APPENDIX 20-A

Economic Impact Roberts Bank Terminal 2

Technical Report

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February 6, 2015

REPORT

Appendix 20-A: Economic Impact Roberts Bank Terminal 2 Technical Report

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1.0 INTRODUCTION

1.1 Project Background

The Vancouver Fraser Port Authority (doing business as Port Metro Vancouver (PMV)) proposes to construct a marine container terminal, Roberts Bank Terminal 2 (RBT2 or the Project), adjacent to the existing terminals at Roberts Bank, Deltaport Terminal and Westshore Terminals, in Delta, B.C. PMV commissioned Golder Associates Ltd. (Golder) to estimate the economic effects on the B.C. and Metro Vancouver economies[1] of the construction and operation of the Roberts Bank Terminal 2 Project. RBT2 is a proposed three-berth marine container terminal that would provide additional deep-sea container handling and storage capacity on Canada's West Coast. There are currently three primary terminals with container handling infrastructure located within the boundaries of Port Metro Vancouver: Deltaport Terminal (currently Canada's largest container terminal), Vanterm and Centerm. The last two are located on the shores of Burrard Inlet. A secondary container terminal, Fraser Surrey Docks, is located on the Fraser River within the boundaries of Port Metro Vancouver. The Project is part of PMV's Container Capacity Improvement Program (CCIP), which is PMV's strategy to help meet anticipated demand for container capacity in B.C. until 2030.

On September 12, 2013, Port Metro Vancouver filed a Project Description with the Canadian Environmental Assessment Agency (the Agency) and the British Columbia Environmental Assessment Office (BCEAO). The Agency has determined that a federal environmental assessment is required for the Project pursuant to the *Canadian Environmental Assessment Act*, 2012. On December 19, 2014 the B.C. Minister of Environment issued an order under s. 14 of the B.C. *Environmental Assessment Act*, establishing the Province's scope of assessment and procedures and methods for conducting the EA of the Project.

This Technical Report (TR), entitled 'Economic Impact Roberts Bank Terminal 2 Project', was prepared to assist in the assessment of the Project's potential effects on valued economic and social components and is incorporated into the Project's Environmental Impact Statement (EIS) as an appendix.

1.2 Report Outline

RBT2 is a large scale and complex project in both its construction and operation phases. The construction activities will have a substantial marine-based component, which has certain economic implications that distinguish the Project from land-based construction endeavours. The operation phase will feature the on-terminal handling capability of approximately 2 million TEUs[2] of marine containers per annum. The on-terminal (on-dock) activities will consist of the loading and unloading of container ships, temporary container storage, and container transfers to and from rail and road transport.

To facilitate the understanding of the different dimensions of the Project's economic impact, the various construction and operational activities of the Project that give rise to its economic effects are outlined in **Section 2.0**. The methodology for estimating the Project's economic impact is described in **Section 3.0**. The estimated economic impact results for the construction and operation phases are presented in **Section 4.0**. A

[1] Metro Vancouver is used herein as including the communities and resident population located within the boundaries of Metro Vancouver (formerly known as Greater Vancouver Regional District).

[2] TEU stands for Twenty-foot Equivalent Unit, which is a unit of cargo capacity that is based on the volume that a 20 foot long intermodal container can carry. Most containers transported on marine vessels are 40 foot long containers, equivalent to 2 TEUs.

summary of the analysis findings is in **Section 5.0**. The estimated economic effects associated with the off-terminal activities of handling the marine containers that are unloaded and loaded at RBT2 are summarised in **Appendix A**. In **Appendix B** is an overview of the determination of the gross revenues associated with the supply of B.C. produced of materials, goods and services to the Project. A summary of the Project's economic effects by phase, indicator and region appears in **Appendix C**.

2.0 SUMMARY OF CONSTRUCTION AND OPERATION ACTIVITIES

2.1 Construction

The construction phase will require sophisticated marine construction as terminal land area will be developed 5.5 km offshore and approximately 600 m from the existing Roberts Bank terminals.[3] The core construction activities, methods and sequencing for the Project are expected to be much the same as were applied in the Deltaport Third Berth Project (DP3), but reflect the larger scale of RBT2.[4]

The marine construction activities will be capital intensive, relying on the utilisation of marine derricks, scows and tugs, dredges, vibro-densification equipment, and barge mounted conventional cranes. This marine-based characteristic will drive certain aspects of the Project's economic effects. For example, construction labour requirements are expected to be lower compared to land-based developments and marine weather conditions may affect construction progress. The Project entails the building of four main components:

- New marine terminal;
- New berth pocket (dredged mooring basin for container ships);
- Expanded Roberts Bank tug basin; and
- Widened Roberts Bank causeway with addition of the Project's road and rail infrastructure.

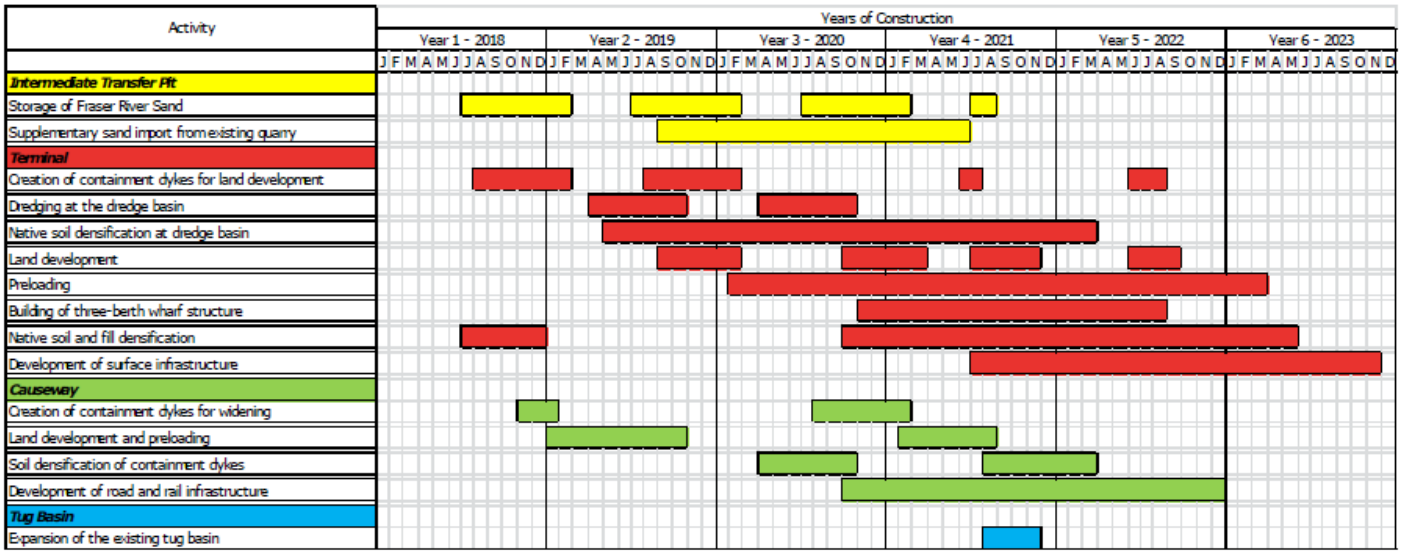
The Project's construction also comprises the installation of large scale container handling equipment, including 12 ship-to-shore gantry cranes on the new terminal and a start-up period in 2023 that incorporates training with the new equipment. The terminal, berth pocket, tug basin, and causeway construction is expected to be overseen by a PMV-contracted Infrastructure Developer.[5] It is anticipated that the installation of gantry cranes will be undertaken by manufacturers and tradespersons contracted by the PMV selected Terminal Operator Concessionaire.

There is a planned 5.5-year construction phase, starting mid-2018 and concluding in late 2023. **Figure 2-1** shows the approximate scheduling by year of the main activities for constructing the new terminal and causeway expansion. The container handling equipment and associated terminal operating and computerised automation systems will be installed and tested in late 2023.

[3] Information for this section was primarily drawn from **Section 4.0 Project Description** and 'Planning Services for Roberts Bank Terminal 2 (T2) Planning and Capacity Study' (AECOM 2012).

[4] The terminal area for Roberts Bank Terminal 2 will be more than five times larger than the DP3 Project's terminal addition. The DP3 Project's construction proceeded over three years (March 2007-December 2010).

[5] The Infrastructure Developer is likely to be a consortium that will act as the design, build, finance and maintain (DBFM) contractor(s).

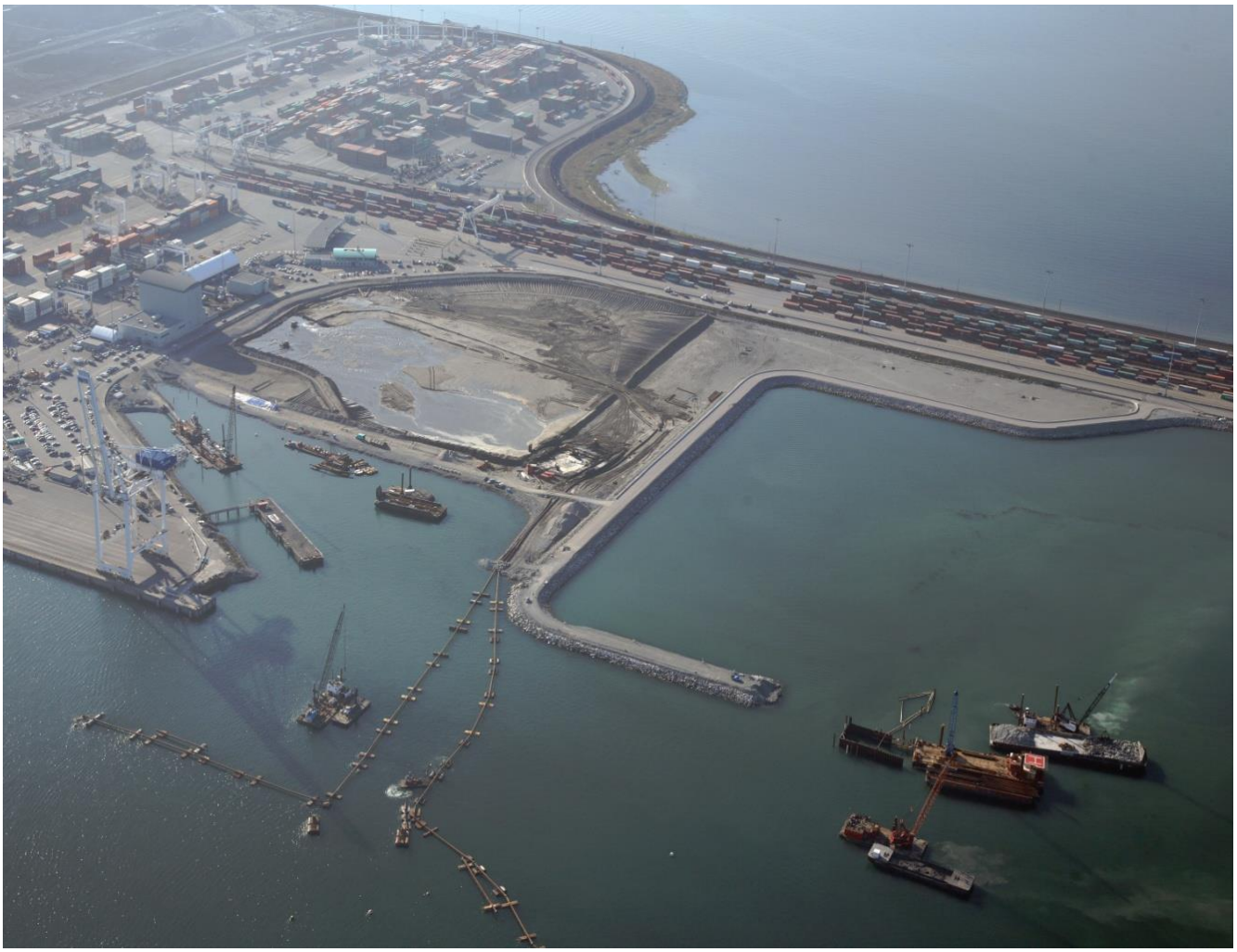


Source: Section 4.0 Project Description

Figure 2-1: RBT2 Project Construction Activities by Year

Early in the first year of construction, containment dykes will be built with rock, gravel, and rip-rap acquired from existing quarries. Sand dredged from the sea bottom to help create the berth pocket and adjacent caisson trench (combined dredge basin) will be used as initial fill for the terminal within the containment dykes. A primary source of fill material for the new terminal and widened causeway will be sand that is annually dredged from the Fraser River maintenance dredging program. A temporary underwater intermediate transfer pit for storage of the Fraser River sand will be used between the existing Roberts Bank terminals and the B.C. Ferries Terminal. A cutter suction dredge will pump the sand from the intermediate transfer pit to the fill areas within the containment dykes.

The native soil at the bottom of the dredge basin will undergo densification by marine derricks. **Figure 2-2** is an aerial photo of a later stage of the DP3 Project's construction, and shows a wide range of marine construction equipment similar to what will be deployed for the Roberts Bank Terminal 2 Project.



Source: PMV

Figure 2-2: Deltaport Terminal viewed from the south, showing the 3rd berth and additional terminal land area in a later stage of construction

Concrete caissons are expected to be constructed off-site and transported by sea to the site for installation as the three-berth wharf face structure. They will be sunk in place and partially filled with crushed rock that provides ballast. A concrete cap, referred to as a cope wall, will be installed to tie the caissons together to provide a berthing structure that can resist vessel impacts. The terminal will be able to accommodate 2014 Post-Panamax and Ultra-large criteria container vessels with overall lengths of 370 – 400 m and capacity of 12,000 – 18,000 TEUs. [6]

Infrastructure for the new terminal's container storage and rail intermodal yards will require full utility systems, paved pads and corridors, gantry crane guideways, and rail tracks. Work on this terminal infrastructure is

[6] Panamax refers to maximum dimensions for ships that want to transit the Panama canal and are published by the Panama Canal Authority. New Panamax is the maximum dimensions (366 m in length) for the under construction third lock of the Panama Canal. Post-Panamax references ships that exceed these dimensions.

anticipated to begin midway through the fourth year of construction. The installation of container handling equipment is planned for the last year of construction.

Widening of the existing causeway is needed to provide access to the new terminal for both rail and road traffic, and will include the building of a new overpass structure, access road, vehicle access and control system, two new rail yards, and an emergency gravel access road.

The gantry cranes will be of a size and scale capable of loading and unloading Ultra-large container ships; they will each weigh 800-900 tonnes and have a beam and boom that can extend across 23 rows of containers. These cranes are expected to be manufactured and assembled in an offshore location and transported by a specialised ship to the almost completed terminal. The crane manufacturer will likely provide a majority of the skilled labour that installs and commissions the gantry cranes. **Figure 2-3** and **Figure 2-4** show, respectively, the installation of the concrete caissons and building of guideways for ship-to-shore gantry cranes during the DP3 Project.

Figure 2-3: Installation of concrete caissons during the Deltaport Third Berth Project

Source: PMV

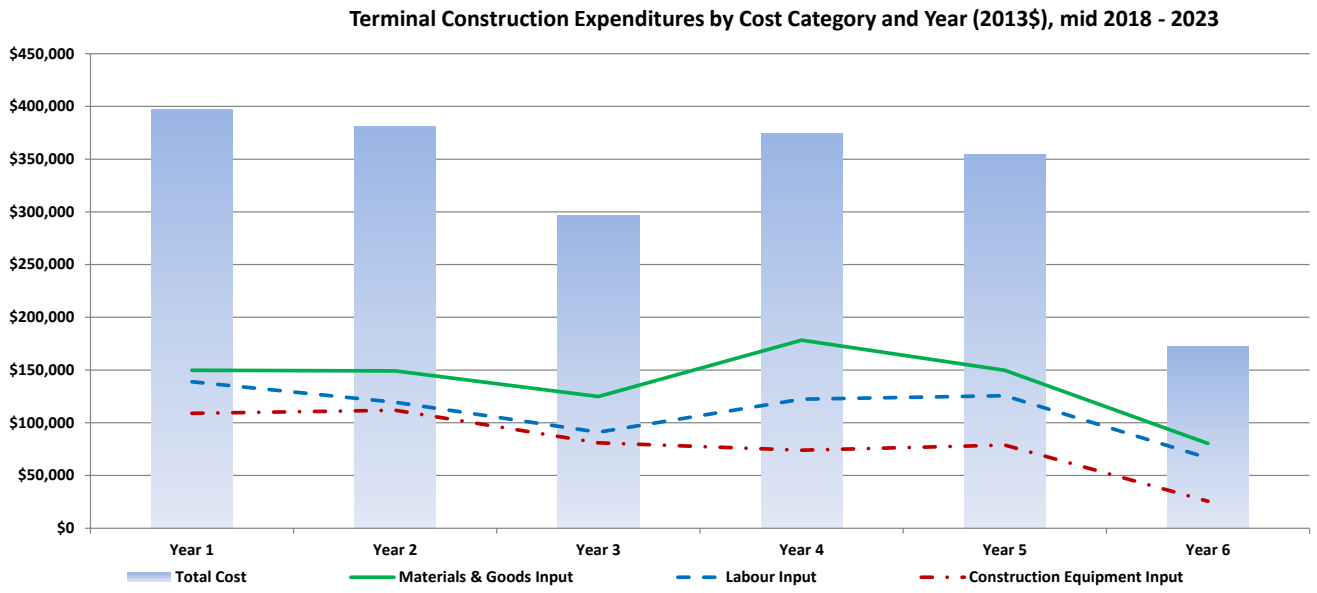
Figure 2-4: Building of crane support beams for the ship-to-shore gantry cranes at Deltaport Third Berth Project

PMV will select an Infrastructure Developer to design, build, finance and maintain the new terminal. The PMV selected Terminal Operator Concessionaire is anticipated to be responsible for the selection, purchase, transport and installation of all container handling equipment, such as gantry cranes, automated stacking cranes, rail mounted gantry cranes, mobile horizontal-transfer equipment, utility forklifts and associated terminal operating and computerised automation control systems. This equipment is projected to be installed in the last construction year, 2023, and there will be on-site training and start-up measures undertaken by the Terminal Operator Concessionaire during this year too.

The estimated economic cost is approximately $1.9 billion for building the new marine terminal, widening the causeway, dredging the dredge basin, expanding the existing tug basin, and testing and training on the container handling equipment.[7] The goods and materials category accounts for the highest category expenditure in every year of the construction phase. Labour expenditures are important, but so too is the cost of construction equipment because of the offshore marine construction aspects of developing almost 117 ha of land several kilometres from shore.

[7] This estimate (in 2013 dollars) excludes expenditures for land acquisition and most of the container handling equipment. Land and tax expenditures are not included in the economic impact analysis because they are asset transfers, which do not have an economic impact. Almost all anticipated expenditures on container handling equipment and systems were not included because PMV foresees most of this equipment and systems being sourced from outside Canada so the economic impact in B.C. associated with the manufacture, transportation, and installation of the container handling equipment is likely to be very limited. Labour will be sourced from B.C. (Metro Vancouver) for container handling equipment testing, start-up and training in 2023, and these expenditures were incorporated into the input-output modelling.

Figure 2-5 shows the estimated construction phase expenditures by broad cost category and year.[8]



Source: Chart based on PMV supplied expenditure estimates

Figure 2-5: Estimated economic cost by year and construction expenditure category for RBT2, mid 2018-2023

2.2 Operation

2.2.1 Marine Container Traffic Forecast

Marine container handling activity is the main driver of the Project's economic effects during the operation phase. The new terminal would have the capacity to reach its peak container handling capacity level very quickly, which has direct implications for the level of operation phase economic activity. In 2024, the initial full year of operation, the new terminal is foreseen as having the potential to handle 1.96 million TEUs of marine containers, very close to its practical capacity level. The following year, Roberts Bank Terminal 2 is anticipated to have the potential to ramp up to handle its practical annual capacity of 2.04 million TEUs, and sustain that level over the long-term.

The design capacity of Roberts Bank Terminal 2 will be 2.4 million TEUs; however, it has been found that container terminals begin to lose their efficiency when they attempt to sustain operations above 85% of their design capacity. By operating at 85% efficiency, the practical capacity, the Terminal Operator Concessionaire is better able to adapt to seasonal variations in container volumes and avoid or lessen the impact of any supply chain disruptions (Ocean Shipping Consultants 2013). This ability to adjust to fluctuations in container traffic is an important factor in the container terminal market as it is an indicator of reliability and has positive cost containment implications.

[8] Year 1 is mid 2018 – mid 2019 and Year 6 is the last half of 2023.

Based upon PMV-commissioned third-party consultant forecasts, Canada's West Coast container traffic is expected to double over the next 15 years from the 3.5 million TEUs that transited Canada's West Coast terminals in 2014. Terminals in PMV's jurisdiction handled 2.9 million (82%) of Canada's West Coast container volume in 2014. The forecasts show that, in the near term, existing container capacity on Canada's West Coast and specifically in B.C.'s Lower Mainland will become constrained and require additional capacity, starting as early as 2015 (Ocean Shipping Consultants 2014). While there are current capacity improvements underway to help alleviate the foreseen constraints at container handling terminals within PMV jurisdiction[9], and also at Port of Prince Rupert's Fairview Terminal, the current demand forecasts indicate that additional container capacity will be needed on Canada's West Coast by the mid- 2020s. Even with underway capacity improvements, additional terminal capacity is needed as container traffic is expected to increase to 7.0 million TEUs by 2030 in the base case scenario, with a forecasted range from approximately 6.0 million TEUs in the low case to 8.6 TEUs in the high case forecast. Development of the Project with its 2.4 million TEUs design capacity will assist PMV in handling this forecasted future growth in the province's container traffic and avoiding the shifting of this container traffic (and its associated economic benefits) to other North American ports.

2.2.2 On-Terminal and Off-Terminal Activities

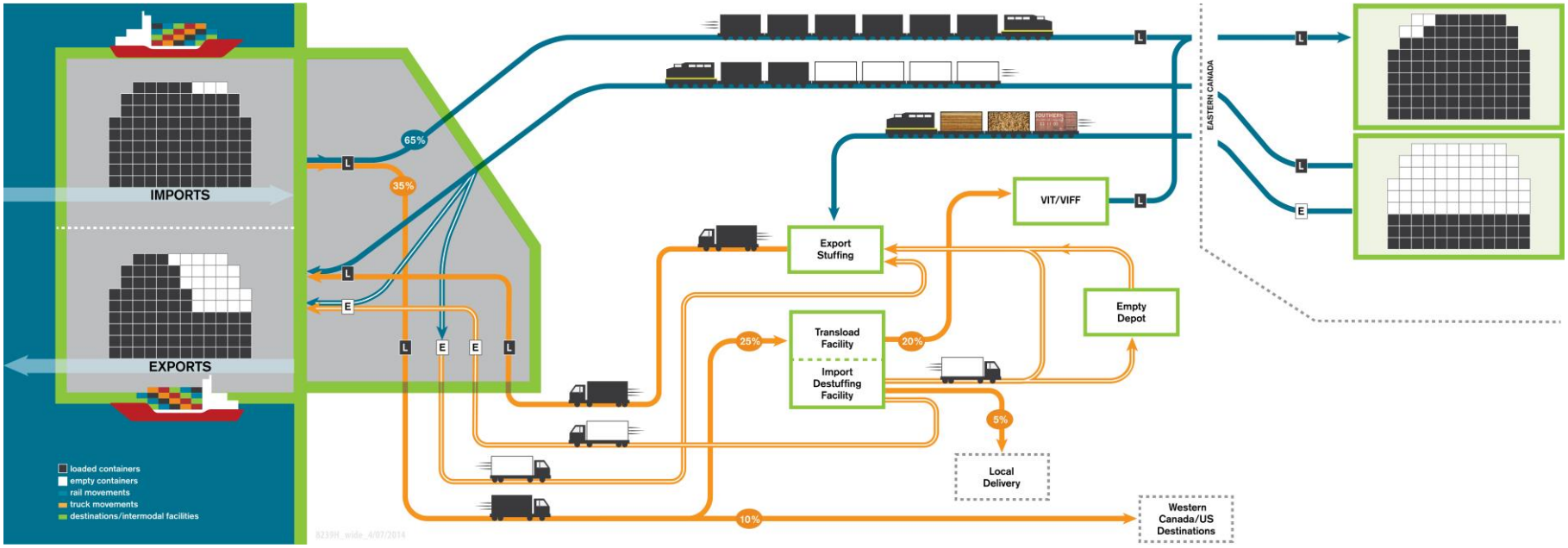
All North American marine container terminals feature a supply chain comprised of on-terminal (or on dock) and off-terminal (or off-dock) service providers to move containers to North American markets from offshore producers and from North American producers to offshore markets.[10]

Figure 2-6 is a diagram of the likely movement or flow of containers for Roberts Bank, and shows its on-terminal activities along with the off-terminal activities and their broad locales in Metro Vancouver.

Trucks and trains will transport loaded and empty containers to and from the terminal's intermodal yards. There is an anticipated 65:35 split in the laden import container traffic that will be transported by rail and truck services, respectively. The land transport of containers at Roberts Bank Terminal 2 is expected to be similar to that of Deltaport Terminal; 65% of the containers landed at the new terminal are anticipated to leave via intermodal rail services for delivery to Eastern Canada (mainly Toronto and Montreal) and the U.S. Approximately 25% would be loaded onto trucks for transport to local transload facilities, distribution centres or warehouses. An estimated 10% would be loaded on trucks for transport to Canadian and U.S. destinations.

[9] For example, the design capacity of Deltaport Terminal will increase to a level of 2.4 million TEU by 2016/17.

[10] Marine ports and airports share the same characteristic of being the transport hub for moving goods and passengers within a spatially dispersed supply chain of independent operators integrated through commercial arrangements.



Source: PMV

Figure 2-6: Container movement flow diagram for Roberts Bank.

During the operation phase, there would be a Terminal Operator Concessionaire responsible for most on-terminal activities including providing, operating and maintaining container handling equipment, managing utilities and undertaking a portion of terminal maintenance. The Infrastructure Developer would have a role in terminal maintenance and PMV would have the role of landlord. The Terminal Operator Concessionaire would contract for terminal security and other services and goods to operate the new terminal and would arrange for the longshore workers, including supervisors, who would operate and maintain the container handling equipment. Canada Border Service Agency (CBSA) would operate a vehicle and cargo inspection (VACIS) facility on the new terminal for inspection of containers on an as-required basis.

The off-terminal activities would include pilots (provided by Pacific Pilotage Authority Canada) guiding container ships to and from the new terminal. A tug operator would provide vessels to assist with container vessel berthing and de-berthing operations within and outside of PMV's jurisdiction. There would be support services provided by Transport Canada, ship chandlers[11], customs brokers, and freight forwarders.

Truck haulage of containers would be another important off-terminal activity in the supply chain. Trucks from Lower Mainland container drayage and long haul trucking operations would travel to and from the new terminal to pick up and drop off containers. Their clients would be the shipping lines, freight forwarders, third party logistic providers (3PLs), big box retailers, importers and exporters, and container leasing entities that route their containerised cargo through terminals within PMV jurisdiction. Container trucks are licensed by PMV to access the terminals; the trucks are owned by businesses that contract with shipping lines and other entities for local drayage and long haul of containers. Trucking companies maintain their own off-dock parking and maintenance facilities.

Canadian Pacific Railway (CP) and Canadian National Railway Company (CN) provide rail transport services to and from the Deltaport Terminal facility and are expected to provide railcars to transport containers to and from the new marine terminal. The train marshalling operations at Deltaport Terminal are carried out by Toronto Terminals Railway, which would likely be providing this service at the new terminal.[12] Train crews and locomotives would be exchanged between the railways and the train marshalling operations service provider at one of the two new Project rail yards on the widened causeway.

A significant portion of the supply chain of container handling and shipment services would be situated off-terminal, primarily in the Metro Vancouver region. At transload facilities, empty marine containers would be 'stuffed' for export and trucked to the new terminal for loading onto ships and incoming (full) marine containers would be destuffed and re-loaded into the larger domestic containers for transfer to intermodal railcars. Examples of transload facilities and services are South Fraser Container Services (2005) Ltd., which has yards in Delta, CN's Thornton Yard transload facility in Surrey, Euro Asia in the Richmond Logistics Hub, Ray-Mont Logistics in Richmond, and Purolater's automated package handling facility in Richmond that services Vancouver International Airport as well as terminals in PMV jurisdiction. Distribution centres include HBC Logistics' facility in Richmond that handles goods from over 5,000 offshore factories and distributes them to Hudson's Bay Company stores across Canada, Atlas Logistics in Surrey, DAMCO Distribution Services in Delta, and London Drugs distribution centre in Richmond. There are off-terminal facilities providing empty container storage, repair, cleaning, and liner installation services; an example is Delco Delta Container Limited Partnership

[11] Ship chandlers are intermediaries that supply ships with food, maintenance supplies and other goods (sometimes referred to as ship's stores) needed to sustain crews, passengers and a ship's operation. They accept orders from ship operators, secure the requested goods from local retailers and arrange for transport and expeditious loading of the goods onto ships.

[12] Toronto Terminals Railway is a jointly owned subsidiary of CN and CP.

(Delco) in Delta. Some operators offer several container related services, an example is TDK Metro Terminals in Delta. A recent report estimated that container trucks servicing terminals in PMV jurisdiction dispatch to approximately 65 operations in the Greater Vancouver area that provide off-dock container support services (Mainline Management Inc. et al 2013).

Source: PMV and Delco

Figure 2-7: Clockwise, a ship-to-shore gantry crane at Deltaport Terminal, inter-modal train service on the Roberts Bank causeway, an off-dock container storage yard in Delta, B.C., and container trucks exiting a terminal gate.

A major factor in the current make-up of the supply chain is the handling of empty containers. Most container traffic for export is transloaded in the Metro Vancouver area. Empty containers are shipped from Toronto and Montreal (the main destinations for stuffed import containers) via CN and CP rail to a terminal in PMV's jurisdiction (such as Deltaport Terminal), unloaded from the rail cars, and then loaded onto trucks at the marine terminal and drayed to Lower Mainland transload facilities where the empty containers are stuffed (with forest products and grains for example) and then drayed back to the marine terminal for loading onto ships that will transport them to offshore markets.

3.0 METHODS

3.1 Study Area

The local study area is Metro Vancouver and the regional study area is Province of B.C. The local study area was established to encompass the area within which the Project is expected to interact with and potentially have an effect on the local labour market and economic development. In determining local study area boundaries, consideration was given to the community and regional labour forces in B.C., the Project's likely geographic sourcing of its direct workforce, and the maximum extent of the Project's potential effects on the labour market and economic development.

3.2 Temporal Scope

Temporally the economic impact analysis focuses on two phases, the 5.5 year Project construction phase, which is projected to start in mid-2018 and conclude in late 2023, and a 30-year operation phase extending from 2024 through 2053. The Project would have the capacity to be fully operational beginning in 2024. This 30-year time period was selected for the impact modelling as it represents the possible duration of a concession agreement with the terminal operator. Regular maintenance of marine terminal infrastructure and container handling equipment replacement is expected to extend the terminal's life significantly beyond this initial 30-year time period.

The economic impact of expenditures associated with the planning, engineering design, and environmental assessment work for the Project that occurs over the 2014-2017 period was not included in the analysis. Only the planned construction and start-up expenditures that are incurred post-issuance of a Decision Statement Government of Canada and a Certificate of Environmental Assessment from the B.C. Government were used in the economic impact analysis.

3.3 Study Methods

The economic impact analysis was undertaken using an input-output (I-O) impact modelling methodology. The BC Input-Output Model (BCIOM), which is maintained by BC Stats, was used to estimate the Project's potential effects on direct GDP, output and tax revenue and on indirect, induced and total employment, labour income, economic output, GDP and tax revenue. PMV-supplied estimates of Project direct expenditures and direct employment were used to determine potential effects on direct employment and direct economic (gross) output and as inputs for the BC Input-Output Model.

The modelling generated estimates of the Project's effects on the B.C. and Metro Vancouver economies. These effects are largely incremental to these economies as the Project's spending on construction related goods, materials, services and labour, and most spending and revenues associated with the Project's on-terminal activities would not occur in the absence of the Project. The Project's direct economic effects are amplified through the local and provincial economies and also the national economy via the indirect economic effects flowing from the Project's direct spending on materials, goods and services and the induced effects from the spending on consumer and personal services that is supported by Project related wages and salaries. Using the

employment indicator as an example, direct, indirect, and induced impacts for the province have the following key characteristics.

- **Direct employment** is employment in an industry or a company that is attributable to direct spending in B.C. by a project's proponents. In the case of container traffic at Roberts Bank Terminal 2, the jobs involved in handling containers on the new terminal would be considered direct employment. From a terminal construction perspective, direct employment encompasses the various tradespersons, labourers, equipment operators, supervisors, engineers, technicians, and managers that the Infrastructure Developer hires.
- **Indirect employment** is employment at supplier businesses that is supported by direct expenditures on materials, goods and services made by the Infrastructure Developer during the construction phase and by direct expenditures on goods and services during on-terminal operations made mainly by the Terminal Operator Concessionaire. The BCIOM calculates and reports two components or aspects of indirect employment. The initial component is the employment at the businesses supplying goods or services directly to a project proponent or its agent (for example, directly to the Infrastructure Developer). This is called *direct B.C. supply industry employment* or the first round of goods and services spending effect. For example, a B.C. company that provides electrical system maintenance services to the Terminal Operator Concessionaire would be categorised as a terminal supplier and its employment as *direct* supply employment. There are subsequent rounds of purchases, often many, as the direct suppliers need inputs for their production processes (natural gas and steel for a steel fabricator, for example). These subsequent rounds of spending are cumulatively referred to as *upstream B.C. supply industry employment*. All the rounds of this spending on goods and services are summarily reported as *total indirect employment*.
- **Induced employment** is employment generated via the household spending of the income of workers employed directly or indirectly through the Project. For example, when longshore workers and their families go out for dinner at local restaurants, this would result in additional (induced) employment hours in the local food and beverage industry.
- **Total employment** is the sum of direct, indirect, and induced effects and represents the maximum potential stimulus to the B.C. economy resulting from construction of the new marine terminal and causeway widening over the 2018-2023 period and from on-terminal handling of containers over the 2024-2053 period.

For this analysis, the direct output and employment estimates for the construction and operation phases are based on expenditure and employment estimates developed by engineering and shipping industry consultants that were commissioned by PMV as part of the Project's planning. Other direct and all indirect and induced economic effects for the construction and operation phases were estimated through modelling runs of the BCIOM and use of certain PMV supplied expenditure and employment estimates as modelling inputs.

The BC Stats maintained BCIOM incorporates detailed information collected by Statistics Canada about the flow of goods and services among the many industries of the national and provincial economies.[13] The model incorporates Statistics Canada data to structure linked production function relationships between 300 industries producing 727 commodities and having 172 final demand categories and also incorporates algorithms that drive the model's computations. This information provides comprehensive and detailed representations of the national and provincial economies for 2008. BCIOM is typically used to predict how an increase or decrease in supply of a product or service (commodities) from one industry (such as heavy construction) would impact that industry, upstream (supplier) industries, labour supply related industries (retailers for example), and cumulatively, the entire B.C. economy.[14]

The modelling for this analysis included "shocking" the BCIOM with the estimates of Project associated spending on goods and services produced in B.C. (i.e., the direct B.C. supply).[15] These Project expenditures are incremental and hence a 'shock' to the economy.

As primary inputs for the economic modelling, PMV provided to Golder detailed estimates of direct employment by general occupations and expenditures by detailed goods, materials, and services for construction of the proposed marine terminal and causeway widening, and the terminal services of the subsequent operating phase. These estimates are current as of Fall 2013, but are subject to change as the Project design is refined in response to various processes that are internal and external to PMV.[16]

The detailed expenditures in the PMV supplied engineering and accounting framework were mapped to commodity categories and this commodity data was applied as the inputs for the modelling runs. The known relationships, represented in the model's tables or matrices, between *input* commodities (goods and services), *produced* commodities and *final demand* categories in the economy are the basis for estimating indirect and induced impacts due to the Project's direct expenditures in B.C. The modelling results are reported in constant 2013 Canadian dollars over the terms of the two phases.

The modelling was undertaken from a B.C. provincial perspective so the estimated value of imported labour, goods and services[17] was deducted from the Project's total direct spending to identify Project expenditures on goods and services produced in B.C. and on B.C.-based labour (See Appendix A for a calculation of direct supply of B.C. produced materials, goods and services). Only the Project spending on labour, materials, goods, and services originating in B.C. was inputted into the model.

Project expenditures on a few items were not inputted into the BCIOM as they do not result in incremental economic output, GDP or employment; rather they are a transfer of economic resources between parties within

[13] BC Stats is the central statistics agency of the B.C. Government. It undertakes economic analyses for internal B.C. Government purposes and provides fee for service access to the BCIOM. The BCIOM has been used to assist with estimating the economic impact of several projects that have been reviewed by the B.C. Environmental Assessment Office.

[14] The BCIOM can also be used to estimate impacts based on a change in industry gross output, i.e. a change in demand.

[15] See **Tables B-1**, **B-2**, and **B-3** in **Appendix B** for a presentation of the calculation of direct B.C. supply of materials, goods and services for the Construction and Operation Phases. Project spending on wages and salaries for direct labour, profits of direct proponents, and taxes are not part of direct B.C. supply. Direct employment (number of person-years and labour income) and profits (operating surplus) are direct impacts however and are presented as such in **Section 4**.

[16] The selected Infrastructure Developer will design and build the new terminal, subject to PMV approvals, and the Terminal Operator Concessionaire will determine its equipment requirements, and as such estimated expenditures and their underlying choices about construction approaches, equipment, etc. may vary from methodologies and equipment used to prepare this economic impact analysis.

[17] Imported either from other provinces or outside of Canada.

the province. Direct Project payments of taxes, which includes Provincial Sales Tax (PST) and property taxes, fall into the transfers category.[18] Another transfer excluded from the impact modelling is the acquisition of submerged lands for the Project; in this case, PMV as a Federal Government entity will acquire certain submerged lands from the Province of British Columbia, which is a transfer of assets between the two levels of government.

The Project's effects on the Metro Vancouver economy were isolated from the overall B.C. effects through two steps. The first step was to use information on the geographical sourcing of direct labour for the construction of the DP3 Project and the geographical sourcing of direct labour for on-terminal activities at Port Metro Vancouver.[19] The second step was to use the Metro Vancouver economy's regional share of total employment in each of the more than 300 industries in the BCIOM. Information from Statistics Canada's Labour Force Survey was combined in the model with Statistics Canada Census data to estimate indirect and induced employment levels and labour market characteristics in the region and for each industry. The model takes account of the supply of available workers in the affected industries and demand for workers by the Project. The Metro Vancouver supplier industry (and induced) impact is determined by allocating a proportion of the output in each industry to the region.

[18] Taxes associated with spending on the Project are reported.

[19] Geographical sourcing of temporary and permanent labour and location of permanent residences of labour is relevant for estimating potential effects on Metro Vancouver. An estimated 95% of construction phase labour for the DP3 Project was sourced from the Metro Vancouver area. Five percent was sourced from outside the province (Edgar 2014 and Atwell 2014). The DP3 Project infrastructure construction experience for labour sourcing is projected to apply to the infrastructure construction activities of the Project. Assumptions for RBT2 about the sourcing of direct labour for on-terminal activities during operations came from interviews (Pennell and Doran 2014) and Project information (such as AECOM 2012). Assumptions about the residential location of on-terminal labour were developed from two sources: a survey of employers that identified the location of Port Metro Vancouver associated employment for on- and off-site activities/facilities (InterVISTAS May 2013) and data on place of residence of members of ILWU 502 (BC Maritime Employers Association n.d.). Based on these sources, it was assumed that on-terminal labour would be sourced from the Lower Mainland labour force, which includes ILWU members, and 90% of on-terminal direct employment would reside in Metro Vancouver, and most of the other 10% would reside in the upper Fraser Valley and there would be a small number of workers who reside in the Squamish area.

4.0 RESULTS

This section presents the results of the economic impact analysis of the Roberts Bank Terminal 2 Project. Impact results for each of employment, labour income, GDP, output, and tax revenue are shown. The results for the construction and operation phases are reported separately. The impacts for B.C. and Metro Vancouver are presented for each phase, showing direct, indirect, induced, and total impacts where applicable. A summary of the economic effects by phase, indicator, and region is presented in **Appendix A**. The estimated economic effects of off-terminal activities associated with handling marine containers that are loaded and unloaded at RBT2 are presented in **Appendix C**.

4.1 Construction Phase Impacts, 2018-2023

The construction phase is expected to span mid-2018 through 2023. Activities requiring expenditures in this phase include building the terminal and widening the causeway, plus acquiring and installing container handling equipment and conducting start-up training.

4.1.1 B.C.

The total on-site direct employment requirements for construction are anticipated to be 4,368 person-years over a five and a half year period, starting in mid-2018. A large portion of the Project's direct employment (an estimated 95%) is expected to be sourced from the pool of workers residing in Metro Vancouver. The 5% of direct labour not sourced locally is anticipated to be sourced (on a temporary basis) from outside of B.C., and provide expertise for certain specialised construction activities.

The Project's direct employment effect for B.C. residents is expected to be an estimated 4,150 person-years or an annual average of 754 person-years over the five and a half years of construction.[20] This is the number of person-years of direct construction employment anticipated to be taken up by residents of B.C. A small portion of the direct construction employment requirements (estimated 218 person-years) is anticipated to be filled by specialised workers who have permanent homes outside of the province.

There will also be indirect employment in B.C. through direct Project expenditures on materials, goods and services produced in B.C. (also called direct B.C. supply). The Project's purchased materials, goods and services would include, for example, concrete products, sand, gravel, rip-rap, fuel, food supplies, reinforcing steel, structural steel, piping, general building supplies, and engineering and transport services.

[20] Employment effects are reported in person-years, which takes into account the number of hours worked in one year by full-time, part-time, and temporary employees, as well as self-employed persons. The person-years job unit transforms the different employment categories into one unit based on overall averages of full-time hours worked in one year in the business and government sectors. The employment unit of full-time equivalent (FTE) jobs is an alternative term. The person-years job unit is used herein because many industries are represented in the economic impact modelling undertaken for this Project and they have an array of full-time, part-time, and temporary employment attachment structures. The use of the person-years job unit provides a consistent approach across industries to portraying employment activity. It should be noted that a person-year represents a typical employment period in terms of hours worked for one year, and, in and of itself, a person-year should not be interpreted as a permanent or long-term, sustaining job unit of measurement. Within an operation phase situation, an estimate of person-years can be used to help determine an estimate of the number of permanent or long-term jobs of a project or program. The short-term structure of construction employment precludes assigning an estimate of permanent or long-term jobs to a project or program.

A large expenditure category would be container handling equipment, which will be sourced from specialised manufacturers, and the majority of which is expected to be manufactured and assembled outside of Canada and transported by ship, barge, and rail to the Project site. As this equipment will be made outside of B.C., the expenditures to acquire and transport it are not seen as having an economic effect on the province. The indirect employment in B.C. direct supply industries during RBT2's construction phase is anticipated to be an estimated 3,870 person-years, an annual average of 704 person-years.

The direct suppliers will need various inputs to produce the goods and services acquired for terminal construction and capital equipment. Only a portion of these inputs are expected to be produced in B.C. The indirect employment in upstream B.C. supply industries stimulated by construction phase spending on B.C. produced goods and services is expected to be an estimated 2,394 (435) person-years. [21]

The construction phase induced employment impact in B.C. is estimated as 2,305 person-years so the total employment impact over the Project's construction phase is expected to be an estimated 12,719 person-years, an annual average of 2,312 person-years.

Table 4-1 displays the estimated economic effects of the construction phase in B.C. over the 2018-2023 period.

Table 4-1: Economic Impact in B.C. of the Construction Phase, 2018-2023[22]

	Employment (person-years)	Labour Income ($Millions)	GDP[23] ($Millions)	Economic Output ($Millions)	Tax Revenue ($Millions)
Direct (terminal infrastructure construction)	4,150 (754)	494 (90)	496 (90)	1,945[24] (354)	177 (32)
Direct supply industries (indirect)	3,870 (704)	241 (44)	407 (740	862[25] (157)	61 (11)
Upstream supply industries (indirect)	2,394 (435)	133 (24)	209 (38)	482 (88)	33 (6)
Induced	2,305 (419)	129 (23)	225 (41)	361 (66)	30 (5)

[21] The inputs used for making concrete products that are purchased for Project construction provide an example of upstream production. If a concrete product is manufactured in B.C. then there would be direct supplier employment associated with its manufacture. In addition, there would likely be indirect upstream employment in connection with extracting or making the inputs used in concrete manufacture (e.g., Portland cement, sand, gravel, and other additives) if they are sourced from B.C. (which is likely). Further upstream there would be indirect employment associated with making or extracting the inputs used in Portland cement production (e.g., limestone, gypsum, clay, and fly ash) if they are sourced from B.C. (which is also likely).

[22] Annual averages are presented in brackets. The annual average estimates are rounded so the total annual average may not equal the sum of the rounded direct, indirect and induced estimates.

[23] Direct Project expenditures that go towards wages and operating surplus (profits) represent value added or GDP to the economy and accordingly are reported as a direct GDP impact ($496 million) of the construction phase. The direct GDP results in this report should be interpreted as conservative as components of direct GDP other than labour income are not fully captured in the estimated expenditures. Labour income typically makes up the largest portion of GDP and the associated labour cost is fully estimated for this Project but direct operating surplus (profits), investment income and depreciation associated with the Project are not as fully captured.

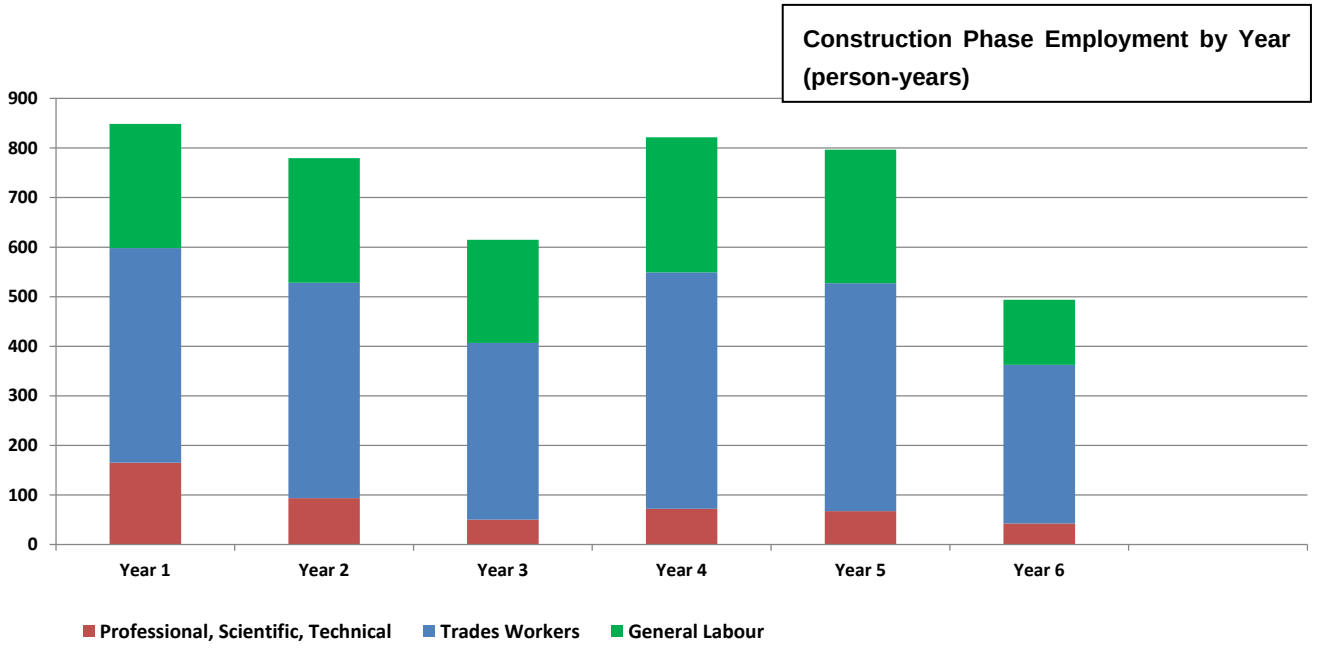
[24] Total Project expenditures in the construction phase for economic modelling purposes were estimated as $1.945 billion. This amount is approximately equivalent to the gross revenues or output for the business enterprises that will build the Project. This amount does not include expenditures for the container handling equipment that is expected to be manufactured outside of Canada.

[25] Project expenditures on goods and services produced in B.C., i.e. direct acquisitions from B.C. supplier industries, was estimated as $862 million. See **Table B1** in **Appendix B** for the derivation of the direct B.C. supply output estimate. The BCIOM was 'shocked' by this change in B.C. supply industries output in order to estimate the indirect economic impact of the construction phase on the B.C. and Metro Vancouver economies.

Total	12,719 (2,312)	997 (181)	1,337 (243)	3,650 (664)	301 (55)

Source: author's calculations and BC Stats 2014

Figure 4-1 shows direct employment for terminal construction by year and general occupation category over the 5.5-year construction phase (year 1 is shown as mid-2018 to mid-2019 and year 6 is last half of 2023). Tradespersons and operators are expected to account for the largest share of labour, more than half of all workers in each year, and an estimated 56% over the construction phase. General labourers are expected to account for an estimated 32% of employment and the professional, scientific and technical occupations (taking up various project design and management positions) may make up 12% of the construction workforce.



Source: Chart based on PMV supplied estimates of direct employment

Figure 4-1: Construction phase direct employment (person-years) by year and general occupation category

The top five direct supplier industries are anticipated to account for two-thirds of direct B.C. supply employment. The Architectural, Engineering, and Related Services industry is expected to garner the largest share of direct B.C. supply employment (938 person-years). Employment in the Equipment Rental and Leasing (882 person-years) and Sand, Gravel, Clay and Ceramic and Refractory Minerals (407 person-years) industries follow. These are logical impact modelling results because Project construction will require a large volume of fill to develop land several kilometres from the shore, ongoing engineering services will be required throughout the construction period, and a wide array of construction equipment will be needed over the 5.5 years of building the new terminal.

The top five upstream industries supplying inputs to the direct B.C. suppliers of materials, goods and services are projected to be: Retail Trade, Truck Transport, Other Administration and Support Services, Water Transportation, and Repair and Maintenance. Collectively they account for 30% of the employment impact of the

upstream B.C. supply industries. **Table 4-2** presents the B.C. employment impact for the top five direct and upstream supplier industries.

Table 4-2: Top Five Direct Supplier Industries and Upstream Supplier Industries in B.C. by Employment Impact for the Construction Phase, 2018-2023

Direct B.C. Supplier Industry	Employment (person-years)	Upstream B.C. Supplier Industry	Employment (person-years)
Architectural, Engineering and Related Services	938	Retail Trade	199
Equipment Rental and Leasing	882	Truck Transportation	186
Sand, Gravel, Clay and Ceramic and Refractory Minerals	407	Other Administration and Support Services	124
Stone Mining and Quarrying	253	Water Transportation	109
Concrete Product Manufacture	244	Repair and Maintenance	88
Top five industries as a percentage of total direct B.C. supplier employment	65%	Top five industries as a percentage of total upstream B.C. supplier employment	30%

Source: author's calculations and BC Stats 2014

The direct employment for terminal construction is expected to generate approximately $494 million in wages and salaries, an annual average of $119,000 per person-year.

The construction phase would account for approximately $1.34 billion in provincial GDP over the five-and-a-half-year construction period, an annual average of an estimated $243 million.[26]

There would be new business opportunities in the province as a result of Project construction. The total gross revenues for businesses supplying B.C. produced materials, goods, and services for Project construction is estimated as $1.3 billion:

- $862 million, or an annual average of $157 million, would be spent on materials, goods, and services produced in British Columbia and directly supplied to the Project; and
- $482 million would be spent on production inputs from B.C. to make or provide the directly supplied materials, goods, and services.

Government revenues by way of taxes paid by construction employers, suppliers, and Project associated workers would be an estimated:

- $127 million in federal government taxes;
- $154 million in B.C. government taxes; and

[26] GDP is the acronym for Gross Domestic Product, and its main components are labour income and business profits, and is often referred to as value added. Project construction would also generate about $3.65 billion in total economic (or gross) output. The economic output figure includes intermediate goods and services as Project spending cycles through the economy. The GDP figure provides the best summary representation of the Project's incremental impact on the B.C. economy.

- $20 million in local government taxes.

Total tax revenues derived from direct Project expenditures on terminal construction are expected to amount to an estimated $177 million, of which three-fifths is anticipated to accrue to the B.C. government. There is expected to be approximately $301 million in total tax revenues directed to governments during the construction phase due to the Project, 42% directed to the Federal Government, 51% to the B.C. Government, and 7% to local governments. Personal income tax payments to the Federal and B.C. Governments are anticipated to account for the largest portion of the tax revenues, 49% in relation to labour incomes of direct workers who will construct the new terminal and 46% in connection with the labour incomes of Project associated direct, indirect and induced workers in the construction phase. **Table 4-3** presents the government tax revenue impact for the Project's construction phase.

Table 4-3: Tax Revenue by Tax Type and Government for the Construction Phase, 2018-2023

	Direct ($millions)	Direct B.C. Supplier Industries ($millions)	Upstream B.C. Supplier Industries ($millions)	Induced ($millions)	Total ($millions)
Federal Government	68.3	34.7	14.8	9.6	127.4
Personal Income Tax	61.0	20.1	10.5	7.2	98.8
Corporation Income Tax	0.1	12.7	5.5	3.9	22.2
Net Taxes on Products	7.2	1.9	-1.2	-1.5	6.4
Taxes on Factors of Production	-	-	-	-	-
Province of B.C.	107.3	22.1	13.5	11.4	154.3
Personal Income Tax	25.6	7.6	4.0	2.8	40.0
Corporation Income Tax	0.1	5.8	2.5	1.7	10.1
Net Taxes on Products	81.4	8.7	7.0	6.9	104.0
Taxes on Factors of Production	0.2	-	-	-	0.2
Local Governments (B.C.)	1.9	4.3	4.6	8.8	19.6
Taxes on Factors of Production	1.9	4.3	4.6	8.8	19.6
Total	177.5 (32.3)	61.2 (11.1)	32.9 (6.0)	29.7 (5.4)	301.3[27] (54.8)

Source: author's calculations and BC Stats 2014

4.1.2 Metro Vancouver

The Metro Vancouver economy and labour force is expected to capture a substantial portion of the economic impact of the construction phase since the Project is located within this large metropolitan area, which has a labour force of approximately 1.4 million and an extensive construction services infrastructure. The DP3 Project sourced an estimated 95% of its terminal infrastructure construction labour from the Metro Vancouver area (Edgar 2014, Atwell 2014). RBT2 is expected to source the same share of its direct construction requirements from the Metro Vancouver labour pool, an estimated 4,150 person-years. This relatively large employment effect in Metro Vancouver means that the associated direct labour income and direct GDP effects in the local area

[27] Vertical column and horizontal row results do not sum to the same total because of decimal rounding.

would be similarly high. **Table 4-4** displays the estimated economic effects of the construction phase in Metro Vancouver.

Table 4-4: Economic Impact in Metro Vancouver of the Construction Phase, 2018-2023

	Employment (person-years)	Labour Income ($Millions)	GDP ($Millions)	Economic Output ($Millions)
Direct (terminal infrastructure construction)	4,150 (754)	494 (90)	496 (90)	-
Direct supply industries (indirect)	2,448 (445)	162 (29)	281 (51)	555 (101)
Upstream supply industries (indirect)	1,494 (272)	85 (15)	137 (25)	282 (51)
Induced	1,632 (297)	83 (15)	149 (27)	238 (43)
Total	9,723 (1,768)	824 (150)	1,063 (193)	1,075[28] (195)

Source: author's calculations and BC Stats 2014

The majority of supplier industry employment is expected to be based in Metro Vancouver. For example, most sand requirements will be sourced from the production of the Fraser River maintenance dredging program. However there is anticipated to be more supplier industry employment elsewhere in B.C. compared to the direct construction employment case because certain key construction materials, goods and services are expected to be sourced from outside the Metro Vancouver area. An estimated 64% of supply industry employment (2,448 person-years) during the construction phase is expected to be Metro Vancouver based (versus the 95% for direct construction employment). An estimated total of 9,723 (annual average of 1,620) person-years are expected to be Metro Vancouver-based, which would be 76% of the Project's direct, indirect, and induced employment during the construction phase.

Materials, goods and services contracting revenues of Project suppliers are an indicator of the scale and breadth of the business opportunity offered by the Project either through its construction or operation. The estimated gross revenues (output) of direct supplier industries in Metro Vancouver due to the Project are expected to be approximately $555 million over the 5.5 year construction period or an annual average of $101 million. There is anticipated to be an additional $282 million in revenues for Metro Vancouver businesses due to expenditures on production inputs to make or provide the materials, goods and services that are sold directly to the Project. Approximately 60% of the Project's construction-focused contracting and purchase opportunities in the province are anticipated to occur in the Metro Vancouver area.

[28] Total of indirect and induced economic (gross) output

4.2 Operation Phase Impact, 2024-2053

The operation phase impact for B.C. and Metro Vancouver are presented in the following sections. The operation phase activities refer to on-terminal (on-dock) activities, consisting of the loading and unloading of container ships, temporary container storage, and on-terminal container transfers to and from rail and road transport. For the purposes of this study, the operation phase is the 30-year time frame from 2024 to 2053. However, with regular upkeep and maintenance, the terminal is expected to operate well beyond the 30-year time frame used in the economic impact assessment.

The impact analysis is based on the new terminal handling 1.96 million TEUs in 2024, close to its practical capacity in the initial full year of operation, and ramping up and handling 2.04 million TEUs in 2025 and the years thereafter, which would be its practical capacity.

4.2.1 B.C.

Based on the above cited level of marine container traffic, total direct employment in B.C. is expected to be an estimated 27,846 person-years over the 30-year time frame in connection with the terminal operator's handling of containers, an annual average of an estimated 928 person-years.[29] There would also be employment in B.C. through direct expenditures on goods and services, such as utilities, certain aspects of terminal security, terminal maintenance, and certain aspects of equipment maintenance. The employment in B.C. supplier industries, associated with direct goods and services spending in support of on-terminal activities during the operation phase, is expected to be an estimated 1,346 person-years or an annual average of 45 person-years. The employment in upstream supplier industries stimulated by the direct spending on B.C. produced goods and services is expected to be an estimated 3,417 (annual average of 114) person-years.

The induced employment impact in B.C. associated with the spending of wages and incomes earned through direct and indirect employment tied to on-terminal activities is estimated as 15,330 (annual average of 511) person-years. The total employment impact of on-terminal activities over a 30-year operation phase is expected to be an estimated 46,593 person-years or an annual average of 1,553 person-years. The driving factor behind the total employment result is the direct employment of longshore workers and their incomes and associated household spending. The supplier industries employment tied to on-terminal activities is relatively small by comparison as the expenditures for on-terminal container handling are focused on longshore workers and the equipment they operate and help maintain.

Table 4-5 displays the estimated economic impact in B.C. of operation phase on-terminal activities.

Table 4-5: Economic Impact in B.C. of the Operation Phase, 2024-2053

	Employment (person-years)	Labour Income ($Millions)	GDP ($Millions)	Economic Output ($Millions)	Tax Revenue ($Millions)
Direct (on-terminal activities)	27,846 (928)	4,602 (153)	4,659 (155)	5,523 (184)	1,030 (34)
Direct supply industries (indirect)	1,346 (45)	78 (3)	170 (6)	700 (23)	28 (1)
Upstream supply industries (indirect)	2,071 (69)	103 (3)	151 (5)	301 (10)	23 (1)

[29] All on-terminal container handling workers are expected to reside in B.C.

Induced	15,330 (511)	785 (26)	1,371 (46)	2,198 (73)	180 (6)
Total	46,593 (1,553)	5,568 (186)	6,351 (212)	8,722 (291)	1,261 (42)

Source: BC Stats 2014

As presented in **Section 3**, the volume of container traffic is the driving factor in determining on-terminal employment. The dock worker dispatch process developed by the BC Maritime Employers Association and the International Longshoremen's and Warehousemen's Union (ILWU) locals is also a key factor as it matches the dock workforce to cargo handling demand at various facilities in Port Metro Vancouver on a shift to shift basis. The percentage distribution between management/administrative employment and labour/operator/tradesperson employment on the new terminal is projected to be approximately 14% and 86%, respectively. As described in **Section 4**, RBT2 is foreseen to be able to operate at its practical operating capacity in 2025, the 2nd full year of operation, so the annual range of employment for terminal operator activities is anticipated to be fairly narrow over the operation phase. Some fluctuation in container traffic due to various economic factors is likely over the 30-year term of this analysis but the container traffic estimation of this analysis is based on operating at 85% capacity over the long-term. There is expected to be years when this factor is superseded (and on-terminal employment is accordingly higher than the annual averages in this analysis) and years when container traffic is below the new terminal's practical capacity.

The top five direct supplier industries to terminal operations are projected to account for about 90% of direct supplier employment in B.C. The Professional, Scientific and Technical Services industries are anticipated to garner the largest share of direct B.C. supplier employment (392 person-years). Administrative and Support, Waste Management Remediation Services (255 person-years) and Utilities (228 person-years) industries follow. The top five B.C. suppliers of inputs to the direct B.C. suppliers of goods and services are projected to be: Wholesale Trade, Retail Trade, Manufacturing, Accommodation and Food Services, and Transportation and Warehousing. Collectively, they are expected to account for about three-fifths of the employment of upstream B.C. supplier industries. **Table 4-6** presents the employment impact for the top five direct and upstream B.C. supplier industries.

Table 4-6: Top Five Direct Supplier and Upstream Supplier Industries in B.C. by Employment Impact of Operation Phase, 2024-2053

Direct B.C. Supplier Industry	Employment (Person-years)	Upstream B.C. Supplier Industry	Employment (Person-years)
Professional, Scientific and Technical Services	407	Wholesale Trade	446
Administrative and Support, Waste Management Remediation Services	398	Retail Trade	363
Utilities	229	Manufacturing	191
Finance, Insurance, Real Estate and Rental and Leasing	86	Accommodation and Food Services	177
Manufacturing	49	Transportation and Warehousing	156
Top five industries as a percentage of total B.C. direct supplier employment	89%	Top five industries as a percentage of total B.C. indirect supplier employment	63%

Source: BC Stats 2014

The direct employment for on-terminal activities is expected to generate an annual average of $153 million in labour income, an annual average of approximately $165,000 per person-year.

The Project's operation phase would account for approximately $6.3 billion in provincial GDP over the 30-year 2024-2053 period, an estimated annual average of $212 million.

There is expected to be a total of approximately $1.3 billion (annual average of $42 million) in tax revenues directed to governments from the overall economic activities (direct, indirect and induced) associated with the on-terminal handling of marine containers during the Project's operation phase, 53% directed to the Federal Government, 30% to the B.C. Government and 16% to local governments. Personal income tax payments to the Federal and B.C. Governments are expected to account for the largest portion of the tax revenues, 95% in relation to direct expenditures on terminal operator activities and 82% in connection with the overall impact of the Project's terminal operator activities. Over four-fifths of the total tax revenue is anticipated to be derived from direct on-terminal activities as the direct spending on labour is seen as out-weighing the direct spending on goods and services in the operation phase. **Table 4-7** presents the government tax revenue impact for the Project's operation phase.

Table 4-7: Tax Revenue by Tax Type and Recipient Government for the Operation Phase, 2024-2053

	Direct	Direct B.C. Supplier Industries($millions)	Upstream B.C. Supplier Industries ($millions)	Induced ($millions)	Total ($millions)
Federal Government	589.5	12.7	11.0	58.1	671.3
Personal Income Tax	579.0	6.2	7.4	43.8	636.4
Corporation Income Tax	3.7	6.3	3.4	23.6	37.0
Net Taxes on Products	6.8	0.2	0.2	-9.3	-2.1
Taxes on Factors of Production	-	-	-	-	-
Province of B.C.	297.0	9.4	8.6	68.5	383.5
Personal Income Tax	269.5	2.4	2.8	16.8	291.5
Corporation Income Tax	1.9	2.6	1.5	10.5	16.5
Net Taxes on Products	25.6	4.4	4.3	41.2	75.5
Taxes on Factors of Production	-	-	-	-	-
Local Governments (B.C.)	144.0	5.5	3.3	53.3	206.1
Taxes on Factors of Production	144.0	5.5	3.3	53.3	206.1
Total	1,030.5 (34.3)	27.6 (0.9)	22.9 (0.8)	179.9 (6.0)	1,260.9[30] (42.0)

Source: author's calculations and BC Stats 2014

[30] Vertical column and horizontal row results do not sum to the same total because of decimal rounding.

4.2.1.1 Metro Vancouver

The anticipated direct employment requirements for on-terminal activities (which are located in Metro Vancouver at Delta. B.C.) would be an annual average of 928 person-years and a total of 27,848 person-years over a 30-year operation period. Most of this direct employment at the new terminal is expected to be filled by Metro Vancouver residents, an estimated 90%. The Project's employment of Metro Vancouver residents in connection with on-terminal activities is expected to be an estimated annual average of 835 person-years and a total of 25,063 person-years over a 30-year operation period. The other 10% of on-terminal employment is anticipated to reside in the eastern Fraser Valley for the most part and a small number in the Squamish-Whistler area.

Because a large portion of the direct and indirect employment is expected to reside in Metro Vancouver, the Project's induced employment in the operations phase is expected to be based in and resident in Metro Vancouver too, an annual average of 468 person-years. This large total employment impact within Metro Vancouver means that the associated direct labour income and direct GDP impacts would be similarly very high relative to the effects in the rest of B.C.

The estimated gross revenue impact on Metro Vancouver supplier industries, the business contracting opportunity for suppliers of B.C. produced goods and services offered by the Project's on-terminal activities, is anticipated to be an annual average of approximately $31 million, which is more than 90% of the expected impact for the province. **Table 4-8** displays the estimated economic impacts of the Project's operation phase activities in Metro Vancouver.

Table 4-8: Economic Impact in Metro Vancouver of the Operation Phase, 2024-2053

	Employment (person-years)	Labour Income ($Millions)	GDP ($Millions)	Economic Output ($Millions)
Direct (terminal operator)	25,063 (835)	4,142 (138)	4,193 (140)	-
Direct supply industries (indirect)	1,200 (40)	69 (2)	132 (4)	642 (21)
Upstream supply industries (indirect)	2,070 (69)	99 (3)	144 (5)	294 (10)
Induced	14,029 (468)	774 (26)	1,344 (45)	2,139 (71)
Total	42,362 (1,412)	5,084 (169)	5,813 (194)	3,075[31] (102)

Source: author's calculations and BC Stats 2014

[31] Total of indirect and induced economic output

5.0 DISCUSSION

5.1 Discussion of Key Findings

The total direct employment impact on B.C. residents over the course of construction is estimated as 4,150 (annual average of 754) person-years, with direct construction wage and benefits costs anticipated to total almost $500 million. A further 3,870 person-years of employment is projected to be generated in B.C. industries supplying goods and services used directly in construction activity, and 2,393 person-years in industries further back in the supply chain. Including induced impacts that are tied to the household spending of the labour income of the Project's direct and indirect workers, total employment of B.C. workers due to the Project's construction phase is expected to be approximately 12,700 (annual average of 2,300) person-years.

Despite the Project having a relatively lengthy construction period of 5.5 years, its construction employment cannot be described as long-term. As well, construction sector work attachments are often short-term in duration. However, the Project's spending during this time period can be said to support the equivalent of almost 750 full-time construction focused jobs over this 5.5 period and the equivalent of about 1,100 full-time jobs in supplier industries, a total of 1,850 full-time jobs. Because of the structure of employment attachments in construction, there would be many more than 750 workers involved in the building of the terminal and its associated infrastructure during this time period.

Direct and indirect purchases from B.C. supplier industries, essentially the materials, goods and services procurement opportunities presented by the Project, are anticipated to be an estimated $862 million and $482 million, respectively. The direct GDP expected to be generated by building RBT2 is projected at nearly $500 million, with an additional GDP impact of $616 million in B.C. supplier industries, plus an induced GDP impact of $225 million, for an anticipated total GDP impact on the B.C. economy of approximately $1.3 billion, an annual average of $243 million.

Federal, provincial, and local tax revenue impacts are expected to be $301 million, made up of $177 million in direct impacts, and an additional $124 million generated in supplier industries and those benefitting from spending by workers.

Over a 30-year operation phase, on-terminal activities are anticipated to generate direct employment in B.C. of an annual average of 928 person-years, with a further 45 person-years expected to be generated in B.C. industries supplying goods and services and 69 person-years in industries further back in the supply chain. Including induced impacts of 511 person-years, total employment associated with on-terminal activities is projected as an annual average of 1,553 person-years.[32]

[32] As well, increased demand for approximately 2 million TEUs of containerised trade would ultimately generate employment and other economic benefits through activities that would occur off-terminal. The off-terminal activities would include services provided by truck drivers, harbour pilots, tug operators, Canada Border Services Agency, railways, transload and distribution facility operations, and container storage yards, and would generate an estimated annual average of 6,700 person-years of direct employment in B.C. The majority of the direct employment for off-terminal activities is expected to be connected to warehouse and distribution centres (43%) and trucking (21%). The activities would also generate about 3,100 person-years of indirect and 1,050 person-years of induced employment annually; an estimated annual total of 10,850 person-years. The aggregate of on-terminal and off-terminal activities associated with handling Project containers would annually support approximately 12,400 direct, indirect and induced person-years of employment in B.C. and $813 million in wages. Other estimated economic effects of the off-terminal activities are presented in **Appendix A**, along with the employment effects.

In general, the annual average person-year figures can be viewed as the number of direct long-term jobs that will be generated through the operation of the new terminal, i.e., although individuals may leave a position at the new terminal, their position will be filled by another worker. It can be said that the Project would result in the creation of an estimated 928 long-term jobs in connection with on-terminal activities. A portion of the induced employment is likely to be part-time employment so 1,550 long-term jobs would be a conservative estimate of the total number of long-term jobs created and supported via the Project's on-terminal activities.

The annual average revenues for businesses due to on-terminal operations spending on B.C. produced goods and services are estimated at $33.3 million, with about $31 million of this revenue accruing to businesses in Metro Vancouver:

- $23.3 million in total gross revenues for businesses directly supplying B.C. produced goods and services for on-terminal operations; and
- $10.0 million in goods and services revenues for upstream B.C. supplier industries.

The spending of employment income during the operation phase would result in induced revenue of an annual average of $73 million spread over a wide variety of businesses, and would be mainly due to household spending by marine terminal workers.

RBT2's on-terminal activities would account for approximately $212 million in provincial GDP each year.

The operation phase annual average tax payments to the three levels of government by the Terminal Operator Concessionaire, Infrastructure Developer, suppliers, and Project associated workers are estimated at:

- $22.4 million in federal government taxes;
- $12.8 million in B.C. government taxes; and
- $6.9 million in local government taxes.

5.2 Assumptions and Limitations

The following are the study's modelling assumptions and limitations.

Assumptions

- The terminal construction and operation expenditures provided by PMV are based on the most current data available at the time that this analysis was undertaken. Final expenditure estimates for the Project may differ however, from the amounts contained in this report.
- The operation phase analysis is based on a container handling level at the new terminal that is at its practical capacity level of 2.04 TEUs in 2025 and thereafter. RBT2 will have the capability to exceed this level on a short-term basis and may ramp up to this level later in the 2020s (rather than in 2025) but over a 30-year operation phase the reported total and annual average economic impact results in this analysis are reasonable given the marine container traffic and terminal capacity forecasts in reports commissioned by PMV.

- The BCIOM assumes that consumers spend an average of 80% of their personal income on goods and services. The remaining 20% of personal income is consumed by taxes, or goes into savings.
- The BCIOM uses averages for a commodity or industry to produce tax estimates.
- Off-terminal container handling employment estimates are largely based upon previous economic impact studies conducted on container handling activities at Port Metro Vancouver (InterVISTAS 2013 and InterVISTAS 2011).

Limitations

- Input-output models are linear and do not factor in economies of scale, i.e., they assume that a given change in the demand for a commodity will translate into a proportional change in production.
- Input-output models do not take into account the amount of time required for economic changes to occur. Economic adjustments resulting from a change in demand are assumed to happen immediately.
- Input-output models assume there are no capacity constraints and that an increase in the demand for labour will result in an increase in employment (rather than simply re-deploying workers).
- The BCIOM is based on a "snapshot" of the B.C. economy in 2008 so the model reflects relationships between industries from that year.
- While use of the BCIOM has limitations, its commodity and industry relationships are based on a very large database accumulated over several years and the model has been found to generate impact estimates that are indicative of realised economic impacts. Nevertheless, the reported impacts are estimates and are accurate to probably no better than +/- 10%.

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APPENDIX A

Aggregate Economic Impact of On-Terminal and Off-Terminal Activities, 2024-2053

1.0 IMPACT OF OFF-TERMINAL ACTIVITIES, 2024-2053

The handling of import and export containers at the new terminal would ultimately generate employment and other economic benefits through activities that occur off-terminal (which are outside of the Project scope). Off-terminal activities include services provided by ship chandlers, truckers, harbour pilots, tug operators, Canada Border Services Agency, railways, transload and distribution facility operations and container storage yards. The main locales of these services would be at locations in Metro Vancouver and along highway and rail routes in B.C.

The starting point for the calculation of the economic impact associated with off-terminal activities (which are outside of the Project scope) is a projection of the level of marine container traffic that could be handled at the new terminal over the 2024-2053 period. The same long-term container traffic volume was used in this analysis as was presented in **Section 4.2**; 1.96 million TEUs in 2024 and 2.04 million TEUs in 2025 and the years thereafter. These annual container traffic levels were multiplied by employment per TEU factors to estimate annual direct employment levels over the 2024-2053 period for the various off-terminal activities.[1] The employment per container TEU factors were created from data developed in surveys of PMV associated employment undertaken by Inter*VISTAS* Consulting Inc. in 2011 and 2012.[2] These estimates of direct employment in B.C. for off-terminal activities were inputted into the BC I-O Model to generate direct impact estimates for the other economic indicators and indirect, induced, and total impact estimates for all of the economic indicators.

1.1 B.C.

Based on the above cited level of marine container traffic, the total employment impact in B.C. related to off-terminal activities over the 30-year 2024-2053 period is estimated as 326,341 person-years or an annual average of 10,878 person-years. There is expected to be 201,620 (annual average of 6,721) person-years of direct employment in trucking companies, transload facilities, and other off-terminal operations earning approximately $12 billion in wages and income (an annual average of $59,657 per person-year). There are also expected to be 59,145 (annual average of 1,972) person-years of employment stimulated through direct goods and services production in B.C. via the spending of these operations in support of handling Roberts Bank Terminal 2 containers.

As well, it is anticipated that off-terminal activities would generate an annual average of approximately $1 billion in additional GDP for the B.C. economy. **Table A-1** displays the projected 30-year total and annual average economic impact related to off-terminal activities in B.C. This is the economic impact over a three decade period in B.C. that flows from the support activities needed to inspect, transport, stuff, and unstuff the more than 60 million TEUs of containers that are expected to transit Roberts Bank Terminal 2 during this time frame.

[1] The employment was segmented by service category. Employment by TEU factors were estimated for truck transport, rail transport, distribution/transloading and other activities (ship chandlers, Canada Border Service Agency, etc.).

[2] The two surveys are documented in the reports entitled '2012 Port Metro Vancouver Economic Impact Study' (InterVISTAS 2013) and 'Micro Economic Impact Study of Container Activity at Port Metro Vancouver' (InterVISTAS 2011). Data for the micro analysis in 2011 was collected via in-person observations of ongoing container activity occurring at Deltaport and through interviews with TSI Terminal Systems Inc. staff and other support services. There were in-person observations and discussions with TSI staff about vessel handling and container movements. The different types of employment and the amount of time associated with the various tasks required in handling of containers were framed on a per ship basis. TSI provided an estimate of 6,500 TEU per ship. For the current analysis, employment information in terms of FTEs was then scaled from a per ship basis to a per TEU basis. The collected data included information about truck and rail movements. The 2013 study was utilized to estimate the share of container handling labor based in British Columbia.

Table A-1: Economic Impact in B.C. of Off-terminal Activities, 2024-2053

	Employment (person-years)	Labour Income ($Millions)	GDP ($Millions)	Economic Output ($Millions)	Tax Revenue ($Millions)
Direct	201,620 (6,721)	12,028 (401)	18,988 (633)	36,997 (1,233)	3,021 (101)
Direct supply industries (indirect)	59,145 (1,972)	3,284 (109)	5,323 (177)	12,136 (405)	1,017 (34)
Upstream supply industries (indirect)	34,456 (1,148)	1,781 (59)	2,879 (96)	8,082 (269)	455 (15)
Induced	31,120 (1,037)	1,742 (58)	3,042 (101)	4,878 (163)	400 (13)
Total	326,341 (10,878)	18,835 (628)	30,232 (1,007)	62,093 (2,070)	4,894 (163)

Source: author's calculations and BC Stats 2014

The top five direct supplier industries to off-terminal activities are projected to account for 58% of direct B.C. supply employment. The Repair Construction industry is anticipated to account for the largest share of direct B.C. supply employment in support of off-terminal activities, 13,888 (annual average of 463) person-years. Truck Transportation and Support Activities for Transportation are next in line with 10,200 (annual average of 340) person-years and 4,107 (annual average of 137) person-years, respectively. The projection of industries that are expected to supply goods and services to off-terminal operations is logical given the transport and warehousing orientation of off-terminal services for handling marine containers.

The top five B.C. suppliers of inputs to the direct B.C. suppliers to off-terminal activities are projected to be: Retail Trade, Wholesale Trade, Services in Buildings and Dwellings, Truck Transportation, and Other Administrative and Support Services. Collectively they account for approximately 40% of the indirect employment that the Project is expected to stimulate in upstream B.C. supplier industries. **Table A-2** presents the employment impact for the top five direct and upstream B.C. supplier industries.

Table A-2: Top Five Direct B.C. Supplier and Upstream Supplier Industries by Employment Impact of Off-terminal Activities, 2024-2053

Direct B.C. Supplier Industry	Employment (person-years)	Upstream B.C. Supplier Industry	Employment (person-years)
Repair Construction	13,888	Retail Trade	3,141
Truck Transportation	10,200	Wholesale Trade	3,084
Support Activities for Transportation	4,107	Services in Buildings and Dwellings	2,813
Other Administrative and Support Services	3,257	Truck Transportation	2,658
Wholesale Trade	2,546	Other Administrative and Support Services	1,440
Top five industries as a percentage of total direct BC supplier employment	58%	Top five industries as a percentage of total upstream BC supplier employment	38%

Source: BC Stats 2014

The total tax revenues derived from direct off-terminal activities is expected to amount to approximately $3 billion (annual average of $100 million), and almost half is anticipated to accrue to the Federal Government. There is expected to be a total of almost $5 billion in tax revenues (annual average of $163 million) directed to governments due to the overall spending and revenues associated with the off-terminal activities over the 30-year 2024-2053 period: 45% would be directed to the Federal Government, 39% to the B.C. Government, and 16% to local governments. Personal income tax payments to the Federal and B.C. Governments are anticipated to account for 37% of the total, which is much smaller than for the on-terminal case, because spending on goods and services is proportionately much higher in the off-terminal activities instance. **Table A-3** presents the estimated government tax revenues impact associated with off-terminal activities.

Table A-3: Tax Revenues by Tax Type and Recipient Government for Off-terminal Activities, 2024-2053

	Direct ($millions)	Direct B.C. Supply Industries ($millions)	Upstream B.C. Supply Industries ($millions)	Induced ($millions)	Total ($millions)
Federal Government	1,418.0	449.8	216.4	128.7	2,213.0
Personal Income Tax	810.7	259.2	133.5	97.1	1,300.5
Corporation Income Tax	457.5	163.3	77.5	52.3	750.6
Net Taxes on Products	306.8	27.4	5.4	-20.7	318.9
Taxes on Factors of Production	-157.0	-	-	-	-157.0
Province of BC	1,142.7	408.5	175.2	153.4	1,879.8
Personal Income Tax	303.1	99.0	51.0	37.3	490.4
Corporation Income Tax	236.0	73.3	36.3	23.4	369.0
Net Taxes on Products	363.3	236.3	87.9	92.7	780.2
Taxes on Factors of Production	240.2	-	-	-	240.2
Local Governments (BC)	460.5	158.9	63.6	118.3	801.3
Taxes on Products	-0.4	-	-	-	-0.4
Taxes on Factors of Production	460.9	158.9	63.6	118.3	801.7
Total	3,021.1 (100.7)	1,017.3 (33.9)	455.2 (15.2)	400.4 (13.3)	4,894.1[3] (163.1)

Source: BC Stats 2014

1.1.1.1 Metro Vancouver

It is projected that 86% of the direct employment in B.C. for off-terminal activities connected to RBT2 container traffic, 172,426 (annual average of 5,747) person-years, would be filled by persons residing in Metro Vancouver. An estimated three-quarters of the total employment in B.C. generated via terminal support activities would accrue to Metro Vancouver residents, an estimated direct, indirect and induced total of 236,446 (annual average of 7,881) person-years. Approximately $22 billion of incremental GDP is expected to be pumped into the Metro Vancouver economy as a result of off-terminal activities over a 30 year period, an annual average of $732 million. **Table A-4** displays the 30-year economic impact related to off-terminal operations in Metro Vancouver.

[3] Vertical column and horizontal row results do not sum to the same total because of decimal rounding.

Table A-4: Economic Impact in Metro Vancouver of Off-terminal Activities, 2024-2053

	Employment (person-years)	Labour Income ($Millions)	GDP ($Millions)	Economic Output ($Millions)
Direct	172,426 (5,747)	10,286 (343)	16,239 (541)	-
Direct supply industries (indirect)	30,060 (1,002)	1,659 (55)	2,661 (89)	6,144 (205)
Upstream supply industries (indirect)	17,850 (595)	921 (31)	1,485 (49)	3,132 (104)
Induced	16,110 (537)	900 (30)	1,572 (52)	2,526 (84)
Total	236,446 (7,881)	13,766 (459)	21,957 (732)	11,802[4] (393)

Source: author's calculations and BC Stats 2014

1.1.2 Total Impact of On-terminal and Off-terminal Activities, 2024-2053

The estimated impacts of on-terminal and off-terminal activities were combined to give an estimate of the total impact in B.C. and Metro Vancouver over the 30-year 2024-2053 period from the handling of RBT2 marine containers.

1.1.2.1 B.C.

The direct employment impact of the aggregate of on-terminal and off-terminal activities is expected to be an estimated 229,466 person-years over the 2024-2053 period, an annual average of 7,650 person-years. The number of direct long-term jobs connected to the off-terminal activities is approximately equivalent to this figure of 7,650 given that Roberts Bank Terminal 2 is expected to operate over a long time frame and the amount of person-years is anticipated to remain similar from year to year during the 2024-2053 period based on the container forecast.

A large majority (88%) of the aggregated on-terminal and off-terminal direct employment is anticipated to be working in off-terminal operations, such as distribution warehouses, trucking operations and container storage and repair facilities. These off-dock services are economically linked with the on-dock services to fulfill the function of moving containers to and from ships, thereby connecting markets and producers.

In addition to the direct spending on labour, there will also be direct spending on B.C. produced goods and services by a wide array of enterprises connected to the new terminal, including the Terminal Operator Concessionaire (and the Infrastructure Developer, which will have responsibilities for certain maintenance activities during the Project's operation phase). Only a small spend on B.C. produced goods and services by the Terminal Operator Concessionaire terminal operator is projected, but a relatively large portion (20%) of total off-terminal employment is anticipated to be tied to the spending on B.C. produced goods and services by the many enterprises in B.C. that would handle the containers that are moved through the new terminal.

[4] Total of indirect and induced

Taken together, the on-terminal and off-terminal handling of RBT2 container traffic is expected to inject an additional $1.2 billion of GDP into the B.C. economy on an annual basis, and two-thirds of this GDP boost would be attributable to the wages and salaries of direct, indirect, and induced workers.

Approximately $205 million of tax revenues are expected to be annually paid to the Federal, B.C., and local governments as a result of the on-terminal and off-terminal economic activities. Most tax revenues would be generated via off-terminal activities, about 80% because of the larger scale of its economic impact. **Table A-5** displays the estimated economic impact in B.C. of the aggregate of on-terminal and off-terminal activities.

Table A-5: Economic Impact in B.C. of On-Terminal and Off-Terminal Activities, 2024-2053

	Employment (person-years)	Labour Income ($Millions)	GDP ($Millions)	Economic Output ($Millions)	Tax Revenue ($Millions)
Direct (on-terminal and off-terminal activities)	229,466 (7,649)	16,630 (554)	23,647 (788)	42,520 (1,417)	4,051 (135)
Direct supply industries (indirect)	60,491 (2,016)	3,362 (112)	5,493 (183)	12,836 (428)	1,045 (35)
Upstream supply industries (indirect)	36,527 (1,218)	1,884 (63)	3,030 (101)	8,383 (279)	478 (16)
Induced	46,450 (1,548)	2,527 (84)	4,413 (147)	7,076 (236)	581 (19)
Total	372,934 (12,431)	24,403 (813)	36,583 (1,219)	70,815 (2,361)	6,155 (205)

Source: author's calculations and BC Stats 2014

1.1.2.2 Metro Vancouver

The direct employment impact in Metro Vancouver over the 30-year 2024-2053 period is projected to be an estimated 197,489 (annual average of 6,583) person-years. A large majority (86%) of the Project's direct employment is expected to reside in Metro Vancouver, which is largely due to the Delta, B.C. location of the new terminal and the large base of experienced enterprises that currently supply goods and services to facilities at Port Metro Vancouver, many of which are expected to expand where and when necessary to accommodate the incremental business and employment opportunities associated with the new terminal.

As in the provincial case, the off-terminal activities are anticipated to account for a larger portion of the Metro Vancouver economic impact than on terminal activities; for example, 87% of the aggregated direct employment will be due to direct employment at various off-terminal operations. The average income in Metro Vancouver per direct employment person-year for the aggregate of on-terminal and off-terminal activities is expected to be an estimated $73,000, and $67,000 per total employment person-year. On an annual basis there is anticipated to be approximately $225 million of goods and services contracting within Metro Vancouver via the aggregate of on-terminal and off-terminal activities, and together they are projected to generate in Metro Vancouver approximately $18.8 billion over a 30-year operating period (annual average of $628 million) in labour income and $27.8 billion (annual average of $926 million) in GDP.

Table A-6 displays the aggregated economic impact in Metro Vancouver of the on-terminal and off-terminal activities associated with handling of RBT2 marine container traffic.

Table A-6: Economic Impact in Metro Vancouver of On-terminal and Off-terminal Activities, 2024-2053

	Employment (person-years)	Labour Income ($Millions)	GDP ($Millions)	Economic Output ($Millions)
Direct (on-terminal and off-terminal activities)	197,489 (6,583)	14,428 (481)	20,432 (681)	-
Direct supply industries (indirect)	30,690 (1,023)	1,728 (58)	2,793 (93)	6,786 (226)
Upstream supply industries (indirect)	20,340 (678)	1,020 (34)	1,629 (54)	3,426 (114)
Induced	31,219 (1,041)	1,674 (56)	2,916 (97)	4,665 (156)
Total	279,740 (9,325)	18,850 (628)	27,770 (926)	14,877 (496)

Source: author's calculations and BC Stats 2014

APPENDIX B

Direct Supply of B.C. Produced Materials, Goods and Services

Table B-1: Direct B.C. Supply for Construction Phase, 2018 to 2023

Allocation of Project Expenditures	$Millions
Total terminal construction expenditures on materials, goods and services (including labour and profits)	1,945[1]
Minus leakages:	
Imports from other countries	214
Imports from other provinces	270
Other leakages (e.g., withdrawals from inventory)	14
Equals:	
Expenditures on materials, goods and services (including labour and profits) produced in B.C.	1,447
Less:	
Wages, benefits, unincorporated business income and operating surplus	496
Taxes on products net of subsidies	88
Taxes on factors of production net of subsidies	1
Direct B.C. Supply	862 (157) [2]

Source: author's calculations and BC Stats 2014

Table B-2: Direct BC Supply for Operational Phase – On Terminal, 2023-2054

Allocation of Project Expenditures	$Millions
Total on-terminal operations expenditures on goods and services (including labour and profits)	5,523[3]
Minus leakages:	
Imports from other countries	43
Imports from other provinces	88
Other leakages (e.g., withdrawals from inventory)	1
Equals:	
Expenditures on goods and services (including labour and profits) produced in B.C.	5,391
Less:	
Wages, benefits, unincorporated business income and operating surplus	4,659
Taxes on products net of subsidies	32
Taxes on factors of production net of subsidies	0
Direct B.C. Supply	700 (23.3)[4]

Source: author's calculations and BC Stats 2014

[1] This estimate (in 2013 dollars) excludes expenditures for most on-terminal marine container handling equipment and associated systems, such as the ship-to-shore gantry cranes. Almost all anticipated expenditures on container handling equipment were not included because PMV foresees most of this equipment being sourced from outside Canada.

[2] Annual average

[3] This estimate (in 2013 dollars) excludes replacement expenditures for most on-terminal marine container handling equipment and associated systems as PMV forsees most container handling equipment and systems being sourced from outside Canada.

[4] Annual average

Table B-3: Direct B.C. Supply for Off-Terminal Activities, 2023-2054

Allocation of Project Expenditures	$Millions
Total off-terminal activities expenditures on goods and services (including labour and profits)	36,997
Minus leakages:	
Imports from other countries	907
Imports from other provinces	4,222
Other leakages (e.g., withdrawals from inventory)	52
Equals:	
Expenditures on goods and services (including labour and profits) produced in B.C.	31,817
Less:	
Wages, benefits, unincorporated business income and operating surplus	18,264
Taxes on products net of subsidies	713
Taxes on factors of production net of subsidies	704
Direct B.C. Supply	12,136 (405)[5]

Source: author's calculations and BC Stats 2014

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[5] Annual average

APPENDIX C

Summary Tables of RBT2 Economic Impact Results

Table C-1: Summary of Economic Impact Results for Construction Phase, 2018-2023

	Employment (person-years)	Labour Income ($millions)	GDP ($millions)	Economic Output ($millions)	Tax Revenue ($millions)
Direct					
Metro Vancouver	4,150	$494	$496	-	
Other BC	0	$0	$0	-	
BC	***4,150***	***$494***	***$496***	***$1,945***	***$177***
Direct Supply (indirect)					
Metro Vancouver	2,448	$162	$281	$555	
Other BC	1,422	$79	$126	$307	
BC	***3,870***	***$241***	***$407***	***$862***	***$61***
Upstream Supply (indirect)					
Metro Vancouver	1,494	$85	$137	$282	
Other BC	900	$48	$72	$200	
BC	***2,394***	***$133***	***$209***	***$482***	***$33***
Total Indirect					
Metro Vancouver	3,942	$247	$418	$837	
Other BC	2,321	$127	$198	$507	
BC	**6,263**	**$374**	**$616**	**$1,344**	**$94**
Induced					
Metro Vancouver	1,632	$83	$149	$238	
Other BC	673	$46	$76	$123	
BC	**2,305**	**$129**	**$225**	**$361**	**$30**
Total					
Metro Vancouver	9,723	$824	$1,063	$1,075[1]	
Other BC	2,996	$173	$274	$630[2]	
BC	**12,719**	**$997**	**$1,337**	**$3,650**	**$301**

Source: author's calculations and BC Stats 2014

[1] Total of indirect and induced economic (gross) output for Metro Vancouver

[2] Total of indirect and induced economic (gross) output for other B.C.

Table C-2: Summary of Economic Impact Results for Operational Phase – On Terminal, 2023-2054

	Employment (person-years)	Labour Income ($millions)	GDP ($millions)	Economic Output ($millions)	Tax Revenue ($millions)
Direct					
Metro Vancouver	25,063	$4,142	$4,193	-	
Other BC	2,783	$460	$466	-	
BC	***27,846***	***$4,602***	***$4,659***	***$5,523***	***$1,030***
Direct Supply (indirect)					
Metro Vancouver	1,200	$69	$132	$642	
Other BC	146	$9	$38	$58	
BC	***1,346***	***$78***	***$170***	***$700***	***$28***
Indirect Supply (indirect)					
Metro Vancouver	2,070	$99	$144	$294	
Other BC	1	$4	$7	$7	
BC	***2,071***	***$103***	***$151***	***$301***	***$23***
Total Indirect					
Metro Vancouver	3,270	$168	$276	$936	
Other BC	147	$13	$45	$65	
BC	**3,417**	**$181**	**$321**	**$1,001**	**$51**
Induced					
Metro Vancouver	14,029	$774	$1,344	$2,139	
Other BC	1,301	$11	$27	$59	
BC	**15,330**	**$785**	**$1,371**	**$2,198**	**$180**
Total					
Metro Vancouver	42,362	$5,084	$5,813	$3,075[3]	
Other BC	4,231	$484	$538	$124[4]	
BC	**46,593**	**$5,568**	**$6,351**	**$8,722**	**$1,261**

Source: author's calculations and BC Stats 2014

[3] Total of indirect and induced economic (gross) output for Metro Vancouver

[4] Total of indirect and induced economic (gross) output for other B.C.

Table C-3: Summary of Economic Impact Results for Off-Terminal Activities, 2024-2053

	Employment (FTE Jobs)	Labour Income ($millions)	GDP ($millions)	Economic Output ($millions)	Tax Revenue ($millions)
Direct					
Metro Vancouver	172,426	$10,286	$16,239	-	
Other BC	29,194	$1,742	$2,749	-	
BC	***201,620***	***$12,028***	***$18,988***	***$36,997***	***$3,021***
Direct Supply (indirect)					
Metro Vancouver	30,060	$1,659	$2,661	$6,144	
Other BC	29,085	$1,625	$2,662	$5,992	
BC	***59,145***	***$3,284***	***$5,323***	***$12,136***	***$1,017***
Indirect Supply (indirect)					
Metro Vancouver	17,850	$921	$1,485	$3,132	
Other BC	16,606	$860	$1,394	$4,950	
BC	***34,456***	***$1,781***	***$2,879***	***$8,082***	***$455***
Total Indirect					
Metro Vancouver	47,760	$2,580	$4,146	$9,276	
Other BC	45,841	$2,485	$4,056	$10,942	
BC	**93,601**	**$5,065**	**$8,202**	**$20,218**	**$1,472**
Induced					
Metro Vancouver	16,110	$900	$1,572	$2,526	
Other BC	15,010	$842	$1,470	$2,352	
BC	**31,120**	**$1,742**	**$3,042**	**$4,878**	**$400**
Total					
Metro Vancouver	236,446	$13,766	$21,957	$11,802[5]	
Other BC	88,895	$5,069	$8,275	$13,294[6]	
BC	**326,341**	**$18,835**	**$30,232**	**$62,093**	**$4,894[7]**

Source: author's calculations and BC Stats 2014

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[5] Total of indirect and induced economic (gross) output for Metro Vancouver

[6] Total of indirect and induced economic (gross) output for other B.C.

[7] Column and row results do not sum due to decimal rounding.

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