



WorleyParsons
resources & energy



PORT METRO
vancouver



PORT METRO VANCOUVER

Projections of Vessel Calls and Movements at Deltaport and Westshore Terminals

Deltaport Terminal Road and Rail Improvement Project (DTRRIP)

09409

09409-04-GE-REP-90003-500 - Rev. B

28-Nov-11

DRAFT

WorleyParsons Canada
Suite 600, 4321 Still Creek Drive
Burnaby, BC
V5C 6S7 Canada
Phone: +1 298-1616
Facsimile: +1 298-1625
www.worleyparsons.com

© Copyright 2011 WorleyParsons



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

PROJECT 09409 - PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS

FILE LOC.: BURNABY, BC

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for review	T. Smyth	J. McKinnell	W. Major	02-Aug-11		
B	Issued for customer review	<i>T. Smyth</i> T. Smyth	<i>J. McKinnell</i> J. McKinnell	<i>W. Major</i> W. Major	28-Nov-11		



WorleyParsons

resources & energy

**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Disclaimer

The projections of WorleyParsons Canada Services Ltd. and Seaport Consultants Canada Inc. contained in this report are contingent upon factors over which WorleyParsons Canada Services Ltd. and Seaport Consultants Canada Inc. have no control and the projections are by their nature uncertain. WorleyParsons Canada Services Ltd. and Seaport Consultants Canada Inc. provide no warranties that actual events will not vary from the projections of WorleyParsons Canada Services Ltd. and Seaport Consultants Canada Inc.

DRAFT

**PORT METRO VANCOUVER****PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRIP)****EXECUTIVE SUMMARY**

This report develops projections of ship movements at the Roberts Bank port area of Port Metro Vancouver (PMV). These include container ships calling at the Deltaport container terminal and at the coal terminal of Westshore Terminals. The report uses traffic projections in conjunction with projections of vessel size characteristics to generate ship calls and ship movements. Projections for three cases are provided.

The report deals first with container traffic. It uses a base year 2010 ship size distribution for Deltaport and projections of changing ship characteristics over time to develop likely projections of container ship size distributions in future years. Table A summarizes the container ship size distributions that result from this exercise. As one moves out in time to the right in the table, the smaller vessels in the upper left slowly disappear to be replaced by larger vessels to the lower right. The average container ship size at Deltaport in 2010 was approximately 6,000 twenty-foot equivalent container units (TEU); the projected ship size for 2030 is approximately 9,500 TEU.

The trend towards increasing container ship size in Port Metro Vancouver has been evident for at least the last dozen years and it is consistent with the numbers of large container ships that have been delivered in recent years and are on order today. There is a reasonably strong correlation between the average container ship size in PMV and that of the world fleet.

Table A Projected Deltaport Container Ship Distributions Actual 2010 to 2030

	Actual		Projected		
Item	2010	2015	2020	2025	2030
Distribution of Vessel Capacity (Percent of Ships)					
<= 2,000	0	0	0	0	0
2,000 - 3,000	3	0	0	0	0
3,000 - 4,000	0	0	0	0	0
4,000 - 5,000	12	3	0	0	0
5,000 - 6,000	30	22	12	2	0
6,000 - 7,000	16	16	11	6	1
7,000 - 8,000	9	15	15	15	15
8,000 - 9,000	27	32	35	35	35
9,000 - 10,000	0	5	14	17	17
>10,000	3	7	13	25	32
Total	100	100	100	100	100

Sources: Consultant estimates, 2011.



PORT METRO VANCOUVER

PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRIP)

In the case of ship calls at Westshore Terminals, data was obtained from Westshore on coal shipments and ship calls over the last 30 years. This was used as the basis for projecting the cargo lot sizes (the average tonnage of coal loaded onto each ship), which in recent years has been quite consistently 100,000 tonnes per ship call. The report also briefly reviews the outlook for the coal market and the prospects for increased capacity at Westshore Terminals. The end result is a projection of coal exports and numbers of ship calls and movements.

Table B summarizes the results for all types of vessels calling at the two terminals at Roberts Bank: Deltaport (containers) and Westshore (coal). The table includes actual numbers for 2010 and projections for 2014 to 2030. It also includes cargo volumes. Projections of vessel calls and movements by vessel type are summarized in Tables R and S of this report. Details of container vessel projections for selected years are in Tables I to K and details of coal ship projections for selected years are in Table Q.

There are three projection cases:

- Case 1: High "Direct" container traffic projection. Deltaport has a sustainable capacity of 2.4 million TEU. Container vessel sizes are as in Table A. Deltaport has a maximum capacity of 3.0 million TEU in interim years of high demand. Maximum Westshore throughput is 35 million tonnes of coal.
- Case 2: High "Direct" container traffic projection. Deltaport has a sustainable capacity of 3.0 million TEU. Container vessel sizes are as in Table A. Maximum Westshore throughput is again 35 million tonnes of coal.
- Case 3: High "Direct" container traffic projection. Deltaport has a sustainable capacity of 3.0 million TEU. Container call size remains at 2010 level of 6,250 TEU per ship call. Maximum Westshore throughput is again 35 million tonnes of coal.

Deltaport in 2010 had a split service that called twice at the terminal: the first call to discharge import containers and the second call to load export containers. Between the Deltaport calls, the vessel visited a U.S. Pacific Northwest port. The split service adds 52 vessel calls and 104 movements for 2010. Although unusual, this practice was assumed to persist at Deltaport in all projection years so as not to understate potential ship movements. The ship movements in the summary table reflect this service.

In 2010, there were approximately 1,100 ship movements at the Roberts Bank terminals. The 2030 projections range from 1,300 vessel movements in Case 1 to 1,700 vessel movements in Case 3.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRIP)**

Table B Summary of Vessel Movement Projections for Deltaport and Westshore

Case / Year	Cargo Volume (Million)		Average Ship Movements			Peak Ship Movements	
	Containers (TEU)	Coal (Tonnes)	Annual	Monthly	Daily	Monthly	Daily
Case 1							
2010	1.54	24.7	1,086	91	3	105	10
2014	1.74	25.0	1,124	94	3	109	10
2015	2.02	26.0	1,144	95	3	111	10
2016	2.28	27.0	1,268	106	3	122	10
2017	2.55	28.0	1,392	116	4	133	10
2018	2.85	29.0	1,412	118	4	136	10
2019	3.00	30.0	1,432	119	4	138	10
2020	2.40	31.0	1,348	112	4	131	10
2021	2.40	32.0	1,368	114	4	133	10
2022	2.40	33.0	1,388	116	4	135	10
2023	2.40	34.0	1,408	117	4	137	10
2024	2.40	35.0	1,428	119	4	140	10
2025	2.40	35.0	1,324	110	4	130	10
2026	2.40	35.0	1,324	110	4	130	10
2027	2.40	35.0	1,324	110	4	130	10
2028	2.40	35.0	1,324	110	4	130	10
2029	2.40	35.0	1,324	110	4	130	10
2030	2.40	35.0	1,324	110	4	130	10
Case 2							
2010	1.54	24.7	1,086	91	3	105	10
2014	1.74	25.0	1,124	94	3	109	10
2015	2.02	26.0	1,144	95	3	111	10
2016	2.28	27.0	1,268	106	3	122	10
2017	2.55	28.0	1,392	116	4	133	10
2018	2.85	29.0	1,412	118	4	136	10
2019	3.00	30.0	1,432	119	4	138	10
2020	3.00	31.0	1,452	121	4	140	10
2021	3.00	32.0	1,472	123	4	142	10
2022	3.00	33.0	1,492	124	4	144	10
2023	3.00	34.0	1,512	126	4	146	10
2024	3.00	35.0	1,532	128	4	149	10
2025	3.00	35.0	1,532	128	4	149	10
2026	3.00	35.0	1,532	128	4	149	10
2027	3.00	35.0	1,532	128	4	149	10
2028	3.00	35.0	1,428	119	4	140	10
2029	3.00	35.0	1,428	119	4	140	10
2030	3.00	35.0	1,428	119	4	140	10
Case 3							
2010	1.54	24.7	1,086	91	3	105	10
2014	1.74	25.0	1,228	102	3	118	10
2015	2.02	26.0	1,248	104	3	120	10
2016	2.28	27.0	1,372	114	4	131	10
2017	2.55	28.0	1,496	125	4	143	10
2018	2.85	29.0	1,620	135	4	154	10
2019	3.00	30.0	1,640	137	4	156	10



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRIP)**

Case / Year	Cargo Volume (Million)		Average Ship Movements			Peak Ship Movements	
	Containers (TEU)	Coal (Tonnes)	Annual	Monthly	Daily	Monthly	Daily
2020	3.00	31.0	1,660	138	5	158	10
2021	3.00	32.0	1,680	140	5	160	10
2022	3.00	33.0	1,700	142	5	163	10
2023	3.00	34.0	1,720	143	5	165	10
2024	3.00	35.0	1,740	145	5	167	10
2025	3.00	35.0	1,740	145	5	167	10
2026	3.00	35.0	1,740	145	5	167	10
2027	3.00	35.0	1,740	145	5	167	10
2028	3.00	35.0	1,740	145	5	167	10
2029	3.00	35.0	1,740	145	5	167	10
2030	3.00	35.0	1,740	145	5	167	10

Sources: Consultant estimates, 2011.

DRAFT



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

CONTENTS

1. INTRODUCTION..... 1

2. CONTAINER SHIPS 2

 2.1 Port Metro Vancouver Container Vessel Services..... 2

 2.2 The World Container Ship Fleet..... 9

 2.3 Port Metro Vancouver Average Container Ship Size and TEU per Call..... 13

 2.4 Projection of Container Ship Calls and Movements 17

3. COAL SHIPS AT WESTSHORE TERMINALS 28

 3.1 Trends in Coal Shipments..... 28

 3.2 Coal Market Outlook 32

 3.3 Outlook for Westshore Exports 36

 3.4 Projection of Coal Ship Calls and Movements..... 36

4. OVERALL SHIP MOVEMENT PROJECTIONS..... 38

Tables

TABLE A PROJECTED DELTAPORT CONTAINER SHIP DISTRIBUTIONS ACTUAL 2010 TO 2030 III

TABLE B SUMMARY OF VESSEL MOVEMENT PROJECTIONS FOR DELTAPORT AND WESTSHORE V

TABLE C PORT METRO VANCOUVER CONTAINER SERVICES 1999 TO 2010 4

TABLE D INCREMENTAL CHANGES IN AVERAGE SHIP SIZE AND TEU PER SHIP CALL 1999 TO 2010 5

TABLE E PORT METRO VANCOUVER CONTAINER SHIP SIZE DISTRIBUTIONS 1999 TO 2011 6

TABLE F SIZE DISTRIBUTIONS OF CONTAINER SHIPS CALLING AT PORT METRO VANCOUVER AND DELTAPORT 2010 8

TABLE G DELTAPORT VESSEL SIZE DISTRIBUTIONS ACTUAL 2010 TO PROJECTED 2030 19



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRIP)**

TABLE H	PROJECTED DELTAPORT CONTAINER VOLUMES 2015 TO 2030	22
TABLE I	CASE 1 DELTAPORT CONTAINER SHIPPING SERVICES ACTUAL 2010 TO PROJECTED 2030	23
TABLE J	CASE 2 DELTAPORT CONTAINER SHIPPING SERVICES ACTUAL 2010 TO PROJECTED 2030	24
TABLE K	CASE 3 DELTAPORT CONTAINER SHIPPING SERVICES ACTUAL 2010 TO PROJECTED 2030	26
TABLE L	COAL EXPORTS BY TERMINAL 2001 - 2010.....	28
TABLE M	WESTSHORE COAL SHIPMENTS BY DESTINATION 2008 TO 2010.....	29
TABLE N	WESTSHORE COAL EXPORT ACTIVITY 1970 TO 2010.....	29
TABLE O	WORLD METALLURGICAL COAL TRADE OUTLOOK 2011 TO 2016.....	34
TABLE P	WORLD THERMAL COAL TRADE OUTLOOK 2011 TO 2016.....	35
TABLE Q	WESTSHORE TERMINALS SHIP CALLS AND MOVEMENTS ACTUAL 2010 TO PROJECTED 2030	37
TABLE R	ANNUAL VESSEL PROJECTIONS FOR DELTAPORT AND WESTSHORE	39
TABLE S	MONTHLY AND DAILY VESSEL PROJECTIONS FOR DELTAPORT AND WESTSHORE	42

Figures

FIGURE A	PORT METRO VANCOUVER CONTAINER SHIP SIZE DISTRIBUTIONS 1999 TO 2010	7
FIGURE B	TRENDS IN WORLD CONTAINER SHIP FLEET COMPOSITION 1990 TO 2015 (NUMBER OF SHIPS)	10
FIGURE C	TRENDS IN WORLD CONTAINER SHIP FLEET COMPOSITION 1990 TO 2015 (TEU CAPACITY).....	11
FIGURE D	POST PANAMAX CONTAINER SHIP DELIVERIES BY YEAR AND SIZE CLASS 1985 TO 2015 (NUMBER OF SHIPS)	12
FIGURE E	POST PANAMAX CONTAINER SHIP DELIVERIES BY YEAR AND SIZE CLASS 1985 TO 2015 (TEU CAPACITY).....	13



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRIP)**

FIGURE F AVERAGE CONTAINER SHIP SIZE: PORT METRO VANCOUVER VERSUS
WORLD FLEET 14

FIGURE G AVERAGE PORT METRO VANCOUVER CONTAINER SHIP SIZE AS
FUNCTION OF AVERAGE WORLD FLEET CONTAINER SHIP SIZE 15

FIGURE H PORT METRO VANCOUVER TEU MOVES PER VESSEL CALL 1995 TO
2010 16

FIGURE I PROJECTED CONTAINER SHIP SIZE DISTRIBUTIONS AT DELTAPORT 21

FIGURE J WESTSHORE VESSEL CALLS 1970 TO 2010 30

FIGURE K WESTSHORE EXPORT TONNAGE PER VESSEL CALL 1970 TO 2010 32

FIGURE L B.C. COAL PRODUCTION AND VALUES 1980 TO 2010 33

DRAFT



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

1. INTRODUCTION

This report deals with shipping services at Port Metro Vancouver (PMV) of relevance to the Container Capacity Improvement Program (CCIP) and trends in their characteristics over time. It first addresses container shipping services for the port as a whole and those calling at Deltaport. It then addresses coal ships calling at the Roberts Bank coal terminal of Westshore Terminals.

The main outputs from this report are:

- Estimates of 2010 and future container shipping services and their characteristics for Deltaport: 2010 actual and projections for various years out to 2030.
- Estimates of the number of container ship calls and movements at Deltaport in 2010 and projections for various years out to 2030.
- Estimates of the number of coal ship calls and movements at Westshore Terminals in 2010 and projections for various years out to 2030.

DRAFT



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

2. CONTAINER SHIPS

2.1 Port Metro Vancouver Container Vessel Services

This section uses three general sources of data for the evaluations. One is a series of container shipping schedules developed for particular years over the past dozen years for other projects. The other data sources are major statistical databases of the world container ship fleet and the container vessels that called at Port Metro Vancouver in 2010.

This section uses estimates of container shipping schedules for Port Metro Vancouver in early 2011 and previous years to develop characteristics of the container ships over time. The sources of data were published schedules of container services, online databases of shipping schedules from *Containerisation International* and in some cases the online vessel schedules of container shipping lines. The data includes estimates of average vessel size for each service but not the actual sizes of individual vessels in the service strings. The data was created as part of past projects with focuses that differed from those of the CCIP. In general, the previous studies involved market reviews of container shipping services as part of feasibility studies of container terminals and the main focus was on the potential container terminal market. Nevertheless, the data collected for the past shipping services provides reasonable estimates of their characteristics at the time and are useful as a guide to trends in Port Metro Vancouver over time. The data in the earlier years includes Fraser Port and Port of Vancouver together, which is consistent with recent data for Port Metro Vancouver.

Table C begins the review by summarizing the characteristics of the container shipping services calling at Port Metro Vancouver for a sample of four years between 1999 and 2010. The schedule characteristics for 2010 were developed from data in early 2011. While there may have been some minor changes in vessel patterns between 2010 and early 2011, they are sufficiently small to ignore for the purposes of this review.

The table uses the term “slot capacity,” which is defined as the product of container ship TEU capacity and the number of port calls, yearly in the table. If a ship discharged and loaded its full slot capacity, the vessel would generate container traffic equal to two times its TEU capacity. But this rarely happens: container vessels almost always load and discharge a portion of their TEU capacity in each port of call. Slot capacity is useful primarily as a measure of aggregate container shipping services to a port; it also provides a way to calculate a weighted average size of ships for a service or a port.

The table is broken into three sections. The first deals with all vessels and services in PMV, the second covers larger vessels only, generally those of Panamax size and larger, and the third only the services that called at Deltaport.

**PORT METRO VANCOUVER****PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

For the port as a whole (all vessels and services), slot capacity increased from approximately 2.2 million TEU in 1999 to about 3.7 million TEU in 2010 (growth rate of 4.7% a year). The average ship TEU capacity increased from approximately 2,500 TEU in 1999 to 4,800 TEU in 2010, an increase of 5.9% per year. The number of container ship calls declined, from 842 in 1999 to 739 in 2010. This was due to both the increasing size of ships and the increasing utilization of the slot capacity of the ships. The number of shipping services declined slightly from 18 in 1999 to 16 in 2010 for similar reasons. The table also lists the container traffic in the ports in these years, ranging from 1.1 million TEU in 1999 to 2.5 million TEU in 2010, a growth rate of 7.8% a year over this period. The ratio of container traffic to slot capacity increased from about 50% in 1999 to 70% in 2010. The final line in this section is the TEU volume discharged and loaded per ship call taken from Port Metro Vancouver data. It has increased consistently from about 1,800 TEU in 1999 (Port of Vancouver) to 3,600 TEU in 2011 (Port Metro Vancouver). Note that these volumes are in TEU; it is most common to discuss activity per ship call in terms of container lifts but in this particular study the focus is on container TEU.

In the case of large vessels only, smaller ships, generally the Westwood combined forest products / container carriers and those calling at Fraser Surrey docks, were eliminated from the calculations. The main focus regarding these vessels is on average ship TEU capacity. In this case, it ranged from 2,700 TEU in 1999 to 6,000 TEU in 2010, an increase of 7.6% a year. With this adjustment, the average size of 6,000 TEU for PMV is very close to that of all West Coast ports. An article in *Containerisation International* provided schedule data for the U.S. West Coast ports in April 2011 and from this data it was possible to estimate average ship sizes¹. The larger ship services between the U.S. West Coast ports and Asia, in both California and Puget Sound, were also about 6,000 TEU. In the case of California, the ship sizes were adjusted by eliminating the small U.S.-flag carriers that provide some services to Asia; this was comparable to removing the Westwood and Fraser Surrey Docks ships from PMV data.

In the case of Deltaport only, slot capacity increased at almost twice the rate for PMV as a whole (8.0% a year) and the average ship capacity increased from about 2,700 TEU in 1999 to about 6,400 TEU in 2010. The number of container ships calls at Deltaport and the number of services remained constant over this period. It should be noted that in 2010 one container shipping service called twice at Deltaport each week: once to discharge containers and the second time to load containers. Between the Deltaport calls, the vessel visited a U.S. Pacific Northwest port. This would add another 52 vessel calls to the 260 in the table but involves only one effective ship call and the 260 number was used for this reason. It would add 104 vessel movements and this is utilized in vessel movement estimates below. The TEU volume per ship call is from TSI Terminal Systems Inc. (TSI) data. It ranges from about 2,000 TEU in 1999 to over 6,000 TEU in 2010. In 2010, the TEU volume per ship call was approximately equal to ship TEU capacity.

¹ Rebecca Moore, "Tug-of-war," *Containerization International*, May 2011.

**PORT METRO VANCOUVER****PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)****Table C Port Metro Vancouver Container Services 1999 to 2010**

					Growth (%/a)
Item¹	1999	2003	2008	2010	1999 - 2010
All Vessels and Services					
Slot Capacity (TEU)	2,156,005	3,642,772	4,070,164	3,567,780	4.7
Average Ship TEU Capacity	2,561	3,404	4,615	4,831	5.9
Number of Ship Calls	842	1,070	882	739	-1.2
Number of Shipping Services	18	22	19	16	-1.1
Container Traffic (TEU)	1,102,092	1,791,568	2,492,107	2,514,309	7.8
Traffic / Slot Capacity Ratio	51%	49%	61%	70%	3.0
TEU / Ship Call ²	1,802	2,028	2,915	3,551	6.4
Large Vessels Only³					
Slot Capacity (TEU)	1,927,530	3,063,372	3,608,020	3,139,151	4.5
Average Ship TEU Capacity	2,707	3,927	5,337	6,037	7.6
Number of Ship Calls	712	780	676	520	-2.8
Number of Shipping Services	14	15	13	10	-3.0
Deltaport Only					
Slot Capacity (TEU)	709,322	1,487,200	981,708	1,661,845	8.0
Average Ship TEU Capacity	2,728	4,086	4,720	6,392	8.0
Number of Ship Calls ⁴	260	364	208	260	0.0
Number of Shipping Services	5	7	4	5	0.0
TEU / Ship Call ⁵	2,005	2,492	4,965	6,116	10.7

Sources: Vessel information from published schedules, *Containerisation International* database and shipping line web sites. Container traffic and TEU per ship call for PMV from Port Metro Vancouver, 2011.

Notes:

¹ Data in most cases is for Port of Vancouver and Fraser Port combined for 1999 and 2003, and for Port Metro Vancouver in 2008 and 2010.

² Data is for Port of Vancouver alone for 1999 and 2003, and for Port Metro Vancouver in 2008 and 2010.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

³ Excludes Westwood services and services calling at Fraser Surrey Docks.

⁴ One Deltaport service called twice at the terminal in 2010: once to discharge containers and the other to load. The 260 ship calls in the table count this split service only once.

⁵ Data from TSI Terminal Systems Inc., 2011.

Table D provides estimates from the data in Table C of the incremental changes between 1999 and 2010 broken down into the three individual periods and the entire period 1999 to 2010. The first section deals with the average ship size for all vessels and services. The increase in each year ranges from 108 TEU to 242 TEU. This means, for example, that between 1999 and 2010 in each year the average ship capacity increased by 206 TEU. For large vessels only, the annual increase is higher, typically between 200 and 400 TEU. For Deltaport, the changes are more volatile but are generally the highest of the three categories summarized in this table. Between 2008 and 2010, for example, the Deltaport ships increased 836 TEU per year and the long-term average was 333 TEU per year.

In terms of increments of TEU handled per ship call for all vessels and services the range was between 57 and 318 depending on the period, and the long-term average was 159 TEU. For Deltaport alone, the increases were much greater: long-term average of 374 TEU and between 2008 and 2010, 575 TEU.

These incremental values are used as a guide later in this report to project average ship size and average TEU call size as part of building up the characteristics of container shipping in future years.

Table D Incremental Changes in Average Ship Size and TEU per Ship Call 1999 to 2010

Item	Increases by Period (TEU per Year)			
	1999-2003	2003-2008	2008-2010	1999-2010
Average Ship Size (TEU)				
All Vessels and Services	211	242	108	206
Large Vessels Only	305	282	350	303
Deltaport	339	127	836	333
TEU Handled per Ship Call				
All Vessels and Services	57	177	318	159
Deltaport	122	494	575	374

Source: Calculated from data in Table C.

**PORT METRO VANCOUVER****PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Table E again uses the schedule data to provide estimates of numbers of services by ship size between 1999 and 2011. The total number of services is the same as in Table C but the table illustrates the changing pattern of ship sizes. The upper part of the table addresses all vessels and services in PMV; the port lower part addresses Deltaport. In both categories, there is a general shift in the number of vessel services from the upper left of the table (many smaller ships up to a maximum of 6,000 TEU in 1999) to larger ships to the lower right, including those in excess of 8,000 TEU. In the case of Deltaport, all vessels have shifted from less than 5,000 TEU in 1999 to predominantly above 5,000 TEU in 2010. In 2010 the average container vessels of two services are in excess of 7,000 TEU.

Table E Port Metro Vancouver Container Ship Size Distributions 1999 to 2011

Vessel Size (TEU)	Number of Services by Ship TEU Class				Growth (%/a)
	1999	2003	2008	2010	1999 - 2010
All Vessels and Services					
<= 2,000	7	5	3	3	-6.8
2,000 - 3,000	8	6	2	3	-7.8
3,000 - 4,000	1	5	3	1	0.0
4,000 - 5,000	1	5	2	0	
5,000 - 6,000	1	1	6	5	14.4
6,000 - 7,000	0	0	2	2	
7,000 - 8,000	0	0	1	1	
> 8,000	0	0	0	1	
Total	18	22	19	16	-1.0
Deltaport					
<= 2,000	2	0	0	0	
2,000 - 3,000	1	2	0	0	
3,000 - 4,000	1	2	1	1	
4,000 - 5,000	1	2	1	0	
5,000 - 6,000	0	1	2	1	
6,000 - 7,000	0	0	0	1	
7,000 - 8,000	0	0	0	1	
> 8,000	0	0	0	1	
Total	5	7	4	5	0.0

Sources: Estimated from published schedules, *Containerisation International* database and shipping line web sites.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Notes: Data is for Port of Vancouver and Fraser Port combined for 1999 and 2003, and for Port Metro Vancouver in 2008 and 2010.

Figure A repeats the data in Table E. The data, for PMV as a whole, shows the relatively small vessels in 1999, the emergence in 2003 and 2008 of increasingly large ships, and 2010 with a “long tail” that extends to over 8,000 TEU.

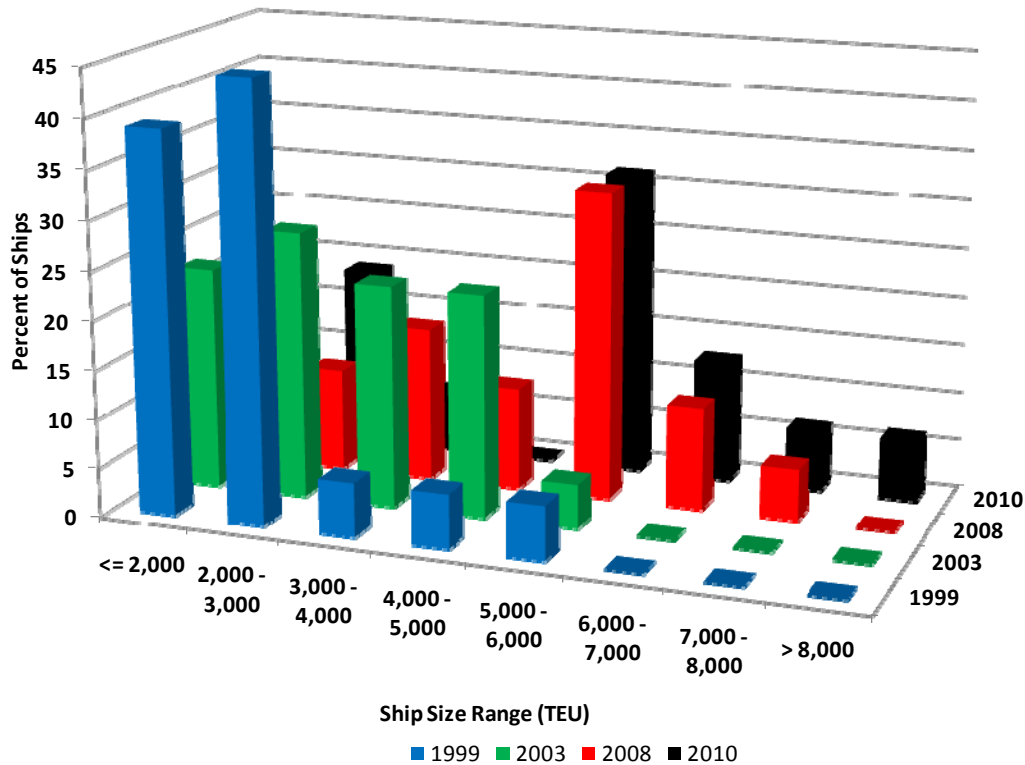


Figure A Port Metro Vancouver Container Ship Size Distributions 1999 to 2010

Sources: Estimated from published schedules, *Containerisation International* database and shipping line web sites.

Notes: Data is for Port of Vancouver and Fraser Port combined for 1999 and 2003, and for Port Metro Vancouver in 2008 and 2010.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Table F utilizes ship call data for Port Metro Vancouver in 2010 broken down into the port as a whole and Deltaport. It presents the data in terms of numbers of ships and percent distributions for these two categories. The table also provides a more detailed breakdown of the larger ships than above: it includes the categories of 8,000 to 9,000 TEU, 9,000 to 10,000 TEU and greater than 10,000 TEU. It shows, for example, that in Deltaport a reasonably large number of ship calls were between 8,000 and 9,000 TEU and a few ships were in excess of 10,000 TEU. The table again shows that Deltaport has few ships under 4,000 TEU (these are particular vessels in a service that mixes a number of smaller ships with significantly more large vessels).

This data set for 2010 provides the basis for the projections later in this report. In general, actual 2010 data from Port Metro Vancouver provides the statistical base for the projection of future vessel characteristics and the schedule-related data discussed above provides background for the changes over time of these ship characteristics.

Table F Size Distributions of Container Ships Calling at Port Metro Vancouver and Deltaport 2010

Vessel Capacity TEU)	Number of Ship Calls		Percent Distribution	
	PMV	Deltaport	PMV	Deltaport
<= 2,000	84	0	12	0
2,000 - 3,000	97	8	14	3
3,000 - 4,000	3	0	0	0
4,000 - 5,000	63	29	9	12
5,000 - 6,000	248	74	36	30
6,000 - 7,000	91	38	13	16
7,000 - 8,000	23	23	3	9
8,000 - 9,000	66	66	10	27
9,000 - 10,000	0	0	0	0
> 10,000	7	7	1	3
Total	682	245	100	100

Source: Port Metro Vancouver, 2011.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

2.2 The World Container Ship Fleet

This section reviews the broad trends in the composition of the world container ship fleet between 1990 and 2015. The data up to 2010 is for the existing fleet while the data for 2011 to 2015 reflects the vessel order book as it was on December 31, 2010.

Figure B provides the number of ships by year of delivery in the fleet up to 2010 and the 2010 fleet plus ships on order for 2011 to 2015 broken down into the six container ship size ranges that Clarkson Research Services Limited (Clarkson) uses in its container ship registers. These are:

- Feeder: less than 500 TEU.
- Feedermax: 500 TEU to 1,000 TEU.
- Handy: 1,000 TEU to 2,000 TEU.
- Sub-Panamax: 2,000 TEU to 3,000 TEU.
- Panamax: 3,000 TEU to about 5,000 TEU but with beam and length within the present limits of the Panama Canal.
- Post Panamax: vessels which have at least one dimension of beam and length that exceeds the present limits of the Panama Canal.

There has for years been an overlap in TEU capacity between the larger Panamax and smaller post Panamax ships, typically those between about 4,000 and 5,000 TEU. In the last few years, however, a number of smaller container ships have been built with beams that exceed 32.2 m. This is discussed below.



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

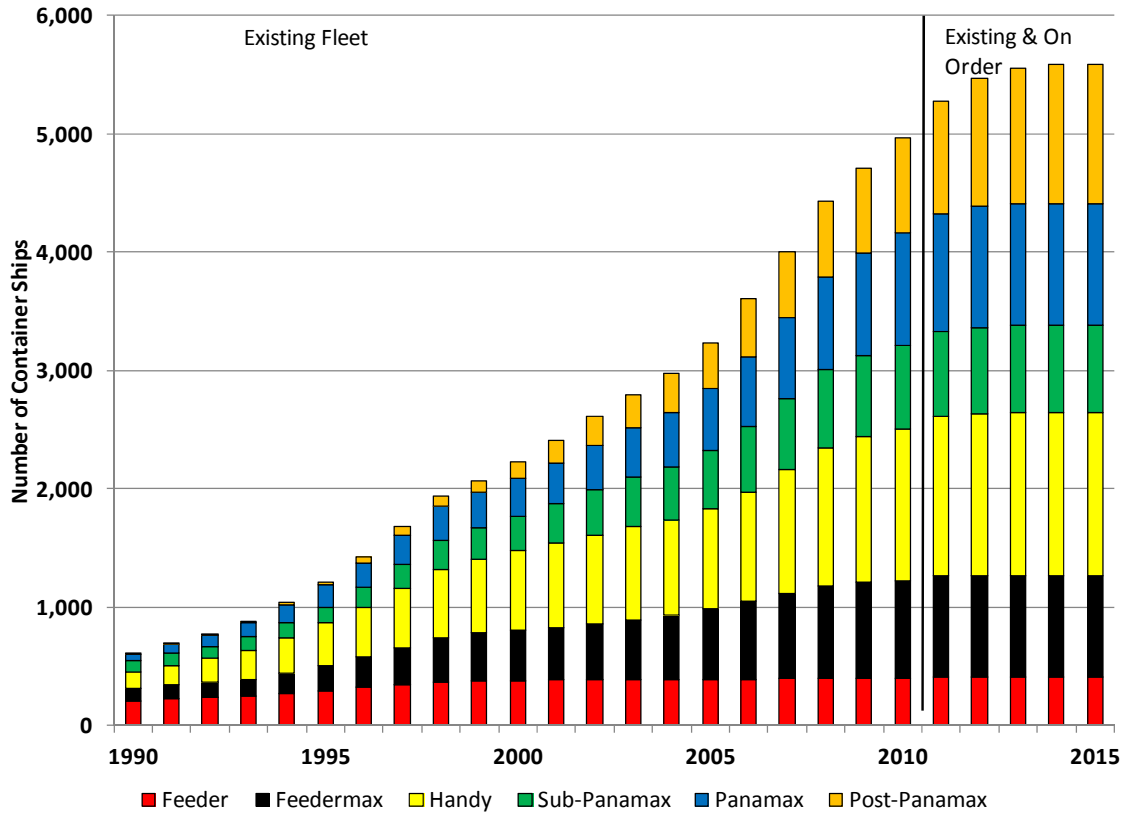


Figure B Trends in World Container Ship Fleet Composition 1990 to 2015 (Number of Ships)

Source: Clarkson Container Fleet CD, January 2011.



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Figure C repeats the distribution but in terms of the TEU capacity of each category of ships.

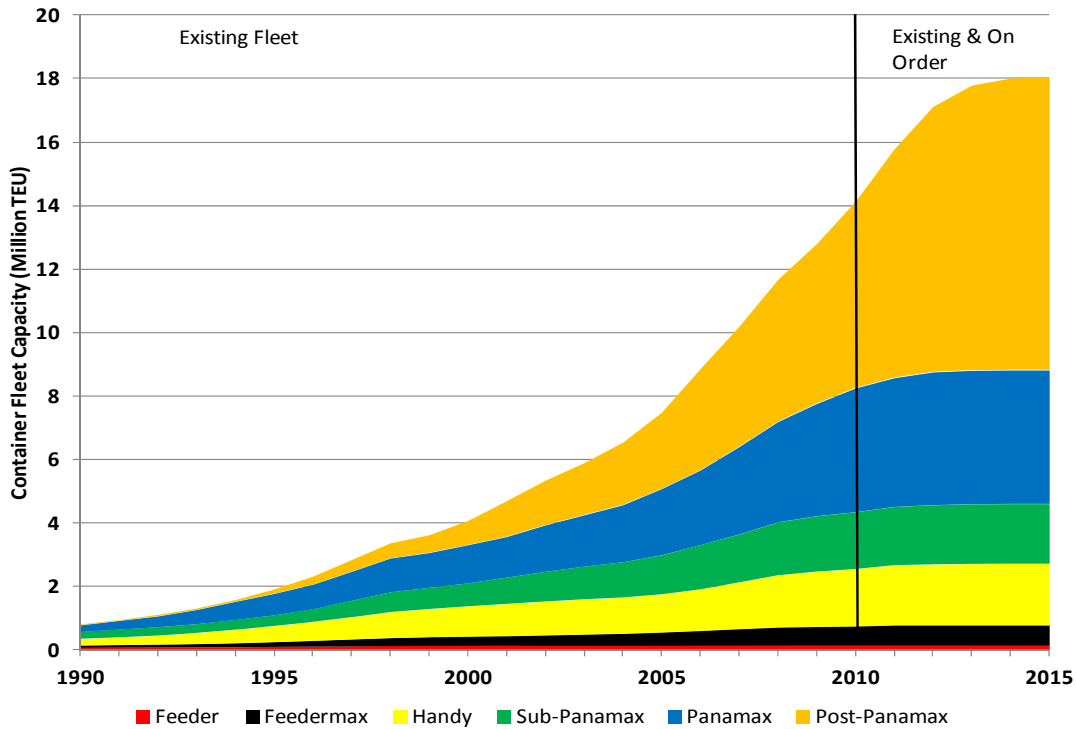


Figure C Trends in World Container Ship Fleet Composition 1990 to 2015 (TEU Capacity)

Source: Clarkson Container Fleet CD, January 2011.

Figure D shows the numbers of post-Panamax ships delivered by year broken down into size classes from less than 4,000 TEU to greater than 14,000 TEU and Figure E repeats the exercise in terms of TEU capacity delivered each year.

The number of container ships in service reached about 5,000 in 2010. In terms of numbers, post-Panamax ships are less than 20% of the total. In terms of TEU capacity, however, the picture changes considerably. As of 1990, there were too few post-Panamax ships to show up in the charts. By 2010, post-Panamax ships made up over 40% of the TEU capacity of the world fleet. While there are a few smaller ships on order, the vast majority of the new capacity that will enter service between 2011 and 2015 will be in the post-Panamax category and within the category biased toward larger ships. Between the ships in the fleet and those on order as of December 2010, within two years post-Panamax vessels will exceed 50% of the TEU capacity of the world fleet.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

The first post-Panamax ships were delivered in 1988. Although a few post-Panamax ships were built in the early 1990s, ordering of post-Panamax ships did not begin in earnest until 1995 and until the early 2000s these were in the smaller size ranges. The majority of ships delivered since 2005 have been in excess of 8,000 TEU and in recent years the largest size class, between 12,000 and 14,000 TEU, has been dominant. A new but minor phenomenon that began in 2010 and is continuing with deliveries in the next few years is ships of less than 4,000 TEU that have one dimension, beam, in excess of the present Panama Canal limits. These ships are probably of a more efficient design than vessels constrained to the 32.3 m beam limit of the existing Panama Canal and after 2014 their beams will not constrain the deployment of the ships.

Eight Maersk Line ships with a capacity of 15,550 TEU were delivered in 2006 to 2008, the only ships in excess of 14,000 TEU capacity. These vessels plus one other are the only ships in the existing fleet to exceed the post-2014 Panama Canal limits. In 2011, Maersk ordered a number of 18,000 TEU ships whose dimensions also exceed the limits of the expanded Panama Canal.

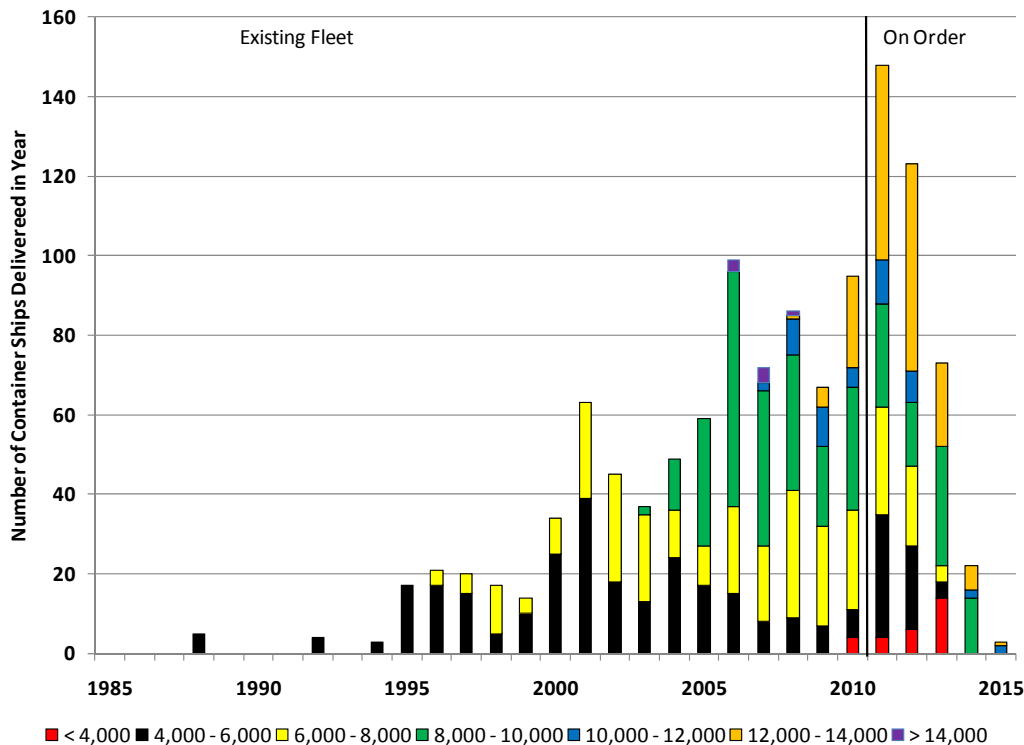


Figure D Post Panamax Container Ship Deliveries by Year and Size Class 1985 to 2015 (Number of Ships)

Source: Clarkson Container Fleet CD, January 2011.



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

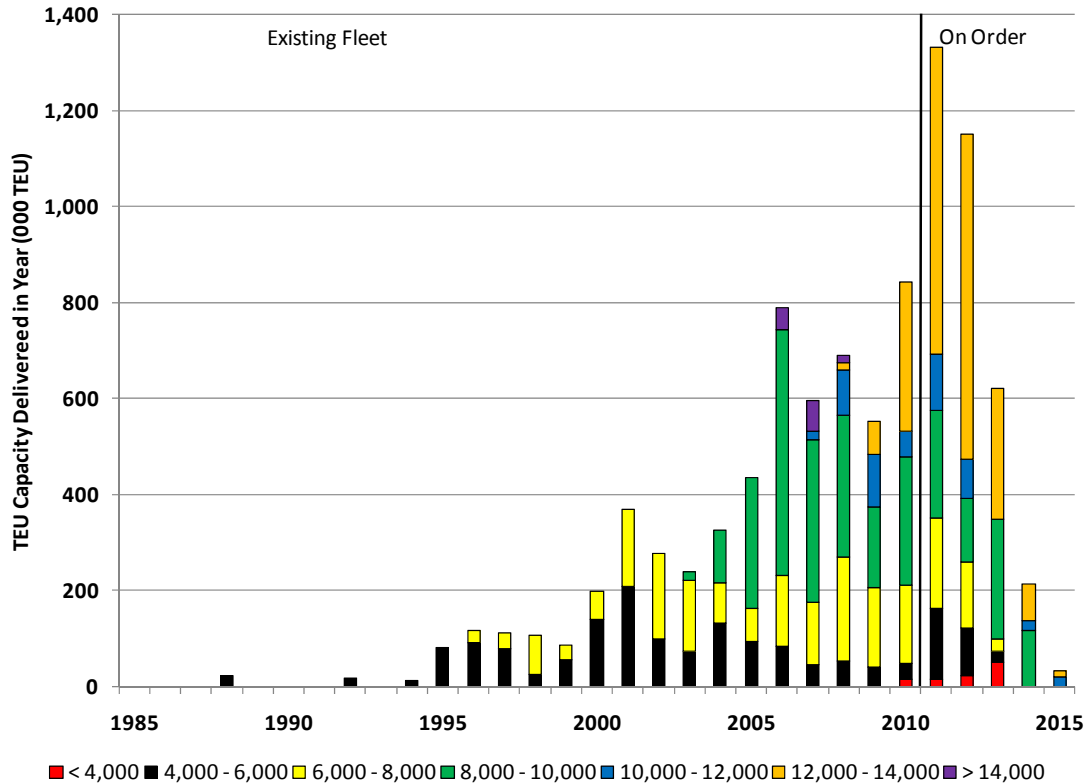


Figure E Post Panamax Container Ship Deliveries by Year and Size Class 1985 to 2015 (TEU Capacity)

Source: Clarkson Container Fleet CD, January 2011.

2.3 Port Metro Vancouver Average Container Ship Size and TEU per Call

Figure F utilizes the average container vessel sizes for Port Metro Vancouver from the schedule data discussed above (see Table C) in conjunction with the average container ship size from the world fleet data to show the relationship between the two. In general, there is a high degree of correlation between the average container ship size in Port Metro Vancouver and the average container ship size in the world fleet. The equation, which is shown in the chart, has a coefficient of determination (R^2) of 0.96. This shows that as the world fleet moves toward increasingly large ships, there will be upward pressure on the sizes of Port Metro Vancouver ships.



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

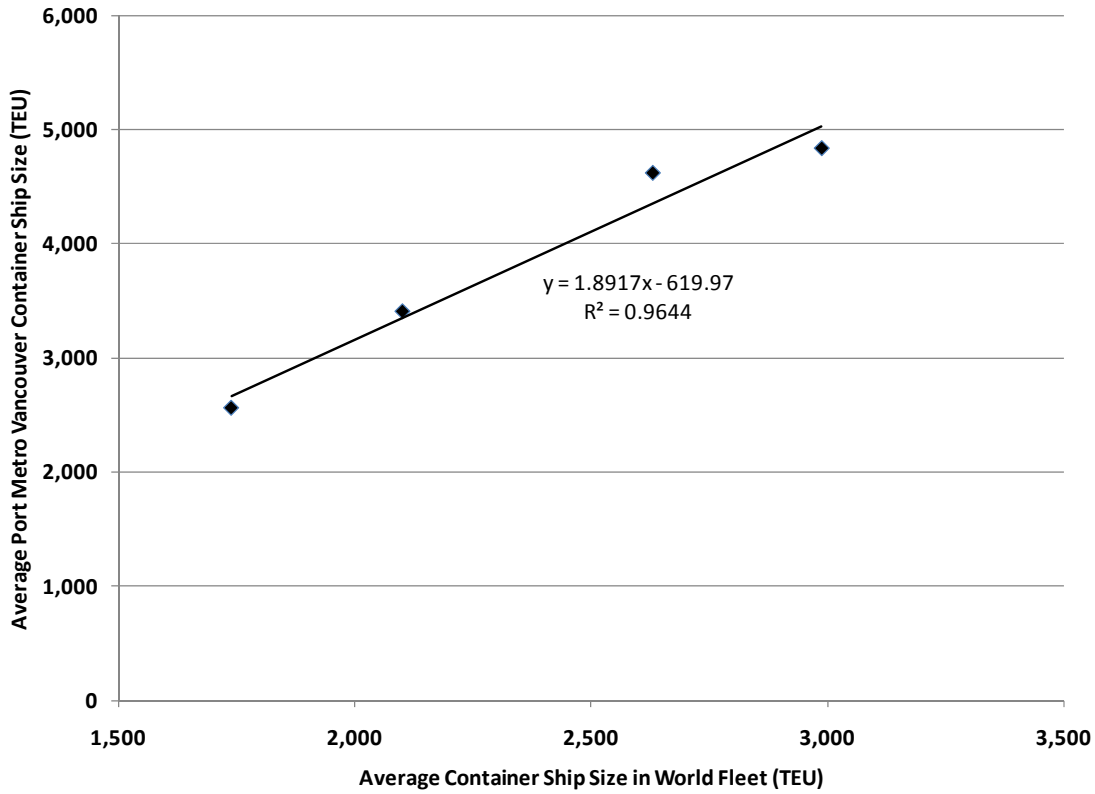


Figure F Average Container Ship Size: Port Metro Vancouver versus World Fleet

Sources: Table C above and Clarkson Container Fleet CD, January 2011.

Figure G utilizes the equation in Figure F to develop a projection over time of the average container ship size at Port Metro Vancouver from the average vessel size in the world fleet. It also plots the four points for Port Metro Vancouver. The curve is upward for all years but became increasingly steep beyond 2000 as significant numbers of large post-Panamax container ships were delivered in this period. Beyond 2011, the projected average vessel size for PMV seems to level off, but this is only because the new buildings on order were as of December 31, 2010 and do not reflect the ships that have been ordered since then and will be ordered in future. Orders of large ships continued in 2011.

It is likely that this line will continue upward more or less as shown between 2000 and 2011 for a number of years. At some point, however, growth in ship size will taper off.



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

The chart is used in an indicative sense, not in a predictive sense, in this report. It provides a strong basis for the assumption of increasingly large container ships in Port Metro Vancouver.

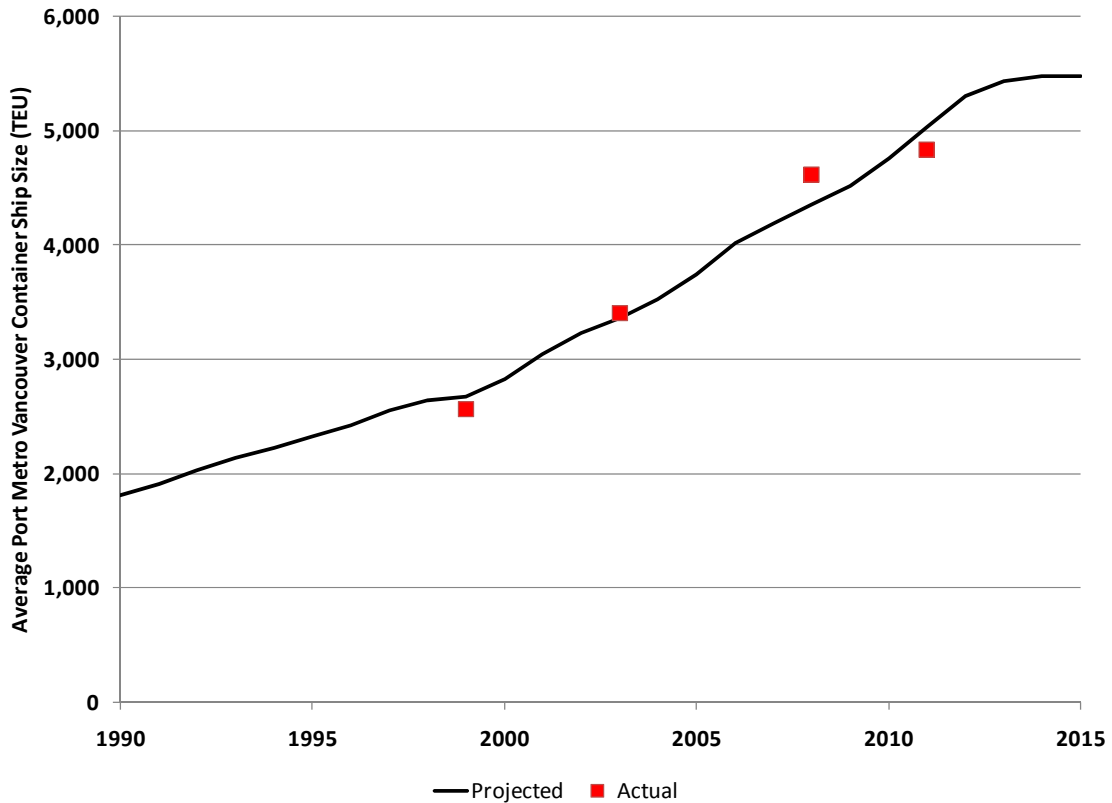


Figure G Average Port Metro Vancouver Container Ship Size as Function of Average World Fleet Container Ship Size

Source: Calculated from equation in Figure F and average container ship size in the world fleet.

Figure H deals with the average TEU volumes per ship call for Port Metro Vancouver as a whole and for Deltaport alone. The data for Port Metro Vancouver is for the Port of Vancouver between 1995 and 2007 (i.e., excluding Fraser Port) and for Port Metro Vancouver in 2008 to 2010. Although this creates a distortion in the years between 2000 and 2007, the overall upward trend is evident. The straight line projection from this data for 2015 is approximately 4,000 TEU per ship call.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

The Deltaport data from TSI is consistently upwards over the full period between 1998 and 2010. It shows a high rate of increase to 6,000 TEU per ship call in 2010 and a projection for 2015 of about 7,000 TEU. Although a linear trend line is plotted on the chart, the Deltaport data is more consistent with exponential growth at a relatively high rate. The growth rate between 1998 and 2010 was about 11 percent a year (R^2 of 0.97). Nevertheless, a linear approach was chosen for the projections of this report so as not to overstate the rates of increase of call sizes in future years.

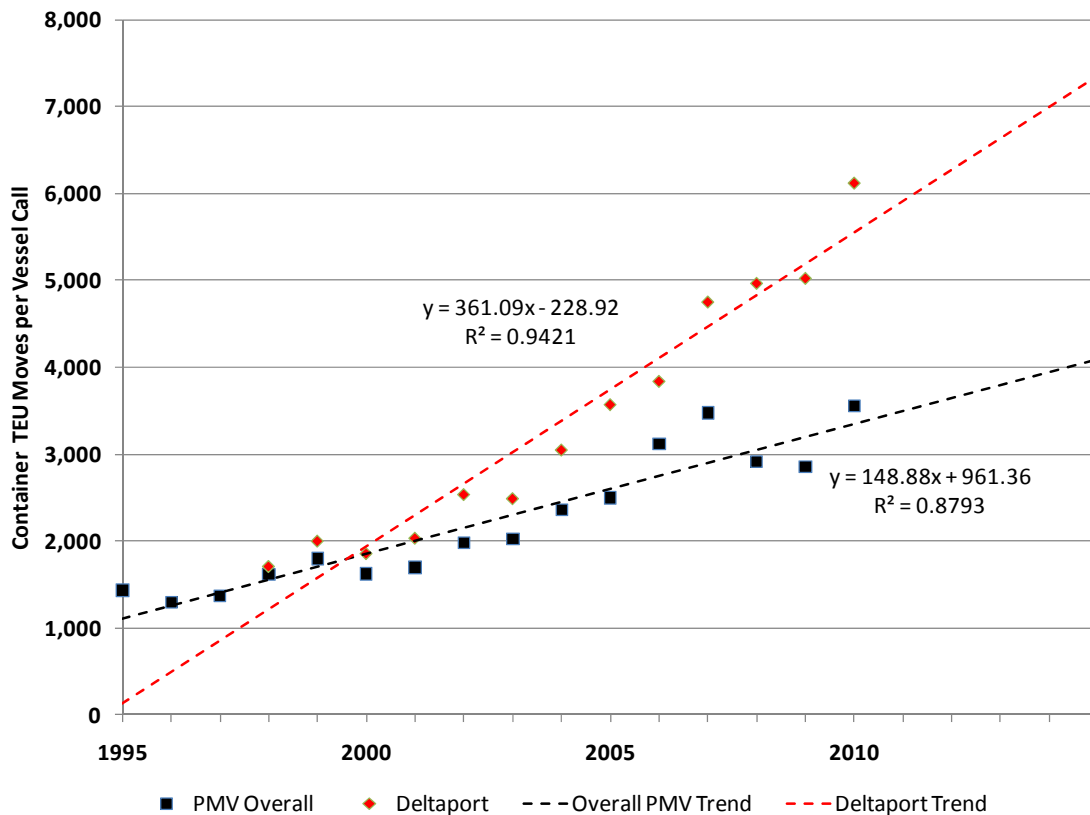


Figure H Port Metro Vancouver TEU Moves per Vessel Call 1995 to 2010

Notes: Data to 2010, projection to 2015.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

2.4 Projection of Container Ship Calls and Movements

This section builds up projections of the numbers of container ship calls and distributions of container ship size from the base provided by the 2010 ship call data from PMV. It deals specifically with Deltaport.

Table G begins this exercise by projecting ship size distributions for Deltaport between 2010 and 2030 that reflect the data available. Although the table summarizes five-year intervals beyond 2015, the actual projections were year-by-year.

The general approach to this exercise is described below:

- To project TEU per ship call between 2010 and 2030 (toward the top of the table). From the 2010 base, the projection uses the “projection increments” shown near the centre of the table for TEU per ship call. These range ranging from 200 TEU in 2011 to 150 TEU in 2030. The average TEU per ship call is projected to increase from 6,250 in 2010 to 7,250 in 2015 (essentially as projected by the trend line in Figure H above) and to rise to 9,500 TEU by 2030.
- To project the average ship size between 2010 and 2030 from the actual for 2010 and the trends discussed above. The ship size is projected to increase year-by-year using the increments of average ship size shown near the center of the table: from 6,519 TEU in 2010 to about 9,600 TEU in 2030. The projection of the average container ship size in PMV of just under 10,000 TEU in 2030 is reasonable given the nature of the world container trade:
 - As shown above, many of the new ships on order are very large, in excess of 12,000 TEU in many cases, and there are a significant number of 14,000 TEU ships because this is a natural ship size within the new Panama Canal limits. Maersk Line has several 18,000 TEU ships on order and the ships may actually prove to be larger given Maersk's tendency to understate its ship capacities in public. Other shipping lines have increased the size of their 14,000 TEU ships on order to about 16,000 TEU by changing the specifications of ships under construction.
 - The largest ships will continue to be on the trades between Asia and Europe for a number of reasons. These include the long voyages on this trade and the economies of scale that long voyages bring out, and the high productivity of the major container terminals in Asia, the Middle East, the Mediterranean and northern Europe. High productivity in terms of container moves per ship hour at berth assists the economics of very large ships.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

- Ship sizes in the trade between Asia and the West Coast of North America are more constrained in part because of the relatively low productivity of North America’s container terminals today and likely in the future. The ship size on the West Coast will increase considerably, but will not reach the maximum in the world trade and in particular that of the Asia – Europe route.
- To project ship size distributions. The approach to ship size distributions must be subjective because there is no firm statistical basis on which to base it. The bottom part of the table includes under “projection increments” the year-to-year change in the percentage of ships in each ship size category, ranging from less than 2,000 TEU (in which the percentage has been zero for years for Deltaport) up to ships in excess of 10,000 TEU. These increments were chosen to reflect a reasonable pattern for changing ship size over 2010 to 2030. From these increments, the container vessel distributions in the upper part of the table were calculated year-by-year from the 2010 base.
 - As a cross check, the weighted average ship sizes were calculated from the resulting vessel size distributions and the means of each ship size range.
 - The results were compared with the projected vessel sizes from the 2010 base and the incremental changes over time. The ship size distributions were adjusted so that the projected ship sizes calculated from the two approaches were consistent.
 - In general, it was possible to get reasonable agreement between the average ship size calculated from the vessel distributions and the values projected out to 2030. For example in 2030, the value projected from the vessel capacity distribution and the mean ship sizes is 9,620 TEU; the projected ship size from the 2010 base plus ship size growth increments is 9,644 TEU.



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Table G Deltaport Vessel Size Distributions Actual 2010 to Projected 2030

Item	Mean	2010	2011	2012	2013	2014	2015	2020	2025	2030	Growth Rates (%/a)				
											2010-15	2015-20	2020-25	2025-30	2010-30
TEU / Ship Call		6,250	6,450	6,650	6,850	7,050	7,250	8,000	8,750	9,500	3.0	2.0	1.8	1.7	2.1
Vessel Capacity Distribution															
<= 2,000	1,000	0	0	0	0	0	0	0	0	0					
2,000 - 3,000	2,500	3	2	1	0	0	0	0	0	0					
3,000 - 4,000	3,500	0	0	0	0	0	0	0	0	0					
4,000 - 5,000	4,500	12	11	9	7	5	3	0	0	0					
5,000 - 6,000	5,500	30	29	28	26	24	22	12	2	0					
6,000 - 7,000	6,500	16	16	16	16	16	16	11	6	1					
7,000 - 8,000	7,500	9	10	11	13	14	15	15	15	15					
8,000 - 9,000	8,500	27	28	29	30	31	32	35	35	35					
9,000 - 10,000	9,500	0	1	2	3	4	5	14	17	17					
>10,000	12,000	3	3	4	5	6	7	13	25	32					
Total		100	100	100	100	100	100	100	100	100					
Average Ship Size															
Calculated from Above		6,620	6,765	6,970	7,195	7,370	7,545	8,365	9,215	9,620	2.6	2.1	2.0	0.9	1.9
Actual 2010 / Projected		6,519	6,719	6,919	7,119	7,319	7,519	8,394	9,144	9,644	2.9	2.2	1.7	1.1	2.0



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Item	Mean	2010	2011	2012	2013	2014	2015	2020	2025	2030	Growth Rates (%/a)				
											2010-15	2015-20	2020-25	2025-30	2010-30
Projection Increments															
TEU / Ship Call			200	200	200	200	200	150	150	150					
Average Ship Size			200	200	200	200	200	175	150	100					
Vessel Distributions															
<= 2,000			0	0	0	0	0	0	0	0					
2,000 - 3,000			-1	-1	-1	-1	-1	-1	-1	-1					
3,000 - 4,000			0	0	0	0	0	0	0	0					
4,000 - 5,000			-1	-2	-2	-2	-2	-1	-1	-1					
5,000 - 6,000			-1	-1	-2	-2	-2	-2	-2	-1					
6,000 - 7,000			0	0	0	0	0	-1	-1	-1					
7,000 - 8,000			1	1	2	1	1	0	0	0					
8,000 - 9,000			1	1	1	1	1	0	0	0					
9,000 - 10,000			1	1	1	1	1	1	0	0					
> 10,000			0	1	1	1	1	2	3	1					
Calculated Ratios															
TEU / Call / Average Ship		94%	95%	95%	95%	96%	96%	96%	95%	99%	0.4	-0.1	-0.1	0.8	0.2

Sources: Consultant estimates, 2011.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Figure I plots a summary of the data in Table G to show the size trends of the major container vessel size groups over time. It shows that the smaller vessels (less than 4,000 TEU) are projected to disappear rapidly and that the smaller post-Panamax ships are projected to disappear around 2025. Vessels of over 10,000 TEU are projected to become of increasing importance in line with the numbers of large ships on order today.

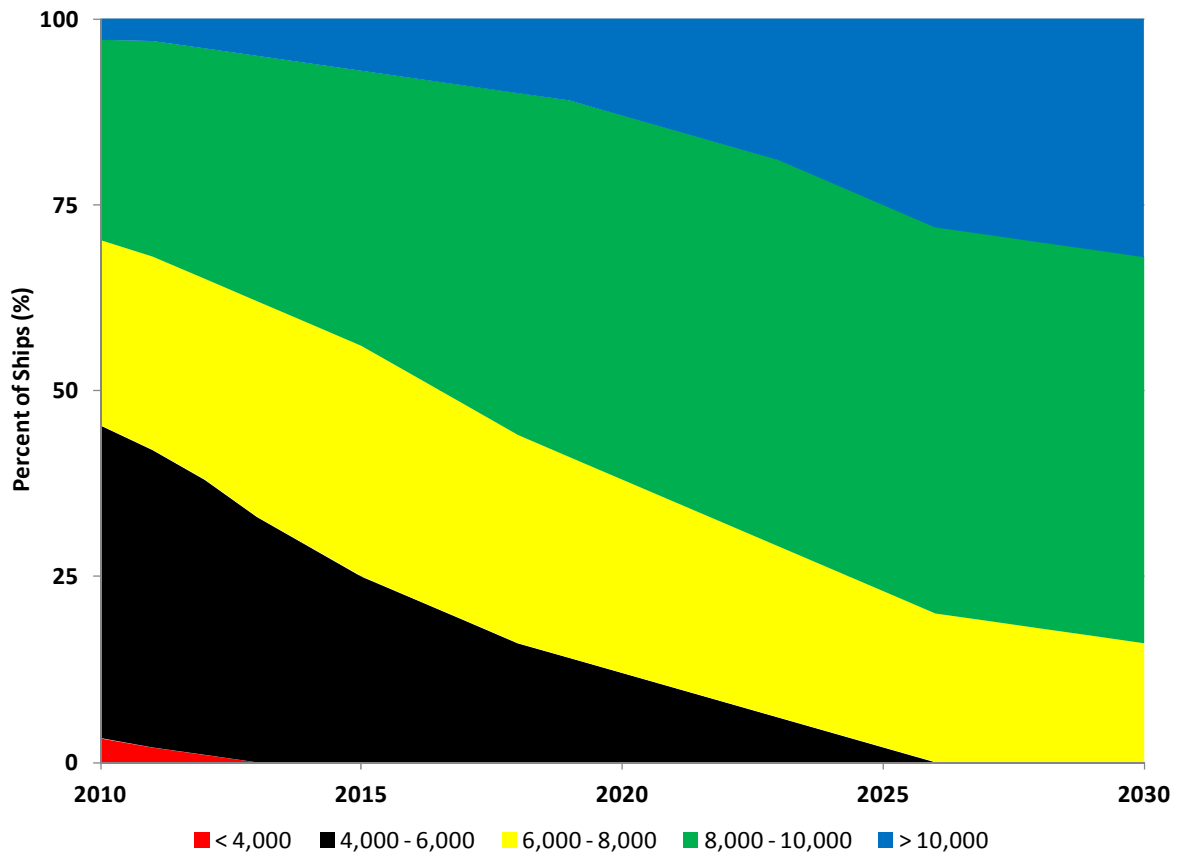


Figure I Projected Container Ship Size Distributions at Deltaport

Source: Consultant estimates, 2011.

Table H summarizes the traffic projections used for the three vessels projection cases. They are based on the highest preliminary traffic projections prepared for PMV as part of the CCIP (the direct approach that utilized the share of PMV in the Canadian market). The cases are summarized below:

- Case 1: Deltaport has a sustainable capacity of 2.4 million TEU. Deltaport has maximum capacity of 3.0 million TEU in the interim years of high demand up to about 2020.



**PORT METRO VANCOUVER
PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

- Cases 2 and 3: Deltaport has a sustainable capacity of 3.0 million TEU.

Table H Projected Deltaport Container Volumes 2015 to 2030

Year	Deltaport Traffic (Million TEU)	
	Case 1	Cases 2 & 3
2010	1.54	1.54
2014	1.74	1.74
2015	2.02	2.02
2016	2.28	2.28
2017	2.55	2.55
2018	2.85	2.85
2019	3.00	3.00
2020	2.40	3.00
2025	2.40	3.00
2030	2.40	3.00

Sources: Consultant estimates, 2011.

Table I utilizes the distribution of vessel capacity from Table G in conjunction with other data to build up the Case 1 characteristics of container terminal traffic for selected years between 2010 and 2030 (the projections were prepared by year from 2014 to 2030). The components of the estimates are:

- The container traffic listed at the top of Table I. This ranges from 1.54 million TEU for Deltaport in 2010 to a peak of 3.00 million TEU in years of high demand out to 2020 and ultimately Deltaport’s “nameplate” capacity upon expansion of the intermodal yard of 2.4 million TEU.
- The TEU per ship call. The container traffic volumes are used in conjunction with the TEU per ship call to calculate the number of ship calls required to meet the traffic volume. From this and the assumption of 52 ship calls per year in each service the number of services is calculated as a fractional number.
- The number of services is then normalized to an even number and the normalized number of ship calls calculated on a 52-call-per-year basis. For example:
 - Deltaport in 2020 with container traffic of 2.4 million TEU and 8,000 TEU per ship call would require 300 vessel calls per year.
 - This results in 5.77 services, which is unlikely; fractional services (i.e., calls other than weekly) are possible but uncommon.

**PORT METRO VANCOUVER****PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

- This was normalized to six services calling at the terminal, which generates 312 ship calls per year.
- The ship size distribution at the bottom of the page is utilized in conjunction with the annual number of ship calls to calculate the distribution of ship calls by vessel size range.
- The number of ship movements is calculated.

Regarding ship movements, Deltaport in 2010 had a split service that called twice at the terminal: the first call to discharge import containers and the second call to load export containers. Between the Deltaport calls, the vessel visited a U.S. Pacific Northwest port. The split service adds 104 ship movements for 2010. Although unusual, this practice was assumed to persist at Deltaport in all years so as not to understate potential ship movements. The ship movements in Table I reflect this service, but the ship calls are those of a standard service (for example, five services result in 260 calls but 624 ship movements).

Table I Case 1 Deltaport Container Shipping Services Actual 2010 to Projected 2030

Item	Actual	Projected			
	2010	2015	2020	2025	2030
Container Traffic (Million TEU)	1.54	2.02	2.40	2.40	2.40
TEU / Ship Call	6,250	7,250	8,000	8,750	9,500
Number of Calls	245	278	300	274	253
Number of Services					
Calculated	5.00	5.35	5.77	5.27	4.86
Normalized	5.0	5.0	6.0	5.0	5.0
Normalized No. of Calls		260	312	260	260
Number of Movements ¹	594	624	728	624	624
Number of Ships by Size Class					
<= 2,000	0	0	0	0	0
2,000 - 3,000	8	0	0	0	0
3,000 - 4,000	0	0	0	0	0
4,000 - 5,000	29	8	0	0	0
5,000 - 6,000	74	57	37	5	0
6,000 - 7,000	38	42	34	16	3
7,000 - 8,000	23	39	47	39	39
8,000 - 9,000	66	83	109	91	91



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

9,000 - 10,000	0	13	44	44	44
> 10,000	7	18	41	65	83
Total	245	260	312	260	260
Distribution of Vessel Capacity (Percent of Ships)					
<= 2,000	0	0	0	0	0
2,000 - 3,000	3	0	0	0	0
3,000 - 4,000	0	0	0	0	0
4,000 - 5,000	12	3	0	0	0
5,000 - 6,000	30	22	12	2	0
6,000 - 7,000	16	16	11	6	1
7,000 - 8,000	9	15	15	15	15
8,000 - 9,000	27	32	35	35	35
9,000 - 10,000	0	5	14	17	17
>10,000	3	7	13	25	32
Total	100	100	100	100	100

Sources: Consultant estimates, 2011.

Notes: ¹Number of ship movements reflects the Deltaport split service.

Table J summarizes the Case 2 projection of container ship calls. It follows the procedures described above and again uses the distribution of vessel capacity from Table G. Case 2 differs from Case 1 in that Deltaport is assumed to have sustainable capacities of 3.0 million TEU.

Table J Case 2 Deltaport Container Shipping Services Actual 2010 to Projected 2030

	Actual	Projected			
Item	2010	2015	2020	2025	2030
Container Traffic (Million TEU)	1.54	2.02	3.00	3.00	3.00
TEU / Ship Call	6,250	7,250	8,000	8,750	9,500
Number of Calls	245	278	375	343	316
Number of Services					
Calculated	5.00	5.35	7.21	6.59	6.07
Normalized	5.0	5.0	7.0	7.0	6.0
Normalized No. of Calls		260	364	364	312
Number of Movements	594	624	832	832	728



PORT METRO VANCOUVER

PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS

DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)

Number of Ships by Size Class					
<= 2,000	0	0	0	0	0
2,000 - 3,000	8	0	0	0	0
3,000 - 4,000	0	0	0	0	0
4,000 - 5,000	29	8	0	0	0
5,000 - 6,000	74	57	44	7	0
6,000 - 7,000	38	42	40	22	3
7,000 - 8,000	23	39	55	55	47
8,000 - 9,000	66	83	127	127	109
9,000 - 10,000	0	13	51	62	53
>10,000	7	18	47	91	100
Total	245	260	364	364	312
Distribution of Vessel Capacity (Percent of Ships)					
<= 2,000	0	0	0	0	0
2,000 - 3,000	3	0	0	0	0
3,000 - 4,000	0	0	0	0	0
4,000 - 5,000	12	3	0	0	0
5,000 - 6,000	30	22	12	2	0
6,000 - 7,000	16	16	11	6	1
7,000 - 8,000	9	15	15	15	15
8,000 - 9,000	27	32	35	35	35
9,000 - 10,000	0	5	14	17	17
>10,000	3	7	13	25	32
Total	100	100	100	100	100

Sources: Consultant estimates, 2011.

Table K summarizes the Case 3 projections of container vessel calls. These projections utilize the Case 2 traffic assumptions of terminal capacity (3.0 million TEU each) with a constant average call size of 6,250 TEU per ship call as in 2010. The ship size distribution is also assumed to remain the same as in 2010.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Table K Case 3 Deltaport Container Shipping Services Actual 2010 to Projected 2030

	Actual		Projected		
Item	2010	2015	2020	2025	2030
Container Traffic (Million TEU)	1.54	2.02	3.00	3.00	3.00
TEU / Ship Call	6,250	6,250	6,250	6,250	6,250
Number of Calls	245	323	480	480	480
Number of Services					
Calculated	5.00	6.20	9.23	9.23	9.23
Normalized	5.0	6.0	9.0	9.0	9.0
Normalized No. of Calls		312	468	468	468
Number of Movements	594	728	1,040	1,040	1,040
Number of Ships by Size Class					
<= 2,000	0	0	0	0	0
2,000 - 3,000	8	10	15	15	15
3,000 - 4,000	0	0	0	0	0
4,000 - 5,000	29	37	55	55	55
5,000 - 6,000	74	94	142	142	142
6,000 - 7,000	38	48	73	73	73
7,000 - 8,000	23	29	44	44	44
8,000 - 9,000	66	85	126	126	126
9,000 - 10,000	0	0	0	0	0
>10,000	7	9	13	13	13
Total	245	312	468	468	468
Distribution of Vessel Capacity (Percent of Ships)					
<= 2,000	0	0	0	0	0
2,000 - 3,000	3	3	3	3	3
3,000 - 4,000	0	0	0	0	0
4,000 - 5,000	12	12	12	12	12
5,000 - 6,000	30	30	30	30	30
6,000 - 7,000	16	16	16	16	16
7,000 - 8,000	9	9	9	9	9



PORT METRO VANCOUVER

PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS

DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)

8,000 - 9,000	27	27	27	27	27
9,000 - 10,000	0	0	0	0	0
>10,000	3	3	3	3	3
Total	100	100	100	100	100

Sources: Consultant estimates, 2011.

DRAFT

**PORT METRO VANCOUVER****PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)****3. COAL SHIPS AT WESTSHORE TERMINALS**

This section addresses coal shipping from the Westshore Terminals coal terminal at Roberts Bank. It begins with an overview of trends in coal shipments through Westshore Terminals and other coal terminals on the West Coast of Canada and goes on to examine the characteristics of Westshore's trade. It also provides a brief overview of trends in the world coal trade as a guide to the outlook for Westshore coal exports. It concludes by developing a projection of coal exports, coal shipment sizes and the numbers of coal ship calls.

3.1 Trends in Coal Shipments

Table L lists the throughput of the two coal terminals in Port Metro Vancouver and the Ridley terminal in the Port of Prince Rupert between 2001 and 2010. With the exception of a jump in coal throughput in 2010, coal exports in recent years were no higher than in 2001.

The table also provides a breakdown of Westshore exports into metallurgical and thermal coal and petroleum coke. The dominant export is metallurgical coal but the tonnages in recent years have been lower than 5 to 10 years ago. Thermal coal exports have increased considerably and a substantial amount of the volume in 2010 was U.S. thermal coal exports. The terminal has handled modest amounts of petroleum coke.

Table L Coal Exports by Terminal 2001 - 2010

Terminal and Port	Coal Shipments (Million Tonnes)							Growth Rate (%/a)		
	2001	2005	2006	2007	2008	2009	2010	2001-05	2005-10	2001-10
PORT METRO VANCOUVER										
Westshore Terminals										
Metallurgical Coal	20.6	20.0	16.5	18.7	17.3	14.8	16.4	-0.7	-3.9	-2.5
Thermal Coal	2.7	1.9	2.5	2.5	3.7	5.3	8.2	-8.4	34.0	13.1
Petroleum Coke	0.0	0.0	0.0	0.0	0.1	0.0	0.1	NA	NA	NA
Total Westshore	23.3	21.9	19.0	21.2	21.1	20.1	24.7	-1.5	2.4	0.7
Neptune Bulk Terminals	3.9	3.4	5.0	3.7	4.8	4.3	5.6	-3.4	10.5	4.1
Total Port Metro Vancouver	27.2	25.3	24.0	24.9	25.9	24.4	30.3	-1.8	3.7	1.2
Port of Prince Rupert ¹	2.2	1.0	2.8	5.1	4.8	4.0	6.9	-17.9	47.2	13.5
Total Shipments	29.4	26.3	26.8	30.0	30.7	28.4	37.2	-2.7	7.2	2.6

Source: Westshore Terminals Investment Corporation, *Annual Information Form*, March 30, 2011.

Notes: ¹Ridley Terminals Inc. Includes some petroleum coke.

**PORT METRO VANCOUVER****PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Table M lists Westshore coal shipments by destination in recent years. The dominant and increasing destination is Asia but Europe and South America also receive substantial amounts of coal from this terminal. The volume to Europe and South America in 2008 was approximate 6 million tonnes and in 2010 approximately 5 million tonnes. All of the European shipments and most of the South American shipments transit the Panama Canal. This brings into consideration the expansion of the Panama Canal to be completed in 2014 and its possible impact on bulk carrier size.

Table M Westshore Coal Shipments by Destination 2008 to 2010

Destination	Shipments (000 Tonnes)		
	2008	2009	2010
Asia	14,591	16,306	19,078
Europe	5,488	3,030	3,439
South America	628	317	1,680
Other	372	400	481
Total	21,079	20,053	24,678

Source: Westshore Terminals Investment Corporation, *Annual Information Form*, March 30, 2011.

Table N summarizes Westshore's activity from its opening in 1970 to 2010. It presents the number of ship calls, export tonnage and the tonnes of coal cargo per ship call for this period. In recent years, the number of ship calls has been between 200 and 250. The cargo size per ship call has steadily increased to reach a plateau since 2006 of approximately 100,000 tonnes.

Table N Westshore Coal Export Activity 1970 to 2010

Year	Number of Ship Calls	Export Tonnage (Tonnes)	Tonnes per Ship Call
1970	33	1,427,372	43,254
1980	161	10,596,540	65,817
1990	226	19,054,016	84,310
2000	251	22,502,061	89,650
2005	241	21,873,955	90,763
2006	187	18,958,461	101,382
2007	210	21,159,994	100,762
2008	213	21,078,958	98,962
2009	197	20,052,528	101,789
2010	246	24,678,348	100,318

Source: Westshore Terminals Ltd. Partnership, July 2011.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Figure J presents the number of ship calls at Westshore Terminals since 1970. It shows in more detail than Table N that the number of ship calls over the last 15 years has generally fallen between 200 and 250 with no particular trend.

Over the long term, increasing cargo lot sizes have offset the increasing coal exports. The bulk carrier fleet went through a large transformation from 1970 to the late 1980s in which increasingly large vessels entered the world fleet. The bulk carrier fleet subsequently stabilized and for many years the largest vessels in the fleet were built in the mid-to-late 1980s. In recent years, there has been an increase in the number of large bulk carriers ordered and delivered because of rapid growth in the coal and iron ore trades that use such ships.

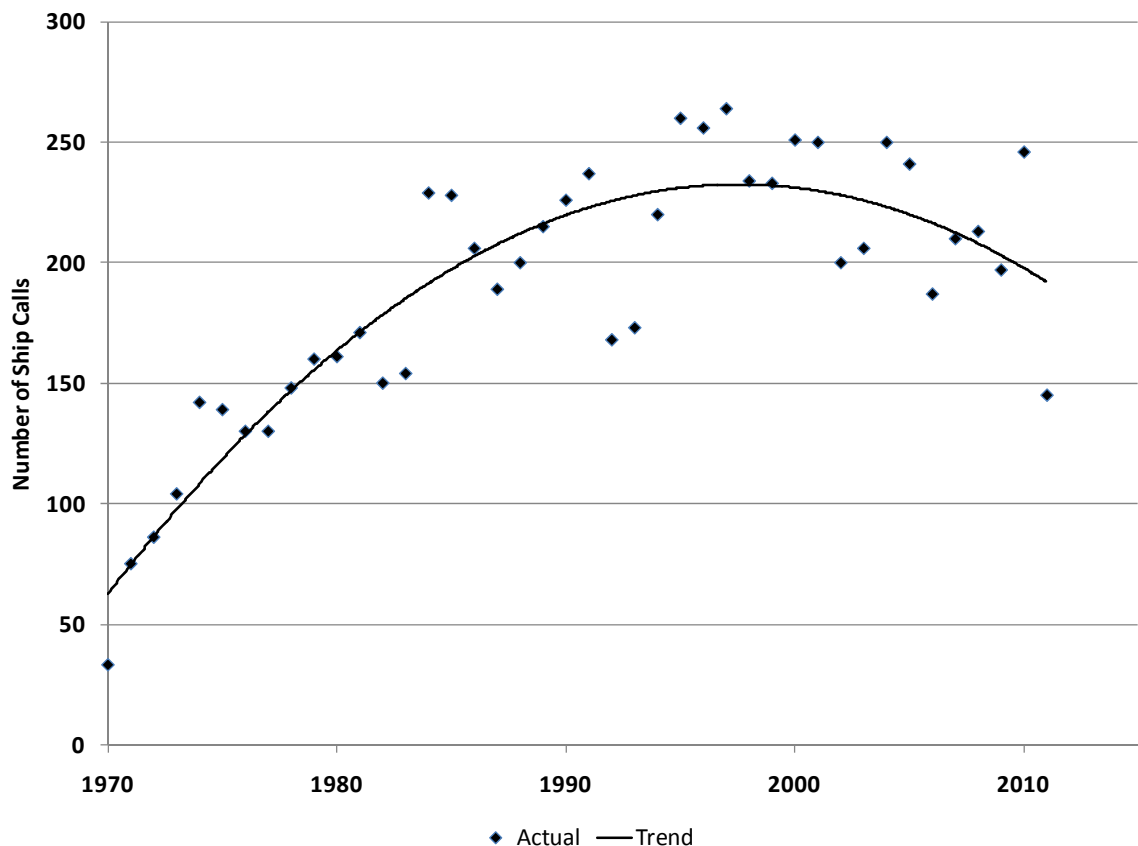


Figure J Westshore Vessel Calls 1970 to 2010

Source: Westshore Terminals Ltd. Partnership, July 2011.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Figure K shows graphically the tonnage of coal shipments per vessel that called at Westshore between 1970 and 2010. It shows again the distinct trend toward the 100,000 tonnes level of recent years. With the existing destinations and mix of ships, it appears that a limit of 100,000 tonnes has been reached.

The Panama Canal Authority announced a few years ago the new Panama Canal dimensions following the completion in 2014 of the current expansion project. The new ship size constraints are: 366 m overall length, 49 m beam and tropical fresh water draft of 15.2 m. The largest of the bulk carriers in the world fleet (excluding ore carriers) have overall lengths somewhat in excess of 300 m, beams of 50 m or greater and typical drafts between 18 and 20 m.

The new Panama Canal constraints will have limited impact on bulk carrier length and beam capability because most bulk carriers are within the post-2014 Canal limits. The most important impact will be on draft. Within the 15.2 m tropical freshwater limit, the maximum size of a fully-laden bulk carrier is a "Capesize" ship of approximately 120,000 deadweight tonnes. The Canal expansion will roughly double the bulk cargo limitation from the typical 55,000 cargo tonnes with Panamax bulk carriers today to some 110,000 cargo tonnes with larger bulk carriers in future. This will improve the ability of Western Canada coal exporters to serve markets in Europe and on the east coast of South America (Brazil has been a consistently larger importer of Canadian metallurgical coal). It may also have a modest impact on average cargo sizes at Westshore, although the Asian market, with no route limits on ship size, is both the largest and the fastest-growing market for coal.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

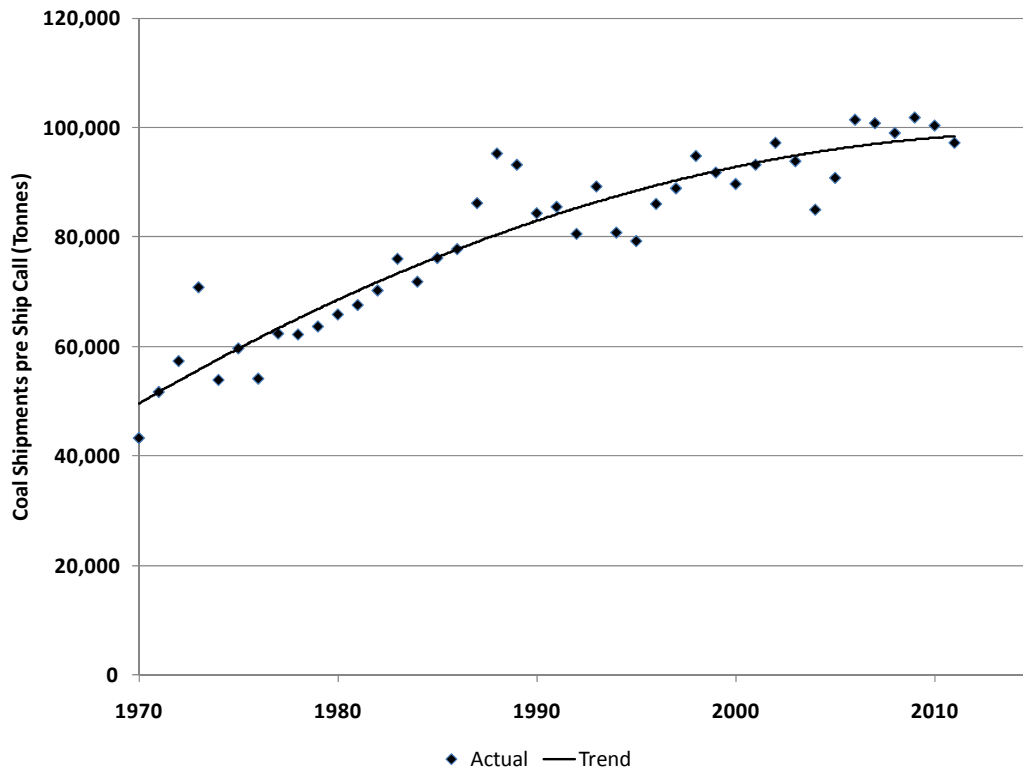


Figure K Westshore Export Tonnage per Vessel Call 1970 to 2010

Source: Westshore Terminals Ltd. Partnership, July 2011.

3.2 Coal Market Outlook

Coal exports from Western Canada and British Columbia in particular are dominantly of the metallurgical variety that is used to make steel. There are also some exports of thermal coal and coal used for pulverized coal injection (PCI) in steelmaking.

Figure L presents on one chart coal production in British Columbia and its nominal and real average selling prices with the coal a mix of metallurgical and thermal coals. This chart brings out the history of the B.C. coal sector since 1980. In the late 1970s to early 1980s, coal prices were relatively high and expansion of metallurgical coal production in Southeast and Northeast British Columbia took place.

The production of B.C. coal more than doubled between 1980 and 1985 as new mines were developed and existing mines were expanded. It was also a period of extensive infrastructure development for the coal sector. This included increases of the Roberts Bank port area in the Port of Vancouver and the expansion of the Westshore coal terminal, the construction of the coal terminal of Ridley Terminals Inc. in the Port of Prince Rupert, the development of a new rail line into north-eastern B.C. and the construction of the town of Tumbler Ridge.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

As can be seen on the chart, coal prices fell in nominal terms from approximately \$50 a tonne to reach a plateau of around \$40 a tonne between the late 1980s and early 2000s. The real price of coal, however, fell to one third of its 1980 level by 2000. By 2004, demand for coal for steelmaking had taken off, largely due to Chinese steel production, and coal prices began to rise. Real prices reached the level of 1980 in about 2007.

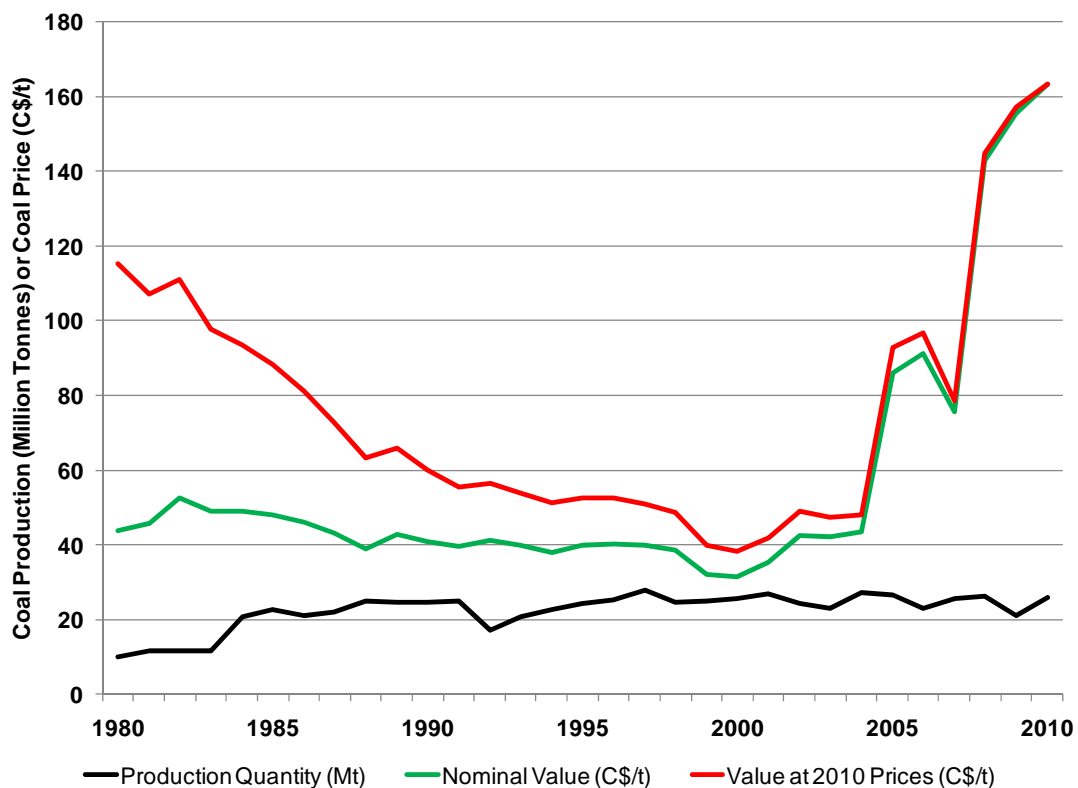


Figure L B.C. Coal Production and Values 1980 to 2010

Source: British Columbia Ministry of Energy, 2011.

Table O provides the outlook of the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) for the world metallurgical coal trade. Between 2010 and 2016, ABARES is projecting that world metallurgical coal imports and exports will grow by 5% a year to reach about 340 million tonnes in 2016. ABARES is also projecting that coal prices will remain relatively high in nominal and real terms but below the peak of 2011. Although the coal exports of both Australia and Canada are projected to grow by a similar 5% a year, in absolute terms the increase in Australian exports is projected at 60 million tonnes while that of Canada is projected at 8 million tonnes. Exports of the Russian Federation are projected to grow in line with world demand while exports from other countries, probably including Mongolia, are projected to grow very rapidly.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Table O World Metallurgical Coal Trade Outlook 2011 to 2016

	Actual		Forecast						Growth (%/a)
	2009	2010	2011	2012	2013	2014	2015	2016	2010-16
Coal Prices (US\$/t)¹									
Nominal	\$171.00	\$191.00	\$256.00	\$250.00	\$235.00	\$208.00	\$193.00	\$186.00	-0.4
Real (2011 Prices)	176.00	193.00	256.00	245.00	226.00	196.00	178.00	169.00	-2.2
Imports (Mt)									
European Union	41	46	48	50	51	52	54	56	3.3
Japan	46	53	57	59	61	62	63	65	3.5
China	34	44	43	44	50	56	64	73	8.8
South Korea	15	23	26	27	28	29	30	32	5.7
Taiwan	4	6	6	7	7	7	7	7	2.6
India	23	25	28	32	36	41	46	52	13.0
Brazil	9	11	13	14	16	17	19	21	11.4
Other	39	46	43	42	37	40	39	35	-4.5
Total Imports	211	254	264	275	286	304	322	341	5.0
Exports (Mt)									
Australia	135	159	163	174	179	194	207	219	5.5
Canada	22	25	25	27	30	31	32	33	4.7
United States	34	51	45	42	40	38	37	35	-6.1
Russian Federation	13	17	20	21	23	24	24	25	6.6
Other	7	2	11	11	14	17	22	29	56.2
Total Exports	211	254	264	275	286	304	322	341	5.0

Source: Australian Bureau of Agricultural and Resource Economics and Sciences, *Australian Commodity Statistics*, March 2011.

Notes: ¹World contract prices.

Table P provides a comparable review for thermal coal, which is roughly double the trading volume of metallurgical coal. Rapid demand growth is projected in India and rapid increases in production projected for Australia. More moderate growth is projected for Indonesia but it remains the largest exporter of thermal coal.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Table P World Thermal Coal Trade Outlook 2011 to 2016

	Actual		Forecast						Growth (%/a)
	2009	2010	2011	2012	2013	2014	2015	2016	2010-16
Coal Prices (US\$/t)¹									
Nominal	\$70.35	\$98.00	\$125.00	\$115.00	\$110.00	\$105.00	\$97.00	\$90.00	-1.4
Real (2010 Prices)	71.27	98.00	123.09	111.02	104.11	97.43	88.24	80.27	-3.3
Imports (Mt)									
Asia									
China	92	119	115	118	121	124	127	130	1.5
Chinese Taipei	59	62	63	63	65	67	69	70	2.0
India	49	60	77	92	104	112	120	128	13.5
Japan	113	126	127	128	127	127	126	125	-0.1
South Korea	82	94	95	96	97	100	104	107	2.1
Malaysia	16	16	17	18	19	20	20	21	3.8
Other Asia	33	33	36	42	47	55	62	70	13.5
Total Asia	444	511	529	557	580	604	629	651	4.1
Europe									
European Union	170	148	152	155	161	167	173	174	2.8
Other Europe	37	40	41	43	45	47	47	49	3.5
Total Europe	207	187	193	198	205	214	220	223	2.9
Other	74	73	70	74	78	80	84	88	3.2
TOTAL IMPORTS	725	771	792	829	863	899	933	962	3.8
Exports (Mt)									
Australia	139	142	149	170	189	215	232	250	9.8
China	22	18	20	18	17	16	15	15	-3.0
Colombia	63	69	72	77	82	86	89	92	4.9
Indonesia	233	270	280	294	307	315	330	340	3.9
Russian Federation	84	87	90	92	94	95	96	97	1.8
South Africa	67	70	73	74	76	79	82	85	3.3
United States	20	22	25	22	21	20	19	18	-3.3
Other	97	92	84	82	77	72	71	65	-5.6
Total Exports	725	771	792	829	863	899	933	962	3.8



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

Source: Australian Bureau of Agricultural and Resource Economics and Sciences, *Australian Commodity Statistics*, March 2011.

Notes: ¹World contract prices.

3.3 Outlook for Westshore Exports

The outlook for Westshore exports depends on three factors: the world demand for metallurgical and thermal coal, the availability of coal in Western Canada and the western U.S. for export, and the capacity of the coal terminal.

- The above section has shown that the outlook for internationally-traded coal is one of substantial demand growth. This will create potential demand for exports of metallurgical and thermal coal from Western Canada and thermal coal from the U.S.
- The response of the western Canadian coal industry to the high coal prices of recent years has been modest, especially in comparison with major coal exporting countries such as Australia and Indonesia. Nevertheless, new mines have opened, closed mines have reopened and mine expansions are planned.
- The capacity of Westshore Terminals is discussed below.

Westshore Terminals has just gone through an expansion that has brought its capacity to a nominal 29 million tonnes a year. Westshore considers that its terminal can export a sustained 27 million tonnes a year today and with incremental improvements will approach its expanded capacity of 29 million tonnes. The company has also committed to further expansions that will bring its capacity to 33 million tonnes by 2013. Beyond this, the company is studying ways of increasing the capacity in the longer term but has not provided estimates of its future capacity².

With the limited coal terminal capacity in Port Metro Vancouver and essentially no possibility of new coal terminal development other than in Prince Rupert, the capacity of Westshore Terminals will probably be the main determinant of its coal volumes. The terminal should be able to utilize a significant portion of its practical capacity as long as coal markets do not crash.

3.4 Projection of Coal Ship Calls and Movements

Table Q summarizes the projections of ship calls and ship movements for Westshore terminals. It takes into consideration three parameters: the terminal capacity, a projection of export tonnage given that capacity and the tonnes of coal per ship call.

² Source: Westshore Terminals Investment Corporation, *Annual Information Form*, March 30, 2011 and "Another major upgrade," *Mining & Exploration*, summer 2011.



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

The terminal is assumed to achieve its planned capacity of 33 million tonnes in 2015 and beyond that extend tonnage capacity modestly to a maximum of 35 million tonnes by 2025. The export tonnage is assumed grow incrementally at 1.0 million tonnes a year until it reaches terminal capacity. The coal volume per ship call is assumed to remain at 100,000 tonnes.

The number of ship calls range from about 250 today to 350 in future. Ship movements are estimated at two times the number of ship calls.

Table Q Westshore Terminals Ship Calls and Movements Actual 2010 to Projected 2030

Case and Ship Activity	2010	2015	2020	2025	2030
Base Case Ship Calls					
Export Tonnage (Mt)	24.7	26.0	31.0	35.0	35.0
Tonnes per Ship Call	100,318	100,000	100,000	100,000	100,000
Ship Calls	246	260	310	350	350
Ship Movements	492	520	620	700	700



PORT METRO VANCOUVER

**PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS
DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)**

4. OVERALL SHIP MOVEMENT PROJECTIONS

Table R summarizes the overall annual results for Deltaport (container) and Westshore (coal) shipping for 2010 (actual) and 2014 to 2030 (projections). It begins with the traffic projections and develops projections by year of container ship and coal ship annual calls and movements on the bases as discussed above.

Table S summarizes average and peak monthly and daily movements:

- Average monthly movements are annual movements divided by 12 in all cases.
- Peak monthly container ship movements are estimated at 5% above average movements. Container ships are highly scheduled and while container ship arrivals are frequently not exactly as planned, most schedule variations are minor.
- In the case of coal ships, a monthly peaking factor was estimated from 1995 to 2010 PMV data at 30%.
- Average daily movements are annual movements divided by 365 in all cases.
- Peak daily movements are estimated as full turnover of each berth in one day. This is an extreme situation because most container ships and essentially all coal ships require multiple days at berth for cargo handling.



PORT METRO VANCOUVER

PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS

DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)

Table R Annual Vessel Projections for Deltaport and Westshore

Case/Year	Prediction	Cargo Volume (Million)		Annual Ship Calls			Annual Ship Movements		
		Container (TEU)	Coal (Tonnes)	Container	Coal	Total	Container	Coal	Total
Case 1									
2010	Actual	1.54	24.7	245	246	491	594	492	1,086
2014	Prediction	1.74	25.0	260	250	510	624	500	1,124
2015	Prediction	2.02	26.0	260	260	520	624	520	1,144
2016	Prediction	2.28	27.0	312	270	582	728	540	1,268
2017	Prediction	2.55	28.0	364	280	644	832	560	1,392
2018	Prediction	2.85	29.0	364	290	654	832	580	1,412
2019	Prediction	3.00	30.0	364	300	664	832	600	1,432
2020	Prediction	2.40	31.0	312	310	622	728	620	1,348
2021	Prediction	2.40	32.0	312	320	632	728	640	1,368
2022	Prediction	2.40	33.0	312	330	642	728	660	1,388
2023	Prediction	2.40	34.0	312	340	652	728	680	1,408
2024	Prediction	2.40	35.0	312	350	662	728	700	1,428
2025	Prediction	2.40	35.0	260	350	610	624	700	1,324
2026	Prediction	2.40	35.0	260	350	610	624	700	1,324
2027	Prediction	2.40	35.0	260	350	610	624	700	1,324
2028	Prediction	2.40	35.0	260	350	610	624	700	1,324
2029	Prediction	2.40	35.0	260	350	610	624	700	1,324
2030	Prediction	2.40	35.0	260	350	610	624	700	1,324
Case 2									
2010	Actual	1.54	24.7	245	246	491	594	492	1,086
2014	Prediction	1.74	25.0	260	250	510	624	500	1,124
2015	Prediction	2.02	26.0	260	260	520	624	520	1,144
2016	Prediction	2.28	27.0	312	270	582	728	540	1,268
2017	Prediction	2.55	28.0	364	280	644	832	560	1,392



PORT METRO VANCOUVER

PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS

DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)

Case/Year	Prediction	Cargo Volume (Million)		Annual Ship Calls			Annual Ship Movements		
		Container (TEU)	Coal (Tonnes)	Container	Coal	Total	Container	Coal	Total
2018	Prediction	2.85	29.0	364	290	654	832	580	1,412
2019	Prediction	3.00	30.0	364	300	664	832	600	1,432
2020	Prediction	3.00	31.0	364	310	674	832	620	1,452
2021	Prediction	3.00	32.0	364	320	684	832	640	1,472
2022	Prediction	3.00	33.0	364	330	694	832	660	1,492
2023	Prediction	3.00	34.0	364	340	704	832	680	1,512
2024	Prediction	3.00	35.0	364	350	714	832	700	1,532
2025	Prediction	3.00	35.0	364	350	714	832	700	1,532
2026	Prediction	3.00	35.0	364	350	714	832	700	1,532
2027	Prediction	3.00	35.0	364	350	714	832	700	1,532
2028	Prediction	3.00	35.0	312	350	662	728	700	1,428
2029	Prediction	3.00	35.0	312	350	662	728	700	1,428
2030	Prediction	3.00	35.0	312	350	662	728	700	1,428
Case 3									
2010	Actual	1.54	24.7	245	246	491	594	492	1,086
2014	Prediction	1.74	25.0	312	250	562	728	500	1,228
2015	Prediction	2.02	26.0	312	260	572	728	520	1,248
2016	Prediction	2.28	27.0	364	270	634	832	540	1,372
2017	Prediction	2.55	28.0	416	280	696	936	560	1,496
2018	Prediction	2.85	29.0	468	290	758	1,040	580	1,620
2019	Prediction	3.00	30.0	468	300	768	1,040	600	1,640
2020	Prediction	3.00	31.0	468	310	778	1,040	620	1,660
2021	Prediction	3.00	32.0	468	320	788	1,040	640	1,680
2022	Prediction	3.00	33.0	468	330	798	1,040	660	1,700
2023	Prediction	3.00	34.0	468	340	808	1,040	680	1,720
2024	Prediction	3.00	35.0	468	350	818	1,040	700	1,740
2025	Prediction	3.00	35.0	468	350	818	1,040	700	1,740



PORT METRO VANCOUVER

PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS

DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)

Case/Year	Prediction	Cargo Volume (Million)		Annual Ship Calls			Annual Ship Movements		
		Container (TEU)	Coal (Tonnes)	Container	Coal	Total	Container	Coal	Total
2026	Prediction	3.00	35.0	468	350	818	1,040	700	1,740
2027	Prediction	3.00	35.0	468	350	818	1,040	700	1,740
2028	Prediction	3.00	35.0	468	350	818	1,040	700	1,740
2029	Prediction	3.00	35.0	468	350	818	1,040	700	1,740
2030	Prediction	3.00	35.0	468	350	818	1,040	700	1,740

Sources: Consultant estimates, 2011.

Description of Cases:

- Case 1: High "Direct" container traffic projection. Deltaport has a sustainable capacity of 2.4 million TEU. Deltaport has a maximum capacity of 3.0 million TEU in interim years of high demand. Container vessel sizes are as in Table G. Maximum Westshore throughput is 35 million tonnes of coal.
- Case 2: High "Direct" container traffic projection. Deltaport has a sustainable capacity of 3.0 million TEU. Container vessel sizes are as in Table G. Maximum Westshore throughput is again 35 million tonnes of coal.
- Case 3: High "Direct" container traffic projection. Deltaport has a sustainable capacity of 3.0 million TEU. Container call size remains at 2010 level of 6,250 TEU per ship call. Maximum Westshore throughput is again 35 million tonnes of coal.



PORT METRO VANCOUVER

PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS

DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)

Table S Monthly and Daily Vessel Projections for Deltaport and Westshore

Case/Year	Average Monthly Ship Movements			Peak Monthly Ship Movements			Average Daily Ship Movements			Peak Daily Ship Movements		
	Container	Coal	Total	Container	Coal	Total	Container	Coal	Total	Container	Coal	Total
Case 1												
2010	50	41	91	52	53	105	1.6	1.3	3.0	6.0	4.0	10.0
2014	52	42	94	55	54	109	1.7	1.4	3.1	6.0	4.0	10.0
2015	52	43	95	55	56	111	1.7	1.4	3.1	6.0	4.0	10.0
2016	61	45	106	64	59	122	2.0	1.5	3.5	6.0	4.0	10.0
2017	69	47	116	73	61	133	2.3	1.5	3.8	6.0	4.0	10.0
2018	69	48	118	73	63	136	2.3	1.6	3.9	6.0	4.0	10.0
2019	69	50	119	73	65	138	2.3	1.6	3.9	6.0	4.0	10.0
2020	61	52	112	64	67	131	2.0	1.7	3.7	6.0	4.0	10.0
2021	61	53	114	64	69	133	2.0	1.8	3.7	6.0	4.0	10.0
2022	61	55	116	64	72	135	2.0	1.8	3.8	6.0	4.0	10.0
2023	61	57	117	64	74	137	2.0	1.9	3.9	6.0	4.0	10.0
2024	61	58	119	64	76	140	2.0	1.9	3.9	6.0	4.0	10.0
2025	52	58	110	55	76	130	1.7	1.9	3.6	6.0	4.0	10.0
2026	52	58	110	55	76	130	1.7	1.9	3.6	6.0	4.0	10.0
2027	52	58	110	55	76	130	1.7	1.9	3.6	6.0	4.0	10.0
2028	52	58	110	55	76	130	1.7	1.9	3.6	6.0	4.0	10.0
2029	52	58	110	55	76	130	1.7	1.9	3.6	6.0	4.0	10.0
2030	52	58	110	55	76	130	1.7	1.9	3.6	6.0	4.0	10.0
Case 2												
2010	50	41	91	52	53	105	1.6	1.3	3.0	6.0	4.0	10.0
2014	52	42	94	55	54	109	1.7	1.4	3.1	6.0	4.0	10.0
2015	52	43	95	55	56	111	1.7	1.4	3.1	6.0	4.0	10.0
2016	61	45	106	64	59	122	2.0	1.5	3.5	6.0	4.0	10.0
2017	69	47	116	73	61	133	2.3	1.5	3.8	6.0	4.0	10.0



PORT METRO VANCOUVER

PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS

DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)

Case/Year	Average Monthly Ship Movements			Peak Monthly Ship Movements			Average Daily Ship Movements			Peak Daily Ship Movements		
	Container	Coal	Total	Container	Coal	Total	Container	Coal	Total	Container	Coal	Total
2018	69	48	118	73	63	136	2.3	1.6	3.9	6.0	4.0	10.0
2019	69	50	119	73	65	138	2.3	1.6	3.9	6.0	4.0	10.0
2020	69	52	121	73	67	140	2.3	1.7	4.0	6.0	4.0	10.0
2021	69	53	123	73	69	142	2.3	1.8	4.0	6.0	4.0	10.0
2022	69	55	124	73	72	144	2.3	1.8	4.1	6.0	4.0	10.0
2023	69	57	126	73	74	146	2.3	1.9	4.1	6.0	4.0	10.0
2024	69	58	128	73	76	149	2.3	1.9	4.2	6.0	4.0	10.0
2025	69	58	128	73	76	149	2.3	1.9	4.2	6.0	4.0	10.0
2026	69	58	128	73	76	149	2.3	1.9	4.2	6.0	4.0	10.0
2027	69	58	128	73	76	149	2.3	1.9	4.2	6.0	4.0	10.0
2028	61	58	119	64	76	140	2.0	1.9	3.9	6.0	4.0	10.0
2029	61	58	119	64	76	140	2.0	1.9	3.9	6.0	4.0	10.0
2030	61	58	119	64	76	140	2.0	1.9	3.9	6.0	4.0	10.0
Case 3												
2010	50	41	91	52	53	105	1.6	1.3	3.0	6.0	4.0	10.0
2014	61	42	102	64	54	118	2.0	1.4	3.4	6.0	4.0	10.0
2015	61	43	104	64	56	120	2.0	1.4	3.4	6.0	4.0	10.0
2016	69	45	114	73	59	131	2.3	1.5	3.8	6.0	4.0	10.0
2017	78	47	125	82	61	143	2.6	1.5	4.1	6.0	4.0	10.0
2018	87	48	135	91	63	154	2.8	1.6	4.4	6.0	4.0	10.0
2019	87	50	137	91	65	156	2.8	1.6	4.5	6.0	4.0	10.0
2020	87	52	138	91	67	158	2.8	1.7	4.5	6.0	4.0	10.0
2021	87	53	140	91	69	160	2.8	1.8	4.6	6.0	4.0	10.0
2022	87	55	142	91	72	163	2.8	1.8	4.7	6.0	4.0	10.0
2023	87	57	143	91	74	165	2.8	1.9	4.7	6.0	4.0	10.0
2024	87	58	145	91	76	167	2.8	1.9	4.8	6.0	4.0	10.0
2025	87	58	145	91	76	167	2.8	1.9	4.8	6.0	4.0	10.0



PORT METRO VANCOUVER

PROJECTIONS OF VESSEL CALLS AND MOVEMENTS AT DELTAPORT AND WESTSHORE TERMINALS

DELTAPORT TERMINAL ROAD AND RAIL IMPROVEMENT PROJECT (DTRRIP)

Case/Year	Average Monthly Ship Movements			Peak Monthly Ship Movements			Average Daily Ship Movements			Peak Daily Ship Movements		
	Container	Coal	Total	Container	Coal	Total	Container	Coal	Total	Container	Coal	Total
2026	87	58	145	91	76	167	2.8	1.9	4.8	6.0	4.0	10.0
2027	87	58	145	91	76	167	2.8	1.9	4.8	6.0	4.0	10.0
2028	87	58	145	91	76	167	2.8	1.9	4.8	6.0	4.0	10.0
2029	87	58	145	91	76	167	2.8	1.9	4.8	6.0	4.0	10.0
2030	87	58	145	91	76	167	2.8	1.9	4.8	6.0	4.0	10.0

Sources: Consultant estimates, 2011.

Description of Cases:

- Case 1: High "Direct" container traffic projection. Deltaport has a sustainable capacity of 2.4 million TEU. Deltaport has a maximum capacity of 3.0 million TEU in interim years of high demand. Container vessel sizes are as in Table G. Maximum Westshore throughput is 35 million tonnes of coal.
- Case 2: High "Direct" container traffic projection. Deltaport has a sustainable capacity of 3.0 million TEU. Container vessel sizes are as in Table G. Maximum Westshore throughput is again 35 million tonnes of coal.
- Case 3: High "Direct" container traffic projection. Deltaport has a sustainable capacity of 3.0 million TEU. Container call size remains at 2010 level of 6,250 TEU per ship call. Maximum Westshore throughput is again 35 million tonnes of coal.