GREATER VANCOUVER
SHORT-SEA CONTAINER SHIPPING STUDY

PRE-FEASIBILITY REPORT

Submitted by the Consulting Team of:

NOVACORP INTERNATIONAL - Vancouver

in association with

JWD GROUP - Oakland

with specialist sub-contracting firms:

Royal LePage Advisors Inc. – Vancouver

and

Trow Associates - Vancouver

January - 2005

PORT VANCOUVER FRASER RIVER PORT PORT NORTH FRASER Canada Transport Canada Transports Canada Burrard Inlet Environmental Action Program Fraser River Estuary Management Program

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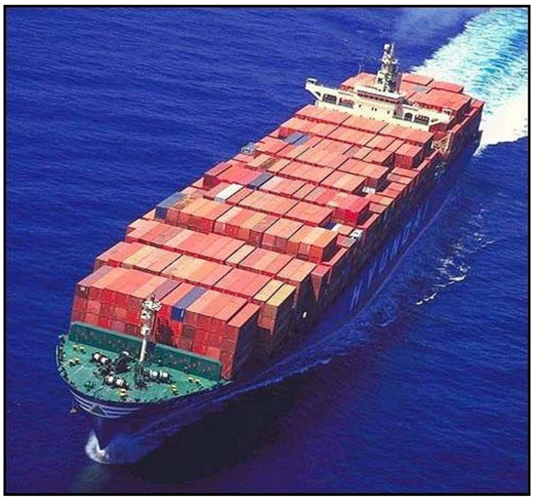

SUBMITTED BY THE CONSULTING TEAM OF:

NOVACORP CONSULTING INC. – VANCOUVER

IN ASSOCIATION WITH:

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ROYAL LEPAGE ADVISORS INC. - VANCOUVER
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EXECUTIVE SUMMARY

The Situation

Greater Vancouver is home to one of the largest ports in North America and some of the most modern container terminals in the world. The trans-Pacific container trade has grown dramatically in recent years, and this growth is not expected to subside significantly over the next two decades. Container handling facilities on the Lower Mainland are, accordingly, being expanded and developed to capitalize on this major market opportunity and the considerable economic benefits it represents. The region's container terminals are well positioned to capture a large share of the growth in container imports from and exports to Asia.

Container terminals in Greater Vancouver include those located in Vancouver's Inner Harbour, at Roberts Bank in Delta and Fraser Surrey Docks in Surrey. Combined, these facilities handled 2 million TEUs (twenty-foot equivalent units) in 2004, an increase of more than 11% from 2003. With capacity expansion and new terminal development, the area's container terminals are expected to handle 4.3 million TEUs within six years, an annually compounded growth of 13.7%. Throughput is expected to nearly triple by 2020 to 5.8 million TEUs. Business expansion of this magnitude has extremely important economic and transportation system implications.

The Issue and The Opportunity

Containers, and the goods they carry, must move efficiently throughout the supply chain. It is simply not enough to process containers effectively at the terminal. The most efficient rail and road transportation infrastructure must also be in place to move containers and their cargoes to and from their ultimate destinations throughout North America.

Currently, about 65% of Greater Vancouver's containers leave or arrive at the deep-sea terminals by rail. The remaining 35% are transported within the region by truck to a wide variety of container industry businesses. These ratios are not expected to change dramatically in the future as major throughput expansion occurs. This study focused on those containers which are transferred intra-regionally by truck. Intra-regional container transport demand is projected to more than double in six years and triple within 16 years.

Greater Vancouver's road and highway network is becoming more congested, especially during peak periods and primarily because of increasing commuter traffic. Despite the major road transportation improvements planned on the Lower Mainland, trucking companies are expected to face increasing challenges in the future to move containers in a timely manner and at reasonable rates.

The proponents of this study have had the foresight to assess the potential for transporting some intra-regional container traffic via tug and barge (i.e. “short-sea” service) to and from the myriad of container businesses already located within the region. The ability to do so is somewhat unique in Greater Vancouver, and potentially possible, given the navigable Fraser River and its access to many industrial areas. Short-sea container operations have proven to be successful in many parts of the world, especially in Europe and Asia. Determining the likely commercial viability of such a network connecting the Lower Mainland’s container terminals with remote short-sea terminals and nearby container businesses along the Fraser River was the fundamental objective of this study.

Proponents of Short-Sea Container Service

Since short-sea container transfer within Greater Vancouver does not presently take place, the industry is just ‘warming up’ to the concept. The work undertaken went a long way to instill interest within the private sector, and several companies are interested in discussing the opportunity further.

The current study was conceived and funded cooperatively by the following organizations:

- Vancouver Port Authority (VPA);
- Fraser River Port Authority (FRPA);
- Fraser River Estuary Management Program (FREMP); and
- Transport Canada.

Each of these proponents is keenly aware of the potential benefits of short-sea container service and very interested in the results of the work and the direction they provide.

An Overview of the Work Carried Out

This pre-feasibility study was carried out by Novacorp Consulting Inc. of Vancouver in association with JWD Group (Oakland), Royal LePage Advisors (Vancouver) and Trow Associates (Vancouver). The research and analysis focused on the following:

- Prospective site areas along the Fraser River which might reasonably support commercially viable short-sea container terminals within the next several years, and the key operational and market factors for container barge terminal location;
- Preliminary operating and capital cost analyses for short-sea operations on “priority” routes;
- The operational practicality of the proposed short-sea service and how it might be configured (i.e. equipment, short-sea terminals, integration with deep-sea terminals, etc.);
- The conditions under which commercially viable (i.e. fully private sector operated, profitable and non-subsidized) short-sea container services might be established;
- The prospective markets for these services, their competitive positioning relative to truck transport (i.e. advantages and disadvantages) and the conditions under which markets, and more particularly customers, might be successfully secured; and

- A preliminary comparison of the greenhouse gas emissions for trucking and short-sea transport of containers to identify any possible environmental benefits from barging.

Conclusions

The results of the work were revealing and provide reliable and practical guidance and direction for those private and public sector organizations who may wish to pursue the opportunity. A summary of the principal conclusions reached by the Consulting Team is included below:

- Intra-regional short-sea container shipping in Greater Vancouver offers promising, commercially viable, private sector opportunities in the short to medium-term for several short-sea container terminals on the Fraser River … specifically in the Fraser Surrey area, the Tilbury Island area and the Coast 2000 area … if route volume can be secured in the range of 200 containers per round trip or greater (i.e. a minimum of 20,000 to 40,000 containers annually).

- It is critical for short-sea container terminals to be strategically located close to (or have sufficient land to establish) a variety of container industry facilities and businesses and to have, on-site or nearby, rail inter-modal capability.

- The 'target market' (i.e. intra-regional container transfer) share required to support commercially viable short-sea operations is quite small (i.e. 4 ½% to 9% of current -2004 - demand and 2% to 4% of demand in 2010). It is expected that short-sea operators will need to secure 45% to 60% of the current container transfer business located close-by in the Fraser Surrey, Tilbury or Coast 2000 areas (and/or 20% to 30% of the same local area market in 2010) to maximize their opportunity for commercial success.

- Given the likely competitive positioning of short-sea shipping, it is expected that the levels of market share described in the previous paragraph are achievable for the locations specified.

- Short-sea container shipping, on selected routes with sufficient volume, can offer price competitiveness with trucking and some competitive advantages, which will likely expand dramatically over time, in the areas of delivery time and delivery time reliability.

- It will be critical for short-sea service investors and proponents to invest the capital and make the long-term commitment necessary to establish reliability and confidence in the market place.

- It will be critical for the short-sea operator to secure sufficient base, container transfer volume commitments from nearby importers, exporters, agents and/or logistics companies to approach the annual volume 'threshold' levels required for commercial success. These levels are relatively low and can likely be achieved in the Fraser Surrey, Tilbury Island and/or Coast 2000 areas over the next year or two.

- Expected increases in environmental emissions from the intra-regional transfer of containers by truck will be moderated to the extent that short-sea operations absorb some of the future growth. This is particularly true of the key greenhouse gas emission (CO_2) as well as VOC emissions.

- More detailed work is required before investors can be expected to commit to the opportunity, but the promotion of, and transfer to, the private sector can likely be achieved within six months. There is genuine private sector interest in this opportunity.

1. INTRODUCTION

This study was conceived by and jointly funded by the Vancouver Port Authority (VPA), the Fraser River Port Authority (FRPA), Transport Canada and the Fraser River Estuary management Plan (FREMP). The North Fraser Port Authority and the Burrard Inlet Environmental Action Program (BIEAP) are also associated with the project. It was carried out by Novacorp Consulting Inc. (Vancouver) in association with JWD Group (Oakland), Royal LePage Advisors Inc. (Vancouver) and Trow Associates (Vancouver) over the period from August, 2004 through January, 2005.

The following members of the Steering Committee participated extensively and provided valuable input and guidance throughout the project:

- Dennis Bickel – Transportation Planner (Project Manager)
  Vancouver Port Authority

- Barbara Yandel – Senior Account Representative – Trade Development
  Vancouver Port Authority

- Mark Griggs – Manager – Container Development Group
  Vancouver Port Authority

- Anna Mathewson – Manager/Policy Coordinator
  FREMP and BIEAP

- Pat Weber – Vice President, Operations
  Fraser River Port Authority

- Philip Davies – Acting Manager - Coordination
  Transport Canada

The Consulting Team gratefully acknowledges the support and participation of the Steering Committee throughout the study.

1.1 BACKGROUND

B.C. ports and the communities they serve have a tremendous opportunity over the next 10 to 15 years to capitalize on forecasted growth in trade with China and other Asia Pacific nations. Transportation stands to be the next great growth industry in British Columbia, potentially generating billions of dollars in investment and tens of thousands of new jobs.

However, demands on the Lower Mainland's road and rail transportation network are also expected to grow significantly over the next two decades as the Greater Vancouver Gateway realizes an expanded role as a transportation centre. This is particularly true of container traffic as the area is poised to capture a large share of the forecasted 250% growth in container traffic between Asia and North America over the next 20 years. Major container capacity expansions are underway or planned and the Gateway is well positioned to take advantage of its competitiveness relative to United States west coast ports.

The need for an integrated multimodal transportation system that efficiently and safely moves goods and people while respecting the environment is critical to reaching these goals. Realizing this opportunity will require that all interested parties work together. The landside transportation network within the Greater Vancouver area is experiencing significant levels of congestion. As ports within the Greater Vancouver Gateway seek opportunities to expand container terminal capacity, they need also to consider whether or not there is any viable inter-regional marine transportation that could be integrated into the terminal planning process that could, also, help to reduce congestion on the landside.

Available suitable land for major transportation network expansion is scarce and the costs are high. Short-sea shipping is defined for purposes of this study as the intra-regional transfer of marine containers via water to/from Greater Vancouver's deep-sea container terminals. This mode of container transport is being seen as a possible way in which to help accommodate expected traffic growth, ease some traffic congestion and assist in alleviating air pollution by moving additional freight and passengers by water thus helping meet Kyoto Protocol targets (requiring a 6% reduction in greenhouse gas emissions from 1990 levels by 2012).

The Burrard Inlet Environmental Action Program (BIEAP) and the Fraser River Estuary Management Program (FREMP) are inter-governmental partnerships established to coordinate the environmental management of two significant aquatic ecosystems in the Lower Mainland of British Columbia - Burrard Inlet and the Fraser River Estuary. The programs have two main roles: policy coordination achieved through environmental management plans, and the coordinated environmental review of projects that can affect the shoreline.

Established in 1991, BIEAP and its partners coordinate a joint action program to improve and protect the environmental quality of Burrard Inlet. FREMP was established in 1985 and provides a framework to protect and improve environmental quality, provide economic development opportunities and sustain the quality of life in and around the Fraser River Estuary. The organization completed a study in 2002 entitled "Economic Vision for the Fraser River" which is relevant to this project.

The Greater Vancouver Gateway Council is comprised of senior executives from industry and government who subscribe to a common vision that Greater Vancouver become the gateway of choice for North America. In January, 2003 the Council released its Major Commercial Transportation System (MCTS) paper, which explored issues and opportunities around water routes for cargo and passengers. As part of this, the Council identified 11 potential waterborne nodes for development in Greater Vancouver including the land's ownership, its development potential for goods/cargo, how it is serviced by road or rail, and environmental and social considerations. The report also recommended next steps: to determine the viability for marine movement of goods and passengers at these 11 sites or other locations still to be identified. According to the MCTS, protecting, acquiring and developing these strategic lands as waterborne routes for freight and passenger movements is key to establishing an effective integrated system that will help reduce traffic congestion.

Strategically located container service and operational hubs may well enable viable short-sea feeder operations to become established parts of the regional transportation network and lead to reductions in congestion, reductions in environmental emissions and enhanced competitiveness of Lower Mainland container terminals. Short-sea services would enhance the overall capabilities of the Greater Vancouver transportation network. Accordingly, VPA, FREMP, FRPA, the North Fraser Port Authority, Transport Canada and BIEAP cooperated to undertake this study.


Tugs Waiting For Container Barge Transfer

1.2 OBJECTIVES OF THE STUDY

"The primary objective of this phase of the work will be to establish the short and long term viability of a nodal based waterborne transportation network for the movement of containerized cargo within the Greater Vancouver Gateway."

In accepting that there will be increased movement of containerized cargo within the Greater Vancouver Gateway, the primary objective of this phase of the work has been to identify locations within the Lower Mainland that have the potential to help alleviate congestion from existing and planned terminal developments. Once identified, these locations – or "nodes" – would be analyzed to determine each node's potential to help alleviate road congestion within the Lower Mainland and to further consider their potential viability as profitable private business ventures.

The commissioning of this study was based on several important underlying objectives which are summarized below:

- to determine if short-sea operations are sufficiently viable to reduce the future growth of container trucking on Greater Vancouver's road network;

- to determine the conditions under which short-sea operations may be commercially viable as well as the associated infrastructure and operational characteristics;

- to describe the market potential for short-sea container operations and the competitive advantages and disadvantages of the service; and

- to determine if short-sea operations can contribute to lower greenhouse gas emissions.

As an integral part of this report, a number of important analyses were carried out which are fundamental to achieving these objectives. They deal directly with the competitive and environmental advantages and/or disadvantages of short-sea operations compared with trucking. To the extent that intra-regional short-sea shipping of containers can compare favourably with the trucking industry in terms of transportation costs, delivery time, service reliability and environmental emissions, its future in Greater Vancouver may be determined.

1.3 APPROACH TO AND LIMITATIONS OF THE PRE-FEASIBILITY ANALYSIS

This study comprises a pre-feasibility assessment of the short-sea container shipping opportunity in Greater Vancouver. A considerable number and a wide variety of issues, factors, costs, options, locations, routes, constraints and opportunities were identified and assessed during the work. To accomplish this effectively, the Consulting Team adjusted its approach numerous times and made a variety of reasonable assumptions during the work in pursuit of its stated objectives. This report provides a summary of the research findings, analysis results, assumptions and conclusions developed. The material will provide the reader with reliable information on which to make judgments as to the timeliness and scope of the short-sea shipping opportunity.

The research and analyses reported on, herein, are reliable and defendable. The work carried out was intended to define the extent and scope of the short-sea opportunity. More detailed research and analysis will be required to clarify and further describe specific site opportunities, operational costs, investment requirements and costs, market potential, operational benefits and implications and a number of other important factors and issues. The intention of this report is to provide information on which informed decisions can be made concerning the potential commercial viability of short-sea container operations in Greater Vancouver, and the general conditions under which this may be achieved. It is not intended to provide the necessary detail in support of capital financing, specific customer prospect definition, specific site acquisition and development requirements, deep-sea terminal container flow implications, route-by-route environmental emission forecasts and other detailed work which will be required as and when short-sea shipping options are pursued. However, sufficient information is provided within each of these (and other) areas to provide relevant knowledge based on overview assessments and reliable information which should enable the client organizations and other proponents to move forward, in one direction or the other, with confidence given the results and conclusions of the work.

1.4 OVERVIEW OF THE PRE-FEASIBILITY REPORT

We have prepared this Pre-Feasibility Report to provide the Steering Committee and other proponents of short-sea container operations with direction and analysis results concerning a variety of important issues and factors. The remaining chapters of the report are described briefly in the following paragraphs:

- Chapter 2 – An Overview of the Short-Sea Opportunity in Vancouver – This chapter provides an overview of the generators of container movements in Greater Vancouver relative to the general location of short-sea nodes as well as the operational functions that could be established and land requirements at any container service nodes developed in the future which are connected by short-sea service to the region's principal container terminals.

- Chapter 3 – Short-Sea Container Node Site Options - Overview and Priorities – This chapter identifies the waterfront industrial site areas which were considered as prospective locations for container operational nodes and provides important information on the suitability and capability of each for this purpose. A number of criteria are described specifically for this study. Importantly, it indicates which site areas were selected for further analysis, recognizing that most of the locations examined could serve as container short-sea nodes in the future.

- Chapter 4 – Overview of Practical Short-Sea Operations – This chapter describes research findings and analysis results for practical short-sea operations in Greater Vancouver given the characteristics of the region's container trade and terminals, water navigation opportunities and the barging equipment, productivity, labour and other factors which are normal within the industry in south western British Columbia.

- Chapter 5 – Short-Sea Terminal Infrastructure Requirements – This chapter provides initial findings and conclusions regarding the physical interaction (i.e. barge loading/unloading issues, capabilities and techniques) between short-sea services in Greater Vancouver and the existing container terminals as well as the proposed container operation nodes.

- Chapter 6 – Capital and Operating Cost Estimates for the Short-Sea Alternatives – This chapter describes the analysis of capital and operational costs which are expected to be incurred for basic short-sea service establishment and business operations on the selected routings identified for this study. Since a variety of routes were examined with varying characteristics, these results can be effectively used to interpolate operational and financial performance for other short-sea container service routes in Greater Vancouver.

- Chapter 7 – Short-Sea Competitive and Emissions Assessment – This chapter uses the research findings and analysis results developed to compare the competitive performance (i.e. transit times, etc.) as well as environmental emissions for both short-sea service operations and trucking on the same routings.

- Chapter 8 – Short-Sea Market Opportunities and Share Requirements – This chapter summarizes the region's expected container deep-sea throughput forecasts and the extent to which this throughput is expected to be transported regionally versus that which is expected to be loaded to or unloaded directly from rail now and in the future. The analysis includes consideration of the location and throughput characteristics of the area's deep-sea terminal traffic generators and the short-sea routings described earlier. The chapter provides an overall assessment of the competitive factors and issues associated with the short-sea shipping concept proposed as a viable alternative in Greater Vancouver in the short-term and over the longer term as container throughput volumes build at the region's existing and new deep-sea container terminals. Market opportunities for short-sea are identified over time and related to the 'base volume' requirements for successful commercial operations.

- Chapter 9 – Conclusions – This chapter provides a summary of the study's key conclusions which are directly relevant to the objectives of the work and the participating organizations.

2. OVERVIEW OF THE VANCOUVER SHORT-SEA OPPORTUNITY

Greater Vancouver's container industry is significant and on the verge of major expansion over the next two decades. Forecasts of new deep-sea container terminal throughput growth over the next 20 years approach 300%. Much of the current and new traffic will be transferred directly to rail at Centerm, Vanterm, Fraser Surrey Docks and Roberts Bank for delivery throughout North America. It is expected, however, that the intra-regional delivery of full and empty containers will grow dramatically as more import cargo manipulation occurs and more empty containers are returned to the region … many of which will be 'stuffed' with export cargo while many others will eventually make their way back to Asia through the Lower Mainland empty.

The intra-regional trucking of containers amongst the many and various industry facilities is currently the only means to meet the needs of the shipping lines, importers, exporters and logistics companies. Greater Vancouver's road network, while expanding, is already congested and delays are expected to increase in the future resulting in longer dray times and more costly operations.

This challenge must be addressed by the region's container industry and its stakeholders. The challenge is one which faces most deep-sea ports on North America's west coast. Greater Vancouver, however, does have an opportunity, through short-sea shipping of a portion of this traffic, to keep transportation costs 'reasonable' and enhance the competitiveness of all area container terminals. This important opportunity is the subject of this study.

The study is concerned with the feasibility of short-sea container barge operations connecting Greater Vancouver's container terminals with remote container nodes on the Fraser River and/or the North Arm of the Fraser River. As such, the barging operations as well as the deep-sea container terminals and the remote river barge terminals each play an important role in the analysis.

Self Loading/Unloading Container Barge

The Consulting Team has done the conceptual thinking necessary to describe potential logistical changes in the region as an integral part of its work. The results of this thinking and our internal analysis are described in this chapter.

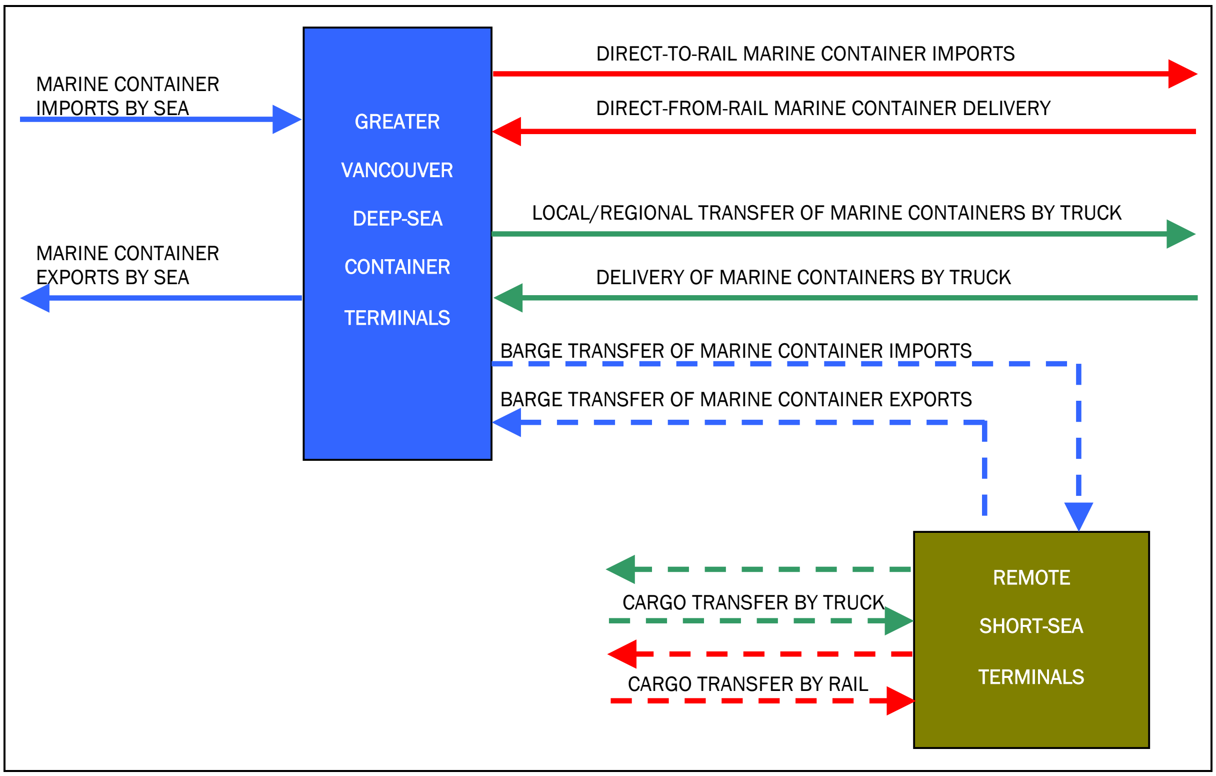
2.1 GENERATORS AND ABSORBERS OF SHORT-SEA CONTAINER TRAFFIC

Conceptually, the transfer of marine containers (i.e. those imported and exported via container ship) within the Greater Vancouver transportation network can be described graphically as shown in Figure

2.1 (below). The figure also shows, graphically, the flow of containers to and from a potential remote short-sea terminal.

The current and expected growth in throughput of import and export marine containers in Greater Vancouver will be the "drivers" of demand on the transportation network. The area's deep-sea container terminals are, therefore, the generators of traffic within the regional system. These include Centerm, Vanterm, Fraser Surrey Docks and, potentially, Lynnterm on Burrard Inlet as well as Deltaport, Deltaport's planned expansion and the planned Terminal 2 development at Roberts Bank.

FIGURE 2.1
CONCEPTUAL OVERVIEW OF GREATER VANCOUVER MARINE CONTAINER FLOWS



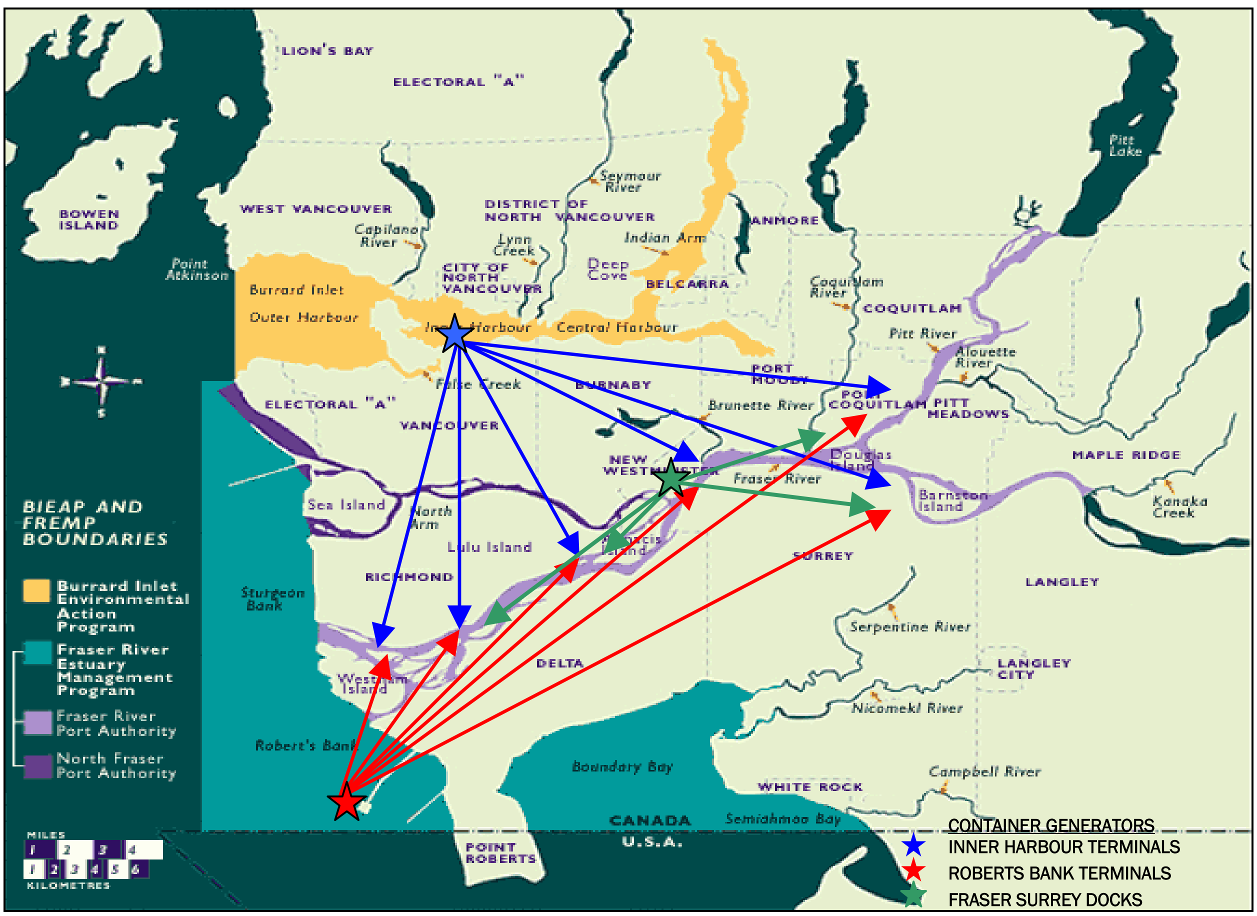
The following map (Figure 2.2) provides a general appreciation of the container generating deep-sea terminals which could, potentially, "drive" the short-sea service demand on any routes which might eventually be established.

Most deep-sea arriving and departing containers are, and will continue to be, transported by rail from/to the container terminals. These are destined for (and subsequently arrive back from) distant importers and/or logistics providers located elsewhere in Canada and the United States. The proportions of 'direct-to-rail' transshipments are changing, however, with current trends in the North American supply chain. One evolving trend is for more containerized cargo manipulation at the port-of-entry. This generates more containers for local/regional delivery by truck to third party logistics providers (3PL's) located within the region and distribution centres owned by large importers.

The potential short-sea shipping market in Greater Vancouver is defined as a portion of the throughput which is currently moved by road, or will in the future move by road, within the Greater Vancouver region. This "market penetration" will be determined, in part, by a variety of factors including the operational characteristics of the short-sea service(s), transit times, dwell times at the container terminals, delivery costs compared to road and, importantly, the extent to which cargo manipulation can effectively occur at or close to the remote short-sea terminals. These are all factors which were analyzed as part of the study.

It is important to recognize that river-front short-sea terminals offering substantially more services to importers and exporters than a just a transfer point will provide commercial advantages and, therefore, enhanced economic opportunities for the developer/operator. While the comparative barging and trucking costs are an important part of this evaluation, time and cost savings to importers and exporters will also be a key factor in determining the market share that can be attracted by an efficient short-sea service.

FIGURE 2.2
PRIMARY CONTAINER GENERATORS FOR PROSPECTIVE SHORT-SEA SERVICES



The extent to which remote short-sea terminal sites are integrated with, located adjacent to or located nearby associated distribution facilities is therefore very important to site selection. Such distribution facilities require land and, therefore, the availability of developable land could be critical to commercial viability unless a proposed location is adjacent to or nearby a variety of existing distribution operations.

2.2 THE CONTAINER OPERATIONS CENTRE CONCEPT

With the foregoing in mind, the optimum short-sea terminal will have sufficient land to establish a "container operations centre" and/or be located amongst a variety of existing distribution companies involved in deep-sea container importing and/or exporting.

There are many companies in Greater Vancouver which are involved directly in logistics support for major importers and exporters and in the handling or manipulation of marine container cargoes. These include the large freight forwarders and 3PL's as well as import distribution companies and export consolidators. Other companies provide essential services to the container industry including off-dock storage yards, container servicing operations, refrigerated cargo storage facilities and the like.

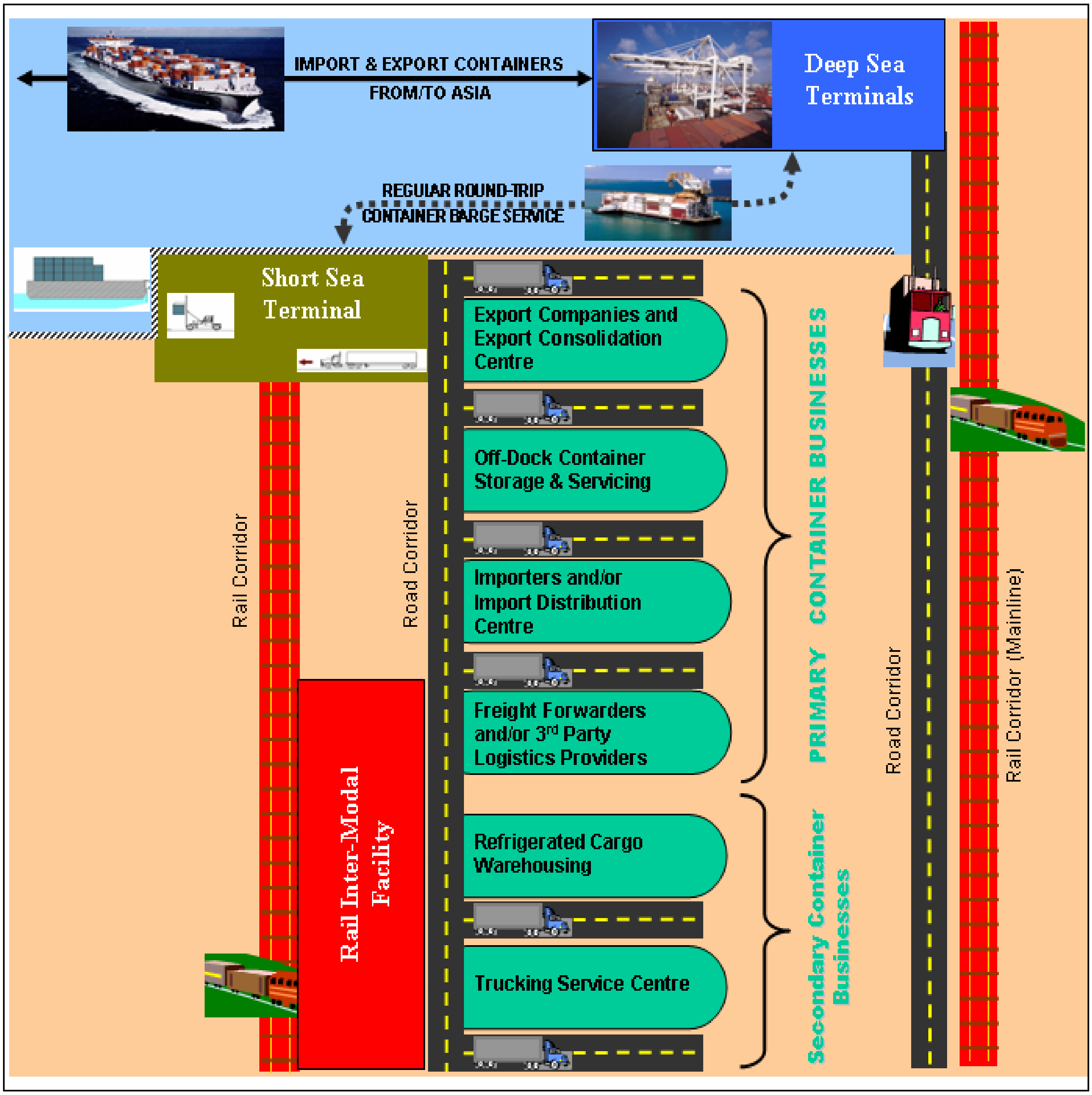
The concept for a "container operations centre" integrated with a remote short-sea terminal could effectively combine many of these related business operations, contingent on suitable land availability. The essential components for such a centre to be established include the following:

- an efficient short-sea transfer and storage terminal operation with effective barging connections connecting to the deep-sea terminals; and
- a rail inter-modal yard (IY) capable of transferring domestic and marine containers directly to/from railcars on-site or nearby.

The Consulting Team has researched and analyzed the opportunities for such an integrated facility. The commercial advantages of this concept (and for a location with adjacent or nearby container distribution businesses) are primarily related to the savings in drayage (trucking) costs around and amongst the congested road network of the region.

A conceptual sketch of the various possible components of an integrated short-sea service / container operations centre is provided in Figure 2.3.

FIGURE 2.3
SHORT-SEA / CONTAINER OPERATIONS CENTRE CONCEPT
FUNCTIONAL OVERVIEW



2.3 PRELIMINARY ESTIMATES OF LAND REQUIREMENTS FOR SHORT-SEA TERMINALS AND CONTAINER OPERATIONS CENTRE

Barge terminal land requirements have been estimated based on research and preliminary estimates. Greater Vancouver's deep-sea terminals are currently utilized at a rate of approximately 7000 TEU per acre per year. This is considered to be a good 'rule-of-thumb' to estimate the upper limit of what could be expected from a barge terminal. However, throughput in the range of 4000 to 5000 TEU per acre per year is expected to be more realistic for a short-sea facility during its early years of operation. These estimates translate to an annual capacity of up to 50,000 TEU annually on a 10 acre site, which equates to 1000 TEU or about 600 containers per week.

Sites of at least 10 acres are required for the short-sea transfer terminal alone. Smaller sites will likely start to constrict the required traffic circulation for an efficient marine terminal. Larger sites will be required if volume is expected to exceed 50,000 TEU, which is quite possible in a couple of locations within several years. The importance of sufficient land (i.e. 10 to 15 acres) and/or the capability for expansion after several years as warranted by volume growth should not be under-stated. Relocation of a short-sea terminal in response to unexpected success would be costly.

For perspective, it is useful to understand the total throughput of Greater Vancouver's container terminals. In 2004, the Port of Vancouver handled 1.67 million TEU while Fraser Surrey Docks handled 325,000 TEU … a total of close to 2 million TEU. The majority of this volume currently moves via on-terminal rail yards. If, for example, between 2 ½ % and 5% of 2004 volumes could be attracted to a short-sea service connected with a single barge node, this would represent in the range of 50,000 TEU to 100,000 TEU annual volume and require in the range of 10 to 20 acres of land.

Such estimates are approximations and are included only to provide perspective as regards the approximate land area and relative volumes required. The container market volume secured by future short-sea service operators will eventually determine the land area required for land-side barge facility and container handling/storage operations.

A rail inter-modal yard (IY) will be an essential and integral part of the optimum container operations centre described above. Research and preliminary estimates have been used to understand the land area associated with this function of the proposed centre.

Small Rail Inter-Modal Facility

If 50% of the barge terminal traffic (described above) eventually moves by rail, the IY would need capability of up to 50,000 TEU annually. This represents a daily average of 137 TEU or, say, 200 TEU on a busy day. Using these preliminary estimates, it is expected that a rail IY of the size required could be constructed on about 8 to 10 acres of land using the following assumptions:

- each 300+-foot, five-well double stack railcar can hold 20 TEU;

- the terminal would need a static capacity of about 10 cars or about 3200 feet of track if switching in and out of the terminal is relatively prompt;
- rail line requirements may necessitate the storage of cargo for several days to assemble sufficiently large train sections which, in turn will generate the need for, perhaps, 9,000 feet of working track; and
- three parallel tracks of 3,000 feet in length and about 100 feet wide would require in the range of 7 acres of land.

Other container business operations would be developed under the right conditions requiring land of varying areas depending on the operations themselves. For this study, it is sufficient to indicate that the greater the available, suitable land as part of the overall container operations centre the better. An export consolidation centre, for example, could be established on as little as 3 or 4 acres with effective traffic flows or on as much as 10 acres of land or more. Similar opportunities and land requirements would occur for other container industry operators such as distribution centres, off-dock storage, container servicing, refrigerated cargo warehousing and the like.

In summary, land requirements for a conceptual short-sea terminal with rail inter-modal facilities and supporting business operations are expected to be approximately in the following ranges:

• Short-Sea Terminal Operations And Storage:	10 to 20 acres
• Rail Inter-Modal Yard:	8 to 10 acres
• Supporting Container Industry Business Operations:	10 to 40 acres +
• Total Approximate Land Area Requirements:	28 to 70 acres +

It is important to note that the above totals are for an integrated container operations centre containing a variety of facilities and operations. For prospective node sites with adjacent or nearby distribution centre facilities and/or inter-modal facilities, an effective short-sea terminal could be established on as little as 10 to 15 acres of land.

3. SHORT-SEA CONTAINER NODE SITE OPTIONS - OVERVIEW AND PRIORITIES

An important part of the early work in this study was to identify and investigate container node site area opportunities in Greater Vancouver which might serve as terminus locations for proposed short-sea service operations. This research and assessment was intended to assemble sufficient information to identify site candidates which should be focused on during this study and to demonstrate which sites and site areas might serve as candidates for container barge operations over the longer term.

An overview of the nodal site (and corresponding site area) options is presented in this chapter as are preliminary findings for each, relative to a defined set of criteria. The "priority" sites and site areas are identified for further analysis in the study.

3.1 SITES AND SITE AREAS IDENTIFIED FOR INVESTIGATION

A total of 18 sites (or site areas) were identified and investigated during the study. Not every site area was researched with the same thoroughness since some were determined to be less suitable in the short-term while having development possibilities for this purpose in the longer term. The work focused on those which demonstrated the most advantages for the proposed service and associated container industry operations.

Eleven of the site areas included had been identified earlier in the Greater Vancouver Gateway Council's study mentioned earlier. The remaining seven site areas were identified by the Consulting Team based on its knowledge of industrial lands in the region and the research which was conducted as part of the work. All of the prospective container node site areas are located along the Fraser River.

The map in Figure 3.1 identifies the location and distribution of candidate sites and site areas from the lower reaches of the river upstream to the most remote location in Mission. It is divided into four sections as follows:

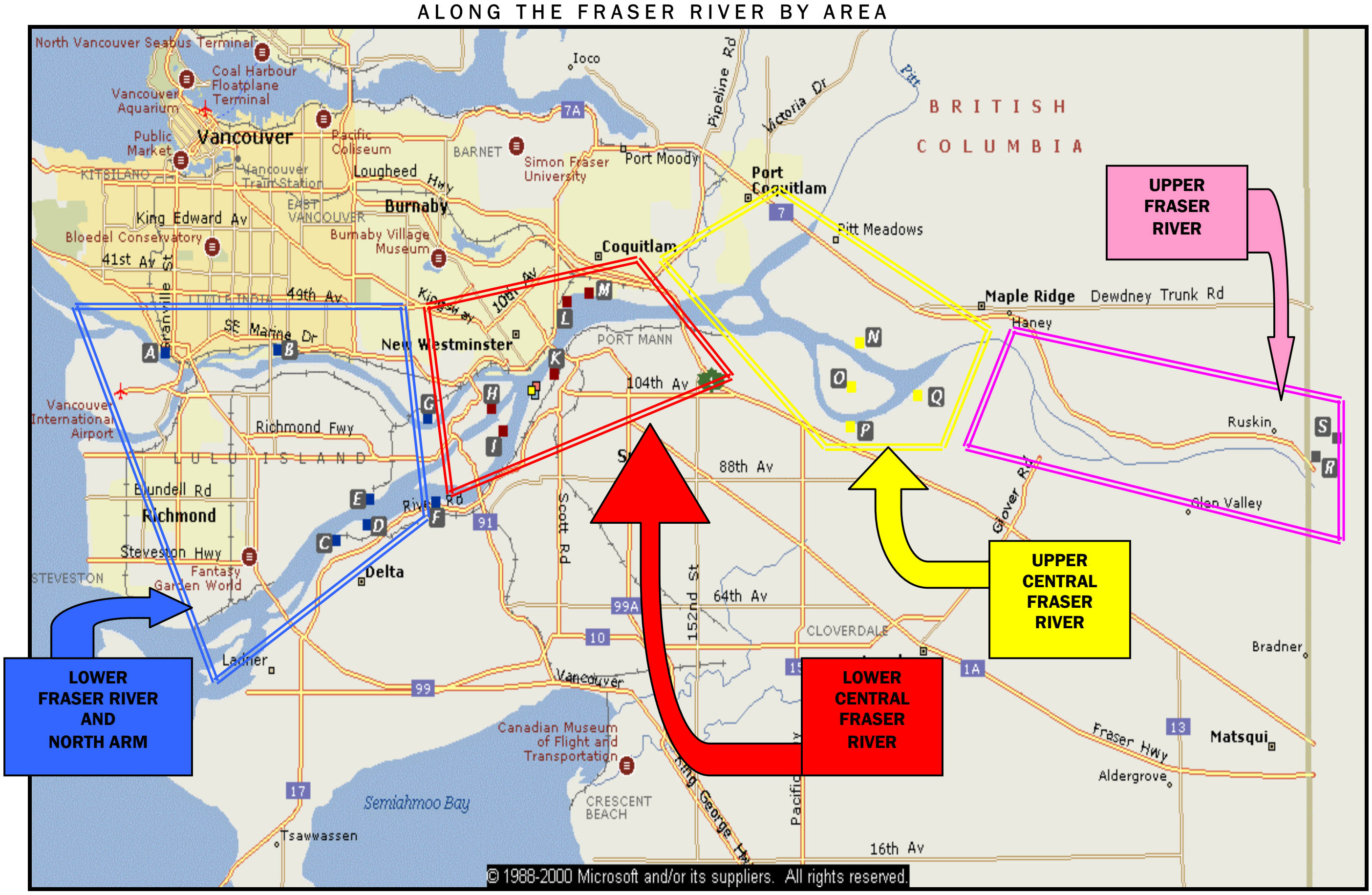
- the "Lower Fraser River and North Arm" area including the South Arm and North Arm of the river (approximately from Steveston to the Alex Fraser Bridge);
- the "Lower Central Fraser River" area (approximately from the Alex Fraser Bridge to the Port Mann Bridge);
- the "Upper Central Fraser River" area (approximately from the Port Mann Bridge upstream to the Maple Ridge area); and
- the "Upper Fraser River" area (approximately from the Maple Ridge area to Mission).

The identified sites and site areas, as shown in Figure 3.1, are listed below according to the area of the Fraser River in which they are located and with the identification letter shown on the map … from the furthest downstream at the mouth (Steveston) to the furthest upstream at Mission:

Lower Fraser River and North Arm

- Eburne - Map location A
- Mitchell Island - Map location B
- Tilbury Island – Chatterton - Map location C
- Tilbury Island – Seaspan - Map location D
- Coast 2000 - Map location E

FIGURE 3.1
PROSPECTIVE SHORT-SEA CONTAINER NODE SITES
ALONG THE FRASER RIVER BY AREA



Lower Central Fraser River

- Fraser Delta - Map location F
- Burnaby Big Bend - Map location G

- Queensborough - Map location H
- Annacis Island - Map location I
- Fraser Surrey Area - Map location J
- Fraser Surrey Van Isle - Map location K
- Brunette Creek and Canfor - Map location L
- Fraser Mills - Map location M

Upper Central Fraser River

- Parsons Channel - Map location N
- Barnston Island - Map location O
- Port Kells Area - Map location P
- Pitt Meadows - Map location Q

Upper Fraser River

- Mission Foreshore - Map location R

The location of each of these prospective site areas is shown in larger scale in Figure 3.2 through Figure 3.5 below (4 sheets).

FIGURE 3.2
PROSPECTIVE SHORT-SEA CONTAINER NODE SITES
LOWER FRASER RIVER AND NORTH ARM

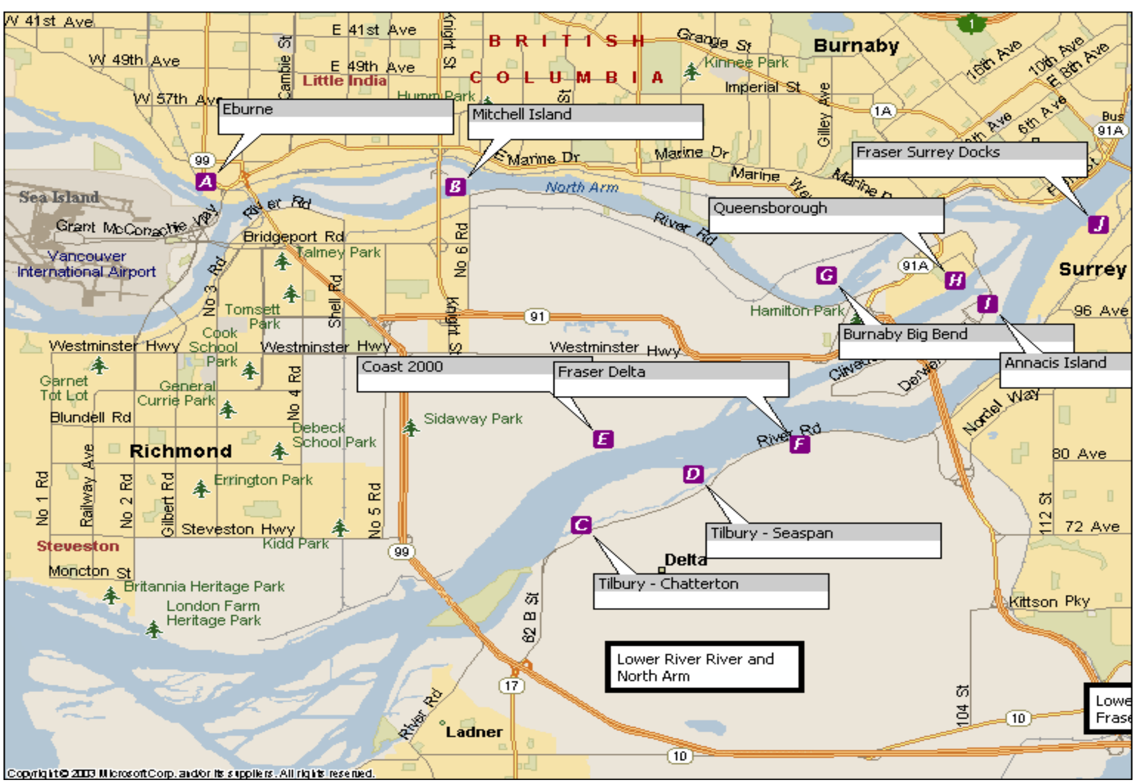


FIGURE 3.3
PROSPECTIVE SHORT-SEA CONTAINER NODE SITES - LOWER CENTRAL FRASER RIVER

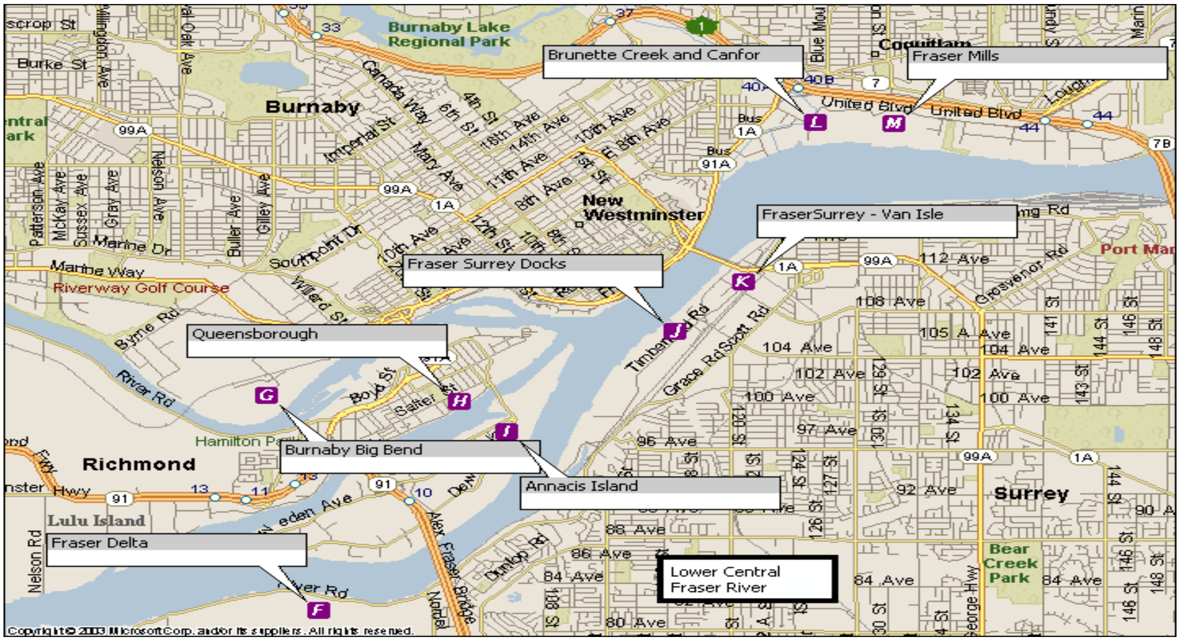


FIGURE 3.4
PROSPECTIVE SHORT-SEA CONTAINER NODE SITES
UPPER CENTRAL FRASER RIVER

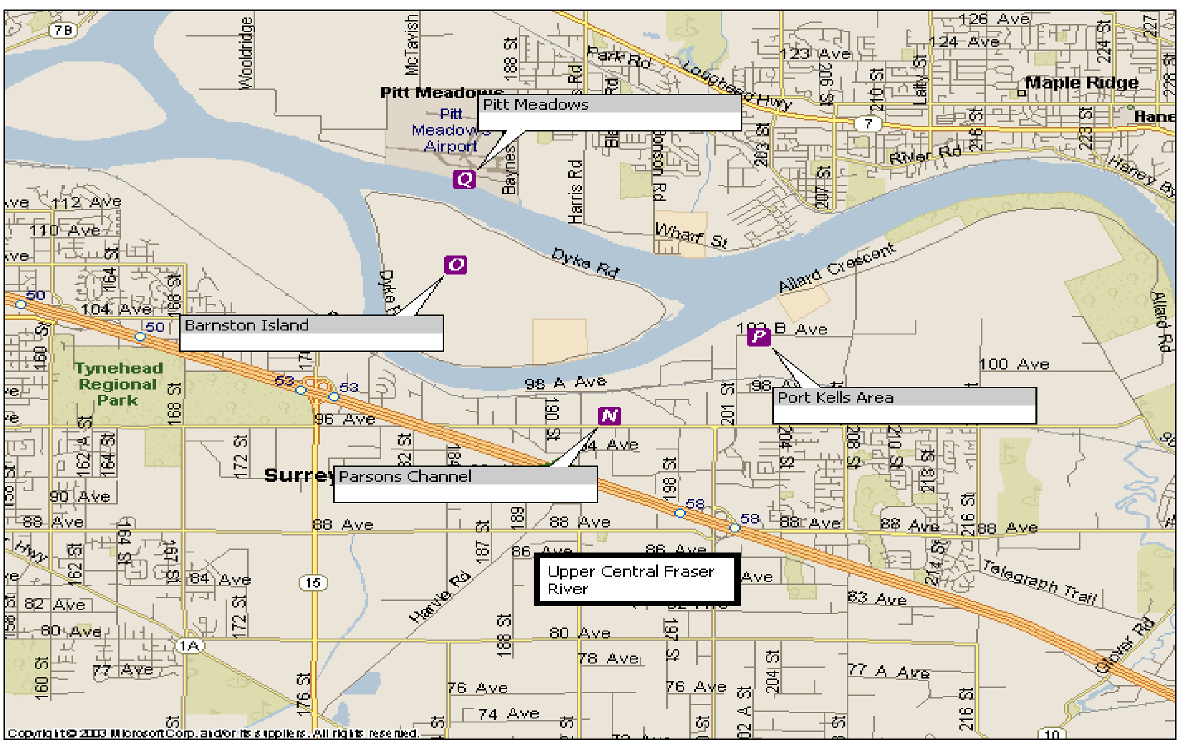


FIGURE 3.5
PROSPECTIVE SHORT-SEA CONTAINER NODE SITES - UPPER FRASER RIVER

Each of these site areas was investigated during the study relative to the opportunities and constraints they may present for the proposed marine container barge service nodes described above.

3.2 OVERALL SITE ASSESSMENT CRITERIA

The Consulting Team established a set of criteria against which the relative assessment of the sites and site areas would be weighed. As mentioned above, some sites were investigated more thoroughly than others. Not every site, therefore, was assessed against all criteria. Nevertheless, sufficient knowledge and information on all of the sites and site areas was assembled to evaluate the relative capability and suitability of each as a prospective short-sea node.

The assessment results were reviewed with the project Steering Committee and a consensus was reached on the sites to be short-listed for further evaluation during this study. Many of the sites not short-listed remain as possible options for short-sea service node development over the medium or longer term. The short-listed or "priority" sites and site areas were used to further refine the pre-feasibility assessment of marine container barging service potential in Greater Vancouver.

The criteria used to identify which locations have the best potential to become waterborne node routes for containers are included in the following categories:

Physical Characteristics and Site Suitability

- Appropriate size for a short sea shipping facility (e.g., minimum of 10 acres);
- Site suitability – for minimum, moderate and optimum node concept;
- Site preparation costs and issues.

Accessibility Issues

- Shorefront suitability;
- Water frontage to tie up barges;
- Water depth;
- Potential for dredging, if needed;
- Proximity, access, and distance to major railways;
- Proximity, access and distance to major highways.

Operational Issues and Suitability

- Travel time from short sea facility to deep-sea terminals;
- Ease of navigation in and around the site;
- Level of labor costs and issues (union and non-union);
- Barge load/unload capabilities and issues;
- Intra-service centre flow capability (site configuration suitability);
- Ability to support other related container operations;
- Existence of or potential for on-site rail and rail siding.

Development Factors

- Land availability/cost;
- Planning, zoning and re-zoning issues;
- Site preparation costs and issues;
- Level of support from neighboring municipality;
- Environmental issues;
- Development cost level.

In many instances detailed information on the sites (e.g. environmental) is not readily available and where possible, is inferred from other sources.

3.3 RELATIVE SITE ASSESSMENT SUMMARY

A spread sheet summary was prepared of the key suitability characteristics relative to short-sea container service operations for the identified sites and site areas. This overview summary includes the results of qualitative assessments against the criteria listed above and is included in Appendix A.

It is important to emphasize that the purpose of the site assessment process was to screen out unsuitable sites and identify those that may offer potential in the longer term. The list of prospective short-sea service / nodal routings was narrowed down to five which were then tested to determine the likelihood of commercial viability in each case. The site opportunities and limitations were presented to and discussed with the Steering Committee and a consensus was reached amongst Steering Committee members and Consulting Team members as to the sites which should be evaluated further in the study.

The 5-page table in Appendix A provides a summary of the study's research findings and conclusions regarding the relative suitability of each prospective site and site area considered. These assessment results address the criteria described above. This table was used as the basis for discussions on the relative merits of the site areas with the Steering Committee and for identifying the priority short to medium term site areas for purposes of this study. Many of these site areas may serve effectively as short-sea container transfer centres over the longer term.

3.4 PRIORITY AREAS IDENTIFIED FOR FURTHER EVALUATION

Based on the research, analysis and discussions with the Steering Committee, a consensus was reached on the container barge site areas which were to be included as "priority site areas" for further assessment.

3.4.1 Priority Site and Site Area Identification

The process to identify priority sites and site areas was subjective. A number of the sites which were not included on this 'short list' offer considerable potential as short-sea container nodes in the future. In some instances, locations which may provide important opportunities in five or ten years for short-sea operations were not identified as "priority" site areas because land use approvals are not in place and/or transportation infrastructure improvements are several years away. This study has focused on sites which could be available and suitable in the relatively short term.

A key part of the priority listing methodology was to narrow down the prospective site areas to a manageable number which are representative of the variety of potential sites and zones on the river. These sites could then undergo preliminary feasibility assessment in a manner which would also enable the results to be interpreted for other sites and site areas.

It was important, for example, for at least one site to be selected from several sections of the Fraser River (i.e. downstream, mid-stream and upstream) since short-sea operational costs and competitive performance will vary with distance traveled. It was also important for some smaller sites as well as some larger sites (or those with adjacent developable land) to be selected so the feasibility assessment could 'test' the competitive advantages and costs where larger sites can support the optimum container operations centre concept. Sites already located in close proximity to existing container industry distribution facilities and operations have similar commercial advantages for short-sea service operations. Finally, it was important to identify sites which have existing infrastructure and those which do not since the relative capital investment required will impact directly on overall commercial viability.

Accordingly, the sites or site areas which met the most important criteria and which were focused on are listed below:

- Coast 2000 … with its direct water and rail access and its proximity to a large industrial area expected to become home to a variety of container industry companies;

- Fraser Surrey Docks Area … with its existing infrastructure, water access and rail access and the variety of existing container industry businesses located in the neighbourhood;

- Port Kells / Parsons Channel Area … with its location further up the river, limited land for related industry development and limited existing infrastructure;

- Pitt Meadows Airport Area … with its available land, location on the north side of the river and limited existing infrastructure; and

- Tilbury –Seaspan … with its proximity to a variety of industrial activity, existing infrastructure and rail access and location towards the mouth of the river and on the south side of the river vs. Coast 2000 on the north side.

The priority site areas listed above provide a useful array of options for assessment. They include good geographic coverage of the area over which future nodes may be established and they also incorporate both established marine sites as well as undeveloped marine sites.

3.4.2 Overview of Priority Site Areas – Physical and Environmental Status and Issues

The five outer harbour sites identified as prospective short-sea container operational nodes vary from being highly developed to, essentially, greenfield. A brief summary of key physical and environmental characteristics for each of the five possible container node areas on the Fraser River is provided below. FREMP coding, where it is mentioned in the following paragraphs, refers to habitat productivity.

Coast 2000 – This site is largely sand and flat (tidal) backed by riparian grasses and shrubs with some sedge. It is characterized by the Fraser River Estuary Management Program (FREMP) as having moderately productive habitat, is coded yellow and is adjacent to the Fraser Richmond Landfill Compensation Site.

Delta Tilbury – FREMP has designated this prospective container node site as having low to moderate habitat productivity with much of the shoreline disturbed. There are trees and marsh in the riparian area to the northeast and southwest, but not much on the adjoining flats or river-face of the property. While the area's sensitivity depends on the land parcels considered for development, there are a fair number of areas in Tilbury Slough with red coding by FREMP.

Fraser Surrey Docks Area – There are no real habitat values at the existing dock face. FREMP cites some marsh and high productivity shoreward in the slough area.

Pitt Meadows Airport Area – FREMP designations range from low to high productivity in this area depending on exactly where the berth face would be located. Much of the area immediately south of the airport is low to moderate in productivity. Once above the sand flat shore, the riparian area is comprised largely of deciduous trees.

Port Kells / Parsons Channel Area – Much of the shoreline is disturbed and of low productivity with patches of moderate productivity. The riparian area is largely tall (i.e. 2 to 6 metre) shrubs and deciduous trees. Miller Contracting has a fishery compensatory area to the east of Port Kells.

In addition to possible land ownership/lease issues, any of these prospective container node sites along the Fraser River would require application to the Fraser River Port Authority. FRPA, after internal review, would submit its comments to FREMP for a coordinated review by Environment Canada, Fisheries and Oceans Canada (who may issue separate authorization under the *Fisheries Act*), the Ministry of Water, Land and Air Protection and Transport Canada (*Navigable Waters Protection Act*).

3.4.3 Overview of Priority Site Areas – Land Prices

The current price of a waterside lot in the range of +/- 10 acres is relatively difficult to estimate as few sites of this size sell each year. The number of comparable land sales is low and quoted prices are subject to a wide range of site specific issues. Some properties have major off-site costs required before development can proceed. In other instances the cost of poor soils or environmental issues can detract from possible land values. Some sites, which appear to be similar, but are ready to develop with no additional costs have higher land values. As such, definitive estimates of value are only possible after an in-depth analysis of a site which was beyond the scope of this study.

The table in Figure 3.6 (below) provides 2004 year-end general industrial statistics for the region and demonstrates the wide range of land prices. Based on this data it appears that $400,000 per acre is close to the lowest price for land in most of the region. It is reasonable to assume that waterfront land with an attractive location close to road and rail connections would be well above the minimum and closer to $600,000 per acre.

FIGURE 3.6
GREATER VANCOUVER
GENERAL INDUSTRIAL REAL ESTATE STATISTICS – YEAR-END 2004

Municipality	Building Inventory1 (sq.ft.)	*% Vacant TOTAL*	Land Price Range ($/acre)	Lease Rate Range WAREHOUSE ($/sq.ft./annum)	Operating Costs WAREHOUSE ($/sq.ft./annum)
Burnaby	24,505,262	1.92%	$600,000-1,000,000	$5.00-8.00	$1.80-2.50
Coquitlam	6,494,601	4.33%	$550,000-700,000	$6.00-8.00	$2.25-3.00
Delta	19,228,039	3.49%	$400,000-650,000	$5.50-7.00	$1.50-3.00
Langley	12,390,608	3.69%	$500,000-750,000	$5.50-7.00	$1.75-2.75
Maple Ridge	2,219,414	3.06%	$175,000-300,000	$5.50-7.00	$1.25-2.00
New Westminster	4,375,230	2.24%	$400,000-600,000	$4.50-6.00	$1.75-2.25
North Shore	4,750,737	0.35%	$1,000,000-1,300,000	$6.75-9.00	$2.25-3.80
Port Coquitlam	5,071,765	4.61%	$400,000-500,000	$5.00-6.50	$1.50-2.25
Port Moody	904,444	0.76%	N/A	$5.50-6.50	$2.00-2.50
Richmond	28,832,096	1.92%	$550,000-825,000	$4.75-7.75	$1.60-2.95
Surrey	23,323,881	0.89%	$450,000-700,000	$5.50-7.00	$1.75-2.75
Vancouver	21,881,263	2.00%	$800,000-1,200,000	$6.00-10.00	$2.25-3.25
TOTAL:	159,747,471	2.19%	$400,000-$800,000	$6.15	$2.50
Fraser Valley	60,712,659	2.20%	$350,000-650,000	$4.00-6.50	$2.00-3.00
Lower Mainland	99,034,812	2.19%	$550,000-1,200,000	$4.50-7.00	$1.75-3.25
Total	159,747,471	2.19%	$400,000-$800,000	$6.15	$2.50

There is clearly a speculative premium on land prices which restricts site options. In addition to the impact of speculation on prices, many industrial firms will pay a premium to own rather than lease their land and buildings. This too has the effect of driving up prices and may indicate that leasing is a more cost effective option.

The median vendor asking price for vacant land may be above $500,000 per acre with the final selling price being slightly lower. That said, the industrial real estate market has seen unprecedented gains and similar waterfront sites on the Vancouver side of the river are selling for as much as $1 million per acre.

Four of the five priority site areas are directly comparable to each other in terms of value, being in the $500,000 per acre range. The Coast 2000 site is located in Richmond., which is considered as one of the most desirable industrial areas due to its proximity to the airport, port facilities and downtown Vancouver. However the price to purchase industrial land in this area is expected to be higher than the other sites identified after improved highway access is completed.

The only significant exception to this general price range is Pitt Meadows where the land price would be closer to $250,000 per acre. The prices of suitable land in this area can be expected to increase to levels comparable with the other sites once the Golden Ears Bridge and North Fraser Perimeter Road are completed in 2008 and 2011 respectively.

It is understood that vacant and/or suitable lands are located in each of the five priority site areas. This does not mean, however, that suitable sites in any of the areas are actively for sale. It can be stated that a reasonable site acquisition program initiated by a serious purchaser should typically result in successfully securing a suitable site within the selected areas considered.

3.4.4 Overview of Priority Site Areas – Planned Transportation Improvements

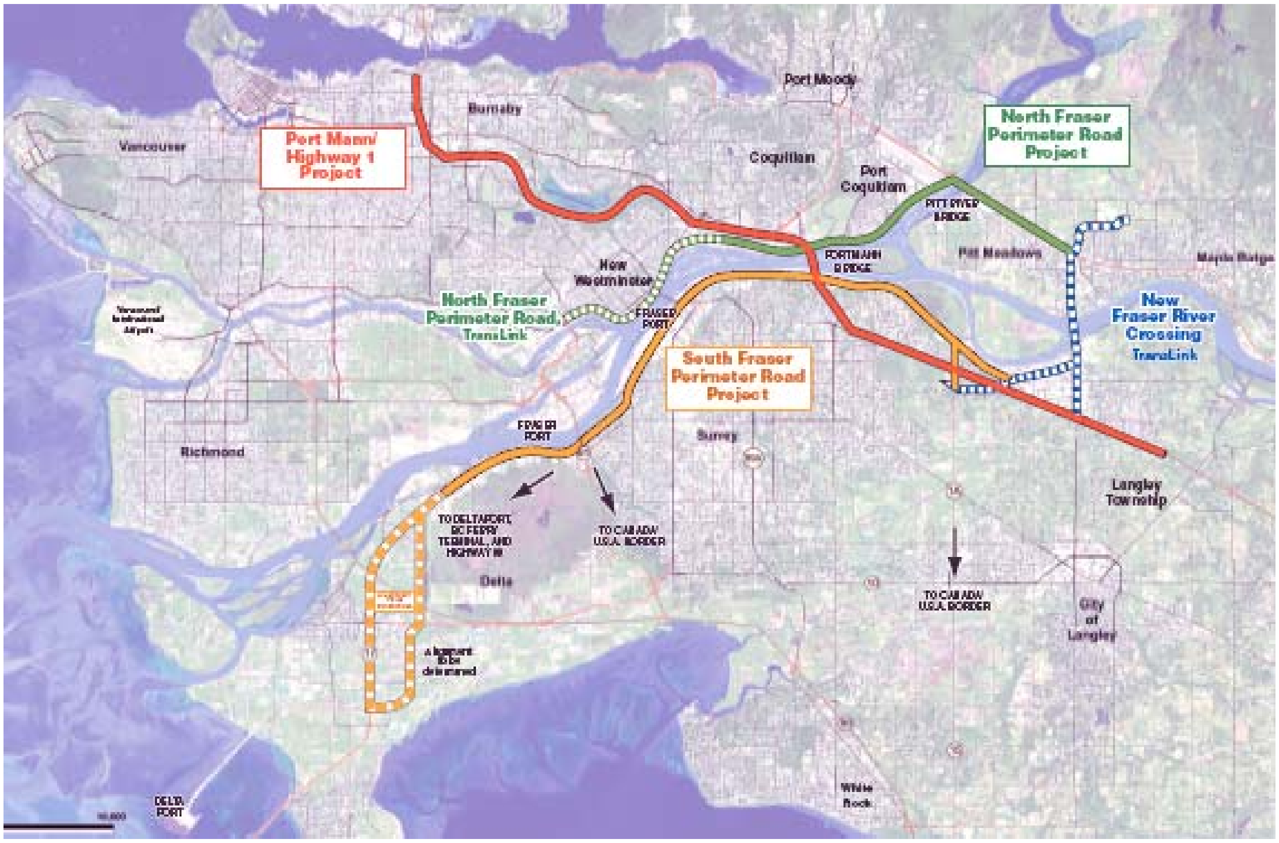
As stated earlier in the list of criteria, it is important that each of the potential locations for short-sea container developments have good links to water, highway and rail transportation services. While there is no need to describe the current transportation infrastructure of the Lower Mainland, a summary description of key future improvements is warranted and provided below.

Golden Ears Bridge and the North Fraser Perimeter Road: Although Pitt Meadows is relatively remote from the balance of the GVRD at the present time, it is expected that the Golden Ears Bridge will be completed by 2008 and the North Fraser Perimeter Road will be completed by 2011. These two improvements will result in a dramatic improvement in road accessibility and the area will then be comparable, in this regard, to other areas which are the subject of this assessment. The bridge will also benefit Port Kells as it will link that area directly to CP Rail's inter-modal facility.

The twinning of the Port Mann Bridge and the South Fraser Perimeter Road: The most important of all proposed transportation projects in Greater Vancouver is the planned twinning of the Port Mann Bridge and the widening of Highway 1 to 6 lanes, by 2011. The area which should benefit the most is Port Kells and the other industrial parks in Surrey. The South Fraser Perimeter Road will connect Port Kells in Surrey with Roberts Bank in the west. Thus, by 2011, it will have a strong positive impact on three of the priority sites: Port Kells/Parsons Channel area, Fraser Surrey Docks area and Tilbury.

A profile of these major transportation improvements in Greater Vancouver is provided in Figure 3.7.

FIGURE 3.7
GREATER VANCOUVER – MAJOR PROPOSED TRANSPORTATION IMPROVEMENTS

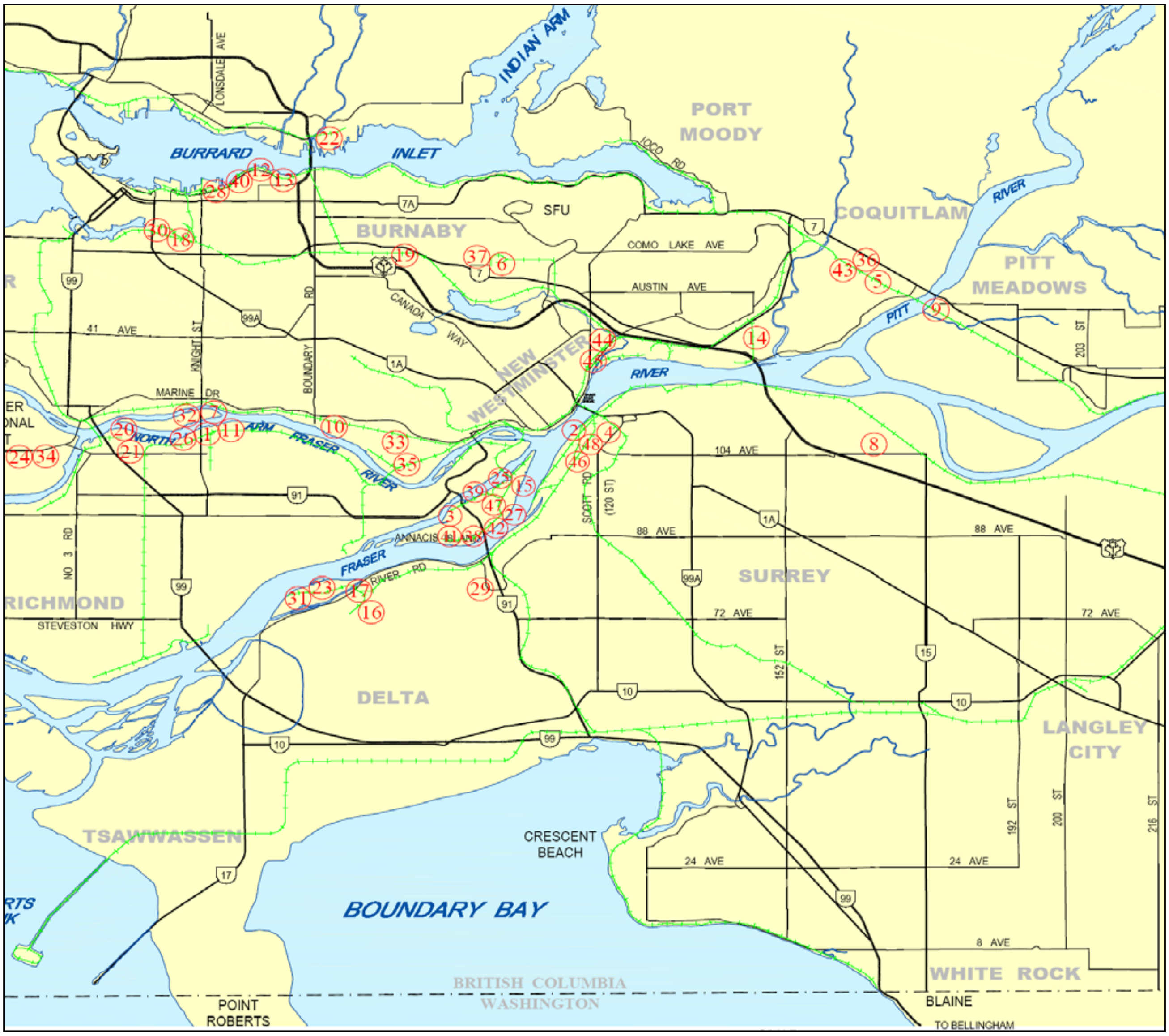


3.4.5 Overview of Priority Site Areas – Proximity to Container Industry Businesses

The following assessment profiles the five "priority" container node sites and site areas in terms of their relative location to Greater Vancouver's off-dock container facilities which support Greater Vancouver's container terminals. Figure 3.8 illustrates the location of the region's principal container industry businesses. It clearly indicates that they are concentrated on the western side of the Fraser River Valley.

The location of any future short-sea container nodes will benefit from their relative ease of access to the largest number of these off-dock facilities. Most of the facilities listed are within a 20 minute drive of one of the selected sites. The only exception are some of those located within the City of Vancouver which are quite distant from the identified Fraser River sites.

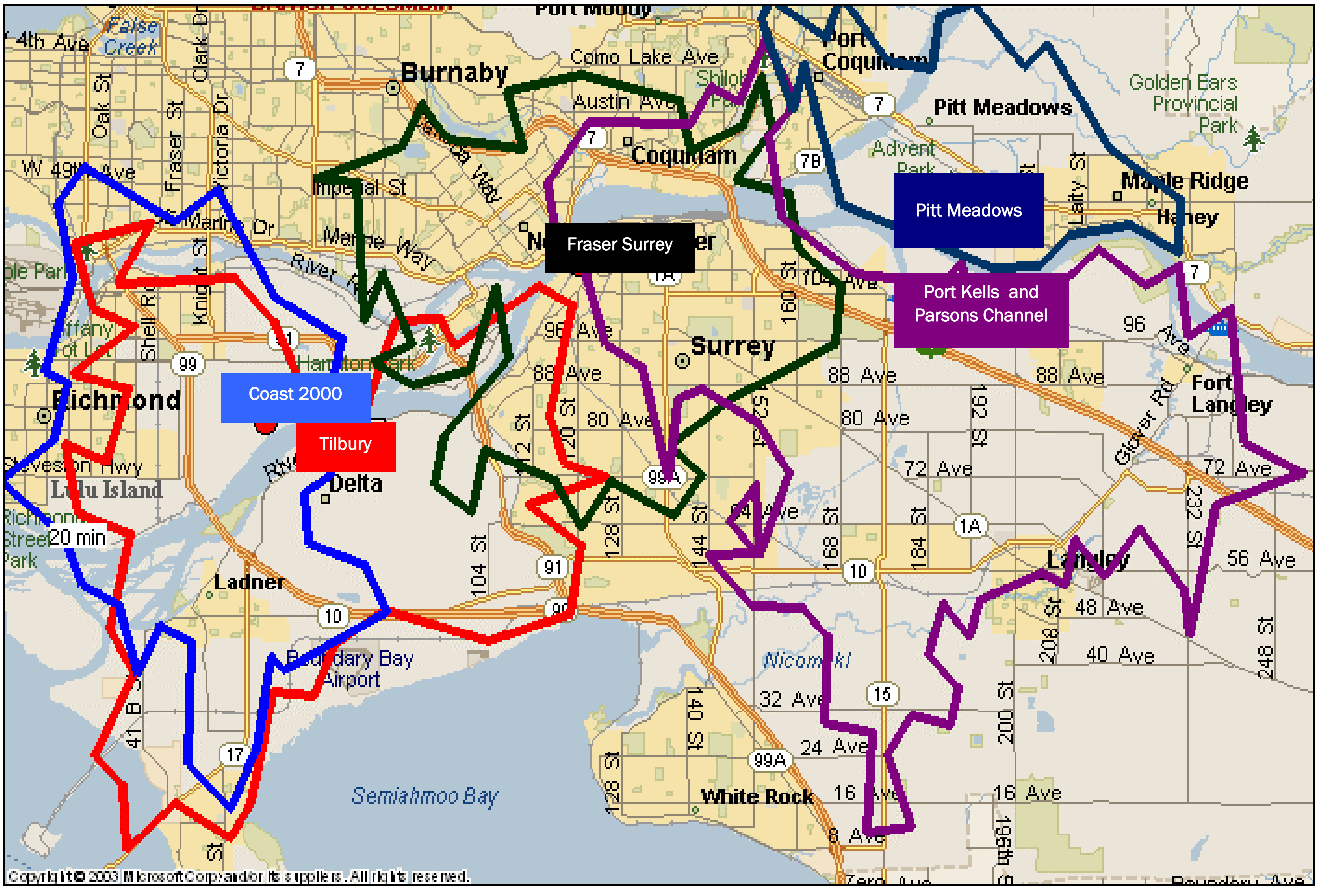
FIGURE 3.8
GREATER VANCOUVER
LOCATION AND DISTRIBUTION OF CONTAINER INDUSTRY BUSINESSES



Source: Vancouver Port Authority

In order to assess the relative ease of access between prospective container nodes and off-dock facilities, the map in Figure 3.9 was prepared. This exhibit describes 20-minute travel time contours around each of the priority site areas. The mapping software's output appears reasonable, except in Richmond where adjustments were made and reflected in Figure 3.10, which indicates how many of the facilities are located within a twenty minute drive of each of the five priority sites.

FIGURE 3.9
20-MINUTE TRAVEL TIME CONTOURS FOR PRIORITY CONTAINER NODE SITES



An analysis of container off-dock facilities located within a 20-minute driving distance of the priority short-sea container nodes is shown in Figure 3.10. This provides a valuable indicator of the competitive strength of each of the proposed site areas as access to existing business infrastructure is considered to be a distinct advantage for short-sea shipping operations. As indicated Tilbury, Coast 2000 and the Fraser Surrey Docks area all have over 20 off-dock facilities located within a twenty minute drive.

FIGURE 3.10
OFF-DOCK FACILITIES LOCATED WITHIN A 20-MINUTE DRIVE TIME OF PRIORITY CONTAINER NODE SITES

Company	Location	Tilbury Island	Coast 2000	Fraser Surrey	Port Kells Area	Pitt Meadows
A Plus Transport Ltd	Richmond	1	1			
Atlas Cold Storage	Richmond	1	1	1		
Apex Terminals Division (Mountain View Group)	Delta	1	1	1		
Burlington Northern (Intermodal)	Surrey			1	1	
Canadian Freight Terminals	Port Coquitlam					1
Canadian Freightways	Burnaby			1		
Canadian Intermodal Services (CIS) Ltd.	Richmond	1	1			
Canadian National Intermodal	Surrey				1	
Canadian Pacific Rail Division (Intermodal)	Pitt Meadows					1
Canamex International Distribution Services Inc.	Burnaby			1		
Coast 2000 Terminals Ltd.	Richmond	1	1			
Coastal Containers Ltd.	Vancouver					
Columbia Containers Ltd.	Vancouver					
Cratex Container Services Ltd.	Coquitlam			1	1	
Delta Container Distribution (Mountain View Group)	Annacis Island	1	1	1		
Delta Container Inc.	Ladner	1	1			
DSL Distribution Canada Ltd.	Delta	1	1			
Euro Asia Teminals Inc.	Richmond					
Ever-Cold Storage Ltd.	Burnaby			1		
Fraser River Terminals Ltd.	Richmond	1	1			
Gatehouse International Freight Ltd. (ASL Group)	Richmond	1	1			
Global Pacific Terminals Inc.	North Vancouver					
Imtech International Services Ltd.	Ladner	1	1			
Kintetsu World Express	Richmond	1	1			
Kuehne & Nagel International	Annacis Island	1	1	1		
Leader Cold Storage Ltd.	Richmond	1	1			
Locher Evers International	Annacis Island	1	1	1		
Marco Marine Container Ltd.	Vancouver					
Metropolitan Container Repair & Storage	Delta	1	1	1		
Modern Lumber Terminal	Vancouver					
MTE Logistix Inc.	Delta	1	1			
Richmond Terminal	Richmond	1	1			
Schenker Distribution	Burnaby	1		1		
Secure Freight Systems Inc.	Richmond	1	1			
South Burnaby Terminal (Div. of Westminster Termina	Burnaby	1		1		
Transpacific Container Terminal Ltd.	Port Coquitlam					1
United Terminals Ltd.	Burnaby			1		
Versacold Group	Annacis Island	1		1		
Versacold Group	Annacis Island	1		1		
Versacold Group	Vancouver					
Westcoast Transloading Corporation	Annacis Island	1	1	1		
Westcon Terminals Ltd.	New Westminster	1		1		
Western Assembly Ltd.	Port Coquitlam					1
Western Select Transload System	Coquitlam			1	1	
Westminster Terminals Ltd.	New Westminster			1	1	
Westnav Container Services Ltd.	Surrey			1	1	
Westow Distribution & Storage Ltd.	Annacis Island	1	1	1		
Westran Intermodal Ltd.	Surrey			1	1	
TOTAL WITHIN A 20 MINUTE DRIVE		**26**	**21**	**23**	**7**	**4**

3.4.6 *Overview of Priority Site Areas – Status Against Assessment Criteria*

As indicated earlier, the spreadsheets in Appendix A provide a summary of the characteristics of the 18 sites and site areas originally considered in the study based on the criteria identified. Figure 3.11 provides this summary, describing key features and issues for the five priority site areas identified for purposes of this study.

FIGURE 3.11
GENERAL CHARACTERISTICS OF CONTAINER NODE PRIORITY SITES

Priority Site Area Identification	Tilbury Island - Seaspan	Coast 2000	Fraser/Surrey Area-FSD	Pitt Meadows Airport	Port Kells Parsons Channel
Jurisdiction	Delta	Richmond	Surrey	Pitt Meadows/Maple Ridge	Surrey
Identification By [1]	CT/GC	GC	GC	GC	CT
Ownership	Private - Seaspan	FRPA Administration	FRPA + Prov of BC (FSD)	Airport + Municipalities	Private - 5 old saw mills
Status	Existing barge operations	Former landfill/Leasable	Adjacent marine/distrb'n	A/P use / Much unused?	Available land to develop?
PHYSICAL CHARACTERISTICS & SUITABILITY					
- Size (Acres)	25 acres	90 acres	20 ac + 150 ac adjacent	Ample Land in the area	Land assembly required
Potential for aquiisition or Long term lease of 5 to 10 acre waterfront parcel	Potential	Potential	Potential	Potential	Potential
- Size Suitability - For Minimum Node Concept	Yes	Yes	Yes	Possible	Yes - with land
- For Moderate Node Concept	Yes	Yes	Yes	Unknown	Yes - with land
- For Optimum Node Concept	Unknown	Yes	Possible	Unknown	Yes - with land
- Site Preparation Costs & Issues	Low-Existing Businesses	Unknown	Low/Already in business	Moderate	Moderate
ACCESSIBILITY					
- Shorefront Suitability	High - Ext'g operation	Satisfactory	Satisfactory	Satisfactory	Satisfactory
- Water Frontage	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory
- Water Depth	Satisfactory	Satisfactory	Satisfactory	Good deep water site	Satisfactory
- Dredging Requirement	None	Unknown/Unlikely	None	None	None
- Rail Access / Proximity / Distance	OK	CN Rail on-site	CNR/CPR/BNSF/SRY	New FR X'g nearby	Close to IY
- Highway Access / Proximity / Distance	OK/S Fr Perimeter Road	E-W Richmond Corridor	S Fraser Perimeter Road	Close as is CPR IY	Close to Hwy 1 and Perimeter Rd
number of logistics firms within 20 minutes	26	21	23	4	7
OPERATIONAL ISSUES & SUITABILITY					
- SS Service Distance / Travel Time	very close	Close	Moderate	Long	Moderate
- Navigation Issues	None	None	None	3-mo freshet restriction	None
- Labour Issues / Costs	Teamsters	Teamsters	ILWU / Higher costs	non-ILWU	non-ILWU
- Barge Load/Unload Capability & Issues	Good - Existing operation	OK/No issues	OK/No issues	Unknown	Unknown
- Intra-Service Centre Flow Capability (Configuration)	Satisfactory	Excellent	Unknown	Unknown	Unknown
- Capability To Support Related Container Operations	Good	Excellent/Ext'g op'ns	Some/Others nearby	Unknown	Depends on land assembly
- In/Out Road Transport Requirements & Costs	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory
- Rail Siding Development Capability	OK	Rail on-site/Addt'l OK	IY on-site	Unknown	OK - Nearby
DEVELOPMENT FACTORS					
- Land Availability / Cost	Moderate	Lease only / $? /ac/yr	Existing business to do	Moderate	Moderate as there are operating mills on the site
- Planning / Zoning / Rezoning Issues	None	None - Marine/Industrial	None - Industrial	Much in ALR	OK
- Site Preparation Costs & Issues	Satisfactory	Moderate costs?	Limited/Developed	High - Much in floodplain	OK
- Municipal / Regional Support	Yes	Richmond/FRPA	No issue	A/P Society motivation?	OK
- Environmental Issues [2]	Some red coding	In hand/Yellow coded	In hand / No issues	(*) - Fisheries issue	(*) - Fish habitat value
- Development Cost Level	Low-In the business	Moderate	Limited/Developed	High - Much in floodplain	Moderate
- ST vs MT vs LT Potential	ST	ST	ST	MT - maybe	MT
OVERALL ASSESSMENT					
- Potential Opportunity (Yes/No)	Yes	Yes	Yes	Possible-A/P willing	Yes
- Priority	High	High	High	Moderate	Medium
- Assessment Comments	Likely available Ext'g operation	Excellent Opportunity	Very Good Opportunity	Long way fm industry Issue w current	Land assembly possible?
- Conclusion	Priority Site Area	Priority Site Area	Priority Site Area	Priority Site Area	Priority Site Area

[1] GC indicates identification by the Gateway Council; CT indicates identification by the Consulting Team
[2] In areas where dredging is required, some environmental remediation measures may be required, notably where marked with an asterisk (*)

4. OVERVIEW OF PRACTICAL SHORT-SEA SERVICE OPERATIONS

The Consulting Team undertook a variety of research and analysis for existing and potential container-based short-sea operations in the Greater Vancouver area. This work provided an understanding of the nature, configuration and operational parameters and costs for container barging operations. An overview of the key findings of short-sea operations in Greater Vancouver are described below.

For a barge operation to be successful in the Greater Vancouver area, it needs to allow for the following:

- efficient barge size for the expected volume of containers;
- appropriate physical interaction with the deep-sea terminals;
- ability to load/unload at the river terminal(s) without overhead cranes; and
- appropriate terminal facilities at each end of the system.

The first three of these parameters, the operational ones, are discussed briefly in this chapter. The fourth, deep-sea and river terminal infrastructure, is discussed in Chapter 5.

4.1 EFFICIENT OPERATIONAL SIZE

The economic feasibility of a short-sea service operation is very much dependent on volume. Barge operations allow for economies of scale with large volumes, compared to moving containers by road. For example, the cost of a tug pulling a barge with one container is only marginally different from the cost of a tug towing a barge with 100 containers.

The "efficient" size of a barge is driven largely by existing ILWU labour agreements at the deep-sea terminals. The terminal operators there must pay for a minimum eight hours of labour to work a barge, regardless of how much is actually needed. An efficient volume on any particular barge service, therefore, is one that will occupy eight hours of deep-sea terminal labour.

The highest productivity will be achieved at deep-sea terminals where quay cranes are already in place. These should enable a handling rate of approximately 25 moves per hour or 200 moves per eight-hour shift. If the barges are running full in each direction, this would mean 100 containers could be discharged and 100 more loaded onto the barge with the use of quay cranes.

With volumes significantly lower than 100 moves in each direction, a more efficient operation would be to use a reach-stacker on the barge instead of a quay crane for loading and unloading. This will result in less manning and a lower equipment use charge, but also lower productivity of only about 100 moves per shift. If short-sea service volumes are more in this lower range (e.g. 50 each direction), the reach-stacker will result in the lowest overall cost. As volumes per barge call decline below 100 total moves, per-container handling costs will rise dramatically.

4.2 PHYSICAL INTERACTION WITH DEEP-SEA TERMINALS

The typical deep-sea wharf is built 3 to 5 meters above high tide. The tidal range at Vancouver's Roberts Bank and Inner Harbour terminals is quite large at +/- 5 meters. If the barge deck is only one meter above the water, during extreme low tides the barge deck may be 7 to 9 meters below the surface of the terminal.

Assuming that the fendering system can handle this large variation, the short-sea service operation will still require either the use of a quay gantry crane, or a reach-stacker on the barge, to transfer containers between the barge and the wharf at the deep-sea terminal. Some river terminals have used reach-stackers on the dock with special spreaders (as shown in the photograph in Figure 4.1 below) to reach down a moderate distance for loading and unloading a barge. Depending on the final overall scope, routing and configuration of a short-sea container operation in Greater Vancouver, one or a combination of these handling techniques may be applied. The tide-generated differential height between the terminal and the barge deck at Vancouver's Inner Harbour and Roberts Bank deep-sea terminals will require the use of quay cranes or a reach-stacker on the barge at those locations.

FIGURE 4.1
DOCK-BASED REACH-STACKER OPERATION

Because the deck of the barge will be significantly lower than the deck of the Inner Harbour and Roberts Bank terminals, a reach-stacker will be required to lift containers up from the barge and onto the terminal. The Consulting Team expects that this machine could place the container onto a waiting 'bombcart' on the wharf which would then be driven into the container yard and unloaded with another top-pick or reach-stacker in a "pitch-and-catch" operation.

Because a reach-stacker can also extend its boom horizontally, it can remain near the center of the barge while lifting containers onto the wharf. This will be helpful in balancing the barge, which is important since barge stability will be a critical factor in the operation. Stability issues will merit further study if the overall system looks economically promising.

Figure 4.2 and Figure 4.3 (below) show the Consulting Team's concept for a reach-stacker operation unloading a barge. The reach-stacker will initially pick a container with the spreader rotated in-line with the machine. It will then lift and spin the container 90 degrees while also maneuvering the machine 90 degrees so that the container remains parallel with the wharf. At this time the machine will be perpendicular to the wharf and the reach-stacker can place the container onto an empty 'bombcart' parked near the edge of the terminal.

FIGURE 4.2
BARGE-BASED REACH-STACKER PICKING UP CONTAINER

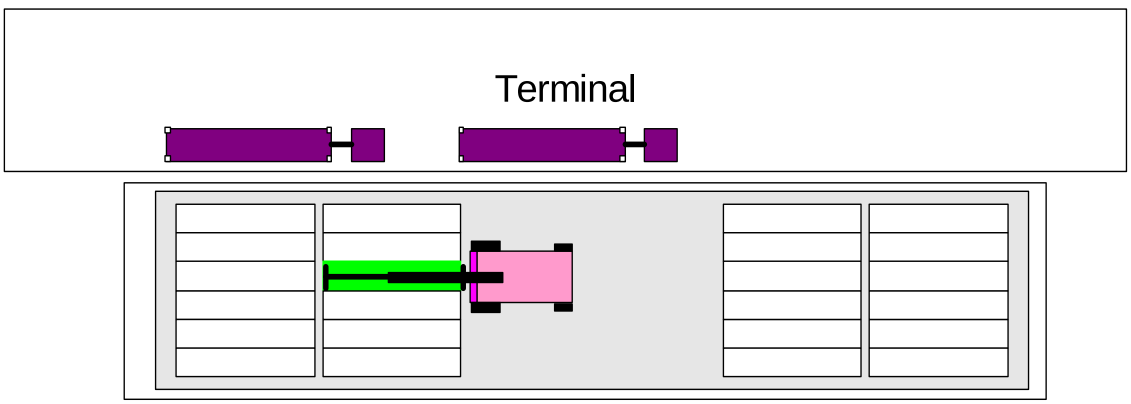
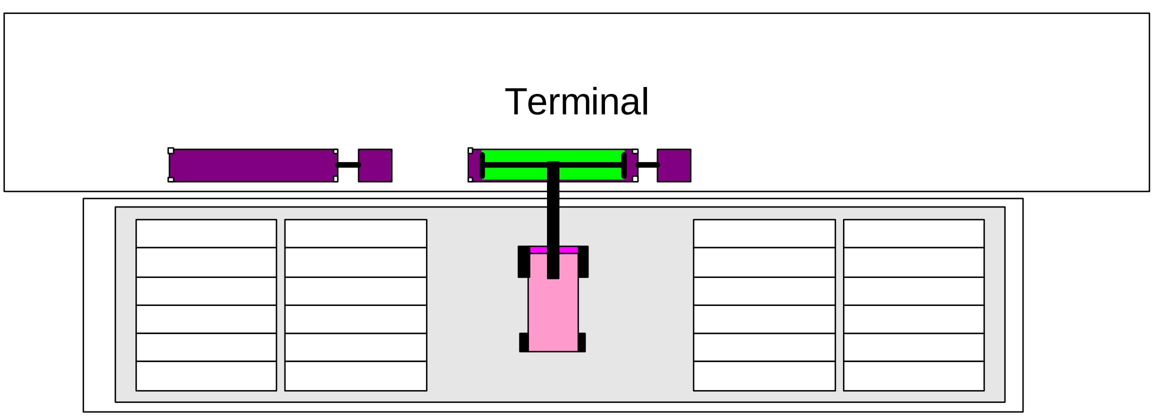


FIGURE 4.3
BARGE-BASED REACH-STACKER LOADING CONTAINER TO BARGE



The shape of the fenders on the deep-sea terminals is also important to the feasibility of barge operations. They must allow for safe quayside interaction with both a low-profile barge and large container ships throughout the entire tidal range. The horizontal distance required to reach onto the 'bombcart' as shown above will also be a function of the thickness of the fendering system.

4.3 PHYSICAL INTERACTION WITH CONTAINER OPERATIONS CENTRE NODE (RIVER) TERMINALS

Fraser Surry Docks (FSD) is one of Greater Vancouver's principal container generators. The facility also has the capability to be used as a short-sea nodal hub for short-sea service operations on the Fraser River. If this opportunity is pursued at FSD, there is a possibility of using quay cranes on each end of a short-sea service. This will depend on service volumes being sufficiently high and berth availability not being a problem.

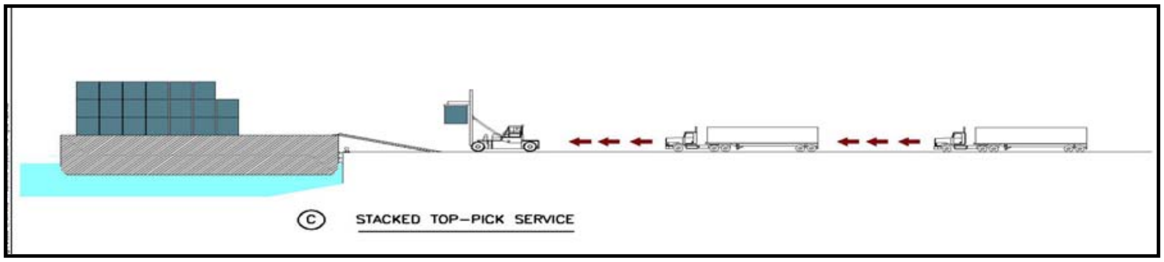
For all other priority sites identified above, it currently appears preferable to use a reach-stacker on the barge as the method of container transfer. This will be much less expensive than purchasing a mobile harbor crane or RMG crane for the barge terminal. If the operation is a success and volumes grow over the medium term, the higher productivity offered by a dedicated overhead crane may be desirable.

The photograph in Figure 4.4 (below) shows a dedicated barge-handling rail mounted gantry crane (RMG) in Europe.

FIGURE 4.4
DEDICATED BARGE-HANDLING RAIL-MOUNTED GANTRY CRANE OPERATION

If quay cranes can be used 100% of the time on the deep-sea terminals, another option for barge operations at the river terminal would be to use top-picks to drive onto and off of the barge with a ramp as shown in Figure 4.5 (below). The more moderate tidal range and custom built barge wharf at the river terminal(s) should make this practical at the container operational node sites. This option is not practical at the deep-sea terminals due to the substantial difference in height between the barge and the terminal at low tide.

FIGURE 4.5
TOP-PICK RO/RO BARGE LOADING OPERATION



If FSD is used as a short-sea container node, the same ILWU labour agreements will apply as do at all of Greater Vancouver's deep-sea terminals. This will have important cost implications for the operation. Unless other arrangements are concluded with the ILWU, it will be highly desirable to have an operations centre where a block of work can be accomplished in an eight hour shift.

All other river terminal sites (other than FSD) will be able to use non-ILWU labour and will not be subject to the same operational labour requirements. If only three hours of labour are needed, the terminal will only have to pay for three hours of labour. These terminals will also be able to run 24 hours per day without rigid start times for work shifts.

5. SHORT-SEA TERMINAL INFRASTRUCTURE REQUIREMENTS

Greater Vancouver's deep-sea container terminals, as well as the river based short-sea container nodes, will require infrastructure adjustment and/or development to accommodate an effective short-sea service. The type and extent of infrastructure development will, in part, determine both capital and operational costs for the short-sea operation.

Preliminary work has been undertaken on these requirements with the key initial findings and conclusions being outlined below.

5.1 DEEP-SEA TERMINAL INFRASTRUCTURE

Each of the deep-sea container terminals in Greater Vancouver should be physically able to handle barges without any problems. The only possible exception to this are the fendering systems which may or may not be appropriate for low-profile barges as well as large ocean going vessels. This situation will need to be investigated further as and when more detailed plans are prepared for the establishment of container-based short-sea services. The physical and operational requirements, as well as the operational and competitive benefits, will need to be discussed at length with the terminal operators so that effective plans are established for all parties.

The other important concern at the deep-sea terminals is berth availability. Deep-sea terminals in Vancouver, especially at Deltaport, are already heavily utilized. Container ships will clearly be given priority over barges. This may result in delays for barges to gain access to the berth if the short-sea service relies on quay cranes for loading and unloading. Such delays have been taken into account when assessing the potential market for short-sea cargo, but could be effectively eliminated if a barge-based reach-stacker is used for loading/unloading at both ends of the short-sea service.

Further investigation of alternate barge berthing positions at each of the deep-sea terminals, as well as the potential for delay, will be required as and when short-sea operations are actively pursued.

Short-sea operations will not increase the total demand for space in the container yard (CY) at the deep-sea terminals. Indeed, this demand may even be reduced because the dwell time for cargo being trans-shipped by barge will likely be shorter than the current mean for local cargo moving through the gate. Barge cargo can probably be stored in a higher density configuration with a top-pick as opposed to that achieved using an RTG. This capability can be expected to increase deep-sea terminal utilization and provide an additional important benefit to the deep-sea operator.

Greater Vancouver's deep-sea container terminal sites at Roberts Bank, Fraser Surrey Docks and the Inner Harbour sites are totally anthropogenic and fully developed (with the possible exception of some fendering modifications). No environmental considerations, save best environmental management practices including appropriate environmental review and approvals, are expected to be required to support the transfer of marine containers to/from short-sea operations.

5.2 CONTAINER SHORT-SEA SERVICE NODE TERMINAL INFRASTRUCTURE

If FSD is used as a barge terminal / container operations centre, new facilities will not likely be required and there should be little impact on the overall operation, except for the concern of conflict between barges and container vessels for berth space if quay cranes are relied on for loading/unloading. Some expansion in the container yard may be required. Depending on the capabilities of the company's existing terminal operating system, some modifications to their software may be required.

If Coast 2000 is used as a barge terminal / container operations centre, only a wharf will be required since all of the necessary landside infrastructure is in place. Some expansion of the CY will be required, but no other new development (e.g. administration building, maintenance building, gate, etc.) will be needed. Few if any additional management staff would need to be hired to oversee the operation. Some upgrade to the company's terminal management software will almost certainly be required.

If a site is selected for a new barge terminal / container operations centre that is not currently being used for container handling of any kind, all of the following will be required:

- land purchase or long-term land lease agreement;
- construction of a barge-capable wharf with sufficient water depth (4 to 5 meters);
- installation of heavy duty pavement over most of the site;
- construction of administration and maintenance buildings and a gate;
- management staffing to run the terminal; and
- installation of adequate terminal operating system software.

At a virgin site all of these costs will need to be borne by the new barge operation, whereas at Coast 2000 or FSD, some or all of these costs are already integrated into the existing operation. The additional cost of adding a barge operation at Coast 2000 or FSD is expected to be considerably lower.

6. COST ESTIMATES FOR THE SHORT-SEA ALTERNATIVES

A key component of this study involved the preparation of preliminary capital and operating cost estimates for a number of prospective container short-sea routes in Greater Vancouver. These costs are a fundamental part of the preliminary feasibility assessment of the short-sea opportunity.

While the cost estimates prepared are preliminary, they provide an understanding of the scope of the proposed business operation and the revenues (and, therefore, volumes) required to achieve commercial success. Interested investors in, and proponents of, intra-regional container transfer in Greater Vancouver by short-sea will need to undertake more detailed financial analysis of this opportunity. Specific site development and operational opportunities will need to evaluated carefully, and market and operational analyses will need to be refined. Nevertheless, the cost estimates provided herein are considered to be accurate reflections of the business proposed and, while preliminary and general in nature, should provide the private sector with reliable guidance on the issues, concerns, leverage and opportunities associated with this proposed business venture.

6.1 BASIS AND LIMITATIONS OF COST ESTIMATES

The cost estimates developed for this study are intended as 'order-of-magnitude' projections used specifically to identify if, and under what conditions, the short-sea operations proposed could be commercially viable. Capital costs have been estimated for site areas generally … not specific sittes. Operational cost estimates have been prepared for a series of prospective operational routings as described earlier. In particular, these routings include short-sea operations between each of Greater Vancouver's principal container terminals and the five "priority" short-sea container nodes identified in Chapter 4. These routings are summarized below:

- Vancouver Inner Harbour (i.e. Centerm/Vanterm) to/from
  - Coast 2000
  - Tilbury
  - Fraser Surrey Docks area
  - Port Kells area
  - Pitt Meadows
- Fraser Surrey Docks to/from
  - Coast 2000
  - Tilbury
  - Port Kells area
  - Pitt Meadows
- Roberts Bank (Deltaport and Terminal 2) to/from
  - Coast 2000
  - Tilbury
  - Fraser Surrey Docks area
  - Port Kells area
  - Pitt Meadows

The Consulting Team has made a number of baseline assumptions about the technical aspects of the operation that directly affect this preliminary cost analysis and will need to be confirmed prior to the introduction of a barge service. Key assumptions that should be noted are as follows:

- the reasonable availability of berth space and quay cranes at deep sea terminals;
- no significant operational delays due to the freshet or spring run-off from snowmelt;
- no problems with fendering systems and tidal variation at deep-sea terminals for barge operations; and
- no problems with barge stability with a reach-stacker in use on the barge.

6.2 OPERATIONAL SCENARIO ASSUMPTIONS

This analysis considered the following two different short-sea operational scenarios:

- **Scenario A**: 100 containers transported each direction, with quay cranes at the deep-sea terminal and reach-stackers at the barge terminal; and

- **Scenario B**: 50 containers transported each direction, with a reach-stacker at each terminal.

All costs presented in this chapter are in Canadian Dollars (CAD). In some cases, the Consulting Team was given base costs in U.S. Dollars (USD) and converted these to CAD, where required, based on an estimated exchange rate of 0.80 USD per CAD.

Other assumptions used throughout the economic analysis were as follows:

- Annual interest rate: 8% (used for amortizing capital expenditures); and
- Target profit rate: 15%

6.3 OPERATING COST ESTIMATES

Short-sea operational costs were estimated for the priority origin/destination routes described earlier. These cost estimates, and the manner in which they were developed, are summarized in the following sections for tug/barge operations and labour and equipment costs.

6.3.1 Tug and Barge Operating Costs

The costs associated with short-sea service operations include the cost of the both the barge and the tug.

Total tug and barge operating costs for a point-to-point journey have been calculated as follows:

- Total costs = (hourly cost of barge and tug) * (hours per journey)

The hours per journey have been calculated as follows:

- Total hours = (travel distance between terminals) / (barge travel speed)

Figure 6.1 shows the hourly costs for barge and tug operations. The third column includes a profit margin of 15% that the operators would receive from the shipping lines using their facilities.

FIGURE 6.1
TUG AND BARGE OPERATIONAL COSTS (2004 $ PER HOUR)

Barge & Tug Costs (per hour)	Base Cost	Incl. 15% Profit
Tug	$ 350	$ 403
Barge	$ 63	$ 72
Barge + Tug	$ 413	$ 474

From conversations with tug/barge operators, the Consulting Team learned the average tug/barge travel speed on the Fraser River is approximately 10 km/hour. This speed was combined with the data on navigable river distances received from a technical expert on river dredging at the Fraser River Port Authority as presented in Figure 6.2.

FIGURE 6.2
SHORT-SEA SERVICE ROUTE DISTANCES (KILOMETRES)

Container Generating Area	Coast 2000/ Tilbury	Fraser Surrey Docks	Pitt Meadows/ Parsons Channel
Inner Harbor	50	60	77
Roberts Bank	33	43	60
Fraser Surrey Docks	10	N/A	17

Dividing the distances by the travel speed, the total one-way travel durations for short-sea operations were calculated and are presented in Figure 6.3.

FIGURE 6.3
SHORT-SEA SERVICE TRAVEL TIME (HOURS ONE-WAY)

Container Generating Area	Coast 2000/ Tilbury	Fraser Surrey Docks	Pitt Meadows/ Parsons Channel
Inner Harbor	5	6	8
Roberts Bank	3	4	6
Fraser Surrey Docks	1	0	2

The total time required for a round trip short-sea operation includes travel each way along with the time it takes to load and/or unload containers to and/or from the barge. The load/unload times were determined based on the following productivity rates for terminal equipment:

- Quay crane: 25 lifts per hour
  200 container moves per 8-hour shift

- Reach stacker: 12 lifts per hour
  100 container moves per 8-hour shift

Combining these productivity rates with the number of containers anticipated under the two scenarios, the dwell times shown in Figure 6.4 were determined. These tug/barge dwell times were based on the assumption that a quay crane will be used at the deep-sea terminal under Scenario A, and a reach-stacker will be used at the same terminal under Scenario B.

FIGURE 6.4
TUG/BARGE DWELL TIMES AT DEEP-SEA AND SHORT-SEA TERMINALS (HOURS)

Dwell Time Parameters	Scenario A	Scenario B
Containers Moved per Round-Trip	200	100
Dwell Time at Deep-Sea Terminal (Hours)	8	8
Dwell Time at Barge Terminal (Hours)	16	8

The total time required to complete a round-trip short-sea journey includes barge loading at the origin, point-to-point travel, barge unloading at the destination, and return travel to the origin. For example, considering a round-trip journey from Roberts Bank to Pitt Meadows under Scenario A, the total trip duration is calculated as follows:

- 8 hours to load containers at the Roberts Bank deep-sea terminal (quay crane)
- 6 hours to travel from Roberts Bank to Pitt Meadows
- 16 hours to unload containers at Pitt Meadows (reach stacker)
- 6 hours to travel from Pitt Meadows to Roberts Bank
- 36 hours - Total round trip time

The round-trip journey times for both scenarios are presented in Figure 6.5.

FIGURE 6.5
SHORT-SEA SERVICE SCENARIO ROUND-TRIP TIMES (HOURS)

Scenario A	Coast 2000/ Tilbury	FSD	Pitt Meadows/ Parsons Channel
Inner Harbor	34	36	39
Roberts Bank	31	33	36
FSD	26	N/A	27

Scenario B	Coast 2000/ Tilbury	FSD	Pitt Meadows/ Parsons Channel
Inner Harbor	26	28	31
Roberts Bank	23	25	28
FSD	18	N/A	19

Since the tug cost is significantly higher than that for the barge alone, barge operating costs will consist of two components: with and without tug. The tug is required for the duration of transit plus two hours for mobilization in each direction. It is not needed while containers are being loaded or unloaded to or from the barge.

Going back to the same example considered above (i.e. a round trip from Roberts Bank to Pitt Meadows), the fraction of time a tug is required is calculated as follows:

	2 hours to mobilize at Roberts Bank
+	6 hours to travel from Roberts Bank to Pitt Meadows
+	2 hours to mobilize at Pitt Meadows
+	6 hours to travel from Pitt Meadows to Roberts Bank
=	16 hours = Tug Requirement Time

The total tug requirement time was divided by the total hours spent on the Roberts Bank to Pitt Meadows round trip (as shown in Figure 6.5) to estimate the tug utilization rate as shown below:

- Tug Utilization Rate = 16 hours / 36 hours = 45%

Figure 6.6 presents these percentages for all the cases under consideration.

FIGURE 6.6
TUG UTILIZATION RATE BY OPERATIONAL SCENARIO AND ROUTE
(% OF ROUND-TRIP TIME)

Fraction of time a tug is required								
Scenario A	**Coast 2000/ Tilbury**	**FSD**	**Pitt Meadows/ Parsons Channel**		**Scenario B**	**Coast 2000/ Tilbury**	**FSD**	**Pitt Meadows/ Parsons Channel**
Inner Harbor	41%	44%	49%		**Inner Harbor**	54%	57%	62%
Roberts Bank	35%	39%	45%		**Roberts Bank**	47%	51%	57%
FSD	23%	N/A	27%		**FSD**	33%	N/A	38%

The following formula was used to calculate total costs using the hourly costs, including 15% profit, as shown in Figure 6.1:

- <u>Total Cost</u> = (% of time with Tug) * $474 + (% of time without Tug) *$72

The estimated total round-trip costs by scenario and by short-sea service route are shown in Figure 6.7 (below).

FIGURE 6.7
TOTAL ROUND-TRIP SHORT-SEA SERVICE COSTS BY SCENARIO AND ROUTE

Total round trip cost								
Scenario A	Coast 2000/ Tilbury	FSD	Pitt Meadows/ Parsons Channel		Scenario B	Coast 2000/ Tilbury	FSD	Pitt Meadows/ Parsons Channel
Inner Harbor	$ 8,079	$ 9,028	$ 10,640		Inner Harbor	$ 7,504	$ 8,453	$ 10,065
Roberts Bank	$ 6,498	$ 7,446	$ 9,059		Roberts Bank	$ 5,923	$ 6,871	$ 8,484
FSD	$ 4,284	N/A	$ 4,948		FSD	$ 3,709	N/A	$ 4,373

Note: Total round trip costs include a 'built-in' 15% profit margin for the short-sea operator.

The round trip cost per container was determined for direct comparison later with the current per-container transport cost via truck. These operational cost estimates (in 2004 $) are presented in Figure 6.8 and result from dividing the "Total Round Trip Cost" in Figure 6.7 by the number of containers per barge round trip (i.e. 200 for Scenario A and 100 for Scenario B).

FIGURE 6.8
ROUND-TRIP SHORT-SEA SERVICE COST PER CONTAINER BY SCENARIO & ROUTE

Total round trip cost per container move								
Scenario A	Coast 2000/ Tilbury	FSD	Pitt Meadows/ Parsons Channel		Scenario B	Coast 2000/ Tilbury	FSD	Pitt Meadows/ Parsons Channel
Inner Harbor	$ 40	$ 45	$ 53		Inner Harbor	$ 75	$ 85	$101
Roberts Bank	$ 32	$ 37	$ 45		Roberts Bank	$ 59	$ 69	$ 85
FSD	$ 21		$ 25		FSD	$ 37		$ 44

Note: Total round trip costs per container include a 'built-in' 15% profit margin for the short-sea operator.

6.3.2 Labour and Equipment Costs

This section describes the Consulting Team's best estimates of the labour and equipment costs associated with converting to a barge operation.

Labour Costs

Staffing levels for stevedoring and yard operations at the deep-sea terminals were based on input from Terminal Systems Inc (TSI). The corresponding longshore staffing costs were estimated based on data found on the website for BC Marine Employers, adjusted by an assumed inflation rate of 10% to move from 2002 data to 2004 costs.

For the prospective short-sea terminals (excluding FSD which is effectively a deep-sea operation), staffing levels were based on discussions with Seaspan and Coast 2000 as well as the Consulting Team's general knowledge of container terminal operations. These facilities are not expected to use ILWU labour and, therefore, will not have the same labour practices as are set forth by the ILWU. The terminal operations, in that case, will be able to work less than eight hours without a penalty.

Under existing ILWU agreements at the deep-sea terminals, each shift must be paid for eight hours of work regardless of the actual duration of the tasks. If a barge needs only four hours of labour, the operator will still charge the operation with eight hours of labour cost. Arbitrary scenarios were generated for a barge service that matched the duration of the deep-sea call to the eight hour ILWU shift duration to avoid this penalty. **It is important to realize that if actual volumes are less than those described for the two scenarios evaluated, stevedoring costs will increase in a non-linear fashion**. Figure 6.9 presents the hourly labor costs for two unionized categories in Greater Vancouver.

FIGURE 6.9
GREATER VANCOUVER UNIONIZED LABOUR RATES

Hourly Labour Costs	
BC Marine Labour	$47.19
Teamster Labour	$37.00

Equipment Costs

Regardless of whether or not new container handling equipment will need to be purchased to accommodate a barge service, the terminal operator will charge for the use of this equipment. Figure 6.10 presents the estimated hourly capital costs of the main container handling equipment required for a short-sea service operation. The number of shifts per week are higher for quay crane utilization because these cranes will presumably be employed every day of the week while the reach-stackers will be used five days per week.

FIGURE 6.10
ESTIMATED HOURLY COSTS FOR EQUIPMENT UTILIZATION

Capital Costs		
	Quay Crane	Reach-Stacker
Purchase Price	$8,000,000	$625,000
Life (years)	20	10
Annual recovery cost	$814,818	$93,143
Shifts per week	14	10
Cost per shift	$1,119	$179
Cost per hour	$140	$22

Labour and Equipment Cost Summary – Operational Scenario A

Figure 6.11 and Figure 6.12 present the labour and equipment costs for Scenario A (100 containers in each direction) at a deep-sea terminal and a short-sea barge terminal, respectively. The maintenance costs were estimated from similar costs at container terminals in California. It should be noted that two shifts (i.e. 16 hours) are required to move 200 containers at the barge terminal.

FIGURE 6.11
TOTAL LABOUR & EQUIPMENT CHARGES AT DEEP-SEA TERMINAL – SCENARIO A
(PER BARGE CALL)

Deep-Sea Terminal Scenario A				
Labor	Manning	Hrs/shift	Gross Labor Cost	Cost per shift
Quay Crane Operator	2	8	$47.19	$ 755
Checker	1	8	$47.19	$ 378
Top-Pick Operator	1	8	$47.19	$ 378
Conemen	2	8	$47.19	$ 755
Foreman (1 vsl, 1 yard)	2	8	$47.19	$ 755
YTR Driver	4	8	$47.19	$1,510
Total Labor Cost	**12**	**--**	**----**	**$4,530**
Equipment	Quantity	Hrs/shift	Gross Equip Cost	Cost per shift
Quay Crane	1	8	$208.66	$1,669
Top-Pick or RS	1	8	$40.99	$ 328
YTR	4	8	$31.25	$1,000
Bombcart	4	8	$ 7.50	$ 240
Total Equipment Cost	--	--	----	**$3,237**
Total Base Load/Unload Cost				$7,768
Total Load/Unload Cost Incl. Profit				**$8,933**

FIGURE 6.12
TOTAL LABOUR & EQUIPMENT CHARGES AT SHORT-SEA TERMINAL – SCENARIO A
(PER BARGE CALL)

Barge Terminal Scenario A				
Labor	Manning	Hrs/shift	Gross Labor Cost	Cost per shift
Reach Stacker Operator	1	8	$37.00	$296
Clerk	1	8	$37.00	$296
Top-Pick Operator	1	8	$37.00	$296
Coneman/Lasher	2	8	$37.00	$592
YTR Driver	3	8	$37.00	$888
Total Labor Cost per Shift				$2,368
Total Labor Cost (2 shifts)	**8**			**$4,736**
Equipment	Quantity	Hrs/shift	Gross Equip Cost	Cost per shift
Barge RS	1	8	$47.39	$379
Yard Top-Pick	1	8	$47.39	$379
UTR	3	8	$31.25	$750
Bombcart	3	8	$ 7.50	$180
Total Equipment Cost per Shift				$1,688
Total Equipment Cost (2 shifts)				**$3,376**
Total Base Load/Unload Cost				$8,112
Total Load/Unload Cost Incl. Profit				**$9,330**

Labour and Equipment Cost Summary – Operational Scenario B

Figure 6.13 and Figure 6.14 present the labour and equipment costs for Scenario B (50 containers in each direction) at a deep-sea terminal and a short-sea barge terminal, respectively. This scenario requires less yard equipment (YTRs, Bombcarts) than Scenario A due to the lower productivity rate.

FIGURE 6.13
TOTAL LABOUR & EQUIPMENT CHARGES AT DEEP-SEA TERMINAL – SCENARIO B (PER BARGE CALL)

Deep-Sea Terminal Scenario B				
Labor	Manning	Hrs/shift	Gross Labor Cost	Cost per shift
RS Operator on Barge	1	8	$47.19	$ 378
Checker	1	8	$47.19	$ 378
Top-Pick Operator	1	8	$47.19	$ 378
Conemen	2	8	$47.19	$ 755
Foreman (1 vsl, 1 yard)	2	8	$47.19	$ 755
YTR Driver	3	8	$47.19	$1,133
Total Labor Cost	**10**			**$3,775**
Equipment	Quantity	Hrs/shift	Gross Equip Cost	Cost per shift
Quay Crane	0	8		
Top-Pick or RS	2	8	$40.99	$ 656
YTR	3	8	$31.25	$ 750
Bombcart	3	8	$ 7.50	$ 180
Total Equipment Cost				**$1,586**
Total Base Load/Unload Cost				$5,631
Total Load/Unload Cost Incl. Profit				**$6,165**

FIGURE 6.14
TOTAL LABOUR & EQUIPMENT CHARGES AT SHORT-SEA TERMINAL – SCENARIO B (PER BARGE CALL)

Barge Terminal Scenario B				
Labor	Manning	Hrs/shift	Gross Labor Cost	Cost per shift
Reach Stacker Operator	1	8	$37.00	$296
Clerk	1	8	$37.00	$296
Top-Pick Operator	1	8	$37.00	$296
Coneman/Lasher	2	8	$37.00	$592
YTR Driver	3	8	$37.00	$888
Total Labor Cost	**8**			**$2,368**
Equipment	Quantity	Hrs/shift	Gross Equip Cost	Cost per shift
Barge RS	1	8	$47.39	$379
Yard Top-Pick	1	8	$47.39	$379
UTR	3	8	$31.25	$750
Bombcart	3	8	$ 7.50	$180
Total Equipment Cost				**$1,688**
Total raw load/unload cost				$4,056
Total load/unload cost incl. profit				**$4,665**

Summary of Stevedoring Costs – Operational Scenarios A and B

There are four basic combinations which need to be considered in the evaluation of terminal stevedoring costs. The variables include volume (i.e. Scenario A @ 100 containers per one-way trip or Scenario B @ 50 containers per one-way trip) and whether or not the barge terminal uses ILWU labour or Teamster labour (i.e. FSD vs. the others). Figure 6.15 presents a summary of the costs detailed above and expressed in terms of cost per container moved.

FIGURE 6.15
COMPARATIVE SUMMARY OF STEVEDORING COSTS PER SHIFT

	FSD as Barge Terminal		FSD as Deep-Sea Terminal	
	Scenario A	Scenario B	Scenario A	Scenario B
Deep-Sea Stevedoring Cost	$8,933	$6,165	$8,933	$6,165
Barge destination stevedoring cost	$9,329	$4,665	$8,933	$6,165
Total extra stevedoring cost	$18,262	$10,830	$17,866	$12,331
Container lifts at each terminal	200	100	200	100
Containers moved from origin to destination	200	100	200	100
Extra Stevedoring Cost per container	**$91**	**$108**	**$89**	**$123**

6.4 TERMINAL CAPITAL INVESTMENT ESTIMATES

The estimated costs for terminal development are presented in this section are based on the assumption that a 10-acre site is developed for the short-sea operational node. Further assumptions which are important to these capital investment estimates are provided below:

- Coast 2000 and Tilbury are partially built-up and will require only 50% of the total development costs that a greenfield site would need;
- Coast 2000 and Tilbury currently have about three quarters of the management staff required to oversee a short-sea terminal operation;
- FSD is already equipped to handle a barge operation and will incur no additional costs relating to infrastructure;
- Pitt Meadows and Port Kells/Parsons Channel are greenfield sites that will have to be built from the ground up; and
- Investors at any and all of the priority sites will seek to derive the same amount of profit from a short-sea container operation.

Figure 6.16 describes the percentage of full (i.e. greenfield) investment that would be required at each site for each component of infrastructure development based on the above assumptions. For example, it has been assumed that Tilbury already has half of the required land, so the allocation of total, maximum land cost in this case identifies that the relative investment required at Tilbury will be 50% of that required at a virgin, greenfield site.

FIGURE 6.16
PROPORTION OF MAXIMUM INVESTMENT REQUIRED FOR PRIORITY SITE AREAS

	Coast 2000	Tilbury	FSD	Pitt Meadows	Parsons Channel /Port Kells
Land purchase	50%	50%	0%	100%	100%
Paving, utilities, striping, etc.	50%	50%	0%	100%	100%
Wharf/Ramp	100%	100%	0%	100%	100%
Buildings & Misc	0%	0%	0%	100%	100%
Annual property tax and insurance at 7% of value	50%	50%	0%	100%	100%
Management salary per year	25%	25%	0%	100%	100%
Profit target for facility	100%	100%	100%	100%	100%

Figure 6.17 presents a summary of the estimated capital investment required for each of the five priority short-sea node site areas based on the proportionate investment levels described in Figure 6.16.

FIGURE 6.17
TOTAL SITE DEVELOPMENT COST ESTIMATES FOR PRIORITY SITE AREAS

Infrastructure Development Cost for New 10-acre Barge Terminal								
	Unit Cost	Units	Total cost	Coast 2000	Tilbury	FSD	Pitt Mead.	Parsons Ch.
Land purchase	$400,000	10	$4,000,000	$2,000,000	$ 2,000,000	$ 0	$4,000,000	$4,000,000
Paving, utilities, striping, etc.	$375,000	10	$3,750,000	$1,875,000	$ 1,875,000	$ 0	$3,750,000	$3,750,000
Wharf/Ramp		LS	$2,500,000	$2,500,000	$ 2,500,000	$ 0	$2,500,000	$2,500,000
Buildings & Misc		LS	$2,500,000	$ 0	$ 0	$ 0	$2,500,000	$2,500,000
Total			$12,750,000	$6,375,000	$ 6,375,000	$ 0	$12,750,000	$12,750,000
Annualized at	30	years	$1,132,550	$566,275	$ 566,275	$ 0	$1,132,550	$1,132,550
Annual property tax and insurance (7%)			$ 892,500	$446,250	$ 446,250	$ 0	$892,500	$ 892,500
Management salary per year			$ 375,000	$93,750	$93,750	$ 0	$375,000	$ 375,000
Total annual cost for barge term w/o profit			$2,400,050					
Profit target (15%)			$360,007	$360,007	$ 360,007	$ 360,007	$360,007	$ 360,007
Total Annual Costs				$1,466,282	$1,466,282	$360,007	$2,760,057	$2,760,057

The total annual cost was divided by hypothetical annual volumes of container traffic on the proposed short-sea service to determine costs per container for infrastructure development. These estimates are summarized in Figure 6.18. For these calculations, the Consulting Team used nominal annual volumes of 30,000 moves under Scenario A and 20,000 under Scenario B. The rationale for Scenario B having two-thirds the volume of Scenario A is that a higher number of smaller trips would likely take place with smaller barges. Both of these throughputs are below the estimated 40,000 move-per-year capacity of a 10 acre barge terminal.

FIGURE 6.18
ANNUALIZED SITE DEVELOPMENT COST ESTIMATES FOR PRIORITY SITE AREAS
(PER CONTAINER MOVED)

Infrastructure Cost per Container	Scenario A	Scenario B
Expected Volume (Container Moves) per Year	30,000	20,000
Coast 2000	$ 49	$ 73
Tilbury Island	$ 49	$ 73
Fraser Surrey Docks	$ 12	$ 18
Pitt Meadows	$ 92	$ 138
Port Kells/Parsons Channel	$ 92	$ 138

6.5 TOTAL SHORT-SEA CAPITAL AND OPERATIONAL COST SUMMARY

To estimate total costs for the short-sea service proposed under the operational scenarios described, the labor, equipment, barge operating and terminal development costs were combined. The analysis was used to determine the total costs for each container moved by short-sea operations. These costs assume that the container businesses to/from which containers are being moved via short-sea service are in the general vicinity of the barge terminal. Accordingly, the Consulting Team has assumed a short-haul truck drayage cost of $50. for each container moved to and from the short-sea terminal for purposes of this study.

A summary of the total estimated costs for short-sea operations, including profit, are presented in Figure 6.19.

FIGURE 6.19
ANNUALIZED SITE DEVELOPMENT COST ESTIMATES FOR PRIORITY SITE AREAS
(PER CONTAINER MOVED)

SCENARIO A – INNER HARBOUR	Coast 2000 / Tilbury	Fraser Surrey Docks	Pitt Meadows /Parsons Channel
Transportation	$ 40	$ 45	$ 53
Stevedoring	$ 91	$ 89	$ 91
Barge Terminal Development	$ 49	$ 12	$ 92
Dray To Final Destination(1)	$ 50	$ 50	$ 50
Total Costs Per Move (Incl Profit @ 15%)	**$ 231**	**$ 196**	**$ 287**
SCENARIO A – ROBERTS BANK	**Coast 2000 / Tilbury**	**Fraser Surrey Docks**	**Pitt Meadows /Parsons Channel**
Transportation	$ 32	$ 37	$ 45
Stevedoring	$ 91	$ 89	$ 91
Barge Terminal Development	$ 49	$ 12	$ 92
Dray To Final Destination(1)	$ 50	$ 50	$ 50
Total Costs Per Move (Incl Profit @ 15%)	**$ 223**	**$ 189**	**$ 279**
SCENARIO A – FRASER SURREY DOCKS	**Coast 2000 / Tilbury**	**Fraser Surrey Docks**	**Pitt Meadows /Parsons Channel**
Transportation	$ 21	N/A	$ 25
Stevedoring	$ 91	N/A	$ 91
Barge Terminal Development	$ 49	N/A	$ 92
Dray To Final Destination(1)	$ 50	N/A	$ 50
Total Costs Per Move (Incl Profit @ 15%)	**$ 212**	**N/A**	**$ 258**
SCENARIO B – INNER HARBOUR	**Coast 2000 / Tilbury**	**Fraser Surrey Docks**	**Pitt Meadows /Parsons Channel**
Transportation	$ 75	$ 85	$ 101
Stevedoring	$ 108	$ 123	$ 108
Barge Terminal Development	$ 73	$ 18	$ 138
Dray To Final Destination(1)	$ 50	$ 50	$ 50
Total Costs Per Move (Incl Profit @ 15%)	**$ 307**	**$ 276**	**$ 397**
SCENARIO B – ROBERTS BANK	**Coast 2000 / Tilbury**	**Fraser Surrey Docks**	**Pitt Meadows /Parsons Channel**
Transportation	$ 59	$ 69	$ 85
Stevedoring	$ 108	$ 123	$ 108
Barge Terminal Development	$ 73	$ 18	$ 138
Dray To Final Destination(1)	$ 50	$ 50	$ 50
Total Costs Per Move (Incl Profit @ 15%)	**$ 291**	**$ 260**	**$ 381**
SCENARIO B – FRASER SURREY DOCKS	**Coast 2000 / Tilbury**	**Fraser Surrey Docks**	**Pitt Meadows /Parsons Channel**
Transportation	$ 37	N/A	$ 44
Stevedoring	$ 108	N/A	$ 108
Barge Terminal Development	$ 73	N/A	$ 138
Dray To Final Destination(1)	$ 50	N/A	$ 50
Total Costs Per Move (Incl Profit @ 15%)	**$ 269**	**N/A**	**$ 340**

(1) A trucking (dray) cost allowance of $50 per move has been included to account for the road transport of containers between the short-sea terminal and area container industry businesses.

7. SHORT-SEA COMPETITIVE AND EMISSIONS ASSESSMENT

The commissioning of this study was based on several, important, underlying objectives which are summarized below:

- to determine if short-sea operations are sufficiently viable to reduce the future growth of container trucking on Greater Vancouver's road network;
- to determine the conditions under which short-sea operations may be commercially viable as well as the associated infrastructure and operational characteristics;
- to describe the market potential for short-sea container operations and the competitive advantages and disadvantages of the service; and
- to determine if short-sea operations can contribute to lower greenhouse gas emissions.

As an integral part of this report, a number of important analyses were carried out which are fundamental to achieving these objectives. They deal directly with the competitive and environmental advantages and/or disadvantages of short-sea operations compared with its primary competitor … trucking. To the extent that intra-regional short-sea shipping of containers can compete effectively with the trucking industry in terms of commercial competitiveness and emissions, its future in Greater Vancouver may be determined.

This chapter addresses the above objectives by reporting analysis results in the following areas:

- short-sea versus truck transport pricing;
- short-sea versus truck transport times (including terminal dwell times);
- short-sea versus trucking implications for Greater Vancouver container terminals; and
- short-sea versus trucking environmental emissions.

7.1 SHORT-SEA SHIPPING VERSUS TRUCK TRANSPORT PRICING

Truck transport is currently the only mode for the intra-regional transfer of marine containers in the Greater Vancouver area. It is expected that trucking will continue to predominate in the movement of containers locally and regionally to and from the area's deep-sea container terminals. Indeed, regardless of short-sea service development which may occur, truck transport can be expected to experience major growth in the future as container throughput in the Lower Mainland expands.

To the extent that short-sea services can expect to capture a share of intra-regional container movement, their pricing will need to be competitive while taking into account any other competitive factors and advantages as discussed later in this chapter. The Consulting Team undertook a preliminary analysis of container dray rates charged between the origins and destinations which are the focus of this study. This competitive pricing of the trucking industry is summarized below.

Figure 7.1 provides the approximate cost of existing trucking operations (i.e. dray rates charged), to be used for comparison with short-sea operations later in this chapter.

FIGURE 7.1
ESTIMATED CONTAINER TRUCKING COSTS (DRAY RATES) FOR SELECTED ROUTES
(ROUND-TRIP – 2004 $)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS/ PARSONS CHANNEL
Roberts Bank	$217	$217	$233	$310	$264
Fraser Surrey Docks	$233	$228	N/A	$270	$243
Inner Harbour – South Shore	$233	$260	$253	$270	$253

To translate these round-trip costs into cost per container, the Consulting Team estimated that one out of every four truck trips would involve a truck delivering a container and returning with another container. The other three trips would, therefore, be ones where trucks return without containers. This assumption will need to be researched further as and when short-sea operations are pursued. To the extent that a higher ratio of trips includes two-way transfer of containers, the average cost per container will be lower. Similarly, if fewer round-trips are full in each direction, the trucking cost per container will be higher.

Based on the assumption used for this study, on average, 1.25 container moves are accomplished for for each round-trip completed by trucks carrying marine containers.

Dividing the costs presented in Figure 7.1 by the 1.25 factor, dray cost estimates per container were calculated and are summarized in Figure 7.2 (below).

FIGURE 7.2
ESTIMATED CONTAINER TRUCKING COSTS (DRAY RATES) PER CONTAINER MOVE
(2004 $)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS/ PARSONS CHANNEL
Roberts Bank	$174	$174	$186	$248	$211
Fraser Surrey Docks	$186	$182	N/A	$216	$194
Inner Harbour – South Shore	$186	$208	$202	$216	$202

Figure 7.3 provides a comparison of short-sea shipping costs with trucking costs for intra-regional container transfer on the selected priority routes. The short-sea costs summarized in Figure 6.19 were subtracted from the savings in dray cost listed in Figure 7.2 to calculate the net savings or (loss) in dollars per move if a short-sea service was used, instead of trucking, to transport marine containers within Greater Vancouver.

FIGURE 7.3
COST COMPARISON OF CONTAINER TRANSPORT BY SHORT-SEA AND TRUCK
(2004 $ - PER CONTAINER MOVEMENT)

Cost Difference between Truck Draying and Barge Transport											
Scenario A	Coast 2000	Tilbury	FSD	Pitt Meadows	Parsons Channel	**Scenario B**	Coast 2000	Tilbury	FSD	Pitt Meadows	Parsons Channel
Inner Harbor	$ (44)	$ (23)	$ 6	$ (71)	$ (84)	Inner Harbor	$ (120)	$ (99)	$ (73)	$ (181)	$ (195)
Roberts Bank	$ (49)	$ (49)	$ (2)	$ (31)	$ (67)	Roberts Bank	$ (117)	$ (117)	$ (74)	$ (133)	$ (170)
FSD	$ (25)	$ (29)	NA	$ (42)	$ (64)	FSD	$ (82)	$ (86)	NA	$ (124)	$ (146)
	Note: negative value means barge cost exceeds truck draying cost										

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The purpose of the above transportation rate comparison (Figure 7.3) is to 'test' the competitive pricing of short-sea service with truck transport of marine containers in Greater Vancouver on selected routes for two different volume scenarios. The comparison leads to the following preliminary conclusions:

- at barge-load volumes of 100 containers per round-trip (i.e. 50 containers each way), short-sea service is at a distinct pricing disadvantage compared with truck transport;
- at barge-load volumes of 200 containers per round-trip (i.e. 100 containers each way), short-sea services on all routes become more price competitive, and on selected routes become directly price competitive, with truck transport; and
- as barge-load volumes increase to 200 containers and higher per round-trip, short-sea services are expected to offer price advantages versus truck transport on some routes and become directly price competitive on other selected routes (recognizing that the volume/pricing comparison is not linear since volumes of sufficient size need to be achieved to secure the overall efficiencies dictated, in part, by deep-sea terminal labour agreements relative to barge loading/unloading time).

For commercially competitive short-sea operations to be achieved at comparable rates with the trucking industry, it appears that certain routes offer the best opportunity, in order as follows:

1. Fraser Surrey Docks to/from Vancouver's Inner Harbour;
2. Fraser Surrey Docks to/from Roberts Bank;
3. Tilbury to/from Vancouver's Inner Harbour;
4. Coast 2000 to/from Fraser Surrey Docks; and

5. Coast 2000 to/from Vancouver's Inner Harbour.

For commercially competitive short-sea operations to be achieved at comparable rates with the trucking industry, it is evident that volumes at or in excess of 200 containers per round-trip need to be secured on the most lucrative routes. Based on the parameters of the analysis, and through interpolation, 400 containers per round-trip on a number of short-sea routes is expected to provide significant competitive pricing advantages when compared with truck dray rates on the same routes.

This comparison of relative pricing between the two modes (i.e. short-sea and trucking) considers only the rates which need to be charged for commercially viable (and profitable) short-sea operations. It does not take into account any other competitive advantages associated with short-sea services on the various routes (e.g. potentially lower delivery time because of shorter dwell times at the deep-sea terminals, comparatively higher cost increases for trucking in the future because of road congestion and travel time increases, etc.) Some of these other competitive advantages of prospective short-sea container operations are discussed later in this report.

The short-sea cost analysis has assumed that quay cranes would be used at Fraser Surrey Docks for the Fraser Surrey barge terminal operation. One of the reasons that FSD is shown to be a more economical short-sea terminal is that the quay cranes can unload 200 containers in eight hours instead of 16 hours for other short-sea terminals using reach-stackers. FSD also has the advantage of having all of the required land, equipment, support buildings and personnel already in place whereas other potential terminal locations would need to invest more capital in infrastructure development.

Further analysis is required to determine the optimum equipment configuration at both the deep-sea and the short-sea terminals. Reach-stackers located on the barge may prove, ultimately, to be the preferred method for container loading/unloading at one or more of the deep-sea terminals if berth availability is an issue and if labour agreement shift-time minimums can be matched to barge dwell times at the dock. While this pre-feasibility assessment sets out key parameters, issues and options, more detailed analysis of the most practical and viable alternatives is warranted given the direction provided herein and the conclusions reached during this study.

7.2 SHORT-SEA SHIPPING VERSUS TRUCK TRANSPORT TIME ANALYSIS

One of the most fundamental impacts on market demand for the intra-regional transportation of marine containers is the time it takes to transport these containers from/to the deep-sea shipping terminals to/from their regional destinations. During this study, a preliminary comparative analysis was carried out of these times, which are critical to many importers and exporters, between the two primary competing transportation modes: barging and trucking. Transit times directly impact on overall logistics costs and the market appeal of the system for those who make final decisions on container routing.

This preliminary transit time analysis was integrated into the assessment of market potential for the proposed container short-sea shipping services.

The assessment of comparative transit times is preliminary, and will need to undergo further refinement for specific routings and market opportunities. Nevertheless, it provides a fair comparison of the relative time to move inbound and outbound containers between the origins and destinations, described above, for this study.

The transit time analysis takes into account the following:

- comparative dwell times for the containers at the import/export terminals (for both barging and trucking) and the inland transfer nodes; and

- estimated comparative transit times currently, and in the future, between deep-sea terminals and the primary inland destinations and origins of the containers for the principal competitive routings described.

7.2.1 Deep-Sea Terminal and Short-Sea Terminal Dwell Time Estimates

The time it takes for containers to move through the system is generally critical to the importers and exporters involved … especially the former. It is, therefore, important to compare the time that containers spend at the deep-sea terminals (for both barging and trucking) and at the short-sea shipping nodes to effectively assess the ability of short-sea shipping to attract both inbound and outbound marine containers. The length of time a container spends on a deep-sea or an inshore terminal can become a critical component of overall time within the supply chain.

Total delivery time is especially critical to North American importers and is the key focus of this part of the analysis. Exporters tend to deliver containers in a timely manner based on ship arrival schedules. Their cargoes (e.g. pulp, lumber, chemicals, grains, etc.) are also, generally, not time-sensitive … with the very notable exception being refrigerated cargo. Dwell times for export containers (at both deep-sea terminals and short-sea terminals) are effectively ignored in this analysis and, thereby, assumed to be equal (or not competitively relevant) for both truck and short-sea transport. The assessment below refers only to the comparative positioning of short-sea transport and road transport regarding inbound containers … with their, comparatively high-valued, time-sensitive (often retail) merchandise.

The length of time it takes to move a container from Asian exporters to its final destination in Canada or the United States is a crucial factor to importers and their agents in determining which shipping lines and which North American 'ports of entry' to use. This is evidenced, recently, with the adjustments being made by importers and third party logistics providers to move some inbound containers from Asia through the Panama Canal to North America's east coast ports to avoid the growing delays on the west coast.

As is well known, the international container supply chain is a multi-business system with many components … all of which can help or restrict the flow of cargo. Greater Vancouver's container terminals are an integral part of this system. To the extent that containers can flow more smoothly, reliably and/or quickly through the Lower Mainland, the port as a whole will benefit and the terminals will become more competitive with their U.S. west coast counterparts.

The length of time a container remains at a deep-sea terminal before pick-up and delivery is as important as the time it takes to deliver, by rail or by truck, the merchandise it contains. These terminal "dwell times" are critical factors within the supply chain.

The intra-regional transport of containers in Greater Vancouver via short-sea operations offers an opportunity for inbound container dwell times to be reduced, perhaps considerably. To the extent that this can take place, short-sea services could realize a distinct and important competitive advantage over intra-regional truck transport.

The competitive importance of container dwell times at Greater Vancouver's deep-sea terminals needs to be studied in more depth than it has been in this study. It may, or may not, provide advantages for proponents of short-sea operations.

It is evident to the Consulting Team that both inbound and outbound containers destined to or arriving from a short-sea service can be moved efficiently through deep-sea terminals. The inevitable 'gate', reservation and hours-of-operation delays associated with truck transfer can be largely avoided. Given a designated area within the terminal for short-sea operations, and with unrestricted access for a tug/barge service, the dwell time at the container port for short-sea destined/arriving containers will depend, primarily, on the frequency of short-sea services.

Specific research concerning container dwell times was not carried out during this study. The Consulting Team has, however, obtained some preliminary information from the Vancouver Port Authority on this subject and believes that this potential competitive advantage for short-sea shipping should be pursued further.

Preliminary information indicates that inbound containers destined for rail remain at Port of Vancouver's terminals, on average, for more than the five 'free' days they are allowed. In late 2004 and early 2005, these dwell times for container imports have soared to upwards of two weeks, primarily because of difficulties by the railways in supplying adequate numbers of railcars. The extent to which these unusually high delays for inbound containerized cargo will continue is uncertain.

The comparable dwell time for inbound containers transferred to truck (which is the 'target market' for future short-sea services) ranges from three to more than four days, according to the preliminary numbers received. Information was not available concerning how often the higher dwell times for truck-transferred containers are realized, but this will be required research if the short-sea opportunity is pursued further. If a prospective tug/barge operation calls at a deep-sea terminal once every two days, it is possible that non-rail transferred, inbound containers may save up to one or two days of time within the supply chain. If this, as yet un-substantiated operational advantage could be realized, it would provide a substantial competitive advantage to short-sea operations over truck transport … which is its only competitor at the present time.

A disadvantage for short-sea operations compared with trucking with respect to inbound containers is the time required at the short-sea transfer terminal to unload the barge, marshal the container and deliver it to its final destination.

Short-sea service unloading and loading times are taken into account in the following section which analyzes transit times. The dray costs for local delivery of containers to/from the short-sea terminal are taken into account in the comparative cost analysis with trucking in Section 7.1 (above). On-terminal container dwell times estimates, and delivery time estimates, based on the Consulting Team's experience and the preliminary numbers described above, are summarized in Figure 7.4 (below). These estimates are based on the assumption that the deep-sea terminal is served by short-sea operations every two days.

FIGURE 7.4
DEEP-SEA AND SHORT-SEA TERMINAL
DWELL TIME ESTIMATES FOR INBOUND CONTAINERS
(HOURS)

TERMINAL ►	DEEP-SEA	INLAND/SHORT-SEA
Pre-Loading Dwell Time - Trucking	85	N/A
Pre-Loading Dwell Time – Short-Sea	24	N/A
Post-Unloading Dwell Time - Trucking	N/A	0
Post-Unloading Dwell Time – Short-Sea	N/A	5
Post-Unloading Delivery Time – Short-Sea	N/A	1
	ALL TERMINALS	
TOTAL TERMINAL DWELL TIME - TRUCKING	85	
TOTAL TERMINAL DWELL TIME – SHORT-SEA	30	

The dwell time estimates in Figure 7.4 need to be researched and confirmed or adjusted. However, they are based on information available to the Consulting Team at the time this report was prepared. The estimates suggest a distinct competitive advantage, in terms of on-terminal dwell time only, for short-sea service operations when compared with trucking. This advantage is expected to occur, for inbound containers, because of the relatively efficient flow 'across the dock' for short-sea destined containers at the deep-sea terminal … and the delays resulting from container marshaling, gate congestion, reservation requirements and operating hour limitations for road transport pick-up of containers at the container port.

7.2.2 Short-Sea Shipping Transit Time Analysis

A preliminary assessment of the transit times for barging operations was carried out as part of this study. The results are summarized below:

Navigable water distances between each of the origin/destination pairs included in this analysis were described in Chapter 6 and are repeated in Figure 7.5 (below).

FIGURE 7.5
SHORT-SEA SERVICE ROUTE DISTANCES (KILOMETRES)

TERMINALS ▼ SS NODES ▶	Coast 2000/Tilbury	Fraser Surrey	Port Kells/Parsons Channel /Pitt Meadows
Roberts Bank	33	43	60
Fraser Surrey	10	N/A	17
Inner Harbour - South Shore	50	60	77

As described in the preceding chapter, the Consulting Team has used an average tug/barge travel speed on the Fraser River of 10 kilometres per hour for purposes of this study. This speed was combined with the above data on navigable river distances to determine the total one-way travel durations for short-sea operations. The results of these calculations are summarized in Figure 7.6 (below).

FIGURE 7.6
SHORT-SEA SERVICE TRAVEL TIME (HOURS ONE-WAY)

TERMINALS ▼ SS NODES ▶	Coast 2000/Tilbury	Fraser Surrey	Port Kells/Parsons Channel /Pitt Meadows
Roberts Bank	3	4	6
Fraser Surrey	1	N/A	2
Inner Harbour - South Shore	5	6	8

To effectively compare short-sea travel time with truck travel time it is necessary to understand the loading/unloading time in each case. Containers are delayed longer while being loaded and unloaded if transported by short-sea service in comparison with truck transport, since the barge loading/unloading process for 100 or more containers takes considerably more time than does the truck loading/unloading process for one or two containers.

Barge loading and unloading times were estimated using the equipment productivity rates described in Chapter 6. Combining these productivity rates with the number of containers anticipated under the two short-sea operational scenarios described earlier, barge loading/unloading time estimates were determined and are summarized in Figure 7.7 (below). These estimates are based on the assumption that a quay crane will be used at the deep-sea terminal under Scenario A and a reach-stacker will be used at the same terminal under Scenario B.

FIGURE 7.7
TUG/BARGE LOAD/UNLOAD TIMES AT DEEP-SEA AND SHORT-SEA TERMINALS (HOURS)

SS OPERATING SCENARIO ►	Scenario A	Scenario B
Containers Moved per Round-Trip	200	100
Deep-Sea Terminal Unload/Load Time	8	8
Short-Sea Terminal Unload/Load Time	16	8

The total time required to a complete a round-trip short-sea journey includes barge unloading/loading at the origin, point-to-point travel, barge unloading/loading at the destination and return travel to the origin. For example, considering a round-trip journey from Roberts Bank to Pitt Meadows under Scenario A, the total trip duration is calculated as follows:

- 8 hours to unload/load containers at the Roberts Bank deep-sea terminal (quay crane)
- 6 hours to travel from Roberts Bank to Pitt Meadows
- 16 hours to unload/load containers at Pitt Meadows (reach stacker)
- 6 hours to travel from Pitt Meadows to Roberts Bank
- 36 hours - Total round trip time

The round-trip journey times, including sea/river travel and unloading/loading at both docks, for both short-sea operational scenarios considered in this study are presented in Figure 7.8 (below).

FIGURE 7.8
TOTAL ROUND-TRIP TIMES FOR SHORT-SEA SERVICE SCENARIOS (HOURS)

TERMINALS ▼ NODES ►	Coast 2000/Tilbury	Fraser Surrey	Port Kells/Parsons Channel /Pitt Meadows
	OPERATIONAL SCENARIO A – BARGE CONTAINER VOLUME PER ROUND-TRIP = 200		
Roberts Bank	31	33	36
Fraser Surrey Docks	26	N/A	27
Inner Harbour - South Shore	34	36	39
	OPERATIONAL SCENARIO B – BARGE CONTAINER VOLUME PER ROUND-TRIP = 100		
Roberts Bank	23	25	28
Fraser Surrey Docks	18	N/A	19
Inner Harbour - South Shore	26	28	31

7.2.3 Trucking Transit Time Analysis

All import and export marine containers in the Greater Vancouver area which are destined to or originating from regional facilities are currently transported by road. This intra-regional transfer of containers is expected to increase dramatically as import and export container volumes from/to Asia expand in the years and decades ahead. The ability of short-sea shipping to handle a portion of the intra-regional demand, in a commercially viable manner, is the principal objective of this study.

An important component of the trucking transit time analysis for this study was to estimate the time to transport import and export containers intra-regionally on the current and future Greater Vancouver road network. This work focused on road transportation times between the primary container generating terminals (i.e. Centerm and Vanterm in the Inner Harbour, Fraser Surrey Docks and the existing and new terminals at Roberts Bank) and the prospective ("priority") locations for short-sea (barging) nodes and, potentially, "container operations centres" at or nearby these nodes.

Responsibility for planning and operating Greater Vancouver's regional road and transit systems rests with the Greater Vancouver Transportation Authority (GVTA or TransLink). The GVTA Strategic Planning Department maintains a sophisticated computer demand (Emme/2) model used to forecast the operational impacts of growth and transportation developments in the Greater Vancouver area. TransLink generously provided a number of specific analyses using the Emme/2 model which were used directly in this feasibility assessment. These analyses provided forecasted transit distances and morning peak period travel time estimates between selected origins and destinations relevant to the work for intra-regional road transportation. The results facilitated a comparative assessment of transit times between short-sea shipping and trucking and, thereby, contributed to the conclusions concerning the relative attractiveness of intra-regional container barging.

The results of TransLink's Emme/2 model analysis for the routings included in this study including road transportation distances, transit times and speeds under the various scenarios analyzed are described below. For each of these parameters, three figures are provided as follows:

- 2003 status … given the road transportation infrastructure in place today;
- 2021 status … assuming that committed, major road network improvements (only) are completed such as:

  - a third crossing of the Fraser River between Langley and Maple Ridge (Golden Ears Bridge);

  - Fraser Highway widening; and

  - a section of the North Fraser Perimeter Road;
- 2021 status … assuming that committed and planned (but not yet committed) major road network improvements are completed with the additional planned, but uncommitted, projects such as:

- the Port Mann Bridge/Highway 1 Project;

- the South Fraser Perimeter Road Project.

__Truck travel distance__ comparisons for the priority origin/destination areas are summarized in Figure 7.9 (for 2003), Figure 7.10 (for 2021 with committed projects only) and Figure 7.11 (for 2021 with both committed and planned projects).

FIGURE 7.9
ROAD TRAVEL DISTANCE – 2003 (KILOMETRES)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS
Roberts Bank	29	21	32	58	50
Fraser Surrey Docks	16	12	0	27	21
Vancouver (S Inner Harbour)	19	29	25	38	42
Vancouver (N Inner Harbour)	24	33	23	36	40

It can be noticed in Figures 7.9 through 7.11 that travel distances are not expected to change dramatically in the future as road improvements are implemented. Infrastructure development is focused on travel times and, while link distances shorten slightly for some routes over time, generally they remain fairly constant for the origin/destination pairs considered.

FIGURE 7.10
ROAD TRAVEL DISTANCE – 2021 – WITH COMMITTED IMPROVEMENTS ONLY (KILOMETRES)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS
Roberts Bank	30	21	32	59	51
Fraser Surrey Docks	17	12	0	27	21
Vancouver (S Inner Harbour)	19	29	25	38	41
Vancouver (N Inner Harbour)	25	33	24	36	40

FIGURE 7.11
ROAD TRAVEL DISTANCE – 2021 – WITH COMMITTED & PLANNED IMPROVEMENTS (KILOMETRES)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS
Roberts Bank	29	21	32	60	49
Fraser Surrey Docks	16	13	0	27	22
Vancouver (S Inner Harbour)	19	29	25	38	39
Vancouver (N Inner Harbour)	26	33	24	37	38

__Truck travel time__ comparisons (i.e. am peak period) for the priority origin/destination routes are summarized in Figure 7.12 (for 2003) and Figure 7.13 (for 2021 with committed projects <u>only</u> in place). Similar data for 2021 with both committed and planned projects in place is presented in Appendix B.

Each figure is comprised of a table and four travel time maps prepared by the VPA. The table summarizes travel time data from the Emme/2 model analysis. The maps present, graphically, the travel times (in each direction) between the four container terminal generators and the five 'priority' short-sea container node locations on the Fraser River. One map is provided for each deep-sea terminal generator in the following order:

- Roberts Bank;
- Fraser Surrey Docks;
- Vancouver Inner Harbour – North Shore; and
- Vancouver Inner Harbour – South Shore.

Similar maps corresponding to 2021 with both committed and planned transportation improvements in place are included in Appendix B.

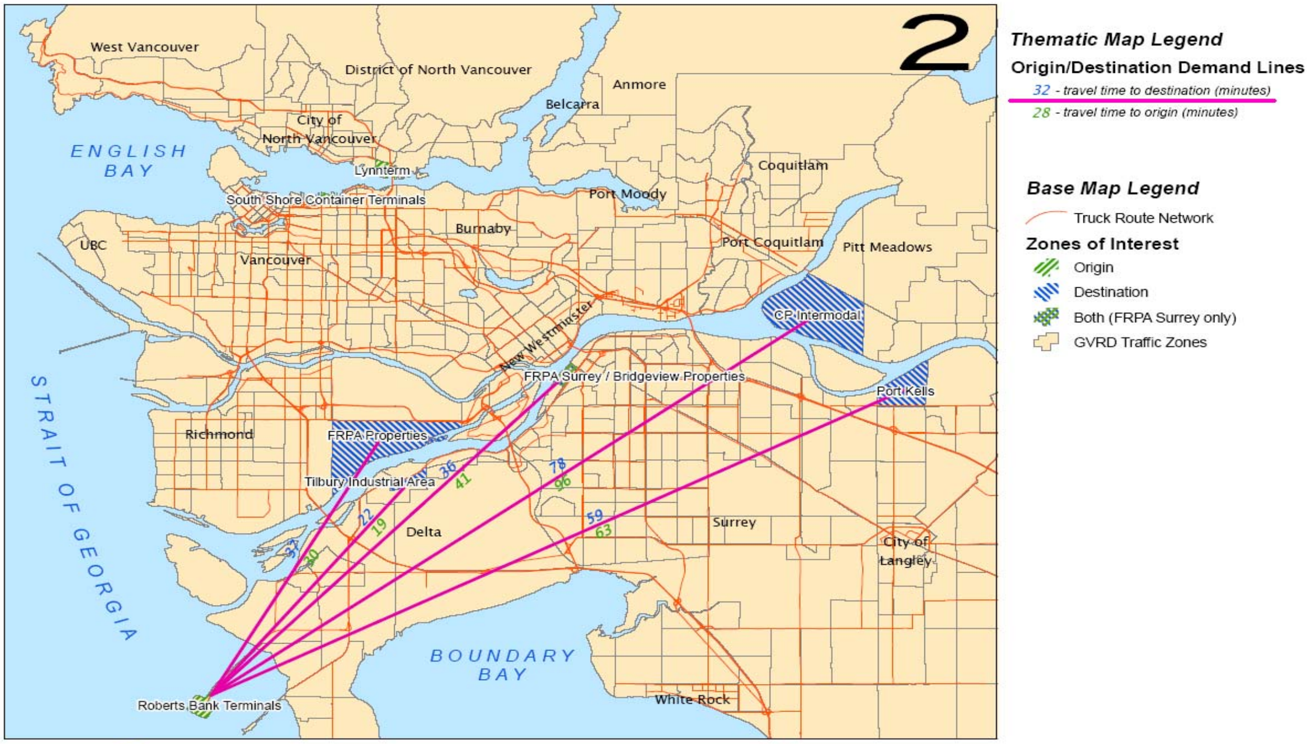
◄ FIGURE 7.12
ROAD TRAVEL TIME – 2003 (MINUTES)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS
Roberts Bank	37	22	36	78	59
Fraser Surrey Docks	27	23	0	44	33
Vancouver (S Inner Harbour)	32	45	37	39	42
Vancouver (N Inner Harbour)	45	56	37	39	42

Current travel times for container transfer by truck, as shown in Figure 7.12, provide base information against which travel times in the future can be evaluated. This is important information given the major road and highway transportation improvements planned for Greater Vancouver and recognizing that current dray rates, which were summarized earlier, are based on current travel time characteristics. If and when road transport times increase on the routes of concern because of congestion, trucking dray rates can be expected to increase accordingly and provide an enhanced competitive pricing advantage to short-sea operations.

The four travel time maps (below), which are tied to Figure 7.12, present travel time data from the Emme/2 model for 2003 (and have been validated by GVTA with real travel time data for 2003) between the region's container generating areas (deep-sea terminals) and the priority short-sea terminal areas along the Fraser River. The maps (numbered 1 to 4) provide this information to/from Roberts Bank, Fraser Surrey Docks, Vancouver Harbour's North Shore and Vancouver Harbour's South Shore respectively.

FIGURE 7.12 – MAP 1 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM ROBERTS BANK -2003



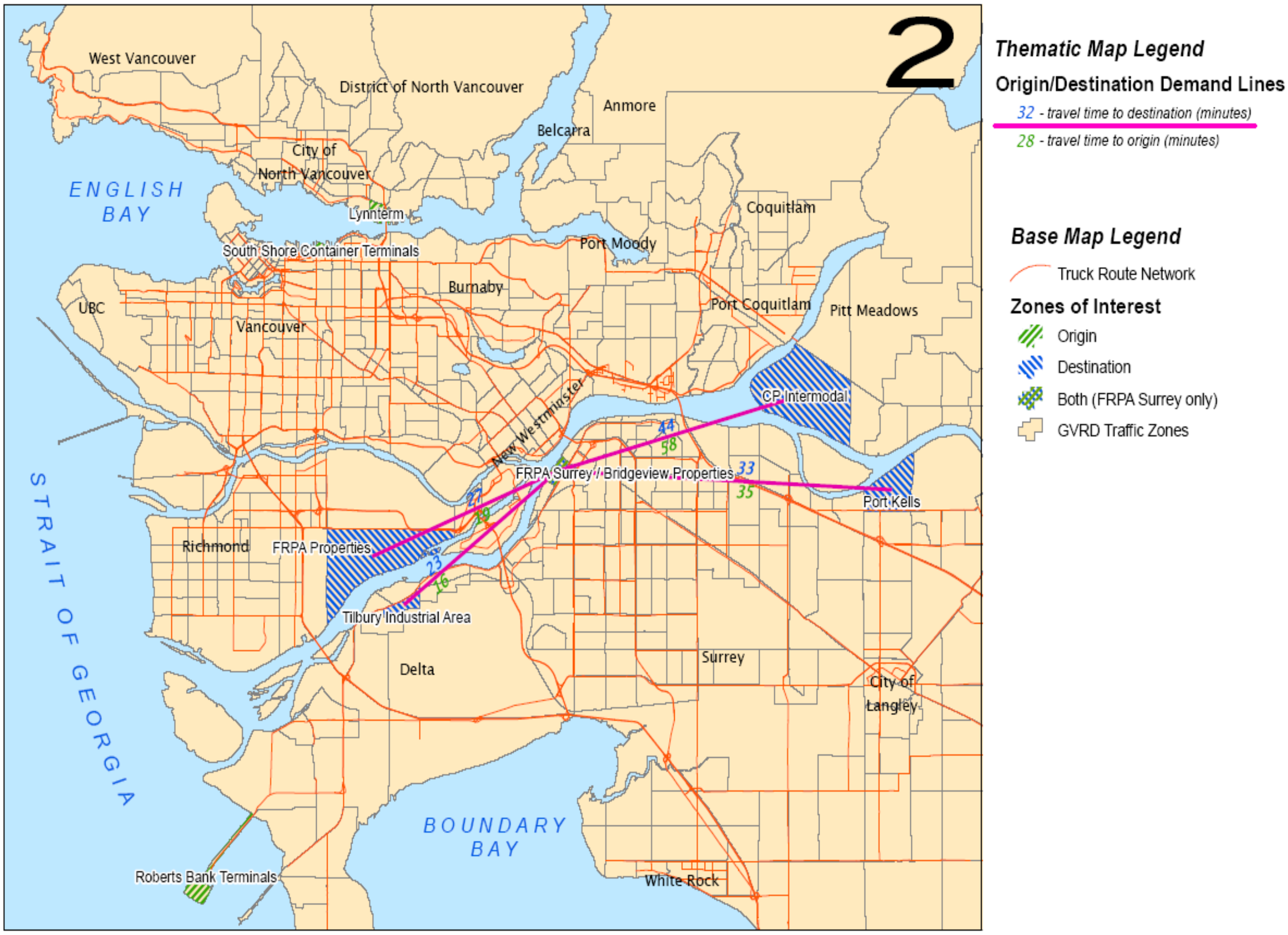
Travel Time Mapping

Travel Time from/to Deltaport - Current (2003 Data)

DRAFT

Scale 1:250,000
UTM Zone 10, NAD83 Datum
January 24, 2005
VPA Project G2005-003

FIGURE 7.12 – MAP 2 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM FRASER SURREY DOCKS -2003



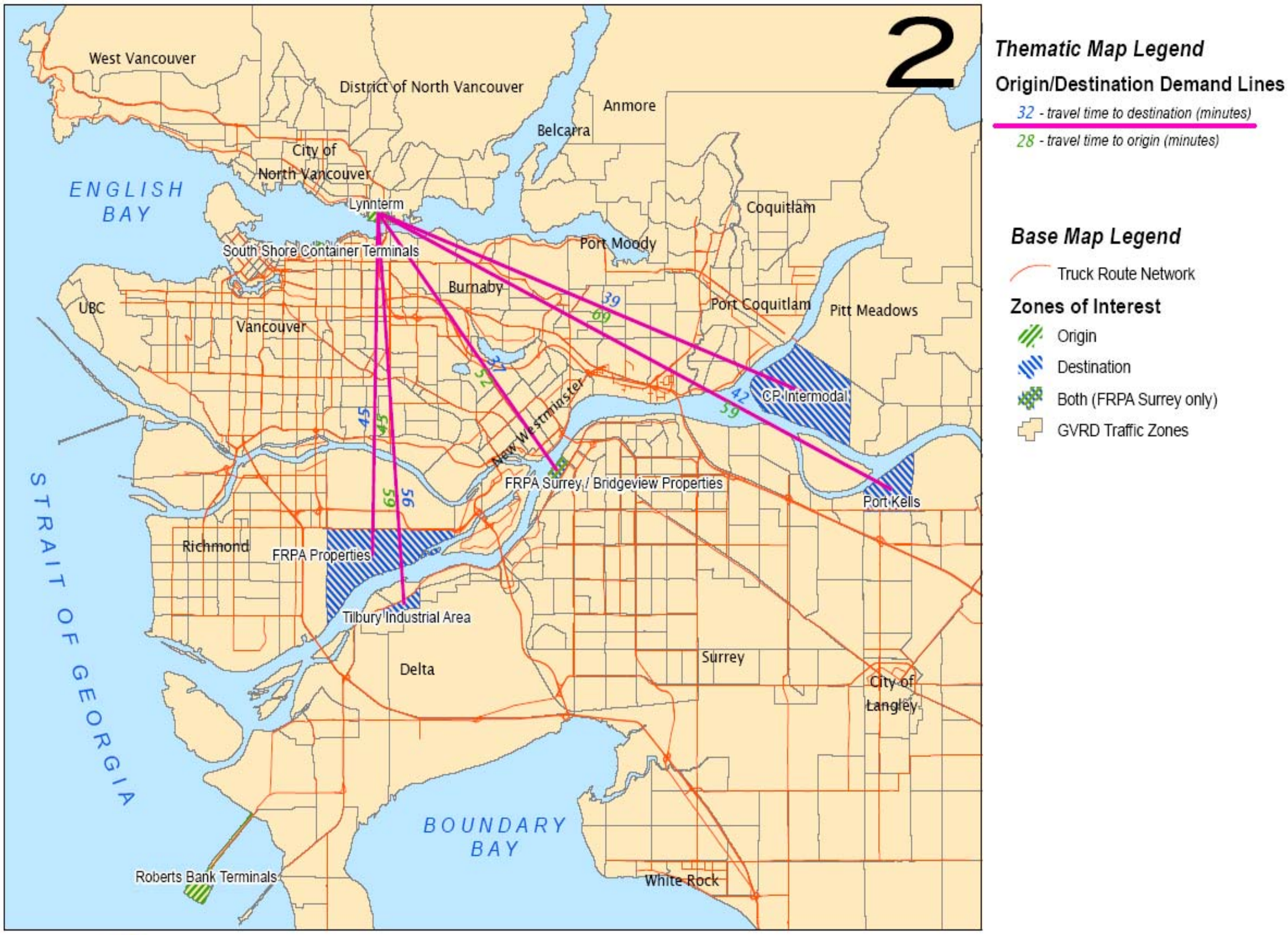
Travel Time Mapping

Travel Time from/to FRPA Surrey - Current (2003 Data)

DRAFT

Scale 1:250,000
UTM Zone 10, NAD83 Datum
January 24, 2005
VPA Project G2005-003

FIGURE 7.12 – MAP 3 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM VANCOUVER INNER HARBOUR - NORTH SHORE -2003



PORT VANCOUVER

Travel Time Mapping

Travel Time from/to Lynnterm - Current (2003 Data)

DRAFT

Scale 1:250,000
UTM Zone 10, NAD83 Datum
January 24, 2005
VPA Project G2005-003

FIGURE 7.12 – MAP 4 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM VANCOUVER INNER HARBOUR - SOUTH SHORE -2003

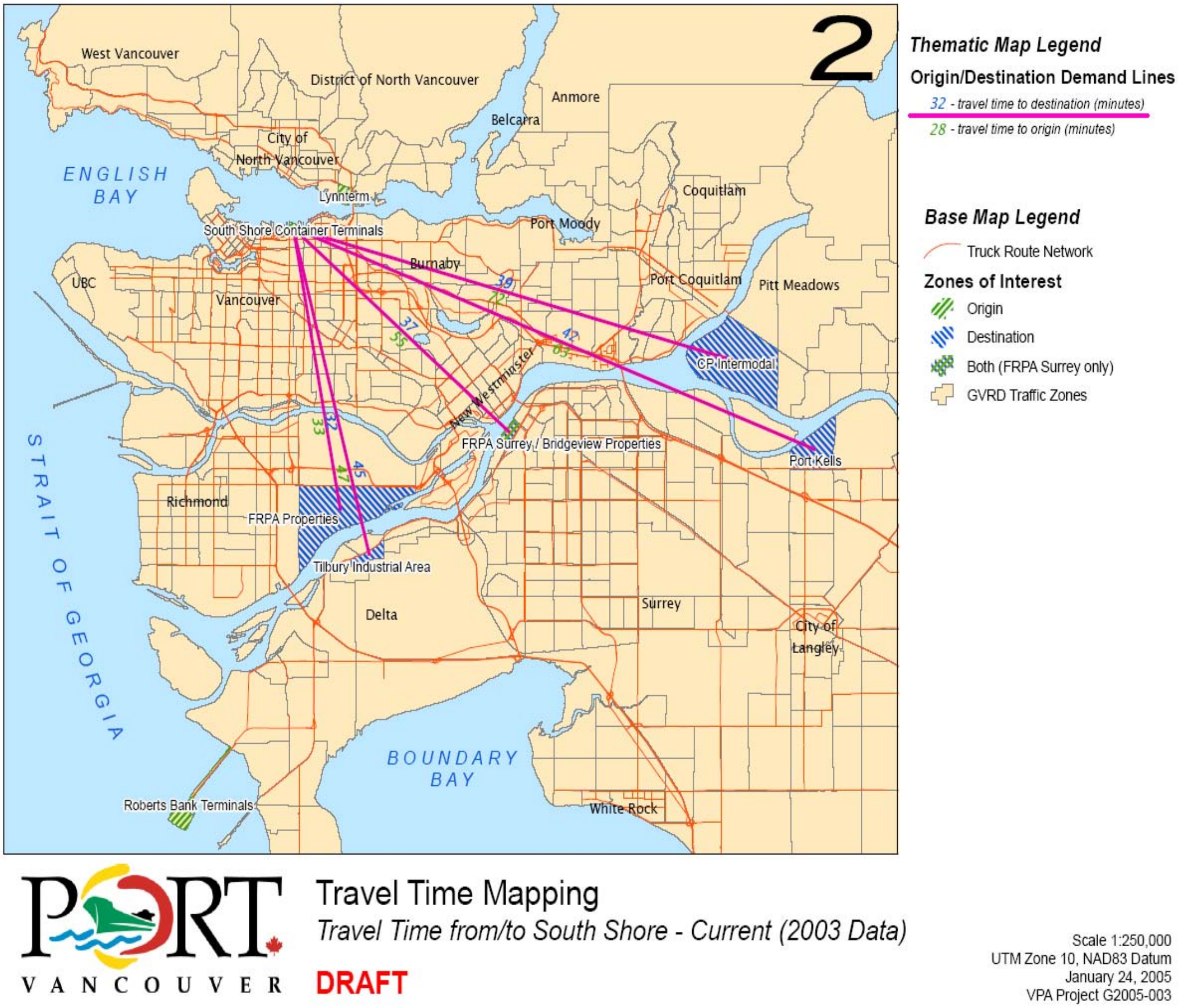


FIGURE 7.13

LINK TRAVEL TIME AND CHANGE – 2021
WITH COMMITTED TRANSPORTATION IMPROVEMENTS (ONLY) IN PLACE
(MINUTES / % CHANGE FROM 2003)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS
Roberts Bank	40 / +8.1 %	23 / +4.5 %	39 / + 8.3 %	83 / +6.4 %	67 / +13.6 %
Fraser Surrey Docks	35 / +29.6 %	25 / +8.7 %	0	46 / +4.5 %	37 / +12.1 %
Vancouver (S Inner Harbour)	38 / +18.8 %	50 / +11.1 %	42 / +13.5 %	41 / +5.1 %	46 / +9.5 %
Vancouver (N Inner Harbour)	54 / +20.0 %	64 / +14.3 %	42 / +13.5 %	41 / +5.1 %	47 / + 11.9 %

Travel time estimates in 2021 for container transfer by truck reflect that, despite the completion of already committed transportation infrastructure improvements in Greater Vancouver, travel times on the roadway network over the links defined are expected to increase, in some cases dramatically. This is due to the anticipated growth in overall transportation demand as a result of forecasted growth throughout the Region which has been accounted for in TransLink's Regional Emme/2 Demand Model.

The potential implications of increasing congestion on Greater Vancouver's road network, to the extent it occurs, are significant for the proposed short-sea container services. For container industry customers located in the Coast 2000 vicinity, dray times (and, therefore, dray rates) are expected to increase between 8% and 30% by 2020 between this location and the region's deep-sea container terminals. Importantly, this expected increase in travel time and costs is only attributable to roadway congestion and does not reflect increased fuel or other operational costs. The similar trucking rate increases for container industry customers located in the Fraser Surrey area are less dramatic, but still significant, ranging from 8.3% to 13.5%. Dray time increases over this period to/from the other prospective short-sea terminal locations described vary, but all approach or exceed 5% as shown in Figure 7.13.

While these increases may not appear to be very dramatic over 16 years, they do, nevertheless, indicate that the trucking industry will likely come under increasing pressure to increase its container dray rates consistently over time because of travel time increases alone. The proposed short-sea operations will not be faced with cost increases of this nature since the travel time by water will not vary over time. There is, therefore, a 'built-in' competitive cost advantage for short-sea services when compared with trucking over time, in addition to its considerable cost advantage as barge trip volumes increase.

The four travel time maps (below), which are tied to Figure 7.13, present travel time data from the Emme/2 model for 2021 … assuming that committed, major transportation infrastructure improvements are in place … between the region's container generating areas (terminals) and the priority short-sea node areas along the Fraser River. The maps (numbered 1 to 4) provide this information to/from Roberts Bank, Fraser Surrey Docks, Vancouver Harbour's North Shore and Vancouver Harbour's South Shore respectively.

As referenced above, travel time maps for 2021 with both committed and planned transportation infrastructure improvements in place are included in Appendix B. The information provided therein indicates that, with all of the road improvement projects now under consideration, dramatic travel time savings for commercial vehicles on the travel links described are not expected to be realized as regional road traffic expands. Even under this 'best case' scenario, the trucking industry is likely to come under ongoing pressure to increase dray rates for the intra-regional transfer of containers.

FIGURE 7.13 – MAP 1 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM ROBERTS BANK – 2021 WITH COMMITTED TRANSPORTATION IMPROVEMENTS IN PLACE

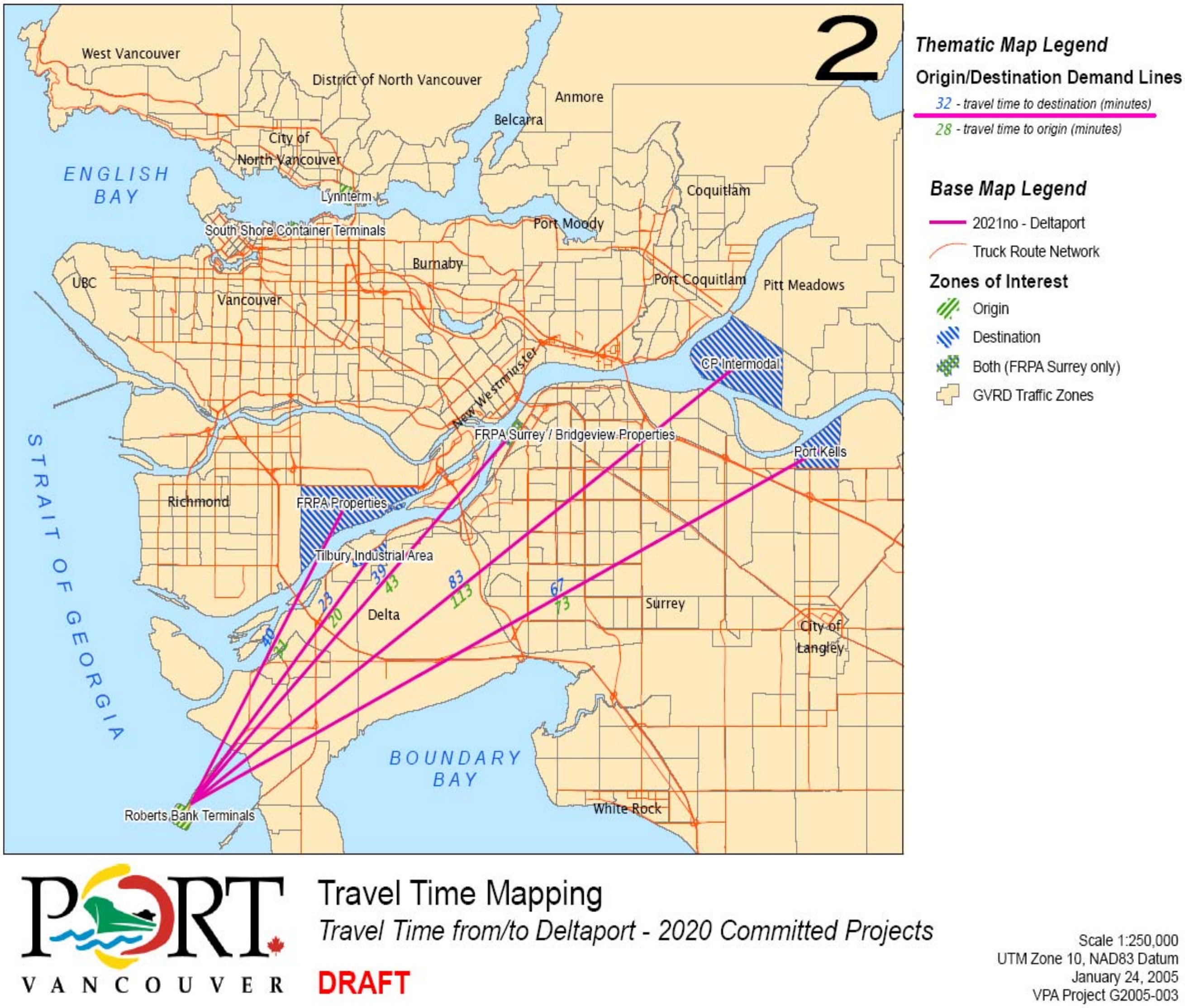
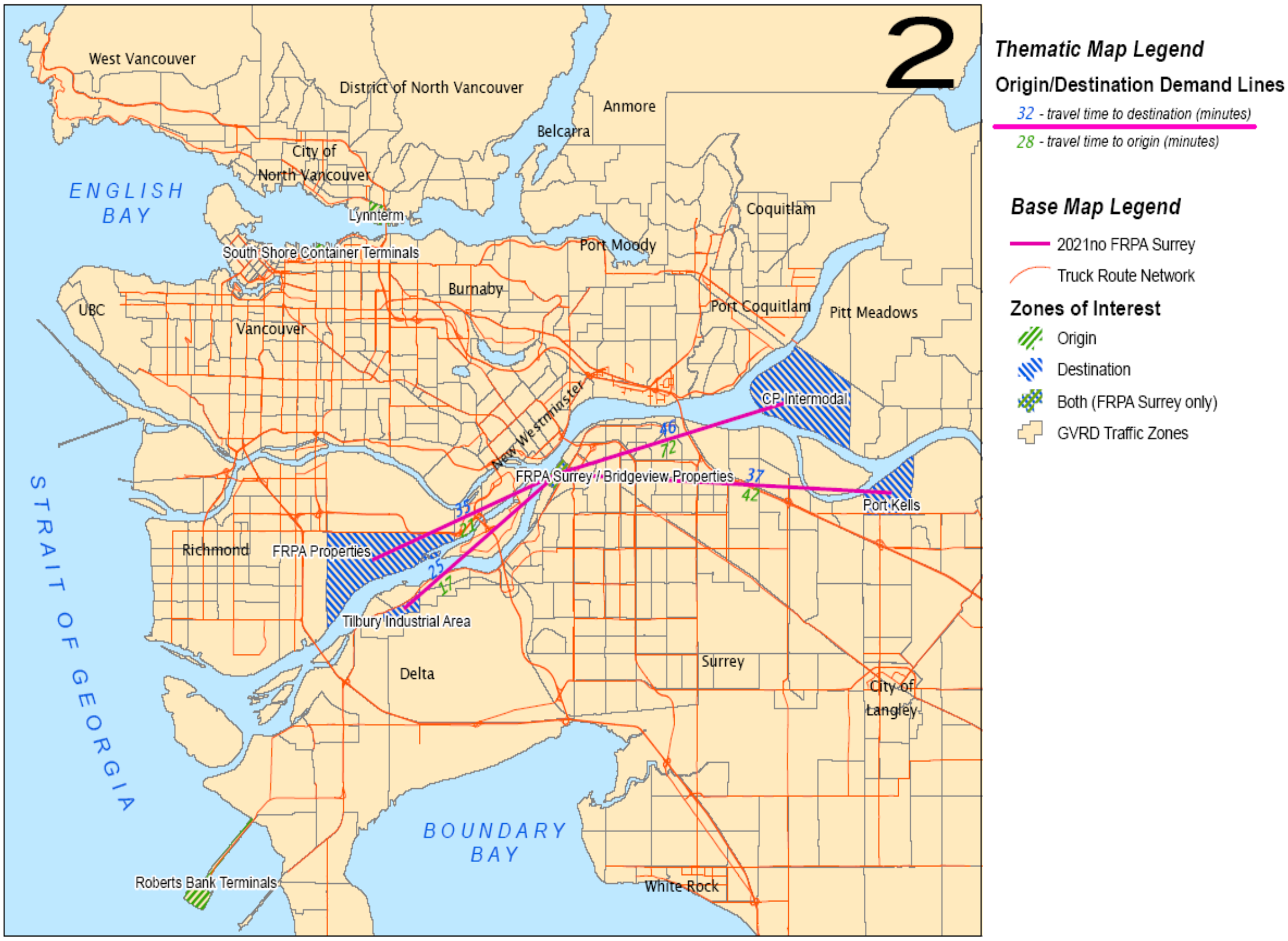


FIGURE 7.13 – MAP 2 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM FRASER SURREY DOCKS – 2021 WITH COMMITTED TRANSPORTATION IMPROVEMENTS IN PLACE



PORT VANCOUVER

Travel Time Mapping

Travel Time from/to FRPA Surrey - 2020 Committed Projects

DRAFT

Scale 1:250,000
UTM Zone 10, NAD83 Datum
January 24, 2005
VPA Project G2005-003

FIGURE 7.13 – MAP 3 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM VANCOUVER INNER HARBOUR - NORTH SHORE – 2021 - WITH COMMITTED TRANSPORTATION IMPROVEMENTS IN PLACE

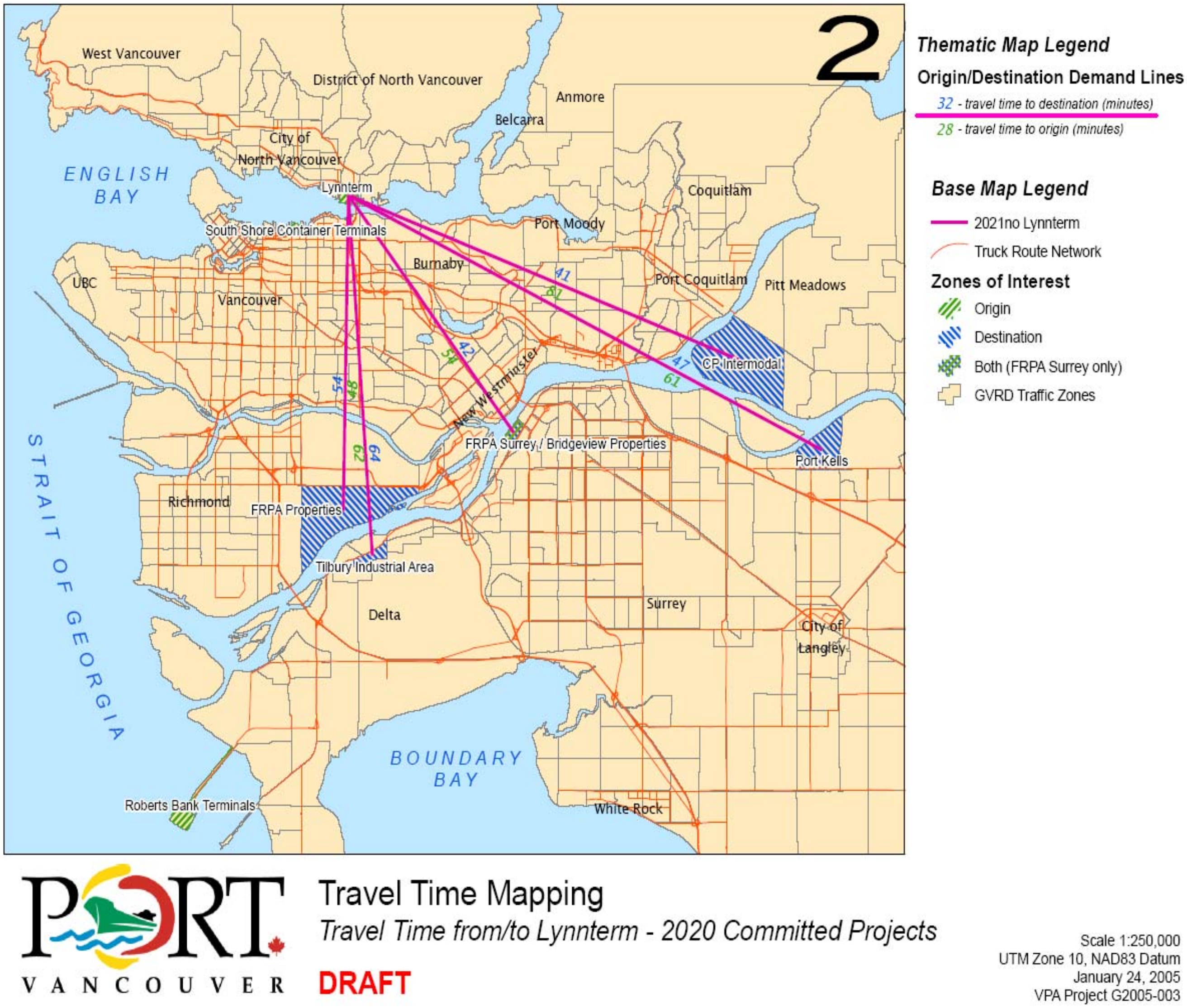
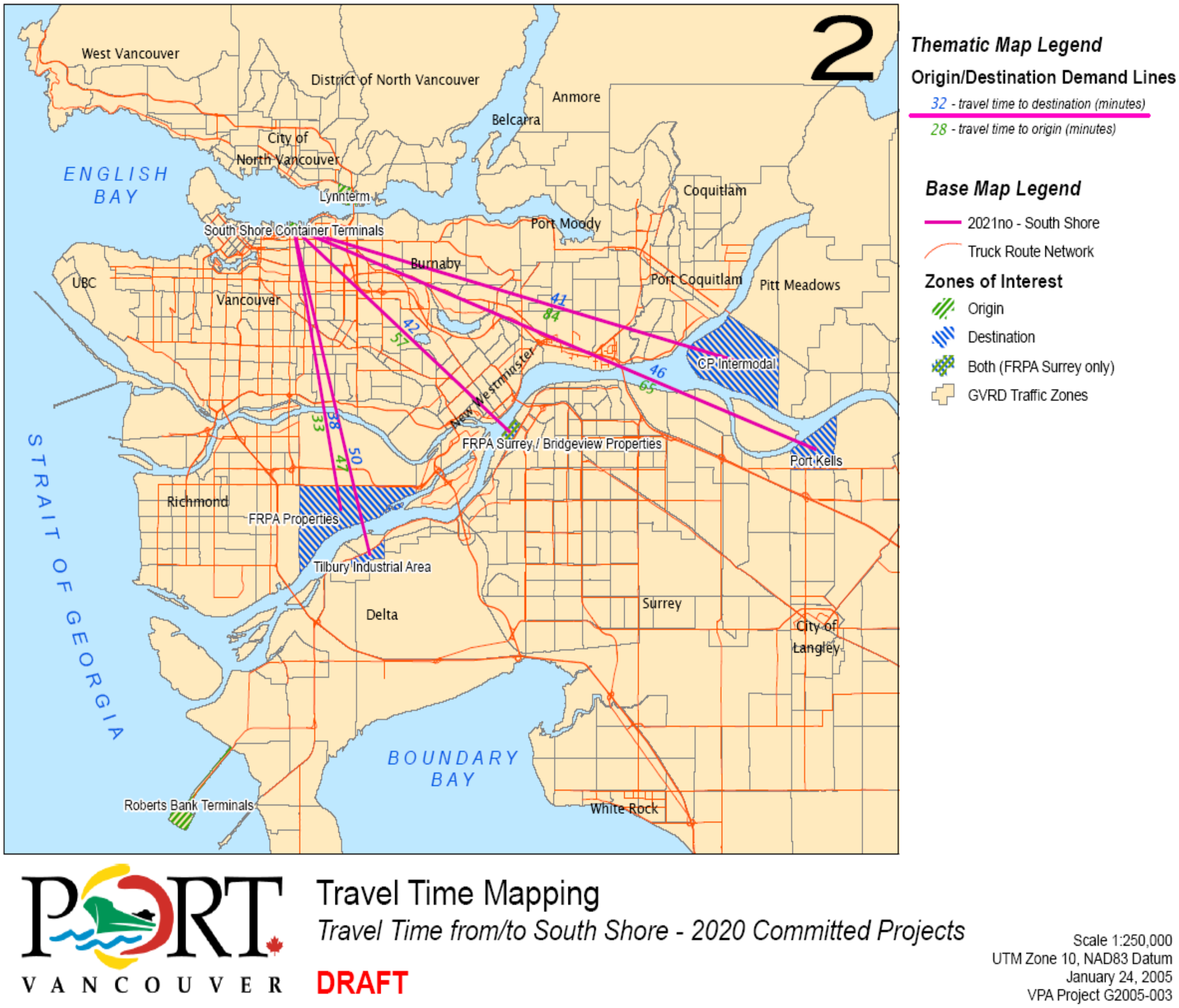


FIGURE 7.13 – MAP 4 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM VANCOUVER INNER HARBOUR - SOUTH SHORE – 2021 - WITH COMMITTED TRANSPORTATION IMPROVEMENTS IN PLACE



Average truck speed assumptions which are used in the Emme/2 model and, therefore, inherent in the travel time estimates described above, are summarized in Figure 7.14 through Figure 7.16 for each of the route options (origin/destination pairs) considered in this study. The assumptions shown in Figure 7.14 represent the status in 2003. Those in Figure 7.15 reflect average route speeds expected in 2021 once major, committed transportation infrastructure improvements are in place. The 2021 estimates provided in Figure 7.16 are based on the assumption that both currently committed and planned, major transportation infrastructure improvements to the road network have been completed.

◄ FIGURE 7.14
AVERAGE LINK SPEED ASSUMPTIONS – 2003
(KILOMETRES PER HOUR)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS
Roberts Bank	48	58	54	45	51
Fraser Surrey Docks	35	32	0	37	38
Vancouver (S Inner Harbour)	35	38	41	58	59
Vancouver (N Inner Harbour)	32	35	38	56	57

◄ FIGURE 7.15
AVERAGE LINK SPEED ASSUMPTIONS – 2021
WITH COMMITTED TRANSPORTATION IMPROVEMENTS (ONLY) IN PLACE
(KILOMETRES PER HOUR)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS
Roberts Bank	45	55	50	42	45
Fraser Surrey Docks	30	29	0	36	34
Vancouver (S Inner Harbour)	30	34	37	56	54
Vancouver (N Inner Harbour)	28	31	34	53	51

◄ FIGURE 7.16
AVERAGE LINK SPEED ASSUMPTIONS – 2021
WITH COMMITTED AND PLANNED TRANSPORTATION IMPROVEMENTS IN PLACE
(KILOMETRES PER HOUR)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS
Roberts Bank	48	58	59	64	65
Fraser Surrey Docks	31	49	0	46	54
Vancouver (S Inner Harbour)	30	41	41	52	63
Vancouver (N Inner Harbour)	31	39	38	49	59

7.3 SHORT-SEA SHIPPING IMPLICATIONS FOR GREATER VANCOUVER'S CONTAINER TERMINALS

The implementation of short-sea container services in Greater Vancouver is an opportunity whose time is near. Truck delivery delays are likely to increase in the future (from terminal gate and highway congestion) as more and more containers are transferred to and from trucks and transported to/from their regional destinations/origins.

This study did not examine in detail the flows of short-sea destined/originating containers on-dock at the deep-sea terminals. However, the combined experience of the Consulting Team and its familiarity with container terminals in Greater Vancouver suggests that some efficiencies may be achieved at the terminals to the extent that some of the intra-regional transfer of containers takes place by short-sea operations.

Some of the possible efficiencies, which need to be evaluated in more detail, may include the following:

- faster movement of containers to/from the on-dock short-sea marshalling area;
- more dense and more efficient storage of containers loaded to and unloaded from short-sea operations; and
- fewer containers moving by truck through the gate thus reducing truck calls, gate delays and reservation system demand.

To the extent that these or other operational advantages are achieved at the terminals, the inherent efficiencies will be advantageous. To the extent that the intra-regional supply chain can become slightly more efficient (or, more likely, lose less efficiency in the future than would otherwise be the case) because short-sea operations reduce (albeit nominally) future growth in container trucking on the road system, and potentially deliver imported containers more rapidly, the terminals themselves will become more competitive relative to their counterparts on the United States west coast where 'spreading' the intra-regional transfer demand to tug/barge services is not possible or not implemented.

7.4 SHORT-SEA SHIPPING VS. TRUCK TRANSPORT EMISSIONS ANALYSIS

The comparative assessment of environmental emissions between the intra-regional short-sea shipping of marine containers with the intra-regional trucking of marine containers was an important objective of this study. The extent that lower emissions can be achieved by one transportation mode over another will facilitate policy and support decisions in the public interest and contribute to objectives under the Kyoto Protocol.

In the following paragraphs, the results of the preliminary assessment of comparative emissions between intra-regional short-sea shipping and trucking of marine containers in the Greater Vancouver area are presented.

7.4.1 Vessel Emissions, Status and Issues

While cargo vessels are extremely efficient with regard to fuel use on a ton–kilometre basis, they are becoming noted for emissions other than carbon dioxide. Comparative emissions between vessels and trucks, based on a recent European study, are summarized in Figure 7.17 with the cargo vessel being the equivalent dead weight tonnage of a tow boat and barge. This does not correspond to emissions equivalence since short-sea operations are known, generally, to generate substantially lower emissions than cargo ships which are similar in size (as discussed below).

FIGURE 7.17
EMISSIONS[1] FROM TRUCKS AND CARGO VESSELS
(GRAMS PER TON-KILOMETRE)

	CO_2	PM	SO_2	NOx	VOCs
Heavy Truck With Trailer	50	0.005	0.0093	0.31	0.025
Cargo vessel <2000 dwt	30	0.02	0.51	0.72	0.016

CO_2 is the most commonly referenced green house gas, but the other emissions are not without effect. SO_2 is known to contribute to acid rain. In addition, a recent Indian Ocean Experiment in 1998-1999 suggests aerosol emissions from ships (and other sources) may be enhancing solar heating by burning away clouds through emissions of sulfate, nitrates and particulate matter. Such an effect would increase warming through loss of the heat-reflecting cloud cover. As well, there are other effects of these pollutants beyond those associated with green house gases.

The above table reflects emissions from bunker fueled ships. Bunker fuel is the least expensive and dirtiest form of liquid fuel available. As a result of improved oil refining techniques, higher levels of sulphur, ash, asphaltines and metals are left in the residual which is sold as bunker.

It is important to note that the emissions from Canadian registered tugs are expected to generate lower emissions than the comparative numbers shown in Figure 7.17. Emissions data was not readily available for the tug fleet in Canada. Indeed, as and when federal regulations for more strict emission controls on Canadian registered vessels are implemented (i.e. 500 ppm sulphur in 2007 and 150 ppm sulphur in 2012) the comparative emissions can be expected to improve on a ton-kilometre basis in

[1] Emissions are average in each case (CO_2 – carbon dioxide, PM – Particulate matter, SO_2 – sulphur dioxide, NOx – oxides of nitrogen, VOCs – volatile organic compounds). Truck assumptions include a maximum overall weight of 40 tons, loading at 70% and operating on diesel with a sulphur content of 300 ppm. Cargo vessel assumptions include fueling with bunker oil with an average sulphur content of 2.6 % and no cleaning of NOx. Source: Environmental Factsheet from the Swedish NGO Secretariat on Acid Rain, May 2003 – www.ntm.a.se

favour of short-sea operations. While tugs currently use low sulphur fuels, the implementation of regulation limits in 2007 and 2012 will require that sulphur levels are lowered even further.

Lower sulphur content lowers SO_2 emissions and, because there is a direct relationship between sulfur and particulate emissions, it also lowers the latter. There are a number of methods for reducing emissions of NOx as follows:

- Water Injection and Water Emulsion … lowering the temperature of combustion and thus limiting NOx formation and, while there is a higher fuel consumption cost, this is the lowest capital cost improvement for such benefits (providing, at best, a 50% reduction); and

- Humid Air Motors … which inject humid air into the combustion chamber thereby lowering the fuel and lubricating oil consumption and reducing NOx emissions by 70% to 80%.

Other emission reduction methods exist, but are more applicable to the larger engines of deep-sea vessels.

Emissions from internationally flagged vessels are regulated by the International Maritime Organization (IMO) whose recent MARPOL Annex VI only slightly lowered NOx levels, and only for new engines. However, this study is concerned with coastal vessels, registered in Canada.

It can be foreseen that Canada may, in the future, impose additional emission limits for vessels registered in this country. Sulphur regulations are already in place while NO_x regulations are not. Although further regulation would have to occur at the federal level, it is certainly possible that additional regulations will be forthcoming. New regulations will inevitably generate conversion costs, but the appropriate retrofit is relatively easily accomplished with today's technology.

The primary approach for reducing vessel emissions is likely to be a lowering sulphur content (as is now in place for the BC Ferries fleet). Changes in the sulphur content of diesel fuel is coming. Currently, there are also numerous additives to improve lubrication, which lowers fuel consumption (and thus CO_2 emissions) and the need for higher sulphur for lubricity in older marine engines. This lowers both sulphur dioxide and particulate matter, leaving the retrofit to NOx controls. If all commercial diesel vessels that are Canadian registered were required to comply, the situation would be the same (by 2012) as with over-the-road heavy vehicles with regard to emissions and the question then turns to the scale of movement and fuel consumption (with fuel consumption being equated with CO_2 emissions.)[2]

The comparative evaluation of emissions, described herein, is based on the expectation that tugs in Canada will bring their particulate matter (PM), SO_2 and NO_x emissions to a level which approximate

[2] This preliminary assessment is beyond the scope of a high level study. If required, further detail can be found in The New York, New Jersey Long Island Non-Attainment Area Marine Commercial Vessel Emissions Inventory, 2003 - Port Authority of New York & New Jersey and the publications of James Corbett, P.E., Ph.D., University of Delaware.

truck transport emissions on a ton-kilometre basis. It is anticipated that this will be achieved using one or a series of the above methods through government regulation. These actions are further expected to enhance the comparative emission performance of short-sea shipping intra-regionally over trucking in terms of both CO_2 and VOC emissions. To the extent that Canadian registered vessels are regulated to produce lower emissions in the coming years, the environmental benefits of using intra-regional short-sea shipping of containers on specific routes, instead of trucking, will be magnified.

The above expectations and assumptions effectively normalize the particulate matter, SO_2 and NO_x emissions of short-sea shipping and trucking and enable the effective comparison of emissions by these two modes to be carried out, with the comparative fuel consumption ratios directly reflecting (or under estimating) the comparative advantage of short-sea operations over trucking in terms of CO_2 and VOC emissions.

7.4.2 Comparative Emissions for the Short-Sea Origin/Destination Pairs Evaluated

An evaluation was carried out of comparative emissions for the short-listed container terminal / short-sea container node pairs (or routings) described earlier. This assessment was predicated on the assumption that equivalent emissions are normalized to fuel consumption (as described above) and, therefore, the following comparison is based on average fuel use and travel distances.

Table 7.18 shows estimated fuel consumption using truck transport between the short-listed container origin/destination pairs in Greater Vancouver.

FIGURE 7.18
TRUCKING DISTANCE AND FUEL CONSUMPTION BETWEEN CONTAINER NODES[3] (KILOMETRES & LITRES)

TERMINALS ▼ NODES ▶	Coast 2000	Delta Tilbury	Fraser Surrey	Pitt Meadows	Port Kells
Roberts Bank	29 (13.72)	21 (9.94)	32 (15.14)	58 (27.44)	50 (23.66)
Fraser Surrey	16 (7.57)	12 (5.68)	N/A	27 (12.77)	21 (9.94)
Inner Harbour - North Shore	19 (8.99)	29 (13.72)	25 (11.83)	38 (17.98)	42 (19.87)
Inner Harbour - South Shore	24 (11.36)	33 (15.61)	23 (10.88)	36 (17.03)	40 (18.92)

Note: The first number in each cell of the table is the one-way trip distance in kilometres. The second number (in parentheses) is fuel consumption, in litres, per trip (with a two-TEU configuration per trip) over that distance. N/A indicates not applicable.

Table 7.19 presents the fuel consumption by a tow boat between the short-listed container terminal / short-sea container node pairs (or routings) described earlier based on time. The calculations assume a fuel consumption of 35 U.S. gallons per hour, which converts to 136 litres per hour.

[3] Heavy over-the-road diesel usage is cited by the USEPA as about 5 mpg. This calculates to 2.11 kilometres per litre which equates to 0.47 litres per kilometer for a tandem tow of two TEUs (the most fuel efficient configuration).

FIGURE 7.19
TOW BOAT TRANSIT TIME AND FUEL CONSUMPTION BETWEEN CONTAINER NODES
(HOURS & LITRES)

TERMINALS ▼ NODES ▶	Coast 2000	Delta Tilbury	Fraser Surrey	Pitt Meadows	Port Kells
Roberts Bank	3 (408)	3 (408)	4 (544)	6 (816)	6 (816)
Fraser Surrey	1 (136)	1 (136)	N/A	2 (272)	2 (272)
Inner Harbour (North & South)	5 (680)	5 (680)	6 (816)	8 (1088)	8 (1088)

Note: Over the distances traveled, short-sea travel times to/from either the south shore or the north shore of the Inner Harbour are equivalent. The first number in each cell of the table is the average one-way travel time in hours. The second number (in parentheses) is tug fuel consumption, in litres. N/A indicates not applicable.

Table 7.20 presents the comparison of fuel consumption for truck and short-sea transport between the short-listed container terminal / short-sea container node pairs (or routings). The calculation is based on a two-TEU haul by truck (the most efficient configuration) and a one hundred-TEU haul by tow boat. Shaded cells designate routings where short-sea fuel consumption, and therefore CO_2 and VOC emissions, are lower than those for truck transport on a per TEU basis under the conservative assumptions outlined above.

FIGURE 7.20
TRUCK & TOW BOAT FUEL CONSUMPTION COMPARISON BETWEEN CONTAINER NODES
(LITRES PER TEU)

TERMINALS ▼ NODES ▶	Coast 2000	Delta Tilbury	Fraser Surrey	Pitt Meadows	Port Kells
Roberts Bank	13.7 (8.16)	9.9 (8.16)	15.1 (10.9)	27.4 (16.3)	23.7 (16.3)
Fraser Surrey	7.6 (2.72)	5.7 (2.72)	N/A	12.8 (5.4)	9.9 (5.4)
Inner Harbour - South Shore	9.0 (13.6)	13.7 (13.6)	11.8 (16.3)	18.0 (21.8)	19.9 (21.8)
Inner Harbour - North Shore	11.4 (13.6)	15.6 (13.6)	10.9 (16.3)	17.0 (21.8)	18.9 (21.8)

Note: The first number in each cell of the table is the average one-way fuel consumption by truck per TEU in litres using a two-TEU per trailer configuration. The second number (in parentheses) is the average one-way tug fuel consumption per TEU in litres assuming a barge load of 100 TEU per one-way trip. Neither dwell time nor idle time are included in the calculations, and nor are secondary sources such as heating or electrical generation. N/A indicates not applicable.

It is apparent that transfer between nodes in the outer harbour (i.e. along the Fraser River to/from Roberts Bank at the mouth) by tow boat is consistently the most fuel efficient and, accordingly, these routings will have lower CO_2 and VOC emissions for each container transported.

7.4.3 Sensitivity of Comparative Short-Sea and Truck Emissions to Barge Volume

Under the assumptions made, truck transfer is generally more emission efficient from the Inner Harbour to most container nodes on the Fraser River based on a 100 TEU barge trip. This is due, primarily, to the comparatively low transport time for trucking combined with the conservative barge volume assumptions used. If the barge load was increased to 120 TEU, then both Coast 2000 and

Delta Tilbury become more emission efficient using short-sea transport. At this barge volume, the other routings are essentially the same with respect to emissions.

It is clear that the comparative emissions (notably CO_2 and VOCs) between intra-regional short-sea transport and intra-regional truck transport of containers favour the former more dramatically as one-way barge volumes increase. Operational volumes in the future will directly impact the extent to which environmental benefits are realized … with higher volumes resulting in greater benefits.

A comparative assessment of emissions was carried out at several one-way short-sea volume levels for purposes of this study. This comparison is summarized in Table 7.21. Percentages in the table indicate the proportion of CO_2 and VOC emissions generated per TEU by truck compared with short-sea operation. Shaded areas highlight the routings where short-sea shipping is advantageous from an emissions point-of-view compared with trucking under the barge volume levels indicated.

FIGURE 7.21
TRUCK VS SHORT-SEA CO2 AND VOC EMISSIONS BY ROUTE AND BARGE VOLUME

TERMINALS ▼ NODES ▶	Coast 2000	Delta Tilbury	Fraser Surrey	Pitt Meadows	Port Kells
	BARGE CONTAINER VOLUME PER ONE-WAY TRIP = 100 TEU				
Roberts Bank	168 %	121 %	139 %	168 %	145 %
Fraser Surrey	279 %	210 %	N/A	237 %	183 %
Inner Harbour - S Shore	66 %	101 %	72 %	83 %	91 %
Inner Harbour - N Shore	84 %	115 %	67 %	78 %	87 %
	BARGE CONTAINER VOLUME PER ONE-WAY TRIP = 150 TEU				
Roberts Bank	252 %	182 %	208 %	252 %	218 %
Fraser Surrey	419 %	314 %	N/A	356 %	275 %
Inner Harbour - South Shore	99 %	151 %	109 %	124 %	137 %
Inner Harbour - North Shore	126 %	172 %	100 %	117 %	130 %
	BARGE CONTAINER VOLUME PER ONE-WAY TRIP = 200 TEU				
Roberts Bank	336 %	243 %	277 %	336 %	291 %
Fraser Surrey	559 %	419 %	N/A	474 %	367 %
Inner Harbour - South Shore	132 %	201 %	145 %	165 %	183 %
Inner Harbour - North Shore	168 %	229 %	134 %	156 %	173 %

Note: The cell numbers indicate the estimated proportionate levels of CO_2 and VOC emissions per laden TEU for truck transport compared with short-sea transport of containers for the origin/destination pairs and the barge load volumes described. In fact, with improved engine efficiencies, comparative VOC emissions levels are expected to be lower than those shown for short-sea shipping (i.e. a higher ratio of VOC emissions for trucking vs. short-sea shipping than those indicated).

In summary, the short-sea shipping alternative is expected to generate lower CO_2 and VOC emissions for many, but not all, of the routes identified with barge loads in the 100 TEU range. The advantage of short-sea shipping with respect to these emissions is expected to increase dramatically, and apply to all routes, as the barge load volumes increase over time to 150 and 200 TEU per load and upwards from there.

8. SHORT-SEA MARKET OPPORTUNITIES & SHARE EXPECTATIONS

The market for intra-regional short-sea shipping in Greater Vancouver is, in general, defined by the container throughput forecasts of the region's deep-sea terminals. Extensive analysis has been undertaken concerning future container throughput potential by both the Vancouver Port Authority and the Fraser River Port Authority. The results of the most recent analyses of this type by both the VPA and the FRPA are used as a basis, in combination with the research carried out during the study, to identify prospective market opportunities for the proposed short-sea service.

More detailed research and discussions with potential specific customers of the proposed short-sea service will be required as and when the business is pursued more actively. Indeed, as is outlined below, it will be important for the proponents and operators of short-sea services to negotiate with those companies which make decisions on the logistics of intra-regional container transfer and to commit individual customers to the service in order to establish the base volumes required to ensure commercial viability. The research undertaken during this study indicates that there are such potential short-sea customers in Greater Vancouver who could make commitments of this nature given the pricing and competitive characteristics of the services planned.

This chapter of the report summarizes market related information which is known and which is relevant to the work. Further, more detailed and customer specific research will build on the market opportunities defined herein. These opportunities are based on reliable data and forecasts and, thereby, provide confidence in the market and demand conclusions described.

This assessment of market opportunities for short-sea container services in Greater Vancouver is reported on below in the following order:

- Overall Market - Greater Vancouver deep-sea terminal container throughput demand and forecasts;
- Target Market – Greater Vancouver intra-regional transfer of inbound and outbound marine containers;
- Target market origin/destination distribution data;
- Short-Sea shipping competitive assessment summary; and
- Short-sea target market share requirements and conclusions.

8.1 GREATER VANCOUVER CONTAINER THROUGHPUT FORECASTS

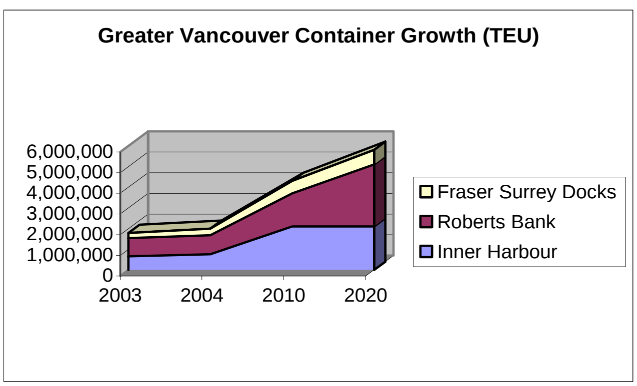
The potential for import/export container growth in Greater Vancouver is well recognized and well researched. Indeed, this demand growth represents only a portion of the major container throughput growth already being experienced on the west coast of North America as imports from Asia continue to expand to markets in Canada and the United States and as North American exports to Asia also increase. Container ports on the west coasts of both Canada and the United States are planning and implementing deep-sea container terminal expansions to keep pace with, and take advantage of, long-term growth in the trans-Pacific container trade.

As Lower Mainland container throughput growth occurs, the opportunity for short-sea transfer of containers intra-regionally will also grow proportionately. Overall throughput growth in Greater Vancouver is expected to be dramatic and is evidenced by the throughput forecasts summarized in Figure 8.1 (below).

FIGURE 8.1
GREATER VANCOUVER CONTAINER THROUGHPUT FORECASTS BY TERMINAL (TEU)

		ACTUAL 2003	ACTUAL 2004	FORECAST 2010	FORECAST 2020
VANCOUVER INNER HARBOUR	ALL TERMINALS	650,000	750,000	2,100,000	2,100,000
FRASER-SURREY DOCKS	EXISTING	250,000	325,000	600,000	700,000
ROBERTS BANK	EXISTING + NEW	890,000	920,000	1,600,000	3,000,000
TOTAL – GREATER VANCOUVER	ALL TERMINALS	1,790,000	1,995,000	4,300,000	5,800,000
COMPOUNDED ANNUAL GROWTH -	FROM 2004	N/A	N/A	13.7%	6.9%

The growth rate of Greater Vancouver's container throughput between 2003 and 2004 exceeded 11%. Over the next six years this rate of throughput expansion is expected to approach the considerable rate of nearly 14% per annum, with a 7% annual compounded growth projected over the next sixteen years as container terminal facilities are expanded and developed to accommodate demand.



These overall container throughput forecasts for Greater Vancouver begin to define the total market for proposed short-sea container services. Because of this growth in container throughput, the container industry in and around the Lower Mainland is expected to realize equally impressive growth, including and especially the demand for intra-regional transfer of containers by road and by short-sea services as is described in the following section.

8.2 THE TARGET MARKET FOR SHORT-SEA SERVICES

It is clear that Greater Vancouver will serve as the port-of-entry and port-of-departure for a dramatically greater number of containers over the next decades, as evidenced by the throughput forecasts for the area's container generating terminals above. This expansion will result directly in a similarly dramatic increase in a wide variety of container industry operations in and around the region.

Much of the current and new traffic is, and will be, transferred directly to rail at Centerm, Vanterm, Fraser Surrey Docks and Roberts Bank for delivery throughout North America. It is expected, however, that the intra-regional delivery of full and empty containers will grow dramatically with increased regional throughput, and as more import cargo manipulation occurs and more empty containers are returned to the region, many of which will be 'stuffed' with export cargo while many others will eventually make their way back to Asia through the Lower Mainland empty.


TRUCK DELIVERY/PICK-UP OF CONTAINERS

The intra-regional trucking of containers amongst the many and various industry facilities is currently the only means to meet the needs of the shipping lines, importers, exporters and logistics companies. Greater Vancouver's road network, while expanding, is already congested and delays are expected to increase in the future resulting in longer dray times and more costly operations. Dray rates are, therefore, expected to increase in response.

This challenge must be addressed by the region's container industry and its stakeholders. The challenge is one which faces most deep-sea ports on North America's west coast. Greater Vancouver, however, does have an opportunity, through short-sea shipping of a portion of this traffic, to keep transportation costs 'reasonable' and enhance the competitiveness of all area container terminals.

Both the VPA and the FRPA have analyzed past, present and future container movements through the region's deep-sea terminals. Their findings are generally consistent with the conclusions of this study regarding the ongoing requirement for the intra-regional transfer of containers as follows:

- **most inbound and outbound containers in Greater Vancouver will continue to be transferred 'direct-to-rail' or delivered 'direct-from-rail' in the future; and**

- **the proportion of inbound and outbound containers transferred to and from regional facilities (currently carried out by truck) is expected to continue at, or expand slightly from, current levels in the future.**

Statistics compiled by the VPA and the FRPA indicate that in the range of 35% to 40% of inbound and outbound containers at the Lower Mainland's container terminals are transferred to/from truck for intra-regional delivery. Vancouver Port Authority forecasts indicate that the current proportion, or a slightly greater proportion, of inbound and outbound containers will depart from or arrive at the area's terminals by truck in future years.

The target market for short-sea shipping services in Greater Vancouver will be those containers that would otherwise be transferred intra-regionally by truck … and, thereby, target customers for the services will be those businesses which dictate and control the logistics of those containers.

For purposes of this study, it has been assumed conservatively that 36% of inbound and outbound containers in Greater Vancouver currently require intra-regional delivery and that this ratio will increase nominally to 37% by 2010 and 38% by 2020. Based on these expectations, an average conversion rate from containers to TEU of 1.6 and the terminal throughput forecasts above, the demand for intra-regionally transferred containers in the Lower Mainland is summarized in Figure 8.2. This demand effectively represents the "target market' for proposed short-sea container services in the region.

FIGURE 8.2
GREATER VANCOUVER INTRA-REGIONAL CONTAINER TRANSFER DEMAND
(SHORT-SEA SERVICE TARGET MARKET- CONTAINERS)

	ACTUAL 2004	FORECAST 2010	FORECAST 2020
GREATER VANCOUVER THROUGHPUT (TEU)	1,995,000	4,300,000	5,800,000
GREATER VANCOUVER THROUGHPUT (CONTAINERS)	1,247,000	2,688,000	3,625,000
PROPORTION OF CONTAINERS TRANSFERRED INTRA-REGIONALLY	36%	37%	38%
CONTAINERS TRANSFERRED INTRA-REGIONALLY (TARGET MARKET)	449,000	994,000	1,378,000
COMPOUNDED ANNUAL GROWTH FROM 2004	N/A	14.2%	7.3%

The actual and forecast intra-regional container transfer demand shown in Figure 8.2 describes the very dramatic increase expected over the coming years and decades. This growth in the short-sea service "target market' directly parallels the throughput expansion expected at Greater Vancouver's container terminals. The market demand, which is presently serviced only by the region's trucking companies, represents very substantial opportunities for both trucking and short-sea transfer of containers in the Lower Mainland. Indeed, over the next six years, the demand for intra-regional container transfer is expected to more than double (i.e. 221% growth) and it would be challenging for the trucking industry alone to service this demand growth, especially given increasing congestion on the region's roadways and any continuing or future terminal gate congestion issues or truck reservation and operating hour restrictions.

8.3 TARGET MARKET ORIGIN-DESTINATION DISTRIBUTION DATA

As was mentioned earlier, it will be important for the optimal short-sea container nodes to be situated within reasonably close proximity of the inland absorbers and generators of intra-regional container traffic. This will preclude long dray times and costs to the initial or eventual origin/destination of the containers and make short-sea services more directly competitive with the road transport alternative. With this in mind, it is useful to understand relevant origin/destination information for the intra-regional container transfer target market now and in the future.

The best such information is available from the "2001 Origin-Destination Survey of Container Terminals" commissioned by VPA and undertaken by UMA Engineering. The research described, through sampling in 2001, the characteristics of truck movements of containers to and from those container terminals operating under lease agreements with the Vancouver Port Authority. The logistics of intra-regional containers will change over time as container industry facilities and businesses are relocated and developed in new locations. Some of the data in the study is relevant, however, to an understanding of those areas within the Lower Mainland where container transport by truck is particularly heavy. This data is presented in Figure 8.3 for the top ten truck transfer zones handling containers to/from Centerm, Vanterm and Deltaport.

◄

FIGURE 8.3
GREATER VANCOUVER
10 BUSIEST TRUCK TRANSFER ZONES FOR VPA TERMINAL CONTAINER TRAFFIC
(2001)

RANK	LOCATION	% OF ALL TRIPS
1	River Road, Delta	10.8%
2	Patullo Bridge Area, Surrey	8.2%
3	Vanterm, Vancouver	6.9%
4	Annacis Island, Delta	6.9%
5	Walnut Grove, Langley	5.2%
6	Bridgeport, Richmond	4.3%
7	BC Rail, North Vancouver	3.6%
8	Marine Drive, Vancouver	3.6%
9	CN Intermodal, Surrey	3.4%
10	First Avenue, Vancouver	3.4%
TOTAL		56.3%

The intra-regional container trucking distribution shown in Figure 8.3 provides evidence that the concentration of container industry businesses and facilities in the Fraser-Surrey, Annacis Island and Tilbury areas results in comparatively high levels of marine container transfer activity. Since the analysis pre-dated the establishment of Coast 2000 in Richmond, these numbers will have altered somewhat. Nevertheless, they provide useful support to understanding the short-sea service target market and, particularly, those container short-sea node locations which may offer specific advantages over, and direct competition to, truck transport services.

8.4 SHORT-SEA SHIPPING COMPETITIVE ASSESSMENT SUMMARY

Future short-sea container shipping in Greater Vancouver will compete only with truck transport of marine containers over the foreseeable future … until any other options become available such as short-haul rail which would then only be available to/from one or selected locations. Currently, only the trucking option is available to the area's container industry for moving containers intra-regionally to and from the deep-sea terminals.

To the extent that competitive forces do prevail, trucking and short-sea shipping will attract customers based on the traditional comparative service factors including the following:

- transport pricing (final origin/destination);
- service frequency;
- service reliability;
- delivery time (final origin/destination);
- delivery time consistency and reliability; and
- security.

The work carried out in this study has provided important insight into the relative competitiveness of these two modes for intra-regional container transfer which is summarized as follows:

- **short-sea shipping becomes price competitive with trucking on specific routes when barge volumes are in the 200 containers per round-trip range;**

- **short-sea shipping becomes more competitive with trucking, and in some cases may offer pricing advantages, as volumes per round-trip exceed 200;**

- **the short-sea versus trucking comparative pricing analysis herein is based on 2004 dollar and cost levels and per container costs in the future are expected to rise more rapidly for trucking (e.g. fuel cost and dray time per container moved) than for short-sea shipping providing potential pricing advantages for tug/barge operations over time;**

- **service frequency with short-sea shipping will be scheduled and regular (perhaps two or three times weekly) and will not be able to provide the 'on call' advantages of trucking;**

- **service reliability between the two competing modes will not have much differentiation except that short-sea operations will not be subject to unpredictable weather or road congestion delays;**

- **despite its less frequent service, short-sea services may offer distinct and important transit time advantages once service frequency exceeds two round-trips weekly and under the assumption that on-terminal container flows, gate restrictions, operating time limitations and reservation system restrictions continue to result in dwell times for truck-destined containers in the three to four day range; and**

- **security issues between short-sea operations and trucking are not expected to provide an advantage for one mode over the other.**

Each of these issues and factors, amongst others, will play an important role in the ability of short-sea operations to compete effectively with trucking companies and, indeed in some cases, to 'lock-up' specific customers and/or market segments. Considerably more competitive research will be required before investors may commit to the establishment of short-sea container services in Greater Vancouver. Nevertheless, given the market size and growth, it is evident to the Consulting Team that the competitive environment should not dissuade, but rather encourage, proponents to pursue this opportunity further … recognizing that base volume levels in the +/-250 container per round-trip range will be needed for commercial viability and that nodes close to major customers will offer distinct advantages in securing these volumes.

REACH-STACKERS WORKING AT SHORT-SEA TERMINAL

Given the very considerable growth expected within the target market for short-sea shipping, competitive forces with trucking may be low since it is quite possible that the trucking industry will face a number of challenges in servicing the rapidly growing demand on its own. With the expanding need, price competitiveness may well become less important that other service factors (e.g. delivery time and reliability) in a highly competitive and time-sensitive import/export industry.

8.5 SHORT-SEA TARGET MARKET SHARE REQUIREMENTS & CONCLUSIONS

This pre-feasibility assessment for short-sea container shipping identified and examined a variety of issues, characteristics, routes, costs and factors which will enable the reader to make informed decisions on the magnitude of the opportunity. Further more detailed work in a number of areas is required and warranted. Because existing short-sea container operations are not in place, and because the level of investment is considerable and long-term commitment is required, this does not represent an incremental growth opportunity for existing businesses but, rather, a new investment opportunity in a new logistical asset for Greater Vancouver.

A short-sea service can be established using one river-front container node and several established routes to selected or all container terminals. It may lead to multiple nodes and routes in the future. Nevertheless, the node and service initially established must have sufficient capability and credibility to secure the container volumes required for successful operation.

Detailed analyses of specific customer requirements and potential commitments are required if this opportunity is to be pursued. The Consulting Team has, however, assembled a variety of market related information, and market share requirement estimates, to satisfy the reader whether or not such additional efforts are warranted.

8.5.1 Short-Sea Annual Container Volume Requirements for Commercial Viability

The short-sea cost analysis described earlier for "priority" routes was compared with current dray (trucking) costs for similar routes in Chapter 7 and summarized in Figure 7.3. That analysis effectively provided a competitive pricing analysis of the two modes on the selected routes since the tug/barge evaluation incorporated all capital and operational costs and a 15% profit margin whereas the dray costs represent the average prices charged by the industry to customers. Based on the analysis results, the Consulting Team developed the following conclusions with respect to pricing competitiveness and commercial viability for the various intra-regional transfer routings defined by the priority container nodes and the region's container terminals. These conclusions assume that short-sea and trucking pricing are the same at 2004 $ and cost levels.

- At 200 Containers per Tug/Barge Round-Trip - The following routes currently appear to be viable for short-sea operations:
    - Container node at Fraser Surrey to/from the Inner Harbour – South Shore; and
    - Container node at Fraser Surrey to/from Roberts Bank.

- At 250+ Containers per Tug/Barge Round-Trip - The following additional routes may well be viable for short-sea operations:
    - Container node at Tilbury to/from the Inner Harbour – South Shore;
    - Container node at Tilbury to/from Roberts Bank;

- Container node at Tilbury to/from Fraser Surrey Docks;
- Container node at Coast 2000 to/from the Inner Harbour – South Shore;
- Container node at Coast 2000 to/from Roberts Bank;
- Container node at Coast 2000 to/from Fraser Surrey Docks;
- Container node at Pitt Meadows to/from Roberts Bank; and
- Container node at Pitt Meadows to/from Fraser Surrey Docks.

- At 300+ Containers per Tug/Barge Round-Trip - The following additional routes may be viable for short-sea operations in the future:
  - Container node at Pitt Meadows to/from the Inner Harbour – South Shore;
  - Container node at Parsons Channel / Port Kells to/from the Inner Harbour – South Shore;
  - Container node at Parsons Channel / Port Kells to/from Roberts Bank; and
  - Container node at Parsons Channel / Port Kells to/from Fraser Surrey Docks.

These conclusions reflect the distance, operational costs and investment level advantages and disadvantages for each of the priority short-sea container node locations described earlier. The "threshold" round-trip volume requirements identified above have been converted to annual volume requirements to enable these to be related to market size and competitive position. These conversions are summarized in Figure 8.4 (below):

FIGURE 8.4
RELATIONSHIP BETWEEN TRIP AND ANNUAL SHORT-SEA SERVICE VOLUMES

CONTAINERS PER SHORT-SEA ROUND-TRIP	200	250	300
ANNUAL CONTAINERS MOVED – 2 TIMES WEEKLY SERVICE	20,800	26,000	31,200
ANNUAL CONTAINERS MOVED – 3 TIMES WEEKLY SERVICE	31,200	39,000	46,800
ANNUAL CONTAINERS MOVED – 4 TIMES WEEKLY SERVICE	41,600	52,000	62,400

In conclusion, the threshold round-trip volumes in Figure 8.4 are known or expected to enable a short-sea service to have a good chance of commercial success for the routes described above. These round-trip volumes equate to annual volume levels ranging from 21,000 containers to 62,000 containers depending on the trip volume and service frequency. In the following sections, the "commercial" annual volume requirements are related to the size of the target market to provide perspective into the likelihood that these levels can be achieved.

SELF LOADING/UNLOADING CONTAINER BARGE

8.5.2 Target Market Share Required for Commercially Viable Short-Sea Operations

An understanding of the extent to which the proposed short-sea service needs to capture market share is fundamental to assessing the likelihood that such a business could be commercially successful. Five threshold, annual volume requirements were identified using the results described in Figure 8.4 … and an assessment was carried out to relate these traffic levels to the total "target market" demand expected over the short-term and the longer term. A summary of the results of this analysis are presented in Figure 8.5 (below):

FIGURE 8.5
TARGET MARKET SHARE REQUIREMENT VS SHORT-SEA SERVICE VOLUMES
(MARKET SHARE)

ANNUAL SHORT-SEA CONTAINER VOLUME	20,000	30,000	40,000	50,000	60,000
SHARE OF TARGET MARKET - 2004	4.5 %	6.7 %	8.9 %	11.2 %	13.4 %
SHARE OF TARGET MARKET - 2010	2.0 %	3.0 %	4.0 %	5.0 %	6.0 %
SHARE OF TARGET MARKET - 2020	1.5 %	2.2 %	2.9 %	3.6 %	4.4 %
SHARE OF 2004 – 2010 TARGET MARKET GROWTH	3.7 %	5.5 %	7.3 %	9.2 %	11.0 %
SHARE OF 2004 – 2020 TARGET MARKET GROWTH	2.2 %	3.2 %	4.3 %	5.4 %	6.5 %

The significance of the market share requirements to achieve commercially viable short-sea operations on selected routes (as summarized in Figure 8.5) is considerable. Two of the "priority" routes (i.e. a short-sea node at Fraser Surrey connecting with the Inner Harbour and Roberts Bank container terminals) demonstrate, on a preliminary basis, commercial feasibility for annual volumes in the 20,000 to 40,000 range. To achieve this would only require a "target market share" of between 4 ½ % and 9 % at current (2004) container throughput levels and, a much lower, 2 % to 4 % at expected 2010 throughput levels. Eight more of the container terminal / container short-sea node pairs identified as priority routings earlier could be expected to be commercially viable with annual volumes in the 30,000 to 50,000 container range … representing only a 3 % to 5 % share of the target market six years from now.

Perhaps the most 'telling' numbers in Figure 8.5 are those which identify the share of the growth (only) of the intra-regional container transfer market growth which are tied to short-sea volumes. A total short-sea volume of 20,000 containers annually represents only 3.7 % of the growth in this demand between 2004 and 2010 … six years hence. Even if a short-sea service was able to capture 10% of the growth in demand, a full 90% would be left to share amongst the region's trucking companies.

It must be recognized that the identified "target market" for short-sea operations is not all "achievable" as base volume for the proposed service. Indeed, only those container businesses and facilities which are located within a reasonable distance of the short-sea container node location can be regarded as key customer targets with high and secured potential. Hence the importance that the node(s) is(are) located reasonably close (i.e. within a dray of +/- $50.) to a number of important industry operators.

It is noteworthy that, with the container industry businesses which are located in close proximity to the Fraser Surrey Docks area and Tilbury Island, and with those which are located, or will be located, at and around Coast 2000, it is reasonable to expect that 8% to 10% of the total "target market" demand could be generated within either and each of these geographic areas based on the 2001 VPA O/D survey research data described earlier concerning container trucking distribution. Those specific node opportunities (i.e. Fraser Surrey, Coast 2000 and Tilbury) are considered by the Consulting Team to offer, in the short-term, the greatest potential to support commercially viable short-sea operations.

Assuming that, within each of these areas, approximately 10% of the identified "target market" intra-regional container traffic takes place, the target market share numbers referenced above to achieve base volume numbers for commercially viable short-sea operations would need to be multiplied by 10. Based on 2010 volumes, therefore, a share in the range of 20 % to 40 % of the "immediately accessible target market" would need to be achieved by the short-sea operator to sustain annual volumes in the 20,000 to 40,000 container range.

8.5.3 Short-Sea Commercial Viability Conclusions

The market share expectations (described above) for commercially viable short-sea operations on selected routes are relatively low and, therefore, provide important opportunities for investors and proponents. The Consulting Team believes the market shares are achievable given the relative competitive advantages of short-sea and trucking. Indeed, it is quite possible that the proposed short-sea operation, if properly situated and effectively operated and marketed, could well exceed the base volume levels required over the short-term. The competitive advantages for short-sea services in several areas (e.g. transit time, reliability, etc.) may well be sufficient to attract larger volumes and/or offer pricing incentives for customers who commit to significant volumes and who can take advantage of the location and operational advantages offered.

The above conclusions, in combination with the results presented in Figure 8.3, offer important information concerning the relative short-term capability of specific short-sea container node locations to support commercially viable tug/barge operations at the volume levels indicated. Several node locations clearly offer the most distinct advantages for short-sea service in the short-term, while a variety of locations offer longer term opportunities.

In conclusion, and importantly, the Consulting Team believes that the time is right to actively pursue the short-sea option for intra-regional container transfer in Greater Vancouver. Market demand is increasing dramatically. This can be expected to off-set any direct concern, action and/or resistance within the trucking industry. The Consulting Team has received positive feed-back and interest from several private sector firms. The competitive advantages for short-sea operations are evident and expected to strengthen in relative terms as container throughput in the Lower Mainland expands. Specific container node locations and short-sea routes offer competitive pricing with trucking at the present time … and more are expected to do so in the future. Some environmental emission benefits will be achieved immediately, and dramatically enhanced as and when short-sea operations attract higher volumes of container traffic.

9. CONCLUSIONS

A number of conclusions have been described or alluded to in preceding chapters of this report. The key conclusions reached by the Consulting Team which are directly relevant to the objectives of the study, and to the future opportunity for short-sea container shipping in Greater Vancouver, are summarized below:

- **Intra-regional short-sea container shipping in Greater Vancouver offers promising, commercially viable, private sector opportunities in the short to medium-term for specific short-sea container terminal locations on the Fraser River … specifically the Fraser Surrey area, the Tilbury Island area and the Coast 2000 area … if volume can be secured in the range of 200 containers per round trip or greater.**

- **As short-sea volumes approach and exceed 250 containers per round-trip, the most (commercially) attractive short-sea container nodes along the Fraser River (listed above) offer greater commercial opportunities and, in addition, other short-sea nodes and routes become price competitive with the trucking alternative.**

- **It is critical for short-sea container terminals to be strategically located close to (or have sufficient land to establish) a variety of container industry facilities and businesses and to have, on-site or nearby, rail inter-modal capability.**

- **The "target market" for short-sea container services is that segment of container terminal throughput (inbound and outbound) that is not directly transferred to or from rail and, therefore, is delivered to/from regional container businesses. This market is growing rapidly and is expected to more than double in the next six years and triple in 16 years.**

- **The 'target market' share required to support commercially viable short-sea operations is quite small (i.e. 4 ½% to 9% of current -2004 -demand and 2% to 4% of demand in 2010). Relating these share requirements to a much narrower "nearby", achievable, base volume market … it is expected that short-sea operators will need to secure 45% to 60% of the current container transfer business located nearby the barge terminal in the Fraser Surrey, Tilbury Island or Coast 2000 areas (and/or 20% to 30% of the same local**

area market in 2010) to maximize their opportunity for commercial success. Given the likely competitive advantages of short-sea shipping, it is expected that these levels of market share are achievable.

- **Short-sea container shipping, for selected terminal locations and routes and with sufficient volume, offers price competitiveness with trucking and some competitive advantages (likely to expand dramatically over time) in the areas of delivery time and delivery time reliability. These advantages occur because of road network congestion as well as deep-sea terminal flow issues, gate congestion, reservation limitations and operating hour limitations. All of these factors impact on truck transfer delivery time and costs but do not affect a short-sea operation with on-dock marshalling areas.**

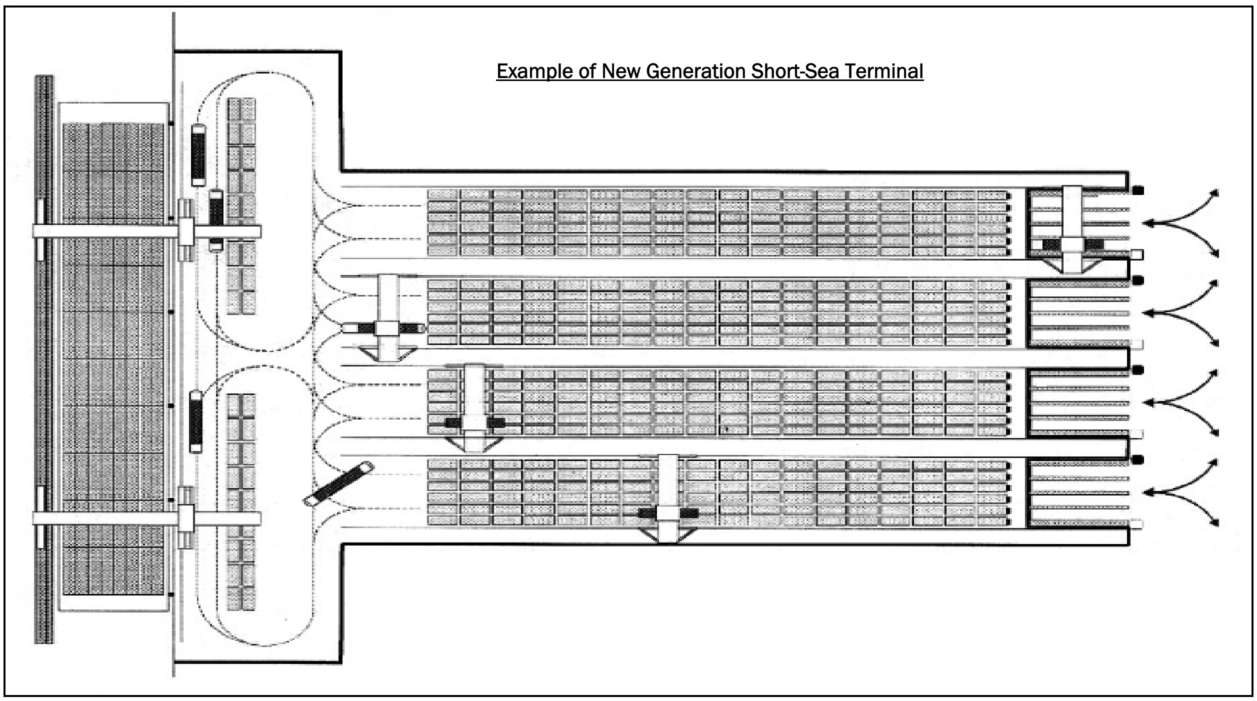
- **It will be critical for short-sea service investors and proponents to invest the capital and make the long-term commitment necessary to establish reliability and confidence in the market place. The Consulting Team is aware of a number of regional operators and external investors who are seriously interested in this opportunity.**

- **It will be critical for the short-sea operator to secure sufficient base, container transfer volume commitments from nearby importers, exporters, agents and/or logistics companies to approach the annual volume 'threshold' levels required for commercial success. The Consulting Team suggests that these levels can be achieved by negotiating commitments from several key customers in the Fraser Surrey, Tilbury and/or Coast 2000 areas as appropriate. In many cases, one or two such commitments could provide the volume necessary to establish a base for short-sea commercial success.**

- **Expected increases in environmental emissions from the intra-regional transfer of containers by truck will be moderated to the extent that short-sea operations absorb some of the future growth. This is particularly true of the key greenhouse gas emission (CO_2) as well as VOC emissions … and less true of other emissions such as particulate matter (PM), VO_x, and SO_2.**

- **This pre-feasibility assessment provides reliable information and guidance on the factors, issues and options which must be addressed to achieve commercially successful short-sea operations. More detailed work is required in a number of specific areas before investors can be expected to commit to the opportunity. However, the data and information**

provided, herein, should encourage port authorities, governments, agencies and the private sector to take the steps and make the investment necessary to more strictly define and analyse this new business and logistical opportunity for Greater Vancouver.



Example of New Generation Short-Sea Terminal

APPENDICES

APPENDIX A

OVERVIEW ASSESSMENT AND SCREENING OF PROSPECTIVE SHORT-SEA CONTAINER NODE SITE AREAS

APPENDIX A

OVERVIEW ASSESSMENT AND SCREENING OF PROSPECTIVE SHORT-SEA CONTAINER NODE SITE AREAS

The 5-page table below provides a summary of the study's research findings and conclusions regarding the relative suitability of each prospective site considered. The assessment addresses a variety of criteria as described in Chapter 3. This table was used as the basis for discussions on the relative merits of the site areas with the Steering Committee and for identifying the priority site areas for purposes of this study. Many of these site areas may serve effectively as short-sea container transfer centres in the future.

GREATER VANCOUVER WATERBORNE INTERMODAL TRANSPORTATION STUDY

Appendix A - CONTAINER SERVICE CENTRE NODES - PRELIMINARY ASSESSMENT AND SCREENING - Page 1 of 5

	Map Designation - I	Map Designation - O	Map Designation - L	Map Designation - G
Site Identification	Annacis Island (Various)	Barnston Island	Brunette Creek	Burnaby Big Bend
Jurisdiction	Delta/New Westminster	GVRD / Surrey	Coquitlam/GVRD	Burnaby
Identification By [1]	CT	CT	GC	GC
Ownership	Private- 2 trucking firms?	Private	Mainly private + GVRD	Private/NFPA
Status	Under use/availability?	ALR/No fixed link	Urban developmt nearby	Development proceding
PHYSICAL CHARACTERISTICS & SUITABILITY				
- Size (Acres)	20 acres +/-	Substantial - Long term	Limited land	Unknown
- Size Suitability - For Minimum Node Concept	Possible	LT Potential	Possible	Possible
- For Moderate Node Concept	Unlikely/But close to DC's	LT Potential	Unknown	Unknown
- For Optimum Node Concept	Unlikely/But close to DC's	LT Potential	Unknown	Unknown
- Site Preparation Costs & Issues	Moderate	Unknown	Unknown	Unknown
ACCESSIBILITY				
- Shorefront Suitability	Satisfactory	Satisfactory	Satisfactory	Satisfactory
- Water Frontage	Satisfactory	Satisfactory	Satisfactory	Satisfactory
- Water Depth	Satisfactory	Satisfactory	Satisfactory	Satisfactory
- Dredging Requirement	Satisfactory	Unknown	Unknown	Unknown
- Rail Access / Proximity / Distance	Satisfactory	None currently		CN Rail on-site/adjacent?
- Highway Access / Proximity / Distance	Congested	None currently		Existing - Suitability?
OPERATIONAL ISSUES & SUITABILITY				
- SS Service Distance / Travel Time	Short/Located close-in	Moderate to long		
- Navigation Issues	None	None likley		
- Labour Issues / Costs	Teamsters	Non-ILWU		Non-ILWU
- Barge Load/Unload Capability & Issues	Satisfactory	To be determined		To be determined
- Intra-Service Centre Flow Capability (Configuration)	Unknown	To be determined		To be determined
- Capability To Support Related Container Operations	Many nearby/Not on-site	To be determined		Close by
- In/Out Road Transport Requirements & Costs	Existing	Substantial		
- Rail Siding Development Capability	Located on island	Possible LT with $$		
DEVELOPMENT FACTORS				
- Land Availability / Cost	High	Unknown/Reasonable?		High/Competition?
- Planning / Zoning / Rezoning Issues	None - Industrial	ALR - Low capability		
- Site Preparation Costs & Issues	Satisfactory	Unknown		
- Municipal / Regional Support	Satisfactory	Problematic		
- Environmental Issues [2]	None-Good site-Brownfield	(*) Productive shoreline	(*)DFO enhancement area	(*) Remediation ongoing
- Development Cost Level	Satisfactory	Unknown	Various / Constraints	
- ST vs MT vs LT Potential	Tied to land availability	LT Potential	Partial/CPR/Inactive?	
OVERALL ASSESSMENT				
- Potential Opportunity (Yes/No)	Yes	LT only	Yes	Yes
- Priority	Moderate	Low	??	??
- Assessment Comments	Look at area as node	Keep on LT list	Sensitive areas / Issues	
- Conclusion (Eliminate / ST / LT Only)	POSSIBLE WITH	ELIMINATE FROM	ELIMINATE FROM	ELIMINATE FROM
	SUITABLE LAND	ST PRIORITY LIST	ST PRIORITY LIST	PRORITY LIST

(1) GC indicates identification by the Gateway Council; CT indicates identification by the Consulting Team

(2) In areas where dredging is required, some environmental remediation measures may be required, notably where marked with an asterisk (*)

APPENDIX A (continued)

Overview Assessment And Screening Of Prospective Short-Sea Container Node Site Areas

GREATER VANCOUVER WATERBORNE INTERMODAL TRANSPORTATION STUDY				
Appendix A - CONTAINER SERVICE CENTRE NODES - PRELIMINARY ASSESSMENT AND SCREENING - Page 2 of 5				
	Map Designation - E	Map Designation - A	Map Designation - F	Map Designation - J
Site Identification	Coast 2000	Eburne	Fraser/Delta Area	Fraser/Surrey Area-FSD
Jurisdiction	Richmond	Vancouver	Delta	Surrey
Identification By [(1)]	GC	GC	GC	GC
Ownership	FRPA Administration	NFPA ?	FRPA & Private	FRPA + Prov of BC (FSD)
Status	Former landfill/Leasable	Development planned	18 +/- small parcels	Adjacent marine/distrb'n
PHYSICAL CHARACTERISTICS & SUITABILITY				
- Size (Acres)	+/- 90 ac	30 ac +/- (?)	55 ac + (non-contiguous)	20 ac + 150 ac adjacent
- Size Suitability - For Minimum Node Concept	Yes	Yes	Yes	Yes
- For Moderate Node Concept	Yes	Yes	Unlikely	Yes
- For Optimum Node Concept	Yes	Yes	Unlikely	Possible
- Site Preparation Costs & Issues	Unknown	Most preparation done	Satisfactory	Low/Already in business
ACCESSIBILITY				
- Shorefront Suitability	Satisfactory	Satisfactory	Satisfactory	Satisfactory
- Water Frontage	Satisfactory	Satisfactory	Problematic/But SFP Rd	Satisfactory
- Water Depth	Satisfactory	Satisfactory	Satisfactory	Satisfactory
- Dredging Requirement	Unknown/Unlikely	Unknown/Unlikely	Unknown/Unlikely	None
- Rail Access / Proximity / Distance	CN Rail on-site	CPR on-site	CNR/BNSF	CNR/CPR/BNSF/SRY
- Highway Access / Proximity / Distance	E-W Richmond Corridor	Congested/Urban roads	Adjacent to River Road	S Fraser Perimeter Road
OPERATIONAL ISSUES & SUITABILITY				
- SS Service Distance / Travel Time	Close	Close	Moderate	Moderate
- Navigation Issues	None	None	None ?	None
- Labour Issues / Costs	Teamsters	Teamsters	non-ILWU	ILWU / Higher costs
- Barge Load/Unload Capability & Issues	OK/No issues	OK/No issues	OK/No issues	OK/No issues
- Intra-Service Centre Flow Capability (Configuration)	Excellent	Good	Unknown	Unknown
- Capability To Support Related Container Operations	Excellent/Ext'g op'ns	Moderate	No	Some/Others nearby
- In/Out Road Transport Requirements & Costs	Satisfactory	Satisfactory/Congestion	Satisfactory	Satisfactory
- Rail Siding Development Capability	Rail on-site/Addt'l OK	Rail on-site	Satisfactory	IY on-site
DEVELOPMENT FACTORS				
- Land Availability / Cost	Lease only / $? /ac/yr	High/Unavailable ?	Consolidation needed	Existing business to do
- Planning / Zoning / Rezoning Issues	None - Marine/Industrial	None	None ?	None - Industrial
- Site Preparation Costs & Issues	Moderate costs?	Moderate	Moderate	Limited/Developed
- Municipal / Regional Support	Richmond/FRPA	Unknown	Probably	No issue
- Environmental Issues [(2)]	In hand / No issues	No issues	No issues	In hand / No issues
- Development Cost Level	Moderate	Moderate	Satisfactory	Limited/Developed
- ST vs MT vs LT Potential	ST	Limited potential	MT-After SFP Rd	ST
OVERALL ASSESSMENT				
- Potential Opportunity (Yes/No)	Yes	No	Yes	Yes
- Priority	High	N/A	Low/Wait for SFP Road	High
- Assessment Comments	Excellent opportunity	Likely unavailable	Good prospects MT	Very Good Opportunity
- Conclusion (Eliminate / ST / LT Only)	INCLUDE ON	ELIMINATE FROM	CONSIDER AS	INCLUDE ON
	ST PRIORITY LIST	PRIORITY LIST	MED-TERM OPPORTUNITY	ST PRIORITY LIST

[(1)] GC indicates identification by the Gateway Council; CT indicates identification by the Consulting Team

[(2)] In areas where dredging is required, some environmental remediation measures may be required, notably where marked with an asterisk (*)

APPENDIX A (continued)

Overview Assessment And Screening Of Prospective Short-Sea Container Node Site Areas

GREATER VANCOUVER WATERBORNE INTERMODAL TRANSPORTATION STUDY				
Appendix A - CONTAINER SERVICE CENTRE NODES - PRELIMINARY ASSESSMENT AND SCREENING - Page 3 of 5				
	Map Designation - K	Map Designation - R	Map Designation - B	Map Designation - N
Site Identification	Fraser/Surrey-Van Isle	Mission Foreshore	Mitchell Island	Parsons Channel
Jurisdiction	Surrey	Mission Foreshore	Richmond?/NFPA	Surrey
Identification By[1]	CT	GC	GC	CT
Ownership	Private - Van Isle Barge	Mission Raceway+private	Private	Private - 5 old saw mills
Status	New hyd barge ramp/op'n	Raceway+adj ind'l lands	Developed/Congested	Available land to develop?
PHYSICAL CHARACTERISTICS & SUITABILITY				
- Size (Acres)	Ext'g site/Limited back-up	Unknown	Limited-esp large parcel	OK with land assembly
- Size Suitability - For Minimum Node Concept	Yes	Yes	Maybe	Yes - with land
- For Moderate Node Concept	Unknown	Yes	Unlikely	Yes - with land
- For Optimum Node Concept	Unknown	Unknown	Unlikely	Yes - with land
- Site Preparation Costs & Issues	Low/Already in business	Flat/developable-Floodpl	Reasonable	Moderate
ACCESSIBILITY				
- Shorefront Suitability	Satisfactory	Satisfactory	Depend on parcel	Satisfactory
- Water Frontage	Satisfactory	Good river access	Depends on parcel	Satisfactory
- Water Depth	Satisfactory	Unknown	Satisfactory	Stisfactory
- Dredging Requirement	None	Unknown	None	None
- Rail Access / Proximity / Distance	OK	CPR adj-CNR via CP bridge	No rail access	Close to IY
- Highway Access / Proximity / Distance	OK	Good-Lougheed & Hgwy 1	Congested road access	Close to S Fr Perimeter Rd
OPERATIONAL ISSUES & SUITABILITY				
- SS Service Distance / Travel Time	Moderate	Long	Very close	Moderate
- Navigation Issues	None	3-mo freshet restriction	None	None
- Labour Issues / Costs	Teamsters	non-ILWU	non-ILWU	non-ILWU
- Barge Load/Unload Capability & Issues	OK/No issues	Unknown	Unknown	Unknown
- Intra-Service Centre Flow Capability (Configuration)	Unknown	Unknown	Unknown	Unknown
- Capability To Support Related Container Operations	Limited	Unknown	Limited/Non existent	Depends on land assembly
- In/Out Road Transport Requirements & Costs	Satisfactory	Unknown	Unknown/Congested	S Fraser Perimeter Road
- Rail Siding Development Capability	Satisfactory	Unknown	None	OK - On-site?
DEVELOPMENT FACTORS				
- Land Availability / Cost	Moderate	Relocate raceway/Cost?	Moderate	Availability?/Moderate
- Planning / Zoning / Rezoning Issues	OK	Difficult?	OK	OK
- Site Preparation Costs & Issues	OK	Unknown	OK	OK
- Municipal / Regional Support	OK	Maybe problematic	OK	OK
- Environmental Issues [2]	None	Productive shore-DFO issue	Brownfield-Compensatory	(*) - Fish habitat value
- Development Cost Level	Moderate	High?-Land in floodplain	OK	Moderate
- ST vs MT vs LT Potential	MT	LT - maybe	MT-maybe	MT
OVERALL ASSESSMENT				
- Potential Opportunity (Yes/No)	Yes-MT-With land assembly	No	Limited	Yes
- Priority	Moderate	N/A	Low	Medium
- Assessment Comments	Needs land to free up	Too far/Land not available	Sig access & land issues	Land assembly possible?
- Conclusion (Eliminate / ST / LT Only)	VERY GOOD ST-MT	ELIMINATE FROM	ELIMINATE FROM	INCLUDE ON PRIORITY
	OPPORTUNITY	PRIORITY LIST	PRIORITY LIST	LIST WITH PORT KELLS
[1] GC indicates identification by the Gateway Council; CT indicates identification by the Consulting Team				
[2] In areas where dredging is required, some environmental remediation measures may be required, notably where marked with an asterisk (*)				

APPENDIX A (continued)

Overview Assessment And Screening Of Prospective Short-Sea Container Node Site Areas

GREATER VANCOUVER WATERBORNE INTERMODAL TRANSPORTATION STUDY

Appendix A - CONTAINER SERVICE CENTRE NODES - PRELIMINARY ASSESSMENT AND SCREENING - Page 4 of 5

	Map Designation - Q	Map Designation - P	Map Designation - H
Site Identification	Pitt Meadows Airport	Port Kells Area	Queensborough
Jurisdiction	Pitt Meadows/Maple Ridge	Surrey	New Westminster
Identification By [1]	GC	GC	CT
Ownership	Airport + Municipalities	Private - 5 forestry cos	Private?
Status	A/P use / Much unused?	Adj lands possible?	Resident'l/comm'l nearby
PHYSICAL CHARACTERISTICS & SUITABILITY			
- Size (Acres)	?? - Some land in area	+/- 20 acres	Unknown
- Size Suitability - For Minimum Node Concept	Possible	Yes	Yes
- For Moderate Node Concept	Unknown	Yes ?	Yes
- For Optimum Node Concept	Unknown	Unknown	Unknown
- Site Preparation Costs & Issues	Moderate	Unknown	Unknown
ACCESSIBILITY			
- Shorefront Suitability	Satisfactory	Eroded foreshore ldg opp	Satisfactory
- Water Frontage	Satisfactory	Satisfactory	Satisfactory
- Water Depth	Good deep water site?	Satisfactory	Satisfactory
- Dredging Requirement	None	None	None
- Rail Access / Proximity / Distance	Proposed FR X'g nearby	Close to CN mainline	Close
- Highway Access / Proximity / Distance	Close as is CPR IY	Good-176th St to Hgwy 1	Close
OPERATIONAL ISSUES & SUITABILITY			
- SS Service Distance / Travel Time	Long	Long	Close
- Navigation Issues	3-mo freshet restriction	3-mo freshet restriction	None
- Labour Issues / Costs	non-ILWU	non-ILWU	non-ILWU
- Barge Load/Unload Capability & Issues	Unknown	Unknown	Unknown
- Intra-Service Centre Flow Capability (Configuration)	Unknown	Unknown	Unknown
- Capability To Support Related Container Operations	Unknown	Limited	Close to DC's @ Annacis
- In/Out Road Transport Requirements & Costs	Satisfactory	Satisfactory	Satisfactory
- Rail Siding Development Capability	Unknown	Unknown	Unknown
DEVELOPMENT FACTORS			
- Land Availability / Cost	Moderate	Moderate	High
- Planning / Zoning / Rezoning Issues	Much in ALR	OK	Unknown/Problematic?
- Site Preparation Costs & Issues	High - Much in floodplain	OK	Moderate
- Municipal / Regional Support	A/P Society motivation?	OK	Unknown/Problematic?
- Environmental Issues [2]	(*) - Fisheries issue	Most coded "Green"	No issues
- Development Cost Level	High - Much in floodplain	Moderate	Moderate
- ST vs MT vs LT Potential	MT - maybe	ST to MT	MT
OVERALL ASSESSMENT			
- Potential Opportunity (Yes/No)	Possible-A/P willing	Yes - Given distance issue	Depends on mun priority
- Priority	Low	Medium	Low?
- Assessment Comments	Long way/Current issue	Long way/Current issue	Non-ind'l nearby
- Conclusion (Eliminate / ST / LT Only)	INCLUDE 'TO TEST'	INCLUDE ON PRIORITY LIST	ELIMINATE FROM
	ON PRIORITY LIST	WITH PARSONS CHANNEL	PRIORITY LIST

(1) GC indicates identification by the Gateway Council; CT indicates identification by the Consulting Team

(2) In areas where dredging is required, some environmental remediation measures may be required, notably where marked with an asterisk (*)

APPENDIX A (continued)

Overview Assessment And Screening Of Prospective Short-Sea Container Node Site Areas

GREATER VANCOUVER WATERBORNE INTERMODAL TRANSPORTATION STUDY

Appendix A - CONTAINER SERVICE CENTRE NODES - PRELIMINARY ASSESSMENT AND SCREENING - Page 5 of 5

	Map Designation - C	Map Designation - D	Map Designation - M
Site Identification	Tilbury Island	Tilbury Island - Seaspan	Fraser Mills
Jurisdiction	Delta	Delta	Coquitlam
Identification By (1)	GC	CT/GC	CT
Ownership	Chatterton + 2 private	Private - Seaspan	Private
Status	Exp'n @ Chatterton site	Existing barge operations	Being decommissioned
PHYSICAL CHARACTERISTICS & SUITABILITY			
- Size (Acres)	65 acres in total	25 acres	50+ acres
- Size Suitability - For Minimum Node Concept	Yes	Yes	Yes
- For Moderate Node Concept	Yes	Yes	Yes
- For Optimum Node Concept	Yes	Unknown	Unknown
- Site Preparation Costs & Issues	Old bulk loading exists	Low-In the business	Old saw mill site
ACCESSIBILITY			
- Shorefront Suitability	Satisfactory/Berth exists	High - Existing operation	Satisfactory
- Water Frontage	Satisfactory	Satisfactory	Satisfactory
- Water Depth	Satisfactory	Satisfactory	Satisfactory
- Dredging Requirement	None	None	None
- Rail Access / Proximity / Distance	OK	OK	OK / On CPR line
- Highway Access / Proximity / Distance	OK/S Fr Perimeter Road	OK/S Fr Perimeter Road	N Fraser Perimeter Road
OPERATIONAL ISSUES & SUITABILITY			
- SS Service Distance / Travel Time	Very (too?) close to RB	Very (too?) close to RB	Moderate
- Navigation Issues	None	None	None
- Labour Issues / Costs	Teamsters	Teamsters	non-ILWU
- Barge Load/Unload Capability & Issues	Satisfactory	Good - Existing operation	Satisfactory
- Intra-Service Centre Flow Capability (Configuration)	Satisfactory	Satisfactory	Good - Lots of land
- Capability To Support Related Container Operations	Good	Good	Good / Near Coq dist area
- In/Out Road Transport Requirements & Costs	River Road - Poor connect	Satisfactory	Satisfactory
- Rail Siding Development Capability	Ext'g - CNR/BNSF	OK	Existing on-site ?
DEVELOPMENT FACTORS			
- Land Availability / Cost	Moderate/High	Moderate	High
- Planning / Zoning / Rezoning Issues	None - Ext'g marine/ind'l	None	Unknown
- Site Preparation Costs & Issues	Satisfactory	Satisfactory	OK
- Municipal / Regional Support	Yes	Yes	Unknown
- Environmental Issues (2)	Brownfield-Fisheries issues	None	Unknown
- Development Cost Level	Moderate/High	Low-In the business	Unknown
- ST vs MT vs LT Potential	MT	ST	MT
OVERALL ASSESSMENT			
- Potential Opportunity (Yes/No)	Yes	Yes	Yes
- Priority	Medium	High	Medium
- Assessment Comments	Property adjacent	Owner is keen/Ext'g op'n	Good possibility in time
- Conclusion (Eliminate / ST / LT Only)	INCORPORATE AS	INCLUDE ON	EXCLUDE FROM
	ADJUNCT TO SEASPAN	ST PRIORITY LIST	ST PRIORITY LIST

(1) GC indicates identification by the Gateway Council; CT indicates identification by the Consulting Team

(2) In areas where dredging is required, some environmental remediation measures may be required, notably where marked with an asterisk (*)

APPENDIX B

CONTAINER TRANSFER TIMES BY TRUCK
ON SELECTED ROUTES IN 2021
WITH BOTH PLANNED & COMMITTED TRANSPORTATION IMPROVEMENTS IN PLACE

APPENDIX B

CONTAINER TRANSFER TIMES BY TRUCK ON SELECTED ROUTES IN 2021 WITH BOTH PLANNED AND COMMITTED TRANSPORTATION IMPROVEMENTS IN PLACE

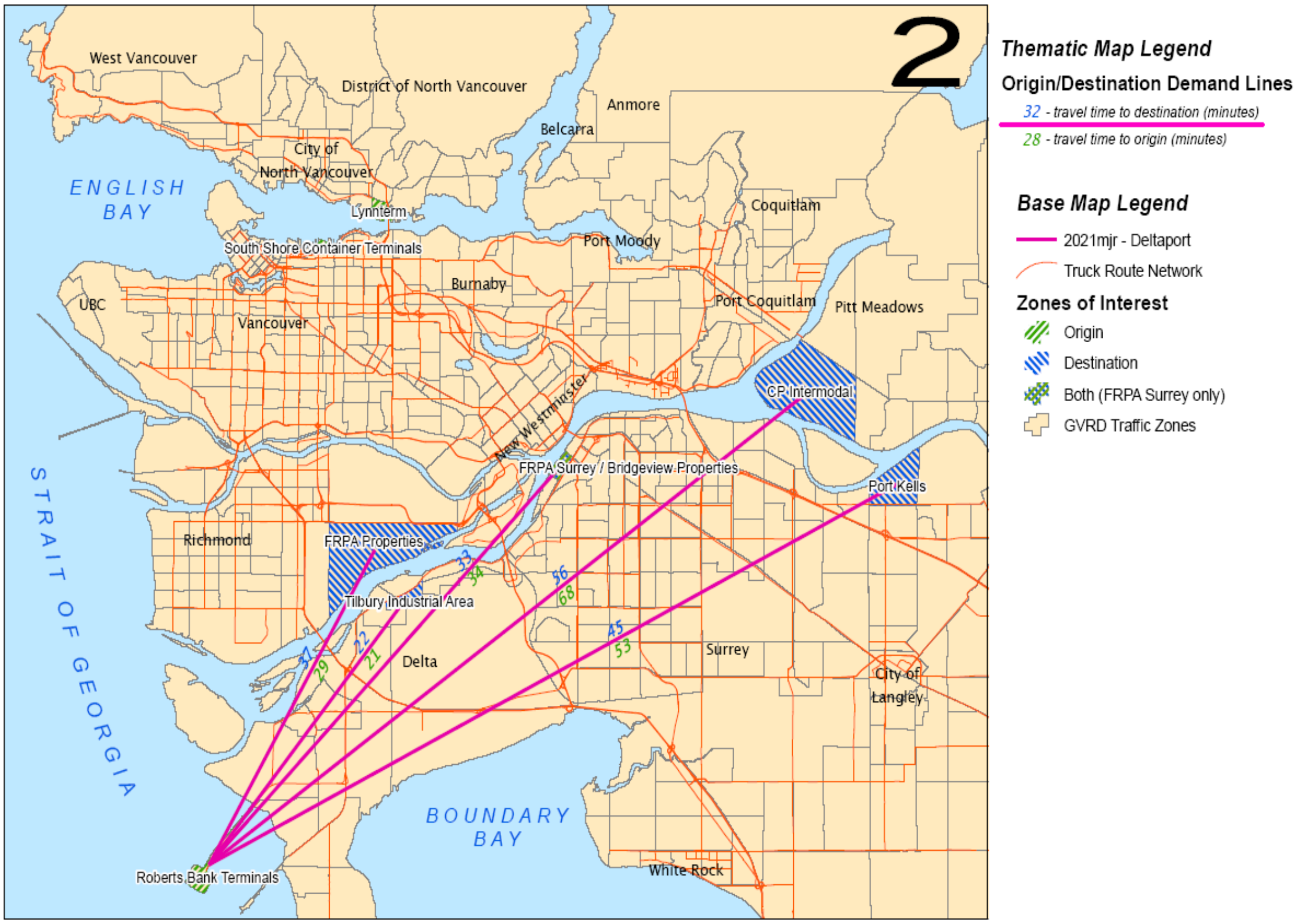
The following table and four maps provide a summary of the travel time in 2021 by truck for container transfer between Greater Vancouver's deep-sea container terminals and the five 'priority' site areas on the Fraser River representing prospective locations for a short-sea terminal. The data in the table was provided by TransLink from a special run of its Emme/2 model specifically for this study and assumes that both committed and planned (but as yet uncommitted) transportation improvements are in place. The maps were prepared by the Vancouver Port Authority and are based on the data provided by TransLink.

LINK TRAVEL TIME – 2021
WITH COMMITTED AND PLANNED TRANSPORTATION IMPROVEMENTS IN PLACE
(MINUTES)

GENERATOR / SSS NODE	COAST 2000	DELTA TILBURY	FRASER SURREY	PITT MEADOWS	PORT KELLS
Roberts Bank	37	22	33	56	45
Fraser Surrey Docks	31	15	0	36	24
Vancouver (S Inner Harbour)	38	42	37	44	38
Lynnterm (N Inner Harbour)	49	51	38	45	38

The four travel time maps (below), which are tied to the above table, present travel time data from the Emme/2 model for 2021 … assuming that committed and planned, major transportation infrastructure improvements are in place … between the region's container generating areas (terminals) and the priority short-sea node areas along the Fraser River. The maps (numbered 1 to 4) provide this information to/from Roberts Bank, Fraser Surrey Docks, Vancouver Harbour's North Shore and Vancouver Harbour's South Shore respectively.

APPENDIX B – MAP 1 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM ROBERTS BANK – 2021 WITH COMMITTED AND PLANNED TRANSPORTATION IMPROVEMENTS IN PLACE



PORT VANCOUVER

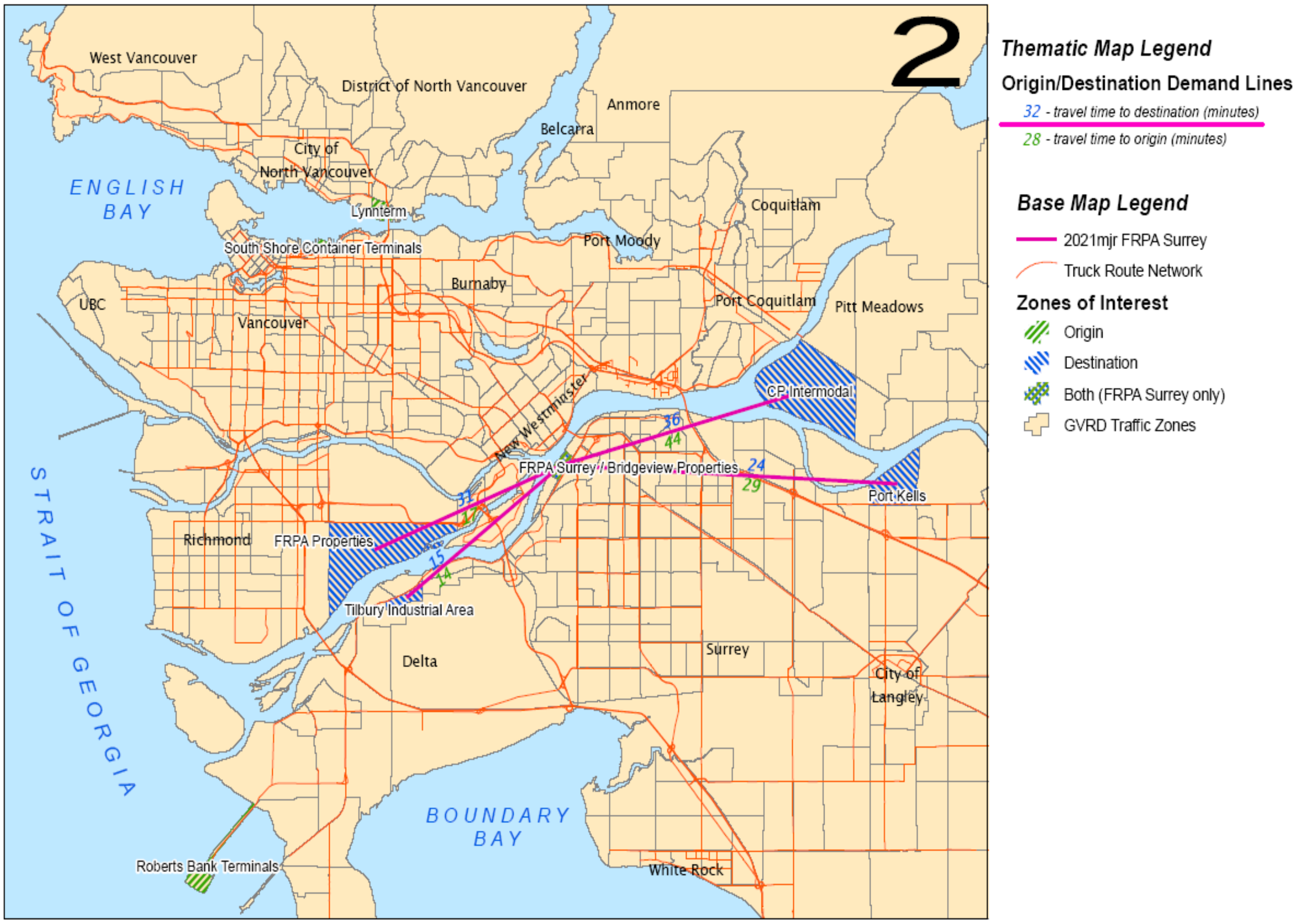
Travel Time Mapping

Travel Time from/to Deltaport - 2020 Committed and Non-Committed Major Projects

DRAFT

Scale 1:250,000
UTM Zone 10, NAD83 Datum
January 24, 2005
VPA Project G2005-003

APPENDIX B – MAP 2 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM FRASER SURREY DOCKS – 2021 WITH COMMITTED AND PLANNED TRANSPORTATION IMPROVEMENTS IN PLACE



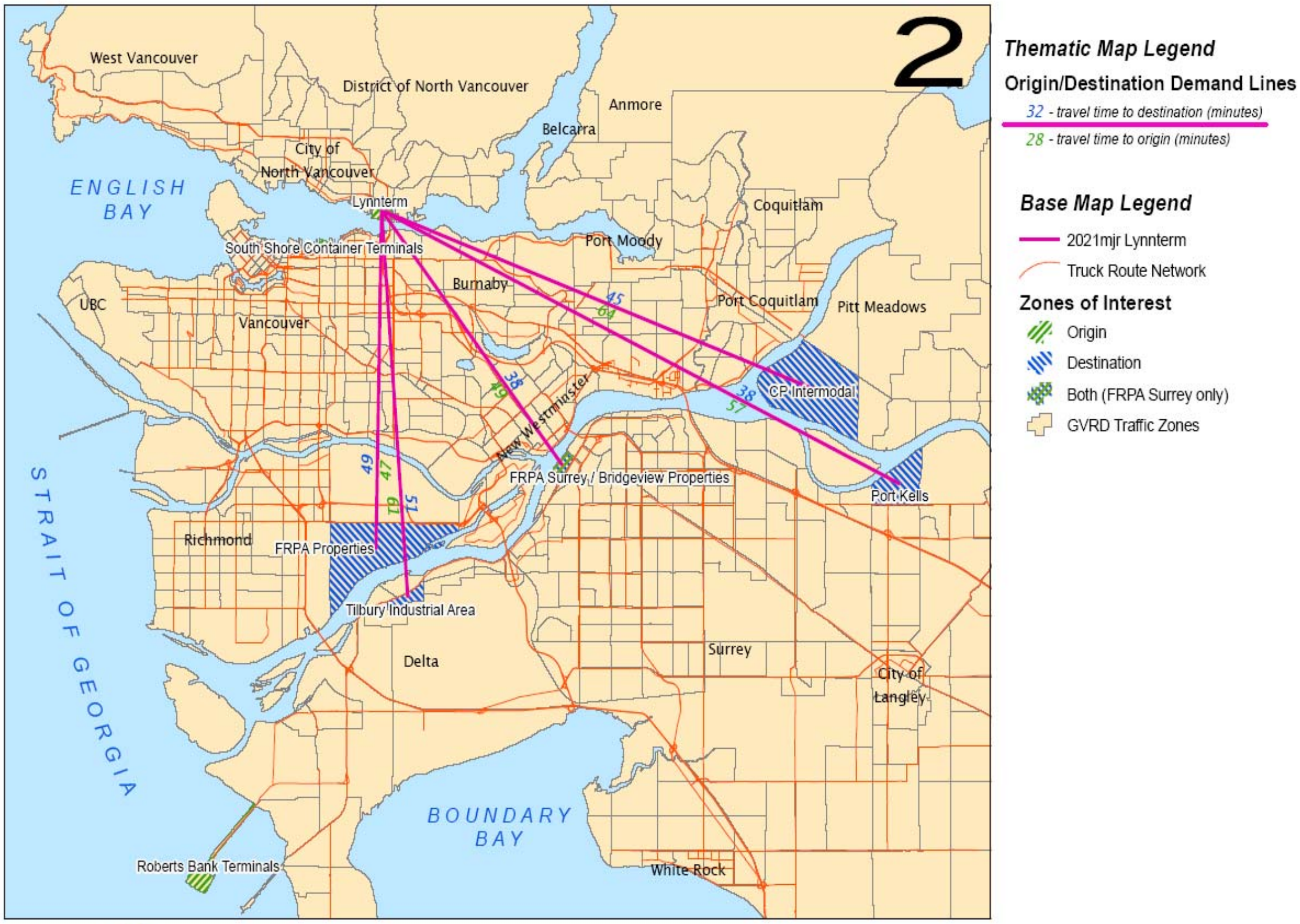
Travel Time Mapping

Travel Time from/to FRPA Surrey - 2020 Committed and Non-Committed Major Projects

DRAFT

Scale 1:250,000
UTM Zone 10, NAD83 Datum
January 24, 2005
VPA Project G2005-003

APPENDIX B – MAP 3 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM VANCOUVER INNER HARBOUR - NORTH SHORE – 2021 - WITH COMMITTED AND PLANNED TRANSPORTATION IMPROVEMENTS IN PLACE



PORT VANCOUVER

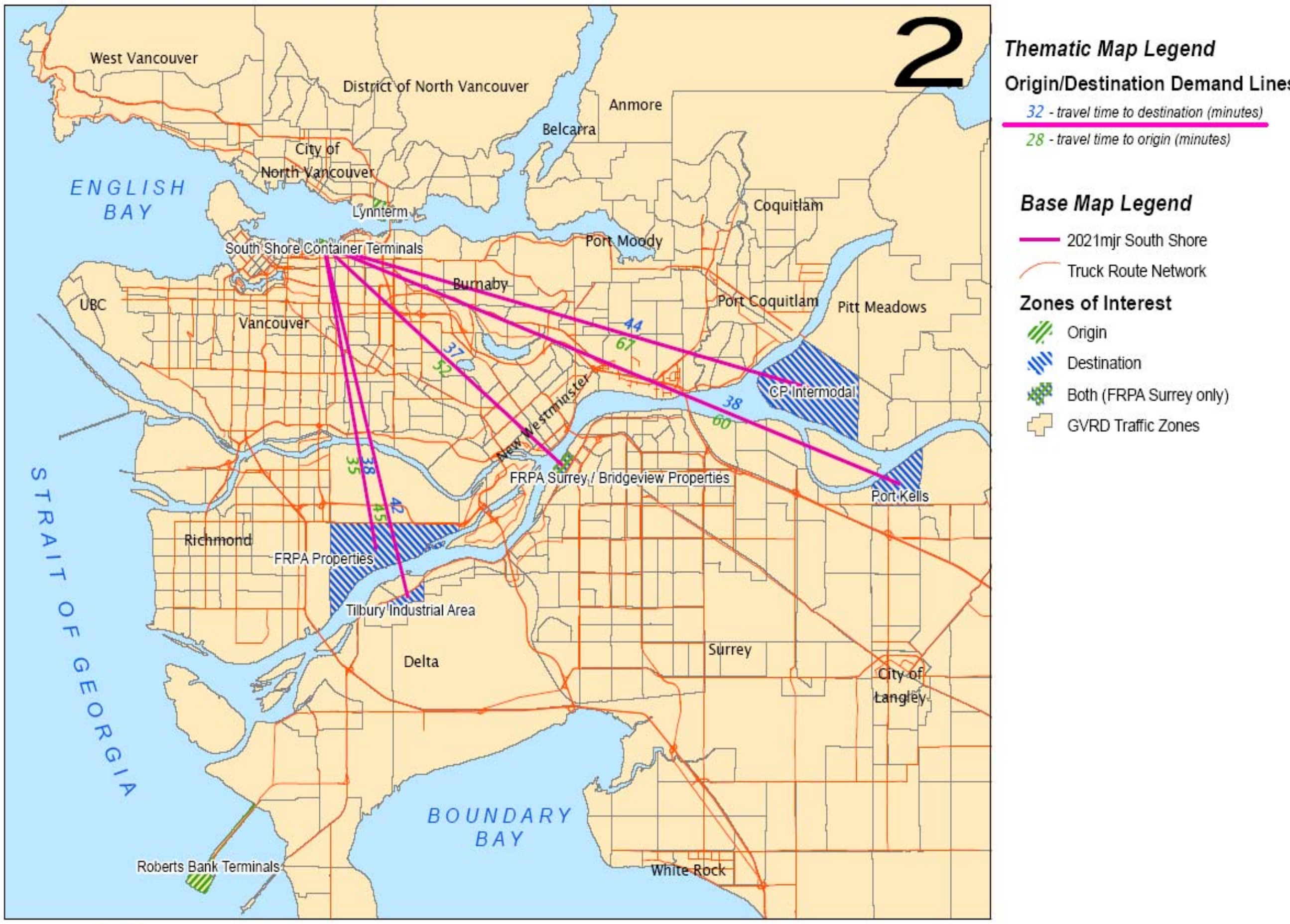
Travel Time Mapping

Travel Time from/to Lynnterm - 2020 Committed and Non-Committed Major Projects

DRAFT

Scale 1:250,000
UTM Zone 10, NAD83 Datum
January 24, 2005
VPA Project G2005-003

APPENDIX B – MAP 4 – SHORT-SEA NODE TRUCK TRAVEL TIME TO/FROM VANCOUVER INNER HARBOUR - SOUTH SHORE – 2021 - WITH COMMITTED AND PLANNED TRANSPORTATION IMPROVEMENTS IN PLACE



PORT VANCOUVER

Travel Time Mapping

Travel Time from/to South Shore - 2020 Committed and Non-Committed Major Projects

DRAFT

Scale 1:250,000
UTM Zone 10, NAD83 Datum
January 24, 2005
VPA Project G2005-003