ocean Shipping Reform Act (OSRA) in 1998, steamship lines offered no price differentiation between the intermodal and the all-water Canal services to the US East Coast, - no discount for all-water and no premium for intermodal. OSRA introduced confidentiality in the deals between lines and their customers, and since then, all-water service became a rate/service competitor of the intermodal route.
5. Today, higher value import cargo tends to move through the intermodal system and less time sensitive cargo moves mainly through the Canal route.
6. The 2002 west coast labor deadlock has caused shippers -- even of high value items -- to reassess their total reliance on intermodal. A balanced portfolio approach, where there is some all-water, seems to be evolving although the

long-term impact is unknown. The current labor situation in the west coast is in marked contrast to the east coast, where the ILA has taken steps in certain ports (e.g., New York/New Jersey) to reduce assessments on intermodal cargo.

7. There are at least 59 steamship line services that provide transpacific or Canal services between NE Asia and the US East Coast, mainly from Hong Kong to LA or Hong Kong to NY. Increasingly, transpacific services use Post-Panamax vessels. About 24% of total TEU capacity of the worldwide container fleet is Post-Panamax. More than 75% of the container vessel capacity on order is Post-Panamax.

The following Chapter presents recent trends that affect shipper logistic requirements and defines various future scenarios based on the major factors that drive long-term vessel transit demand through the Panama Canal.

CHAPTER III

3. Industry Trends, Understanding Changing Markets/User Requirements and Scenarios

3.1 Industry Interviews

As part of this study, The Louis Berger Group, Inc. assisted the Panama Canal Authority (ACP) in conducting interviews with various industry experts and Canal users, including among them representatives of shippers, steamship lines, ports, logistics companies, and terminal operators. Presented in Appendix A are all the details and findings of each interview, divided by category of industry expert (shippers, steamship lines, ports, and others). Summaries of the findings of the interviews and relative trends can be found in Appendix G for shippers and Appendix F for steamship lines.

In the course of conducting the study, it became apparent that there is a strong interrelation between shipping lines and shippers in defining patterns of liner services, especially over the long term. Although the deployment of liner services is decided by shipping lines, this deployment is a reflection of shippers' requirements and steamship lines pricing. As ACP and the consultant conducted extensive interviews with shipping lines, those executives quite often stated that their future deployment decisions would be determined by analyzing trends in logistics management and by the actual location and number of retailers' distribution centers (DCs). In fact, when it comes to the long-term future, input from shippers themselves is as important as the insight provided by the shipping lines.

Additional information was gained from interviews conducted with operators of the US ports most relevant to Panama Canal traffic, focusing on the US East Coast since they share the Canal objective of attracting additional all-water (AW) Services and expanding the market share of inbound AW cargo from Asia.

3.2 Summary of Perspectives and Concerns

The perspectives and concerns of the various categories of current and potential Canal users as expressed in the interviews are summarized in this section.

3.2.1 Shippers

Extensive interviews were conducted with major shippers, including a mix of manufacturers and retailers involved in trade between East Asia and the US. Of the 30 shippers interviewed (excluding freight forwarding companies), eight were large retailers and the others were involved in production of a variety of products from automobile parts to consumer electronics. Together they accounted for about 1.4 million TEU of cargo or about one quarter of the Asia-US container traffic after excluding empties. While the focus of the interviews was on the routing of the cargo, there was

considerable data collected on the logistics activities of the firms and the structure of their supply chains. This information along with a more detailed analysis of the interviews is presented in Appendix G.

Each of the shippers handled a mix of functional and innovative products.[1] The large retailers handled primarily functional products with relatively long shelf life and predictable demand. The manufacturers of electronics, apparel and footwear produced innovative products with shorter shelf life and less predictable demand. Most of the innovative products were higher value.

The annual volume of imports per shipper average about 50 thousand TEU but varied considerably. Most handle between 10 and 25 thousand TEU from Asia.

About half the manufacturers did not operate factories, but rather outsourced their production to one or more factories. These factories were responsible for producing the products and delivering them to the export port. The manufacturers themselves retained responsibility for design, scheduling production and quality control. Each of the manufacturers had their own distribution networks but a portion of their merchandise was shipped directly to large retail customers.

Not surprisingly, all of the respondents to surveys and interviews mentioned transport cost and time in transit as critical factors in selection of mode of transport. However, a number of other factors were also mentioned. The following discussion examines these other factors.

The choice between the all-water (AW) route and the intermodal (IM) route for merchandise to be sold on the East Coast is often determined by an across-the-board corporate policy rather than by separate policies for groups of products with similar characteristics. These policies are often reviewed or changed in response to specific disruptions in the network. There was no clear correlation between the average value of cargo and choice of route. There appears to be a greater tendency for AW utilization

[1] This distinction is based on Marc Fisher's classification "The first step in devising an effective supply-chain strategy is therefore to consider the nature of the demand for the products one's company supplies. Many aspects are important-for example, product life cycle, demand predictability, product variety, and market standards for lead times and service (the percentage of demand filled from in-stock goods). But I have found that if one classifies products on the basis of their demand patterns, they fall into one of two categories: they are either primarily functional or primarily innovative… Functional products include the staples that people buy in a wide range of retail outlets, such as grocery stores and gas stations. Because such products satisfy basic needs, which don't change over time, they have stable, predictable demand and long life cycles. But their stability invites competition, which often leads to low profit margins…To avoid low margins, many companies introduce innovations in fashion of technology to give customers an additional reason to buy their offerings. Fashion apparels and personal computers are obvious examples…Although innovation can enable a company to achieve high profit margin, the very newness of innovative products makes demands for them unpredictable. In addition their life cycle is short-usually a few months-because imitators erode the competitive advantage. ..The shorter life cycles and the greater variety typical of these products further increase unpredictability" What is the Right Supply Chain for Your Product, Marshall Fisher, Harvard Business Review, March/April 1997.

for lower cost commodities, but there are notable exceptions due to other factors, such as location of Distribution Centers (DC's).

There is a significant distinction between retailers and manufacturers in their choice of route. Several of the large retailers make maximum use of the all-water route, whereas manufacturers generally prefer the intermodal (IM) route. This can be explained in part by the retailer's control of the supply chain from port of loading to retail outlet, whereas the manufacturer generally controls the supply chain only up to his distribution warehouse. Also, the retailers have better information on where and when the merchandise is to be delivered.

Among the major retailers, Wal-mart makes the most extensive use of the AW route, in part because of the nature of its sales and in part because of its own logistics management strategy, products have relatively long shelf life and its retailing plan does not rely on event marketing. A large part of its merchandise is locally sourced. Most of its direct imports are low value, functional products, whereas higher value branded imports are purchased from importers. Wal-mart creatively uses the inventory moving through its distribution system to meet unexpected product demand. It controls its own Distribution Centers and has located them along the eastern seaboard, in close proximity to major ports and its own customers. It is clear that Wal-mart's supply chain is sufficiently integrated to accommodate the longer order cycle time associated with the AW route, and that its information system reliably provides timely and accurate data to all users along the supply chain.

Other large retailers, including K-Mart, J.C. Penney, and Federated Department Stores, rely much more on the IM route than the AW, citing the seasonal nature of their demand, their frequent use of event marketing which requires short turn-around delivery, and their overall concerns with timely delivery, given the higher value and shorter shelf life of their merchandise, as well concerns about the reliability of some of its suppliers. While these concerns are legitimate, they also reflect the less effective logistics and supply chain management practices of these retailers.

Among the big-box stores, both Home Depot and Lowes use the all-water (AW) route extensively for East Coast shipments. The physical characteristics of much of the merchandise sold by these stores, as well as the low value, the functional nature, and the long shelf life of their products make the 20-foot container the ideal shipping mode. Home Depot relies on a third party logistics provider for its port-to-DC movement while Lowes assigns this responsibility to the shipping lines.

Nike uses only the intermodal route because about two-thirds of its shipments go direct to its retailers, and many of its products have short shelf lives or are sold through event marketing. Although Reebok has similar merchandise and marketing strategies, it ships a large portion of its East Coast cargo via the all-water route and expects to increase this percentage as it improves the 'on-time" performance of its suppliers. This decision reflects its corporate policy that costs and improving reliability is of greater concern that reducing the order cycle.

Of the three automobile companies importing parts to the US that were interviewed, Toyota and Honda stated that they do not use the all-water route for shipments to the East Coast whereas Daewoo uses only all-water. Honda ships about 60% of its automobile parts and other merchandise such as lawnmowers to the East Coast. It had used all-water but stopped due to customs delays. Since the West Coast labor lockout, it has been reconsidering that decision but has not made any changes yet. Toyota, which is a strong proponent of just-in-time delivery, imports replacement parts for its Lexus and other high-end vehicles on very tight schedules, precluding the use of AW. Daewoo, on the other hand, also imports mostly replacement parts, but uses the AW route as it does not face the same time pressures as Toyota because of a different supply chain management philosophy.

CVS, a major retailer of pharmaceuticals and functional merchandise, transports about half of its East Coast cargo via the all-water route. Presumably this split reflects the value and time-sensitivity of the goods being imported. In contrast, Avon, a manufacturer and retailer of cosmetics, uses only the intermodal route based on the time-sensitive nature of its products and distribution network. Conair, which manufactures cosmetics and appliances uses intermodal exclusively for shipment to its US East Coast DC, from where the products are shipped to retailers.

This sampling of the perspectives reflects the diversity of factors that affect shippers' decisions on route choice. Many shippers within the same industries make different route choice decisions based on factors such as the location of their distribution centers, the value of merchandise, manufacturing practices and other decision-making idiosyncrasies. And even though transport time and cost are the factors most often mentioned, each shipper's perspective of the relative importance of each of these factors, and their view as to how different product lines are affected by each factor, can be significantly different.

Trends in Logistics

A significant portion of the future container traffic that would use the Panama Canal comprises imports of consumer intermediate goods from East Asia and, to a lesser extent, South Asia that are destined for the East Coast of the United States. Second in importance, but with declining market share, are goods from Europe for the U.S. West Coast. Both are susceptible to diversion to the IM route, which is faster by 3 to 8 days but more costly by $200 to $900 per TEU. In order to understand how these routing decisions will be made in the future, it is necessary to consider how the sourcing of products and their distribution has changed over the last decade and how it is likely to change in the future. In the past decade, as the costs and time involved in international transportation were declining, profound changes were also occurring in logistics. This includes changes in the sourcing of production, supply chain management and the role of retailers in the supply chain.

Sourcing

Among the factors that have had a profound affect on the movement of goods both as inputs for manufacturing and finished goods for wholesaling/retailing are the overall reductions of transport costs and delivery times, as well as the changing locus of manufacturing centers. In the 1980s there was a rapid growth of exports to the United States from Southeast Asia, especially Thailand and Taiwan, just as in the 1970s there had been a rapid expansion of exports from Japan. In the 1990s, China's exports grew enormously. South Asia looms on the horizon as a potential manufacturing zone, but has not yet emerged as such.

Redesign of Supply Chains

The routing of import cargo is decided primarily by the consignees, based on considerations of time, cost and reliability. However, time has assumed an increasingly important role in this decision. For the industrial sector dependent on imported inputs, there has been growing use of just-in-time deliveries. For retailers, the concern is to reduce inventory while ensuring that stock is available when required.

Role of Retailers and Their Supply Chains

The most radical change over the last decade has been in the relationship between manufacturers and the retailers. The traditional "push" approach of manufacturers designing goods that retailers are expected to promote and sell was replaced by a "pull" strategy in which the retailers select what they perceive the customer wants. This initially occurred in the apparel industry[2] and the department stores[3] in both Europe and the United States. More recently, it occurred in the grocery store business in Europe[4] and subsequently in the United States as European firms established a presence in the US.

As retailers assumed greater control over the supply chains, more attention was given to the impact of final demand for products on design of the supply chain. While the value of the commodity continues to play a pivotal role in the choice of mode of transport, the concern for timely delivery to avoid overstockage and stock outages has had an increasing impact on this choice. This, in turn, has led to separate supply chains designed for individual products or groups of products.

Products can be differentiated based on volatility of demand and shelf life. For goods with demand that is relatively steady, it is possible to maintain inventory in transit as well as in storage and to design a low-cost supply chain similar to a pipeline. For goods with volatile demand, cost is less important than responsiveness and more agile supply chains are required. Where demand is volatile, the supply chain must be flexible enough to handle peak flows and also provide shorter delivery times. Shelf life is also important in determining how lean or agile a supply chain should be. The concept of

[2] Benetton, The Limited, Nike
[3] Marks and Spencer, Wal-Mart, Zara
[4] Ahold, Sainsbury, Seven-Eleven

shelf life applies not only to perishables but also to seasonal goods. While it is possible to build inventory gradually in preparation for a change in season, there is a relatively short period for replenishing or adjusting for significant variations from the forecasted demand. Increasingly, seasons are defined not by climate changes but rather by events such as Christmas, Chinese New Year, Memorial Day, Labor Day, etc. The fashion industry is moving from the traditional four seasons to six. The result is that shelf life is decreasing even for basic, non-perishable goods. Shorter shelf life requires more agile supply chains.

Information and Communications Technology

The level of ICT required for effective supply chain management has increased dramatically as a result of the increased role of retailers. The search for more effective forecasting tools continues but with greater recognition of the limit of these efforts. More emphasis has been placed on reducing the time horizon of the forecasts and providing more responsive supply chains.

Warehousing

The location and configuration of warehousing had traditionally been decided by comparing the costs of inbound and outbound transport plus handling and storage. Once constructed, planning focuses on improving the efficiency of the supply chains that utilize these warehouses. As a result, these fixed facilities introduce a constraint on the design of distribution networks and cause a lag in the adjustment of supply chains to changes in demand for faster or more flexible supply. The technology of warehousing had not advanced significantly over the last thirty years, but the application of automation and computer-based inventory control is now widespread, allowing the integration of the warehouse information systems with those of other components of the supply chain.

Large enterprises plan the location of individual warehouses on a network basis using computer programs to define the most cost-effective additions. However, these programs optimize against a legacy of fixed assets so the network evolves slowly. This evolution varies depending on the requirements of the users. For larger retailers, the role of warehousing has evolved into a network of regional DCs, which often serving as cross-dock facilities, and local warehouses. These are complemented by privately operated warehouses. For manufacturers handling semi-finished goods, the role of warehouses has diminished with the emphasis on just-in-time manufacturing. For manufacturers providing products to retailers, there is a growing emphasis on deliveries of marine containers or truck trailer loads direct to the retailer's DC or individual stores.

The location of warehousing is determined not only by transport cost and accessibility but also by the costs of land and labor. These costs have discouraged development of large scale warehousing near large container ports. However, distribution parks adjoining ports, as pioneered by Dubai, Rotterdam and Singapore, have now spread to other ports including in the US East Coast, such as Savannah. Warehouses located in

these parks enjoy simplified procedures, fewer handlings and lower cost for ship-warehouse movement. The higher costs of land and labor can be offset through better equipment, computerization of job assignments and inventory management and the use of multi-storey warehouses. At the same time, these parks provide the port with baseload traffic that is less vulnerable to the vicissitudes of routing decisions by footloose shipping lines.

3.2.2 Shipping Lines

It was made apparent in the interviews that there is great uncertainty in the industry regarding the long term future; indeed, none of the interviewed lines articulated long-term plans beyond 3 years. Any long-term thinking is affected by the dire current situation, with all lines, without exception, experiencing hefty losses. However, nearly all lines indicated that they are pursuing Post-Panamax vessel orders and would immediately deploy such vessels through the Canal if the Canal expanded.

One of the main areas of uncertainty is the expected introduction time of large containerships, especially the 12,000 TEU vessels defined by the new locks' dimensions (NPX). While the introduction time is vague, there is a general agreement that "mega" ships will eventually materialize, but not in the near to medium term.

Increasingly lines are emphasizing Post-Panamax vessels in their fleet plans. Even the surprising announcement of Evergreen of their intention to order 20 x 4,200 TEU ships was for Post-Panamax, which was also the case with Maersk Post-Panamax ships of 3,700 TEU.

Lines act upon the demand of shippers. Hence, the ultimate decision on introducing all-water services and the related diversion of traffic from intermodal services lies with shippers. Despite its relative decline in market share to the intermodal route, the all-water route is still very much a viable competitor and is in fact growing. One indication of this is that the all-water market freight rates held firm, while rates for the alternative intermodal services fell sharply in the 2001 recession

All lines agree that the all-water alternative will become more attractive once the Canal has expanded and larger and faster ships can be deployed. Finally, some lines noted that the all-water alternative could grow even at a faster rate than recently. Some suggested a comprehensive marketing campaign, to educate shippers, intermediaries and others of its advantages.

3.2.3 Ports

A series of interviews were conducted with several USEC ports (New York / New Jersey, Philadelphia, Norfolk, Savannah and Miami), to determine their present operating constraints to handle Post-Panamax vessels and their plans to expand their facilities and access channels. The main objective was to assess these ports' capacity and to consider their capability with regards to the Canal expansion project: both their capacity to handle larger trade flows to/from Asia carried by all-water, cross-Canal

services; and their capability to accommodate the larger containerships to be deployed on these services. In addition, a related objective was to explore the potential for creating strategic market alliances between ACP and these ports, based on their shared interest in promoting and facilitating all-water services.

Determining Port Capacity and Port Capability to Post-Panamax Vessels

Port capacity is generally determined by the facility's physical dimensions, especially the length of berth and the area of terminals. In most ports, the most constraining capacity factor is the terminal area. Terminal area is also the main cost item for future expansion, which often involves large-scale reclamation of waterfront lands. Hence, the review of USEC port capacity revolves on their present and future terminal areas along with land productivity, measured in TEU/acre.

Port capability to accommodate larger ships mainly relates to dimensions of its access channel, especially its depth. Several major USEC ports indicated, during interviewers, that the largest ship being considered is the Post-Panamax II vessel. Post-Panamax II vessels require depth of 50 ft when fully loaded. Hence, the assessment of USEC port capability to handle Post-Panamax revolves around their present and future channels capability to handle Post-Panamax II vessels fully loaded.[5]

USEC Port Capacity

The USEC has a favorable geography for ports, with many river estuaries, barrier islands and natural bays. As a result the USEC has many more ports compared to the West Coast, a total of 11 separate container ports that handle more than 100,000 TEU: Halifax, Boston, New York, Philadelphia, Baltimore, Norfolk, Wilmington, Charleston, Savannah, Jacksonville, and Port Everglades/Miami. The current total terminal area of these 11 USEC ports is over 3,000 acres. Four of these ports handle over 1 million TEU annually, i.e. New York, Norfolk, Charleston and Savannah. These are the major container ports in the USEC at the present time. Historically, EC ports worked jointly with the railroads in developing intermodal business, such as Norfolk with NS, Baltimore with CSX and NY/NJ with Conrail. These rail-port preferences are now gone, and the two major remaining railroads work on equal terms with all ports they serve.

All USEC ports have master plans that call for significant facility expansion based either on capacity increases to existing facilities or new terminals. For example, conversion of general cargo areas and minor addition of waterfront lands to existing terminals are the main components of New York's recently-published master plan; conversion of the 250-acre Navy Base, is the main component of Charleston's master plan; replacing a low-density top-lift yard system by higher-density RTG system is the main component of Miami's master plan.

[5] Industry debate is ongoing regarding possible eventual deployment of larger than Post II vessels. Some observers believe that deployment of vessels larger than 10,000 TEU is likely beyond the next 10 years.

Two ports are in the midst of planning large, new terminals: Norfolk, VA and Jasper County, SC. Norfolk is planning new terminals at 2 sites: (a) Craney Island, an island that has been used for the dredged materials removed from the channel with a total of 800 acres; and (b) the Cox property, recently acquired by APM, a subsidiary of Maersk-Sealand, with 570 acres. The Jasper County, SC facility is actually on the Savannah River and a major terminal there is being planned by a private operator. The area has a total of 1,800 acres, of which 800 acres will be leased to Stevedoring Services of America (SSA). Another major terminal development, although halted at this time, is Charleston's Daniel Island with 1,200 acres.

The above-listed developments only relate to major ports. In addition, a change in the role of secondary ports could provide added future capacity. This could happen either by a change in vessel rotations to offer wider port coverage, or, as a result of the development of increased use of offshore transshipment hubs, as some lines have been doing to serve some secondary ports. If future all-water services choose to serve secondary USEC services through offshore hubs, secondary ports will be called by coastal feeders. In this case, such feeder ports will only be required to accommodate smaller containerships and the major ports will be the ones with Post-Panamax vessels.

The planned projects to expand USEC major ports could result in a doubling in capacity from the current total terminal area of 3,000 acres. Additional terminal acres could also be provided by secondary ports, some of which have large unutilized waterfront areas. Additional capacity could be provided by increasing the land productivity of port facilities through denser storage systems and by reducing the dwell time of containers. In general, it can be concluded that if USEC ports expand as planned, they will have the potential capacity to handle at least three to five times their present throughput, well beyond the growth in trade flow forecasted during the study period.

Accommodating Large Containerships

Only two USEC ports, Norfolk and Baltimore, and one Canadian port, Halifax, presently have 50-ft access channels that can accommodate Post-Panamax II containerships. All major ports have pending programs to dredge their channels to this depth in the future. For example, New York, the largest USEC port, is nearing completion of a program to deepen the port from 40 to 45 ft. New York is also publicly committed to further deepening to 50-ft. The deepening may require $1.8 billion of which local participation would amount to about $1.1 billion. Part of the local participation has already been committed. Savannah can currently only provide 42-ft channel, but has already approved deepening plans to 47-ft. A 47-ft channel is not sufficient for fully loaded Post-Panamax II vessels. However, containerships usually do not sail fully loaded. It is reasonable to expect that in 10 years, the planned time for completion of the Canal expansion project, at least two and possibly more USEC major ports will be able to accommodate Post II containerships. In any case, it is unlikely that steamship lines will serve more than one or two EC ports with the high capacity Post-Panamax vessels.

Strategic Alliance with ACP

All visited USEC ports expressed great interest in cooperating with the Canal in promoting and facilitating all-water services to/from Asia. Several strategic initiatives listed in a proposed Memorandum of Understanding presented by ACP representatives were discussed and agreed upon. In addition, the possibility of organizing a special annual conference dedicated to USEC-Asia all-water services at a major USEC port, and joint promotions and marketing initiatives between the Canal and individual ports are under discussion.

3.3 Main Drivers of Future Canal Traffic

The demand for freight transportation services is derived from economic activity. As the world's economy grows, the trends affecting manufacturing and distribution, and the shifts in location of economic activity are the main determinants of transportation demand. The main drivers of future Panama Canal traffic are therefore:

1. Economic and trade growth, trends toward globalization and shifts of manufacturing to the lowest-cost locations around the world far away from the consuming areas of the world;

2. Shipper logistics requirements for this trade; and

3. Steamship lines' strategies to serve the shippers and improve their profitability.

The market share of the Panama Canal (defined as the cargo handled out of the total trade and related vessel transits) have been analyzed under many scenarios that reflect the various factors that influence these key demand drivers. The scenarios have been combined into alternative futures that reflect the uncertainty as to future economic growth, trade, shipper logistics, as well as shipping industry technology and infrastructure

3.4 Alternative Futures and Scenarios

In order to understand the full range of possible traffic anticipated for container vessels transiting the Panama Canal, a series of alternative futures have been considered. These futures are constructed by combining scenarios for the range of factors and variables that influence future demand for the Canal. Scenarios covering three sets of factors are considered:

- Economic and Trade Growth

- Shipper Logistics and Operations

    - Cargo Type and Value

- Types of Shippers and their Supply Chains (including sourcing, the roles of retailers and manufacturers, distribution centers networks and logistics, and order cycle time and reliability)
- Quality of Service Offered on Alternative Routes (including US port development and efficiency)

- Shipping Technology and Infrastructure
  - Vessel Size and Canal Expansion

These scenarios are discussed in the following sections. The forecasting approach assumes certain trade flows are captive. For those captive trade flows, shippers have no reasonable choice, so the forecast is only based on economic trade/growth and shipping technology/infrastructure scenarios.

3.4.1 Economic and Trade Growth Scenarios

Economic and trade forecasts developed for this study are based on an analysis of economic and trade data to characterize the size and composition of trade flows that are relevant to the Panama Canal. PIERS Maritime Research Services data and other information from the Journal of Commerce were used to carry out this analysis. The forecasts provide estimates of the growth in trade relevant to the Panama Canal and were used as input into the overall modeling framework for the study. The approach and forecasts are presented in Appendix B (see also the methodology section in the next Chapter). Essentially, the key factors that affect trade flows (e.g., income growth) are assumed across a range as follows:

1. Worst Case – slowest economic growth and trade assumptions;
2. Best Case – fastest growth assumptions; and
3. Base Case – reflecting moderate growth assumptions.

The future economic and trade scenarios are based on PIERS forecasts that are provided by individual US market segment. The major trades forecasted are the US to world region segments, as well as Latin American trade “diagonals” defined as Latin American trade that is directly relevant to the business of the Panama Canal, but does not include the United States.

The analysis begins with a detailed examination of global, country-to-country and region-to-region trade flows. The focus is narrowed to consider only relevant trades -- those that either already use or may use the Panama Canal during the study horizon. US trades account for about 95% of the relevant trades. The largest of these trades is with Asia, accounting for 69% of the relevant trade, including 55% with Northeast Asia and 14% with Southeast Asia. The US-Asia trade is driven by US imports, since its volume is twice that of exports. Hence, the analytical effort hinges on the US trades and, especially, on imports from Asia.

The economic and trade forecast results indicate that US-Asia trade is forecasted to grow between 2000 and 2025 at an average rate ranging from 6.5% to 4.6% for the Best and Worst Case scenarios, respectively, and of 5.3% for the Base Case (See Table 3-1). Within Asia, rates vary from a high of 7.8% for US-China to a flat or stable trade for US-Japan. Exports from China to the US are, and should remain in the future, the main generator of container traffic of the Panama Canal. Currently, this trade accounts for 54%; in 2025 it is projected to amount to about 75% of the total container traffic from North East Asia crossing the Canal. Economic analyses indicate that the China role in international trade is sustainable for the foreseeable future. Currently, most of the manufacturing activity in China is concentrated in the South Eastern part of the country, leaving a huge labor and production potential yet to be developed.

Generally, growth rates for non-US trade routes relevant to the Canal (i.e. non-US Latin American trades) are about half that of the US-Asia trade. For example, one of the largest non-US trades, the WCSA imports from Europe, is forecasted to grow at an average of 2.2%. Hence, the US trades are expected to further advance their already dominant share of the relevant trades.

Altogether, the Canal's relevant trades are forecasted to grow from 10.7 million TEU in 2001 to 36.2 million TEU in 2025 under the base case, with a range between 30.5 and 51.8 million TEU in 2025 under the worst and best cases (See Table 3-1 below), indicating average annual growth rates of 5.2, 4.4 and 6.8%, respectively, for the Best, Worst and Base Case scenarios. The economic forecast developed for this study is in line with recent forecasts published by DRI-WEFA, Drewry, and the US Chamber of Commerce.

Table 3-1: Relevant Trade Flows Forecast (TEU)

Trade Flow			2001	2025					
	Origin	Destination	Base	Base Case		Worst Case		Best Case	
1	NE Asia	USA	5,932,441	20,442,553	5.3%	16,744,031	4.4%	29,765,726	7.0%
2	SE Asia	USA	1,085,644	3,294,107	4.7%	3,229,299	4.6%	5,162,418	6.7%
3	USA	Oceania	169,817	684,637	6.0%	584,185	5.3%	895,892	7.2%
4	USA	NC/ECSA	412,632	2,058,660	6.9%	1,828,523	6.4%	2,869,900	8.4%
5	WCSA	USA	243,541	1,052,413	6.3%	878,289	5.5%	1,767,722	8.6%
6	Europe	USA	2,266,124	6,924,118	4.8%	5,738,341	3.9%	9,186,843	6.0%
7	WCSA	Carib	5,997	10,339	2.3%	10,341	2.3%	14,018	3.6%
8	NE Asia	ECSA	144,131	583,802	6.0%	485,918	5.2%	770,586	7.2%
9	Europe	WCSA	169,052	316,011	2.6%	279,750	2.1%	397,333	3.6%
10	NC/ECSA	WCSA	93,507	150,975	2.0%	147,468	1.9%	171,672	2.6%
11	Asia	WCSA	41,611	78,667	2.7%	71,779	2.3%	84,012	3.0%
12	Asia	WCSA	171,159	649,994	5.9%	534,625	5.1%	801,033	6.9%
			10,735,655	**36,246,255**	**5.2%**	**30,532,548**	**4.4%**	**51,877,156**	**6.8%**

The best and worst case trade growth scenarios are intended to reflect shifts in production and consumption, and the related distribution of economic growth and trade. The major trends affecting economic growth, increased trade, and globalization are:

1) shift in production facilities to low cost locations
2) globalization - move towards one global economy, and
3) specialization by companies, countries and regions

Shift in Production to Low Cost Locations

In recent years, industries requiring low skilled and inexpensive labor have been shifting their production facilities from industrialized countries to lower cost developing countries. This trend has included both the manufacture of basic commodities and consumer products, such as steel, textiles, footwear, and cement, as well as the more sophisticated high technology products, such as computers, electrical and electronic products. This trend is anticipated to continue, with further shifts taking place from countries that in the not too distant past were considered low-cost developing countries, like Taiwan and Korea, to China, countries in Southeast Asia, the Indian sub-continent, the Middle East, Latin America, Africa, and Eastern Europe. As production facilities move around the globe to locations where products can be produced more economically, the demand for more efficient and cost effective transportation will continue to increase.

Globalization - Move towards One Global Economy

The growing trend towards greater interdependence of the world economies continues in many industries, with the creation of one global market. There are more and more products today that are designed in one country and produced at one or a few locations around the world for distribution worldwide. The trend towards a global economy means that manufacturers must be able to quickly design their products to serve changing tastes, and efficiently plan their production runs and distribution to markets in far away locations

Specialization

The trends towards globalization also is resulting in further company and country specialization. The further developed economies increasingly specialize in design and product development while manufacturing shifts to lower cost producing locations. Efficient distribution and transportation are key to making the evolving systems achieve their goals. Companies must move raw materials, partially assembled products and finished goods to and from all areas of the world to be able to remain competitive. Decentralized manufacturing at multiple locations, often in several countries, has increased the information requirements for managing the manufacturing and distribution logistics for these firms. Their logistics systems must be able to manage changing demand and inventories during the various stages of the production and distribution cycle around the globe.

3.4.2 Shipper Logistics and Operations Scenarios

The alternative futures for shipper logistics and operations consider three basic drivers of demand for those US trades in which there is significant competition between the all-

water route and the intermodal route. The three basic drivers considered were: the nature of the cargo, the types and changing nature of shippers and their supply chains, and the quality of service offered on the alternative routes. A total of three alternative futures have been defined as follows:

1. Increased Intermodal Competition (Pessimistic) future in which improved performance of the services in the competing intermodal route would attract cargo away from the all-water route, the mix of cargo favors speed and reduced inventories in the pipeline and shippers focus on reducing order cycle times.

2. Resurgence of All-water Route (Optimistic) future in which the performance and quality of the all-water services improve relative to the competing intermodal route, the mix of cargo shipped is on the margin more sensitive to cost than to time and large sophisticated retailers that can manage longer order times are increasingly important.

3. Competitive Balance Status Quo (Moderate) future in which improvements in the performance and quality of the all-water route are comparable to those for the competing intermodal route, the mix of cargo and its average value remains relatively unchanged, while shippers improve the quality of their distribution networks to take advantage of modern supply chain management techniques to improve order times gradually.

Increased Intermodal Competition (Pessimistic)

In the Increased Intermodal Competition (Pessimistic) future, the U.S. retail sector evolves into increasingly customer-driven merchandising, resulting in smaller production runs and increasing demand for outbound logistics. This would be complemented by a trend away from generic, "one size fits all" functional products marketing to specialized products with higher value per piece and per TEU. As a result there would be a significant increase in the portion of innovative cargo for which demand is less predictable and, therefore, order cycles must be shortened. The percentage of innovative cargo would increase to 40% by the middle of the planning period and peak at 45% towards the end. The average value for functional cargoes would increase by only 10% greater than inflation over the planning period, but the innovative cargo would increase in value per TEU by 30% over inflation during the next ten years and by 60% for the entire planning period.

The large-scale retailers would modify their business model to participate in these higher value-added markets, but would lose market share to niche retailing companies. The latter would be regional and national rather than local. These niche companies would take advantage of modern supply chain management processes less through developing in-house capabilities and more through third party logistics providers (3 PL). Their distribution networks would be oriented towards their geographical roots rather than being distributed in proportion to their regional markets. Some of these companies

would utilize on the national level networks of the 3 PL service providers, but most would rely on a network of distribution centers concentrated around their regional markets. Importers operating out of single large warehouses concentrated primarily on the West Coast would continue to play an important role in supplying the regional and local retailers. As a result, the concentration of Distribution Centers on the East Coast would remain unchanged at about 41% while that for innovative cargoes would increase slowly to 30% over the next ten years and reaching 35% by the end of the planning period.

In this future, the all-water route is assumed to provide service with reliability comparable to that of the intermodal route with the exception that quality of port performance on the West Coast improves faster than on the East Coast due to increased capital investment and greater rationalization of labor practices. In this pessimistic scenario, it is assumed that the larger Post-Panamax vessels are introduced relatively rapidly on the Pacific routes but not on the all-water routes due to a delay in widening of the Canal.

The establishment of intercontinental rail service with double-stack trains from the PNW ports, port of Vancouver, (and perhaps other Pacific ports[6]) through to the East Coast would bypass Chicago. It would reduce the sailing time from Asia relative to the port of Los Angeles by approximately two days and the time for the cross-country move by one to two days. At the same time, the cost and time for the existing intermodal services out of Los Angeles/Long Beach would decrease as a result of greater use of large van trucking services to the East Coast. The combination of more efficient clearance of cargo and cross-docking to 53 foot domestic containers would reduce trucking costs. The average difference between the cost for the intermodal and all-water routes is expected to decrease by 30% over the next decade and 40% over the planning period. The average savings in time using the intermodal route is expected to increase by 50% within the next ten years and remain at that level. The adjusted elasticity of demand with respect to changes in the ratio of additional cost for intermodal to additional time for all-water is 0.71 in the medium term and 0.83 in the long run. This is a modification of the assumed medium and long term elasticities of 0.85 and 1.00 to reflect the increasing weight given to time as opposed to cost as a result of the growing importance of niche marketing and innovative goods.

Resurgence of All-water Route (Optimistic)

The Resurgence of All-water Route (Optimistic) future is, in many ways, the mirror image of the pessimistic future. It is assumed that the retail sector of the United States would move towards big box retailing, and that the majority of retailing is focused on functional items that emphasize price over style. As a result, the proportion of innovative cargoes is expected to decline slightly to 27% over the next ten years and leveling off at 25% by the end of the period. The average value per TEU during the planning period would track inflation for both functional and innovative cargo. The large retailing

[6] Ensenada in Mexico has been considering terminal development as an alternative to san Pedro Bay ports.

companies would use integrated supply chain management to control the flow of cargo from their suppliers through to their retail outlets. Consolidation of orders would occur as early as possible in the supply chain. This would mean more consolidation in China and other Asian countries that either have a large number of suppliers or act as a transshipment hub. The result would be more direct shipments, which would favor all-water moves for cargo from Asia to the East Coast of the United States.

These trends would cause an increase in the concentration of regional distribution centers near to the ports and an increase in cross-docking movements as opposed to deconsolidated-store-consolidate movements. The resulting concentration of regional distribution centers on the East Coast would increase for functional cargoes to 45% over the next decade and then level off. For innovate cargoes, there would be an increase in the portion of East Coast regional distribution centers to 40% within the next ten years and to 45% over the planning period.

The ability of the large companies to plan and control the movement of goods from the supplier through to the retail outlet combined with more sophisticated information gathering systems from point-of-sale through to point of production would allow for the management of inventory throughput the pipeline between the supplier and the retail outlet. Efforts to reduce order cycle times would continue but at a gradual pace. The primary focus would be to minimize the delivered cost of products. This commercial environment favors the all-water route for goods moving between Asia and the US East Coast.

Services on the all-water route would improve through a combination of rapid introduction of Post-Panamax II vessels and an early widening of the Canal. Quality of service in the East Coast ports in terms of both capital investment and labor relations would improve significantly resulting in a competitive advantage relative to the West Coast. The difference between the cost for the intermodal and all-water routes is expected to increase by 10% over the next decade and 20% over the planning period. The savings in time using the intermodal route is expected to decrease by 10% over the next decade and a total of 18% over the planning period. The adjusted elasticity of demand with respect to changes in the ratio of additional cost for intermodal to additional time for all-water is 1.02 in the medium term and 1.20 in the long run. This modification reflects the increasing weight given to cost relative to time as a result of the growing dominance of the larger retailers and functional goods.

Competitive Balance Status Quo (Moderate)

The Competitive Balance Status Quo (Moderate Growth) Future assumes that the retailing sector will continue to develop along current lines. There would be a gradual increase in the market share of the Big Box retailers but their competitive advantage will decline. The regional and local retailers will improve their competitive position by focusing on niche markets and customer-driven services while gradually adopting modern supply chain management practices both to control their costs and to improve their responsiveness to customer demand. As a result, the proportion of innovative

cargo would increase to 31% in the next ten years and 33% by the end of the planning period. While typical order cycle times would decrease, this would occur gradually. The role of importers would decline and direct deliveries of goods would increase as the regional and local retailers took advantage of the network of established contract suppliers and logistics established in Asia by the Big Box retailers.

The relative proportion of innovative and functional cargoes would not change significantly, with Big Box retailers increasing their volume of functional products and regional and local retailers moving into innovative products. The result would be an average value per piece and per TEU similar to that for the Pessimistic future. The distribution networks would evolve with increased location of Regional Distribution Centers nearer to the retail markets. The percentage of cross-docking would increase with the result that the throughput per square meter and per man-hour would increase, allowing greater use of multi-storey warehouses in areas closer to the ports despite higher land and labor costs. As a result, the concentration of Regional Distribution Centers on the East Coast would rise to 42% for functional cargo within the next ten years and reach a peak of 45% by the end of the planning period. For innovative cargoes, the transition would be more dramatic increasing to 35% within the decade and 40% at the end of the planning period.

Improvements in port performance would continue on both Coasts, with competitive advantage shifting back and forth but without any long term competitive advantage being established by either. The amount of Post-Panamax II vessels would increase in services to both the East and West Coasts but at a moderate pace. The Canal widening would be undertaken to encourage the re-deployment of these larger vessels on the all-water route. These events would decrease the savings in time using the intermodal route by 5% over the next decade and a total of 15% over the planning period. They would also increase the differential cost of using the intermodal route by 5% over the next decade and a total of 10% over the planning period. The elasticity of demand with respect to changes in the ratio of additional cost for intermodal to additional time for all-water is assumed to be 0.85 in the short run and 1.00 in the long run.

Summary

The major different elements of the three shipper logistics and operations scenarios are summarized in Table 3-2.

3.4.3 Vessel Deployment Scenarios

Two scenarios are considered for the future size of the vessels (measured in TEU) based on the assumption of slow and accelerated change. Both scenarios relate to the trends in ship technology discussed in detail in Chapter II and Appendix C. For the sake of convenience, the scenarios consider changes in vessel size related to three types of services: Transpacific, North/South and Feeders. The Transpacific services, which account for most of the Canal services, are the main concern here.

Table 3-2: Summary of Shipper Logistics and Operations Scenarios

Factor	Measure	Scenario		
		Pessimistic	Moderate	Optimistic
Cargo Type and Value	Value per FEU and Share of Innovative Product Mix	Increase value much faster than inflation and rapid increase of share of high value innovative products	Gradual increase in average value slightly faster than inflation and gradual increase of share of high value innovative products	Increase reflecting inflation with stable mix of functional/innovative product mix
DCs Location and Network	Concentration of DC's in East Coast Ports	Slow to change with significant legacy component	Focus on distribution parks near ports and airports	Flexible outsourced network with move towards EC ports DC's
Role of Retailers in Managing Supplies	Concentration of DC's in East Coast Ports and Reliability	More specialization and smaller orders	Regional retailers resurgence targeting upscale buyers	Large retailers dominate with efficient logistics
Increased Reliability and Reduced Order Cycle Time	Transit time and reliability	Rapid reduction in order cycle time	No changes in order cycle times	Gradual Slow reduction in order cycle time

In accordance with the Terms of Reference, this study has considered the vessel size definitions as shown in Table 3-3. Three different Post-Panamax sizes are included, based on the TEU vessel capacity. Panamax dimensions refer to present lock constraints. Any vessel which cannot transit through the locks as they currently exist is considered Post-Panamax. It is important to note that some Post-Panamax vessels (with dimensions larger than the existing lock and Canal depth constraints) have TEU capacity lower than what a Panamax vessel can carry. This is referred to in this study as Mini-Post-Panamax vessels (e.g. the Maersk-SeaLand L Class vessels).

Table 3-3: Vessel Size Categories

Vessel Size description	TEU Capacity
Feeder	0-499
Feedermax	500-999
Handy	1000-1999
Sub-Panamax	2000-2999
Panamax I	3000-3999+
Post-Panamax I	4000-4999
Mini-Post-Panamax	3700-4999
Post-Panamax II	6500-9999
Post-Panamax III	10000+

Under the slow Post-Panamax deployment scenario, the main assumption is that the introduction of Post-Panamax in the Transpacific services would be relatively slow, with lines facing difficulties in their attempt to find alternative deployment for the large fleet of existing Panamax services. In contrast, under the accelerated change scenario, the main assumption is that lines anticipating the expansion of the Canal will continue

ordering Post-Panamax ships ahead of the time when the Canal expansion is ready, because of increasing market competition and demand. As soon as the expanded Canal is ready, these lines will quickly deploy these Post-Panamax vessels on this route, replacing older and less efficient Panamax vessels that by 2010 will be reaching their scrapping age. This is defined as the Rapid Post-Panamax Vessel Deployment Scenario. In both scenarios, the dominant vessel category at the end of the planning horizon in year 2025 is expected to be the Post-Panamax II (6500-9999 TEU).[7]

The differences between vessel deployment scenarios in the North/South and Feeder services are smaller than in the Transpacific. In North/South services, the conversion to Post-Panamax would be marked initially by the appearance of the so-called "mini" Post-Panamax (a vessel similar in capacity to existing Panamax but with Post-Panamax dimensions), which is well adapted to the port conditions of South America. Larger Post-Panamax vessels would be introduced later on. However, Post-Panamax II, assumed to become the dominant vessels of the transpacific services, are not expected to handle a large share of these trades even in 2025. The change in Feeder services is even more limited with no Post-Panamax expected here even in 2025.

For purposes of sensitivity analysis, a third vessel deployment scenario is also considered, in which it is assumed that vessel deployment remains as is currently (i.e. only Panamax vessels are used for all Canal crossings). This scenario is not considered likely if the Canal is expanded to larger dimensions, but it has been considered as a base to analyze the impact of future changes in vessel deployment on the traffic and revenue forecasts. This deployment scenario has been considered only under the base case economic scenario and the Increased Intermodal Competition (Pessimistic) Operating Scenario.

3.4.4 Summary of Scenarios

Table 3-4 presents an overall summary of the scenarios and vessel allocation assumptions that were used to develop forecasts of TEU, vessel transits, and Canal revenues. Chapter IV discusses the methodology and assumptions used for each of the scenarios and Chapter V presents the forecast results under each of these scenarios.

[7] There is still on-going debate in the industry whether even larger vessels might be eventually deployed in the long-term future (see Chapter 2, Appendix C and Drewry Report "Global Container Terminals, Oct. 2002").

Table 3-4: Summary of Scenarios and Vessel Allocation Assumptions

Operating Scenario	Economic Scenario	Vessel Allocation
PESSIMISTIC:	Base	Slow Deployment of Post-Panamax
		Rapid Deployment of Post-Panamax
Increased Intermodal Competition		No Deployment of Post-Panamax
	Worst	Slow Deployment of Post-Panamax
		Rapid Deployment of Post-Panamax
	Best	Slow Deployment of Post-Panamax
		Rapid Deployment of Post-Panamax
MODERATE:	Base	Slow Deployment of Post-Panamax
		Rapid Deployment of Post-Panamax
	Worst	Slow Deployment of Post-Panamax
Competitive Balance (Status Quo)		Rapid Deployment of Post-Panamax
	Best	Slow Deployment of Post-Panamax
		Rapid Deployment of Post-Panamax
OPTIMISTIC:	Base	Slow Deployment of Post-Panamax
		Rapid Deployment of Post-Panamax
	Worst	Slow Deployment of Post-Panamax
		Rapid Deployment of Post-Panamax
Resurgence of All-water Route	Best	Slow Deployment of Post-Panamax
		Rapid Deployment of Post-Panamax

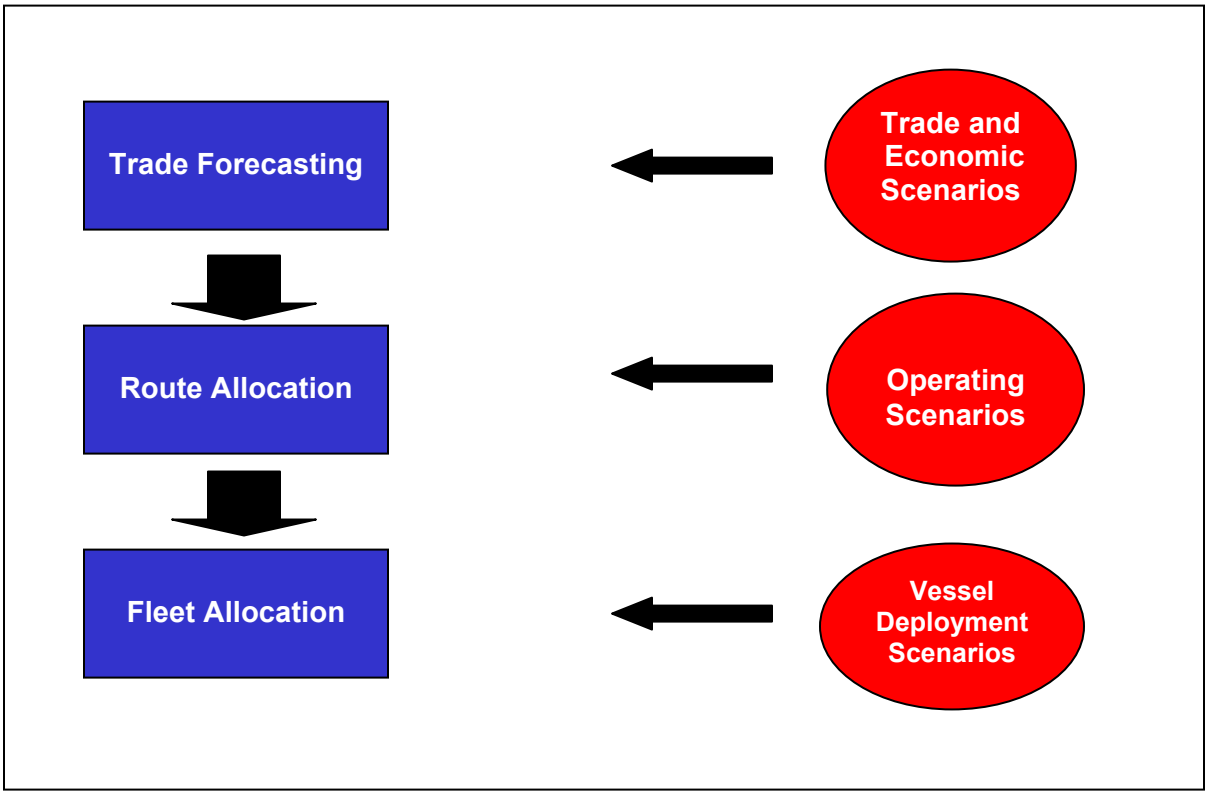
CHAPTER IV

4. Analytical Approach and Forecasting Model/Methodology

4.1 Overall Modeling Framework

A three-stage approach to forecasting the future container shipping traffic through the Panama Canal was employed. This approach is characterized in the graphic in Figure 4-1

Figure 4-1: Modeling Framework



In the first stage, the Trade Forecasting Model using PIERS and Journal of Commerce data was used to estimate the total potential demand for the Panama Canal by relevant trade route through the year 2025. As indicated in the graphic, this model is influenced by trade and economic scenarios that produce a range of outcomes that have been reduced to three discrete views of the future: Worst Case, Base Case and Best Case.

In the second stage of the modeling approach, for the divertible trades, the potential demand for the Canal is input into a series of integrated Route Allocation Models.

Different modeling approaches have been developed to capture the distinct competitive dynamics that characterize the various relevant trade flows. All modeling is based on determining a market share of the trade flow allocated to, and thus captured by, the Panama Canal in competition with the alternative route choices. As shown in the graphic, route allocation is influenced by operating scenarios, which combine the range of critical factors that affect route choice decisions as discussed previously in Chapter III. For captive trade routes, the Panama Canal is assigned all the projected trade for that trade flow.

Finally, the share of the total container shipping traffic, measured in TEU, is input into a Fleet Allocation Model to arrive at forecasts of vessel crossings through the Panama Canal. This is influenced by the future vessel deployment scenarios.

The analytical approaches and methodologies employed for each of these models are explained further in the following sections, as well as in Appendices B (for trade forecasting) and H (for route allocation).

4.2 Trade Forecasting Methodology

The forecasting statistical model applied here is country-specific, specifying US imports as a function of aggregated income, import price indices and exchange rates. Data on future income and the GDP are based on DRI-WEFA forecasts and the Economist Intelligence Unit. A major assumption underlying the forecast is that US economic fundamentals are strong and are expected to sustain a long term, albeit moderate, expansion. This cautious optimism is supported by recent trade data, indicating that despite the recent volatility in US equity markets, the US economy has been quietly but steadily rebounding from its post-September 11th lows. The analysis of the non-US trades is based on similar statistical models, adjusted to reflect trade-specific assumptions.

4.2.1 US Trade Forecasts

The structure of US liner trade has exhibited a relatively stable pattern since the early 1980s. Liner imports by volume are primarily composed of relatively high-value, finished consumer goods, household furnishings, apparel, tropical agricultural products such as coffee, cocoa and bananas and equipment for offices. Liner exports by volume are primarily composed of low-value intermediate and raw industrial inputs such as cotton, industrial resins, waste paper and metal scrap. The export mix is so heavily dominated by low-value commodities[1] that it is reasonable to assume that much if not most of what the US exports via liner shipping is used in the manufacture and packaging of finished consumer goods that are destined for the US and European markets.

[1] Includes wastepaper and forest products

Over time, this establishes a statistical relationship between imports and exports among certain commodity groups. Consider, for example, US exports of waste paper, its largest liner export in volume. The statistical relationship between US exports of waste paper and its import of finished packaged consumer goods is strong. Therefore, it is reasonable to state that US domestic demand, and in particular, US consumer demand is the primary driver of imports and indirectly of exports.

What is clear from this pattern of trade is that US income growth affects both its imports and to a lesser extent its exports. And since US incomes affect US exports, then it also affects foreign economic growth, particularly for countries where GDP is highly dependent upon external markets. Hence there is a statistical relationship between US income growth and the growth of its trading partners income. This is consistent with overall trend towards globalization.

4.2.2 Latin American Trade Forecasts

To arrive at volume forecasts it was necessary to establish an average ratio of value to volume. The forecasts in dollar value were structurally the same as the volume forecasts – trade is assumed to be a function of income and exchange rates. To arrive at regional average exchange rates would have required indexing of disaggregated nominal rates, which are not always accurate to begin with. Instead, it is reasonable to assume that the exchange rates for South America and Asia/Europe follow those for the US. The structural models assume that trade is a function of aggregate income and dollar exchange rates. Directionally, increased income should always be followed by increases in trade, as long as protectionism does not interfere with the free market process. Increases in real exchange rates, however, do not always follow the conventional pattern. Instead, when the exchange rate of one country weakens against another it should imply reduced imports and higher exports.

That same weakening of the exchange rate could, however, result in an increase in demand for that country's exports in which case it may have to increase its imports of industrial inputs. In such a case, the signs on parameters in an econometric model of trade may not always follow convention. Furthermore, domestic income in countries that rely heavily upon the US and European domestic markets, such as those in Asia and South America, may be as or even more reliant upon US and European incomes to drive their import markets because higher US and European income imply rising demand for US and European imports, which implies higher demand for industrial raw materials, inputs and capital goods in their trading partners.

Forecasts of GDP for the emerging markets of Latin America rely heavily upon the economic performance of its more developed trading partners. Statistical analysis shows that Latin American GDP is closely related to GDP in the United States, Canada, Europe and Japan. Because the majority of the econometric relationships between US and Latin America national income are solid, and in view of the increasingly strong sentiments towards closer integration between these two regions, it is reasonable to use these parameters to forecast individual Latin American GDP.

4.3 Route Allocation Methodology

The route allocation model is applied to only those segments that are relevant to the Canal and for which the Canal competes with a reasonable alternative. The captive routes are treated as 100% captive in the future. For the divertible segments, we utilize two types of models. The first model is an econometric model that is described in detail in Appendix H. The second modeling approach is a market-share approach, in which market shares are assigned to the Canal and its competing routes based on current/historical shares and consideration of the influence of future changes in key variables that affect these shares.

4.3.1 Variables Considered

The econometric model developed for the allocation of the Panama Canal share of the divertible traffic in segments that are of interest to the Canal is also referred to at times as the "route allocation model". This model considers the choice between using the all-water (AW) route through the Panama Canal and the intermodal (IM) route for freight movements primarily between the East/Gulf Coast of the US and Northeast and Southeast Asia.

The route allocation, or econometric, model considers the following variables.

- Time differential between AW and IM routes.
- Cost differential between AW and IM routes.
- Share of distribution center (DC) space in the Eastern US.
- Value of cargo transported.
- Cargo type.

The data for the development of the route allocation model comes from the interviews of shippers, shipping lines and freight forwarders conducted during the course of the study. The results of these interviews have been summarized earlier in Chapter III, and are presented in detail in LBG's report "Study of the Inter-relationship between Shippers' Logistics and Distribution Systems and the Panama Canal Expansion (Asia – US Trade Route)," as well as in Appendix A.

Table 4-1 provides a summary of the available dataset.

<u>Time and Cost Differentials</u>

Time and cost differentials between alternative routes have been based on the results of interviews with shippers and shipping lines, as well as analysis of the cost structures and transit times of alternative routes. Adjustments are made to consider the influence

of changes in operating conditions under future scenarios, especially regarding the use of larger vessels through an expanded Canal.

Table 4-1: Descriptive Statistics of Available Data

		N	Min.	Max.	Mean	Std. Deviation
CARGOTYP	Type of cargo (functional – mid – innovative)	31	1.00	3.00	1.70	.82
VAL_FEU	Value per FEU (thousands of $ / FEU)	26	16.00	150.00	65.73	39.41
AWEC_SHR	All-water share of shipments bound for East Coast	31	.00	1.00	.40	.39
DC_EC	East Coast share of distribution center space	31	.01	.78	.34	.19
FEU_YR	Number of FEUs shipped per year	31	2.60	200.00	24.99	42.48
VAL_YR	Value of FEUs shipped per year (thousands of $ / year)	26	96.00	4500.00	1083.44	1152.70
EXTTIME	Perceived time differential between AW and IM routes (days)	17	.00	11.00	6.52	3.24
COSTSAV	Perceived cost differential between AW and IM routes ($)	10	250.00	1000.00	575.00	242.95

Eastern US Share of Distribution Centers

The distribution center share for the Eastern US was computed on the basis of data provided in the interviews. For some shippers, sq-ft level data is available for their distribution centers across the US, while for others only the location of the DCs is available. To estimate the shares, we used the sq-ft information when available and for the remaining shippers, we assumed that each DC had approximately similar sq-ft space.

Value of Cargo

The value of cargo was evaluated through two formulations:

- Value per FEU, and
- Value per year (= value per FEU * FEUs transported per year).

After extensive analysis, we determined that the value per FEU had better explanatory power than value per year.

Cargo Type

Cargo type is a categorical variable that splits the cargo into various market segments. We divide the shippers as providers of functional products or innovative products. Note that the discrete categorization is being done to artificially divide a continuous range for modeling purposes.

4.3.2 Non-quantifiable Variables and Factors

There are a number of factors that will affect route choice decisions that are difficult, if not impossible, to quantify and explicitly model. This, however, does not mean that they are insignificant and unworthy of consideration. A brief summary of several key variables and factors deemed non-quantifiable is presented as follows.

Interest Rates

Interest rates will have a direct effect on the inventory cost to shippers. As the cost of financing increases, so does the cost to carry merchandise in inventory. Therefore, the impact of a time differential between two route alternatives will gain importance. It is impossible to predict with any degree of certainty future variations in interest rates worldwide for a 25-year planning horizon. Additionally, it is difficult measure its precise impact on the value of time and cost differentials. It is reasonable to assume that over a period as long as 25 years, year-to-year variations may be both positive and negative, meaning that short-term effects will be at least partially offset in the long term.

In addition to the impact on inventory costs, interest rates affect vessel acquisition costs, related operating costs, and charter rates. However, interest rates will also affect alternate routes, although not necessarily to the same extent.

Fuel Prices

The price of fuel directly affects the transportation costs for all competing routes. Variations in fuel prices may affect alternative routes disproportionately. For example, a substantial increase in fuel prices will adversely affect services that transit longer routes, which is the case of the all-water route versus the intermodal route. Additionally, the influence on total cost of rail transport may be dampened if it is less affected by fuel costs than ocean transport, although fuel surcharges on rail and truck services can be even greater. As in the case of interest rates, the influence of fuel prices on route

choice is more likely to be a short-term phenomenon that loses significance over the long term, as well as being difficult to predict over a long time period.

Perceived Reliability of Alternative Routes

If shippers are to make a long-term commitment to one route option over another, which may require substantial investment in Distribution Centers and logistics, they will be very concerned about the reliability of the route they are choosing. This concern was voiced in the industry interviews. The perception of reliability could work against either the all-water or intermodal routes, stemming from security considerations, fears of congestion or stoppage at either the Canal or at West or East Coast ports, etc. The recent labor problems affecting West Coast ports is an example. It will be important for the Canal to address reliability concerns in its expansion and operational plans, as well as in its marketing efforts.

War and Terrorism

Large-scale international conflicts, such as wars or terrorist events, could have an effect of trade and potentially route choice. Trade as a whole could suffer as a result of wars, and it could affect certain trades more sharply depending on the location of conflict areas. It is not possible to quantify how such conflict could affect future traffic, but it nevertheless important to be aware of it as an important issue. Security programs and perception of their effectiveness can affect long-term and short-term location and routing decisions.

Trade Disputes

Trade disputes that could emerge between trading partners that feed relevant trade routes could result in loss of demand, but most likely will not influence route choice explicitly. The trade forecasts have been made over a long period and are based on consideration of a long period of historical data and trends. The influence of trade disputes would most likely be a short-term phenomenon.

Labor Disputes

Recent labor disputes at West Coast ports caused considerable harm to users of the ports and intermodal system. Such occurrences could in the future affect the functioning of ports on either coast of the US or the Panama Canal, resulting in shifts in relative cost advantages and the perception of reliability.

4.4 Fleet Allocation Methodology

The analysis of future vessels and ship technology is presented in detail in Appendix C. The scenarios concerning future vessel deployment that have been incorporated into this study have been described previously in Chapter III. The present section

summarizes the methodological approach to fleet allocation that has been applied within the traffic forecasting models.
There are two general considerations according to which the size (TEU) of vessel to be deployed on a service is determined:

- ***Traffic Density*** – High density routes usually warrant larger vessels; and
- ***Length of Route*** – Longer routes involving few port calls usually warrant larger vessels.

Another unrelated and short-term consideration is simply the available fleet of vessels. Most vessels typically have life cycles of about 25 years. In cases when lines do not own the vessels they need, they may charter them.

Theoretically, if the route circumstances change, lines can attempt to redeploy vessels from one service pattern to another. This redeployment is sometimes termed as the "cascade effect", whereby vessels are moved from a "higher" pattern, with high density and a longer route, to a "lower" one, with low density and a shorter route. The redeployed vessels of the "higher" pattern are then replaced by newer and larger ones. However, redeployment options are usually limited, since each pattern requires a different number of ships. In most cases, lines tend to keep their vessels deployed on the same services for long time periods, even if they could justify deploying larger vessels. The result is that shifts in vessel distribution are usually gradual.

In line with the above considerations, the methodology employed in this study for determining vessel size begins with the baseline distribution for year 2001. The distribution is then projected for year 2010, one year before the Canal expansion, and 2011, one year after it. The changes in vessel distribution between 2001 and 2010 are mainly attributed to trade growth. The changes between 2010 and 2011 reflect the impact of the Canal expansion, especially the option to deploy Post-Panamax vessels on Cross-Canal service patterns and the related changes in the patterns themselves. The final vessel distribution is projected for the target year, 2025, with the main difference between 2011 and 2025 being in trade and vessel technology. The projected distribution for the intermediate year is based on algebraic interpolation.

CHAPTER V

5. Panama Canal Traffic and Revenue Forecasts

5.1 Forecasts Summary

Panama Canal container and vessel traffic as well as toll revenues have been forecasted by five (5) year increments under various alternative scenarios assuming the present toll structure for Canal transits (forecasts by year are also included in Appendix J). Total Canal traffic, as measured in TEU, for the liner market segment is projected to grow by more than 250 percent, increasing from 3.7 million TEU in the year 2001 to between 10 million and 22.4 million TEU by 2025[1]. Transits are estimated to increase at a lower rate – at least by 37% - increasing from 1,970 vessel crossings in the year 2001 to between 2,712 and 5,824 vessel transits by the year 2025. Toll revenues in current dollars in this period are projected to at least triple from $142 million in 2001 to approximately $433 annually by the year 2025, with the most optimistic revenues reaching close to $1 billion.

These forecasts of liner shipping traffic and revenue for the range of economic and operating scenarios considered are summarized and further described in this Chapter. Detailed forecast results are presented in Appendix J.

5.1.1 Combined Scenarios

The forecasting model has been run for a total of 19 different combinations of the scenarios described in Chapter III, in order to characterize the range of future traffic and revenue that can be expected as a function of variations in key factors that affect demand. The results of the 19 scenarios are described in Table 5-1. It should be noted that by the end of the forecast period 2025, the fleet mix and resulting number of transits for each combination of operating and economic scenarios is the same. Vessel deployment scenarios differ solely in the pace of introduction of larger Post-Panamax vessels on Canal services.

Each of the three operating scenarios (Pessimistic, Moderate and Optimistic) has been analyzed in conjunction with each of the three trade and economic scenarios (Worst, Base and Best Cases). Each of these combined scenarios has then been combined with the two main scenarios concerning future deployment of the Post-Panamax vessels after the expansion of the Canal. This yields a total of 18 combined scenarios.

A final scenario has been considered to consider what might happen if there were no expansion of the Canal. The Base Case economic scenario is combined with the Pessimistic operating scenario and a No Deployment of Post-Panamax vessel scenario to model this situation. The analysis conducted under this study does not consider

[1] Total two way traffic was calculated by doubling one way traffic in the dominant direction. Number of transits was calculated based on projected service pattern and vessel mix of each pattern.

Table 5-1: Panama Canal Traffic under Alternative Trade Growth, Operating and Vessel Deployment Scenarios – 2001-2025

Operating Scenario	Economic Scenario	Vessel Allocation		2001	2005	2010	2015	2020	2025
Pessimistic	Base	Slow Deployment Post Panamax	TEU	3,711,241	4,981,209	6,788,553	8,498,170	10,207,787	11,917,405
			Transits	1,970	2,407	2,878	2,900	3,118	3,209
			Toll	$142,755,226	$214,844,583	$290,133,236	$363,365,629	$438,538,662	$514,254,196
		Rapid Deployment Post Panamax	TEU	3,711,241	4,981,209	6,788,553	8,498,170	10,207,787	11,917,405
			Transits	1,970	2,407	2,878	2,497	2,875	3,209
			Toll	$142,755,226	$214,844,583	$290,133,236	$364,713,181	$439,318,143	$514,254,196
	Worse	Slow Deployment Post Panamax	TEU	3,711,241	4,716,264	6,082,032	7,399,138	8,716,243	10,033,349
			Transits	1,970	2,281	2,579	2,525	2,668	2,712
			Toll	$142,755,226	$203,435,933	$259,909,818	$316,387,143	$374,647,516	$433,137,586
		Rapid Deployment Post Panamax	TEU	3,711,241	4,716,264	6,082,032	7,399,138	8,716,243	10,033,349
			Transits	1,970	2,281	2,579	2,176	2,461	2,712
			Toll	$142,755,226	$203,435,933	$259,909,818	$317,493,532	$375,132,627	$433,137,586
	Best	Slow Deployment Post Panamax	TEU	3,711,241	5,658,908	8,595,750	11,309,367	14,022,983	16,736,599
			Transits	1,970	2,746	3,667	3,865	4,291	4,520
			Toll	$142,755,226	$244,055,080	$367,473,218	$483,483,071	$602,082,922	$722,102,431
		Rapid Deployment Post Panamax	TEU	3,711,241	5,658,908	8,595,750	11,309,367	14,022,983	16,736,599
			Transits	1,970	2,746	3,667	3,330	3,960	4,520
			Toll	$142,755,226	$244,055,080	$367,473,218	$485,210,076	$603,397,811	$722,102,431
Moderate	Base	Slow Deployment Post Panamax	TEU	3,711,241	5,387,864	7,872,965	10,185,033	12,497,102	14,809,170
			Transits	1,970	2,577	3,290	3,456	3,760	3,875
			Toll	$142,755,226	$232,236,153	$335,972,715	$435,132,235	$536,756,429	$639,187,104
		Rapid Deployment Post Panamax	TEU	3,711,241	5,387,864	7,872,965	10,185,033	12,497,102	14,809,170
			Transits	1,970	2,577	3,290	2,938	3,436	3,875
			Toll	$142,755,226	$232,236,153	$335,972,715	$436,822,262	$537,433,862	$639,187,104
	Worse	Slow Deployment Post Panamax	TEU	3,711,241	5,055,233	6,985,949	8,805,231	10,624,513	12,443,795
			Transits	1,970	2,423	2,923	2,989	3,201	3,266
			Toll	$142,755,226	$217,994,403	$298,157,983	$376,223,499	$456,257,186	$537,120,926
		Rapid Deployment Post Panamax	TEU	3,711,241	5,055,233	6,985,949	8,805,231	10,624,513	12,443,795
			Transits	1,970	2,423	2,923	2,542	2,929	3,266
			Toll	$142,755,226	$217,994,403	$298,157,983	$377,360,958	$456,969,596	$537,120,926
	Best	Slow Deployment Post Panamax	TEU	3,711,241	6,255,081	10,185,545	13,782,381	17,379,216	20,976,052
			Transits	1,970	2,995	4,270	4,682	5,231	5,494
			Toll	$142,755,226	$269,556,254	$434,592,139	$588,919,588	$746,024,858	$904,851,502
		Rapid Deployment Post Panamax	TEU	3,711,241	6,255,081	10,185,545	13,782,381	17,379,216	20,976,052
			Transits	1,970	2,995	4,270	4,682	5,231	5,494
			Toll	$142,755,226	$269,556,254	$434,592,139	$588,919,588	$746,024,858	$904,851,502
Optimistic	Base	Slow Deployment Post Panamax	TEU	3,711,241	5,525,152	8,239,066	10,754,524	13,269,982	15,785,440
			Transits	1,970	2,635	3,429	3,643	3,976	4,100
			Toll	$142,755,226	$238,180,328	$351,463,838	$459,216,407	$569,756,207	$681,404,025
		Rapid Deployment Post Panamax	TEU	3,711,241	5,525,152	8,239,066	10,754,524	13,269,982	15,785,440
			Transits	1,970	2,635	3,429	3,086	3,628	4,100
			Toll	$142,755,226	$238,180,328	$351,463,838	$461,056,389	$570,933,814	$681,404,025
	Worse	Slow Deployment Post Panamax	TEU	3,711,241	5,169,670	7,291,114	9,279,933	11,268,751	13,257,570
			Transits	1,970	2,470	3,039	3,146	3,383	3,453
			Toll	$142,755,226	$222,789,634	$311,083,603	$396,504,707	$484,060,097	$572,178,668
		Rapid Deployment Post Panamax	TEU	3,711,241	5,169,670	7,291,114	9,279,933	11,268,751	13,257,570
			Transits	1,970	2,470	3,039	2,667	3,089	3,453
			Toll	$142,755,226	$222,789,634	$311,083,603	$397,735,442	$484,910,184	$572,178,668
	Best	Slow Deployment Post Panamax	TEU	3,711,241	6,456,351	10,722,265	14,617,278	18,512,292	22,407,305
			Transits	1,970	3,079	4,474	4,956	5,548	5,824
			Toll	$142,755,226	$278,197,810	$457,298,502	$624,251,188	$794,573,191	$966,761,905
		Rapid Deployment Post Panamax	TEU	3,711,241	6,456,351	10,722,265	14,617,278	18,512,292	22,407,305
			Transits	1,970	3,079	4,474	4,193	5,064	5,824
			Toll	$142,755,226	$278,197,810	$457,298,502	$626,328,061	$796,334,837	$966,761,905
No Canal Expansion	Base	No Deployment Post Panamax	TEU	3,711,241	4,981,209	6,788,553	8,498,170	10,207,787	11,917,405
			Transits	1,970	2,407	2,878	3,719	4,478	5,237
			Toll	$142,755,226	$214,844,583	$290,133,236	$363,258,927	$436,254,812	$509,230,539

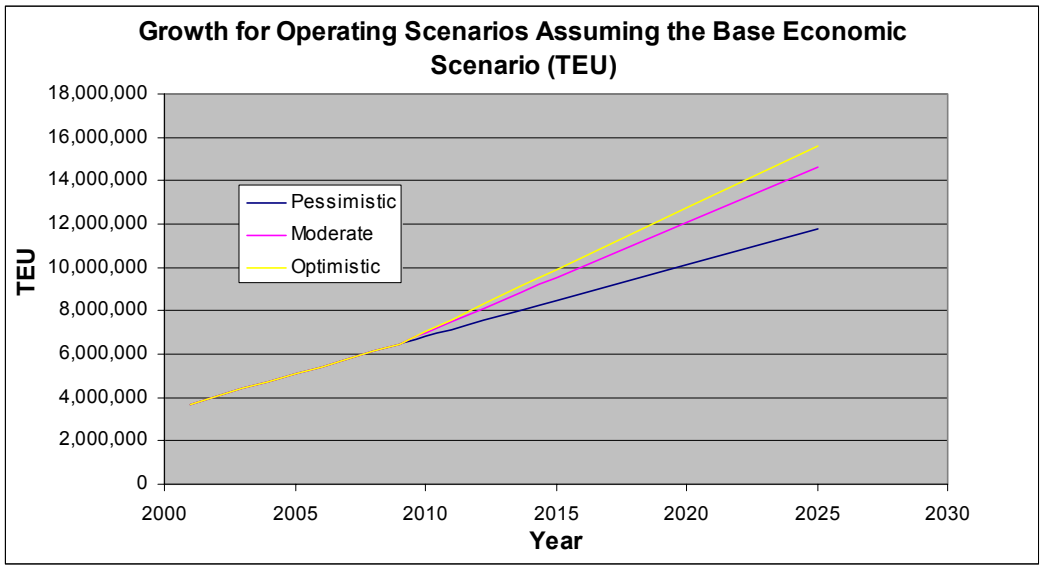
capacity constraints, which would be a key factor in any No-Expansion analysis. Therefore, the implications of this scenario are limited to consequences of the inability to accommodate the Post-Panamax fleet. An unexpanded Canal would be a constraint to the expeditious handling of the forecast growth in trade.

5.1.2 Comparison of Operating Scenarios

Figure 5-1 characterizes graphically the increase in containerized traffic across the range of operating scenarios. This figure shows volume growth for each of the three operating scenarios under the Base Case economic scenario. By the year 2025, the Canal volume measured in TEU is projected to range from 11.9 million under the Pessimistic scenario to 15.7 million under the Optimistic scenario, with a Moderate Scenario level of 14.8 million TEU. Note in Table 5-1 that vessel deployment scenarios have a relatively small impact on the volume growth, and then only in the intermediate years. The differences in fleet composition between the two scenarios result in corresponding differences in the projections of vessel transits and toll revenues, which will be discussed later.

The range of forecasts for the three Operating Scenarios show container volumes in 2025 will be between 250 and 350 percent of the 2001 volumes, under the Base Case economic scenario. The Moderate operating scenario yields results much closer to the Optimistic than to the Pessimistic; in 2025, Pessimistic traffic is 19.7% lower than Moderate, while Optimistic is 6.7% greater. Essentially, forecast 2025 traffic in TEU under the Base Case economic scenario is projected to grow from 3.7 million in 2001 to a range from 11.9 million to 15.7 million TEU.

Figure 5-1



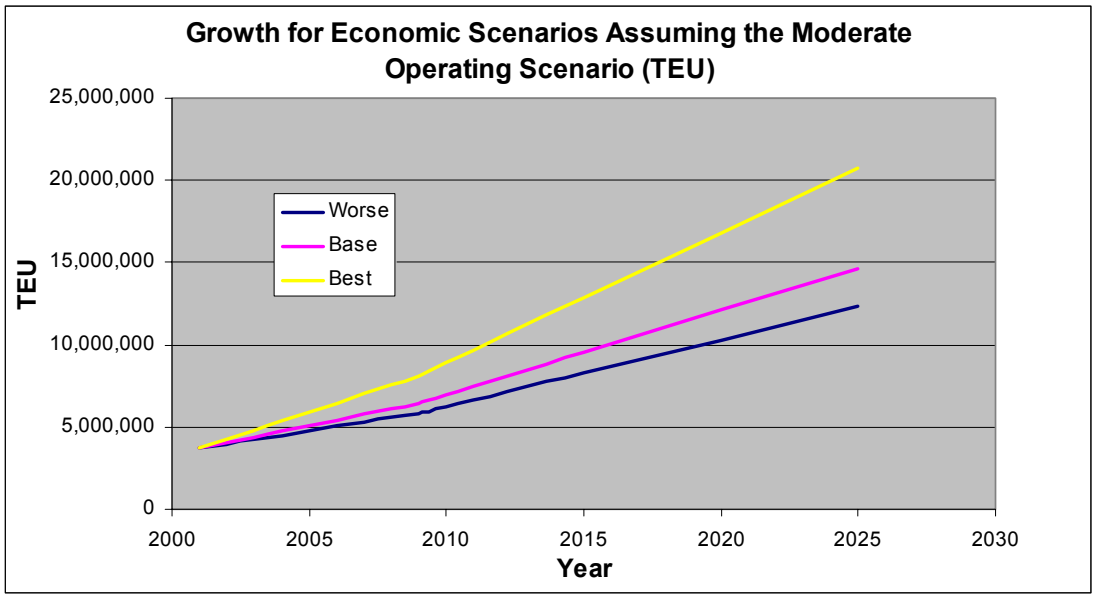
It is interesting to note that the range of forecasts vary only slightly across the three operating scenarios through the year 2010. Beyond 2010, the range widens

increasingly. The main reason for this projected growth rate is the fact that the Canal Expansion is assumed to be completed in 2010. While many of the factors that affect the competitive dynamics between the all-water route using the Panama Canal and the intermodal route can occur regardless of whether the Canal is improved, the expansion under consideration would be a far greater influence than any other single operating factor. These results indicate that in terms of Canal traffic growth, the kinds of changes that can be anticipated across the industry – in US ports, by steamship lines, by shippers, and by shipbuilders – are relatively modest in comparison to the likely impact of an expanded Canal. Furthermore, many industry changes reflected in the Optimistic Operating Scenario may not take effect until the expansion is a reality. At the same time, these results point out that significant Canal traffic growth is anticipated under any of the Operating Scenarios, regardless whether the Canal is expanded or not.

5.1.3 Comparison of Economic Scenarios

Figure 5-2 presents a comparison of TEU forecasts under the three Economic scenarios assuming the Moderate operating scenario. Again, with volume measured in TEU, the results are not influenced by the vessel deployment scenarios.

Figure 5-2



The sensitivity of the forecast results to variations in the economic scenarios is noticeably greater for the operating scenarios. 2025 forecast volume varies from 12.4 million TEU under the Worst Case economic scenario to 20.9 million for the Best Case, with a Base Case of 14.8 million. These results reflect a range of 8.5 million TEU.

While the range under the three economic cases is greater as compared with the operating scenarios, the Base Case is closer to the lower end than the higher. This is the opposite of the Moderate operating scenario, which was closer to the upper end of

the range. The Best Case volumes is 42% greater than that of the Base Case in 2025, while that of the Worst Case is 16% lower.

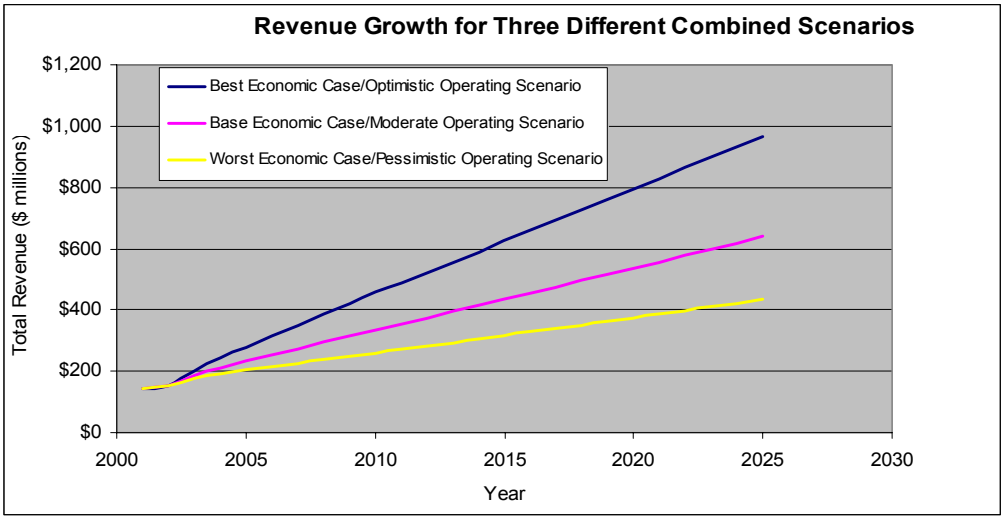
It is again useful to view forecast traffic in relation to base year volumes. All forecasts under the three economic scenarios indicate a significant growth rate for Canal TEU volumes, and the 2025 forecasts under the Moderate operating scenario describe a future in which the volumes may range between 330% and 560% more than the base year.

5.1.4 Forecasts of Vessel Transits and Toll Revenues

Table 5-1 above also presents the forecasts of vessel transits and toll revenues for all the combined scenarios analyzed. These figures are largely proportional to the forecasts of TEU. However, given the same forecast of TEU for a given year, different vessel deployment scenarios will produce differences in the number of vessel transits and the corresponding toll revenues, under the present toll policy. Under the scenario whereby larger vessels are deployed faster, the number of transits will be reduced as each vessel carries a higher volume of freight. The toll revenue will be a function of the number of vessel transits, the composition of vessels by size range and the toll pricing policy. In order to enable meaningful comparison of the results to the current situation, no changes in present toll policies are assumed in these forecasts.

Figure 5-3 presents the projected toll revenue for three combined scenarios in order to present the full range of potential toll revenues under the current pricing policy. The upper end of the range is represented by the combination of the Best Case economic scenario and the Optimistic operating scenario. The lower end of the range is characterized by the Worst Case economic scenario taken together with the Pessimistic operating scenario. To consider what can be interpreted as a most likely forecast, the Base Case economic scenario is combined with the Moderate Operating scenario.

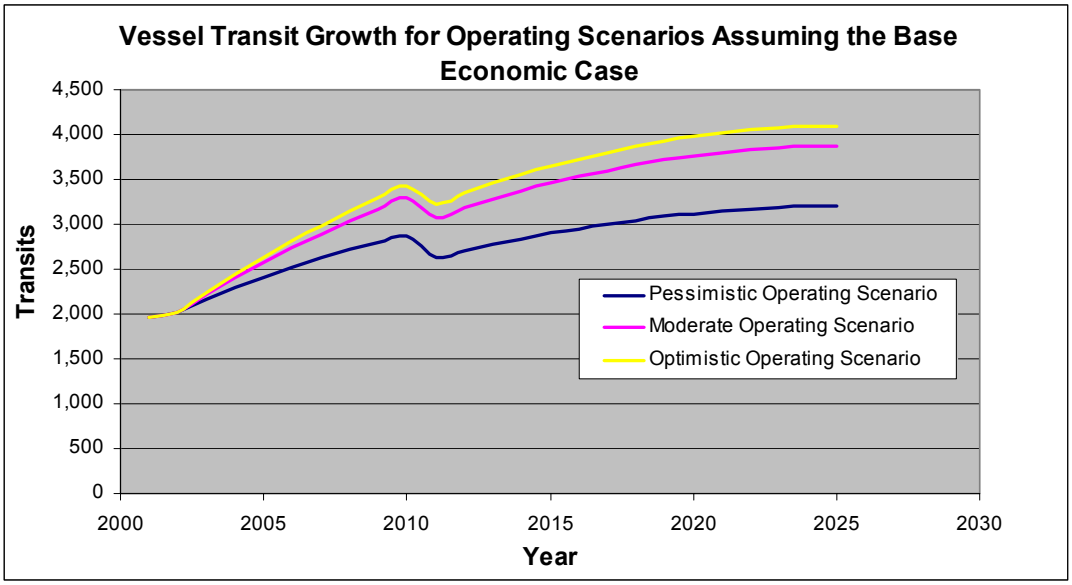
Figure 5-3



The result is an even wider range than those produced by the operating scenarios and economic scenarios individually. By 2025, tolls revenues in constant US$ are estimated to vary between $433 million and an upper level of $966 million. When compared to the medium, or most-likely, scenario with $639 million in projected toll revenue, the low end of the range is 32% lower and the high end 51% higher, respectively. When forecast 2025 revenues are compared with the base year, projected levels are between 300% and 670% greater.

Table 5-1 also shows a relatively slower increase in vessel transits as compared with growth in traffic measured in TEU and projected toll revenues. As can be seen in Figure 5-4, vessel transits increase prior to the assumed opening of the expanded Canal in 2010, then decline as larger vessels are introduced, before resuming the growth trend. For the combined scenarios, vessel transits in 2025 reach levels that are between 140% and 290% higher than current levels. The lower growth rate in transits is a result of the increase in vessel sizes over time as the Post-Panamax fleet serving the expanded Panama Canal is deployed.

Figure 5-4



By the forecast year 2025, the assumed growth in the Post-Panamax vessel fleet and the likely retirement of the Panamax vessel fleet results in the slow Post-Panamax vessel deployment catching up to the rapid deployment fleet composition. The differences in fleet composition between the two scenarios results in corresponding differences in the projections of vessel transits and toll revenues in the intermediate years. It is during the period from 2010 to 2025 that differences are projected, although the projected variation is relatively small.

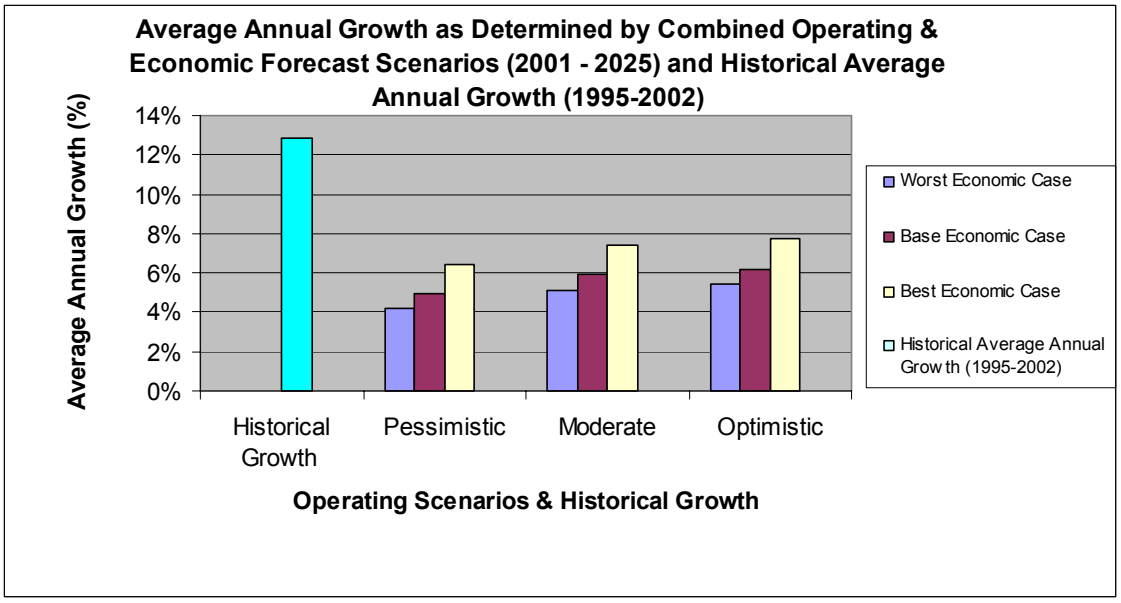
5.1.5 Canal Growth Rates

Figure 5-5 presents graphically the average annual growth rates of container volume measured in TEU for the nine combinations of economic and operating scenarios.

Comparing the average annual volume growth rates over the period from 2001 through 2025 by scenario, we see a range from just over 4% under the extremely pessimistic scenarios (Worst Case economic scenario – Pessimistic operating scenario) to just under 8% under the extremely optimistic (Best Case economic – Optimistic operating) scenarios. To place this range of growth rates within an historical context, we can compare them to recent growth rates at the Panama Canal. As reported in Chapter II, container vessel transits increased at an average annual rate of 6.4% and TEU capacity of the vessels transiting the Canal grew by 12.9% from 1995 through 2001, without the benefit of the Canal expansion program.[2]

This historical TEU capacity growth rate is higher than the range of future forecasts. This helps to validate that the lower end of the range is sufficiently conservative and representative of a lower extreme. It also makes the upper end of the range seem attainable. The combination of the Base Case economic scenario and Moderate operating scenario yields an average annual growth rate of 6%, about the same as the recent historical vessel growth rate and much lower than TEU capacity growth rate. However, the historical period shown includes years of fast growth in trade, increase in all-water services with new alliances, and the passage of OSRA that resulted in price differentiation in the marketplace between the Canal and intermodal routes.

Figure 5-5



[2] Presuming slot utilization rates have not changed significantly, this indicates similar growth rate in TEU traffic.

5.1.6 The No Expansion Scenario

In order to consider the implications of the Canal expansion and the benefits that might result, it is important to determine what might happen if the Canal was not expanded. In the current situation, with the Canal operating at close to capacity and projected to reach capacity within the next decade, one of the most important factors in such an analysis is the impact that capacity constraints would have on demand. The present study focuses on the traffic potential for the liner segment under a number of critical assumptions, most notably unconstrained capacity. Therefore, within the present study it is impossible to provide container traffic forecasts that fully consider likely Canal traffic levels if the Panama Canal does not expand, both because capacity limitations are not considered and also because other market segments are not considered. Under a certain scenario, if the Canal were not expanded, demand could be managed by increasing rates and/or through other Canal initiatives. The Canal is likely to face significant political and competitive issues that may be difficult to address under those circumstances. Considering that shipping lines are already building a large fleet of Post-Panamax vessels, if the Canal does not expand, shipping patterns may also change radically over the long term to favor the Suez Express route for even NE Asia-US East Coast cargo.

The final scenario presented in Table 5-1 has therefore been defined as the No Expansion Scenario. Assumptions have been made that are similar to the Pessimistic operating scenario. In both situations, the intermodal option gains a dominant competitive position in terms of cost and time advantage as the number of Distribution Centers moving to the East Coast diminishes. The main substantive difference between the Pessimistic and No Expansion scenarios is that under the latter, the Canal will be closed to Post-Panamax vessels through the planning horizon. This no expansion scenario was evaluated under the Base Case economic scenario. With these assumptions, both Pessimistic and no Canal expansion scenarios have similar projection levels in TEU, but differ in number of transits and revenues.

The results presented at the bottom of Table 5-1 reveal that by 2025 with Canal expansion under the Base Economic scenario and Moderate Operational scenario the projected volumes of container traffic will reach close to 15 million TEU and revenues close to $640 million, a four-fold increase over 2001. If, however, the Canal is not expanded, and under the assumption of unrestricted capacity for container ship transits, by the same year 2025, traffic is estimated at 12 million TEU and revenues at $509 million, or about 25% lower.

In reality, capacity constrains will result in considerably larger differences between these two alternative futures – with and without Canal expansion. Expansion of the Canal generates two basic results – traffic diversion from competing routes and sufficient capacity to accommodate growth of trade. The latter results, however, cannot be demonstrated in this study. It is therefore difficult to interpret these results without considering the influence of capacity constraints. An investment analysis that considers

traffic forecasts for other vessel types as well as capacity constraints will be necessary to fully develop reasonable traffic estimates without a Canal expansion.

5.1.7 Summary

The combination of scenarios that has been defined enables the evaluation of a reasonable range of anticipated traffic levels that might develop under a variety of scenarios reflective of industry trends and various quantifiable factors that affect future demand. The range of operational and economic scenarios demonstrates that the Canal can expect substantial and steady growth in container traffic even under the most unfavorable scenarios. Under the most favorable scenarios, the Canal can expect even faster growth that results in significant increases in container traffic levels over a 25-year planning horizon.

5.2 Sensitivity Analysis to Key Assumptions

5.2.1 Sensitivity to Model Parameters

The key driver affecting Canal traffic growth both for captive and divertible traffic is economic and related trade growth. Besides trade growth, there are several other variables which affect divertible traffic, particularly in the competition with the IM route.

To determine which factors have the greatest impact on the route allocation model outcome, sensitivity tests were performed on the major parameters. The results are shown in Figures 5-6 to 5-12 for the Optimistic Operating Scenario and Best Economic Scenario. These include not only the basic model parameters, i.e. concentration of distribution centers, cargo value, percentage of innovative products, and the ratio of the differential cost to the differential time, but also the relative weights given to the outputs of the models.

The sensitivity analysis and Figures 5-6 to 5-12 have been prepared using the following assumptions:

- The base values for the different parameters are those used for the Optimistic Operating Scenario for the forecast year 2025 with Base Case trade and economic conditions.

- For each graphic, only one variable is varied, with all other parameters being held constant, thus focusing on the isolated influence of the variable in question.

- The value on the vertical axis represents number of TEU expected to use the Panama Canal route in the year 2025.

- The full route allocation and fleet allocation model was not run for these sensitivities. A linear relationship was assumed between the all-water share and the number of TEU expected to use the all-water route.

The most important parameter remains the ratio of differential in cost to differential in time for the all-water route, even when adjusted for the elasticity of market share relative to this ratio. The sensitivity to the concentration of distribution centers is also important but less so. The value of the cargo has little impact on the outcome. The relative weights given to the cost/time model and the model based on shipping factors (cargo value, concentration of D.C.s) in determining all-water share also have relatively little impact on the outcome.

Figure 5-6

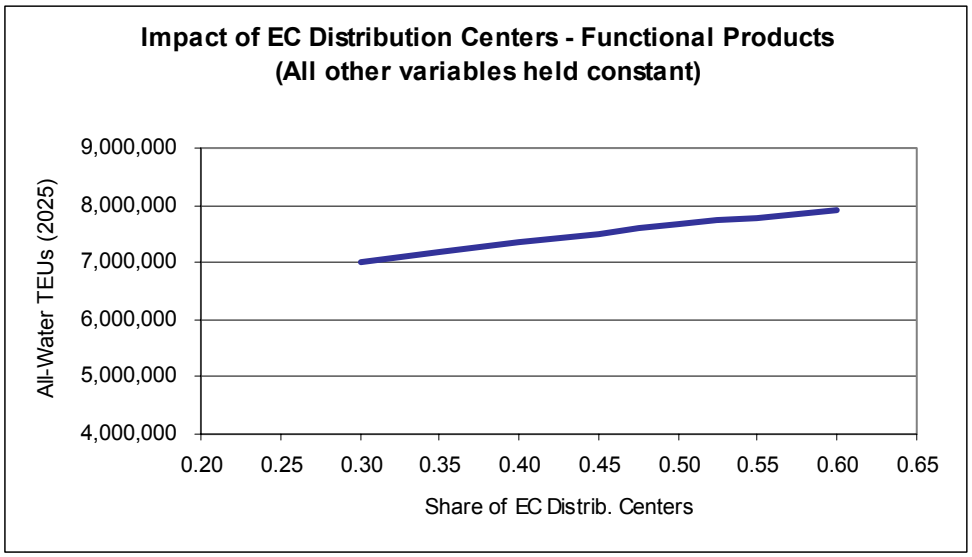


Figure 5-7

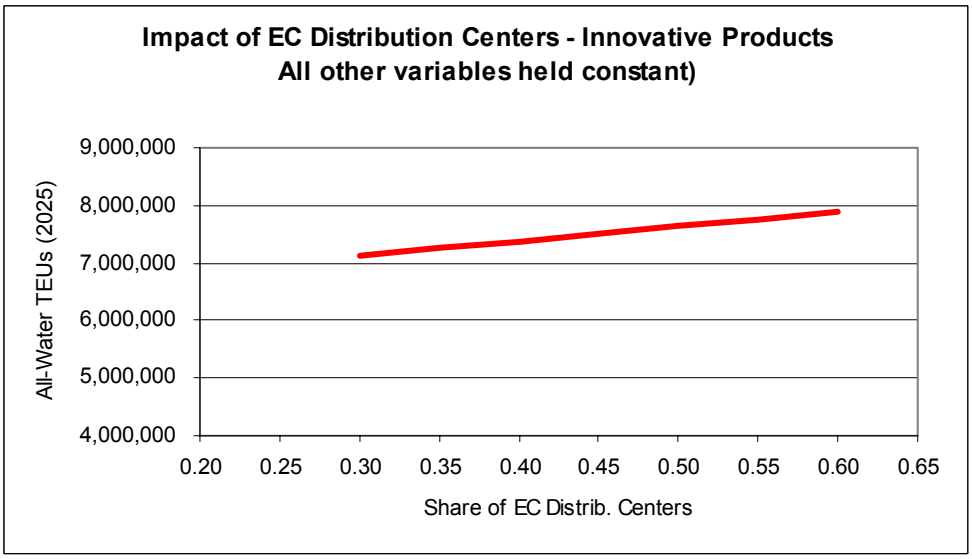


Figure 5-8

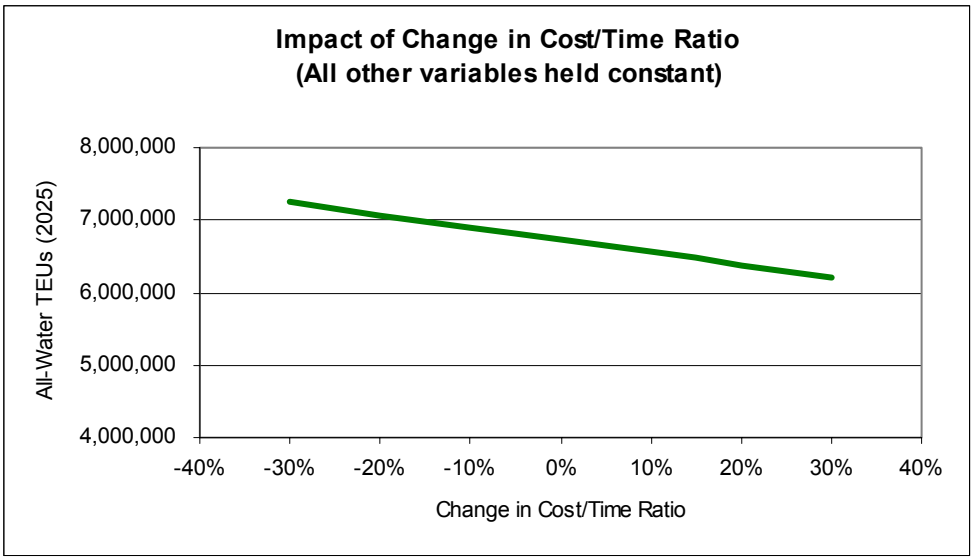


Figure 5-9

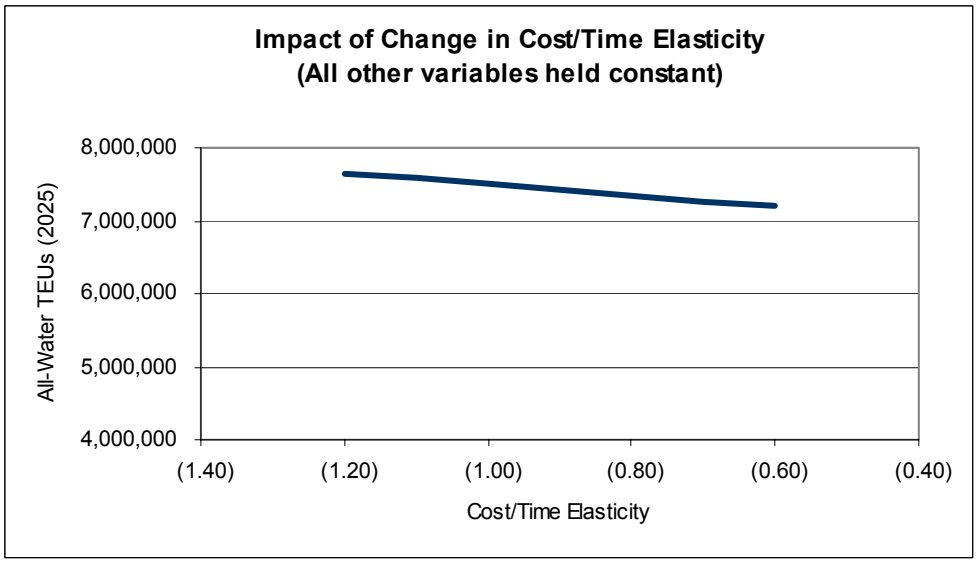


Figure 5-10

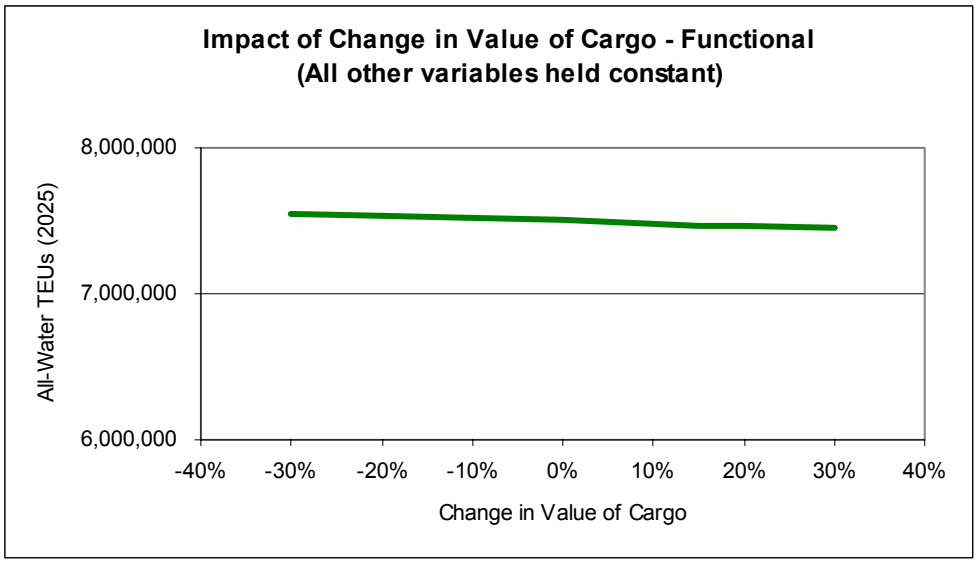


Figure 5-11

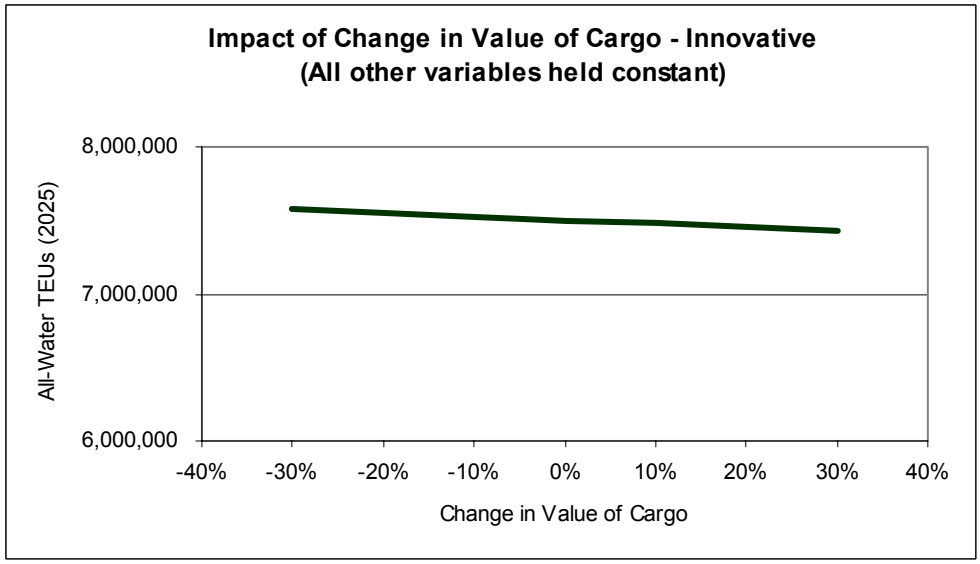
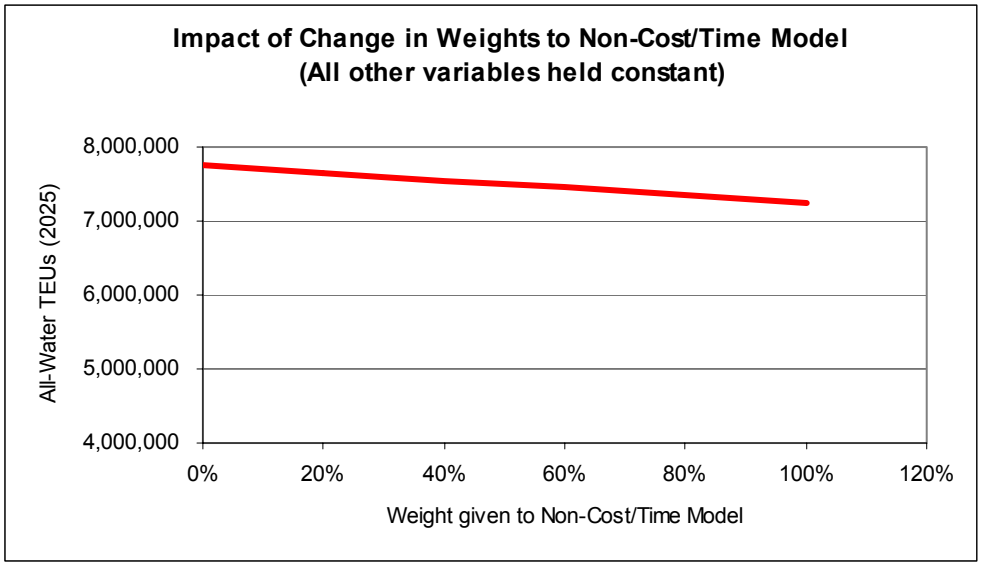


Figure 5-12



5.3 Elasticity of Canal Traffic and Revenue to Changes in Tolls

Pricing of Canal services will be considered further in the next Chapter, including the elasticity of demand. The elasticity of demand for the Panama Canal is an important pricing issue that the Panama Canal Authority needs to consider. Over the past few years, the response to increased tolls has been positive for the Canal, i.e., no reduction in traffic and higher revenues. This, as well as the above referenced estimation, suggests that the Canal's demand is inelastic to the changes in toll levels. Earlier analyses in other studies also concluded that little loss in traffic takes place as a result of toll increases because a large portion of the Canal traffic is captive and the value of the Canal to the users far exceeds the toll charged by the Canal.

The study team agrees with this view that the Canal's demand is inelastic in the short run i.e., users of the Canal have a structure that does not allow them to rapidly redeploy their fleet and change their routing as a response to increase in toll levels and their customers – the shippers – also cannot quickly find reasonable alternatives. In addition, the toll paid per TEU is a small percentage of the overall cost incurred on transporting the container (especially for the longer routes such as North East Asia to East Coast US) and of the merchandise being transported (especially for higher value cargo). This results in the inelastic nature of the Canal's demand.

In the longer term, it is reasonable to expect that the users of the Panama Canal have greater flexibility that will allow them to respond appropriately to the changes in prices. Thus, if the tolls were to change substantially over the next 10-20 year period (especially if the tolls became a much larger percentage of the overall cost of transport

or the value of the cargo), then the Canal traffic is likely to decrease as toll rates are increased.

It is difficult to estimate a long-term price elasticity for the Canal as the demand for the Canal is related to several factors other than tolls on the Canal (both quantifiable and non-quantifiable factors as discussed earlier). The price elasticity is also very much related to the marketing efforts of the Canal that can have a dampening impact (i.e., reduce the long-term elasticity). Thus there is a great potential for the Canal to increase their revenues by carefully coordinating their marketing strategy with their pricing policies. The next Chapter will consider the value of the Canal to its users and the implications for the Canal pricing policy.

CHAPTER VI

6. Competitive Cost Analysis

The perceived economic value of the Canal is expressed, based on the overall methodology adopted in this report, as the transportation cost difference between alternative routes inclusive of the estimated value of time. This Chapter presents an analysis of the transport costs (including value of time) for alternative routes compared to the costs incurred by users of the Canal for each of the 12 relevant trade flows. For each trade flow, a comparison is made of the Panama Canal route to the next best alternative intermodal and/or all-water route.

This analysis provides a framework for considering *pricing and related marketing strategies*, which are discussed in the next Chapter. The results can be useful when considering toll pricing policies or strategies to increase Canal revenues. The comparison considers current conditions, using the base year 2001, as well as future conditions (2025), assuming Canal expansion.

The analysis presented in this Chapter of the value of the Canal primarily emphasizes the perspective of the shipper. From the perspective of shipping lines, the value of the Canal should be viewed differently when comparing all-water and intermodal alternatives. In the case of the former (comparing the Canal with all-water routes), shipping lines generally would increase their revenues if the Canal route was not available, so therefore the Canal would not represent additional value to them. In the case of the latter (Canal versus intermodal), the Canal option generally increases net revenues to the lines. This increase, however, is obviously much lower than savings to the shippers.

Ocean carriers are constantly fine-tuning their vessel deployments and cargo routing practices, balancing the merits and costs of all-water and intermodal services. For example, there are capital cost savings to the steamship lines to deploy USEC intermodal-only services from the Far East, but these capital-cost savings are offset by variable (operating) cost savings gained from their all-water deployments, so Canal route results generally in increases in net revenues. However, these increases are difficult to quantify because of the complex and confidential structure of the agreements between shipping lines and providers of intermodal services. For instance, it is possible that a shipping line might have a mark-up on intermodal delivery comparable with the net revenue it can obtain via the all-water alternative. It should be noted that in addition to transportation costs, the Canal offers to shipping lines a variety of logistical advantages, such as transshipment. These advantages, however, are practically impossible to quantify. The shipping line's perspective is discussed further in Appendix F, section 5.

6.1 Cost Comparison by Relevant Trade Flow

6.1.1 Key Assumptions

The cost differential between alternative routes has been compared considering the unique geographical and market conditions that affect each trade flow. The Canal's relative attractiveness for each of the 12 trade flows varies from captive (where available alternatives are much more expensive) to divertible (where the impact of marketing and competitor initiatives as well as changing shipper requirements influence the relative cost differential among the routes).

The factors that a shipper considers when making a route choice decision have many components, some of which are very difficult to quantify and will likely vary widely among different shippers even within the same trade flow.[1] However, for all trade flows, the two main factors are the cost and time differential between the alternative routes; this cost comparison emphasizes these two main factors. The 2025 year comparison is made under the Moderate Operating Scenario, as defined in Chapter III.

The analysis is then based on an estimate of the total perceived cost by the user of the Canal compared to an alternative route, including both the *direct cost* spent on transport and the *value of the time* associated with the cargo movement. Each of these in turn includes several components as listed below:

<u>Factors that Affect Direct Cost</u>

- Ship voyage costs
- Port handling costs
- Panama Canal tolls
- Alternative route tolls
- Rail transport costs

<u>Factors that Affect the Value of Time</u>

- Value of the cargo
- Cargo inventory and financial carrying costs
- Opportunity cost for seasonal or just-in-time (JIT) products
- Reliability of transport route options

These factors are combined to estimate a total difference in direct cost of the best alternative to the Canal route, measured in $/TEU, and a difference in travel time, measured in days and then converted to cost, considering a unit value of time that incorporates the factors listed above. The main assumptions are briefly described as follows.

[1] See discussion in Chapter III

Identification of Alternative Route

For each trade flow, the main competing route, either all-water or intermodal was identified. The analysis primarily considers only non-Panama intermodal alternatives, but does consider the use of Panama's ports and rail service as an appropriate alternative to the Canal for purposes of analysis.

Ship Voyage Costs

The analysis considers the differences in ocean distances between route options, the average ship speed (which is a function of vessel type and size), and the unit ship voyage cost (measured in $/TEU-day). Average assumptions are made based on industry and market data.

Port Handling and Rail Transport Costs

The cost comparison is made in terms of differences as opposed to total aggregate costs, so for all-water alternatives port handling costs are not explicitly considered, since both alternatives would have the same port costs. In the case of the intermodal option, however, an all-inclusive cost per TEU by trade flow is considered based on market freight rates. This approach internalizes the influence that port costs have on the total cost differential. Similarly, rail transport costs are included in this manner.

Panama Canal Tolls

The cost comparison assumes no Panama Canal tolls, in order to estimate the potential range for toll levels.

Value of Time

As described in Chapter III, there is a wide range of factors that contribute to the value of the time savings or delivery reliability between route options as perceived by the shipper. Because of the differences in cargo type and value and shipper logistics, as well as the confidential nature of shipping information, it is nearly impossible to quantify these factors. The shipper interviews conducted as part of this study, however, provide some information on factors considered by major shippers.

In order to develop a representative value of time, information was analyzed on the current cost and time differences between the Canal route and the US intermodal route for the NE Asia – US East Coast trade flow. Route decisions made by shippers in this trade flow explicitly consider a tradeoff between cost and time. It is estimated, based on the shipper and industry interviews, that on average the direct cost of the Panama Canal route, including tolls, is $300/TEU lower than the intermodal route although the Canal route takes an average of eight (8) additional days.

Therefore, a shipper at the margin, who is considering which alternative to use, must determine whether the eight days savings in transit time is worth $300. Therefore, the

marginal shipper who views both routes as equivalent values the time savings at $37.50 per TEU-day saved, calculated by dividing $300 by 8 days. This is defined as the *premium per day saved*.

Considering that current users of the Canal value time somewhere on the spectrum from $0/TEU-day to this marginal value of $37.50, then the average is somewhere in between. For purposes of illustration, this analysis considers the average value of time to be halfway between the two extremes, equating to a perceived average value of time of $18.75 per TEU-day.

For this competitive cost analysis, the relevant question is how users at or beyond the point of indifference value time rather than those that are below the margin. Changes in the relative cost dynamic, whether favorable or not to the Canal, will affect users at the margin before those with lower values of time. The sensitivity of the analysis to the perceived value of time by a specific shipper is discussed in section 6. 2.

Other Alternative Routes are not Considered

By comparing the Canal route to one main direct service alternative, this analysis does not include the influence that transshipment and service patterns have on costs and the individual shipper's route choice decision. Shipping lines make their vessel deployment decisions to improve their profitability. Therefore, lines often serve a route through a longer and/or more costly option than may be possible through a direct service. This cost comparison is intended mainly to illustrate the relative competitiveness of the Canal for each relevant trade flow to the main alternative route.

It should also be noted that individual steamship lines will consider many factors in their vessel deployment, service pattern, and port call decisions. Each steamship line may choose different operational strategies or approaches to serve a trade route or regional market. For example, in the 1980's, APL decided to eliminate their AW services to the US East Coast while other lines were building and operating Round the World services (in Evergreen's case in both eastbound and westbound directions). Serving the entire US thru the Pacific Coast ports reduces the number of vessels and capital costs required for a steamship line, although the potential revenue from serving the East Coast market is reduced substantially – even when the intermodal rail service is a dedicated train service purchased by the steamship line, since the line must contract with a railroad.

Based on its customer needs and its market assessment as to how to best serve their destination mix in the US, different lines will then offer different products from which shippers select how to move their cargo. Individual shippers sometimes select to move all their cargo through one route, while increasingly major shippers seek to maintain flexibility by moving their cargo through both the Panama and intermodal routes. This analysis is not intended to reflect all these complexities but to present a simple cost comparison of alternative routes.

6.1.2 Route Cost Comparison

For 10 of the 12 relevant trade flows, the lowest cost competitor to the Canal is an all-water route, transiting either the Suez Canal (in the case of SE Asia to US East Coast), the Cape of Good Hope south of Africa (for NE Asia to East Coast South America), or the Magellan route via Cape Horn for all other trade flows. For the remaining two trade flows, the Canal competes directly with an intermodal route, i.e. for NE Asia – US East Coast and Europe – US West Coast trade.

The results of the cost comparison by relevant trade flow are presented in Table 6-1 for the base year 2001 and forecast year 2025[2]. The comparison presents the differences in direct costs and value of time comparing the best Non-Panama alternative route to the Panama Canal route. Positive differences indicate that the alternative route is more costly than the Canal route and, vice versa, i.e. negative differences indicate that the alternative is less costly than the Canal. The Canal traffic for each trade flow is also presented in the table, as an indicator of the relative size of each market. Note that the differences are presented both in unit terms ($ per TEU) and aggregate terms ($), in which the savings are weighted by the volumes of trade flows that use the Canal. The results of the cost comparison lead to the following conclusions:

- For three of the relevant trade routes, the Canal is actually more expensive than the alternative route. For these flows, the Canal attracts no cargo or a very small market share (3.9%, 0%, and 1.4% respectively for SEAsia-USEC, NEAsia-ECSA, and Asia-WCSA in 2001). For the SE Asia-USEC trade flow, the cost differential is very small, so the Canal route attracts a 3.9% share of the traffic, as certain steamship lines choose to move some cargo through the Panama route (besides the Suez route, there are other routing options for this trade flow, involving transshipment in Europe or use of the US intermodal system). For Asia-WCSA trade, use of the Canal route only makes sense when viewed from the operating perspective of the steamship lines. Some lines choose to serve this market by transshipping on the Caribbean side of the Canal thereby involving a Canal crossing (the Canal attracted 1.4% of the trade in 2001).

- For two of the relevant trade routes (WCSA - USEC and Asia - NCSA), traffic is not only captive of the Canal (100% market share in 2001), but the analysis shows that the alternative of shipping across Panama on the railroad (at an extra cost of $215/TEU)[3] is actually cheaper than the AW alternative route through Magellan.

[2] Costs for Canal and alternative routes for 2025 are based on the Moderate Operating Scenario as described in Chapter III.

[3] The rail alternative assumes that containers are unloaded on one coast, transported across the isthmus to a port on the opposite coast, and loaded onto a different ship for transport to its ultimate destination port. The total difference in direct costs using the rail alternative is estimated at $217.50/TEU ($177.50/TEU if the Canal toll is added). Two days of additional transit time are required, which equate to an additional $37.50/TEU at the average value of time estimated for 2001. Therefore, the total net additional cost of the Panama rail alternative is estimated at $215/TEU, including tolls.

Table 6-1

Cost Comparison By Relevant Trade Flow (2001 and 2025)
Difference between Alternative and Panama Canal Route ($/TEU)

Trade Flow			Alternative Route		2001 Actual	Additional Cost/(Savings) of Alternative versus Canal in 2001					2025 Forecast	Additional Cost/(Savings) of Alternative versus Canal in 2025				
	Origin	Destination	Definition	Distance (NM)	Canal Traffic (TEU)	Direct Cost ($/TEU)	Trip Time (Days)	Value of Time ($/TEU)	Equiv. Cost ($/TEU)	Total Savings	Canal Traffic (TEU)	Direct Cost ($/TEU)	Trip Time (Days)	Value of Time ($/TEU)	Equiv. Cost ($/TEU)	Total Savings
1	NE Asia	USA - EC	LBG - N	(2,165)	647,262	340	(8.0)	(150)	190	$122,979,780	2,963,507	374	(6.8)	(167)	207	$613,445,949
2	SE Asia	USA - EC	Suez	(2,261)	72,480	24	(4.2)	(79)	(55)	-	292,312	34	(4.0)	(99)	(65)	-
3	USA - EC	Oceania	Magellan	3,421	134,155	115	6.3	119	234	$31,386,688	506,631	99	6.1	150	250	$126,451,886
4	USA - WC	NC/ECSA	Magellan	1,723	43,326	58	3.2	60	118	$5,105,278	267,626	50	3.1	76	126	$33,642,949
5	WCSA	USA - EC	Magellan	4,155	192,398	140	7.7	144	284	$54,671,014	778,786	121	7.4	182	303	$236,085,678
6	Europe	USA - WC	LBG - S	(1,813)	475,886	227	(6.0)	(113)	114	$54,330,318	1,800,271	249	(5.1)	(125)	124	$223,383,627
7	WCSA	Caribbean	Magellan	1,628	5,998	55	3.0	57	111	$667,800	10,339	47	2.9	71	119	$1,228,030
8	NE Asia	ECSA	Good Hope*	(2,122)	-	(71)	(3.9)	(74)	(145)	-	145,951	(62)	(3.8)	(93)	(155)	-
9	Europe	WCSA	Magellan	1,769	169,051	60	3.3	61	121	$20,451,781	316,011	51	3.2	78	129	$40,785,886
10	NC/ECSA	WCSA	Magellan	1,236	46,754	42	2.3	43	85	$3,952,053	75,487	36	2.2	54	90	$6,807,241
11	Asia	NCSA	Magellan	8,123	41,611	273	15.0	282	556	$23,115,865	78,667	236	14.5	357	593	$46,621,979
12	Asia	WCSA	Magellan *	(160)	26,700	(166)	(2.0)	(38)	(204)	-	94,743	(162)	(2.0)	(49)	(212)	-
	Total				1,855,621					$316,660,577	7,330,331					$1,328,453,223

Canal Traffic - Trades Competing with Landbridge				2001	2025
1	NE Asia	USA - EC	LBG - N	647,262	2,963,507
6	Europe	USA - WC	LBG - S	475,886	1,800,271
	Total			1,123,148	4,763,778
	As Percent of Total Canal Traffic			61%	65%

Comments:

1. For convenience of explanation the US is divided into 4 regions: .
   East Coast (EC), West Coast (WC), Gulf Coast (GC) and Midwest (MW)
2. LBG -N = Landbridge North, LA - New York; LBG - S = Landbridge South, LA - Houston.
3. All Cost and Time Differences are relative to All Water, Cross-Panama services, using the Canal.
4. All comparisons assume point-to-point direct transport, without consideration of transshipment, with the exception of Asia-WCSA that shows additional cost of Canal crossing.
5. Cost Equivalent = Cost Differential + Time Differential x Value of Time.
6. Value of Time considers average premium per day saved as calculated below for base year (2001) and forecast year (2025).
7. For alternative routes indicated with asterisk (*), Canal share of traffic is forecast as transshipment cargo, which limits relevance of this cost comparison.
8. Traffic forecast figures assume Moderate operating scenario and Base Case economic scenario.

- For the remaining seven trade routes, the cost differential of the Canal route compared to the alternative AW or intermodal route ranges between $85/TEU and $234/TEU in 2001, growing to a range of $90-$250/TEU in 2025.

- The alternative routes for the largest two trade flows where the Canal is competitive are intermodal routes (NEAsia-USEC and Europe-USWC). While the influence of the time savings for trades for which the Canal competes with an all-water alternative is to amplify the cost differences, in this case, the time savings via the intermodal alternative compensates for the additional cost. The tradeoff between direct cost and time becomes a central component of the competitive situation. For the NE Asia – USEC trade flow, the cost differential is $190/TEU in 2001 growing to $207/TEU by 2025, while for Europe – USWC, the cost differential with the alternative intermodal route is $114/TEU in 2001 growing to $124/TEU in 2025. For NE Asia-USEC trade, the intermodal route is eight days shorter than the Canal route, resulting in an estimated savings of $150/TEU in equivalent cost, which is partially offset by the additional direct cost estimated at $340/TEU, resulting in a net equivalent additional cost of $190/TEU versus the Canal route. For Europe-USWC trade, the intermodal route is six days shorter, equating to $113/TEU in equivalent cost savings which is partially offset by the $227/TEU in additional direct cost, yielding a net equivalent additional cost of $114/TEU versus the Canal route.

- By 2025, the increased size and speed of Post-Panamax ships is estimated to have a relatively minor effect on the cost differential for routes where the Canal competes with an all-water alternative. The differences, whether negative or positive, are similar as all maritime routes benefit from faster and less costly ships. On the other hand, the influence of larger and faster vessels on the competitive dynamic of the two trade flows for which the Canal competes with the US intermodal system is greater. By 2025, the cost savings versus the intermodal route are expected to be more significant as the time differential is estimated to decrease from eight days to 6.8 days due to the increase in ship speed. The net equivalent additional cost of the intermodal route is estimated at $207/TEU, up slightly from $190/TEU in 2001. The Canal enjoys a similar increase in cost advantage for the Europe-USWC trade flow. It is worth noting that this analysis is based on the Moderate Operating Scenario in which the intermodal system is not expected to achieve time savings. Under a more conservative scenario (from the perspective of the Canal), it may be possible for the intermodal route to achieve time reductions that keep pace with the savings projected for the Canal. This would dampen the relative cost savings gained by the Canal as a result of the expansion program.

6.2 Changes in Value of Time

The cost comparison presented in Table 6-1 and discussed in the previous section assumes an estimated average value of time as perceived by shippers. As has been noted, the value of time will vary widely by trade flow, cargo type and value, its

seasonality, inventory and financing costs, the opportunity cost of a product not reaching its retail destination in time for sales to be made and the shipper logistics systems. Shippers are reluctant to provide data on how the value of time influences their route decision, partly because they view the information as confidential and/or partly because they do not have this value fully quantified.

A range of values was considered based upon analysis of times and costs for the NE Asia-US East Coast trade. The tradeoff between transport costs and travel time savings makes it possible to establish a relationship between the two. For 2001, the competitive cost comparison was based on a premium per day saved of $37.50 at the margin and an assumed average value of time of $18.75, assuming that users will value time anywhere from zero up to this maximum. When the value of time is zero, the total equivalent additional cost for the intermodal route is $300/TEU. This analysis assumes that the average current user of the Canal values time between these two points at $18.75/TEU-day. This means that the Canal is capturing users that value time at points throughout the range from zero to $37.50, but above $37.50 the intermodal route becomes more attractive.

Currently, as the assumed value of time increases, the Canal route becomes less attractive as the time savings from using the intermodal route are perceived as more valuable by shippers. The analysis of market data indicates that the Canal route is currently capturing approximately 30% of the NE Asia-USEC relevant trade. This implies that 70% of this market segment values time at a level that is higher than the $37.50/TEU-day.

The expansion of the Canal is expected to increase the Canal's competitive situation versus the intermodal route in terms of both time and cost. It is estimated that the reduction of the travel time differential and the increase in cost savings will make it more likely for the Canal to capture additional users who value time at higher levels than is the case today. By 2025, a cost difference of $374/TEU and time difference of 6.8 days is estimated between the Canal and the intermodal route. The estimated higher value of time is then $49.12/TEU-day, which would shift the maximum value of time at which shippers would find it attractive to use the Canal route to $24.56/TEU-day from the present $17.50.

This increase in the estimated value of time at which shippers would find the Canal route attractive should not be interpreted as an increase in the relevant market for the Canal route. Rather, the increase in relative competitiveness of the Canal route enables the Canal to compete for a larger share of the market. Shippers that currently choose the intermodal route because their value of time is higher than the point of indifference estimated for 2001 will find the Canal more attractive after the expansion.

6.3 Pricing Considerations

The cost differences presented in this Chapter indicate how the Canal route compares with competing routes. For those trades in which the Canal has a cost advantage

against alternative routes, the cost difference provides a reference point up to which the Canal could consider toll increases without losing substantial traffic. This could provide the basis for various toll strategies to increase revenues, or to consider differential tolls by trade route based on commercial or competitive considerations. It is important not to take this comparison out of context or to assume that tolls can be raised indiscriminately. This is especially true for the trades for which the Canal competes with the intermodal route, in which the competitive dynamic is characterized by many subtle factors and tradeoffs that can not easily be quantified and affect users in different ways.

A more detailed competitive cost pricing analysis should be carried out to develop a tolls policy that results not only in near-term revenue increases, but also long-term higher revenues without a loss of market share. Such an analysis should include consideration of capacity constraints on Canal traffic, the price elasticity of the liner segment of the market operating in various captive or divertible trades at different toll levels, and the demand forecasts for other market segments. Still, several important conclusions emerge from this analysis as follows:

- The trade flows that compete with the US intermodal system, NE Asia-USEC and Europe-USWC, account for over 60% of total current Canal traffic and are expected to grow to over 65% by 2025. These market segments (particularly the NE Asia – USEC trade flows) are the most intensely competitive and the actions taken by the ACP to improve its price/service offering will be important in determining the share of the market it captures and the revenues it generates. Consequently, special attention should be focused on these market segments.

- The trade flows that compete with the all-water alternative routes are generally captive to the Canal route and at current toll levels bring substantial benefits to the Canal's users. If the ACP were to consider a tolls policy based on price differentiation, there is significant opportunity for raising tolls for these trades to increase revenues.

- This analysis supports the findings in previous studies and through Canal experience that demand for the Canal is highly inelastic to toll increases in the short term yet, the impacts of such increases on traffic will vary by route. This inelasticity is a function of the inherent cost advantages that the Canal route offers to certain shippers in certain trades. While there clearly are opportunities to raise revenues by increasing tolls, this should be based on further consideration of the implications on various trade flows, as longer term it can lead to a loss of traffic and market share. Any revised pricing strategy should then be based on commercial considerations as well as conformance with the Canal Treaty. The ACP should explore pricing changes and toll strategies in conjunction with a broader marketing strategy that builds around alliances and close coordination with partners in the US ports and large shippers and steamship lines that should commit to the growth of the Panama Canal route and the utilization of Post-Panamax size vessels on that route.

CHAPTER VII

7. Marketing Strategy

This Chapter presents recommendations for a Canal marketing strategy based on the market analysis, forecasts, and competitive cost analysis for the liner market segment that has been carried out as part of this study. The Canal's objective is not only to pursue a marketing strategy aimed at maximizing the revenues of the ACP from the operation of the Canal but also to facilitate the development of a Panama maritime hub, thereby also maximizing transshipment and related activity in the Republic of Panama. The proposed marketing approach is based primarily on improving the long-term market position of the Canal considering the proposed expansion. At the same time, short-term strategies are noted that the Canal could pursue in the near term in anticipation of an expanded Canal.

7.1 Industry and Market Dynamics

The ACP is evaluating the potential expansion of the Canal at a time of changing dynamics in the liner container shipping industry. Trade is growing rapidly, especially in the critical NE Asia – US East Coast trade flow for which the Canal competes with the US intermodal route. The liner container industry continues to build larger vessels, which is reflected in the increasing number of Post-Panamax vessels in operation on the worldwide containership fleet (see tables 2.8 and 2.9). The growth in trade and the larger fleet of Post-Panamax ships also requires continuing port infrastructure improvements and expansion.

Furthermore, on the heels of the experience of the labor lockout of West Coast ports in 2002, shippers are increasingly pursuing an East Coast alternative. The marketing strategy for the liner segment that accompanies the decisions that the ACP makes regarding its expansion program will be critical to the long-term success of the Canal. Considering the growing worldwide importance of the container market segment and the objectives of ACP to use Canal expansion as a catalyst to make Panama an even stronger container hub than it already is today, a *collaborative marketing initiative involving the various elements of the liner industry (the Canal, steamship lines, and ports) that are interested in improved AW services* should be developed by the Canal to advance joint initiatives amongst the industry groups that are most interested in the success of the expansion program.

7.2 Recommended Marketing Strategy

The Canal's marketing strategy to attract expanded all-water services should involve the following program elements:

- **Data gathering and market understanding** - Follow up on the insights gained through the interviews conducted as part of this study to gather information (including better quantitative data) on changing shipper requirements and industry

trends so as to gain a better understanding of the Canal's increasingly important role in the supply chain that manufacturers and retailers use to move their products to market, manufacturing and/or distribution center locations;

- **Maximize existing Canal capacity utilization; orchestrate a successful transition to Post-Panamax operations** - Work with the steamship line industry to consider how to best use the Canal's limited capacity and further improve the reliability of all-water services pre-expansion; and involve the shipping lines in planning for a transition to Post-Panamax vessels from the present Panamax vessel fleet;

- **Promote increased use of Asia – US East Coast Canal all-water services** - Jointly with steamship lines and ports, promote among shippers the increased use of all-water services and the Canal route;

- **Monitor competitor initiatives** – Consider appropriate market response to any competitive threats that could diminish the competitive position of the Canal route and use the Canal's market position and Panama's strategic location at the crossroads of major trade routes to further increase the Canal's market share of divertible cargo;

- **Consider innovative and commercially sound pricing strategies--** Consider new innovative, market responsive, and commercially sound pricing strategies,[1] including volume discounts, special promotional periods for new services, incentives for bundled rates that result in increased traffic and/or use of Panama ports, and other incentives aimed at attracting increased Canal traffic and increased transshipment in Panama; and

- **Establish alliances with selected key industry partners** – Seek partnerships with selected steamship lines and/or alliances that commit to long term Canal services, e.g. by maintaining a certain minimum and increasing share of their total Asia-US tonnage capacity through the Canal, and/or by making a long-term commitment to significantly higher transshipment volumes at Panama ports. The Canal could also negotiate similar partnerships with a limited number of East Coast ports (and all Panamanian ports) that commit to certain actions (e.g. having adequate infrastructure ready by the time of the opening of the Canal expansion with sufficient channel access and berth depth, crane outreach, increased yard capacity and other steamship line requirements to handle the largest vessels that will be able to use the expanded Canal.) The main candidates for such alliances are New York, Norfolk and Savannah.

Each of these elements of the overall recommended marketing strategy is discussed in the following sections of this Chapter.

[1] Consistent with the provisions of the Permanent Neutrality Treaty, which requires that tolls and other charges for transit and ancillary services shall be just, reasonable, equitable, and consistent with the principles of international law.

7.2.1 Data Gathering and Market Understanding

It is recommended that the Canal establish a marketing data system using not only available operating data but also tapping market information from other sources. The Canal should collect and analyze data on a per container or per bill of lading basis, not solely on a per vessel basis, in order to fill in some of the data gaps identified by this study. For example, although data is regularly gathered on Canal vessel transits, there is no historical, reliable information on actual containers transiting the Canal or the containers moving through alternative routes. Data on value and type of cargo moving on containers through the Canal and alternative routes is also not available. This study has utilized available information to develop estimates for 2001 of actual trade flows through the Canal for each relevant trade route. The Canal should consider regular updating (at least annually) of this data so that it can monitor the Canal's changing competitive situation for each relevant market. The suggested actions should include regularly monitoring and maintaining a historical data base of actual cargo (containers), vessel capacity (TEU) and vessel transits by trade route and type of service. In addition, to the extent possible, information on rates, transit times, and other relevant data should be collected and analyzed.

Similarly, the interviews conducted as part of this study were essential to provide an understanding of the current competitive situation and customer requirements. As noted in Chapter III, the Panama Canal is a critical link in the supply chain that brings products to market or that are input to manufacturing. The nature of the products may vary, from finished products that are transported to retailers for sale to end users to component parts or raw materials supplied to manufacturers, but the role of the Canal remains as only one link in a complex transportation system. Therefore, the competitive position of the Canal can only be understood within the context of the entire supply chain, by better understanding the requirements of the different direct users (the steamship lines) and indirect users (manufacturers, distributors, and retailers – the shippers). The Canal should continue a regular program of meetings with its customers and all its stakeholders, through a program of periodic interviews and surveys to determine user perceptions and gather market intelligence on changing shipper and steamship line requirements, particularly as the expansion program moves forward. Key stakeholders in the Canal route are described below.

7.2.1.1 Shippers

The perspective of the shipper is perhaps the most important to consider, as the shipper is the ultimate – although indirect - customer of the Canal. The shipper makes the main decisions that determine the transportation route that its products use. In making this decision, the shipper considers the cost, time and reliability of the various route options in the context of the many industry-specific factors that affect the shipper's business.

Based on the analysis conducted as part of this study, including extensive interviews with shippers, we can identify several key points that define the shipper's perspective:

- Shippers in the critical NE Asia – USEC trade place a high value on transport time and reliability and will be very sensitive to small changes in transport service level. For some shippers who value the bundle of services and features offered by the Canal as being very close to those offered by the intermodal route (i.e. the savings in transport rates are offset by savings in transit time), cost is also a key factor. Many of these shippers are able to move some of their cargo by either route and are very sensitive to changes in pricing or service levels.

- Shippers in other trades for which the Canal competes with longer and more costly all-water routes may place a high value on time savings, but will not be as price-sensitive due to the lack of a highly competitive option that saves transit time as much as the intermodal system does.

- The location of distribution centers (DCs) within the US is a critical factor in determining how route choices are made. The high concentration of population along the East Coasts will continue to draw DCs to locations close to East Coast ports. This trend is likely to continue as large retailers and other shippers seek to establish viable alternatives routings for their cargo and reduce their dependence on congested West Coast ports that may again at any time experience a labor stoppage.

- The recent West Coast labor lockout, West Coast ports infrastructure capacity, and rail line service issues encourage shippers to maintain a viable Panama Canal-East Coast route alternative for at least some of their cargo. The successful operation of the Canal by the ACP since the Canal's transfer in 1999 has strengthened the image of the Canal as a reliable route, worthy of long-term commitment by shippers.

7.2.1.2 Shipping Lines

For some time, the shipping lines have been under intense competitive pressure worldwide, and continue to seek ways to lower costs and achieve efficiencies that improve their service package and result in improved margins. There are several important points to consider regarding the shipping lines' perspectives:

- Operating in concert with the US intermodal system, the shipping lines must share revenues with US rail operators, often disproportionately. As such, the lines can benefit from increased use of the Panama Canal route and should view the Canal expansion as an opportunity to strengthen their position in the marketplace. The advantages of the all-water services will vary depending on the specific steamship lines´ markets and operating strategies.

- The trend towards alliances (and consolidation) among shipping lines continues and is expected to do so for the foreseeable future, creating opportunities for use of larger capacity Post-Panamax vessels. Shipping lines continue to build larger Post-Panamax vessels for deployment along trans-Pacific routes and

would place a high value on similar deployment along the post-expansion Panama Canal route.

- As direct users, the steamship lines pay the Canal toll. The lines are likely to be receptive to opportunities to obtain volume discounts and toll reductions in return for long-term service commitments, as they are used to at most ports worldwide.

7.2.1.3 Ports

East Coast US ports are today natural allies of the Panama Canal, forming part of the transportation system that competes with the intermodal system through West Coast ports[2]:

- During interviews conducted as part of the present study, East Coast ports expressed a willingness and interest in forging long-term alliances with the Canal.

- A great deal of coordinated improvement and investment in the infrastructure of the Canal, ports and connecting infrastructure will be required to enable deployment of Post-Panamax vessels at East Coast ports.

- The location of DCs and shipper logistics systems will play a critical role in determining the success of East Coast ports in capturing cargo.

7.2.2 Capacity and transition to Post-Panamax vessel fleet

In the near term, prior to the expansion, the Canal may face a situation in which it may not have adequate capacity to meet all its customer needs.[3] If such a situation develops, the Canal may have to ration scarce and valuable capacity over a short period prior to the opening of the new locks. If the Canal is faced with capacity constraints, it must manage the situation carefully, so that its market position, particularly in the liner service market, is not jeopardized. Regardless of what operating strategy is chosen in such a situation, the Canal should pay particular attention to the needs of the liner segment market, as it will remain the backbone of the revenues of an expanded Canal.

Once the expansion has been completed, the ACP should develop an operating strategy for the new locks that prioritizes their use for Post-Panamax vessels. The liner services require an expeditious transit through the Canal – without delays, so the Canal's operating and marketing strategy for the post-expansion period should consider appropriate priority and reliability assurances.

[2] In the 1990's some East Coast port promoted heavily the Suez route, and if the Canal does not expand, the Suez route may eventually become viable for China-US trade.
[3] No capacity analysis has been conducted as part of this market study, but it is unlikely that the Canal will be able to meet the anticipated demand without a capacity expansion program.

The capacity challenge will require that in the near and long term the Canal continue to assure the liner industry that container services will always have access to expeditious and priority transit services. The present reservation system has been welcomed by the liner industry. The long-term pricing and operational strategy should maintain or improve this system and consider whether a toll differential is appropriate for Post-Panamax vessels and/or for use of the new locks. Canal capacity for the new and existing locks, short and long term, could be managed by setting tolls partly based on the greatest need and ability to pay. Service fees and/or tolls could then include a component for priority use of the available capacity near term and for the use of the new locks long term, while other segments continue to use the existing locks. The Canal should also consider strategies to contractually provide capacity both today and after expansion to the liner industry, with pricing set to reflect that value. Such pricing strategies could include volume discounts as well as prepaid "slots" (see section 7.2.5).

It is recommended that such strategies be considered during the upcoming integration study of the various market segments. Whatever approach is selected, a coordinated pricing and communication strategy should be set up to obtain industry input and consider the needs of all market segments.

7.2.3 Promote increased use of all-water services

The Canal should pursue a promotion program of the all-water route jointly with steamship lines and East Coast ports. The recent resurgence of AWS and the proposed Canal expansion create an opportunity for significant long-term benefits to Panama, the Canal, the steamship lines, and the East Coast ports that should be capitalized upon by developing alliances between the various industry participants that share common objectives. A joint promotion program should include advertisements in industry publications, trade conferences, education programs on the benefits of the route, participation on various shipper industry meetings and conferences, etc. The Canal should also explore with the East Coast ports how to involve the ILA as part of the promotion program, advertising the readiness of labor to efficiently handle Post-Panamax container vessels.

7.2.4 Monitor the competition

The competition to the Canal route varies by trade flow. For those competing with all-water routes, the Canal generally offers significant time and cost savings derived from differences in distances. If the Canal expands to enable the deployment of Post-Panamax vessels, it has the opportunity to maintain this competitive edge. If the Canal were not to expand, it would risk losing this edge due to capacity constraints as well as the possible eventual use of larger vessels along all-water routes. It is recommended that the Canal set up a monitoring program of competitor rates and services (either direct or through transshipment), for those flows where alternative AWS routes are operating or could be started. When appropriate, specific marketing initiatives, special pricing strategies and other steps can then be pursued in response to competitor threats.

For the trades that compete with the US intermodal system, the Canal offers cost savings offset by longer transit times. [4] As noted above, recent problems with the US intermodal system, notably the labor lockout at Pacific ports, and trucker delays and capacity concerns, coupled with the increased use of DCs at East Coast ports and the market acknowledgment of the ACP as a successful Canal operator post-transfer, have worked together to strengthen the Canal's competitive position. Coordinated expansion of the Canal and USEC ports can help to strengthen this position in the future.

On the reverse side, however, there are moves being considered to strengthen the US intermodal system, including a program to improve rail connections in Chicago, and some observes anticipate the possible creation of transcontinental rail companies and the potential to develop a more attractive intermodal product through NW, Canadian or Mexican ports. The Canal should establish a monitoring program to consider how changing rates and services in the US intermodal system are likely to affect its competitive position and develop joint initiatives with East Coast ports and steamship lines.[5]

7.2.5 Develop innovative and commercially sound pricing system

The Panama Canal is now at a unique crossroads as it considers a major expansion program. It faces both great challenges and opportunities. The present study indicates considerable potential for growth in the liner container shipping market through 2025. However, this study considers potential demand unfettered by capacity constraints and without considering the demand for transit services by other market segments. To develop an overall coherent and comprehensive marketing strategy, these two factors must also be considered. Based solely on the analysis conducted for this market segment, a revised pricing system for the container market segment is recommended as outlined below. The specifics should be developed based on the following general principles and after integration of these concepts with the results of other ongoing market segment studies.

The Canal's current tariffs have some commercial features but the tariff is not designed to address either capacity constraints or promoting growth. The tariff structure has been recently amended to allow differentiation by vessel type, but the actual tariffs have not yet been restructured along these lines. The current structure does differentiate between vessels carrying cargo and those in ballast, but lacks any differentiation according to the amount of cargo. The unit of charge is the PCUMS, a volumetric measurement of vessel capacity similar to GRT; it does not reflect the amount or value of cargo being transported. In 2002, a sliding rate system was introduced so that the incremental charge per unit of vessel capacity declines as vessel size increases. However, the rate is constant for vessels above 20,000 PCUMS (about 30 thousand DWT, which includes most large vessels.)

[4] This trade-off applies to shippers. For the steamship lines, the decision reflects the specific markets served and their operational strategies

[5] With confidential agreements in place for most large shippers, the rate information cannot be easily obtained.

A market-based pricing system for the Canal would consider traffic levels and cost differential to users of various trade routes. Marketing initiatives and new pricing schemes, price differentials, volume discounts, and other similar strategies can help attract market share in those trade flows which evidence demand for the Canal route. Such strategies can vary depending on whether the canal capacity is constrained (as it will be in the near term) or not (i.e. when the Canal has empty transit slots to sell as will likely be the case when new locks open). At the same time, as competitor routes pursue their own initiatives and/or respond with counter moves to improve any lost competitiveness, the Canal may need to further tailor its pricing and marketing approach. Competition is a factor that affects long term demand and effective marketing strategies must be considered by the Canal to maintain its competitive position and attract additional business. Such initiatives should involve innovative approaches that bundle various services that Panama can offer (including possible port, transshipment, and Canal crossing costs).

7.2.5.1 Suggested General Pricing Principles

It is recommended that the Canal pricing strategy consider the value of the Canal services to users (based on the cost comparison to alternative routes presented in Chapter VI) and the demand elasticity. A new pricing system should be based on the following five principles:

- It should be demand or market based (not cost-based)

- It should be simple and transparent

- It should be verifiable, and the units of measure used should be standard measures that are already recorded for other purposes, and therefore readily available, e.g. GRT, DWT, TEU capacity, etc.

- It should be stable, with any adjustments gradual and predictable. Annual or regular increases with rates subject to annual escalations (e.g. tied to a cost-based factor such as inflation) may be welcomed for their predictability as Canal users may seek some degree of price stability in order to make long-term commitments to the Canal route. At the same time, the ACP will have to preserve sufficient flexibility to raise tolls levels in the future if necessary to service debt that is raised to fund the expansion or to assure adequate revenues if traffic is lower than projected.

- It should not encourage distortions in market behavior (such as the redesign of vessels solely to minimize the Canal defined measurement)

- It should provide for negotiated agreements, which would allow for discounts and priority transit for vessels from steamship lines, alliances or service consortia that sign long-term contracts with revenue guarantees and annual volume

commitments. Discount levels and priority transit preference can be tied to volume commitment level and length of agreement.[6]

- It should be adjustable based on the actual impacts of rate changes on usage, with particular attention to seasonal adjustments and yield management pricing practices, to encourage additional or deflected traffic during otherwise slow periods.

7.2.5.2 Market Segmentation and Price Differentials

The liner container market should be segmented in such a way to allow the development of pricing schemes that are tailored to each trade flow, reflect the degree of competition and consider commercial factors that can increase revenues and/or market share. The market should be subdivided along the following dimensions:

- Trade flow;
- Commodity type and value;
- Major shippers;
- Shipping line and/or alliance;
- US port of entry and region; and
- Vessel type.

This approach will require the design of a data monitoring program that assures that Canal transit and other industry data are collected in a way that is consistent with the market segmentation (see section 7.2.1).[7] In any market segmentation or price differential system, the ACP must assure that its pricing system is fair, reasonable and non-discriminatory in accordance with the Panama Canal's Neutrality Treaty. However, in the consultant's opinion, this requirement does not necessarily eliminate the appropriateness or legality of price differentials or discounts by market segment, vessel size, or use of different size locks, reflective of commercial considerations (e.g. to establish discount programs and special rates for promotional periods, to set up volume incentive programs for certain routes or in return for service guarantees on certain routes, etc.) Under this scheme, prices for Post-Panamax container ships in the NE Asia – USEC trade could be priced in accordance with the desired short and long-term strategies to compete against the intermodal system and/or to increase revenues. At the same time, trades in non-competitive routes could be priced to encourage the maximum use of the existing locks. For example, a surcharge for the use of the new locks could be computed as a percentage of the value that users place on the use of the Canal for all routes, but with lower percentages for price sensitive routes and higher percentages for routes that are relatively price insensitive. Alternatively, a discount could be offered for price sensitive routes and/or to encourage larger Post-Panamax vessel use on certain competitive routes at the time that a general increase in tolls is instituted.

[6] This type of agreements are widespread in most landlord ports and is well accepted in the industry
[7] This data is currently not available but recent security initiatives increase the likelihood that this data may be available in the future

The analysis presented in Chapter VI indicates that there is potential to increase revenues by increasing tolls for certain trades. Other trades may involve traffic that is more sensitive to toll increases and/or could result in traffic losses as a result of use of competitor routes or product substitution. The Canal should consider toll policies that generate sufficient revenue to finance the proposed expansion while considering the differences for various market segments.

7.2.5.3 Pricing based on containers with per vessel minimum

In selecting a variable to be used as the basis for tolls for the liner segment, it is important to assure fairness, transparency, ease in data collection and relationship to cost and market factors.[8] The PCUMS system is not used elsewhere, nor is it a data point readily collected, since it is not a unit typically used by shipping lines. The container as a unit for pricing is accepted worldwide in the maritime and port industries, and it relates directly to the value of the Canal to the user. However, since the actual containers carried will vary with each transit based on utilization rate, it would be difficult to track. The best proxy variable would be the vessel TEU capacity (which would require lines to certify each vessel's TEU capacity) or a vessel's DWT as this relates to its TEU capacity. In addition, a minimum charge per vessel should be set as there is a minimum cost to the Canal for any transit.

For liners, then, the obvious market-based, relatively simple and verifiable measure for pricing should be the vessel TEU capacity, with a per vessel minimum fee. It is recognized, however, that this is not as simple for the larger vessels that can be potentially be operated with more containers above deck increasing TEU capacity (e.g. it is well known in the industry that the Maersk R Class vessels (such as the Regina Maersk) have a potentially much higher TEU capacity than what MSL has announced. In addition, TEU capacity is not reported with the classification societies.

In any case, TEU capacity appears to be the best measure for pricing because it relates directly to revenues collected by the steamship lines, which are now mainly based on per container rates rather than commodity-based rates. Assuming a fixed rate per TEU of capacity could be defined, then discounts would be offered. The key is to keep these simple and verifiable.

7.2.5.4 Volume and/or New Service Discounts and Peak Period Surcharges

Discounts should be offered based on commitments[9] of long term services and/or tangible economic benefits to Panama, such as commitment to long term use of Panamanian ports for transshipment. Surcharges can be applied to spread peak demand periods or raise revenues. Some of the possible discounts/surcharges and measuring problems are listed below:

[8] In addition, the requirements of the Neutrality Treaty must be met.
[9] A performance bond or guarantee could be required to assure that commitment is met.

- Discounts for pioneer or new routes or services, during the first year of operation (distinguishing new operations from extensions of existing operations, changes in a route from a new route may be difficult)
- Discounts for vessels calling and/or transshipping in Panama ports
- High ratio of empties or unused slots (requires electronic submission of ship's manifest)
- Marginal voyages – more or larger vessels on a service (an annual volume discount – becomes difficult with slot chartering and alliances), but a practical approach could probably be applied for all vessels from a steamship line, service, or alliance with a base established considering existing services and discounts granted on a scale reflecting more or larger vessels.
- Shorter routes or low volume routes discounts, e.g. South America routes where there might be significant transshipment potential in Panama – although there may be a problem of defining applicable route or service.
- Seasonal or peak period surcharges (with surcharges for general traffic which creates delays for container vessels – may be particularly relevant prior to expansion, or surcharges when peak demand for transits occur during periods of low water availability)
- Divertible routes discounts (need to define routes and to further consider elasticity which may change over time)

In general, in addition to or instead of price differentiation by vessel size or other criteria, volume discounts to users is another means of pricing the trades differently. Such discounts will need to be designed carefully to avoid distortions and assure sufficient benefits or increased traffic to compensate for revenue losses. Discounts may be conceivably be offered to shippers, shipping lines and/or alliances, depending on the circumstances. It would appear that as the direct Canal users, volume discount programs for steamship lines and alliances would be most logical and are consistent with agreements that are currently negotiated by the lines and ports worldwide. Contracts should be kept confidential to grant the ACP freedom to negotiate with individual customers. Such agreements could be structured based on multi year fixed price guarantees for an assured number of transits (with annual discounted rate for same vessel crossing Canal or for minimum number of crossings by same line, service, or alliance)

7.2.5.5 Reservations and Pre-selling Capacity

Users place a high value on reliability and will be willing to pay for it, as evidenced by the popularity of the present reservations system. The ACP should continue to offer reservations and should consider pre-selling capacity to users. Priority for slot reservations could also be provided with signed long term agreements (as ports do when they provide berth priority to lines that sign long term agreements). Additionally, the Canal could provide priority reservations with the prepayment of annual fees for slot guarantees. The length of commitment by a shipping line to the Canal should be a key factor in negotiating volume discounts. Priority transit and volume commitments could

be applied to individual steamship lines, services, or alliances, depending on whether service and volume commitment is provided by the line or a consortium or alliance.

7.2.5.6 Bundling of Canal and port transshipment services

The common objective of both the Republic of Panama and the Canal Authority is to facilitate and promote the development of additional port capacity for transshipment services could also be considered in establishing special rates or discount programs. For example, the Canal could offer discounts, incentives, and joint rate packages with Panamanian ports so as to increase transshipment port activity at Panamanian ports.

7.2.6 Establish alliances with selected key industry partners

The common objectives of the Canal, the steamship line industry, Panamanian ports and US East Coast ports create an exciting opportunity to establish a unique type of collaboration to create multinational alliances and to set in motion joint efforts that can help finance the Canal expansion and assure its long-term success.

7.2.6.1 Alliances with East Coast Ports

The ACP should pursue formalizing alliances with East Coast ports which commit to having the required depth and expanded facilities to handle Post-Panamax vessels by the time that the Canal expansion is completed. Necessary improvements at the ports related to the selected size of the canal new locks should be identified as soon as possible and a comprehensive program should be developed and communicated to the market. This process should be conducted in close contact with shipping lines and shippers to assure that it responds to their needs and also builds a commitment to using the improved AW system that will be developed. Based on market size, existing DCs and port expansion plans, the main candidate ports for such alliances are New York/New Jersey, Norfolk, and Savannah.[10]

7.2.6.2 Alliances and Long Term Agreements with Shipping Lines

To encourage the long-term commitment of AW services, the Canal should establish alliances with major steamship lines to encourage the commitment of these lines to long-term use and deployment of Post-Panamax vessels on the Panama Canal route. In return for pricing discounts or long-term rate commitments and capacity reservation priority (as noted previously) the Canal should be open to negotiate agreements with steamship lines and be willing to assure the lines that their need to maintain reliability and predictability will be met. Special deals can be made attractive to the lines while obtaining assurances of base traffic levels and competitive services. Such alliances

[10] A South Florida port should also be considered. Miami is a logical candidate because of the domestic/international mix, its role as main Latin America gateway, the closeness to the Canal, and the existing low rates for domestic backhaul cargo which can be leveraged to set up a cost-effective Transloading operation. However, Miami has little room for expansion and direct intermodal connections are non existing and difficult to provide.

and assurance of high service levels can in turn further accelerate the trend towards increased DCs in the US East Coast.[11]

7.2.6.3 Panama Maritime Hub Alliances

The ACP should work jointly with Panama's ports, railroad, Free Trade Zone and other entities that provide trade-related services and will benefit from increased Canal and transshipment traffic. These efforts should be coordinated as part of Panama's national trade strategy and ongoing initiatives to further develop a maritime industry cluster. The Canal can be the center of such a strategy, encouraging the provision of value-added services to those who use the Canal. Carriers and other industry service providers worldwide are moving from simply providing transportation service to becoming logistics service providers. Similarly, the ACP and the Panama maritime industry should work to transform Panama into a trade and logistics center for the Americas built around the Canal. This strategy should capitalize on the Canal's geographic advantages and extend Panama's recognized capabilities in the international financial and service sectors while emphasizing extension of the Canal core business into related maritime and logistics services.

7.2.7 Development and Implementation of a Communications Program

The canal has already embarked on a communication plan to inform all stakeholders who will be critical to the success of the expansion program. This program should be closely coordinated with the Canal's marketing program. The cost and schedule of the expansion, the toll implications of the programmed investments, and the improved capability, service level and reliability of the expanded Canal will be of particular interest to the Canal's users, lending institutions and governments of countries with strategic interest in the Canal, such as the US, China and Latin American countries that rely on the Canal for significant shares of their foreign trade.

[11] The possibility of an alliance with an East Coast railroad could also be explored

CHAPTER VIII

8. Transshipment and Rail Activity in Panama

8.1 Potential for Transshipment in Panama and the Panama Canal Railroad

One of the objectives of this study is to assess the potential implications of the Canal expansion project on transshipment activity in Panama's ports and rail traffic on the cross-isthmus rail line. Container transshipment in Panama has grown rapidly over the past 10 years since the Manzanillo Terminal was developed. Several terminals currently serve this market and plans are under way for additional terminal development. The Panama Canal Railroad was rehabilitated in the late 1990's and is carrying container traffic between ports on both sides of the Canal.

Container transshipment is taking place in Panama and the Caribbean area mainly because of the area's location at a crossroads of the main north/south and east/west trade routes that are served by the Panama Canal. As the Canal traffic grows and as additional liner services are added that use the Canal, the potential for transshipment and for railroad traffic increases.

The Canal, Panamanian ports and the railroad are all important elements in developing a coordinated national strategy for Panama to become an even more important player in serving all aspects of the world containerized cargo distribution market. The specific focus of this analysis is to determine the potential demand for container transshipment in Panama and for the rail service as the Canal traffic grows.

This assessment of the transshipment and rail activities was conducted within the framework of the study of liner container shipping traffic through the Canal, using the same analytical tools. The results of the models and scenarios described in other sections of the study are applied to this analysis to estimate that component of port activity that is directly related to Canal traffic. A portion of the transshipment and rail activities in Panama is *not directly related to Canal traffic*. For example, Panama ports handle the Free Trade Zone, domestic Panamanian and some regional Caribbean distribution cargoes, which are not directly affected by the Canal expansion project. Therefore, this analysis also reviewed the overall regional port market, not only the portions that are directly related to the Canal.

This Chapter is generally divided into two parts: the first section is devoted to transshipment and the second to rail. The transshipment part includes a brief discussion of transshipment patterns and considerations for locating transshipment hubs, a brief summary of existing Caribbean hubs, and an assessment of existing capacity compared to future demand for Panama port facilities under various scenarios. Further details on this analysis are provided in Appendix I.

8.2 Transshipment Patterns

8.2.1 Intersection vs. Hub & Spoke

Transshipment is generally defined as the transfer of containers between two ships, or *ship-to-ship transfer*. In contrast, direct (or domestic) handling is defined as the transfer of containers between ship and shore, or vice versa. In terms of the overall transportation system, transshipment creates a connection between two shipping services at an intermediate port.[1]

Transshipment cargo operations can generally be categorized as follows:

- ***Intersection or Relay*** – Transfer between two out-of-region services, usually (but not necessarily) between North/South and East/West services; and

- ***Hub & Spoke*** – Transfer between an out-of-region and a regional service, usually defined as a transfer between a mother (or linehaul) and a feeder service.

8.2.2 Location of Transshipment Ports

For "hub and spoke" transshipment operations, the location of transshipment ports is not critical; any regional port, assuming it has adequate facilities, can serve as a regional hub. Nevertheless, the selection of a port as a transshipment hub is commonly based on two factors:

- ***Minimizing Port Handling*** – Selecting the port with the largest local market;[2] and

- ***Minimizing Regional Sailing Distances*** – Selecting the most centrally located port.

Other factors considered include minimizing transit time, maximizing frequency of service, and minimizing port handling charges. In most cases, port handling is most important. However, all factors are considered so total costs of rehandling and feedering enter into the decision.

For intersection/relay transshipment operations, the main criterion for locating transshipment ports is geography, since this type of transshipment requires the intersection of two or more shipping routes. Typically, the transshipment is best carried out at a port where the services meet or at the port closest to the trade routes, so as to minimize any *deviation,* since such deviation may require adding ships to the

[1] Other frequently used terms for transshipment are: ship-to-ship exchange and interline connection. (Also, for abbreviation, the term mother is used instead of motherships and feeder instead of feedership.)
[2] The market size may however, increase land costs and other operating costs

intersecting services to compensate for the extra time for sailing the added distance and cargo handling at the added port. Ports located next to the Panama Canal have the advantage of minimizing deviation, as the Canal is the intersection point for many shipping routes.

8.2.3 Single or Double Call in Panama

When Panama is selected as a hub by a line, there is another decision to be made, i.e. on which side of the Canal should the transfer be performed: Pacific, Atlantic or both. The decision is obvious in the case of lines only having cargo for one side of the Canal. It is a much more complex decision for lines having feeder services on both sides, with the mother (out-of-region) services crossing the Canal – the common case for the larger lines and alliances. There are three possibilities:

- Double call by the mother at each side;
- Single call by the mother plus twice crossing of the Canal (back & forth) by at least one of the feeders; and
- Double call by the feeder by re-routing feeder services through the Canal so that the same feeder service feeds ports on the two sides.[3]

Currently, MSL uses the first option, while Evergreen employs the second; and none uses the third one.

8.3 Caribbean Transshipment Market

8.3.1 Relevant Transshipment Range

As previously noted, the potential transshipment market for Panama ports encompasses both Canal-related and unrelated traffic. The non-Canal related traffic includes transshipment cargo between trade routes that do not cross the Canal.

Accordingly, the potential market was defined as the transshipment activity in the Caribbean Basin. This so-called relevant region is defined, for the purpose of this study, to include, on the Atlantic side, ports between Freeport in the north, Puerto Rico in the east, North Coast of South America (NCSA) in the south and Balboa in the west.

Table 8-1 presents a list of all the transshipment hubs in the Caribbean basin, along with their recent throughputs. The Caribbean basin market encompasses nine ports located in seven countries and a total throughput of just over 7 million TEU of which 3.2 million are estimated as transshipment. The following section presents a general

[3] Theoretically, the connection between the two sides can be done by land, using rail or truck. However, land connection is costly, with a current estimate around $450 per box for a full ship-to-ship move.

description of Caribbean Area transshipment hubs, concluding that if Colon is considered as one hub, the Caribbean area consists of three main hubs and 4 secondary hubs. Appendix I includes a detailed review of the main existing hubs along with a brief description of two planned ones.

Table 8-1: Transshipment Hubs in the Caribbean Basin, Throughput (TEU)[4]

Country	Puerto	Terminal	1999	2000	2001
Panama	Balboa	Balboa	24,047	64,217	358,868
	Balboa Total		**24,047**	**64,217**	**358,868**
	Colon	Colon Container Terminal	202,539	180,049	210,446
		Cristóbal	78,499	60,200	60,000
		Manzanillo International Terminal	878,211	1,015,954	960,000
	Colon Total		**1,159,249**	**1,256,203**	**1,230,446**
Panama Total			**1,183,296**	**1,320,420**	**1,589,314**
Colombia	Cartagena	Cartagena - Others	70,635	102,948	82,916
		SPR Cartagena	347,023	320,477	446,562
	Cartagena Total		**417,658**	**423,425**	**529,478**
	Buenaventura	SPR Buenaventura	306,935	336,553	293,507
	Buenaventura Total		**306,935**	**336,553**	**293,507**
Colombia Total			**724,593**	**759,978**	**822,985**
Jamaica			**709,442**	**894,779**	**983,400**
Venezuela			**496,315**	**550,807**	**620,523**
Puerto Rico			**1,762,277**	**1,884,494**	**1,830,125**
Bahamas			**549,993**	**572,224**	**570,000**
Dominican Republic			**415,629**	**460,185**	**487,827**
Grand Total			**5,841,545**	**6,442,887**	**6,904,174**

8.3.2 Regional Setting and Classification of Transshipment Hubs

Based on the consultant's analysis, the ports currently active in transshipment in this market can be clustered around three locations:

- ***Eastern Hub*** – Focusing on intersection of north/south, mainly USEC – ECSA, with east / west, mainly Asia – USEC and Europe – USEC/USGC;
- ***Central Hubs*** – Focusing on *regional* distribution; and
- ***Panama Hubs*** – Focusing on intersection of *diagonal* services, especially, USEC – WCSA, Europe – WCSA and Asia – ECSA, with east/west, mainly Asia – USEC.

Each of these clusters emphasizes a "sub-market" with some overlapping, especially with respect to the regional distribution that, in principle, can be conducted anywhere.

[4] NPWI data base and the ports.

Freeport is the main hub in the first category and Kingston is the main central one. Accordingly, the eastern hub will be frequently referred to hereafter using the name "Freeport", the central as "Kingston" and the Panamanian as "Panama". Accordingly, when referring in the discussion of future hubs to Kingston, it will also include Puerto Rico and other central Caribbean transshipment hubs, which are also considered as Central Caribbean Hubs.

8.3.3 General Trends in Transshipment

Historically, most of the transshipment activity in the Caribbean was based on hub & spoke operations. This is quite understandable in a basin consisting of many small islands, some of which don't even have a container terminal. Accordingly, the transshipment activity mainly included regional distribution of out-of-region cargoes, primarily from Europe, USA, Asia and SAEC. This also explains why Kingston, with its central location, was the first Caribbean hub to develop, about 25 years ago.

Recently, due to its advantages, the intersection transshipment pattern has become more important and has grown faster than the hub & spoke regional distribution transshipment. Following the improvement in transshipment productivity and reduction in cost, this trend is expected to further continue in the future.[5] This is already evident in the case of the fast-growing Freeport and Panama transshipment ports. Hence, the transshipment ports that are expected to enjoy the fastest growth in the future are those located in natural intersection points between major services. This growth may come at the expense of traditional, hub & spoke transshipment hubs. This is a key assumption made for assessing Panama's ports potential.

8.3.4 Present and Near-Future Supply/Demand Relationship for Panama's Ports

Table 8-2 presents the existing and near-term planned capacity of Panama's ports along with their present throughput. The operators´ estimates vary based on their operating systems and their assumptions of maximum throughput. The consultant's estimate is based on uniform assumptions for all terminals based on berth capacity of 400,000 TEU/year at the present, 550,000 TEU/year in the near term and 750,000 TEU in the long term. The combined capacity of all Panama ports based on their current layout is 3.2 million TEU according to the standard estimate and 2.7 million TEU according to operators' estimates. The overall year 2001 throughput was 1.71 million TEU. Hence, there is considerable additional capacity available at the present time. This, however, is not the case on the Pacific side, where Balboa is over 80% capacity utilization.

Once all planned expansion programs become operational, the capacity will increase to 4.0 million TEU according to operators estimates and 6.3 million TEU according to the consultant standard estimate. Assuming throughput growth of about 5 - 6% annually, or about 30% in the next 5 year period, Panama throughput may reach 2 million TEU.

[5] Since intersection involves transfer between mother vessels, improvement in productivity is especially critical for this transshipment pattern.

The above comparison between throughput and capacity combines the terminals on both sides of the Canal. Growth on the Pacific side may be faster, due to existing capacity limitations; its potential growth has not yet been exploited.

Table 8-2: Throughput and Capacity of Panama Terminals

		Present (2001) Facilities and Throughput					Short-Term Expansion Plans			
		Berthage	Berths	Thrpt	Operator Estimate	Standard Estimate	Berthage	Berths	Operator Estimate	Standard Estimate
		m	number	TEU (Thousands)	TEU (Thousands)	TEU (Thousands)	m	number	TEU (Thousands)	TEU (Thousands)
Atlantic	Manzanillo	1,240	4	960	1,500	1,600	1,640	5	2,000	2,750
	Colon Conta	612	2	210	500	800	982	3	750	1,650
	Cristobal	320	1	60	250	400	320	1	250	550
Subtotal Atlantic		***2,172***	***7***	***1,230***	***2,250***	***2,800***	***2,942***	***9***	***3,000***	***4,950***
Pacific	Balboa	350	1	359	450	400	820	2.5	1,000	1,375
Total Panama		***2,522***	***8***	***1,589***	***2,700***	***3,200***	***3,762***	***11.5***	***4,000***	***6,325***

8.4 Panama Ports' Demand

8.4.1 Present and Future Composition of Panama Ports' Demand

As discussed in previous sections (8.1 and 8.2) the attractiveness of Panamanian ports for transshipment is their location at the intersection point of many liner services.
The present throughput of Panama's ports consists of two segments:

- ***Canal-Related Transshipment*** – The transshipment that is generated by Cross Canal services which has been estimated based on the study's methodology previously described; and

- ***Canal-Unrelated Transshipment and Domestic Handling*** – Mainly regional distribution of cargo and domestic Panama cargo, mostly generated by the Free Trade Zone.

The Canal expansion project is expected to change service patterns, especially under the transshipment-intensive operating scenario that favors Panama ports over other Caribbean hubs. As noted before, the growth of transshipment between diagonal services and north/south and east/west services favors ports located next to the Canal as they minimize "deviation" from the main routes. In addition, following the expansion, it is expected that there will be diversion of regional distribution transshipment cargoes from some Caribbean hubs to Panama. Accordingly, in the future, Panama ports are expected to handle additional regional distribution cargo, which is treated in the consultant's methodology as diversion of regional distribution transshipment. Each transshipment market segment is discussed in the following paragraphs within the context of three scenarios which are defined as follows:

Low Transshipment Scenario

In this scenario, the main service patterns of shipping lines involved in the Caribbean basin are not expected to change from 2001 patterns. Thus, transshipment shares of total port throughput are assumed to remain the same, with transshipment volume growths due to general trade growth. The relative position of the three Caribbean area hubs (Panama, Kingston, Freeport), is not expected to change much and no respective diversion of regional transshipment among them is projected. The transshipment share of Canal traffic decreases from the 2001 year level of 8.2% to 5.6% as the Canal traffic of trade routes not involved in transshipment grow faster than those that are involved in transshipment

Medium and High Transshipment Scenarios

The Medium and High transshipment scenarios are characterized by a service pattern of East-West services using large Post-Panamax vessels which will create an opportunity for additional transshipment to/from North-South and regional feeder services. The increased transshipment services will be generated by transfers among intersecting north / south and east / west services. Some lines are already using a similar scheme, e.g. that currently employed by MSC in Freeport and the over 8 percent of Canal transits that transshipped in Panama ports. Hence, under these two scenarios, Caribbean area ports, including Panama ports, can be expected to show a substantial increase in transshipment activity. Under the High transshipment scenario, increased transshipment activity is assumed compared to the Medium Scenario as described below

Freeport already has several European and Mediterranean services. It is reasonable to assume that very much like MSC, lines will tend to concentrate all their out-of-region services in the same regional hub. Such concentration increases the inter-connectedness of the various services and saves feedering costs. A somewhat similar development is expected in Panama.

Under the High transshipment scenario, the transshipment related to the diagonal pattern is expected to increase. This includes USEC services to SAWC, European to USWC and Asian services to NCSA and ECSA, all of which are expected to increase at the expense of direct services, even now limited in number.

Besides growth in the share of Canal flows that are transshipped, under both the Medium and High transshipment scenarios, two additional trade routes generate Canal related transshipment-- USA-NC/ECSA and NE Asia –ECSA.

One of these trade routes that currently generates no Canal related transshipment (USA – NC/ECSA) is assumed to evolve to 50% transshipment under the Medium Scenario and 100% transshipment under the High scenario. These assumptions reflect forecasted changes in the future service patterns. The USWC is currently served by a longhaul service that connects the Mediterranean, NC/ECSA, and the Pacific Coasts of

Central and North America; under the High transshipment scenario, this service is expected to disappear.

For the other trade flow (NE Asia – ECSA), limited use of the Canal is available today because direct services are provided that use geographically more advantageous routes. However, a growing share of these flows that are projected to cross the Canal in the future are assumed to be carried by regional services/feeders connecting to main east/west services for this trade flow.

In addition, two routes will gradually evolve from direct services to totally involve feeder to main lines type of transshipment service:

- WCSA – USA,
- Europe – WCSA

In both of these routes, transshipment is anticipated to grow from the present 25 percent to 50 percent under the Medium transshipment scenario and 100 percent under the High transshipment scenario

In summary, the Medium and High transshipment scenarios are expected to trigger a change in the overall setting of transshipment hubs in the Caribbean region. The region's transshipment activity will grow and Panamanian ports will be in a strong position to become a primary hub, both based on intersection patterns and because of their location next to the trade routes. The growth of these hubs will also increase the ports attractiveness for regional distribution and result in diversion of the transshipment activity from other hubs (such as Kingston, where the activity will be mainly concentrated around smaller lines. Figure 8-1 illustrates the envisioned setting in the High transshipment scenario.

8.4.2 Canal-Related Transshipment

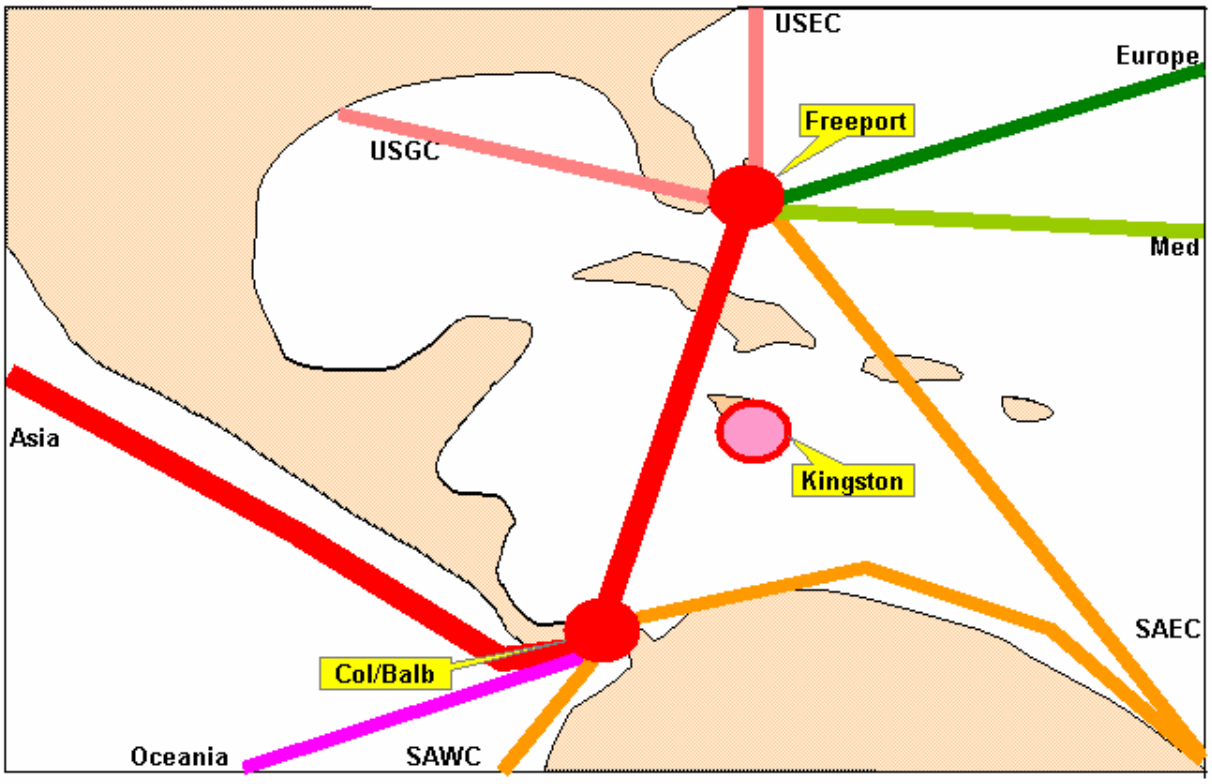
Table 8-3 presents the projections for Canal-related transshipment in the base year (2001) and for the three transshipment scenarios envisioned at the end of the study horizon (2025), all under the combined Moderate operating scenario and Base Case economic scenario. The figures presented are direct output from the Canal traffic projections under the previously described methodology. Most of the additional transshipment traffic is generated due to the substitution of the "diagonal", direct services by a combination of direct services to Panama and regional feeders. Likewise, most of the transshipment connects the SAWC trades with the USEC / USGC and North Europe and the Mediterranean.

8.4.3 Canal-Unrelated Traffic

The second segment that Panama ports now handle and are expected to continue handling in the future includes non-Canal related transshipment and domestic cargo. A

reasonable assumption, though somewhat conservative, is to assume that this segment will grow proportionally to the general growth of trade, or at annual rates ranging between 4 – 6 percent.

Figure 8-1: High Transshipment Scenario Ports Setting



Comments:
Only Inter-region , long-sea services are presented
Line width indicates cargo volumes

8.4.4 Diversion of Transshipment from Other Ports

The review of the non-Panamanian transshipment hubs in the Caribbean indicates no shortage in terminal capacity in the region. This observation relates to the two main existing hub terminals, mainly Freeport and Kingston, each having large expansion plans, and to the two new terminals, Caucedo and Ports of Americas. Accordingly, diversion of transshipment activity is not expected to be related to lack of capacity at other ports, but to the advantages of Panama ports because of their proximity to the main trade routes. Another assumption is that charges and performance are similar in these hubs, a reasonable assumption in a highly competitive market such as regional transshipment.

Table 8-3: Canal Related Transshipment Projections

						2025					
Trade Flow			Year 2001			LOW Transshipment Scenario		MEDIUM Transshipment Scenario		HIGH Transshipment Scenario	
	Origin	Destination	Total	Canal Traffic	Trans-shipment	Canal Traffic	Trans-shipment	Canal Traffic	Trans-shipment	Canal Traffic	Transshipment
1	NE Asia	USA	5,932,441	647,262	0	2,963,507	0	2,963,507	0	2,963,507	0
2	SE Asia	USA	1,085,644	72,480	0	292,312	0	292,312	0	292,312	0
3	USA	Oceania	169,817	134,155	0	506,631	0	506,631	0	506,631	0
4	USA	NC/ECSA	412,632	43,326	0	267,626	0	267,626	133,813	267,626	267,626
5	WCSA	USA	243,541	192,397	48,099	778,786	194,696	778,786	389,393	778,786	778,786
6	Europe	USA	2,266,124	475,886	0	1,800,271	0	1,800,271	0	1,800,271	0
7	WCSA	Carib	5,997	5,997	5,997	10,339	10,339	10,339	10,339	10,339	10,339
8	NE Asia	ECSA	144,131	0	0	145,951	0	145,951	145,951	145,951	145,951
9	Europe	WCSA	169,052	169,052	42,263	316,011	79,003	316,011	158,005	316,011	316,011
10	NC/ECSA	WCSA	93,507	46,754	0	75,487	0	75,487	0	75,487	0
11	Asia	NCSA	41,611	41,611	41,611	78,667	78,667	78,667	78,667	78,667	78,667
12	Asia	WCSA	171,159	26,701	13,350	168,998	84,499	168,998	84,499	168,998	84,499
Totals			**10,735,655**	**1,855,621**	**151,321**	**7,404,585**	**447,204**	**7,404,585**	**1,000,667**	**7,404,585**	**1,681,878**
Crossings Share of Canal Traffic					8.2%		6.0%		13.5%		22.7%
Total Transshipment Generated					**605,283**		**1,788,817**		**4,002,667**		**6,727,511**

8.4.5 Panama Ports' Long-Run Demand

Table 8-4 presents the estimated long-term demand for Panama ports by segments. As discussed in Section 8.4.1, the future composition of cargo includes 3 segments: (a) Canal-related; (b) Canal-unrelated, mainly regional transshipment and domestic/Free Trade Zone; and (c) Diversion of transshipment from central Caribbean hubs, mainly regional distribution of out-of-region cargo. The Canal-related segment is a direct derivative of the study's Canal traffic projections as presented in Table 8-3. The Canal-unrelated segment is based on the assumption of average growth of about 4.5 percent per annum, based on an average of all relevant trades. The regional diversion segment assumes a diversion of 25 percent of the current transshipment activity of Kingston, Cartagena and Puerto Cabello, with their cargo also increasing by the same 4.5 percent per annum.

Table 8-4: Present and Long-Term Canal Demand for Panama Ports

	Year 2001	Year 2025		
		Low Transshipment	Medium Transshipment	High Transshipment
Canal Related Transshipment	***605,283***	***1,788,817***	***4,002,667***	***6,727,511***
Non-Canal Panama related Transshipment	587,398	1,689,366	1,689,366	1,689,366
Domestic (Panamanian Cargo)	396,633	1,140,721	1,140,721	1,140,721
Subtotal	***984,031***	***2,830,087***	***2,830,087***	***2,830,087***
Diversion of Regional Transshipment				***827,996***
Total Panamanian Ports Throughput	***1,589,314***	***4,618,904***	***6,832,754***	***10,385,594***
Effective Growth Rate		4.55%	6.27%	8.14%
Total Panamanian Ports Transshipment	**1,192,681**	**3,478,183**	**5,692,033**	**9,244,873**
Note: Domestic cargo assumed a annual growth rate of 4.5%, similar to general growth of trade.				

8.5 Cross Isthmus Rail Potential

8.5.1 Introduction

The operator of the cross-isthmus rail service is the Panama Canal Railway Company (PCRC), a joint venture between the Kansas City Southern Railroad (KCS) and MiJack Products. Additional analysis of the current rail service, its facilities and equipment, future plans, throughput, performance and rates are discussed in detail in Appendix I.

8.5.2 Panama Canal Rail's Strategic Role

The strategic role of the rail is *not* as a substitute to the Canal but as a *complement to the Canal*. In the future, if the Canal expands and Post-Panamax ships can transit the Canal, the rail service will provide additional flexibility for lines calling at one end of the Canal and will complement the transshipment.

Types of Rail Transfers

The strategic role of the rail service relates to two principal types of transfers:

- ***Ship-to-Ship*** -- Transfer of containers between Marine terminals located on the two sides of the Canal; and

- ***Ship-to-Shore*** – Transfer of containers between a marine terminal on one side and a final land destination on the other side.

The first type of transfer is similar to transshipment, except that the ship handling is done in two marine terminals instead of the same terminal and, therefore, requires an intermediate land transport.

The second type of transfer is similar to any domestic port handling, except that the land leg is provided by rail. It also has much similarity to the US mini-landbridge, but with a much shorter rail leg (80 km).

Demand for Ship-to-Ship Transfer

The demand for rail transit in this type of transfer can be divided into three segments, each corresponding to a different reason for using rail to transit the Canal (instead of water):

- ***Canal Limitations*** – To lighten a fully loaded ship that cannot transit the Canal because of excess draft;

- ***Lack of Connectivity*** – To provide connection between services that call on opposite sides; and

- ***Expedited Transit*** – To provide a shorter transit time than that available by water in order to meet the schedule of a departing service on the other side.

Ship-to-Shore Transfer

Unlike the cases above, the demand for rail in this type of transfer cannot be attributed to any specific reason. The rail service is simply a substitute for trucking. In most cases the rail is used by boxes destined to the Colon FTZ but discharged in Balboa, in cases where it is the only port of call in Panama. Previously, these boxes were trucked.

As before, even in case the ship calls on both sides, some shippers are interested in expediting their delivery by substituting the water crossing by rail crossing. The savings of about two days involves an additional cost of about $450 per box (see above).

8.5.3 Rail Potential

Methodology

The rail service currently handles about 1.3 percent of Canal traffic. The foregoing analysis identified four segments for the rail demand, due to Canal limitations, lack of water connection, expedited connection and mini-landbridge. Based on discussions with the rail operators and shipping lines it is estimated that the portion of the first segment accounts for 25 percent of rail traffic, the second for 65percent and the third and fourth together 10 percent. .

The future composition of the demand of the Canal railroad is assumed to remain unchanged during the study's time horizon, except for the 25 percent share of the current traffic related to Canal limitations. Hence, the demand estimating methodology is based on relating the rail traffic to the Canal's projected traffic in proportions that vary by operational scenario. The Base Case economic scenario is assumed in all the rail estimates.

It is assumed that the competitive setting between truck and rail will not change in the future. More specifically, the assumption is that, in the future, trucks and the rail services will perform similarly to the present and preserve their market shares. That assumption presumes no major highway expansion between Panama City and Colon; although a concession has been granted to a private company to construct a toll road on that corridor, the concessionaire has not taken any steps to extend that highway (the Corridor Norte) beyond the urban area of Panama City.

The current rail activity is restricted due to the lack of handling capacity in Balboa, which for all practical purposes is limited to handling only one line, MSL. Discussions with other lines, Balboa's operator and the rail operator indicate that the rail traffic would grow substantially if Balboa had more space. Therefore, current throughput cannot serve as a base line for future projection. A reasonable assumption is that traffic could double if Balboa's limitations were removed. Since the present rail traffic is about 50,000 TEU, the base line could be assumed as around 100,000 TEU or about 2.7 percent of the Canal's present traffic.

Table 8-5 presents the estimates of long-term rail potential demand for the Canal RR (for the Base Case economic scenario), assumed as 2.7 percent of Canal traffic. As seen in Table 8-5, the range for 2025 is 300,000-425,000 TEU assuming no Canal expansion. This rail potential demand, however, may be reduced by approximately 80,000 – 100,000 TEU once the Canal expands, as it is estimated that 25 percent of the RR traffic is related to present Canal limitations, which will not exist once the Canal expands.

Table 8-5: Potential Demand for Cross-Isthmus Rail

	2001	2025		
		Pessimistic Scenario	Moderate Scenario	Optimistic Scenario
Projected Canal Traffic (TEU)	3,711,242	11,917,405	14,809,170	15,785,440
Estimated Rail Volume (TEU) **with No Canal Expansion**	100,000	321,115	399,035	425,340
Estimated Rail Volume (TEU) **with Canal Expansion**	-	240,836	299,276	319,005

CHAPTER IX

9. Conclusions

Forecasts of future demand for the Panama Canal by liner container shipping services have been developed based on market analysis, extensive interviews with key industry stakeholders and rigorous modeling. It is important to note, however, that these forecasts have been made assuming expansion of the Canal to accommodate Post-Panamax vessels but with no capacity constraints. The results are container, vessel and revenue forecasts under various future scenarios that consider a wide range of economic growth, operating and vessel deployment scenarios. In addition, a cost competitive analysis has been carried out, and elements of a marketing strategy have been recommended. The main conclusions of the study may be summarized as follows:

1. Under the combination of pessimistic scenarios, container volume can be expected to grow at an average of over 4 percent per year, reaching TEU volumes more than 2.5 times greater than current levels by the year 2025. Vessel transits are expected to increase at a slower rate, reflecting the increased capacity of vessels. Under the optimistic scenarios, volume is projected to grow by almost 8 percent annually to a level over 6 times greater than present levels. This range of growth rates compares conservatively with recent history – from 1995 through 2002, container vessel capacity through the Canal grew at an average annual rate of 12.9 percent.

2. The Panama Canal container market was divided into 12 relevant trade flows that connect regions in the Americas with regions in other parts of the world. Three of these flows – relatively small ones - are considered to be effectively "captive" to the Canal in that there are no reasonably competitive alternative routes. Others are considered "divertible" to/from the Canal.

3. Three of the nine divertible routes compete only with all-water routes and involve South America trade. The remaining six trade flows involve US trade and represent close to 85 percent of total Canal traffic. The origin or destination region within the US is a key factor in determining the competitiveness of route options that involve a Canal crossing. These six trades flows have accordingly been subcategorized by US region, meaning that the flows are some **combination of not relevant, divertible and captive** traffic with respect to the Panama Canal.

4. Two of the US based trade flows - the Asia trades - compete with the US intermodal system and other all-water routes. The most significant trade flows for the Panama Canal, both in terms of current traffic, and potential for increased diversion and future growth prospects are the Asia – US trades, which currently amount to about 40 percent of the total Canal container traffic.

5. The main drivers of future Panama Canal traffic are:

   - Economic and trade growth,
   - Shipper logistics requirements for this trade; and
   - Steamship lines' strategies to serve the shippers and improve their profitability.

   Existing distribution center locations in the US as well as present shipper and logistics requirements are factors that affect the use of the Canal in the near term. Large retailers and their logistics systems are increasingly giving greater importance to reliability rather than transit time. In the long term, shippers will make their location and logistics decisions reflecting their perception of Canal service level and its reliability as a dependable long-term route. Furthermore, changes in the competitive balance between the US intermodal system and the Canal will affect long-term volume demand, as will shippers' location and routing decisions. The Canal expansion can clearly influence the long-term market that it can serve.

6. The ACP should concentrate its efforts on competing most effectively against the US intermodal system for the Asia – US trades. The recent West Coast port labor crisis, long-term capacity and cost issues related to the US rail services and West Coast ports, and the successful performance of the Canal since its transfer to Panama in 1999 have increased the perceived value of the Canal route as a competitive option.

7. The Canal's marketing strategy to attract expanded all-water services should involve the following program elements:

   - **Data gathering and market understanding** - Follow up on the insights gained through the interviews conducted as part of this study to gather information on actual traffic routings, changing shipper requirements and industry trends so as to gain a better understanding of the Canal's increasingly important role in the supply chain that manufacturers and retailers use to move their products;

   - **Maximize existing Canal capacity and orchestrate a successful transition to Post-Panamax operations** - Work with the steamship line industry to consider how to best use the Canal's limited capacity and further improve the reliability of all-water services pre-expansion, and involve the steamship lines in planning for a transition to Post-Panamax vessels from the present Panamax vessel fleet;

   - **Promote increased use of Asia – US East Coast Canal all-water services** - Jointly with steamship lines and ports, promote the increased use of all-water services and the Canal route;

- **Monitor competitor initiatives** – Consider appropriate market response to any competitive threats and use the Canal's market position and Panama's strategic location at the crossroads of major trade routes to further increase the Canal's market share of divertible cargo;

- **Consider innovative and commercially sound pricing strategies.** New pricing strategies should include changing the basis of the tolls from PCUMS to TEU, volume discounts, special promotional periods for new services, incentives for bundled rates that result in increased traffic and/or use of Panama ports, and other incentives aimed at attracting increased Canal traffic and increased transshipment in Panama; and

- **Forging alliances with selected key industry partners** – As part of its marketing strategy to assure success of the Canal expansion, the Canal should seek partnerships with steamship lines and ports, including:

    i. partnerships with steamship lines and/or alliances that commit to long term Canal services

    ii. alliances with a limited number of US East Coast ports to present a coordinated and attractive "product" to compete with the intermodal system, including coordinating plans for Canal improvements with port improvements that will be necessary to accommodate the Post-Panamax vessels that are increasingly being used in the east-west trades worldwide, and support for labor policies and practices that maintain the competitiveness of East Coast ports. The most strategic ports for such alliances are New York, Norfolk and Savannah.

    iii. agreements with all Panamanian ports to commit to having adequate infrastructure ready by the time of the opening of the Canal expansion to handle the largest vessels that will be able to use the expanded Canal.

8. The study analysis supports the findings in previous studies and through Canal experience that demand for the Canal in certain market segments is highly inelastic to toll increases in the short term. This inelasticity is a function of the inherent cost advantages that the route offers to certain shippers in certain trades. While there clearly are opportunities to raise revenues by increasing tolls, this should be based on further consideration of the implications on various trade flows, as longer term it can lead to a loss of market share. Any revised pricing strategy should then be based on commercial considerations as well as conformance with the Canal Treaty. The ACP should explore pricing changes and toll strategies in conjunction with a larger marketing strategy that is built around the notion of coordinating closely with partners in the US ports and large shippers and steamship lines.

9. The unfettered demand for the Canal by the liner container shipping market that has been analyzed in this study should be studied in greater depth in conjunction with consideration of capacity constraints, demand for other market segments, alternative pricing strategies and the costs and schedule associated with the Canal expansion program. This will be necessary to develop a unified strategy for undertaking the expansion program and marketing the Canal throughout and beyond this period of transition.

10. A program of communicating the plans and proposed policies for the future expansion of the Canal will be the key to assuring a positive reception by the market. The ACP has already undertaken development of a communication strategy to inform all major stakeholders (shippers, shipping lines, ports, rail lines, national governments, etc.) throughout the period of study, design, implementation and operation of the Canal expansion.