CAMBRIDGE SYSTEMATICS

Cross Border Short Sea Shipping Study

Phase II

Final

Report

prepared for

The International Mobility and Trade Corridor (IMTC) Project

prepared by

Cambridge Systematics, Inc.

with

Moffatt & Nichol Engineers
Seaworthy Systems

January 2007

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1.0 Introduction

The Cross Border Short Sea Shipping Study is part of a coordinated, bi-national strategy to improve the efficiency and security of cross-border trade flows between the U.S. and Canada in the Cascade Gateway region. The overall goals of this two-phase study effort are to determine the feasibility of short sea shipping in the International Mobility Trade Corridor (IMTC) region, to describe the type of services that would be most feasible, and to determine the supporting actions by government necessary to encourage development of these services.

Phase 1 of the study, prepared by Cambridge Systematics and Moffatt & Nichol Engineers in March 2004, focused on the existing services that would form the foundation of any future services and an understanding of the factors that will affect the success of a future service. This report provides results from Phase 2 of the study, which involved conducting a more detailed market feasibility assessment of short sea shipping on the basis of cross-border commodity flow data, truck and rail rate research, cost and performance factors of short sea shipping, interviews with carriers and shippers, and institutional issues.

The remainder of this report is organized into the following sections:

- **Section 2: Summary of Phase 1 Report –** Provides a brief summary of the most pertinent findings from the Phase 1 Report, completed in March 2004.
- **Section 3: Summary of Commodity Flow Analysis –** Summarizes the major findings from the commodity flow analysis technical memorandum submitted to the IMTC in October 2005.
- **Section 4: Summary of Truck Rate Research –** Establishes the relevant cost characteristics of the competing truck mode.
- **Section 5: Vessel, Service, and Infrastructure Analysis –** Summarizes the major findings from the vessel, service, and infrastructure analysis technical memorandum submitted to the IMTC in March 2006.
- **Section 6: Carrier and Shipper Interview Findings –** Contains results from interviews conducted with existing cross-border carriers and shippers regarding their level of interest in a hypothetical short sea service.
- **Section 7: Spreadsheet Model Analysis –** Provides results from a spreadsheet model developed in order to assess the feasibility of short sea shipping in a variety of geographic markets and service scenarios.
- **Section 8: Institutional Issues –** Assesses the potential institutional issues that could affect the success of cross-border short sea shipping.

2.0 Summary of Phase 1 Report

The *Cross Border Short Sea Shipping Study: Phase 1 Report* was completed by Cambridge Systematics and Moffatt & Nichol Engineers in March 2004, on behalf of Transport Canada, the U.S. Maritime Administration, the Whatcom Council of Governments, and other International Mobility Trade Corridor (IMTC) stakeholders. The main objectives of this study were to:

- Profile existing cross-border coastal marine services on the West Coast of North America.
- Assess the factors that will affect the ability of coastal marine services to participate in cross-border freight movements.

2.1 PROFILE OF EXISTING SERVICES

There are relatively few existing cross-border short sea services on the West Coast of North America. Those that exist serve three primary markets: bulk raw materials and semi-finished products; passenger and cargo ferry services to/from islands; and ferry/barging services between British Columbia and Alaska. The decline in such services over the last decade have been the result of on-water natural resource plant closures, availability of more competitive truck and rail services, and an increase in deep sea container services in Vancouver with a decline in trans-shipment. In the past year, there has been growing interest in short sea shipping on the West Coast as a result of landside congestion issues, and a couple of new services have started operation. This is discussed in Section 6.4.

The dedicated West Coast cross-border short sea general freight or passenger services that were identified at the time that the Phase 1 report was completed were:

- Washington State Ferries: transports passengers and vehicles in the Vancouver and Puget Sound regions.
- Black Ball Transport: ferry services between Victoria, BC and Port Angeles, WA.
- The Alaska Marine Highway System: ferry service between Prince Rupert, BC and Ketchikan, Alaska, and between Bellingham, WA and Alaska.
- Canadian National (CN) Rail: barge service between Prince Rupert and Whittier, Alaska.
- Seasonal foot passenger ferries between Victoria and Bellingham, WA.

The specialized West Coast cross-border private short sea services are shown in Table 2.1. These generally cater to exclusive customers using private equipment.

Table 2.1 Cross-Border West Coast Private Short Sea Services

Operator	Commodities	Origins and Destinations
Canada Steamship Lines (under contract to Lehigh Ltd. & Texada Ltd.)	Aggregates, rock	BC, WA, OR, and CA ports
Cominco	Zinc	Vancouver-Alaska
Dunlap Towing Co.	Logs, wood chips, containerized freight	BC and WA ports
Foss Maritime Co.	Wood chips, petroleum, scrap metals, aggregates	BC and WA ports
Gemini Towing	Fish feed	Vancouver-WA ports
Island Tug and Barge Ltd.	Oil	Vancouver-Portland-Alaska
Lafarge	Bulk aggregates	BC ports-Seattle
Marine Petrobulk, ICS, Esso	Bunker and aviation fuel	Vancouver-U.S. ports
Nexan Chemicals	Salts	Vancouver-Mexico
Not identified	Bulk veneer	Nanaimo-WA ports
Not identified	Scrap metal, calcium carbonate	Fraser River-Tacoma
Not identified (planned)	Forest products	Nanaimo-Seattle
Norsk Pacific Ltd.	Newsprint, forest products, toys, paper, general cargo	BC, WA, and CA ports
Olympic Tug & Barge, Inc.	Oil, coal, sand, gravel, rock, containers, wood chips, clay, limestone, constr. materials	BC, WA, and OR ports
Sause Bros.	Lumber, plywood, newsprint, poles, salt, petroleum	BC, WA, OR, and CA ports
Seaspan Intl. (under contract to Lehigh Ltd. & Texada Ltd.)	Cement, aggregates	BC ports-Seattle-Portland
Western Towboat Co.	Bulk aggregates	BC and WA ports

(BC: British Columbia; WA: Washington State; OR: Oregon; CA: California)

Source: *Cross Border Short Sea Shipping Study Phase 1 Final Report*, pages 2-5 to 2-7; Cambridge Systematics, March 2004

The remaining West Coast short sea shipping services are deep sea container vessel services that use the Port of Vancouver and/or U.S. ports as part of their international port rotation. To date, these services do not transport any cargo short sea with the exception of some empty containers for repositioning. Some of the deep sea services that operate out of the Port of Vancouver are operated by:

- China Shipping: Vancouver-Seattle-Los Angeles
- CMA-CGM: Vancouver-Los Angeles
- COSCO: Vancouver-Seattle

- Evergreen: Vancouver-Tacoma-Los Angeles
- Hanjin: Vancouver-Seattle-Portland
- K Line: Vancouver-Tacoma-Portland
- New Grand Alliance: Vancouver-Seattle-Oakland-Los Angeles
- New World Alliance: Vancouver-Seattle-Tacoma-Portland-Los Angeles
- Westwood: Vancouver-other BC ports-Seattle-Longview
- Zim: Vancouver-Seattle

Short sea services are more common with respect to domestic coastal trade on both sides of the border. A total of 86 tug and barge operators were identified in BC, and 63 tug and barge operators were identified in Washington and Oregon.

2.2 FACTORS THAT AFFECT SHORT SEA SERVICES

The primary factors that affect the viability of cross-border short sea services are:

- Trade and Customs Regulations: U.S. and Canada Advance Manifest Rule; cabotage laws; tariffs and duties
- Security Issues: U.S. security initiatives; Canadian security initiatives
- Port Infrastructure: land availability; environmental permitting; local land use policy and taxation
- Vessel Infrastructure and Technology: pull or push barges; lift-on/lift-off vessels; roll-on/roll-off vessels; high-speed vessels. Each vessel type has its own load and unload requirements, capacity, and speed
- Operational Issues: market information; backhaul traffic; trip frequency; port operations; load consolidation requirements
- Institutional Issues: labor rules; public vs. private terminals; water carrier and trucking industry relationships; role of intermodal marketing companies and freight forwarders; community/ environmental impacts; U.S. Harbor Maintenance Tax; BC Ports Property Tax Act; municipal issues
- Costs: vessel cost (varies by country of manufacture); water transit cost; handling costs at the origin and destination port terminals; drayage costs to/from origin and destination terminals

3.0 Summary of Commodity Flow Analysis

The first task of Phase 2 was to establish the baseline markets for potential shortsea shipping services by identifying the current and projected flows of goods along the West Coast of North America, and assess the feasible service areas for shortsea shipping in selected commodity markets. A technical memorandum was provided to the IMTC Marine Subcommittee in October 2005 that presented the detailed methodology and results for the computation of U.S. Canada Cross-Border West-Coast commodity flows. This section summarizes the major findings from that memo.

3.1 FAVORABLE MARKETS

The markets that could be favorable for short sea shipping services were identified through the Phase 1 short sea shipping report and discussions with the IMTC Marine Subcommittee. This analysis pointed to three general potential markets for cross-border short sea services:

1. Traditional bulk/break-bulk commodity markets already handled in existing domestic short sea services that could be extended to cross-border trade.
2. Truckload (TL) and less-than-truckload (LTL) markets that could be adapted to roll-on/roll-off (ro-ro) vessel services.
3. Container-on-barge services aimed at existing containerized cargo markets (marine or intermodal container markets).

With a ro-ro vessel service, there is no clear basis for excluding any commodity groups since the same commodities that are currently shipped by truck could also be shipped by sea – the truck trailer is rolled onto the vessel at the origin port and rolled off the vessel at the destination port. However, there may be specific types of commodities that are extremely time-sensitive and must be delivered by same day service, which would not be feasible for short sea shipping.

3.2 POTENTIAL ORIGINS-DESTINATIONS

Potential origin-destination (O-D) pairs for cross-border short sea shipping operations were identified by determining O-D pairs on the West Coast with significant existing cross-border trade volumes by truck and rail, and with adequate port infrastructure and capacity to handle additional port call traffic related to cross-border short sea shipments. Reebie TRANSEARCH data

showing cross-border truck and rail commodity tonnage for 2002 was used to perform this analysis for various O-D combinations. The following O-D pairs were identified for potential cross-border short sea shipping operations:

- Vancouver, B.C. – Puget Sound region (i.e., Seattle/Tacoma), WA
- Vancouver – Portland, OR
- Vancouver – Oakland, CA
- Vancouver – Los Angeles/Long Beach, CA

For purposes of preparing an initial market assessment, areas lying within a radial distance of approximately 75 miles from the major seaports at the terminii of these O-D regions were considered to represent the geographic market capture regions for short sea shipping services. The basis for this is that distances of more than 75 miles from the ports would result in high drayage costs that would be prohibitive from a cost perspective. Table 3.1 shows the regional districts (for British Columbia) and the counties that fall within these defined regions.

Table 3.1 Geographic Market Capture Regions

Port	Counties/Regional Districts (BC) in Market Area
Vancouver	Greater Vancouver, Fraser Valley, Squamish-Lilloet, Sunshine Coast, Capital, Cowichan Valley, Nanaimo, Alberni-Clayoquot[1]
Seattle	King, Snohomish, Chelan, Kittitas, Jefferson, Mason, Kitsap, Clallam, Grays Harbor (it is assumed that Port of Tacoma has 100% share of the Thurston and Pierce markets)
Tacoma	Mason, Thurston, Pierce, Grays Harbor, Pacific, Lewis, Yakima, Kittitas, King[2]
Portland	Multnomah, Washington, Clackamas, Clark, Columbia, Cowlitz, Skamania, Clatsop, Tillamook, Yamhill, Marion, Polk, Linn, Jefferson, Wasco
Oakland	Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Marin, Sonoma, Napa, Solano, Yolo, Sacramento, San Joaquin, Stanislaus
Los Angeles/ Long Beach	Los Angeles, Orange, Ventura, Kern, San Bernardino, Riverside, San Diego, Imperial

1. While Whatcom County in Washington State is within the 75-mile market radius of the Port of Vancouver, it is assumed that there would be no incentive to move these shipments across the border and then send them back to the U.S.
2. Since subcounty-level commodity flow information is not available, Pacific and Yakima Counties have been included in the market analysis even though only a portion of these counties lies in the market coverage area.

Source: *Task 1 Technical Memorandum: West Coast Commodity Flow Analysis*, Table 3, page 7; Cambridge Systematics, October 2005

3.3 CROSS-BORDER COMMODITY FLOW ANALYSIS

The following data sources were identified for the cross-border commodity flow analysis:

- Reebie TRANSEARCH database
- Strategic Freight Transportation Analysis (SFTA) database
- IMTC Cross-Border Truck Survey database
- U.S. Customs Manifest Data (Imports)

A comparison across the various sources was conducted, which showed that TRANSEARCH cross-border flows are reasonably close to those provided by standard U.S. and Canadian trade data sources at the national, state, and provincial levels. Further, the TRANSEARCH data includes a higher level of detail in geographic disaggregation than do the standard U.S. and Canadian trade data sources. Consequently, the market flows derived from the TRANSEARCH database were selected as being the most reliable for use in this study. The results from this analysis are shown in Table 3.2 (year 2002 truck flows between regions), Table 3.3 (year 2002 rail flows between regions), and Table 3.4 (year 2002 combined truck and rail flows).

In these tables, the commodity types that are believed to be most relevant to short sea shipping (i.e., traditional bulk/break-bulk commodity markets) are provided as separate line items. For these markets, shippers have traditionally located and/or have resources (warehouse and storage facilities) near the coast, and cost is often a more important mode choice factor than time. All other commodity types, which constitute about 10 percent of the capture region truck flows and about 6 percent of the capture region rail flows, are summed together as a single line item. It should be noted that these other commodity types could also be shipped using a short sea service, provided the commodities are not extremely time sensitive in nature.

Table 3.2 Year 2002 Truck Flows Between Regions

		2002 Truck Tons							
		Vancouver-Puget Sound		Vancouver-Portland		Vancouver-Oakland		Vancouver-LA/Long Beach	
STCC	Commodity Description	NB	SB	NB	SB	NB	SB	NB	SB
1	Farm Products	370,463	166,008	48,084	24,295	58,942	10,123	69,904	9,942
11	Coal	1,953	0	126	0	9	0	0	0
14	Nonmetallic Minerals	1,054,088	27,550	33,185	16,510	9,381	1,120	850	1,055
20	Food Or Kindred Products	98,876	190,330	23,400	53,182	65,823	16,654	28,578	29,272
24	Lumber Or Wood Products	237,677	1,566,824	103,757	414,038	5,049	76,056	6,879	202,439
26	Pulp, Paper Or Allied Products	141,793	196,387	65,785	72,665	11,188	54,741	13,738	135,221
28	Chemicals Or Allied Products	186,305	86,123	60,066	21,820	14,570	2,495	22,209	6,475
29	Petroleum Or Coal Products	419,477	44,053	82,480	5,296	6,616	301	6,162	580
32	Clay, Concrete, Glass, Stone	103,070	261,402	23,189	69,963	13,694	13,299	46,002	27,844
35	Machinery	39,824	22,345	11,202	4,906	3,930	907	14,142	2,604
37	Transportation Equipment	63,085	69,047	26,582	7,573	3,723	3,952	11,523	4,527
40	Waste Or Scrap Materials	101,410	90,647	42,766	69,215	1,891	3,163	2,493	4,439
	Total: Likely Commodities	**2,818,022**	**2,720,717**	**520,622**	**759,463**	**194,816**	**182,813**	**222,480**	**424,400**
	Other Commodity Groups[1]	296,656	257,060	159,217	37,446	20,081	22,884	53,368	37,314
	Grand Total	**3,114,677**	**2,977,777**	**679,839**	**796,909**	**214,897**	**205,697**	**275,848**	**461,714**

Source: TRANSEARCH Database

1: primary metal products; fabricated metal products; rubber or misc plastics; misc manufacturing products; electrical equipment; textile mill products; furniture or fixtures; fresh fish or marine products; printed matter; apparel or related products; instruments, photo/optical equipment; leather or leather products; metallic ores; ordnance or accessories; crude petroleum or natural gas; tobacco products

Table 3.3 Year 2002 Rail Flows Between Regions

		2002 Rail Tons							
		Vancouver-Puget Sound		Vancouver-Portland		Vancouver-Oakland		Vancouver-LA/Long Beach	
STCC	Commodity Description	NB	SB	NB	SB	NB	SB	NB	SB
1	Farm Products	16	6,644	0	5,685	2	1,317	16	2,084
11	Coal	0	0	0	0	0	0	0	0
14	Nonmetallic Minerals	9,352	4,337	271	3,913	0	35	0	102
20	Food Or Kindred Products	0	2,232	0	2,953	1,669	94	692	322
24	Lumber Or Wood Products	1,615	166,019	807	217,192	16	79,653	21	203,283
26	Pulp, Paper Or Allied Products	3,702	32,646	28,088	53,191	562	22,811	680	58,347
28	Chemicals Or Allied Products	20,862	53,589	19,358	61,211	1,879	7,218	3,620	21,717
29	Petroleum Or Coal Products	18,770	1,124	4,349	784	6,969	470	6,324	838
32	Clay, Concrete, Glass, Stone	357	76,065	12	136,301	73	102	227	240
35	Machinery	23	137	0	2	0	0	0	0
37	Transportation Equipment	229	29	131	0	823	7	644	14
40	Waste Or Scrap Materials	37,050	7,579	67	8,201	1,573	3,654	2,711	2,472
	Total: Likely Commodities	**91,976**	**350,402**	**53,083**	**489,433**	**13,566**	**115,361**	**14,935**	**289,419**
	Other Commodity Groups[1]	313	26,129	9,901	11,744	532	6,773	222	29,346
	Grand Total	**92,289**	**376,530**	**62,984**	**501,177**	**14,098**	**122,134**	**15,157**	**318,765**

Source: TRANSEARCH Database

1: primary metal products; fabricated metal products; rubber or misc plastics; misc manufacturing products; electrical equipment; textile mill products; furniture or fixtures; fresh fish or marine products; printed matter; apparel or related products; instruments, photo/optical equipment; leather or leather products; metallic ores; ordnance or accessories; crude petroleum or natural gas; tobacco products

Table 3.4 Year 2002 Combined Truck and Rail Flows Between Regions

STCC	Commodity Description	2002 Total Tons (Truck and Rail)							
		Vancouver-Puget Sound		Vancouver-Portland		Vancouver-Oakland		Vancouver-LA/Long Beach	
		NB	SB	NB	SB	NB	SB	NB	SB
1	Farm Products	370,479	172,652	48,084	29,980	58,944	11,440	69,920	12,026
11	Coal	1,953	0	126	0	9	0	0	0
14	Nonmetallic Minerals	1,063,440	31,887	33,456	20,423	9,381	1,155	850	1,157
20	Food Or Kindred Products	98,876	192,562	23,400	56,135	67,492	16,748	29,270	29,594
24	Lumber Or Wood Products	239,292	1,732,843	104,564	631,230	5,065	155,709	6,900	405,722
26	Pulp, Paper Or Allied Products	145,495	229,033	93,873	125,856	11,750	77,552	14,418	193,568
28	Chemicals Or Allied Products	207,167	139,713	79,424	83,031	16,449	9,713	25,829	28,192
29	Petroleum Or Coal Products	438,247	45,176	86,829	6,080	13,585	771	12,486	1,418
32	Clay, Concrete, Glass, Stone	103,427	337,467	23,201	206,264	13,767	13,401	46,229	28,084
35	Machinery	39,847	22,482	11,202	4,908	3,930	907	14,142	2,604
37	Transportation Equipment	63,314	69,076	26,713	7,573	4,546	3,959	12,167	4,541
40	Waste Or Scrap Materials	138,460	98,227	42,833	77,416	3,464	6,817	5,204	6,911
	Total: Likely Commodities	**2,909,998**	**3,071,119**	**573,705**	**1,248,896**	**208,382**	**298,174**	**237,415**	**713,819**
	Other Commodity Groups[1]	296,969	283,188	169,118	49,190	20,613	29,657	53,590	66,660
	Grand Total	**3,206,966**	**3,354,307**	**742,823**	**1,298,086**	**228,995**	**327,831**	**291,005**	**780,479**

Source: TRANSEARCH Database

1: primary metal products; fabricated metal products; rubber or misc plastics; misc manufacturing products; electrical equipment; textile mill products; furniture or fixtures; fresh fish or marine products; printed matter; apparel or related products; instruments, photo/optical equipment; leather or leather products; metallic ores; ordnance or accessories; crude petroleum or natural gas; tobacco products

Tables 3.2 to 3.4 indicate the following:

- Summing all four O-D pairs, both directions, and both modes, the commodity group with the most volume is 24: Lumber or Wood Products (32 percent) followed by 14: Nonmetallic Minerals (i.e., stone, sand, gravel, clay - 11 percent). Most lumber or wood products are shipped southbound (89 percent); most nonmetallic minerals are shipped northbound (95 percent).
- The bi-directional commodity flows for all four O-D pairs is about 8.73 million tons annually with truck (85 percent) and about 1.50 million tons annually with rail (15 percent).
- The bi-directional commodity flows (truck and rail combined) between Vancouver and the Puget Sound region of about 6.56 million tons annually is about 3.2 times higher than Vancouver-Portland (2.04 million tons), 11.8 times higher than Vancouver-Oakland (0.56 million tons), and 6.1 times higher than Vancouver-Los Angeles/Long Beach (1.07 million tons).
- The northbound and southbound flow volumes are more balanced for the truck mode than for rail. For example, for Vancouver-Seattle/Tacoma, the annual northbound truck volume exceeds the annual southbound truck volume by 0.14 million tons (5 percent); the southbound rail volume exceeds the northbound rail volume by 0.28 million tons (308 percent).

Because Vancouver-Puget Sound commodity flows comprises the large majority of total activity, we focused on that market for the remainder of the study.

4.0 Summary of Truck Rate Research

4.1 LINE-HAUL RATES

A technical memorandum was provided to the IMTC Marine Subcommittee in October 2005 that presented cross-border truck rates. The results were based on a survey of shippers and consignees identified from the IMTC cross-border truck survey database. These results were later refined to account for the following:

- Feedback from the IMTC Marine Subcommittee was that the rates presented may be too low, as they did not include fuel surcharges.
- Short sea shipping between Vancouver BC and the Puget Sound region was considered to be the most feasible on the basis of having the most potential market volume available.
- Analysis of rail rates was not conducted given the relatively low cross-border rail tonnage volumes, as identified in Section 3.0. While the diversion of shipments from the rail mode to short sea shipping is possible, the potential market is significantly smaller than for truck to sea diversion.

Consequently, the truck rate research was updated for the Vancouver – Puget Sound corridor. Updated line-haul truck rates between Vancouver, BC and key cities in the Seattle/Tacoma area were obtained by conducting surveys of major carriers providing cross-border truckload shipping services. The surveys gathered information on line-haul truck rates and fuel surcharges for shipping between Vancouver and the key Puget Sound cities of Everett, Seattle, Tacoma, and Olympia, ports which were under consideration for providing the terminal facility for cross-border short-sea shipping services. A critical consideration in obtaining line-haul truck rates from surveys for comparison with short-sea shipping rates was the presence of back-haul. One-way line-haul rates with no back-haul guarantee for the carrier are generally higher than line-haul rates with back-haul guaranteed by the shipper. Line-haul rates with no back-haul are considered more comparable in analyzing modal diversion from truck to short-sea shipping in terms of costs, since shippers with back-haul will have the propensity to use truck mode due to lower rates, which may not necessarily be realized with back-haul in short-sea shipping.

A total of 25 carriers were successfully interviewed in April 2006, and the results of these surveys were used to estimate average line-haul (base) rates and fuel surcharges for truckload shipping between Vancouver, BC and the cities of Everett, Seattle, Tacoma, and Olympia. Table 4.1 summarizes the survey results for total line-haul truck rates by market pair.

Table 4.1 Line-Haul Truck Rates in U.S. Dollars

Market Pair	Average Base Rate	Average Fuel Surcharge	Total Rate (one-way with no back-haul)
Vancouver-Everett	$540	20%	$648
Vancouver-Seattle	$585	20%	$702
Vancouver-Tacoma	$650	20%	$780
Vancouver-Olympia	$715	20%	$858

Source: Cambridge Systematics. Some, but not all, carriers reported they would reduce the total rate by about 10 percent if the shipper has a back-haul. These numbers were rounded to $25 increments for use in Section 7.0: Spreadsheet Model Analysis.

4.2 DRAYAGE RATES

Short sea shipping requires a truck dray from the point of origin to the loading port and another dray from the discharging port to the final destination. These truck drays would be additional costs associated with short sea shipping that would not be applicable to trucking, and create a practical limit from both a cost and a time perspective with respect to the feasible market area around each port of call of short-sea shipping.

Trucking companies typically assess drayage costs in terms of fixed rates for particular mileage bands (i.e., 0-30 miles, 31-60 miles). Drayage costs for estimating the drayage component of short-sea shipping costs were determined by conducting surveys of carriers providing truck drayage services in the Puget Sound. Almost all the carriers surveyed were intermodal drayage carriers, providing container drayage services to and from the Ports of Tacoma and Seattle. Consequently, the drayage costs obtained from these carriers included the cost of empty container movement. This component of the intermodal drayage cost will not be applicable to drayage operations for roll-on/roll-off (ro/ro) services because the truck will not need to pick-up or drop-off empty containers. To account for this, the drayage costs obtained from the surveys were factored down to arrive at drayage costs applicable to ro/ro short-sea shipping. A total of 13 intermodal drayage carriers were successfully interviewed. Average ro/ro drayage rates, inclusive of fuel surcharges, derived from these survey results are presented in Table 4.2.

Table 4.2 Drayage Rates in U.S. Dollars

Base Rate		Average Fuel	Total Rate	
30 miles	60 miles	Surcharge	30 miles	60 miles
$87.50	$150.00	20%	$105.00	$180.00

Source: Cambridge Systematics.

5.0 Vessel, Service, and Infrastructure Analysis

A separate technical memorandum was developed by Moffatt & Nichol Engineers (M&N) that assesses and recommends vessels, service types, and infrastructure that would best serve a regional, cross-border short sea shipping service. This section summarizes the major findings from that memo.

5.1 VESSELS

The short sea shipping barge would most likely be a typical flat-deck type, capable of ocean service. A barge size of 400 feet by 100 feet could be used, which is a good approximation for typical barge sizes that are used in the industry. A flat-decked, roll-on/roll-off (ro-ro) barge could accommodate truck-borne shipments.

Ro-ro operations seem preferable to lift-on/lift-off (lo-lo) operations, due to greater flexibility of the types of commodities that can be shipped. Ro-ro operations were selected for further analysis in this report. There may be smaller ports and terminals within the study area with lo-lo equipment that is not being fully utilized, and therefore could be used at relatively modest marginal costs. In such cases, a combination of ro-ro and lo-lo operations could be possible.

5.2 SERVICE FEASIBILITY

M&N studied the feasibility of hypothetical short sea shipping operations on the basis of whether sufficient commodity volumes are present to support the service. The estimated commodity flows were discussed in Section 3: Summary of Commodity Flow Analysis. M&N then applied estimated truck payload factors of 21-22 tons per truckload to convert these commodity flows into estimated truck hauls. A 400′ by 100′ barge could carry about 65-75 ro-ro trailers.

In order to be cost-competitive, a short sea barge service would need to be as fully loaded as possible. For the Vancouver – Seattle trade lane, assuming a 10 percent diversion of the cross-border truck flows identified in Section 3.0 to a short-sea shipping operation, one barge movement per weekday in each direction could be supported using 400′ by 100′ barges (two barges required).

For the Vancouver – Portland market, also assuming a 10 percent market share, a daily service schedule could not be supported because the commodity volumes are much smaller. Using a 400′ by 100′ barge, nearly 1.5 barge movements per week in each direction could be supported (one barge required).

5.3 TERMINALS

For either a ro-ro or a lo-lo operation, a minimum size for a facility not contiguous to an existing facility would require 4-5 acres. A ro-ro operation would be less expensive than a lo-lo operation with respect to the terminal and yard operations. Ro-ro terminal equipment needs would be minimal, since heavy lifting equipment for container stacking would not be required. Yard equipment may be necessary to move chassis and other rolling stock onto the barge. At least one loading ramp, preferably two, would be required for moving the wheeled cargo from the pier to the barge and vice versa.

For a small non-union ro-ro service, each terminal operation may require a minimum of 4-5 workers (one clerk, two individuals for moving rolling stock, one individual for general support, and one foreman/supervisor). Additional personnel would include customs staffing requirements and company overhead (marketing, accounting, IT, management, etc.). For a union operation, additional staffing of at least 2 workers would likely be required and the labor rates would be higher. Possible alternative labor arrangements and work rules with the International Longshore and Warehouse Union (ILWU) could be investigated.

Lo-lo operations utilize heavy equipment such as mobile cranes, wharf cranes on rail, reach stackers, or top picks. This equipment would require a more costly initial terminal investment, as well as at least two additional equipment operators at each terminal relative to ro-ro operations. However, lo-lo operations for a new short sea shipping service could be practical if facilities exist that have underutilized lo-lo equipment.

As a result of these findings, we believe the most feasible option for short sea shipping would be a ro-ro service with staffing and labor rates that are comparable to those provided for the non-union case.

6.0 Carrier and Shipper Interview Findings

Interviews with cross-border carriers and shippers were conducted in order to obtain background on shipping patterns and the level of interest in short sea shipping, with the intent of using this information to estimate the market potential of short sea shipping under alternative scenarios. Carriers were interviewed as part of the study because it is likely that carrier alliances between ocean carriers and motor carriers could form a core market for short sea services. Carriers could take advantage of potentially lower costs on the line-haul portion of the move and achieve higher levels of equipment utilization on many short trips to and from the short sea terminal (as well as other local moves). Motor carriers or ocean carriers may also partner with (or act as) intermodal marketing companies (IMCs) for the purpose of making these bundled services available to their customers. A total of 31 carriers and 44 shippers were interviewed in December 2005 and January 2006.

This section contains results from a series of interviews conducted with existing cross-border carriers and shippers regarding their types of commodities carried, size and frequency of shipments, origins and destinations, current shipment costs, and level of interest in a hypothetical short sea service.

It should be noted that all of the interviews and subsequent market analysis assume a commercial short sea service operated by a common carrier. It is likely that initial short sea services may be developed to serve single customers as private services. In fact there is already evidence of some large shippers moving in this direction. The cost parameters and level of interest for this type of service is likely to be somewhat different than what has been determined in this report for a commercial service.

6.1 SHIPPING PATTERNS

Of the 75 carriers and shippers surveyed, 57 provided information on the origins and destinations they serve. Of those 57:

- All 57 (100 percent) serve the Vancouver region;
- 50 (88 percent) serve the Puget Sound region;
- 32 (56 percent) serve the Portland region;
- 15 (26 percent) serve the San Francisco Bay Area (i.e., Oakland); and
- 17 (30 percent) serve Southern California (i.e., Los Angeles/Long Beach).

The U.S. market percentages do not add to 100 percent because 33 of the survey respondents (58 percent) serve more than one U.S. region – typically Seattle plus one or more other region(s).

Commodities shipped varied widely among the 75 respondents. The most common commodity group was 24: Lumber or Wood Products (12 respondents; 16 percent) followed by 20: Food or Kindred Products (11 respondents; 15 percent). There were not enough surveys taken to determine statistically significant findings by commodity group.

Among the 17 Vancouver-Seattle shippers who indicated whether they use same day or next day delivery, 3 respondents (18 percent) used same day delivery, 13 respondents (76 percent) used next day delivery (i.e., overnight), and one respondent (6 percent) used both same day and next day delivery.

6.2 INTEREST IN SHORT SEA SHIPPING

Overall Level of Interest

Survey respondents were asked whether they would consider using a short sea ro-ro shipping service that operated on a daily schedule and was priced at least 10 percent lower than their current shipment rate. Table 6.1 shows the level of interest in this service.

Table 6.1 Interest in Short Sea Shipping

		Yes or Maybe		No	
		#	%	#	%
Carrier	Vancouver - WA and/or OR only	5	45%	6	55%
Carrier	Other or Not Stated	6	30%	14	70%
	All Carriers	**11**	**35%**	**20**	**65%**
Shipper	Vancouver - WA and/or OR only	13	50%	13	50%
Shipper	Other or Not Stated	12	67%	6	33%
	All Shippers	**25**	**57%**	**19**	**43%**
Vancouver - WA and/or OR only: All		**18**	**49%**	**19**	**51%**
Other or Not Stated: All		**18**	**47%**	**20**	**53%**
GRAND TOTAL		**36**	**48%**	**39**	**52%**

Carriers on average were less interested in short sea shipping than shippers:

- 11 of the 31 carriers (35 percent) indicated they would use or would consider using the short sea service;
- 25 of the 44 shippers (57 percent) indicated they would use or would consider using the service.

Among the 11 carriers who ship between Vancouver and Washington State and/or Oregon only, 5 expressed interest in the service (45 percent). Among the 20 other carriers, most of whom service California in addition to Washington and/or Oregon, 6 expressed interest (30 percent).

Among the 26 shippers who ship between Vancouver and Washington State and/or Oregon only, 13 expressed interest in the service (50 percent). Among the 18 other shippers, most of whom serve California in addition to Washington and/or Oregon, 12 expressed interest (67 percent).

Yes or Maybe Responses

Table 6.2 summarizes key findings from the 36 "yes or maybe" responses.

Table 6.2 "Yes or Maybe" Survey Response Findings

	Carriers (out of 11)		Shippers (out of 25)		**Both (out of 36)**	
	#	%	#	%	**#**	**%**
Cost advantage of more than 10% needed	0	0%	4	16%	**4**	**11%**
Daily service needed	2	18%	6	24%	**8**	**22%**
Would only consider for some shipments	1	9%	9	36%	**10**	**28%**
Stated truck border crossing not a problem	2	18%	1	4%	**3**	**8%**

Focusing on the 25 shipper respondents:

- Four respondents (16 percent) would need the short sea service to have a cost advantage of more than 10 percent in order to use it. For these four respondents, a cost advantage ranging from 15 to 30 percent was necessary;
- Six respondents (24 percent) would not use the short sea service if it operated on a twice weekly schedule instead of a daily schedule;
- Nine respondents (36 percent) indicated they were not willing to divert 100 percent of their shipments to the short sea service. Among these respondents, the percent willing to divert ranged from 10 to 80 percent;
- One respondent (4 percent) indicated that the truck border crossing was not a problem. The other 24 respondents either indicated the border crossing was a problem or did not address this issue.

Among the eight respondents who indicated a particular preference for an afternoon/evening cutoff time, five wanted a 4:00 pm cutoff time, one wanted a 3:30 pm cutoff, one wanted a 6:00-7:00 pm cutoff, and one wanted an 8:00-9:00 pm cutoff.

No Responses

Table 6.3 summarizes key findings from the 39 "no" responses.

Table 6.3 "No" Survey Response Findings

	Carriers (out of 20)		Shippers (out of 19)		**Both (out of 39)**	
	#	%	#	%	**#**	**%**
Is a trucking company or owns own trucks	7	35%	2	11%	**9**	**23%**
Commodity/shipment is time sensitive	6	30%	2	11%	**8**	**21%**
Distance is too short; not time-effective	1	5%	7	37%	**8**	**21%**
Origin and/or destination too far from port(s)	2	10%	5	26%	**7**	**18%**
Not enough shipment volume	2	10%	2	11%	**4**	**10%**
Used to ship by sea but found it unreliable	1	5%	0	0%	**1**	**3%**
Too much trouble or not stated	3	15%	2	11%	**5**	**13%**

Among the 19 shipper respondents, seven respondents (37 percent) thought the distance was too short and that short sea shipping would not be time-effective. Five respondents (26 percent) believed the origin and/or destination was too far from the port(s) for the short sea service to be effective (i.e., concerns about drayage time and cost).

The carriers were more likely than the shippers to indicate that they were a trucking company or owned their own trucks, and as such were not interested in short sea shipping (35 percent of the "no" responses from carriers, as opposed 11 percent of "no" responses from shippers). Carriers were also more likely than shippers to indicate that short sea shipping would not work because the commodity/shipment was time sensitive (30 percent compared to 11 percent).

Additional Comments and Questions

Many of the 39 "yes or maybe" survey respondents had additional comments and questions about the short sea service:

- Thirteen had questions about how ground transportation/drayage would be handled;
- Nine indicated that service reliability was important to them;
- Nine had questions about customs clearance/paperwork;
- Six had questions about liability/safety/insurance.

6.3 SUMMARY OF FINDINGS

The quantity of survey responses was not large enough to make any definitive estimates about the market share that a short sea service would capture. However, the following key findings are indicative of the market potential that a short sea service could have:

- 21 of the 44 shippers surveyed (48 percent) indicated they would consider using a short sea service if it operated on a daily schedule and was priced at 10 percent lower than their current shipment rate. Another four shippers

would use the service if the price was more than 10 percent less than the rate they currently pay for trucking. Among carriers surveyed, the level of interest was 35 percent.

- If the service operated on a twice weekly schedule instead of a daily schedule, still presuming a 10 percent price advantage, the number of shippers who expressed interest fell from 21 (48 percent) to 16 (36 percent). The level of interest among carriers fell to 29 percent.
- Of the 25 shippers who were receptive to a short sea service, 9 shippers (36 percent) placed a constraint on the percentage of their shipments they were willing to divert.

The most common concerns regarded drayage, reliability, customs clearance, and insurance.

6.4 ADDITIONAL RESEARCH

Additional research was conducted for two marine services that currently serve the West Coast of North America, operated by Westwood and Maruba:

- The Westwood service began operations earlier this year, running between Vancouver B.C. and Long Beach on a schedule of one round trip every 14 days (about two trips per month in each direction). The base load for the service consists of forest products for the company Weyerhaeuser; the service is also available to other companies.

  A representative from Weyerhaeuser was contacted to discuss this service. He indicated that cost is the primary factor they considered when deciding to use the service; travel time is also a consideration but is less important.

- The Maruba service is operated by Westward Shipping. As of January of this year, round trip service is provided between the ports of Vancouver B.C., Seattle, Oakland, Long Beach, Ensenada (Mexico) and Manzanillo (Mexico). The service runs about three trips per month in each direction, and primarily carries manufactured products to Canada and forest products from Canada.

  A representative from Westward Shipping was contacted to discuss the service. He acknowledged that the Maruba service is a long-haul service; it differs significantly from a short-sea service with respect to service frequency and the geography served. The service carries more cargo volume in the northbound direction then it does in the southbound direction. Being cost-competitive with trucking and getting adequate backhauls are the largest challenges for this service. Another challenge is the U.S. Jones Act, which is described in Section 8 of the report.

Two additional stakeholders who are currently investigating the possibility of cross-border short sea shipping services were interviewed (3P Logic and Bellingham Cold Storage). These stakeholders had many of the same observations as the surveyed carriers and shippers:

- Border delays (up to 2-4 hours per crossing), border surcharges (roughly $75 per movement), and the lack of delivery time reliability are the main problems with respect to cross-border trucking services. This is what is generating interest in short sea shipping.
- Understanding that short sea service will not be competitive with trucking with respect to travel time, cost competitiveness of the short sea service is therefore the most important consideration. If the short sea shipping service does not demonstrate a cost advantage, shippers are not going to use it.
- High labor costs and customs clearance rules (delays and fees) are significant barriers with respect to having a commercially viable short sea service. The use of private terminals could possibly reduce the labor costs.
- The short sea service would not be likely to attract shippers with origins or destinations that are too far inland because of the drayage costs involved.
- There are currently cross-border container vessels (primarily carrying seafood) that bypass Bellingham on the way to Seattle/Tacoma, only to have the seafood then be trucked back to Bellingham. A project to upgrade the Port of Bellingham infrastructure (i.e., put a heavy-duty dock in place) is currently underway that would allow these vessels to drop off the seafood in Bellingham on the way to Seattle/Tacoma. The project is expected to be completed in Spring 2008, possibly sooner.
- Recognizing that Bellingham is quite close to Vancouver, it was understood that a commercial short sea service between these two ports would probably not be cost competitive when compared to trucking. It therefore may make sense to look further south than Bellingham for starting a commercial service (i.e., the Seattle or Tacoma ports).

7.0 Spreadsheet Model Analysis

The purpose of the spreadsheet model developed for this study is to assess the feasibility of short sea shipping in select geographic markets and service scenarios identified as being most feasible based on previously completed tasks. Based on the commodity flow analysis results in Section 3.0, the following determinations were made regarding the originally identified potential origin-destination pairs (i.e., geographic markets):

- **Vancouver B.C. – Puget Sound region (Seattle/Tacoma), WA.** Present commodity flow volumes justify further spreadsheet model analysis.
- **Vancouver – Portland, OR; Vancouver – Oakland, CA; Vancouver – Los Angeles/Long Beach, CA.** Present commodity flow volumes do not indicate that these markets are currently viable for the implementation of regularly scheduled commercial services. These markets may become viable in the long run based on continued projected growth in commodity flow volumes, as discussed in Section 7.3 to follow.

For the Vancouver – Puget Sound market, four individual port locations in the Puget Sound region were reviewed: Seattle, Tacoma, Olympia, and Everett. Of these four port locations:

- **Seattle** and **Tacoma** were determined as being the most viable of the four for potential service consideration, due to appropriate steaming time and proximity to counties in the region with significant freight activity (i.e., King and Pierce). This is discussed further in Section 7.1 to follow.
- **Olympia** was determined as not being ideal due to the longer one-way steaming time (about 20 hours), leading to difficulty in developing a service schedule that would effectively allow for next day delivery (would leave only 4 hours for trailer discharge and drayage within the regular business day).
- **Everett** was determined as not being ideal because of low commodity volumes within the capture region (i.e., the drayage distance to/from Pierce County, which has significant freight activity, is too long).

The model parameters and results for Vancouver – Seattle and Vancouver – Tacoma service scenarios are discussed in this section, followed by an assessment of short sea shipping benefits. While the analysis to follow used fixed inputs, the model was set up to enable sensitivity analysis as well (i.e., varying cost numbers and commodity volumes).

7.1 SHORT SEA SHIPPING COSTS

The costs of the short sea shipping service, relative to the costs of competing modes described in Section 4: Summary of Truck and Rail Rate Research, is of

critical importance with respect to determining whether the service would be feasible. A short sea service will not be able to compete with a trucking service on the basis of travel time, so it is essential for the short sea service to be competitive with trucking on the basis of cost in order to generate market share. Seaworthy Systems prepared the cost analysis for this study, based on in-house knowledge of short sea service operations in other parts of the country. The findings from the cost analysis are provided to follow.

Fixed Costs

The fixed cost components of a ro-ro short sea service that do not depend on the number of shipments per barge at present were estimated as follows:

- Tug: A 5,000 horsepower tug was selected to ensure that adequate power is available to support consistent, regularly scheduled service. It is estimated to cost $6,000 per day (amortized based on a 25-year useful life).
- Barge: A 400′ by 100′ barge is estimated to cost $2,000 per day (amortized based on a 15-year useful life).
- Load and Discharge: Loading and discharging the trailers is estimated to cost $6,550 per one-way trip. The cost is considered to be fixed because the personnel need to be staffed and available regardless of the number of trailers that are loaded and discharged per trip.
- Terminal: Two six-acre terminals, each with two gates, one office, and five hostlers are assumed. The terminal cost is estimated at $2,650 per day (amortized based on a 20-year useful life).

These cost estimates assume the use of new, fuel efficient tug and barge units built in China, operated by an American/Canadian crew. If units built in the United States were used, the cost estimates would more than double. The cost estimates also assume the use of private terminals. The use of public terminals would result in significantly higher load/discharge and terminal costs due to differences in labor costs. In order for the short sea service to be cost-competitive, it is essential that the barge utilization be as high as possible so that these fixed costs are divided among a larger number of shipments.

Variable Costs

Other ro-ro service cost components are dependent on the number of shipments per barge, and at present were estimated as follows:

- Fuel: Fuel costs are estimated at $2.25 per gallon. The barge is estimated to use 208.33 gallons of fuel per hour (or $468.74 per hour) when steaming between ports, and 20.83 gallons per hour (or $46.87 per hour) when docked at a port.
- Miscellaneous: Miscellaneous costs per trailer (i.e., port charges) are estimated at $45 per trailer.
- Drayage: Estimated drayage costs per trailer are provided in Section 4.

Cost Analysis

On the basis of these fixed and variable cost estimates, the short sea service cost per trailer was estimated as a function of the barge utilization. This was done for a short sea service between Vancouver and either Seattle or Tacoma that is scheduled each weekday in each direction. Each barge would leave the origin port at 6 pm (all trailers would need to be at the port by 5 pm), steam overnight, and arrive no later than noon the following day at the destination port. This then leaves sufficient time to discharge the trailers and dray them to their final destination. Two barges are needed for this service, as shown in Table 7.1.

Table 7.1 Proposed Service Schedule

	Barge 1	Barge 2
Monday	Leaves Vancouver (6 pm)	Leaves Seattle/Tacoma (6 pm)
Tuesday	Arrives Seattle/Tacoma (by noon); Leaves Seattle/Tacoma (6 pm)	Arrives Vancouver (by noon); Leaves Vancouver (6 pm)
Wednesday	Arrives Vancouver (by noon); Leaves Vancouver (6 pm)	Arrives Seattle/Tacoma (by noon); Leaves Seattle/Tacoma (6 pm)
Thursday	Arrives Seattle/Tacoma (by noon); Leaves Seattle/Tacoma (6 pm)	Arrives Vancouver (by noon); Leaves Vancouver (6 pm)
Friday	Arrives Vancouver (by noon); Leaves Vancouver (6 pm)	Arrives Seattle/Tacoma (by noon); Leaves Seattle/Tacoma (6 pm)
Saturday	Arrives Seattle/Tacoma (by noon); Now on Barge 2 schedule	Arrives Vancouver (by noon); Now on Barge 1 schedule
Sunday	Idle	Idle

These results from the cost analysis are provided in Table 7.2 (Vancouver – Seattle; 129 miles) and in Table 7.3 (Vancouver – Tacoma; 149 miles).

Table 7.2 Cost per Trailer: Vancouver - Seattle

WATERBORNE INTERMODAL SERVICE - Between VANCOUVER and SEATTLE, WA
(100' x 400' Barge)

Nautical Miles - one way		129									
Vessel - % Loaded				100 % (1)	90 % (2)	80 % (2)	70 % (2)	60 % (2)	50 % (2)
Trailers per Day:	(100' x 400' barge)			58	52	46	41	35	29
One Way Time (Hours):	Steaming			15.6	15.5	15.3	15.2	15.1	15.0
	Port			8.4	8.5	8.7	8.8	8.9	9.0
			Total	24.0	24.0	24.0	24.0	24.0	24.0
Cost:									
Tug	(5,000 HP)	$ 6,000	/day	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
Fuel	Steaming	208.33 gals/hr.	@ $2.25/gal.	$ 7,312	$ 7,266	$ 7,172	$ 7,125	$ 7,078	$ 7,031
	Port	20.83 gals/hr.	@ $2.25/gal.	$ 394	$ 398	$ 408	$ 412	$ 417	$ 422
Barge		$ 2,000	/day	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000
Load and Discharge:		$ 6,550	/trip	$ 6,550	$ 6,550	$ 6,550	$ 6,550	$ 6,550	$ 6,550
Terminal		$ 2,650	/day	$ 2,650	$ 2,650	$ 2,650	$ 2,650	$ 2,650	$ 2,650
Miscellaneous:		$ 45	/trailer	$ 2,610	$ 2,349	$ 2,088	$ 1,827	$ 1,566	$ 1,305
Sub Total (3)				$ 27,516	$ 27,213	$ 26,868	$ 26,564	$ 26,261	$ 25,958
Total Water Cost:	Per Trailer			**$ 474**	**$ 521**	**$ 579**	**$ 654**	**$ 755**	**$ 895**
Drayage (each end)		$ 105	/trailer	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210
Total Equivalent Water Intermodal Cost:				$ 684	$ 731	$ 789	$ 864	$ 965	$ 1,105
Truck Rate:				$ 700	$ 700	$ 700	$ 700	$ 700	$ 700
Water Advantage (Disadvantage):				**$ 16**	**$ (31)**	**$ (89)**	**$ (164)**	**$ (265)**	**$ (405)**

(1) With a mix of trailer lengths, 75% - 53-foot and 25% averaging 34-feet.
(2) With a mix of trailer lengths similar to Note 1, but at an lesser load factor.
(3) Does not include any expense for Harbor Maintenance Tax, Security Charges, or Customs fees.

Source: Seaworthy Systems. Assumes short dray at each end (< 30 miles).

Table 7.3 Cost per Trailer: Vancouver - Tacoma

WATERBORNE INTERMODAL SERVICE - Between VANCOUVER and TACOMA, WA
(100' x 400' Barge)

Nautical Miles - one way		149									
Vessel - % Loaded				100 % (1)	90 % (2)	80 % (2)	70 % (2)	60 % (2)	50 % (2)
Trailers per Day:	(100' x 400' barge)			58	52	46	41	35	29
One Way Time (Hours):	Steaming			18.0	17.8	17.6	17.4	17.2	17.0
	Port			6.0	6.2	6.4	6.6	6.8	7.0
			Total	24.0	24.0	24.0	24.0	24.0	24.0
Cost:									
Tug	(5,000 HP)	$ 6,000	/day	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
Fuel	Steaming	208.33 gals/hr.	@ $2.25/gal.	$ 8,437	$ 8,344	$ 8,250	$ 8,156	$ 8,062	$ 7,969
	Port	20.83 gals/hr.	@ $2.25/gal.	$ 281	$ 291	$ 300	$ 309	$ 319	$ 328
Barge		$ 2,000	/day	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000
Load and Discharge:		$ 6,550	/trip	$ 6,550	$ 6,550	$ 6,550	$ 6,550	$ 6,550	$ 6,550
Terminal		$ 2,650	/day	$ 2,650	$ 2,650	$ 2,650	$ 2,650	$ 2,650	$ 2,650
Miscellaneous:		$ 45	/trailer	$ 2,610	$ 2,349	$ 2,088	$ 1,827	$ 1,566	$ 1,305
Sub Total (3)				$ 28,529	$ 28,183	$ 27,838	$ 27,492	$ 27,147	$ 26,802
Total Water Cost:	Per Trailer			**$ 492**	**$ 540**	**$ 600**	**$ 677**	**$ 780**	**$ 924**
Drayage (each end)		$ 105	/trailer	$ 210	$ 210	$ 210	$ 210	$ 210	$ 210
Total Equivalent Water Intermodal Cost:				$ 702	$ 750	$ 810	$ 887	$ 990	$ 1,134
Truck Rate:				$ 775	$ 775	$ 775	$ 775	$ 775	$ 775
Water Advantage (Disadvantage):				**$ 73**	**$ 25**	**$ (35)**	**$ (112)**	**$ (215)**	**$ (359)**

(1) With a mix of trailer lengths, 75% - 53-foot and 25% averaging 34-feet.
(2) With a mix of trailer lengths similar to Note 1, but at an lesser load factor.
(3) Does not include any expense for Harbor Maintenance Tax, Security Charges, or Customs fees.

Source: Seaworthy Systems. Assumes short dray at each end (< 30 miles).

The cost analysis in Tables 7.2 and 7.3 is based on these additional assumptions:

- The barges are 400' by 100'. A lower number of maximum trailers per barge were assumed than in Section 4 (58 as opposed to 65-75), which is based on a mixed load of trailer lengths (75 percent 53-footers and 25 percent 34-footers). The M&N payload factor assumption of about 21-22 tons per trailer were determined to be reasonable. The use of smaller barges is not attractive financially because there is limited reduction in the fixed costs – and those fixed costs would get spread out among fewer trailers.
- Travel time varies as a function of barge utilization. Assuming a fully loaded barge, the one-way travel time between Vancouver and Seattle is 15.6 hours (129 miles; 8.3 miles per hour). The one-way travel time for a fully loaded barge between Vancouver and Tacoma is 18.0 hours (149 miles; 8.3 miles per hour). As barge utilization decreases, travel time decreases – which reduces fuel costs but is more than offset by increases in the fixed costs per trailer.

Tables 7.2 and 7.3 show that, in the absence of harbor maintenance taxes or customs fees, a fully utilized barge can be cost-competitive with trucking at the present time assuming that short drayage charges are applicable. The cost per trailer shipment for a fully utilized barge is estimated at $684 for Vancouver-

Seattle (compared to an estimated $700 for trucking) and $702 for Vancouver-Tacoma (compared to $775 for trucking). Barge shipments at utilization levels of 90 percent or less will not be cost-competitive unless the service is subsidized.

As noted previously, the cost analysis assumes the use of chartered tug and barge units built in China and the use of private terminals. If either of these assumptions were to change, the cost analysis would be significantly different.

The Portland, San Francisco/Oakland, and Los Angeles/Long Beach markets were not considered for this analysis as the tonnage volumes at present do not justify the services at this time. These volumes relative to the volumes to/from the Puget Sound region are indicated in Section 3.3, Cross-Border Commodity Flow Analysis. The short sea service would either be too costly at frequent service intervals or would be too infrequent to generate sufficient market share.

7.2 OTHER MODEL PARAMETERS

Revisions to Commodity Volumes

With the cost information for the short sea service and the trucking mode established, the question then becomes whether there are sufficient commodity volumes present in order for the barges to be near full utilization.

The M&N report established that this is true for the Vancouver-Seattle market. Further refinements were made to the M&N analysis to take into account that the feasible drayage distance in order for the service to be cost competitive is more on the order of 30 miles, as opposed to 75 miles. The exact siting of the ports is therefore a highly relevant consideration. The impacts of these refinements were as follows:

- For the Port of Vancouver, the percentage of BC province flows within the feasible drayage distance was reduced from 90 percent to 75 percent.
- For the Port of Seattle, flows for the following counties were used: King (100 percent), Snohomish (100 percent), and Pierce (50 percent).
- For the Port of Tacoma, flows for the following counties were used: Pierce (100 percent), King (50 percent), Kitsap (50 percent), and Thurston (50 percent).

Some of the relevant distances within Washington State that were used in making these determinations included Seattle-Tacoma (35 miles), Seattle-Everett (29 miles), Seattle-Olympia (62 miles), Tacoma-Everett (61 miles), and Tacoma-Olympia (32 miles). These distances and others are provided in Table 7.4 below.

Table 7.4 also indicates the percentage of barge utilization that would be achieved with a 20 percent market capture in individual counties. This highlights the importance of King and Pierce Counties to potential service feasibility. It should be noted that King County alone has more year 2002 truck tonnage to/from Vancouver (2,113,856) than all of the counties selected for the

Portland region (1,476,748). Pierce County's year 2002 truck tonnage (712,622) is more than Oakland (420,594) and comparable to Los Angeles/Long Beach (737,562).

Table 7.4 Puget Sound County Truck Tonnages and Distances

			DAILY	TWICE WEEKLY	Miles (One-Way)			
County	Major City	2002 Truck Tons to/from Lower Mainland	% of Barge Utilization with 20% Market Capture	% of Barge Utilization with 20% Market Capture	Port of Seattle	Port of Tacoma	Port of Everett	Port of Olympia
King	Seattle	2,113,856	65%	>100%	2	33	62	29
Kitsap	Bremerton	29,540	1%	2%	70*	37	60	98*
Lewis	Centralia	66,384	2%	5%	86	56	26	113
Mason	Shelton	25,284	1%	2%	83	53	23	110
Pierce	Tacoma	712,622	22%	55%	35	2	31	62
Skagit	Mount Vernon	255,604	8%	20%	62	94	34	123
Snohomish	Everett	267,519	8%	21%	29	61	90	1
Thurston	Olympia	73,003	2%	6%	62	32	2	90

Tonnage based on 90% of BC flows (lower mainland)
% of Barge Utilization assumes 21.5 tons per trailer, 58 trailers per vessel, 52 weeks per year
*: distance shorter via Washington State Ferry

Source: Cambridge Systematics.

Chelan, Kittitas, and Yakima counties were deemed to be too far away from the ports to be considered as part of this analysis.

Market Potential

The other relevant model parameters are the market share assumptions for a particular short sea service. Because the number of carrier and shipper surveys conducted was relatively small (31 carriers and 44 shippers), the survey results were used as a measure of market potential instead of market share. The distinction between the two is that market potential represents an upper bound of the possible market share, recognizing that the actual market share could differ significantly from the assumed market potential (i.e., could be substantially lower). The survey findings are indicative of the level of interest, not actual service utilization.

The results provided in Section 6, Carrier and Shipper Interview Findings, suggest that the market potential of a Vancouver – Seattle/Tacoma short sea service that is scheduled daily and provides next day delivery would be about 40 percent of the identified truck tonnage if the short sea service has a 10 percent cost savings relative to trucking. The market potential would increase to about 50 percent if the short sea service cost savings were 20 percent, but a cost savings of this magnitude is not possible without subsidies.

7.3 MODEL RESULTS

Port of Seattle

Based on the commodity volume assumptions described previously, a year 2002 estimate of 2.28 million tons is within the feasible drayage distance from the ports of Vancouver and Seattle (sum of both directions). Using a market potential assumption of 40 percent, this equates to about 912,600 annual tons or 42,400 trailers (at an average of 21.5 tons per trailer). A daily short sea service between the two ports could carry an estimated total of 30,160 trailers annually (58 trailers per barge, 5 barges per week in each direction, 52 weeks per year). Therefore the market potential at the Port of Seattle exceeds the volume necessary for the short sea service to be viable.

However, at the present time, a 10 percent cost savings with short sea shipping is not believed to be possible at this port. Excluding harbor maintenance taxes, security charges, and customs fees, a fully utilized barge service without subsidies between the ports of Vancouver and Seattle is only estimated to yield a cost savings of 2 percent compared to trucking - which is not likely to be enough savings to yield any appreciable market diversion. As such, an annual subsidy of at least $1.6 million ($54 per trailer for 30,160 trailers) would be needed for the short sea service to run at full utilization, until the cost comparison between the two modes changes.

Port of Tacoma

Based on the year 2002 commodity volume assumptions described previously, an estimated 1.51 million tons is within the feasible drayage distance from the ports of Vancouver and Tacoma (sum of both directions). Using a market potential assumption of 40 percent, the model estimates that 602,000 annual tons or 28,000 trailers (at an average of 21.5 tons per trailer). A daily short sea service between the two ports could carry an estimated total of 30,160 trailers annually. Given the high growth rate projections in commodity volumes over time (identified in the next section on growth factors), the present market potential at the Port of Tacoma exceeds the volume necessary for the short sea service to be viable.

Excluding harbor maintenance taxes, security charges, and customs fees, a fully utilized barge service without subsidies between the ports of Vancouver and Tacoma is estimated to yield a cost savings of 9 percent compared to trucking. The use of this port therefore appears more viable from a cost perspective. Based on survey results, this could result in market diversion that is equal to or less than 40 percent of present truck volumes within short drays from the ports.

Growth Factors

In planning for short sea shipping services, it is important to note that growth rate projections in cross-border commodity volumes are high. Looking at the top four U.S. counties:

- **Lower Mainland – King County, WA.** Bi-directional growth from 2.11 million tons in 2002 to 3.13 million tons in 2012 (ten-year growth of 48 percent).
- **Lower Mainland – Pierce County, WA.** Bi-directional growth from 713,000 tons in 2002 to 1.01 million tons in 2012 (ten-year growth of 42 percent).
- **Lower Mainland – Multnomah County, OR.** Bi-directional growth from 546,000 tons in 2002 to 873,000 tons in 2012 (ten-year growth of 60 percent).
- **Lower Mainland – Los Angeles County, CA.** Bi-directional growth from 413,000 tons in 2002 to 670,000 tons in 2012 (ten-year growth of 62 percent).

Based strictly on a volume basis, while a daily service between Vancouver, BC and either Portland, OR or Los Angeles/Long Beach, CA could not be supported now or even in 2012, it would definitely be feasible by 2025. The primary factor to consider is how the cost comparison between short sea shipping and trucking will change in the long-term, as roadway congestion and fuel prices are expected to continue to increase over time.

Other Feasible Services

The findings from this study are not meant to suggest that these are the only possible current applications for short sea shipping. New cross-border short sea container/break-bulk services have recently been started by Westwood Shipping (Vancouver, BC – Long Beach, CA) and Maruba Lines (Fraserport, BC – Seattle, WA – Oakland, CA – Long Beach, CA). It should be noted though that these are services that are run on an as-needed basis by companies with large shipping volumes, and are not commercial services that run on a fixed schedule and compete directly with trucking companies for business.

Sensitivity Analysis

Model results are highly sensitive to the cost inputs. As examples:

- An increase in round-trip drayage costs of $75 would result in a subsidy of about $2.5 million annually being required at the Port of Tacoma in order for the service to be viable from a cost perspective.
- An increase in round-trip trucking costs of $50 (i.e., as a result of higher trucking fuel costs) would reduce the subsidy required for a Port of Seattle cross-border service from about $1.6 million annually to $300,000 annually. An increase in round-trip trucking costs of $75 would eliminate the need for a subsidy altogether.

Therefore, model inputs should be based on the best available information in order to improve the accuracy of model results.

7.4 ASSESSMENT OF BENEFITS

A new short sea service would have benefits associated with reduced truck traffic at the border. Using the Port of Tacoma model results from Section 7.3, the market potential for the service is 28,000 trailers annually, or roughly 108 trailers per weekday (54 trailers in each direction). If the full market potential of the service is realized, this would result in 54 fewer truck trips per weekday in each direction between the Puget Sound region and Vancouver B.C. region.

The Cascade Gateway weekday model for the year 2000 was used for this benefits analysis. This model computes three types of performance measures:

- Delay: daily vehicle-hours of delay
- Emissions: daily tons of reactive organic gases (ROG), carbon monoxide (CO), and nitrogen oxide (NOx)
- Safety: fatalities, injuries, and property damage per million vehicle-miles traveled (VMT)

The results from two model runs were compared, assessing the change in delay, emissions, and safety associated with a reduction of 54 daily truck trips in each direction between the Puget Sound – Vancouver B.C. origin-destination pair. The reduction in truck trips had the following impacts, calculated cumulatively for the entire corridor between the Puget Sound and Vancouver B.C. (relative to the base case of no change in truck trips):

- Delay: reduction in truck delay per weekday from 1,413 vehicle-hours to 1,370 vehicle-hours (reduction of 42 vehicle-hours, or 3 percent)
- Emissions: reduction in tons per weekday of ROG, CO, and NOx emissions from 15.6 tons to 14.8 tons (reduction of 0.8 tons, or 5 percent)
- Safety: reduction in fatalities, injuries, and property damage per million VMT of 3 percent

In addition to these benefits, short sea shipping can promote economic advantages such as relieving driver shortages and reducing operations/ maintenance needs for the highways and at border crossings.

8.0 Institutional Issues

This section discusses the institutional issues that could be relevant with respect to the service types and market areas that appear to be feasible for a short sea shipping operation. These issues have significant impacts on the commercial viability of a potential new short sea shipping service.

8.1 SERVICE

Maintaining a regularly scheduled service would be crucial to the economic viability of short sea shipping. An irregular service would mean that the barge, tugs, and associated equipment would not be fully utilized. This would create the need to raise the cargo rates to cover the cost of equipment down time. In addition, a regular service would provide leverage for the operator to negotiate lower labor, vessel, and terminal cost rates. Short sea shipping operators could offer better prices to the shipping company if they expect regular activity and good utilization of their resources.

The short sea shipping experience elsewhere in the U.S. suggests that the service needs to be scheduled daily in order to be competitive with trucking. A short sea service that is scheduled less than daily is not likely to be successful.

8.2 LABOR

Operations at public terminals typically cost more than operations at private facilities. Public facilities are staffed by International Longshore and Warehouse Union (ILWU) workers. ILWU employees charge higher hourly rates and operate under more restrictive work rules. In conjunction with the other cost components factored into this evaluation of shortsea shipping, current ILWU rates and work rules would result in service prices that would not be competitive with trucking rates on the subject trade lanes.

A small private non-union ro-ro facility, with associated regular service, would be more likely able to allow the operator to negotiate the type of labor rates/work rules that would make the service competitive than one associated with a public facility. In the Seattle-Tacoma area, such small private facilities might be found along the Hylebos Waterway at the Port of Tacoma and along the Duwamish Waterway at the Port of Seattle (south of the West Seattle Bridge).

8.3 REGULATIONS

There are several domestic and international laws, regulations, and restrictions that do not encourage the development of short sea shipping in the Pacific Northwest:

- Cabotage rules, via the U.S. Jones Act, require the utilization of U.S. built, flagged, and crewed vessels in order to ship cargo directly between two U.S. ports. If an operation chooses to utilize a less expensive foreign built, flagged and/or crewed vessel, the operation would not be allowed to carry cargo directly between two U.S. ports. A short sea shipping operation that, for example, begins in Portland then picks up cargo in the Seattle-Tacoma area on the way to Vancouver B.C. would not be possible with a foreign vessel. Such an operation would be forced to have ballast legs, which would result in lower efficiencies and higher costs.
- Post 9-11 security rules have added to the cost of maritime shipping. U.S. and Canadian customs now require the electronic transmission of manifest data for all marine shipments a minimum of 24 hours before the goods arrive in port. This requirement dictates that no cargo can be shipped on short notice. For trucks that cross the border, only one hour of advance notification is required.
- The U.S. Harbor Maintenance Tax is required to be paid by the cargo owner and amounts to $125 for every $100,000 of all in-coming maritime cargo. The tax does not discriminate between the size of the vessel or a vessel's point of origin. In essence, this tax penalizes cargo owners who would choose short sea shipping over more conventional trucking.
- Canada has a customs cost recovery fee requirement that is applied to all new import cargo routing. Existing ports-of-entry are grandfathered in as exempt. This policy discourages new service development.