Appendix:
The Economic Role of the Gateway Transportation System in the Greater Vancouver Region

Prepared for:
Greater Vancouver Gateway Council
800 Robson Street, Vancouver BC V6Z 3B7

Prepared by:
Economic Development Research Group, Inc.
2 Oliver Street, 9th Floor, Boston, MA 02109 USA

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APPENDIX A: THE IMPORTANCE OF TRADE IN GREATER VANCOUVER

This appendix provides back-up information on charts presented in Chapter 2 of the main report[1].

The data provided below in Table A1 corresponds to Figure 2.1 in the report. This shows the value of imports and exports between Canada and BC with the US. The ratio of exports to imports is then compared to the exchange rate of the Canadian and US dollars.

Table A1: The Value of Exports and Imports between Canada and the US (nominal dollars in millions) and Annual Exchange Rate ($CAD/$US), 2002-2007

	2002	2003	2004	2005	2006	2007
Canada						
Exports to US	345,366	326,700	348,144	365,803	359,254	354,210
Imports from US	218,497	203,822	208,987	215,196	217,642	220,426
Ratio Exports/Imports	**1.58**	**1.60**	**1.67**	**1.70**	**1.65**	**1.61**
BC						
Exports to US	20,683	19,517	20,874	22,947	21,353	19,097
Imports from US	11,826	11,572	12,702	14,166	15,499	15,863
Ratio Exports/Imports	**1.75**	**1.69**	**1.64**	**1.62**	**1.38**	**1.20**
Avg. Exchange Rate	**1.57**	**1.40**	**1.30**	**1.21**	**1.13**	**1.07**

Source: Bank of Canada, Statistics Canada International Trade Division, calculations by EDR Group

The following information in Table A2 was used in determining the relative concentration of transportation-related employment in Vancouver and the western provinces found in Figure 2.2. The total number of jobs and those in the transportation and warehousing sector are provided along with the percentage of total employment attributed to the sector. The "location quotient" represents the relative concentration of transportation and warehousing employment to Canada. This is determined by dividing the percentage of transportation and warehousing employment for each area by the same measure in Canada. Therefore, a value higher than "1" means that the sector is more concentrated in that area than in

[1]This report was funded by Transport Canada. The opinions expressed are those of the authors, not of the Government of Canada.

Canada as a whole—this turns out to be true for all of the other geographies included below.

Table A2: Employment in Transportation and Warehousing in Canada, Vancouver, and Western Provinces, 2007(thousands); Relative Concentration of Employment in Transportation and Warehousing Compared to Canada, 2007

	Canada	Sask.	Alberta	Manitoba	BC	Vancouver
Transportation and Warehousing Employment	823	25	106	34	126	76
Total Employment	16,866	502	1,959	597	2,266	1,223
Trans/Warehousing % of total	4.9%	5%	5.4%	5.7%	5.6%	6.2%
Location Quotient	**1.00**	**1.00**	**1.11**	**1.18**	**1.14**	**1.27**

Source: Statistics Canada, Labour Force Survey

APPENDIX B: PERFORMANCE OF THE GATEWAY TRANSPORTATION SECTOR

This appendix provides back-up information on charts presented in Chapter 3 of the main report. Further information on value of trade and passenger activity referred to in Chapter 3 is provided in Appendix C.

Table B1 shows the composition of cargo at the Port of Vancouver in 2002 and 2007. This data is used in Figure 3.1 in the report. The numbers below represent the cargo moving through Vancouver only, not the newly consolidated Port of Vancouver (Vancouver, Fraser and North Fraser).

Table B1: Port of Vancouver Cargo Composition, 2007 (millions of tonnes)

	2002	2007	% change (2002-2007)
Bulk	48	61	28%
Breakbulk	3.2	2.5	-22%
Containers	12	19.2	60%
Total	**62.8**	**82.7**	**32%**

Source: Port of Vancouver

Table B2 shows the containers moved through the Vancouver Gateway (the three consolidated ports) compared to other port regions in 2002 and 2007—corresponding to Figure 3.2. These results show that the Gateway ports now handle more than half of the containers in Canada.

Table B2: Change in Container Traffic, 2002-2007 (millions of TEU's)

	2002	2007	% change (2002-2007)
Vancouver Gateway	1.56	2.50	60%
Pacific Coast (US and Canada)	18.92	27.05	43%
Canada	3.30	4.61	40%
North America	37.57	52.66	40%
Share of Canadian containers moved through Vancouver Gateway	47%	54%	

Source: American Association of Port Authorities

Table B3 shows the annual changes in air passengers and cargo moving through Vancouver International Airport. This information was used in Figure 3.3.

Table B3: Annual Changes in Air Passengers (millions) and Air Cargo (tonnes), 2002-2007

	Passengers	Cargo
2002	14.9	235,039
2003	14.3	215,839
2004	15.7	229,913
2005	16.4	223,678
2006	16.9	223,072
2007	17.5	225,455

Source: Vancouver International Airport and Statistics Canada, International Trade Division. Data for international trade is for all of BC and therefore includes goods traded at other small airports in the province.

Table B4 provides back-up for Figure 3.4 in the main report. This shows the changes in origin and destination of rail freight traffic in BC.

Table B4: Rail Freight Traffic in BC, 2001-2006 (millions of tonnes)

	2001	2006	% change
Rest of Canada	48.0	57.7	20%
US and Mexico	7.7	14.0	83%
Within BC	28.2	31.1	10%
Total	**83.9**	**102.9**	**23%**

Source: Statistics Canada, Rail in Canada 2006

APPENDIX C: ESTIMATION OF ECONOMIC IMPACTS

This appendix explains the calculations and methodology used in estimating the economic impacts of the Greater Vancouver Gateway transportation system. These impacts are provided in detail in Chapter 4 in the main report.

Direct Impacts

The basis of estimating the direct impacts was the direct employment related to each mode in the Gateway transportation system. The estimates (shown in Table 4.1 in the report) were calculated based on the employment and cargo trends for each mode. Information shown below on trade and passenger activity is also referred to in Chapter 3.

In viewing the comparisons of freight activities to jobs it is apparent that an increase in cargo movement does not necessarily translate into more employment. One of the reasons this occurs is due to changes in productivity in activities associated with each mode. There are also changes in commodities traded and, therefore, the types of activities needed to support these movements.

Most importantly, the direct estimates are not necessarily jobs that would be categorized in each mode but also include jobs in sectors that support that mode. Therefore, the need for supporting activities in each mode also informed our estimates. Detailed data on location and employment was acquired through Dun and Bradstreet on firms in the transportation sector in BC. This allowed for estimation of supporting jobs related to each mode.

Tables C1a and C1b compare the trends in marine cargo and passengers moving through the Gateway ports in 2002 and 2007. Cargo activity increased significantly at the marine ports while water transportation employment decreased. However, the study team estimated an increase in direct maritime jobs from 2002 to 2007 partially due to growth in supporting jobs. This increase was also justified since there was significant growth in the number of hours worked at the port in recent years, according to the British Columbia Maritime Employers Association (BCMEA).

Table C1a: Changes in Marine Cargo (million tonnes) and Related Employment (thousands), 2002-2007

	2002	2007	% change
Port Vancouver	62.8	82.7	32%
Fraser Port	32.5	34.8	7%
North Fraser Port	16.3	10.3	-37%
TOTAL	*111.6*	*127.9*	*15%*
BC Water Trans. Employment	6.7	5.6	-16%

Source: Vancouver Marine Ports, Statistics Canada Labour Force Survey

Table C1b: Changes in Marine Passengers and Related Employment (thousands), 2002-2007

	2002	2007	% change
Passengers	1,125,252	960,554	-15%
BC Supporting/Sightseeing Trans. Employment	20.1	22.6	12%

Source: Port of Vancouver, Statistics Canada Labour Force Survey

Table C2 shows the comparison of trends in air cargo and passengers at Vancouver International Airport along with air transportation employment in BC and Greater Vancouver (annual changes in cargo and passengers at the airport were shown previously in Table B3). The study team, as with maritime transportation, used a composite of growth rates to form an estimate of direct jobs related to air transportation. This included an assumption that activity at the airport revolved more around passenger travel than cargo. Therefore, there was a modest increase in direct jobs estimated from 2002 to 2007.

Table C2: Comparison of Air Cargo (thousand tonnes) and Air Passengers (millions) and Related Employment (thousands), 2002-2007

	2002	2007	% change
Passengers	14.9	17.5	18%
Cargo	235.0	225.5	-4%
BC Air Trans. Employment	14.5	14.5	0%
Vancouver Air Trans. Employment	10.6	10.5	-1%

Source: Vancouver International Airport, Statistics Canada Labour Force Survey

Total rail tonnage, shown in Table B4, increased by 23% from 2001 to 2006. However, Table C3 shows that the value of international trade moved by rail decreased slightly (adjusted for inflation) from 2002 to 2007. This has also been

met with a sharp decrease in jobs in this sector. Therefore, after taking supporting jobs into account, there was an estimated decease in jobs from 2002 to 2007.

Table C3: Comparison of Rail Trade (millions) and Related Employment (thousands), 2002-2007

	2002	2007	% change adj. for inflation
BC Rail Exports	5,610	5,985	-0.9%
BC Rail Imports	1,452	1,532	-1.9%
Total Rail Trade	*7,061*	*7,517*	*-1.1%*
BC Rail Trans. Employment	6.7	4.9	-26.9%

Source: BC Stats, Statistics Canada International Trade Division, Statistics Canada Labour Force Survey (employment not adjusted by inflation)

Table C4 below shows a significant increase in trucking jobs along with a decrease in the value of international trade involving trucks. As with the estimates for rail, the estimated jobs related to trucking relied more on the job trends than activity. Therefore, there was an estimated increase in trucking jobs based on the trend in trucking employment from 2002 to 2007. In the interest of having a conservative estimate, the growth in BC employment was used instead of the growth in Vancouver.

Table C4: Comparison of Truck Trade (millions), Truck Volume and Related Employment (thousands), 2002-2007

	2002	2007	% change adj. for inflation
BC Truck Exports	11,046	8,463	-28.8%
BC Truck Imports	14,016	17,867	18.4%
Total Truck Trade	*25,062*	*26,330*	*-2.4%*
Number of Trucks Crossing Border	1,173,654	1,056,629	-10.0%
BC Truck Trans. Employment	28.3	34.7	22.6%
Vancouver Truck Trans. Employment	13.7	17.8	29.9%

Source: BC Stats, Statistics Canada International Trade Division, Statistics Canada Labour Force Survey, (employment not adjusted by inflation), BC Trucking Association

Table C5 presents a summary of the trends used to inform the direct impact estimates. This presents the percentage changes from 2002 to 2007 for several measures of activity by mode.

Table C5: Trends in Tonnage, Passengers, International Trade and Employment by Mode, (% change from 2002 to 2007)

% change 2002-2007	Marine	Air	Rail	Truck	Support Trans.
Cargo Tonnage	15%	-4%	23%	-	-
Passengers	-15%	18%	-	-	-
Int'l Trade by Value	10%	25%	-1%	-2%	-
BC jobs	-16%	0%	-27%	23%	14%
Vancouver jobs	-	-1%	-	30%	12%

Source: BC Stats, Statistics Canada International Trade Division, Statistics Canada Labour Force Survey, Vancouver Marine Ports, Vancouver International Airport, calculations by EDR Group.

The relationship of jobs to GDP, income and output has changed since 2002. In order to take trends into account it was necessary not to simply adjust 2002 dollars with inflation. There have been large increases in GDP and income in transportation sectors in BC over and above inflation including[2]:

- 18% increase in GDP in truck transportation.
- 11% increase in GDP for other transportation.
- 9% increase in income for the transportation sector.

Even when accounting for growth in employment these trends still represent an increase in the GDP per worker (which is a measure of productivity) for all modes except for trucking—the large increase in trucking jobs offset GDP gains per worker. Table C6 shows the increases in GDP per worker used in the direct impact estimates. These factors for BC were also checked against similar growth in Canada and were slightly more conservative in comparison.

Table C6: Changes to GDP per Worker, 2002 and 2007

	GDP/Worker $2002	GDP/Worker $2007 (adjusting for inflation only)	GDP/Worker $2007 (with real growth)
Maritime	$57,923	$63,716	$79,355
Air	$63,459	$69,805	$86,939
Truck	$59,871	$65,858	$63,969
Rail	$80,955	$89,050	$110,908

Source: Statistics Canada

Table C7 shows the direct impact estimates from the previous study. These are compared to the new results in Tables 4.2a and 4.2b in the main report after adjusting dollars for inflation.

[2] These trends are from 2001 to 2006 since data for 2007 was not available.

Table C7: Direct Impact Estimates from Previous Study, 2002 (dollars in millions $2002)

	Jobs	GDP	Output
Maritime	33,527	1,942	5,399
Air	23,385	1,484	2,394
Truck	14,214	851	1,903
Rail	4,064	329	713
All Modes	75,190	4,606	10,409

Source: "Economic Impact Analysis of Investment in a Major Commercial Transportation System for the Greater Vancouver Region," (EDR Group and Delcan, 2003)

Total Impacts

The estimates for total economic impacts used input-output multipliers from multipliers from BC Stats. The multipliers shown below in Table C8 were used to calculate indirect and induced effects.

Table C8: Input-Output Multipliers

	Output			GDP			Jobs (per $1 mil in output)	
	Indirect	SN Induced	Direct	Indirect	SN Induced	Direct	Indirect	SN Induced
Truck	0.42	0.2	0.51	0.2	0.11	8.6	3.03	1.72
Air, Rail, Water, and Scenic Sightseeing	0.61	0.2	0.44	0.27	0.11	5.39	3.95	1.75

Source: BC Stats 2003 Multipliers

Since the multipliers were not available at a finer level of industry detail, the relationships among those used in the old study were used to infer multipliers for air, rail, and maritime. Also, input-output multipliers from Statistics Canada were used to estimate indirect and induced wage multipliers (which were not available from BC Stats). The final multipliers used in this study are shown below in Table C9.

Table C9: Multipliers Used for Total Impacts

	Jobs	GDP	Output	Wages
Maritime	2.182	2.217	1.913	1.985
Air	1.904	1.714	1.813	1.535
Truck	1.552	1.608	1.620	1.605
Rail	2.369	1.905	1.683	1.706

Source: BC Stats, Statistics Canada, "Economic Impact Analysis of Investment in a Major Commercial Transportation System for the Greater Vancouver Region," (EDR Group and Delcan, 2003)

Table C10 shows the total impact estimates from the previous study. These are compared to the new results in Tables 4.4a and 4.4b in the main report after adjusting dollars for inflation.

Table C10: Total Impact Estimates from Previous Study, 2002 (dollars in millions $2002)

	Jobs	GDP	Output
Maritime	65,913	4,012	10,312
Air	40,127	2,370	4,333
Truck	24,834	1,461	3,254
Rail	8,675	584	1,198
All Modes	139,549	8,427	19,097

Source: "Economic Impact Analysis of Investment in a Major Commercial Transportation System for the Greater Vancouver Region," (EDR Group and Delcan, 2003)

APPENDIX D: ESTIMATIONS OF IMPACTS BY MUNICIPALITY

This appendix explains the calculations involved in estimating impacts by municipality which are found in Chapter 4 of the main report.

Economic impacts for all measures were distributed throughout the Greater Vancouver region's municipalities based on the location of direct, indirect and induced jobs. Employment in the region that did not fall under one of the municipalities listed (which was negligible) was distributed evenly throughout the region.

The locations of direct employment by municipality were taken from a database of firms by industry, including their employment. The industries in the database corresponded to jobs associated with each mode's activity, including supporting services. This information was used for maritime, rail and truck employment since these jobs are spread throughout the region. Employment related to air transportation, however, is highly concentrated in Richmond at Vancouver International Airport. Data from a previous study done for the airport was used to apportion air transportation jobs by municipality. Table D1 shows the resulting direct jobs for each municipality in the region by mode.

Table D1: Direct Job Impacts by Mode and Municipality

Municipality	Jobs by Mode			
	Maritime	Air	Truck	Rail
Anmore	0	0	16	0
Belcarra	0	0	6	0
Bowen Island	33	0	9	0
Burnaby	870	58	2,119	78
Coquitlam	213	16	1,019	40
Delta	8,178	143	2,494	717
Langley City	70	16	512	9
LangleyDM	192	74	1,404	24
Lions Bay	0	0	0	0
Maple Ridge	549	11	251	87
New Westminster	813	24	326	433
N. Vancouver City	1,213	35	168	193
N. Vancouver DM	1,081	51	150	172
Pitt Meadows	33	5	249	49
Port Coquitlam	610	29	631	460
Port Moody	640	16	34	1
Richmond	5,855	23,863	2,250	346
Surrey	1,656	126	4,377	471
Vancouver	11,362	545	1,356	235
West Vancouver	2,656	8	38	4
White Rock	20	2	21	2

Source: Dun and Bradstreet, Statistics Canada, air trans. percentages estimated using "Vancouver International Airport Economic Impact" (Intervistas, March 2006).

The indirect (i.e. supplier) impacts by municipality were estimated by using the location of employment by place of work in the region. This form of economic concentration by municipality was used since detailed information on suppliers for each mode was not available. Table D2 shows the distribution of indirect impacts by municipality which applies for all modes.

Table D2: Total Jobs by Municipality - by place of work (% of regional total)

Municipality	
Anmore	0.02%
Belcarra	0.01%
Bowen Island	0.10%
Burnaby	12.01%
Coquitlam	4.10%
Delta	4.90%
Langley City	1.55%
Langley DM	4.26%
Lions Bay	0.03%
Maple Ridge	2.01%
New Westminster	2.45%
N. Vancouver City	2.57%
N. Vancouver DM	2.29%
Pitt Meadows	0.46%
Port Coquitlam	1.90%
Port Moody	0.67%
Richmond	11.28%
Surrey	12.46%
Vancouver	34.58%
West Vancouver	1.69%
White Rock	0.62%

Source: Statistics Canada Catalogue no. 97-561-XWE2006002

The induced (i.e. worker spending) impacts were distributed using the location of residences for direct and indirect jobs. This was done with the assumption that workers spend money where they live. Therefore, to estimate the induced jobs generated from direct worker spending, the distribution of transportation jobs by place of residence was used. In order to calculate the induced jobs from indirect worker spending, the distribution of all jobs throughout the region was used. The results are shown below in Table D3.

Table D3: Total Jobs by Municipality - by place of residence (% of regional total)

Municipality	All jobs	Transportation jobs
Anmore	0.09%	0.12%
Belcarra	0.03%	0.03%
Bowen Island	0.18%	0.05%
Burnaby	9.41%	7.83%
Coquitlam	5.44%	4.76%
Delta	4.52%	6.84%
Langley City	1.13%	1.05%
Langley DM	4.57%	4.81%
Lions Bay	0.06%	0.02%
Maple Ridge	3.29%	3.15%
New Westminster	2.93%	3.14%
N. Vancouver City	2.34%	1.86%
N. Vancouver DM	3.82%	2.69%
Pitt Meadows	0.78%	0.85%
Port Coquitlam	2.62%	2.70%
Port Moody	1.36%	0.95%
Richmond	8.03%	11.10%
Surrey	18.28%	24.86%
Vancouver	28.61%	21.47%
W. Vancouver	1.68%	0.83%
White Rock	0.82%	0.87%

Source: Statistics Canada 2006 Census

Table D4 shows the total jobs by municipality and by mode. These were estimated using the previous tables on employment by place of work and residence.

Table D4: Total Job Impacts by Mode and Municipality

Municipality	Jobs by Mode			
	Maritime	Air	Truck	Rail
Anmore	19	10	20	2
Belcarra	7	3	7	1
Bowen Island	75	22	17	5
Burnaby	5,255	2,412	3,092	551
Coquitlam	2,000	955	1,422	231
Delta	10,288	1,263	2,986	940
Langley City	635	320	638	70
LangleyDM	1,976	1,019	1,810	214
Lions Bay	14	7	3	1
Maple Ridge	1,525	518	473	190
New Westminster	1,885	590	571	547
N. Vancouver City	2,185	554	383	298
N. Vancouver DM	2,128	596	382	283
Pitt Meadows	267	126	303	74
Port Coquitlam	1,482	486	830	552
Port Moody	974	189	108	37
Richmond	10,218	26,204	3,250	812
Surrey	7,993	3,432	5,872	1,132
Vancouver	23,994	7,320	4,144	1,602
West Vancouver	3,272	336	171	71
White Rock	301	149	86	31

Source: Dun and Bradstreet, Statistics Canada, air trans. percentages estimated using "Vancouver International Airport Economic Impact" (Intervistas, March 2006).

APPENDIX E: ESTIMATION OF FISCAL IMPACTS

This appendix provides information regarding the estimations of fiscal impacts found in Chapter 4 of the main report.

Property taxes were estimated based on the location of jobs by residence and place of work. Recent data on municipal tax collections shown in Table E1 was used along with a breakdown of residential and non-residential collections. Then residential collections were attributed to workers living in that municipality while non-residential (i.e. business) collections were apportioned by place of work.

Table E1: Property Tax Collections by Municipality, 2007 ($)

Municipality	Total Prop taxes and charges
Anmore	2,894,117
Belcarra	1,361,387
Bowen Island	7,012,502
Burnaby	334,299,207
Coquitlam	39,704,547
Delta	184,696,075
Langley City	197,563,355
LangleyDM	152,354,256
Lions Bay	2,398,125
Maple Ridge	91,874,966
New Westminster	93,354,521
N. Vancouver City	81,943,146
N. Vancouver DM	136,944,894
Pitt Meadows	26,012,414
Port Coquitlam	77,590,860
Port Moody	46,138,300
Richmond	332,440,939
Surrey	482,436,632
Vancouver	1,184,134,951
W. Vancouver	106,666,188
White Rock	31,264,574
TOTAL	**3,613,085,957**

Source: Statistics Canada

Income tax impacts were estimated based on the collections at the federal and provincial levels. Since there was more information available on personal income taxes they were estimated separately from corporate income taxes. Personal income tax collections were available by ranges of personal income. From this

data, a simple regression was run in order to determine the effective tax rates for each level of income (simply applying the set tax rate would overstate the impact). These effective rates were estimated for the average wages of direct, indirect and induced workers, they were then applied to each level of wage impact for BC. The estimated, effective tax rates (the ratio of taxes collected to income) are shown below in Table E2.

Table E2: Effective Federal and BC Personal Income Tax Rates (%)

Impact	Est. Fed Tax Rate	Est. BC Tax Rate
Direct	13.37	6.08
Indirect	11.81	5.14
Induced	12.15	5.34
Total	12.66	5.65

Source: Statistics Canada

Corporate income taxes were estimated by taking the average corporate income taxes by job at the federal[3] and provincial levels. These were calculated based on the corporate income tax collections shown below in Tables E3 and E4. The average rates ($678 per job in BC and $2,069 per job in Canada) were then applied to the job impacts for BC.

Tables E3 and E4 also show the basis for estimation of sales tax impacts from GST and PST. These impacts were estimated using the percentage of GDP (for Canada and BC) of the economic impacts which was then applied to the sales tax collections at the federal and provincial levels.

Table E3: Federal Income and Sales Tax Revenue, 2007 (millions)

Tax Type	Revenue
Income taxes	**155,082**
Est. Corporate Income taxes	*34,904*
Est. Personal Income taxes	*113,175*
General sales tax (GST)	**33,300**

Source: Statistics Canada

Table E4: BC Income and Sales Tax Revenue, 2007 (millions)

Tax Type	Revenue
Income taxes	**8,847**
Personal income taxes	*6,815*
Corporation income taxes	*1,673*
Mining and logging taxes	*710*
General sales tax (PST)	**4,716**

Source: Statistics Canada

[3] The breakdown of federal corporate and personal income taxes was based on 2006 collections.