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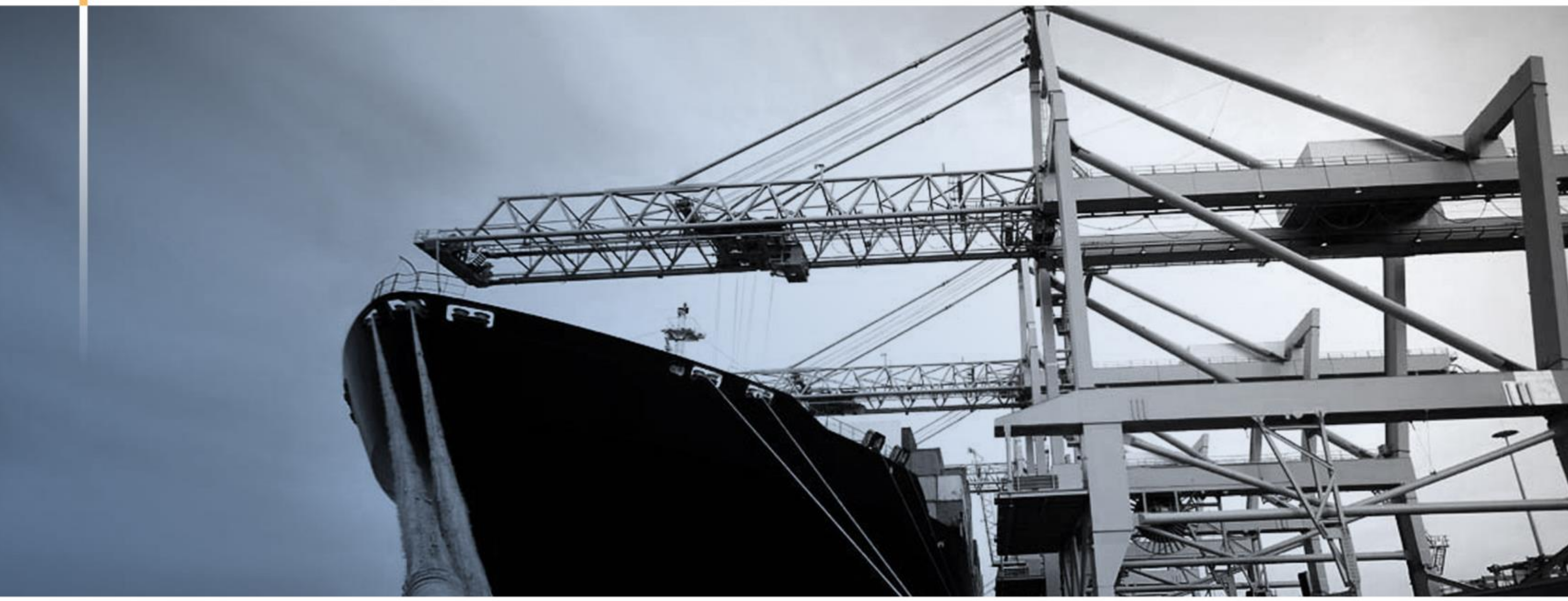

Port Alberni Trans-Shipment Hub (PATH) Feasibility Study

Expected Economic Impacts of PATH Project

Prepared for:

Port Alberni Port Authority

Prepared by:

CPCS

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Solutions for growing economies

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Acknowlegements and Disclaimers

CPCS thanks the Port Alberni Port Authority (PAPA) for the opportunity to undertake this project.

The material herein was developed in part on the basis of PATH project capital and operating cost estimates provided by Hatch engineering consultants and PAPA.

Unless otherwise stated, the opinions provided herein are those of CPCS and they do not necessarily reflect the views of PAPA or the Canadian federal government.

This document should be treated as confidential as it may contain material deemed commercially sensitive.

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Acronyms / Abbreviations

Acronym	Definition
AM	Ante Meridiem
BC	British Columbia
EPA	Environmental Protection Agency
GDP	Gross Domestic Product
FTE	Full Time Equivalent
PAPA	Port Alberni Power Authority
PATH	Port Alberni Trans-Shipment Hub
PM	Post Meridiem
PNW	Pacific North West
TEU	Twenty Foot Equivalent Unit
US	United States

Executive Summary

Introduction

The Port Alberni Port Authority (PAPA) has identified an opportunity to develop a container trans-shipment hub to serve markets on the Canadian West Coast, including along the Fraser River, along the North West United States (together the Pacific North West, or PNW), and from there, further inland, including the US Mid-West.

The project, referred to as the Port Alberni Trans-Shipment Hub (PATH), is premised on a hub-and-spoke container trans-shipment operation concept. The PATH concept envisages a terminal of 400 acres with an annual capacity of 3.5 million TEUs (hub). From PATH, coastal ports and terminals would primarily be served by feeder barge service (spokes).The PATH project could be operational by 2022.

Economic Impact of the PATH Project

The total expected economic impact related to both the construction[1] and operation[2] of the PATH project is estimated as follows:

Increase in Canadian GDP: **$21.3 billion**

Of this, $ 19 billion occurs in BC and close to $20 billion occurs in Western Canada.

Increase in jobs in Canada: **288,079** (full-time equivalents, i.e. person years)

Of this, over 266,000 jobs are created in BC and 273,000 jobs in Western Canada.

Increase in tax revenue: **$1.6 billion**

Of this over $ 1.4 billion would be generated in BC and close to 1.5 billion would be generated in Western Canada.

The figure on the following page presents a summary of the economic impacts.

[1] The total capital cost (including contingency) of the PATH project, located at Sarita Bay South (Option A) is $1.63 billion.

[2] Assumes 50 year operating period, averaging PATH throughput of 1.5 million TEUs per year.

Figure A: Summary of Sarita Bay South Option A Economic Impact [1]

Construction Phase Impact (2)	
Total cost of construction (including contingency)	$1.63 billion
GDP impact	$1,282 million
Jobs impact	13,229
Tax impact	$134 million
Operations Phase Impacts (3)	
Annual operating expense	$271 million
Annual GDP impact	$401 million
Annual Jobs impact	5,497
Annual Tax impact	$30.1 million
Cumulative Impacts (4)	
GDP impact	$21,332 million
Jobs impact	288,079
Tax impact	$1,639 million

(1) Impacts shown are for Canada as a whole, and are the total of direct, indirect and induced effects. Jobs impacts are full-time equivalent, full year jobs and thus equal to person-years of employment. Tax impacts include taxes on production and on products but not on incomes. Dollar figures are 2006 values reflecting the current version of Statistics Canada's Interprovincial Input-Output (I-O) Model.

(2) Construction costs and impacts are totals relating to the entire construction period.

(3) Operating expense and impacts relate to a single year in the operating life of the project.

(4) Cumulative impacts are the sum of the impacts for the construction period and the entire 50 year operating life of the project.

Other Benefits of the PATH Project

Other benefits of the PATH project, relating to changes in congestion and traffic patterns could be in the order of **$74.6 million per year**, or over $30 per TEU.

Figure B: Estimated Value of Traffic-Related Benefits

Description of benefits	Value per Year ($)	Value per TEU ($)
Time Saved by Commuters	6,000,000	2.50
Fuel Saved by Commuters	370,000	0.15
Social Cost of Emissions by Commuters	67,500	0.03
Commercial Savings for Drayage	67,100,00	27.96
Social Cost of Drayage Emissions	1,100,000	0.46
Total	74,637,500	31.1

Source: CPCS estimates. Based on traffic generated by T2, with container volumes estimated at 2.4M TEU per year.

In addition to these savings, other potential benefits include:

- The lower cost of the PATH project relative to the T2 expansion which is expected to be over $2 billion.
- Infrastructure and operating savings transferred to shippers or other supply chain stakeholders, which could increase their competitiveness, that of the region and the Asia Pacific Gateway and Corridor more broadly.
- Better utilization of existing assets in the BC Lower Mainland, including development of terminal capacity along the Fraser River.
- Potential for further economic development, both on Vancouver Island and along the Fraser River.
- Overall, the PATH project is a greener way to handle future container capacity constraints in the BC Lower Mainland and the Pacific North West.

1 Introduction

1.1 Background

The Port Alberni Port Authority (PAPA) has identified an opportunity to develop a container trans-shipment hub to serve markets on the Canadian West Coast, including along the Fraser River, along the North West United States, and further inland, including potentially the US Mid-West. The project, referred to as the Port Alberni Trans-Shipment Hub (PATH), is premised on a hub-and-spoke container trans-shipment operation concept.

CPCS is one of several consultants that have been retained to help assess the feasibility of the project, and its requirements to succeed.

1.2 Objectives

The objective of the CPCS component of the work is to assess the commercial feasibility and economic impacts of the PATH project. This includes the potential market that could be served, the related cost advantage of routing cargo via PATH vis-à-vis the status quo, and the economic impacts and other public benefits of the project.

This feasibility study is intended to provide an independent assessment of the noted opportunity and guidance to PAPA on if and how to move forward with the PATH project.

1.3 Project Structure & Scope

This feasibility study, as defined in the Terms of Reference, is broken down into two parts. Part A addresses the potential market and related strategic and commercial considerations. Part B addresses technical considerations relating to the development of infrastructure, equipment, and operations.

The CPCS component of this work relates largely to Part A of the project, and the following three project phases, specifically:

2. Examination of strategic & business requirements

6. Cost and logistics modeling for container delivery

11. Economic impacts

1.4 Purpose of this Report Component

This report component addresses the economic impacts and other benefits of the PATH project (phase 11).

It complements a larger CPCS report addressing the strategic and business requirements of the PATH project, the market potential and related forecasts, and the potential logistics cost advantages that the PATH facility could deliver.[3]

1.5 Limitations

This report does not on its own constitute a full analysis of the PATH project's feasibility. Its scope is limited to an assessment of the economic impact and other benefits of the PATH project. This is only one dimension of what will inform the overall feasibility of the PATH project. Other technical and capital cost considerations, among others, are being assessed separately by other consultants.

[3] Dated March 21, 2014

2 Port Alberni Trans-shipment Hub (PATH)

2.1 The Concept

The global container shipping industry has seen the emergence of massive trans-shipment hub ports at a variety of locales around the world, serving smaller regional "feeder" ports.[4]

The Port Alberni Trans-Shipment Hub (PATH) project is premised on a hub-and-spoke trans-shipment concept. Under a hub-and-spoke container transport arrangement, containers are transported to a central "hub" facility, then onwards to interacting nodes via a network of "spokes" and vice versa. Under this concept, containers are generally fully unloaded/loaded at the trans-shipment terminal, though the ship could also go on to serve other facilities elsewhere.

The PATH project envisages high efficiency and low cost automated container trans-shipment operations at Port Alberni (hub) to serve containers moving primarily between Asia and markets along the Canadian West Coast, the US Pacific North West (PNW) and potentially further inland.

Inbound containers arriving at PATH would be loaded onto barges or smaller vessels (spokes) for onward transportation to coastal ports and river terminals that provide connections to end markets. Outbound containers would conversely move from coastal ports and river terminals to PATH for onward shipping, primarily to Asia.

PATH Concept

According to documentation obtained from the Port Alberni Port Authority, the PATH concept would be a terminal of 400 acres with an annual capacity of 3.5 million TEUs. Inland markets would primarily be served by barge via inner harbours and river terminals along British Columbia's Lower Mainland. Other regional and inland markets could also be served by PATH.[5]

[4] CPCS, Hub and Spoke Container Trans-shipment Operations for the Marine Movement of Freight, Dec 2008
[5] Presentation, Port Alberni, BC, "Canada Stats Here" (not dated)

Figure 2-1: PATH Concept

Source: Port Alberni Port Authority

3 Economic Impacts of the PATH Project

3.1 Overview of Economic Impact Measures

The purpose of this chapter is to quantify the economic impact of the PATH project. Simulation analysis using an input-output model (a model that replicates the inter-industry relationships in the economy) is the method used to estimate the economic impact. Simulation is carried out by deliberately altering or "shocking" the level of a particular variable (or variables) in the model in order to change it (them) from its (their) status quo, and then observing the effects on the remaining variables in the model. "Economic impact" is measured here in terms of the impacts on the key indicators of GDP, employment and government tax revenue.

The key drivers of these economic impact measures are the project's capital and operating costs as provided to CPCS.

3.2 PATH Project Capital Costs

The engineering analysis has identified three location options for construction of the PATH project: Sarita Bay North, Sarita Bay South Option A and Sarita Bay South Option B. These are all located close together so effectively they are three options at the 'same' location. The vast majority of the work involved is standard across all of three options and it is really only the earthworks and dredging that differ. Given this, we have chosen to carry out the economic impact analysis on the least expensive option. This is Sarita Bay South Option A the option with the least amount of earthworks.

The total capital cost (including contingency) of the PATH project, located at Sarita Bay South (Option A) is $1.63 billion.[6]

In comparison, Sarita Bay North entails a total for construction of $1.963 billion, while Sarita Bay South Option B entails a total for construction of $2.055 billion.

3.3 Sarita Bay South Option A Construction Cost

Figure 3-1 presents a summary of the construction cost for the Sarita Bay South Option A. Because the PATH project is being planned as a fully automated terminal, of which there are very few in the world, the single largest cost item is the container handling equipment at $515

[6] Capital costs were provided by Hatch consulting engineers, who are advising the Port Alberni Port Authority on the engineering components of the PATH project.

million, representing almost one third of the $1.630 billion total for construction. Other major cost items include terminal site excavation and fill at $304 million, wharf structural costs at $171 million, and civil and miscellaneous structural terminal infrastructure at $95 million.

Figure 3-1: Sarita Bay South Option A Total for Construction

Item	Description	Cost $	Contingency $
1	Mobilization/Demobilization	61,033,000	9,155,000
2	Dredging and Land Reclamation	46,792,800	11,698,200
3	Removals and Site Preparation	2,888,750	433,300
4	Excavation and Fill – Terminal Site	304,215,000	45,632,250
5	Wharf Structural	171,257,540	25,224,800
6	Civil & Misc. Structural Terminal Infrastructure	94,684,900	11,457,100
7	Offsite Improvements	4,116,500	617,500
8	Gate Complex	3,407,500	511,100
9	Buildings	26,573,000	2,657,300
10	Electrical Terminal Infrastructure	51,684,000	12,921,000
11	Container Handling Equipment for Fully Automated Terminal	515,045,000	51,504,500
	Total for Capital Cost Construction	1,281,697,990	171,812,050
	Total for Capital Cost Construction, Incl. Contingency	1,453,510,040	
12	Permitting, Engineering, Contract Administration	147,400,000	29,479,100
	Total for Project	1,429,100,000	201,300,000
	Total for Construction, Incl. Contingency	**1,630,400,000**	

Source: Capital cost estimates provided by Hatch

3.4 Economic Impact Methodology

The approach taken to estimate the economic impact of the PATH project has been to make use of Statistics Canada's Interprovincial Input-Output (I-O) model.[7] Through its representation of the inter-industry relationships in the economy, the model allows for the estimation of the direct, indirect and induced impacts of a project and their aggregation. In carrying out this exercise we have worked closely with Statistics Canada's Industry Accounts Division which maintains the model and makes available the service of running the model, and advising on the use of the model. Use of Statistics Canada's I-O model for estimating the economic impact of projects is common practice by project proponents in Canada.

[7] See Statistics Canada product main page at http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=15F0009XDB&lang=eng.

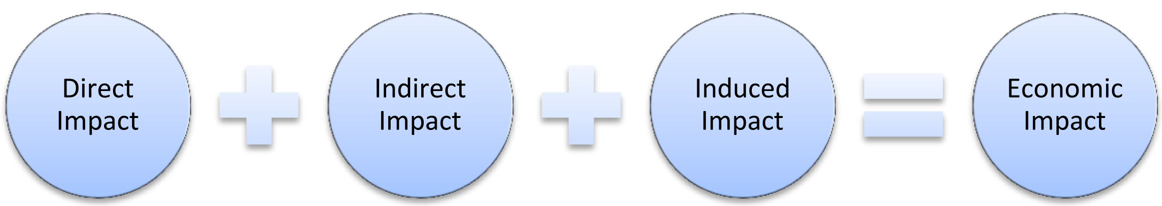
3.4.1 The Input-Output Model

Industry inputs and outputs in the I-O model cover every industry in the economy and must, of course, be expressed in a common unit of measure. They are therefore in value, and not volume, terms. The current Statistics Canada I-O model is based on 2006 values for industry inputs and outputs. This means that the impacts estimated using the model will reflect the 2006 relative prices and inter-industry relationships in the economy.

Modeling inter-industry relationships requires a system for classifying industries and commodities. As described by Statistics Canada,[8] the industry classification in the I-O model is based on the Canadian “Standard Industrial Classification Manual,” designed to accommodate establishment-based data, the building blocks of the input-output system. The commodity classification used was specifically designed for the input-output system. It was intended to provide concordance between a variety of commodity classification systems employed throughout the Canadian statistical system. Consistent classification of commodities is crucial in the construction and balancing of input-output tables. For example, a commodity must be coded consistently whether it be as part of a manufacturer's output, as an item being transported, as an export or import, or as a purchase by a final consumer.

3.4.2 Standard Economic Impact Assessment

Our analysis adopts the standard approach of estimating impacts in three categories: direct, indirect, and induced. Also in keeping with standard practice, we refer to the sum of these as the economic impact of the PATH project.



Direct impact, in general, measures the initial requirements for an extra dollar's worth of output of a given industry. In the present case, the industry is the one that supplies marine terminals. The initial requirements for the PATH project are summarized in Figure 3-1 above and include, for example, the material handling equipment. There will then be a direct impact on the output of the material handling equipment industry. This direct impact is the one dollar change in material handling equipment output to meet the change of one dollar in final demand. Associated with this, there will be direct impacts on GDP, jobs and imports.

[8] Statistics Canada, *A User Guide to the Canadian System of National Accounts, Chapter 3, Input-Output* at http://www.statcan.gc.ca/nea-cen/pub/guide/chap3-eng.htm.

Indirect impact measures the changes due to inter-industry purchases as they respond to the new demands of the directly affected industries. For example, the new material handling equipment will require steel used in the manufacture of the equipment. Indirect impact, in general, includes all the chain reaction of output up the production stream since each of the products purchased will require, in turn, the production of various inputs.

Finally, induced impact measures the changes in the production of goods and services in response to the consumer expenditures induced by households' incomes (i.e. wages) generated by the production of the direct and indirect requirements. To estimate the induced impacts, the model is re-run a second time. In this second iteration, the level of wages and salaries is “shocked” by an amount equal to the additional income generated in the first iteration from the direct and indirect effects, and the impact that this shock to wages and salaries has on the economy is then determined.

In the results discussed below, impacts are presented for British Columbia, the province in which the project is occurring, for the four western provinces as a whole (Manitoba, Saskatchewan, Alberta and BC), and for all of Canada. Also, impacts are calculated and reported in terms of additional GDP, full-time equivalent (FTE) jobs – the same as person-years of employment – and tax revenues. Regarding tax impacts, these are taxes on products or production; the model does not include income taxes.

3.4.3 Interpreting the Results

Every project has a life cycle including both a construction phase and an operations phase. In the case of the PATH project, we have carried out I-O model simulations to estimate the economic impacts of both phases, i.e. construction and operations. However, it is important to recognize that the results of the two phases cannot simply be added together to arrive at the total impact over the project life cycle.

When the model is shocked by an amount representative of the construction or expansion of a facility, the model estimates the economic impact. In reality, however, construction activity occurs over several years and what the model estimates is, in effect, the cumulative impact of the construction phase. In contrast, when the model is shocked by an amount representative of the annual operating costs due to the project, the result given by the model corresponds to the economic impact for a single year. To arrive at the cumulative impact of the annual operating costs, the results given by the model would have to be multiplied by the number of years the facility would be in operation, in the present case 50 years.[9] In the section 3.5.2, we summarize the impacts of the operating costs on both an annual and cumulative basis.

[9] We recognize, of course, that calculating the cumulative impact in this manner does not take into account the “time value of money,” as would be the case in a financial or economic cost-benefit evaluation where future cash flows are discounted to their present values.

3.5 Economic Impact of Sarita Bay South Option A

In this section, we summarize the economic impact of the PATH project's Sarita Bay South Option A. Results are indicated first for the construction and operations phases of the project. Following this, we provide an indication of the impact on a cumulative basis, combining the results for the construction and operations phases.

3.5.1 Sarita Bay South Option A Construction Phase Impact

As noted above, the industry classification used in the Statistics Canada I-O model is based on the Canadian "Standard Industrial Classification Manual." This is not the same categorization as used in the engineering analysis to determine the construction cost for the PATH project. It has therefore been necessary to reclassify the engineering construction cost information according to the I-O model requirements. Figure 3-2 summarizes this re-classification.

Figure 3-2: Sarita Bay South Option A Construction Cost Classified for Economic Impact Analysis

Input-Output Commodity Classification		$ Thousands		
Code	**Title**	**Cost**	**Contingency**	**Total**
MPG23B001	Industrial buildings	26,573	2,657	29,230
MPG23C101	Highway, roads, streets, bridges and overpasses	2,881	432	3,313
MPG23C109	Other transportation construction	84,740	9,965	94,705
MPG23C300	Electric power engineering construction	51,684	12,921	64,605
MPG23C501	Marine engineering construction	318,658	54,704	373,361
MPG23C502	Waterworks engineering construction	5,068	760	5,828
MPG23C503	Sewage engineering construction	6,113	917	7,030
MPG23C509	Other engineering construction	418,337	67,430	485,767
MPG333902	Material handling equipment	513,625	51,363	564,988
MPG336112	Light-duty trucks, vans and SUVs	900	90	990
MPG336120	Medium and heavy duty trucks and chassis	520	52	572
	Total	**1,429,098**	**201,291**	**1,630,389**

Source: CPCS, based on capital cost estimates provided by Hatch

Using the above costs to "shock" the I-O model, Figure 3-3 summarizes the economic impact results for the construction phase. It is not surprising that the bulk of the impact occurs in British Columbia.

Figure 3-3: Economic Impact of Sarita Bay South Option A Construction Costs

Effect	GDP ($ millions)			FTE Jobs Created (number)		
	Canada	BC	Western Canada	Canada	BC	Western Canada
Direct	446	402	410	4,983	4,561	4,619
Indirect	495	327	394	5,130	3,581	4,047
Induced	341	221	259	3,116	1,996	2,311
Total	**1,282**	**950**	**1,063**	**13,229**	**10,138**	**10,977**

Source: Statistics Canada Interprovincial Input-Output Model simulation

In total (adding the direct, indirect and induced impacts together), the construction of the PATH project's Sarita Bay South Option A would lead to an increase in GDP of approximately $1.3 billion in Canada as a whole, of which $950 million occurs in BC and $1.0 billion occurs in Western Canada (Manitoba, Saskatchewan, Alberta and BC). The resulting additional full-time equivalent (FTE) jobs would be 13,229 in Canada, including 10,138 in BC and 10,977 in Western Canada.

Not shown in Figure 3-3 are the tax implications. In total, the construction of the PATH project's Sarita Bay South Option A would lead to an increase in governments' tax revenue of approximately $134 million in Canada as a whole, of which $106 million would occur in BC and $113 million would occur in Western Canada.

3.5.2 Sarita Bay South Option A Operations Phase Impact

As of this writing (May 2014) PATH's proponents are working on developing the financial model for the project, and a complete accounting of the expected operating expenses is not yet available. We have therefore based the economic impact analysis of the PATH's operations on the information provided by the proponents shown in Figure 3-4, which is partial and preliminary.

As may be seen, the annual labour expense during operations is estimated at approximately $237 million. The annual other operating expenses are estimated at approximately $34 million.

The annual total operating expenses are therefore estimated at approximately $271 million, with the labour expense accounting for the great majority of the total (87%).[10]

These estimates are based on an annual container throughput of 1.5 million TEUs.

Figure 3-4: Estimated Annual Operating Expenses for Sarita Bay South Option A

Operating Expense	Cost per TEU	Total Cost at Throughput of 1.5 Million TEUs
Wages and benefits	$157.90	$236,850,000
Other operating expenses	$22.98	$34,470,000
Total operating expenses	$180.88	$271,320,000

In Figure 3-5, we show the estimated economic impacts resulting from the operations, based on the above annual operating expenses. In total, there would be an impact on annual GDP of $401 million for Canada as a whole, including an impact of $362 million in BC and an impact of $376 million in Western Canada.

Of the total annual GDP impact, $237 million, or 59% for Canada and 65% for BC, is the direct impact. The large size of the direct impact is not surprising since it is the direct result of the labour expense. The induced impact, $140 million for Canada and $109 million for BC, is also relatively large since it results from spending the disposable income portion of the wages and salaries. The indirect impact is relatively small since it results from the other operating expenses.

[10] Operating cost cost detail obtained from the Port Alberni Port Authority.

On a cumulative basis, the GDP impact of PATH operations over the 50-year life of the project would amount to approximately $20 billion for Canada as a whole, including $18 billion in BC and $19 billion in Western Canada.

Figure 3-5:Economic Impact of Sarita Bay South Option A Operating Costs

Effect	GDP ($ millions)			FTE Jobs Created (number)		
	Canada	BC	Western Canada	Canada	BC	Western Canada
Direct	237	237	237	3,945	3,945	3,945
Indirect	24	16	20	276	201	229
Induced	140	109	120	1,276	977	1,072
Total	**401**	**362**	**376**	**5,497**	**5,123**	**5,246**
Total over 50 years	**20,050**	**18,100**	**18,800**	**274,850**	**256,150**	**262,300**

Source: Statistics Canada Interprovincial Input-Output Model simulation

Also as shown in Figure 3-5, the number of FTE jobs, i.e. person years of employment, resulting from the PATH's operations would be 5,497 for Canada, including 5,123 in BC and 5,246 in Western Canada per year.

The cumulative impact of PATH operations over the 50-year life of the project would amount to approximately 275, 000 for Canada, including 256,000 in BC and 262,000 in Western Canada.

Although not shown in Figure 3-5, the PATH's operations would also result in increased tax revenues for governments in Canada. In total, government could expect increased tax revenue of $30.1 million per year, including $7.7 million at the federal level, $16.3 million at the provincial level and $6.1 million at the municipal level. With the assumed 50 year life, the cumulative tax impact for government would amount to $1.51 billion.

3.5.3 Summary of Sarita Bay South Option A Economic Impact

Figure 3-6 presents a summary of the Sarita Bay South Option A economic impact. Focusing on the cumulative impacts, the results indicate that the PATH project's Sarita Bay South Option A would over its lifetime add approximately $21 billion to Canada's GDP (2006 dollars). The resulting additional full time equivalent jobs, or person years of employment, would be approximately 288 thousand. The project would also add approximately $1.6 billion to governments' revenue (2006 dollars).

Figure 3-6: Summary of Sarita Bay South Option A Economic Impact [1]

Construction Phase Impact (2)	
Total cost of construction (including contingency)	$1.63 billion
GDP impact	$1,282 million
Jobs impact	13,229
Tax impact	$134 million
Operations Phase Impacts (3)	
Annual operating expense	$271 million
Annual GDP impact	$401 million
Annual Jobs impact	5,497
Annual Tax impact	$30.1 million
Cumulative Impacts (4)	
GDP impact	$21,332 million
Jobs impact	288,079
Tax impact	$1,639 million

(5) Impacts shown are for Canada as a whole, and are the total of direct, indirect and induced effects. Jobs impacts are full-time equivalent, full year jobs and thus equal to person-years of employment. Tax impacts include taxes on production and on products but not on incomes. Dollar figures are 2006 values reflecting the current version of Statistics Canada's Interprovincial Input-Output (I-O) Model.

(6) Construction costs and impacts are totals relating to the entire construction period.

(7) Operating expense and impacts relate to a single year in the operating life of the project.

(8) Cumulative impacts are the sum of the impacts for the construction period and the entire 50 year operating life of the project.

4 Other Benefits Resulting from the PATH Project

In addition to benefits directly related to spending on the construction and operations of the facility, it is also important to note the impacts that PATH would have on the regional transportation system. In this Chapter, we provide a high-level assessment of these benefits.

4.1 Quantifiable Benefits

4.1.1 Context

In the proposed PATH operating concept, the feeder barge operations serving PATH could spread regional container handling capacity over a large number of coastal and inland terminals along the Fraser River and reduce hinterland congestion, particularly by avoiding, reducing and spreading truck transportation (drayage) in the BC Lower Mainland.

The benefits of spreading truck traffic are two-fold.

- First, it reduces congestion on some of the major congested transportations axis, providing benefits to passenger vehicles and trucks using these corridors.
- Second, by unloading containers closer to their final destination, drayage costs and transit time are reduced for these customers.

In both cases, there are beneficial impacts on fuel emissions as transit times and/or distance travelled is reduced. The first impact also minimizes the need for new investment at critical locations, and the second reduces total distance travelled and associated road wear and tear.

Valuing such benefits with a high level of accuracy would require a detailed assessment of where the PATH mainland terminals would be located along the Fraser River. It also involves mapping with significant accuracy the destinations of containers transiting via PATH. Given that this information is not available, we focus on providing a high-level assessment of these benefits.

4.1.2 Current and Forecasted Traffic

In September 2012, the Port of Vancouver published a report on the road impacts of its container capacity improvement program, including the potential impacts of T2 capacity improvements.[11] The following findings are most notable:

- The T2 project, which will add 2.4 million TEU of capacity to Deltaport, would generate 3,692 truck trips per day on average, of which 886 would be at peak hour (8AM to 9AM) (Table 2, page 8).

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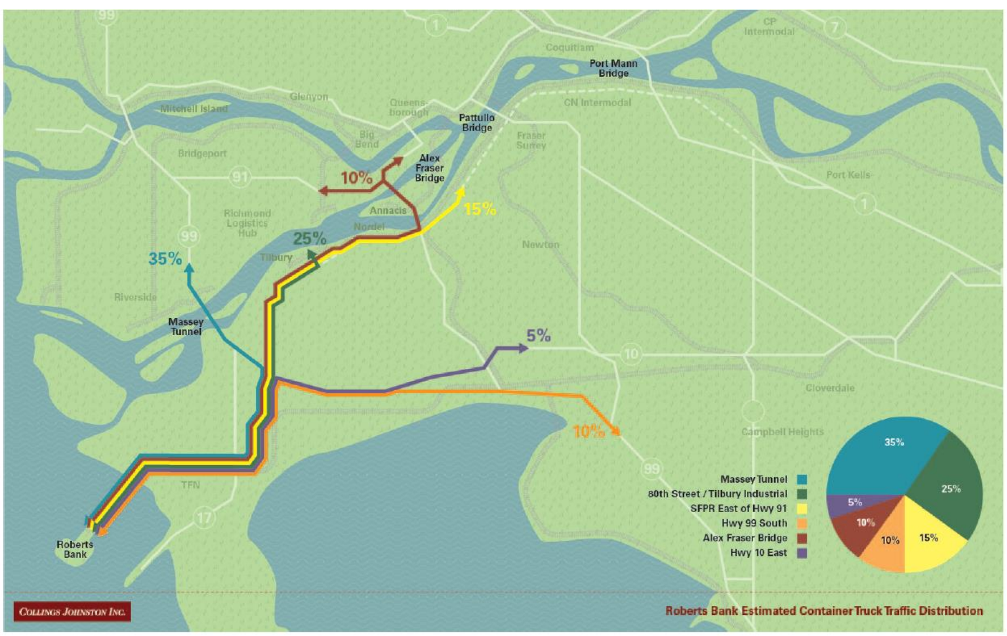
[11] Port Metro Vancouver et al. (2012), "Container Capacity Improvement Program: Road Traffic Distribution Report", September 27, 2012.

- Employees and visitors would also generate a significant increase in passenger vehicle trips, of 2,034 vehicle trips per day, of which 785 at peak hour (7AM to 8AM) (Table 2, page 8).
- This additional traffic would mean that unless mitigating measures are taken, port-related traffic will represent 11% of southbound traffic in the peak AM hour, compared to 5.9% before T2. Northbound, in the evening peak-hour, port-related traffic would represent 8.7%, up from 5% before T2 (Table 8-9, page 31-32).
- The study did not provide a detailed assessment of the additional traffic on delays. It did note, however, that based on modelling the truck traffic in the George Massey Tunnel at peak hour in the base year (140 trucks) increased the average bridge crossing time by over 2 minutes, from under 15 minutes to over 17 minutes (about 15% increase). T2 is expected to increase the number of trucks by 220 in that peak-hour period (Table 10, page 33).
- Truck traffic to/from the port will operate on increasingly congested causeways. On the George Massey Tunnel alone, AM peak traffic, excluding port truck traffic, is expected to increase 38%, from 5,715 to 7,895 (Table 10, page 33).

As shown on Figure 4-1, most of the traffic from Roberts Bank is destined to areas accessible from existing or future containers docks on the Fraser River (e.g. Richmond, Tilbury), which would minimize the needs for truck drayage through congested areas (e.g. George Massey Tunnel, Alex Fraser Bridge, sections of the South Fraser Perimeter Road). This distribution is assumed to also reflect future T2 traffic.

Figure 4-1: Roberts Bank Estimated Truck Traffic Distribution



Source: Exhibit 2, Port Metro Vancouver et al. (2012), "Container Capacity Improvement Program: Road Traffic Distribution Report", September 27, 2012.

4.1.3 Potential Benefits of PATH

There is no doubt that without mitigation, increased container traffic at Roberts Bank will create increased congestion on major corridors in Vancouver. Moreover, as it expands, Robert Bank will concentrate more and more traffic in one location, forcing this traffic to navigate congested roads. Many mitigating measures have been put forward. Most these measures can be put in place, and are justified, even if T2 does not go ahead.

PATH provides a long-term solution to some of these issues. Indeed, by removing truck traffic from these corridors, and shortening the drayage for many customers, it reduces congestion faced by commuters and the costs faced by shippers.

Time Saved by Commuters

Trucks represent a fairly small proportion of traffic at peak hour. Indeed, truck drivers purposefully choose to concentrate their activity on the shoulder periods to avoid, as much as possible, commuter traffic. As such, the benefits of reduced truck traffic on congestion are not very significant.

If we focus on peak AM time only, we can safely assume based on the estimate provided in the Port Metro Vancouver report (2012) that removing trucks related to T2 expansion would diminish average crossing time for the George Massey Tunnel by about three minutes. Given that 7,895 passenger vehicles are estimated to cross each morning in 2031, this represents savings of 395 hours of travel time each business day. Assuming 250 business days per year, this represents savings of 98,750 hours for commuters each year.

In British Columbia, the average hourly wage in March 2014 was $24.51. Using that value as a proxy of the value of time, we estimate that the congestion caused by T2 in the peak AM on the George Massey Tunnel alone could cost approximately $2.4 million per year to commuters.

Assuming a similar pattern for PM traffic, this value could easily be doubled. If we were to value the impact for other routes, the value could also increase significantly.

To be conservative, we estimate the value of time loss for passenger cars at $6 million per year.

Fuel Consumption and Emissions by Commuters

Based on the aforementioned time savings, which is assumed to represent idling, it is possible to measure the associated reduction in emissions. Based on research on idle fuel consumption and emission rates for a small light duty vehicle such as a Ford Fusion,[12] we can estimate that reduced idling would lead to a reduction in fuel consumption and emissions as follows:

- 99,184 litres of gasoline
- 265 tonnes of CO2;
- 95 kilograms of total hydrocarbons;
- 38 kilograms of carbon monoxide; and
- 3.5 kilograms of nitrogen oxides.

In terms of fuel consumption, based on the average price in Vancouver in late April (about $1.49),[13] the annual loss for commuters is $148,000 per year.

The social cost of associated emissions is a fraction of that value. For example, CO2 emissions, which are by far the highest social value emissions in a litre of gasoline,[14] are valued at about $55 dollars by the EPA in 2030 using a 3% discount rate.[15] This means that passenger cars idling at peak AM in the George Massey Tunnel represent about $15,000 in social CO2 costs.

It is reasonable to think that even if we were to value the impacts of other emissions, the total value of fuel and emissions avoided due to reduced idling passenger cars in the AM peak in the George Massey Tunnel would be of the order of $175,000 per year.

Using the same ratio as for time saved (2.5) to capture the impacts on other hours of the day and other routes we estimate that savings in fuel consumption and emissions would represent $435,000 per year, of which $370,000 is associated with fuel savings and $65,000 to the social cost of emissions.

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[12] US Department of Energy, "Which Is Greener: Idle, or Stop and Restart?: Comparing Fuel Use and Emissions for Short Passenger-Car Stops", from http://www.afdc.energy.gov/uploads/publication/which_is_greener.pdf, accessed on April 24, 2014.
[13] Based on http://www.cbc.ca/bc/gasprices/, which reports data from www.gasbuddy.com.
[14] Carbon dioxide emissions are valued highly in large part because their impacts are global (i.e. climate change), rather than local (i.e. local air pollution). As such, they impact a much larger population.
[15] See http://www.epa.gov/climatechange/EPAactivities/economics/scc.html.

Reduction in Truck-Km Traveled

The reduction in drayage distance and time is by far the most significant benefit of PATH. By reducing inefficiencies, it lowers supply chain costs and limits associated emissions. Establishing with certainty the impact of PATH on that metric is near impossible at this stage. It is, however, possible to get a sense of the magnitude of these benefits.

Based on Figure 4-1, it is possible to see that most of the containers trucked from Robert Bank could be barge to terminals much close to their destinations under the PATH operational concept. In many cases, drayage distances could be drastically reduced and would occur on largely uncongested roadways. In some cases, drayage could be completely eliminated (docks at stuffing/de-stuffing facilities, for example).

Moreover, a significant amount of cargo which is currently carried between Vancouver Island and the City of Vancouver to be containerized could be loaded/unloaded directly at PATH, generating significant savings. In this context, it seems reasonable to think that drayage km-traveled could be reduced by nearly half for containers using PATH and destined to be distributed by trucks once on the island.

According to the traffic study mentioned earlier,[16] T2 would generate 959,177 truck trips annually. With about half of trips destined to Tilbury and Richmond (between 20 and 25 km), and the other half to destinations further away, it is reasonable to think that the average drayage distance would be about 30 km.

Assuming that this average distance is halved, to 15 km, it is quite reasonable especially given the much larger than average savings associated with traffic to/from Vancouver Island.

In total, thus, we can estimate that if PATH were to handle the same amount of traffic as T2, savings per year would be about 14.4 million truck-kilometres.

Estimating the value saved is difficult. Indeed, one of the main drivers of drayage cost reduction is the time drivers would save by draying from less congested terminal, reducing their wait time. Indeed, trucker wait times represent nearly 40% of the cost of drayage.[17] For ease of estimation, we assume that drivers also reduce, on average, half the wait time due to lessened congestion.

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[16] Port Metro Vancouver et al. (2012), "Container Capacity Improvement Program: Road Traffic Distribution Report", September 27, 2012.

[17] BC Trucking Association and Asia-Pacific Gateway Skills Table (2013), "Drayage Trucking in Metro Vancouver: Owner-Operator Business Toolkit", accessed from http://toolkit.bctrucking.com/, April 24, 2014.

An estimate of the average trip cost, before and after, was obtained using the financial model posted as part of the Owner-Operator Business Toolkit for Vancouver.[18] The average initial trip was assumed to be a total of 30 km, with 2.5 hours of wait time (queuing, pickup terminal and delivery terminal). For PATH traffic, the average trip was assumed to be 15 km, with an average wait time of 1.25 hours. The difference in cost was $70 (from $140 to $70) per trip. Of that, about $8 to $9 per trip is related to fuel.

Based on this, we estimate that potential commercial savings related to reduced miles-travelled for traffic levels equivalent to T2 are of the order of $67.1 million per year. Fuel savings alone represent $8.6 million. Using a similar ratio of fuel value to social cost as for commuters, we can estimate the social cost of emissions at roughly $1.1 million per year.

Summary of Benefits

The value of these quantifiable benefits is not insignificant. Indeed, on an annual basis, savings related to changes in congestion and traffic patterns would be of the order of $74.6 million per year, or over $30 per TEU.

Figure 4-2: Estimated Value of Traffic-Related Benefits

Description of benefits	Value per Year ($)	Value per TEU ($)
Time Saved by Commuters	6,000,000	2.50
Fuel Saved by Commuters	370,000	0.15
Social Cost of Emissions by Commuters	65,000	0.03
Commercial Savings for Drayage	67,100,00	27.96
Social Cost of Drayage Emissions	1,100,000	0.46
Total	74,635,000	31.1

Source: CPCS estimates. Based on traffic generated by T2, with container volumes estimated at 2.4M TEU per year.

[18] Ibid, see http://toolkit.bctrucking.com/3-0-my-business/3-5-financial-tools/.

4.2 Qualitative Benefits

In addition to these quantifiable savings, other benefits are worth outlining. First, the proposed PATH facility is considerably cheaper than the proposed T2 expansion. Indeed, with PATH is estimated at slightly under $1.7 billion, the cost of T2 was estimated as being *more than $2 billion* in 2011. Since then, costs are believed to have escalated significantly.

This suggests that significant infrastructure savings are possible by developing PATH, savings which could be transferred to shippers or other supply chain stakeholders. Moreover, since PATH would be an automated terminal, operational savings are also expected. The potential for more efficient operations in Vancouver, with the direct loading of trains from barges, for example, would also provide real benefits.

PATH would also allow a better utilization of existing assets in Vancouver. Indeed, with container growth leading to larger vessel calls, significant terminal capacity on the Fraser River cannot be unlocked. With PATH, that capacity and these assets could be better used and developed. This would also lead to increase competition in the marine terminal sector without requiring massive investments at all three PNW ports.

Similarly, PATH provides clear potential for further economic development, both on Vancouver Island and along the Fraser River. The benefits of these developments are not fully understood, but it is clear that such a seismic change in the way of distributing containers would provide new and innovative opportunities for producers, shippers and carriers. These development opportunities would not be unlocked in the same ways by other capacity improvement projects.

Finally, PATH is a relatively environmentally friendly way to improve capacity on the West Coast. It does not require as much environmentally damageable construction methods as other projects and it reduces trucking emissions. Overall, it is a greener way to handle future container capacity constraints in Vancouver and the Pacific North West.