2.0 PROJECT DESCRIPTION

The following section provides a description of the Project, including construction and temporary works necessary for the Project to proceed. Prior to describing the various Project components, this section begins with an overview of design standards and geotechnical considerations that formed the basis of the Deltaport Third Berth design. These sections are included to provide background information on design criteria and set the stage for the Project component descriptions.

2.1 DESIGN STANDARDS

The Project design and construction will meet the following Codes and Regulations, as applicable. The following table outlines the Canadian Codes that are applicable to the Project. Engineers licensed to practice in British Columbia will design the facility.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBCC 1995</td>
<td>National Building Code of Canada</td>
</tr>
<tr>
<td>CSA 2004</td>
<td>Canadian Standards Association</td>
</tr>
<tr>
<td>IESNA 1999</td>
<td>Illuminating Engineering Society of North America</td>
</tr>
<tr>
<td>CEC 2002</td>
<td>Canadian Electrical Code</td>
</tr>
<tr>
<td>CPC 1995</td>
<td>Canadian Plumbing Code</td>
</tr>
<tr>
<td>BCPC 1998</td>
<td>BC Plumbing Code</td>
</tr>
<tr>
<td>ASHRAE 2004</td>
<td>ASHRAE Standards</td>
</tr>
<tr>
<td>CLC 2002</td>
<td>Canada Labour Code – Canada Occupational Safety and Health Regulations</td>
</tr>
<tr>
<td>BCFC 1998</td>
<td>BC Fire Code</td>
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<tr>
<td>NFC 1995</td>
<td>National Fire Code of Canada</td>
</tr>
<tr>
<td>CSA CAN3-S6 2000</td>
<td>Design of Highway Bridges</td>
</tr>
<tr>
<td>AREMA 2004</td>
<td>American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering</td>
</tr>
<tr>
<td>ASTM 2004</td>
<td>American Association of Testing of Materials (ASTM)</td>
</tr>
</tbody>
</table>
2.2 SITE GEOLOGY, SEISMICITY AND GEOTECHNICAL CONSIDERATIONS

The Project will be designed in compliance with the current version of the National Building Code (1995 NBCC), which requires that new structures be designed to resist a 1:475 year seismic event without collapse in order to minimize risk of loss of life.

Table 2.2 summarises the ground motion parameters associated with the 1:475 year seismic event. These values were derived from the seismic hazard models and seismogenic zones used in the current 1995 NBCC.

<table>
<thead>
<tr>
<th>Table 2.2 1:475 Year Seismic Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return Period</td>
</tr>
<tr>
<td>Probability of Exceedence per Annum</td>
</tr>
<tr>
<td>Probability of Exceedence in 50 Years</td>
</tr>
<tr>
<td>Peak Horizontal Ground Acceleration (g)</td>
</tr>
<tr>
<td>Peak Horizontal Ground Velocity (m/s)</td>
</tr>
</tbody>
</table>

The site geology and seismic criteria influence the geotechnical and structural design of the Project. The site geology throughout the general Deltaport area consists of deltaic deposits comprising of layers of silts and sands. The layers generally slope toward the southeast.

Geotechnical evaluations completed to date are based on available test hole data that was gathered for the original Deltaport development. Based on this information, a thick silt layer appears to be present at the north end of the existing container terminal in the area of the proposed berth extension. This layer that will likely undergo deformation under a major earthquake event; possibly as deep as elevation –40 m (chart datum)\(^1\) at the south end of the berth extension. The thickness of this silt layer appears to decrease towards the north end of the berth extension to about elevation –30m. More detailed geotechnical site investigation and evaluation is underway and will form part of the final engineering design.

\(^1\) All elevations presented in this report are presented relative to chart datum.
2.3 PROJECT COMPONENTS

The attached Deltaport Third Berth Terminal and Marine Plan (Figure 2.1) shows the layout of the Project and the associated dredged shipping channel and turning basin. The required rail and road components associated with the Project are shown on Figure 2.2.

The main on-site project components include:

- a wharf to accommodate the third berth;
- creation of land for a container storage yard;
- tug moorage and safety boat launch;
- ship access channel; and
- terminal services and infrastructure.

The main off-site project components include:

- additional rail track; and
- road improvement

These components are described in more detail in the following sections.
Figure 2.1 - Terminal and Marine Plan
NOTE:
All rail improvements will occur within existing BCR Right-Of-Way.

Figure 2.2 - Road and Rail Network
2.3.1 Wharf for the Third Berth

The following operational criteria have been established for the wharf:

- wharf deck length of 427 metres (1400 feet);
- wharf deck elevation of +8.0 metres elevation;
- water depth along the berth will be –15.8 metres elevation;
- a berm located behind the wharf structure with a top elevation of +8 metres; and,
- a 15 m wide road access corridor providing access to the tug berth.

The operational criteria will allow Deltaport Third Berth to handle a range of vessels including the largest 10,000 TEUs ships currently being considered for the Trans-Pacific container trade.

Geotechnical design considerations for the proposed wharf structures have been compiled from information available from previous projects completed at Roberts Bank and are presented below.

- The loose silt and sand deposits that extend to elevation -40m at the south end of the extension and elevation -30m at the north end, are expected to liquefy during the 1:475 year seismic event.
- In-situ densification of the silt materials will not be sufficient to prevent liquefaction. The silt materials will need to be replaced with clean sand or gravel fills.
- The replacement fills will require densification to prevent liquefaction under the 1:475 year seismic event.

The required depths and extent of the soil improvements (dredging, replacement and densification of replaced material) are based on geotechnical information, including adjacent boreholes, available as of July 2004, and the conceptual level of engineering carried to date. An additional geotechnical investigation program is underway and the soil information collected will be used to refine soil improvements and foundation requirements as part of final engineering design.
The conceptual wharf design incorporates concrete caissons as the main support structure. A pile and deck wharf design was also considered, however the caisson design was selected as the preferred alternative for a variety of engineering and environmental reasons (see Section 3.3 Project Alternative and Site Selection for more discussion on the pile and deck option).

The proposed caisson wharf components include:

- densified support fill, mattress rock, berm fill and toe protection rock;
- 15.5 m wide reinforced concrete caisson structures;
- reinforced concrete crane beams and crane rails;
- energy absorbing fenders on the berth face for vessel berthing;
- mooring bollards and quick release hooks, safety ladders and bullrail along the berth face; and
- electrical, water supply and drainage services.

Based on the 1:475 year seismic design criteria and the available geotechnical information, 15.5 m wide caissons (wall to wall) with 18 m wide foundation slabs will be required. A cross section through the caisson wharf structure is shown in Figure 2.3.

Local and global stability for the 1:475 seismic event will be maintained by improving soils along the wharf to prevent liquefaction and prevent flow of weak soils located in the container yard area behind the caissons.
Figure 2.3 Caisson Cross-Section (A-A' from Figure 2.1)
2.3.2 Container Storage Yard Land Area

The Project includes the construction of approximately 20 hectares (50 acres) of new land area for container operations and storage. This will increase the area of Deltaport from 65 hectares (160 acres) to approximately 85 hectares (210 acres).

The proposed terminal area will include:

- creation of approximately 20 hectares (approx. 50 acres) of new land area;
- soil densification along the perimeter berm and under most new structures; and
- rip-rap and tailings slope protection on the northern shoreline of the container yard.

Geotechnical review determined that specific foundation designs such as concrete raft foundations founded on piles would be adequate to support structures within the container yard area, and an extensive soil replacement program of the silty native soil would not be necessary for the container yard.

2.3.3 Tug Moorage and Safety Boat Access

The tug moorage area currently located at the northeast corner of the existing Deltaport terminal will be relocated to the northern corner of the proposed Third Berth, as shown on Figure 2.1. The tug moorage area will consist of a floating dock, walkway and dredged channel to allow tug access. The tug basin will be dredged to an elevation of –6.5 metres.

The safety boat will be located at the new tug moorage facility.

2.3.4 Ship Access Channel

The existing ship access channel will be extended approximately 350 m, as shown on Figure 2.1 to an elevation of approximately –16 metres to provide access and adequate draft for container ships.
2.3.5 Terminal Infrastructure

The terminal infrastructure is designed to support terminal operations such as loading and unloading of container ships, container storage, and container transfers to and from rail and road transport. The container ships are loaded and unloaded by rail mounted electric powered ship-to-shore gantry cranes at the berth face. From there, the containers are moved by tractor-trailers to the container storage yard and stacked by rubber tire gantries (RTG). The containers will be stacked in the storage yard and then loaded onto trucks for road transport or, onto yard-based tractor trailers, which will move the containers to the existing intermodal yard for rail transport. Rail mounted gantries (RMG) are used in the intermodal yard to load the containers onto the rail cars.

This terminal equipment and the terminal operations described above will be supported by the following terminal components on the proposed new land and wharf for the Project:

- paved container yard area;
- 24 reefer towers;
- truck out-gate;
- buildings, including:
  - a truck out-gate building,
  - a truck parking area and shed,
  - a substation building,
  - relocation of the existing International Longshore and Warehouse Union (ILWU) lunchroom and ILWU parking lot,
- highmast lighting towers;
- electrical power and communication systems;
- civil site services (storm sewer, sanitary sewer, water distribution and fuelling facilities);
- parking;
- fencing and security systems;
- terminal roads; and
- rails for ship-to-shore gantry cranes.
The proposed terminal components are described in more detail below. A conceptual layout plan of the proposed expansion is shown on Figures 2.4 and 2.5.

The service life for the upland infrastructures will be 50 years with the exception of pavement structures that will have a service life of 20 years.
Paved Container Yard
The container yard is approximately 400m by 270m in dimension. Containers will be stacked in an east-west direction consistent with the existing storage layout. They will be handled with rubber tire gantry (RTG) equipment operating perpendicular to the wharf.

The container yard area will employ a heavy-duty asphalt pavement structure, capable of handling container-handling equipment and fully loaded containers. Different pavement structures will be used throughout the container yard depending on the loading conditions on the site.

The proposed RTG runways will consist of reinforced concrete-grade beams supported on cement stabilized base (CSB) or equivalent base material.

Reefer Towers
Reefer towers supply power for refrigerated container storage in the container yard. The reefer towers and storage, located along the north end of the site, are shown on Figure 2.5. The reefer towers will be designed to accommodate stacked containers with stairs and platforms to provide access to each container. The height of the towers are approximately 17 metres (55 feet) and similar to the existing towers in the terminal. Reefer power outlets will be located on the towers to provide power for each container. A central monitoring system will be provided to monitor reefer unit operation continuously for each individual container connected to terminal power.

Truck out-gate
The eight-lane out-gate will be provided with an overhead bridge structure for mounting of signage, cameras and traffic lights. Each of the eight lanes will be provided with communication and proxy card scanner equipment mounted on a concrete pedestal at a convenient height for the truck drivers. Each lane will also have a security gate arm. Truck scales are not anticipated at these gates.

Buildings
The terminal development will include the following building structures as shown on Figure 2.4 and Figure 2.5:

- truck out-gate office building with an estimated area of 384 m²;
• ILWU lunchroom building with an estimated area of 257 m².
• small shed with an estimated area of 41 m² (not shown on Figure); and
• an electrical substation building with an estimated area of 290 m².

Foundation details associated with these buildings are described in Section 2.7 Construction Phase.

Highmast Lighting Towers
The lighting requirement in the container yard is 50 lux for average luminance and 30 lux minimum. Lighting on the site will be provided by luminaries on galvanized steel poles (high masts). The location of the existing and the fourteen proposed high mast lights is shown on Figure 2.5. Lighting for the Project will meet the Canada Labour Code requirements for worker safety, and will be designed to minimize environmental and socio-community impact. Detailed design has yet to be determined, however further discussion on lighting and lighting impacts is provided in Chapter 16 Lighting.

The site lighting will be provided by high mast towers with high-pressure sodium luminaries. These non-perimeter masts will comprise 16 x 1,000 watt luminaries at an elevation of 35 m above grade. The high mast lights will be designed and located to provide complete coverage over the full site. Smaller 10 m masts with 3 x 400 watt lamps will be included as needed for parking. Roadway lighting will be provided by 10 m poles with a 400 watt lamp spaced at regular intervals. High mast lighting will use luminaries with cut-off characteristics such that light pollution on to the water and beyond the property line is minimized.

An overall site lighting management system will provide time of day and ambient sensitive multi-level high mast light control. This system will allow the site lighting to be controlled in a multi-stage level from a central location.

Electrical Power and Communications Systems
The existing terminals at Roberts Bank are serviced by an overhead 64 kV powerline that runs from the BC Hydro Substation, located near the north end of the causeway, along the causeway to Deltaport and Westshore Terminals. The overhead line terminates at a transformer that steps the voltage down to a distribution voltage of 4.16 kV. The secondary transformer is connected to
a 5 kV switchgear line-up that has equipped spaces available for use and capacity for the additional load. No power line improvements are required for the Project.

Communication services are required to all building facilities. Additional services will be located around the site to suit the terminal operations requirements.

Additional power and communications will be provided to service the out-gate complex, ship-to-shore gantry cranes, reefer towers, high mast lighting and other miscellaneous operational areas. A new sub-station building will be installed to the northeast of the proposed ILWU parking lot.

Power to the ship-to-shore gantry cranes will be delivered at 4.16 kV via cables installed in underground concrete encased PVC ducts to cable pits. The ship-to-shore gantry cranes will be specified to operate at 4.16 kV.

Power to the reefer towers will be delivered at 4.16 kV via cables installed in underground concrete encased PVC ducts to local reefer substation units.

A unit sub-station with two 4160-600/347 volt transformers will provide power for yard lighting, indoor lighting, offices, buildings and general services. The unit sub-station will be located in the new sub-station building and power will be distributed at the 600/347 volt level via cables installed in underground PVC ducts encased in concrete.

Fibre-optic cabling will be provided between the gate facilities and the main office. This will allow voice communications and data to be transferred between the two locations.

A radio based telemetry system, similar to the system currently in use, will be set up between the truck gate facility and the main office to allow data to be transferred between the two locations.

**Civil Site Services**

There will be limited construction of new site services for the Project, as many of the existing Deltaport site services are adequate to meet the Project needs with appropriate tie-ins to the new Project areas. Site services include storm and sanitary sewers, and water distribution systems.
**Storm Sewers**

A storm drainage system is required to collect and treat surface storm runoff before discharge into the ocean. Some of the proposed storm sewers in the proposed site will be tied-in to the existing system. Where tie-ins are expected, the area will require filling, regrading and repaving. To minimize operational disturbance, no site service improvement work will be performed under the rail tracks. A conceptual sketch that shows the proposed site services for the Project is shown on Figure 2.6.

The storm drainage system will consist of a combination of catch basins, slot drains and open-cover manholes, located in areas to avoid equipment operating areas and runways. All drainage structures will be designed to withstand loads from the container operating equipment. The container yard will be graded in the direction parallel to the RTG runways and will have general drainage grades of 1% or less. Drainage systems will be designed to accommodate the rainfall flows generated from a 1 in 10 year rainstorm.

The storm water will pass through an oil interceptor and sedimentation tank prior to discharge into the ocean. The eight existing storm outfalls, located along the northern perimeter of Deltaport, will be decommissioned and replaced by five new storm outfalls as shown on Figure 2.6. In addition the new storm outfalls will be fitted with shut-off valves to terminate flow from the Project should a sizeable spill occur.
Sanitary Sewers
Sanitary sewers are required to collect domestic and industrial wastewater generated in building facilities and wash down areas.

The increase in sewage output generated by the Project is expected to be low, and will likely fall within the current operating outfall capacity of the existing Deltaport sanitary sewage treatment plant.

The sanitary sewers for the existing ILWU lunchroom will be extended to serve the relocated ILWU lunchroom. The sewer system will be driven by gravity to the sewage treatment plant. Sanitary sewers for the truck out-gate complex and small shed will be connected to the existing sewer pipe that goes into the pump station. The pipes will be connected by a manhole prior to entering the pump station to avoid pump station down time. The sewage will exit from the existing forcemain to the treatment plant.

There are no provisions for sanitary services to be extended to the Project wharf as this area will be serviced by facilities located in the container yard buildings.

Water Distribution System
The existing water supply system to Deltaport is governed by a servicing agreement between Delta and VPA which provides a peak flow of 98.5 litres/second. The supply system is fed by connections to the Corporation of Delta supply feeder, at the water meter located adjacent to the Deltaport west gatehouse along the Westshore Terminal access road, located on the west side of the intermodal yard. This water distribution system is used to provide the necessary domestic and fire protection services. The Corporation of Delta, under a separate servicing agreement, supplies water to the coal terminal operated by Westshore Terminals Ltd., adjacent to the west gatehouse along the Westshore Terminal access road.

The proposed water distribution system servicing the Project area will be tied-in to the existing watermain. A 250 mm diameter under-crossing connection between the existing 300 mm diameter supply main at the Deltaport Third Berth distribution network will be provided. Water services will be provided to the major buildings, fire hydrants, wash down and refer tower areas. The water system will satisfy 200 L/s fire flow demand at all hydrants for fire protection for new
buildings and container storage. The duration of fire flow will be 2.5 hours in accordance with Fire Underwriters Survey Guidelines. In summary, the supply capacity from the existing Corporation of Delta water mains to the site will be sufficient to meet the combined water supply needs of the existing container terminal, the Third Berth Project, and Westshore Terminal under normal operating conditions. The proposed fire hydrants are installed next to high mast lights whenever possible and adequately spaced to provide sufficient ground coverage for fire protection. No railway lines cross water mains for this project.

**Effluent and Emission Control Technology**

Effluent from the on-site facilities for Deltaport Third Berth includes stormwater and sanitary sewer effluent, which has been discussed above. In summary, the stormwater will pass through an oil interceptor and sedimentation tank prior to discharge into the ocean. All domestic and industrial wastewater generated in building facilities and wash down areas will be collected through a sanitary sewer system. The increase in sewage output generated by the Project is expected to be low, and will likely fall within the current operating outfall capacity of the existing Deltaport sanitary sewage treatment plant. Sanitary sewers are required to collect domestic and industrial wastewater generated in building facilities and wash down areas. There are no provisions for sanitary services to be extended to the Project wharf as this area will be serviced by facilities located in the container yard buildings.

Emissions from the on-site facilities for Deltaport Third Berth would include venting emissions (heating/cooling emissions) from the truck out-gate building, substation building, and the relocated existing International Longshore and Warehouse Union (ILWU) lunchroom. Emissions from these buildings will be typical of building venting emissions and very low/negligible relative to ship, truck and rail emissions discussed in Chapter 13.0 Air Quality.

The on-site ship-to-shore gantry cranes are electric powered and therefore do not produce any air emissions. Other emissions related to the Deltaport Third Berth Project are associated with project operations (not on-site facilities). These include:

- terminal operation equipment, such as shuttle carriers and fork lifts;
- container trucks;
• container trains; and,
• container vessels.

Emission control technology related project operation emissions is described in Chapter 13.0 Air Quality, specifically in Section 13.5 Recommended Mitigation Measures – General and Section 13.6 Recommended Mitigation/Initiatives for Deltaport Third Berth Project. Examples of emission control technology for project operation include:

• using ultra-low sulphur diesel for on-site equipment, where appropriate
• trial operation of an electric hybrid rubber tire gantry crane,
• using fuel additives, catalysts and oxidizers for lower emissions on on-site equipment, where appropriate;
• conducting a feasibility study for ships to use shore based power when they are docked at the wharf;
• shut off of container truck engines while trucks wait in queue during times when the Deltaport Terminal gates are closed; and,
• continue working with the railways to reduce emissions due to rail operations (such as evaluating the feasibility of using hybrid switch locomotives for switching service on the Roberts Bank causeway).

**Fuelling Facilities**

The existing fuel facility at Deltaport, located east of the maintenance and repair building, consists of above-grade concrete tanks for diesel, propane and gasoline products. For safety reasons, the tanks are located outside of all major traffic areas. The existing fuelling facility is expected to have adequate capacity to service the Project and no additional fuel supply or fuel storage facilities are required.

**Parking**

The existing ILWU parking lot will be relocated from east to north of the existing maintenance building (Figure 2.5). A new parking lot for trucks will be constructed on the east end of the site expansion. A small staff parking lot will also be provided at the truck out-gate complex.
Fencing & Security

New fencing will be installed as shown on the reference drawing Figure 2.4. Fencing will consist of a 1.8 m high chain link fence topped with three strands of barbed wire. Road and pedestrian fence gates will be manually operated.

The Project will be designed and operated to meet the latest security standards in the International Ship and Port-facility Security (ISPS) Code. For all its container terminals, the VPA is required to meet the ISPS Code that come into effect on July 1, 2004.

Terminal Roads

Road access to the Project is from Deltaport Way along the 4.1 km causeway shown on Figure 2.2. No new road infrastructure along the causeway will be required to support the Project.

Worker vehicles will access the terminal through the existing Deltaport vehicle access (Figure 2.5). The existing Deltaport access road will terminate at the maintenance and repair building, allowing access to the terminal facilities and the ILWU parking lot only. The remainder of the existing road will be decommissioned to accommodate an equipment storage area. Staff parking will be available beside the main Deltaport administration building, while ILWU parking will be located north of the maintenance and repair building. A new road will be constructed on the northern perimeter of the new container yard area to provide access to the relocated tug moorage and boat launch facilities.

Container trucks will access the new container yard area through the truck gate located at the north end of the container yard. Roads will also be constructed within the storage yard area to allow truck loading/unloading operations (see Figure 2.5).

Diesel powered tractor trailers load the containers from the berth to the container yard and the intermodral yard for rail transport. The tractor trailers will travel south along the berth perimeter road and then west into the container yard. Tractor trailers destined for the intermodral yard will travel to the south end of the berth and then head west to the existing intermodral yard along the perimeter road adjacent to Westshore Terminals. Once the containers arrive at the intermodral yard, electrified rail mounted gantries (RMGs) are used to load the containers onto the rail cars.
Rails for Ship-to-Ship Gantry Cranes
The existing crane rails parallel to the ship berth will be extended approximately 420 metres to accommodate electric powered ship-to-shore gantry cranes. This will allow the gantry cranes to travel along the length of the ship to load and unload containers.

2.4 Off-Site Project Components (Transportation Facilities)

The main off-site project components include:

- Rail infrastructure; and
- Road infrastructure.

2.4.1 Rail Components

In 2003, approximately 57% of all import and export containers were handled by rail. This represents an average of six container trains per day (three trains in and three trains out) that currently arrive and depart at Deltaport. In addition, twelve coal trains arrive and depart daily from the Westshore Terminals coal facility.

When the project reaches its capacity by the end of 2011/early 2012, rail container traffic is forecasted to increase to 65% of all import and export containers at Roberts Bank, which will increase container trains by three trains per day, resulting in a total of nine container trains per day (average of four and a half trains in and out a day – meaning on some days there will five trains in and out and other days there will be four trains in and out). Total Roberts Bank rail traffic, including coal trains, will increase from the current 18 trains to a total of 21 trains. These train numbers are summarised below in Table 2.4.

Table 2.4 Current (2003) and Forecasted (2012) Train Traffic for Roberts Bank

<table>
<thead>
<tr>
<th>Facility</th>
<th>2003 Conditions</th>
<th>Forecasted 2012 Conditions¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Trains per day</td>
<td>Total Trains per day</td>
</tr>
<tr>
<td>Deltaport (container trains)</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Westshore (coal trains)</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>21</td>
</tr>
</tbody>
</table>

Note 1: Assumes Deltaport Third Berth is fully operational.
Preliminary rail analysis indicates that there will be a requirement for approximately 23,000 feet of additional rail track for the Project. This rail track will be provided by adding support track on the causeway and extending the arrival/departure tracks at the Gulf Siding. All of the rail improvements will be constructed within BC Rail’s property on the Roberts Bank causeway and within their existing Gulf Siding right-of-way. The additional track requirements are shown on Figure 2.2.

The additional support tracks on the causeway will consist of a 7,000 ft track and 6,000 ft track.

The two existing arrival/departure tracks at the Gulf Siding are 10,000 feet each in length and are located south of Deltaport Way, between 41B Street and 57B Street in Delta. Both of these tracks would be extended by 5,000 feet east of 57B Street to 64th Street, Delta, as shown in Figure 2.2. The rail extensions at the Gulf Siding will require closure of the road-rail grade crossing at 57B Street. No rail changes are required at the 41B Street grade crossing and this crossing will remain open to vehicular traffic.

The 57B Street grade crossing south of Deltaport Way is proposed to be closed to accommodate longer container trains using the extended arrival/departure tracks at the Gulf Siding. A detailed description of rail operations that outlines the reasons for the grade crossing closure is provided in Section 2.9.3 Rail Operations.

2.4.2 Road Components

Road access to the Roberts Bank Port facility is via Highway 99 and Highway 17, both of which are designated provincial highways. Access from Highway 17 is via Deltaport Way, which was constructed in 1995 for the original development of Deltaport. Deltaport Way continues west onto the 4.1 km causeway leading to the Roberts Bank Port facility (Deltaport and Westshore).

In 2003, approximately 43% of all import and export containers were handled by truck. This generated approximately 1800 truck trips per day (900 in and 900 out). By 2012, the percentage of truck traffic is forecasted to decrease to 35% reflecting a further shift to rail being the predominant transportation mode for containers. Overall, truck traffic will increase to approximately 2400 trips per day by 2012.
No new road infrastructure along Deltaport Way will be required to support the increased traffic predicted as a result of the Project.

To address the proposed closure of the south leg of the road-rail grade crossing at 57B Street, vehicles using 57B Street for north south connectivity will be required to detour via Arthur Drive. This would add approximately 1.1 km to a trip between the intersections of 34B Avenue/57B Street and 28 Avenue/56 Street. This extra trip length would add approximately 1 minute to the travel time.

Farm equipment that use 57B Street to travel north to 34B Avenue and east destinations to east of Highway 17 will be provided with another route. Farm equipment will be allowed to use a new rail service road that will be located within the railway right of way, south of the proposed Gulf Yard extensions, between 57B Street and 64th Street. This rail service road would consist of a gravel road approximately 5 metres wide and would be limited to farm equipment access only. Farm equipment would then be able to travel north south along 64th Street (farm equipment currently use 64th Street for north south access).

In addition to the above components, the Ministry of Transportation (MoT) has agreed to implement a number of improvements along the Highway 17 system to mitigate the impact of additional container truck traffic. These improvements are described in more detail in Section 2.9.4 Road Operations.

2.5 LAND AND WATER LOT REQUIREMENTS

The Project requires a combination of land and water areas that are: (1) owned by the crown in right of Canada care of Vancouver Port Corporation; (2) under the administration, control and benefit of Her Majesty the Queen in right of Canada (Lot 851); and (3) to be acquired from the British Columbia Transportation Financing Authority (Remainder of Parcel A), all as illustrated on the attached Figure 2.7

Negotiation of the acquisition of the water area from BC Transportation Financing Authority (BCTFA) is in progress, and the planned completion of the acquisition is mid 2005. The existing rights of administration, control and benefit for Lot 851 are sufficient to cover the intended navigational requirements under the project.
## 2.6 Proposed Project Plan and Schedule

The following section outlines the proposed project plan schedule from submission of the EA Application in January 2005 to project operation in June 2008. A more detailed construction schedule is contained in Section 2.7 *Construction Phase*.

### Pre-Construction - Approvals and Permitting Schedule

<table>
<thead>
<tr>
<th>Activity</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Submission of Application</td>
<td>January 2005</td>
</tr>
<tr>
<td>BC EAO screening of Application</td>
<td>February 2005</td>
</tr>
<tr>
<td>EA Application Review (up to 180 days)</td>
<td>February 2005 to July 2005</td>
</tr>
<tr>
<td>Provincial and Federal project approval</td>
<td>July – August 2005 (tentative)</td>
</tr>
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### Construction - Marine Works Schedule

<table>
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<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed marine works engineering design</td>
<td>January 2005 to May 2005</td>
</tr>
<tr>
<td>Marine and dredging work tender process</td>
<td>June 2005 to July 2005</td>
</tr>
<tr>
<td>Award marine and dredging contract</td>
<td>August 2005</td>
</tr>
<tr>
<td>Mobilization of marine works equipment</td>
<td>August 2005 to October 2005</td>
</tr>
<tr>
<td>Dredging, disposal &amp; terminal fill activities</td>
<td>August 2005 to November 2006</td>
</tr>
<tr>
<td>Site pre-load activities</td>
<td>May 2006 to March 2007</td>
</tr>
<tr>
<td>Caisson fabrication, installation and fill behind</td>
<td>February 2006 to January 2007</td>
</tr>
<tr>
<td>Caisson Scour Protection</td>
<td>April 2007 to June 2007</td>
</tr>
</tbody>
</table>

### Construction - Terminal Infrastructure Schedule

<table>
<thead>
<tr>
<th>Activity</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed terminal infrastructure design and tender</td>
<td>February 2006 to October 2006</td>
</tr>
<tr>
<td>Mobilization and fabrication of infrastructure</td>
<td>October 2006 to December 2006</td>
</tr>
<tr>
<td>Terminal Infrastructure Construction</td>
<td>January 2007 to February 2008</td>
</tr>
</tbody>
</table>

### Construction - Road and Rail Infrastructure Schedule

<table>
<thead>
<tr>
<th>Activity</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Improvements</td>
<td>2005</td>
</tr>
<tr>
<td>Rail and Service Road Construction</td>
<td>October 2007 to December 2007</td>
</tr>
</tbody>
</table>
Operations

Deltaport Third Berth operational June 2008

Decommissioning

This is a permanent structure, therefore, decommissioning of the Project is not anticipated. Maintenance and replacement schedule of major equipment is discussed in general in Section 2.9 Operations Phase.

2.7 CONSTRUCTION PHASE

The estimated total project construction duration from award of contract through to commissioning of major equipment is 32 months. The main construction activities include:

- dredging, landfill and slope protection;
- soil densification;
- site pre-loading;
- caisson fabrication and placement; and
- terminal area work.

These activities are described in more detail in the following sections. The proposed construction schedule is shown in Figure 2.8.
### Vancouver Port Authority
#### Deltaport 3rd Berth Project

<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
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<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ENVIRONMENTAL REVIEW</td>
<td>Tue 2/1/05</td>
<td>Mon 8/1/05</td>
</tr>
<tr>
<td>2</td>
<td>Submission of EA</td>
<td>Tue 2/1/05</td>
<td>Tue 2/1/05</td>
</tr>
<tr>
<td>3</td>
<td>Review Period (up to 180 days)</td>
<td>Wed 2/2/05</td>
<td>Sat 7/30/05</td>
</tr>
<tr>
<td>4</td>
<td>BCEAO Approval (tentative)</td>
<td>Mon 8/1/05</td>
<td>Mon 8/1/05</td>
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<tr>
<td>5</td>
<td>MARINE CONSTRUCTION</td>
<td>Mon 8/1/05</td>
<td>Wed 6/27/07</td>
</tr>
<tr>
<td>6</td>
<td>Award Marine and Dredging Contract</td>
<td>Mon 8/1/05</td>
<td>Mon 8/1/05</td>
</tr>
<tr>
<td>7</td>
<td>Mobilization</td>
<td>Mon 8/1/05</td>
<td>Sat 10/1/05</td>
</tr>
<tr>
<td>8</td>
<td>Clamshell Dredging - Caisson and Berth Area</td>
<td>Mon 8/15/05</td>
<td>Mon 10/3/05</td>
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<tr>
<td>9</td>
<td>C/S Dredging Under Wharf + Tug Basin</td>
<td>Mon 10/3/05</td>
<td>Fri 11/25/05</td>
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<tr>
<td>10</td>
<td>C/S Dredging to disposal basin+terminal</td>
<td>Wed 11/30/05</td>
<td>Tue 12/20/05</td>
</tr>
<tr>
<td>11</td>
<td>Gravel Dyes for Dredge Material Control</td>
<td>Wed 12/21/05</td>
<td>Tue 2/28/06</td>
</tr>
<tr>
<td>12</td>
<td>Slope tailings and riprap</td>
<td>Fri 1/13/06</td>
<td>Fri 10/6/06</td>
</tr>
<tr>
<td>13</td>
<td>Seaspan Float Relocation</td>
<td>Fri 2/17/06</td>
<td>Tue 2/28/06</td>
</tr>
<tr>
<td>14</td>
<td>C/S Dredging to Site Fill</td>
<td>Sat 4/1/06</td>
<td>Wed 7/26/06</td>
</tr>
<tr>
<td>15</td>
<td>Habitat Compensation Area</td>
<td>Wed 8/16/06</td>
<td>Thu 11/16/06</td>
</tr>
<tr>
<td>16</td>
<td>Site Pre-Load and re-grading</td>
<td>Tue 5/30/06</td>
<td>Fri 3/16/07</td>
</tr>
<tr>
<td>17</td>
<td>Replacement Fill under Caissons - Sand with Titan</td>
<td>Sat 11/26/05</td>
<td>Sat 1/7/06</td>
</tr>
<tr>
<td>18</td>
<td>Caisson Base and Densification</td>
<td>Mon 1/9/06</td>
<td>Wed 3/22/06</td>
</tr>
<tr>
<td>19</td>
<td>Caisson Production &amp; Placement</td>
<td>Thu 2/9/06</td>
<td>Wed 10/11/06</td>
</tr>
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<td>20</td>
<td>Caisson Concrete and Topsides Work</td>
<td>Sat 8/26/06</td>
<td>Wed 12/20/06</td>
</tr>
<tr>
<td>21</td>
<td>Sand,Filter,Rock fill behind Caisson + densification</td>
<td>Fri 10/6/06</td>
<td>Fri 1/12/07</td>
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<tr>
<td>22</td>
<td>Caisson Scour Protection</td>
<td>Mon 4/2/07</td>
<td>Wed 6/27/07</td>
</tr>
<tr>
<td>23</td>
<td>Marine Hardware</td>
<td>Thu 12/21/06</td>
<td>Wed 1/24/07</td>
</tr>
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<td>24</td>
<td>CONTAINER CRANES, UPLAND CIVIL WORKS &amp; INFRASTRUCTURE</td>
<td>Wed 2/15/06</td>
<td>Mon 2/18/08</td>
</tr>
<tr>
<td>25</td>
<td>Terminal Design</td>
<td>Wed 2/15/06</td>
<td>Sat 7/15/06</td>
</tr>
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<td>26</td>
<td>Terminal Tender Period</td>
<td>Tue 7/18/06</td>
<td>Sat 9/30/06</td>
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<td>27</td>
<td>Award Terminal Contract</td>
<td>Fri 10/27/06</td>
<td>Fri 10/27/06</td>
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<tr>
<td>28</td>
<td>Mobilization</td>
<td>Sat 10/28/06</td>
<td>Fri 12/1/06</td>
</tr>
<tr>
<td>29</td>
<td>Civil Works, Container &amp; Intermodal Yard Infrastructure, Commission</td>
<td>Sat 1/6/07</td>
<td>Mon 2/18/08</td>
</tr>
<tr>
<td>30</td>
<td>Install &amp; Commission Container Cranes</td>
<td>Tue 5/1/07</td>
<td>Sat 2/16/08</td>
</tr>
</tbody>
</table>

**Figure 2.8 - Proposed Deltaport Third Berth Schedule**
2.7.1 Dredging, Landfill and Slope Protection

Terminal land will be created through dredging and landfill operations. Land filling will be completed by transporting dredge material by pipeline from designated dredge areas. The dredge likely to be used will be a cutter-suction type, similar to equipment used during previous dredging projects at Roberts Bank. The seabed area to be reclaimed will be surrounded by a system of containment dykes. Dredge material will be pumped into the contained area where the solids settle out. Decant water and suspended silt material will be totally contained during the landfill process and will be re-pumped via submerged pipeline to an approved deep-water site. The dykes surrounding the fill area will be built above high-tide, thereby fully containing all materials and preventing spill-over into surrounding foreshore areas. Dredging operations will run 24 hours per day within the allowable dredging windows established by the DFO, and based on the impact of fish presence, composition and abundance in the area.

The dredging program will require further engineering assessment and the estimated volumes of dredge, landfill, and slope protection work given below should be considered preliminary. The preliminary dredge areas are also shown on Figure 2.9.

Dredging for Reclamation: 2,000,000 m³
Approximately 2 million m³ of seabed material will be dredged from the existing turning basin area to produce fill for the terminal. Approximately 50% of this material is estimated to be unsuitable for fill (wastesilt) and will be re-pumped from the terminal fill area to deep-water disposal. The total in-place volume of reclaimed material is estimated to be 1 million m³.

Dredging under Caissons and Terminal: 1,220,000 m³
Weak silt under the terminal structures and yard area requires replacement because of the potential for this material to liquefy during an earthquake. The dredgeate will be pumped directly to the deep-water site.

Dredging for Navigation: 250,000 m³
The existing ship channel will be extended and will be dredged to elevation – 16m to provide adequate depth and access into Berth 3 for container ships. This material is presently estimated to be unsuitable for fill and will be pumped to the deep-water site.
**Replacement Fill under Caissons: 1,150,000 m³**

Good quality sand will replace the soft silt material dredged from under the caissons. This sand will likely be imported from Fraser River dredge operations and will be transported to site by dredge ship.

**Dykes, Berms and Slope Protection: 675,000 m³**

Gravel berms will be used to retain sand fill. Gravel and tailings and rip-rap will be used as permanent slope protection. This material will be transported to site by barge and placed with floating clamshell derrick.

Dredging, disposal and terminal fill activities will take place from August 2005 through November 2006. Some in-water work will be scheduled to take place inside fisheries sensitive periods subject to monitoring and mitigation.
2.7.2 Soil Densification

Soil densification will be done along perimeter berms and under most new structures. Soil improvements will include removal of any native clayey material, replacement with clean sand or gravel fill and installation of rock and granular berms. Replacement fill, mattress rock, rock berms and all granular fill will be densified over the full length of the caisson structures, extending approximately 40 m in front of the wharf face and 35 m to 40 m behind the back end of the caisson structure. The estimated extent of silt removal, replacement fills, granular fill and soil densification required for the 15.5 m wide caisson structure are shown on Figure 2.3.

Densification work will be done after caisson bed material has been placed and is scheduled for January 2006 through to March 2006.

2.7.3 Site Pre-loading

Settlement of fill areas is expected to occur during construction due to the weight of the fill material. Site pre-loading will be done to accelerate the settlement process. Preload fill of 2m to 4m above the design ground elevation of +8.5 m is anticipated. Preloading will be staged throughout the site to allow terminal construction activities to proceed. This sand will likely be imported from Fraser River dredge operations and will be transported to site by dredge ship. This activity can start once site fill operations have advanced sufficiently to allow land-based equipment to work at or near final sub-grade elevation. This activity is expected to take place from May 2006 to March 2007.

2.7.4 Caisson Fabrication and Placement

Concrete caissons are large cellular reinforced concrete boxes that together with a contained fill material, will function as a gravity retaining wharf structure. The new caissons will be similar to the existing Deltaport wharf caissons and will be constructed off site in a suitable dry dock or graving dock facility. Caisson fabrication at the Caisson Yard will consist of:

- concrete base slab cast in dry dock;
- slip form caisson walls and float out;
slip form remaining height of walls; and
sequentially tow completed caissons to wharf site.

Following caisson fabrication, the caissons will be installed at the Wharf Site in the following order:

- position and sink each caisson onto prepared base;
- place ballast material inside caisson cells;
- place precast cover slabs over front cells;
- install precast concrete key slabs between caissons;
- place fill material behind caisson to fill up to containment dyke; and
- construct retaining wall structures at end of wharf and place fill material.

This work will take place from February 2006 through January 2007.

2.7.5 Terminal Area Work

The container yard will be situated on pavement located on top of a dense sand fill. The top sand fill surface will be graded and compacted to form a firm sub-grade overlain with asphalt pavement once all below grade site services and foundations have been installed.

The existing northeast corner of Deltaport, will be converted to container yard and will require a rebuilding of the existing surface to accommodate the heavy loads imposed on the pavement structure. Heavy-duty asphalt pavement will be used in the container handling area and standard road asphalt pavement will be used for the tug berth access road. The reinforced concrete-grade beams for RTG runways will be supported on cement stabilized base (CSB) or equivalent base material. Sub-grade preparation will include compacted pit run, sand and gravel. The concrete runway beams will be constructed to prevent rutting of the asphalt surface.

Reefer towers will be supported on concrete raft foundation on steel piles. Foundations supporting the out-gate building will be piled and constructed using raft foundations. Similar to the reefer towers, foundations supporting the out-gate building will be constructed using concrete
raft foundations resting on steel pipe piles driven into soils located below the liquefiable silt layer.

The ILWU lunchroom building, the substation building and the small truckers shed may be founded on raft concrete foundations and approximately 8 m of granular compacted sub-base material. The granular sub-base material for the structures can be installed during the placement of dredged fill material throughout the site.

The eight-lane out-gate bridge structure will be supported by four concrete foundation pedestals complete with steel stairs. High-mast lighting will be supported by reinforced concrete foundations.

Site civil works, services, power, and terminal yard infrastructure work is expected to take place from January 2007 through February 2008.

### 2.7.6 Construction Materials and Equipment (including toxic/hazardous materials)

Materials for slope protection (gravel, tailing and armor rock) and terminal revetments will be transported to site by barge and placed with marine equipment. Sand fill will either be dredged and pumped to fill or transported to site by barge or dredge ship. The imported sand will be determined at a later date.

Granular base material for the terminal yard, road and parking area is assumed to be delivered to site by barge. Asphalt for terminal pavement is assumed to be transported to site by truck. All ready-mix concrete will be transported to site by truck. Materials for terminal infrastructure such as site services, lighting, power, equipment, fencing, gate structures and buildings will be trucked to site.

The concrete caissons will be constructed off-site at a graving dock or similar type marine construction facility. They will floated and towed to site by tug. Marine hardware such as fenders, bollards, ladders, as well as crane rails will be transported to site by truck. Large equipment such as container cranes will arrive by heavy lift ship.

Material deliveries during construction are estimated shown in Table 2.5.
Table 2.5  Truck Deliveries to Site During Construction

<table>
<thead>
<tr>
<th>Material</th>
<th>Deliveries</th>
<th>Estimated Operating Period (days)</th>
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</thead>
<tbody>
<tr>
<td>Asphalt</td>
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<td>60</td>
</tr>
<tr>
<td>Concrete</td>
<td>1,100</td>
<td>100</td>
</tr>
<tr>
<td>Dump/Disposal</td>
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<td>100</td>
</tr>
<tr>
<td>Flatbeds</td>
<td>750</td>
<td>300</td>
</tr>
<tr>
<td>Delivery Vans</td>
<td>1,000</td>
<td>300</td>
</tr>
<tr>
<td>Total</td>
<td>7,650</td>
<td></td>
</tr>
</tbody>
</table>

2.7.7  Construction Traffic

The traffic associated with construction of the Deltaport Third Berth Project is anticipated to be low compared to traffic associated with operating the expanded terminal. Construction activities have been broken into the following four categories:

- Dredging and filling
- Caissons dock construction
- Terminal and infrastructure construction
- Habitat compensation (exclusive of planting)

The Caisson and Terminal infrastructure construction is tentatively scheduled to take place from September 2006 to April 2008. It is during this activity that the peak onsite work force as well as the peak of construction deliveries has been anticipated. It has been estimated that the workforce would be approximately 100 persons per shift on a two shift per day schedule. This would create approximately 100 passenger trips inbound at the start of the first shift, 200 passenger trips (100 inbound and 100 outbound) at the shift change and 100 trips outbound at the conclusion of the second shift.

The delivery of equipment and construction materials is expected to peak in early 2008 with approximately 2200 deliveries per month. These deliveries are anticipated to be made with trucks and would take place throughout the work shift. Using an average of 22 work days per month,
the average number of deliveries has been estimated to be approximately 100 deliveries per day. This would create 100 inbound and 100 outbound truck trips per day.

During the detailed design stage of the Project, a detailed construction traffic management plan will be developed involving input from the Corporation of Delta Engineering Department and MoT.

2.7.8 Waste Disposal (including toxic/hazardous materials)

Dredge material that is unsuitable to be used as site fill (i.e., silts and clay), will be pumped to a designated offshore deep-water disposal site by submerged pipeline. Disposal of this material will be under permit from Environment Canada.

Construction material waste or other miscellaneous waste materials will be removed from site to appropriate disposal sites during and upon completion of construction.

2.8 Off-Site Construction Activities

2.8.1 Rail Construction

All of the rail improvements will be constructed within BC Rail’s property on the Roberts Bank causeway and within their existing right-of-way. An overview of the additional track requirements is shown on Figure 2.2. The rail industry uses imperial descriptions for measurements. For example, track lengths are defined in miles or feet and train lengths are described in feet. Imperial measurements are therefore used throughout this section, however the metric equivalents are provided in brackets.

The two arrival/departure tracks at the Gulf Siding would be extended by 5,000 feet (1.5 km) east of 57B Street to 64th Street, Delta (Figure 2.10 and 2.11). The two additional support tracks (N0 and N5) are required on the causeway, (Figure 2.12). These tracks will be 7,000 ft (2 km) and 6,000 ft (1.8 km) respectively. These tracks will be constructed by BC Rail from October 2007 to December 2007 and will follow standard railway construction methods.
The rail extensions at the Gulf Siding will require the closure of the south leg of the road-rail grade crossing at 57B Street. No additional rail track will be constructed at the 41B Street grade crossing and this will remain open to vehicular traffic.

A new rail service road will be constructed within the railway right of way, south of the proposed Gulf Yard extensions, between 57B Street and 64th Street. This rail service road would consist of a gravel road approximately 5 metres wide and would be limited to farm equipment access only. Farm equipment would then be able to travel north south along 64th Street (farm equipment currently use 64th Street for north south access).
Figure 2.10 - Gulf Yard Rail - Existing and Proposed
EXISTING

DELTAPORT WAY

TYPICAL RAIL CROSS SECTION
(10m EAST of 57B ST.)

PROPOSED

Figure 2.11 - Deltaport Way Cross-Section (A-A' from Figure 2.10)
Due to scale, rail tracks are shown wider than actual size on drawing. All rail tracks fit on the existing causeway. Riprap encroachment will not occur.

Figure 2.12 - Roberts Bank Causeway Rail - Existing and Proposed
2.8.2 Road Improvements

No new road infrastructure along Deltaport Way will be required to support the increased traffic from the Project.

It is proposed that the 57B Street grade crossing south of Deltaport Way be closed. This will accommodate the additional container trains using the extended arrival/departure tracks at the Gulf Siding. A detailed description of rail operations that outlines the reasons for the grade crossing closure is provided in Section 2.9.3 Rail Operations.

In addition, the Ministry of Transportation (MoT) has agreed to implement a number of improvements along the Highway 17 system to mitigate the impact of additional container truck traffic. These improvements are planned for 2005 and are described in more detail in Section 2.9.4 Road Operations.

2.9 OPERATIONS PHASE

2.9.1 Terminal Operations

Deltaport operations consist of the loading and unloading of container ships, container storage, and container transfers to and from rail and road transport. The container ships are loaded and unloaded by electric powered ship-to-shore gantry cranes that are rail mounted at the berth face.

After the containers are unloaded from the ships, the containers are moved by tractor trailers to the container storage yard and stacked by RTG. The tractor trailers and the RTGs are powered by diesel engines. The containers will be stacked to a maximum of five high in the storage yard. After a brief storage period, the containers are loaded onto trucks for road transport or onto yard based tractor trailers, which will move the containers to the existing Deltaport intermodal yard for rail transport. Electrified RMG are used in the intermodal yard to load the containers onto the rail cars.

New equipment for the Project includes three ship-to-shore gantry cranes, 10 to 12 RTGs, one RMG, numerous tractor trailers and other related equipment.
2.9.2 Terminal Maintenance

Wharf Maintenance
Post construction and long-term differential settlements of the new caisson wharf structure relative to the existing caisson structures at Deltaport will be measured and monitored over time. Crane rails may require re-leveling during the operations phase to ensure a smooth transition across the transition joint between old and new caisson structures. The frequency of required re-leveling is not known at this time but will be addressed during the detailed design phase of the Project. Minor wharf maintenance is anticipated through the full life-cycle of the project.

2.9.3 Rail Operations (Rail Traffic)

This section begins by introducing common rail industry terminology that will be used throughout the rail discussion. As mentioned previously, rail measurements are described in imperial measurements (the conventional units used by the rail industry), however, the metric equivalents are provided in brackets.

Track lengths are divided into named subdivisions (or “sub’s”), which are located between named stations. In addition, some subdivisions contain named sidings, which consist of one or two additional lengths of track running parallel to the main track for a short distance to provide a storage or pull-out area for trains. The stations, subdivisions and sidings related to Roberts Bank operations are shown on Figure 2.13.

Existing and proposed rail operations are described in more detail below and are divided into the following sections:

- Mainline Operations;
- Gulf Yard Operations; and
- Roberts Bank Causeway Operations.
Figure 2.13 - Railway To Roberts Bank Port Facility

Notes:
- Scale is approximately 1:225,000
- Data is in UTM NAD83 format.
Existing Mainline Operations
The mainline to Roberts Bank begins at Hydro station in Fort Langley and runs west approximately 27.5 miles (44 km) to Gulf station (Gulf), located near 64th St. in Delta (shown on Figure 2.13). This line is a combination of four different subdivisions (subs), owned by four different railways: Canadian National Railway (CN), Canadian Pacific Railway (CP), Burlington Northern Santa Fe Railway (BNSF) and BC Rail.

Rail Sub’s
CN's Rawlison Sub comprises the first 2.5 miles (4 km) between Hydro and Livingstone; CP's Page Sub comprises the next 7.5 miles (12.1 km) between Livingstone and Pratt. At Pratt, BC Rail's Port Sub begins, running 7 miles (11.3 km) to Mud Bay, where it connects with BNSF’s New Westminster Sub. The two lines run jointly over a single track for approximately three-quarters of a mile (1.2 km), then the Port Sub separates to the west for the last 9.5 miles (15.3 km) to Gulf while BNSF’s line continues on towards Vancouver.

Rail Sidings
There are three sidings on the line between Hydro and Gulf. The first siding is on the CN section at Rawlison (Rawlison siding), just west of the junction at Hydro. This siding is 7,800 ft (2.4 km) long. The main operating feature of this siding is that because of the grade of the siding, westbound loaded coal trains cannot stop in the siding because they cannot get restarted safely.

The next siding is at Pratt (Pratt siding) at the east-end of BCR's portion of the line and just west of the City of Langley. The siding is also 7,800 ft (2.4 km) in length, and is controlled by BCR dispatchers. There are no restrictions on this siding, including no at-grade highway crossings. This siding is the most versatile of the three sidings on the route.

The final siding is at Mud Bay (Mud Bay siding), just east of the joint BNSF/BCR section of track. The siding is 8,100 ft (2.5 km) in length, however it is bisected by multiple grade crossings through its length. As a result, only short trains (< 4,500 ft) can meet in this siding; therefore, the usage of the Mud Bay siding is minimal.

One feature of the line between Livingstone and Gulf stations is that there is a road level rail crossing (grade crossing) virtually every mile (1.6 km) along the route, with the exception of the
sidings at Rawlison and Pratt. The grade crossings are even more closely spaced through the City and Township of Langley.

With the Mud Bay siding limited by grade crossings, and the Rawlison siding restricted for westbound coal trains, the capacity of the rail line between Gulf and Hydro is limited. Pratt siding is the only siding that can be used on a regular basis to meet multiple trains. In addition, there are no sidings capable of allowing two trains greater than 8,000 ft (2.4 km) in length to meet along this section.

**Existing Gulf Yard Operations**

Trains arriving at Roberts Bank are marshalled through the Gulf Siding (Yard) before being delivered to Deltaport or Westshore (see Figure 2.2). BCR controls all rail operations at Gulf and at the Roberts Bank terminal. The Gulf Yard consists of three 10,000 ft tracks (3 km); Gulf North, Gulf South and Gulf Storage. Gulf North is the mainline through the yard; coal trains moving to Westshore generally use this track. The other two tracks are used for arriving and departing container trains, or storing container rail cars as needed.

The yard is bracketed by two grade crossings: the 41B St. grade crossing is located at the west-end of the Gulf tracks, while the 57B St. grade crossing is located at the east-end of the yard (see Figure 2.10). This leaves approximately 10,000 ft (3 km) of track unaffected by grade crossings, which is used by eastbound trains as another siding for meeting westbound trains coming from Hydro.

The general operating procedures for arriving container trains at the Gulf yard are as follows. Trains carrying export containers arriving at Deltaport that are 6,000 ft (1.8 km) or less, generally arrive directly into one of the storage tracks on the causeway (causeway operations are discussed in more detail below). If no track is available, these trains will be held at Gulf until a track opens up. Container trains that are greater than 6,000 ft (1.8 km) in length are brought into one of the Gulf yard tracks. The head 6,000 ft (1.8 km) is separated from the train, leaving the remaining footage at Gulf. The head end then pulls the 6,000 ft (1.8 km) train into one of the storage tracks on the causeway. A switch engine moves the balance of cars left at Gulf into the causeway storage yard at a later time.
Most westbound container trains that currently arrive at Gulf are 6,000 ft (1.8 km) in length or less. CN currently runs one 12,000 ft (3.7 km) train per day into Roberts Bank, where the procedure described above comes into play.

Trains departing from Gulf with import containers are currently handled in a different manner. If the train is 6,000 ft (1.8 km) in length or less, it can depart directly from the storage yard tracks. These trains use whichever track is open at Gulf to leave the terminal when the dispatcher can take them, usually the Gulf North track. Trains that are longer than 6,000 ft (1.8 km) are assembled by doubling together two tracks from the causeway storage yard, usually using the causeway S1 storage track (refer to Figure 2.12). The S1 track on the causeway is used because it is 12,000 ft (3.7 km) in length and can be used without blocking a road crossing on the terminal or 41B St. east of the terminal. The drawback of using this track is that all other rail movements are blocked from entering or leaving the terminal when the 12,000 ft (3.7 km) train is on the S1 storage track.

Once the train is assembled, it can be pulled out to Gulf if it is 10,000 ft (3 km) long or less. If not, it must depart directly from S1 to avoid blocking 41B St. CN currently runs one eastbound 12,000 ft (3.7 km) train each day.

**Existing Roberts Bank (Causeway) Operations**

The rail track on the Roberts Bank causeway consists of two separate yards: the South Yard and the North Yard, shown on Figure 2.12. The South Yard has five tracks, S1 through S5, which range in length from 5,400 to 7,000 ft (1.6 km to 2 km). The North Yard has four tracks, N1 through N4, which are all approximately 7,000 ft (2.1 km) in length.

Container train movements for Deltaport primarily use the South Yard while coal train movements for Westshore use the North Yard. The South Yard is connected to the intermodal yard where the container trains are loaded and unloaded. The intermodal yard consists of four sets of unloading/loading tracks called pad tracks, each set comprised of two parallel tracks. The pad tracks are numbered from 1 to 8 and are configured such that cars from any pad tracks can get to any storage tracks and vice versa. Electrified rail mounted gantries (RMG) are used to load the containers onto the rail cars in the intermodal yard.
As mentioned earlier, BC Rail controls all movements within the Roberts Bank terminal. BC Rail utilizes Omnitrax, a contract switching company, to handle switching movements between Gulf, the South Yard and the pad tracks. Movement of cars from Gulf to the South Yard requires Omnitrax to pull the cars from the west end of the Gulf Yard onto a storage track in the South Yard.

The movement of export railcars left at Gulf to be moved to the South Yard can add up to two additional moves across 41B St. The first of these is the light engine going to Gulf to pick up the cars, and the second is the movement of the cars pulled from Gulf to the South Yard. If timing permits, to minimize the movements between the storage yard and Gulf, a switch engine will push a track of cars to Gulf and then return with a track of cars from Gulf.

Omnitrax also performs switching on the container rail cars that come from the pad tracks. This switching is performed to “block” (arrange) cars correctly for destination before building the outbound train or to remove a “bad order car” (rail car requiring maintenance) that cannot be repaired within the train. Switching is usually done on the east-end of the storage yards; tracks adjacent to S1 are designated to handle bad order cars that need repairs.

Coal trains generally do not utilize the tracks at Gulf except to pass through on their way to the North Yard. Coal trains arrive and depart from the North Yard tracks. Coal trains arriving at the North Yard are held until Westshore requests that they be brought onto the unloading loop track. After a coal train is unloaded, it is returned to the North Yard for departure from Roberts Bank. The trains normally depart within an hour of the time they arrive into North Yard, although on occasion, track work east of Vancouver forces trains to be held until CP can take them at a later time.

**Forecasted Traffic Volumes and Future Operations**

With the 400,000 TEUs increase in container volume that is projected to occur as a result of the Project, VPA retained MainLine Management, Inc. (MLM) to simulate rail traffic to determine what, if any, infrastructure improvements and operating changes will be needed to meet service requirements for the anticipated growth. Rail model simulations of the existing and projected operations were conducted using Rail Traffic Controller (RTC) modelling software. RTC has become the simulation model of choice for many of the North American Class 1 railways for internal simulation activities. The simulations were performed as part of more extensive
simulations that incorporated movements across all rail lines and terminals in the greater Vancouver area.

Existing operations at Roberts Bank were simulated in the model using actual train arrival and departure data from December 2002. This was assumed to represent typical conditions in 2003 (Base Case). At Deltaport, approximately 57% of all import and export containers were handled by rail. This represents an average of six container trains per day (three trains in and three trains out) that currently arrive and depart at Deltaport. In addition, twelve coal trains arrive and depart from Westshore Terminals coal facility. In the Base Case, most container trains were 6,000 ft (1.8 km) in length. The two exceptions were the daily CN eastbound and westbound 12,000 ft (3.7 km) trains. Coal trains were all 7,000 ft (2.1 km) in length.

By 2012, Deltaport is expected to handle 1.3 million TEUs and rail container traffic is forecasted to increase to 65% of all import and export containers at Roberts Bank. These increases in rail traffic would result in an increase of three additional container trains per day, resulting in a total of nine container trains arriving and departing during an average day. This would mean the total train count would increase from 18 trains per day to 21 trains per day.

These train numbers are summarised below in Table 2.6.

**Table 2.6 Current (2003) and Forecasted (2012) Train Traffic for Roberts Bank**

<table>
<thead>
<tr>
<th>Facility</th>
<th>2003 Conditions</th>
<th>Forecasted 2012 Conditions¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Trains per day</td>
<td>Total Trains per day</td>
</tr>
<tr>
<td>Deltaport (container trains)</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Westshore (coal trains)</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>21</td>
</tr>
</tbody>
</table>

Note 1: Assumes Deltaport Third Berth is fully operational.

With the increase in container train traffic to and from Deltaport, it is projected that there would also be an increase in the length of trains travelling to and from the facility. While CN currently runs only one daily 12,000 ft (3.7 km) train to and from Deltaport, CN has stated that with an increase in traffic, it would anticipate this number to increase to as many as two 12,000 ft (3.7 km) trains in each direction. Likewise, CP believes that their train lengths will be increased from 6,000 ft (1.8 km) to between 7,000 and 8,000 ft (2.1 km and 2.4 km), depending on demand.
This growth in train size was accounted for when calculating the number of container trains per day that would be expected at the 1.3 million TEUs level. Coal trains remained at 7,000 ft (2.1 km) in this scenario.

The additional rail traffic to and from Deltaport, and increase in train lengths as a result of the Third Berth Project, has some implications on rail operations and in some instances requires infrastructure improvements to handle the additional rail traffic. The impacts on each of the three rail operations (mainline operations, gulf yard operations and Roberts Bank operations) are reviewed below.

**Forecasted Mainline Operations**

The increased train lengths would make “meets” (east and west train passes) more difficult on the mainline segment between Gulf and Hydro. With an additional daily 12,000 ft (3.7 km) train in each direction, the odds of one long train meeting another increases. Since existing sidings are incapable of handling these meets, the eastbound train would likely have to wait in a track at Gulf until the other train arrived. In actual operations, a long CN train will also be held occasionally east of Hydro waiting for the eastbound train to pass it, however when this occurs, the westbound train will block a single track section of CN's mainline.

The traffic-split assumptions used in this scenario did not require any 8,000 ft (2.4 km) CP trains, therefore, all CP trains could utilize Pratt and Rawlison for meets and passes. Mud Bay remained off limits to meets because of the grade crossing issues discussed above.

Although there would be a slight increase in rail traffic delays on the Gulf to Hydro mainline segment as a result of the Project, no rail infrastructure improvements are considered necessary on the Roberts Bank mainline.

**Forecasted Gulf Yard Operations**

To accommodate the additional rail traffic and increase in train lengths resulting from the Project, the two siding tracks at Gulf (Gulf South and Gulf Storage) would need to be extended to 15,000 ft (4.6 km) from the current 10,000 ft (3 km), as shown on Figure 2.10 and 2.11. Crossovers would also need to be constructed between the three tracks at Gulf, separating the
15,000 ft (4.6 km) tracks into 7,500 ft (2.3 km) segments, providing additional flexibility to assemble and disassemble trains.

Since most of the container storage tracks on the causeway are 6,000 ft (1.8 km) or less, even 7,000 ft (2.1 km) trains arriving at Gulf would need to utilize rail track in the Gulf yard. The additional 12,000 ft (3.7 km) daily train would also require the use of Gulf, as will the departing 12,000 ft (3.7 km) trains. Since current terminal operations must be suspended when a 12,000 ft (3.7 km) eastbound train is being built, the new yard at Gulf will allow Omnitrax to build a train of that length at Gulf, rather than in the S1 causeway track. This would allow terminal operations to continue while the long train readied for departure, and also allowed it to remain at Gulf to meet an inbound 12,000 ft (3.7 km) train.

The longer tracks at Gulf would rejoin the mainline just west of the 64th Street crossing. To fully utilize these extended tracks, the 57B Street crossing would be closed as an at-grade crossing. This closure would allow trains up to 12,000 ft (3.7 km) to remain in a track at Gulf without blocking the 41B Street grade crossing at the west end or 64th Street at the east end.

With the additional rail traffic and increase in train lengths resulting from the Project, the 41B Street grade crossing would see an additional number of train occupations during the day, as cuts of cars are moved from Gulf to the Deltaport storage yard and vice versa.

**Gulf Yard Road Rail Grade Crossings**

Rail simulations also took into account the potential growth of rail traffic at Roberts Bank and its effect on the communities located along the Gulf Yard through changes to the road-rail grade crossings.

The rail simulations compared the Base Case (2003) statistics to the 2012 statistics and determined the impact of additional rail traffic at the 41B Street, 57B Street and 64th Street grade crossings under the projected growth scenario. For each crossing location, the average number of occupancies per day was recorded from the three-day Base Case and 2012 simulations. Additionally, the average time of occupancy was identified, along with the maximum occupancy time experienced during the simulation.
**41B Street Grade Crossing**

The 41B Street grade crossing was analyzed to determine what impact the additional rail movements will have travelling between the Gulf Siding and the storage tracks on the causeway.

As expected, the additional train movements to and from the Gulf Siding increase the number of occupancies over the 41B Street crossing from 26 to 32 occupancies per day. The average duration of the occupancies remain approximately the same, as coal trains and blocks of container railcars being moved over the crossing do not get materially longer as a result of the Project. The occupancy times for trains of 41B Street is provided below in Table 2.7.

The maximum occupancy time was observed when coal trains were leaving the facility and had to stop at the east-end of Gulf before being allowed onto the Port Sub. These trains slowed from 10 mph (16 km/h) to a stop just beyond the crossing, which accounted for the 18 to 19 maximum minutes of crossing occupancy observed.

<table>
<thead>
<tr>
<th>Table 2.7 Gulf Yard Grade Crossing at 41B Street</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average # of Daily Train Occupancies</strong></td>
</tr>
<tr>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Average Occupancy Time</td>
</tr>
<tr>
<td>Maximum Occupancy Time</td>
</tr>
</tbody>
</table>

**57B Street and 64th Street Grade Crossings**

The 57B Street crossing is located just east of the current east-end of the Gulf Yard. This crossing is proposed to be closed due to the Gulf Siding extension from 57B Street to 64th Street. With the siding extension, this crossing would be blocked for extended periods of time. With the Gulf Siding extension, the new east-end of the yard would be located just west of 64th Street. Trains occupying these crossings will be moving at slower speeds entering the Gulf yard than trains moving over crossings on the mainline. The occupancy times (blockage times) for trains at 57B Street (for 2003) and for 64th Street (for 2012) are provided below in Table 2.8.
### Table 2.8 Gulf Yard Grade Crossing at 57B Street and 64th Street

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average # of Daily Train Occupancies</td>
<td>18</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>Average Occupancy Time</td>
<td>4 min.</td>
<td>2.5 min.</td>
<td>4 min.</td>
</tr>
<tr>
<td>Maximum Occupancy Time</td>
<td>17.5 min.</td>
<td>7.5 min.</td>
<td>14.5 min.</td>
</tr>
</tbody>
</table>

The decrease in occupancies between this zone and the previous zone (41B Street) depicts the number of switch moves that utilize the 41B Street crossing but do not occupy crossings in the Gulf Yard. As expected, there are additional occupancies in the forecasted 2012 Case over the Base Case with more trains arriving and departing in the forecasted case. Average occupancy duration at 64th Street in 2012 will be similar to 2003 base case at 57B Street since trains operate out of the yard tracks at similar speeds in each case.

**Forecasted Roberts Bank (Causeway) Operations**

The increase in container rail traffic would affect the storage yards on the Roberts Bank causeway. The existing storage yard is reaching its capacity as container volumes approach 900,000 TEUs. Therefore, to accommodate the forecasted increases of container rail traffic as a result of the Third Berth Project, two new tracks (N0 and N5) would be required at the causeway storage yard at Roberts Bank. (see Figure 2.12). These tracks could be built on the existing causeway without requiring additional width of the property. With the addition of these tracks, N4 and N5 would be designated for container use, while N0 through N3 would be retained for coal operations. The two additional container tracks could be used to hold 6,000 ft (1.8 km) cuts of cars for spotting to or from the pad tracks (tracks located in the intermodal yard).

The Project would result in Deltaport handling an increased number of trains exceeding 6,000 ft (1.8 km) in length. As outlined above, when a train of this length arrives, the head 6,000 ft (1.8 km) is pulled into an available storage track on the causeway. However, the rear section of the train remaining at Gulf must also be moved, so that the Gulf storage track can be made available for the next train arrival or departure. A switch engine would take a small cut of rail cars...
remaining on the Gulf storage track and move them to an "odds and ends" track on the causeway. These switch engine moves would continue until all the remaining rail cars (between 5,000 and 6,000 ft (1.3 km and 1.8 km)) are accumulated on a pair of unloading tracks. The two South Yard tracks (S3 and S4) that are 5,400 and 5,600 ft (1.6 km and 1.7 km) in length would be utilized as the "odds and ends" tracks for CP and CN respectively.

**Rail Traffic Impacts**

The impacts of the proposed rail operations associated with the Project are explored in each of the respective areas of study (i.e. socio-economic, noise, air quality, etc.).

### 2.9.4 Road Operations (Road Traffic)

This section describes the existing and proposed road traffic conditions, as well as providing suggested mitigation measures. This section is a summary of UMA Engineering Ltd.’s report, titled, *Deltaport Third Berth – Road Systems Impact Assessment (2004)*, which is provided in its entirety in **Technical Volume 1**.

It should be noted that the proposed mitigation contained in this section pertains only to the impacts associated with the Deltaport Third Berth project. There are other initiatives currently being considered by the Ministry of Transportation (MoT), through the Gateway Program, that examine the long-term regional transportation requirements in the Delta area. However, these long-term improvements are not required to mitigate the traffic impact of the Third Berth project.

The road mitigation program described in this section relating to Highway 17 is being viewed positively by the MoT and Gateway Program as it will improve operating conditions along the corridor over what they are today for all road users. In addition, these improvements are entirely consistent with the longer scenarios being considered by the Gateway program and will benefit regional traffic until such time as the longer term road transportation solution for the area can be implemented.

The options being considered by the Gateway Program include a major upgrade to the existing Highway 17/River Road Corridor or retaining and downgrading the existing alignment while introducing a new, access controlled re-aligned, high standard regional facility. More
information on this important transportation topic is available through the MoT website http://www.th.gov.bc.ca/gateway/.

**Existing Road Traffic**

The existing road network that provides access to and from Roberts Bank is shown in Figure 2.14. Road access from the Roberts Bank facility is via a 4.1 km causeway that connects to Deltaport Way. Deltaport Way was constructed in 1995 for the original development of Deltaport. Deltaport Way connects to Highway 17, which in turn connects to Highway 99 at the Ladner interchange. From the Ladner interchange, the road network connects north on Highway 99 to the Massey Tunnel, east to River Road and south to Highway 99.

An examination of existing traffic data identified 07:30 to 08:30 as the AM peak hour and 16:30 to 17:30 as the PM peak hour. The existing traffic volumes were broken into three market segments for analysis purposes. These consisted of Roberts Bank Port traffic, ferry terminal traffic and background/commuter traffic.

Total traffic volumes and Port traffic volumes for the AM and PM peak hours on select links on the road network are presented in Table 2.9.
Figure 2.14 – Traffic Impact Assessment Study Area
Table 2.9 Existing (2002) Hourly Traffic Volumes

<table>
<thead>
<tr>
<th>Link</th>
<th>AM</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Traffic</td>
<td>Port Traffic</td>
</tr>
<tr>
<td>Highway 99 NB – South of Massey Tunnel</td>
<td>5280</td>
<td>53</td>
</tr>
<tr>
<td>Highway 99 SB – South of Massey Tunnel</td>
<td>1651</td>
<td>40</td>
</tr>
<tr>
<td>Highway 17 NB – North of Ladner Trunk Road</td>
<td>2931</td>
<td>95</td>
</tr>
<tr>
<td>Highway 17 SB – North of Ladner Trunk Road</td>
<td>974</td>
<td>217</td>
</tr>
<tr>
<td>Highway 17 NB – South of Ladner Trunk Road</td>
<td>1783</td>
<td>95</td>
</tr>
<tr>
<td>Highway 17 SB – South of Ladner Trunk Road</td>
<td>1054</td>
<td>244</td>
</tr>
<tr>
<td>Deltaport Way WB – West of Roberts Bank I/C</td>
<td>278</td>
<td>244</td>
</tr>
<tr>
<td>Deltaport Way EB – West of Roberts Bank I/C</td>
<td>126</td>
<td>105</td>
</tr>
<tr>
<td>River Road EB – East of Ladner I/C</td>
<td>1516</td>
<td>20</td>
</tr>
<tr>
<td>River Road WB – East of Ladner I/C</td>
<td>996</td>
<td>177</td>
</tr>
</tbody>
</table>

Port Traffic

In 2003, Deltaport handled approximately 880,000 TEUs. This throughput resulted in two way truck volume movements of 1800 per day on peak days (900 inbound trucks and 900 outbound trucks), and approximately 2100 service and passenger vehicle movements per day (1050 vehicles inbound and 1050 vehicles outbound).

The origin of container traffic destined to Deltaport has been estimated from previous origin/destination studies to come from the following general areas:

- 40% from north of the Fraser River via the Massey Tunnel;
- 27% from the south and east via Highway 99 and Ladner Trunk Road; and,
- 33% from the east via River Road.
**Existing Road Network Performance**

The performance of the existing road network with the existing (2002) traffic volumes was evaluated for the AM peak hour, PM peak hour and during the midday hour. With the exception of the Highway 99 onramps during the peak hours, most roadways between intersections are relatively free-flowing while intersection delays are significant.

The network is relatively free flowing during the midday period but average speeds are approximately 10 km/h slower during peak periods. Two factors, queuing from the Massey Tunnel and ferry traffic surges, affect the Highway 17 corridor at times throughout the day. These factors are described below.

Overall Levels of Service (LOS)\(^2\) at Highway 17 major intersections are summarised in **Table 2.10**. This shows that all critical intersections on Highway 17 have an acceptable overall Level of Service at all analyzed traffic conditions with only the Highway 17 / Ladner Trunk Road intersection showing a marginally acceptable Level of Service of “E” during the AM peak hour.

Table 2.10  2002 Intersection LOS Summary

<table>
<thead>
<tr>
<th>Intersection</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hwy 17 @ 56th Street</td>
<td>B</td>
</tr>
<tr>
<td>Hwy 17 @ Ladner Trunk Road</td>
<td>C</td>
</tr>
<tr>
<td>Hwy 17 @ Hwy 99</td>
<td>B</td>
</tr>
</tbody>
</table>

However, **Table 2.11** indicates that during the AM peak hour, the northbound through movement and the eastbound left turn movement at the Highway 17/Ladner Trunk Road intersection are Level of Service “F”, even though the overall AM peak hour performance of the intersection falls in the Level of Service “E” range. The Level of Service “F” for the northbound through movement is caused primarily by background/commuter traffic as the Port and ferry terminal traffic only represent 6% and 7% respectively of the total traffic for this movement. The Level of Service “F” for the eastbound left turn movement is caused primarily by background/commuter traffic as the Port and ferry terminal traffic only represent 6% and 7% respectively of the total traffic for this movement.

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\(^2\) LOS ratings are graded service levels (“A” through “F”), based on vehicle delays. For example LOS of A is equal to an average vehicle delay between 5 and 15 seconds; where an LOS of F is an average vehicle delay greater than 60 seconds.
Service “F” for the eastbound left movement is caused exclusively by background/commuter traffic as the Port and ferry terminal do not contribute traffic to this movement. In the PM peak hour, the westbound through movement falls in Level of Service “F”. This is caused exclusively by background/commuter traffic as the Port and ferry terminal do not contribute to this movement.

Table 2.11 2002 Over-Saturated Movements Summary

<table>
<thead>
<tr>
<th>Period</th>
<th>Location</th>
<th>Movement*</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>Hwy 17 @ Ladner Trunk Rd</td>
<td>EBL</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NBT</td>
<td>F</td>
</tr>
<tr>
<td>PM</td>
<td>Hwy 17 @ Ladner Trunk Rd</td>
<td>WBT</td>
<td>F</td>
</tr>
</tbody>
</table>

*EBL = Eastbound left  *NBT = Northbound through  *WBT = Westbound through

Overall Levels of Service for the AM peak hour at the major intersections along River Road are summarised in Table 2.12. This shows that all critical intersections have a good overall Level of Service.

Table 2.12 LOS for Intersections

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Overall LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordel Way</td>
<td>B</td>
</tr>
<tr>
<td>Alexandra Road</td>
<td>A</td>
</tr>
<tr>
<td>Huston Road</td>
<td>A</td>
</tr>
<tr>
<td>76 Street</td>
<td>B</td>
</tr>
<tr>
<td>72 Street</td>
<td>A</td>
</tr>
<tr>
<td>68 Street</td>
<td>B</td>
</tr>
<tr>
<td>60 Avenue</td>
<td>A</td>
</tr>
</tbody>
</table>

Factors Affecting Existing Levels of Service

There are operational issues that affect the Highway 17 corridor. These issues are described below.
**Massey Tunnel**

The Ladner interchange (Highway 99 and Highway 17) is congested at peak times particularly for traffic heading northbound on Highway 99 toward the Massey Tunnel. During both peak periods, the northbound Highway 99 demand exceeds the available capacity in the tunnel. In both peak periods, queuing often occurs on approaches to the Ladner interchange with the exception of Highway 99 southbound.

As these queues build up in both northbound general purpose (GP) lanes on Highway 17 they impede the free flow of through traffic on Highway 17 to River Road. In addition, severe congestion resulting from incidents on the northbound approach to the tunnel or in the tunnel itself impedes access to Highway 17 south for traffic approaching the interchange from the south on Highway 99. At times these queues extend south to the Ladner Trunk Road intersection and can give an observer the impression that the intersection is operating at a lower Level of Service than reported in Tables 2.10 and 2.11.

**Ferry Traffic**

The effect of ferry surges on traffic operations depends on the capacity and unloading time of the arriving vessel, the platoon dispersal effect of the signalized intersections at Highway 17 / 52 Street and Highway 17/56 Street, and the prevailing level of traffic congestion. During congested conditions, each platoon surge may not completely clear the Highway 17/Ladner Trunk Road intersection leading to a continuous queue of northbound ferry traffic at the intersection for up to 25 minutes after the arrival of the first platoon of ferry traffic at the intersection.

Similar to the Massey Tunnel queues, the ferry traffic queues can give an observer the impression that the intersection is operating at a lower Level of Service than reported in Tables 2.10 and 2.11.

**Existing Road Network Problem Areas**

An examination of the existing road network performance indicated that the Highway 17 corridor from south of Ladner Trunk Road through the Ladner Interchange, primarily in the northbound direction, was the critical section of the existing road network that would be impacted by future traffic volume increases.
Highway 99 through the Massey Tunnel was also identified as a problematic link. However, the low contribution of Port traffic when compared to the total traffic volume indicated that traffic impacts due to increased Port traffic would be negligible (less than 1% of total future northbound AM volumes).

**Highway 17 Performance with Future (2011) Volumes**

Future traffic volumes were developed for two scenarios. In the first scenario volumes were developed to the 2011 horizon without the Deltaport Third Berth Project. In the second scenario Deltaport was assumed to be operating at its future capacity of 1,300,000 TEUs.

In the first scenario volumes were developed to the 2011 horizon without the Deltaport Third Berth Project. Deltaport was assumed to be operating at its existing capacity throughput of 900,000 TEUs. Separate growth factors were developed for the ferry and background/commuter market sectors. MoT, BC Ferries and the Corporation of Delta were consulted during the development of these factors. Total traffic volumes and Port traffic volumes for the AM and PM peak hours on select links on the road network for the first scenario are presented in Table 2.13.

<table>
<thead>
<tr>
<th>Link</th>
<th>AM</th>
<th></th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total Traffic</td>
<td>Port Traffic</td>
</tr>
<tr>
<td>Highway 17 NB – North of Ladner Trunk Road</td>
<td>3349</td>
<td>99</td>
<td>3.0%</td>
</tr>
<tr>
<td>Highway 17 SB – North of Ladner Trunk Road</td>
<td>1085</td>
<td>225</td>
<td>20.7%</td>
</tr>
<tr>
<td>Highway 17 NB – South of Ladner Trunk Road</td>
<td>2053</td>
<td>109</td>
<td>5.3%</td>
</tr>
<tr>
<td>Highway 17 SB – South of Ladner Trunk Road</td>
<td>1176</td>
<td>253</td>
<td>21.5%</td>
</tr>
</tbody>
</table>

In the second scenario volumes were developed to the 2011 horizon with the Deltaport Third Berth Project. In this scenario Deltaport was assumed to be operating at its full future capacity throughput of 1,300,000 TEUs. This throughput resulted in two way truck volume movements of up to 2400 per day on peak days (1200 inbound trucks and 1200 outbound trucks), and
approximately 2600 service and passenger vehicle movements per day (1300 vehicles inbound and 1300 vehicles outbound).

This throughput would increase container truck, service vehicle and employee vehicle trips. The BC Ferries and background/commuter traffic volumes remained the same as in the first scenario. Total traffic volumes and Port traffic volumes for the AM and PM peak hours on select links on the road network are presented in Table 2.14.

**Table 2.14 Future (2011) Hourly Volumes With Deltaport Third Berth Project**

<table>
<thead>
<tr>
<th>Link</th>
<th>AM</th>
<th>PM</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Traffic</td>
<td>Port Traffic</td>
<td>Total Traffic</td>
<td>Port Traffic</td>
</tr>
<tr>
<td>Highway 17 NB – North of Ladner Trunk Road</td>
<td>3415</td>
<td>164</td>
<td>4.8%</td>
<td>1840</td>
</tr>
<tr>
<td>Highway 17 SB – North of Ladner Trunk Road</td>
<td>1228</td>
<td>369</td>
<td>30.0%</td>
<td>2636</td>
</tr>
<tr>
<td>Highway 17 NB – South of Ladner Trunk Road</td>
<td>2124</td>
<td>181</td>
<td>8.5%</td>
<td>1526</td>
</tr>
<tr>
<td>Highway 17 SB – South of Ladner Trunk Road</td>
<td>1337</td>
<td>414</td>
<td>31.0%</td>
<td>2250</td>
</tr>
</tbody>
</table>

**Highway 17 Improvement Options**

A number of improvement options were reviewed along the Highway 17 Corridor between the Roberts Bank Interchange, where Highway 17 intersects with Deltaport Way, and the Ladner Interchange, where Highway 17 meets Highway 99. These improvements consisted of both traffic signal modifications as well as geometric laning and policy changes. These road improvement options were examined in order to mitigate the traffic impacts along the existing Highway 17 corridor that would result not only from the increase in Port traffic associated with the Deltaport Expansion but also increases in ferry and background/commuter traffic forecast for 2011. The 2011 date represents the timeframe by which a long-term regional transportation plan could be implemented for this area of Delta. The responsibility for development of the longer term plan rests with regional and provincial transportation authorities.
Highway 17 Traffic Signal Modifications

In an attempt to improve overall vehicle throughput at all signalized intersections along the corridor the following five potential options were assessed:

- Optimize Signal Timing
- Aggressive Gap Timing
- Move the Detector Loops
- Relocate the Northbound and Southbound Detector Loops
- Skip All-Red Signal Phase.

The results of this assessment indicated that the current signal timing plan is no longer appropriate to the estimated 2003 traffic volumes used for this analysis. The 3-second gap used on all approaches leads to unnecessary extension of the signal phases when traffic volume falls significantly below the volumes for which the signal has been optimized. The unused green time phenomenon created by the use of stop bar detectors for green time extension reduces the efficiency of the intersection and unnecessarily increases vehicle delays. The comparative high lost time per signal cycle necessary to provide safe operation for a wide variety of vehicle types and traffic conditions significantly reduces intersection capacity and increases overall average vehicle delay. The signal modifications produce savings in delay throughout the AM and PM peak hours and improve the current situation even with the additional Port traffic in 2011.

Options to improve the operation of the traffic signal at the Highway 17/Ladner Trunk Road intersection were examined. It was determined that green time usage could be enhanced with signal modifications and operational changes. These changes would allow the intersection to operate more efficiently thereby improving the Level of Service of the intersection.

As part of the assessment of the various laning options, it was assumed that these signal improvement options would be implemented and hence formed part of the overall analysis.

Highway 17 Laning Options

Three laning configuration options were developed for Highway 17 for the area south of Ladner Trunk Road to the area including the Ladner interchange in order to mitigate congestion...
anticipated due to increased traffic. The first option primarily considered a reduction in the vehicle occupancy requirements for the existing northbound HOV lane. The second option expanded on the first option by extend the HOV lane south through the Ladner trunk intersection. The third option consisted of converting the extended HOV lane back into a general purpose lane for all traffic to use. The individual options are described below.

**Option 1A – Converting Existing HOV Lane to 2+**
For this option the existing conditions were modified to allow the threshold of northbound HOV’s to be lowered to two occupants (2+HOV) to utilize the existing HOV 3+ lane. The existing protected/permitted left-turn phase at the signalized ramp terminal between the Highway 17 and the Highway 99 northbound off ramp was increased to accommodate the additional 2+HOV vehicles making this movement. The northbound HOV lane on Highway 99 was not changed.

**Option 1B – HOV Lane Extension**
This option extended the existing HOV lane to approximately 200 metres south of the Highway 17/Ladner Trunk Road intersection. This segment south of the Ladner Trunk Road intersection and the existing segment north of the intersection, including the portion on Highway 99 heading towards the tunnel, were amended to permit vehicles with a HOV 2+ designation. This provided three northbound general purpose lanes through the intersection along with the northbound 2+ HOV lane. In addition, the existing eastbound lanes at the intersection of Highway 17 / Ladner Trunk Road were converted into two dedicated left-turn lanes with the median lane being restricted to HOV only use, one shared left/through lane, and one through lane.

**Option 2 – HOV Lane Extension Converted Into a General Purpose Lane**
In this option the HOV lane extension of Option 1B was converted into a general purpose (GP) lane. The configuration of the Ladner Trunk Road intersection was modified such that the three general purpose lanes developed south of the intersection were continuous through the intersection and northward towards the Highway 99 interchange. As in the other alternative options, the left turn movement at the north ramp terminal at Highway 17 and the northbound off-ramp from Highway 99, was restricted to permit only HOV 2+ vehicles and the existing left-
turn phase increased to accommodate the additional traffic making this movement. The northbound HOV lane on Highway 99 was not changed.

Each of the options was examined using the “PARAMICS” model which was developed in conjunction with input from MoT. This model has the ability to measure the travel time of vehicles along a specific route and allows comparisons to be made between current conditions and a future time period.

Option 1B – HOV Lane Extension (Figure 2.15) provided the best overall performance. The results of the assessment identified that a vehicle in the GP lane destined to River Road will make this trip in slightly less time in 2011 than it does today. Vehicles using the 2+ HOV lane destined to River Road will make this trip in approximately 40 seconds less time in 2011 than they do today. Vehicles using GP lanes destined to the Massey Tunnel will make this trip in slightly less time in 2011 than they do today. HOV traffic destined to the Massey Tunnel will make this trip in approximately 40 seconds less than they do today under forecasted 2011 conditions. Overall the HOV lane extension option provided equivalent or better travel times in 2011 with increased Port, ferry and background/commuter traffic relative to what is being observed today. As a result this improvement option will provides effective mitigation for the anticipated traffic volumes in 2011.
Figure 2.15 – Highway 17 HOV Extension
Operational and Safety Issues on the Road Network

Operational and safety issues have been identified within the road network based on input from the Corporation of Delta, MoT and the local public. These are described in the following sections.

Commercial Vehicles

Concern has been raised about commercial vehicles occupying all lanes on Highway 17 particularly in the vicinity of the intersection with Ladner Trunk Road. In response to this concern MoT has placed signage on Highway 17 - "Commercial Vehicles Use Right Lane" and "Commercial Vehicles" - restricting commercial vehicles to the most easterly and westerly (curb) lanes. The concept and intent of these signs is to ensure that the motoring public are not unduly delayed as a result of commercial vehicles impeding traffic.

These signs are currently difficult to enforce because they have not yet been gazetted into the Motor Vehicle Act. However, these "commercial vehicle" signs are approved traffic control devices implemented by the Ministry of Transportation and are therefore subject to enforcement.

Incident Warning

The mobility of northbound Highway 17 traffic can be seriously affected by an incident occurring in the northbound lane in the Massey Tunnel. Until a longer term transportation solution for the area can be realized the occasional diversion of traffic to Ladner Trunk Road may be an attractive option for some northbound traffic. The key to diverting this traffic would be to inform the Highway 17 northbound drivers of the incident in the tunnel. An existing changeable message sign, located south of the Ladner Trunk Road Intersection on Highway 17 in the northbound direction, that is interconnected to the tunnel incident management centre, would provide this message. This changeable message sign could also be used to inform drivers of traffic conditions without an incident in the tunnel. This would allow the drivers to make an informed decision regarding making a diversion to Ladner Trunk Road due to an incident in the tunnel or due to general traffic conditions.

Ladner Interchange

A concern was raised regarding the yield condition at the Highway 99 on ramps in the southeast quadrant of the Ladner interchange. The geometry of this ramp intersection was examined and a
laning solution to the problem developed. The solution consists of eliminating the yield condition by extending the northbound Highway 17 to southbound Highway 99 ramp parallel to the southbound Highway 17 to southbound Highway 99 ramp. Once the ramps are parallel to one another the outside lane merges with the inside lane. The inside lane then merges with the Highway 99 southbound lane.

**Grade Crossing Assessment**

There are approximately 30 at-grade rail crossings along the Port Subdivision line through Delta, Surrey, the City of Langley and the Township of Langley. The traffic impact study considered the road-rail interface at grade crossings near Roberts Bank. VPA is actively supporting or is directly participating in several initiatives underway in these communities that are addressing specific rail issues.

**41B Street**

The intersection of 41B Street and Deltaport Way is the western most signalized intersection on Deltaport Way. When Deltaport Way was built in 1996, the Land Reserve Commission required that an overpass be constructed at the 41B Street grade rail crossing when additional support track is built across this intersection. No additional tracks are being constructed at 41B Street for the purposes of the Deltaport Third Berth and the number of train blockages will only increase from an average of 26 to 32 per day. In the meantime, a communication system is in place for the farming community to access information regarding train movements in the area.

Because of the proximity of the rail crossing to the intersection, when a train occupies the crossing, the traffic signals at the 41B Street/Deltaport Way intersection remain on the east-west phase. The majority of southbound vehicles on the north leg of this intersection turn left onto Deltaport Way. All of the southbound vehicles share a single lane. Consequently it is not possible to activate a southbound left turn phase to service these vehicles when the railway crossing is occupied. A jointly funded MoT, Corporation of Delta and VPA project to modify the north leg laning to separate the southbound left turn from the southbound through movement is currently underway. The operation of this intersection should be monitored once it is complete to see if additional improvements are required.
It has been reported that truck traffic on Deltaport Way has been observed running through the 41B Street signal on the red phase, as well as speeding trucks on Deltaport Way.

The typical methodology used to determine whether a grade separation may be appropriate for an at grade rail crossing is the “cross product” calculation. This method involves the calculation of the value of the multiplication of the number of trains occupying the crossing per day and the daily traffic volume using the crossing. If the result is 200,000 or greater then a grade separated crossing may be considered for that location.

The need for a grade separation between the railway and 41B Street was examined using the cross product methodology. The cross product calculation yielded a result of 68,672 which is less than 200,000. This result indicated that a grade separation need not be considered at this time.

57B Street

57B Street is a local street that connects 34B Avenue, Deltaport Way and 28 Avenue. It is used as an alternate route to Highway 17 for trips between the Tsawwassen neighbourhood and the area east of Highway 17 including the Boundary Bay Airport. 57B Street is also used by the farming community to move their slow moving equipment between areas south of Deltaport Way and east of Highway 17. Approximately 12 farm vehicles use the south leg of the 57B / Deltaport Way intersection on an average weekday. Approximately 11 farm vehicles use it on an average weekend day. An alternate route is available along Arthur Drive for these movements. However, the farming community prefers not to use this alternative as Arthur Drive serves significantly more traffic that is moving faster than traffic on 57B. The grade of the Arthur Drive overpass may also restrict use by some farm vehicles.

The need for a grade separation between the railway and 57B Street was examined using the cross product methodology. The cross product calculation yielded a result of 17,028 which is less than 200,000. This result indicated that a grade separation need not be considered.

As discussed in **Section 2.9.3 Rail Operations**, the south leg of the Deltaport Way/57B Street intersection is proposed to be closed to accommodate the longer container trains servicing the Deltaport Container Terminal. This closure would impact the current users of the road.
Vehicles using 57B Street for north south connectivity would be required to detour via Arthur Drive. This would add approximately 1.1 km to a trip between the intersections of 34B Avenue/57B Street and 28 Avenue/56 Street. This extra trip length would add approximately 1 minute to the travel time.

The sight distance to the north at the intersection of 34B Avenue/Arthur Drive is limited in the northbound direction. There is a row of trees partially blocking the view for vehicles making a westbound to southbound left turn. The closure of the south leg of the Deltaport Way / 57B Street intersection would divert traffic through the 34B Avenue/Arthur Drive intersection. This additional traffic would exacerbate this existing problem.

**Boundary Bay Airport**

Access to the Boundary Bay Airport is provided via 36 Avenue, 72 Street and 80 Street. In the event of a train stoppage, access to the airport across these three routes could be blocked.

BC Rail Port Sub Ltd. has a central dispatch centre located in Delta which monitors the tracks that run from Deltaport through Delta, Surrey, Langley and Abbotsford. The dispatch centre monitors trains from CN Rail, CP Rail, BNSF and Southern Rail and is in constant radio contact with the train operators providing immediate operational and emergency communication. The centre provides a 24 hour emergency contact for the rail companies and the RCMP and manages the communication plan to deal with incidents that involve the rail line.

**Other At-Grade Crossings**

In the City of Surrey there are currently about 10 grade crossings along the BC Rail Port Sub. The City of Surrey is working with BC Rail Port Sub Ltd. and residents of the Panorama neighbourhood of Surrey to close several private at-grade rail crossings along Colebrook Road and to reduce the number of rail crossing whistles.

Another 4 grade crossings of the Port Sub exist inside the City of Langley. The City of Langley is planning to construct an overcrossing of the railway and the Langley Bypass at 204 Street as a means to address the issues of north-south mobility and congestion along many of the City’s key roadways. The overcrossing will span above the railway and roadway along the extension of the 204 Street alignment. A funding partnership of the City of Langley, Translink, the provincial
government and the federal government have announced that the project will be underway in 2005.

The City of Langley, Transport Canada and Canadian Pacific Railway are carrying out safety improvement work and inspections aimed at improving safety and eliminating trains whistles at four rail crossings. The rail crossings included in this work are: Highway 10 at Mufford Crescent, Fraser Highway near Production Way, 200 Street south of the Langley Bypass, and the Langley Bypass west of Glover Road.

From the border with the City of Langley (not including Mufford Crescent) to Livingstone Rd (232nd St), in the Township of Langley, there are 6 more grade crossings of the Port Sub. The Langley Township has organized a working group consisting of the City of Langley, the City of Surrey, MoT, Transport Canada, Translink, VPA and the railway companies to discuss rail operations in the context of the Township’s long-term transportation plan. As part of the ongoing development of their long-term transportation plan the Township of Langley is considering road options that could see the realignment of Mufford Crescent. This could potentially mean improved road traffic circulation with elimination of the existing grade crossing.

**Summary of Mitigation Measures**

Recommendations regarding the mitigation opportunities are summarised in this section. The recommendations fall into two categories. The first category, proposed project-related mitigation, consists of initiatives to mitigate the impacts of the additional traffic forecast for the 2011 horizon. The second category, ongoing mitigation, consists of current activities to mitigate existing transportation impacts.
Proposed Project-Related Mitigation

Highway 17 Corridor Improvements

It is recommended that traffic signal modifications be implemented to increase the throughput of the Highway 17/Ladner Trunk Road intersection.

It is recommended that the HOV lane extension be constructed on Highway 17. This will provide a continuous 2+HOV lane northbound from approximately 200 metres south of the Ladner Trunk Road intersection to the existing HOV lane located between Ladner Trunk Road and the Ladner interchange. Three GP lanes will be provided through the Ladner Trunk Road intersection with the outside lane merging with middle lane north of the intersection. The project will require the replacement of the pedestrian bridge on the north side of the Ladner Trunk Road intersection.

It is recommended that MoT make application to amend the Motor Vehicle Act to restrict commercial vehicles to the outside (curb) lane on Highway 17. While there may be other ways to enforce the intent of this signage, the amendment of the Motor Vehicle Act will be the most direct method to provide the enforcement. The signing of the laning restriction should be reviewed and additional signing added if deemed appropriate.

It is recommended that three vehicle detector stations be installed along the Highway 17 corridor. This equipment would monitor the volume, speed and occupancy along the corridor and provide this information to an incident management centre. An appropriate message would then be displayed on the existing changeable message located on Highway 17 advising of congestion and suggesting alternative routing.

It is recommended that geometric changes to the ramps in the southeast quadrant of the Ladner interchange be constructed.

41B Street

It is recommended that monitoring equipment be installed at the 41B intersection to observe the operation of the intersection and to monitor if the posted speed on Deltaport Way is being maintained. If problems are observed, a mitigation plan is to be developed to address the problems.

57B Street

It is recommended that access be made available for farm equipment on BC Rail’s proposed maintenance road that would connect from 57B Street to 64 Street. This road would be built
adjacent to the BC Rail tracks and within the BC Rail right-of-way. Further consultation with local farmers, the Corporation of Delta and BC Rail Port Sub Ltd. should be undertaken.

It is recommended that an emergency access protocol be developed between BC Rail Port Sub Ltd. and the Delta emergency service providers to provide a temporary gap in the trains at this location should there be a need.

It is recommended that the Corporation of Delta conduct a preliminary design of improvements to the intersection of Arthur Drive / 34B Avenue to correct the existing sight line problem.

**Construction Traffic Management**

It is recommended that VPA prepare a traffic management plan in conjunction with MoT and the Corporation of Delta, to manage construction traffic during the project construction. This plan will include a public communications plan.

**On-going Mitigation Initiatives**

**Incident Management Program**

It is recommended that VPA continue its participation in this program to develop an incident management program in the Delta area and to develop communication protocols to manage train stoppages that could impact access to such locations as Boundary Bay Airport. It is recommended that VPA assist BC Rail Port Sub Ltd. and the Delta emergency service providers in developing an emergency access protocol at 57B Street, 64 Street and 41B Street.

**Access to Boundary Bay Airport**

It is recommended that VPA continue discussions with BC Rail Port Sub Ltd. and the Delta emergency response providers to ensure that adequate protocol procedures are in place to handle emergency incidents at the Boundary Bay Airport. This plan will include an emergency response plan. These protocols should be integrated into the standard operating procedures and will provide effective coordination to eliminate delays to the airport where train operations can directly affect emergency response. These protocols can also be applied to other grade crossings as identified above.

**Communications Initiative**

It is recommended that VPA continue with this program to improve communications with the trucking community.
Surrey Rail Initiative

It is recommended that VPA continue its participation in this program with the City of Surrey, BC Rail Port Sub Ltd., and the residents of the Panorama neighbourhood of Surrey to mitigate rail impacts in the City of Surrey.

Langley Rail Initiative

It is recommended that VPA continue its participation in this program with the Township of Langley, the City of Langley, the City of Surrey, MoT, Transport Canada, Translink and the railway companies to mitigate rail impacts in the City and Township of Langley.

2.9.5 Marine Operations (Ship Traffic)

Existing Ship Traffic

Ship traffic to the Roberts Bank Port facility includes ship traffic to both Deltaport (container vessels) and Westshore terminals (bulk coal vessels). The following table shows the historic traffic volumes combined with the ship movements for both Deltaport and Westshore Terminals at Roberts Bank.

<table>
<thead>
<tr>
<th>Year</th>
<th>Deltaport</th>
<th>Westshore Terminals</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ships</td>
<td>Movements</td>
<td>Ships</td>
</tr>
<tr>
<td>1996</td>
<td>0</td>
<td>0</td>
<td>230</td>
</tr>
<tr>
<td>1997</td>
<td>70</td>
<td>140</td>
<td>230</td>
</tr>
<tr>
<td>1998</td>
<td>124</td>
<td>248</td>
<td>231</td>
</tr>
<tr>
<td>1999</td>
<td>200</td>
<td>400</td>
<td>219</td>
</tr>
<tr>
<td>2000</td>
<td>247</td>
<td>494</td>
<td>241</td>
</tr>
<tr>
<td>2001</td>
<td>322</td>
<td>644</td>
<td>239</td>
</tr>
<tr>
<td>2002</td>
<td>312</td>
<td>624</td>
<td>196</td>
</tr>
<tr>
<td>2003</td>
<td>365</td>
<td>730</td>
<td>190**</td>
</tr>
</tbody>
</table>

** The drop in volume at Westshore Terminals for 2003 was the result of one berth being out of commission for about 7 months following windstorm damage.

In 2003, there were 365 vessel calls at Deltaport, with an average container ship size (volume) of 4,065 TEUs. The following table provides a breakdown of the 2003 calls, ship volumes and the associated ship size.

<table>
<thead>
<tr>
<th>Table 2.16</th>
<th>Deltaport Vessel Summary 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEU Capacity</strong></td>
<td><strong>Average</strong></td>
</tr>
<tr>
<td></td>
<td>4065 TEUs</td>
</tr>
<tr>
<td><strong>Overall Length</strong></td>
<td>260 m</td>
</tr>
<tr>
<td><strong>Beam (Width)</strong></td>
<td>34.5 m</td>
</tr>
<tr>
<td><strong>Maximum Draft</strong></td>
<td>12.31 m</td>
</tr>
<tr>
<td><strong>Dead Weight Ton</strong></td>
<td>53,278 t</td>
</tr>
</tbody>
</table>

Further breakdown of the Deltaport vessel distribution in 2003 is provided below.

<table>
<thead>
<tr>
<th>Table 2.17</th>
<th>Breakdown of Vessel Sizes at Deltaport 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEU Capacity</strong></td>
<td><strong>&lt;2000</strong></td>
</tr>
<tr>
<td><strong>2003 % of Calls</strong></td>
<td>3.6%</td>
</tr>
<tr>
<td><strong>2003 No. of Calls</strong></td>
<td>13</td>
</tr>
</tbody>
</table>

As shown in the above table, the majority of the vessels fall within the 2000 to 7000 TEU range.

**Forecasted Ship Traffic**

It is expected that there will be only a modest increase in the number of ships arriving at Deltaport following the addition of one more berth. This is due, in part, to the projected increase in size of container ships. It is predicted that the volume of coal shipments will remain fairly static therefore only slight change is projected for the number of ships using the Westshore Terminals. **Table 2.18** shows the forecasted marine traffic.

<table>
<thead>
<tr>
<th>Table 2.18</th>
<th>Projected traffic volumes at Deltaport and Westshore Terminals for 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
<td><strong>Deltaport</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Ships</strong></td>
</tr>
<tr>
<td>2003</td>
<td>365</td>
</tr>
<tr>
<td>2012</td>
<td>393</td>
</tr>
</tbody>
</table>
The projected increase in ship traffic at Deltaport is less than 10.5% (365 ship calls in 2003 to 393 ship calls projected for 2012). Offsetting the modest increase in ship numbers is a projected increase in size of ships using the Deltaport terminal, which will facilitate the approximately 47% increase in container throughput (880,000 TEUs in 2003; projected growth to 1.3 million TEU in 2012).

**Forecasted Ship Size**

Container vessels are described as Panamax sized, post-Panamax sized and super-post-Panamax sized. Panamax vessels are classified as those that have dimensions that allow them to transit the Panama Canal. Panamax vessels have an overall length (LOA) of 290 m; a beam (width) of 32.3 m; a draft (depth of water the ship draws when loaded) of 12.0 m; and have a typical TEU range between 1000 and 5000 TEUs. Vessels that exceed one or more of these dimensions are not capable of passing through the Panama Canal, and are referred to as post-Panamax sized vessels (typical TEU range between 5,000 and 9,000 TEUs).

Currently, the trade to the Vancouver Port Area is largely a “Panamax” trade, with a few “post-Panamax” vessels. In 2003 at Deltaport, approximately 73% of vessel calls were of Panamax size or less, and 27% being of post-Panamax size dimensions. Vessel sizes at Deltaport currently range from approximately 2,000 to 7,000 TEUs with an average size of 4,000 TEUs. The ships calling to Fraser Surrey Docks are smaller (1,500 to 2,500 TEUs) than those calling at the Port of Vancouver terminals.

In addition to being able to handle the forecasted container annual throughput volumes, and while there still will be Panamax sized vessels in service, west coast container terminals should also be able to handle the forecasted larger post-Panamax container vessels. Forecasts show a distribution of approximately 35% post-Panamax sized container vessels calling at Deltaport by 2010 and approximately 40% post-Panamax sized container vessels calling at Deltaport by 2020. The dimensions of post-Panamax vessels have been increasing over the past twenty years. Lengths range from 290 m to 347 m, beam dimensions range from 37 m to 43 m, and draft dimensions have increased from 13.5 m in the mid 1990’s to 14.5 m in the late 1990’s.

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Therefore, it is important that the container terminals in Vancouver are able to berth vessels of this size.

The following table shows the forecasted ship size distribution for Deltaport in 2012, with Deltaport Third Berth in operation.

Table 2.19  Breakdown of Vessel Sizes for 2012 (Deltaport Third Berth operational)

<table>
<thead>
<tr>
<th>TEU Capacity</th>
<th>&lt;2000</th>
<th>2000-2999</th>
<th>3000-3999</th>
<th>4000-4999</th>
<th>5000-5999</th>
<th>6000-6999</th>
<th>7000-7999</th>
<th>&gt;8000</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 Forecasted % of Calls</td>
<td>0.5%</td>
<td>25.3%</td>
<td>19.2%</td>
<td>19.6%</td>
<td>16.2%</td>
<td>14.1%</td>
<td>0.8%</td>
<td>4.3%</td>
<td>100%</td>
</tr>
<tr>
<td>2012 No. of Calls</td>
<td>2</td>
<td>99</td>
<td>76</td>
<td>77</td>
<td>64</td>
<td>55</td>
<td>3</td>
<td>17</td>
<td>393</td>
</tr>
</tbody>
</table>

The majority of the ships are expected to remain in the 2,000 to 7,000 TEUs range, which compares favourably with 2003 levels. The average size is forecasted to increase from 4,065 TEUs to about 4,650 TEUs with the largest ships about 10,000 TEUs.

**Marine Traffic Routing Patterns**

The marine traffic routes and shipping lanes are shown in Figure 2.16 and ship movements, including tug operations, are described in more detail below. The marine traffic flow for Deltaport Third Berth will be the same as the current Deltaport marine traffic flow.
Container ships arriving at Deltaport generally board a licensed Canadian marine pilot at the pilot boarding station at Brotchie Ledge off Victoria. The ship then proceeds around the southern end of Discovery Island into Haro Strait and north around Turn Point into Boundary Pass. At the eastern end of this pass the ship will leave East Point to port and enter the vessel traffic separation zone to the east of Rosenfeld Ledge and proceed in a northwesterly direction up the Strait of Georgia. As the ship approaches Point Roberts, speed will be reduced and at approximately Point Roberts lighthouse, the ship will leave the traffic lanes and head for Deltaport. Speed and actual direction of approach will be adjusted by the pilot’s instructions and Master’s orders to allow for a number of circumstances such as other marine traffic, day or night, visibility, general weather conditions (wind, rain, snow etc.), tidal current and the handling characteristics of the particular ship.

The pilot will then direct the ship to the entrance of the dredged channel between the red and green navigation buoys, leading into the turning basin. There the ship will be met by at least two tugs of suitable size and horsepower to handle a ship of that particular size. Under normal circumstances the ship will be turned with the assistance of the tugs and manoeuvred alongside the allocated berth starboard side alongside (bow facing out towards Georgia Strait).

When the ship is leaving the traffic lanes in preparation for its final approach to Deltaport extreme caution is exercised in relation to other traffic in the vicinity, with particular emphasis on ferries and general north/south movements. For the voyage in from the pilot station the ship is under the watchful eye of the Victoria MCTS (Marine Communications and Traffic Services). Radio communications are maintained with this service and other traffic in the area.

Some ships arrive directly from Seattle or Tacoma in Puget Sound. The Canadian pilot will have boarded prior to their departure from the Puget Sound dock. They will enter the Victoria MCTS zone in the vicinity of Hind Bank, about 14.5 km (9 miles) east southeast of Discovery Island and then follow the route as detailed above.

During times of berth congestion a ship might have to anchor to await a vacant berth in which case the ship will be taken to English Bay until a berth becomes available. The ship will then be piloted down from English Bay following the traffic lanes southbound past Sandheads at the entrance to the Fraser River then will cut across the traffic lanes at as near to right angles as
possible, once again depending on other traffic, weather visibility etc. and make a similar approach to the dock. The need for container ships to anchor to await a berth is rare. There is a designated temporary anchorage “R” to the north of the Roberts Bank “island” however, this location is not considered a safe anchorage, is for emergency use only and the pilot has to remain on board while the ship is at anchor in this location.

For ships leaving Deltaport, the ship will depart the dock under the conduct of a licensed Canadian marine pilot with the assistance of at least two tugs of adequate size and power. Once the ship has cleared the entrance buoys the tugs will be dismissed and the ship will be directed through the precautionary area in the traffic separation zones to join the southbound lane. This will be done in accordance with the *International Regulations for the Prevention of Collision at Sea (ColRegs)* Rule 10. The ship will then proceed outwards past East Point into Boundary Pass and Haro Strait and on to the pilot boarding station off Victoria or to Puget Sound, depending on the next port of call.

**Traffic Density Patterns**

There are no particular ship movement patterns at Roberts Bank or in Georgia Strait. Ships arrive and sail at all hours of day and night and there is no seasonal fluctuation. The sailing time for the ship will be arranged according to completion of cargo operations.

**Tide and Weather**

There is very little concern about the tidal effect on ships arriving or departing from Deltaport. In most cases, prior to arrival from the main shipping channel, the pilot on an inbound ship will ask the tugs for a visual reading of the tidal flow (current) past the channel entrance buoys. The pilot will also have consulted his tide tables to ascertain the state of the tide and current conditions. The current is not an issue on outbound ships.

Weather can be a concern at Deltaport as the prevailing winds are from the southeast, which tend to blow a ship onto the dock when berthing. In addition the sea conditions can become quite rough off the dock for the same exposure reasons. In the six years that Deltaport has been in operation there have been less than ten instances where container ships have been seriously delayed because of wind conditions. There have only been two occasions of a ship not berthing because of dense fog conditions. Other weather conditions such as snow and rain have not had
an effect. In conditions of inclement weather the decision to berth the ship is jointly made by the pilot and Master of the ship. The primary consideration is that of safety, for the ship, the tugs and the dock.

The power and sea keeping abilities of the tugs are critical for the safe berthing of the ships. Two tugs are permanently stationed at Roberts Bank and range from 24.4 to 31.7 meters in length and from 3,100 Brake Horsepower (“BHP”) to 4,000 BHP in power. Both tugs are powered by Z-peller drives. Only one of these tugs is manned 24/7. No additional tugs are required as part of the Project.

**Wharf Access**

At present the turning basin is dredged to -12.5 metres and is adequate for the size of ships using Deltaport. The turning basin will be dredged in select locations for source material for Project terminal fill activities. A preliminary dredging plan has been prepared based on the reclamation requirements to create the terminal area. The final volumes and dimensions of the dredged areas are yet to be determined as they will be based on the results from the geotechnical drilling program, to be completed by the end of 2004.

The shipping channel will be dredged to –16m chart datum which will allow for ships with a maximum draft of 15 metres. An under keel clearance of 5% of the deepest draft has been recommended by the B.C. Coast Pilots as a safety margin when under way and manoeuvring.

**Navigation Equipment and Communications.**

Technological advances in the electronic navigational equipment on board ships are rapid and it is difficult to project where this industry might go in the next 4 years. Included in the advances is the advent of AIS (Automatic Identification System) which is in the process of being implemented on an international basis through the International Convention for the Safety of Life at Sea (SOLAS). This is just one system that aids the mariner in safe navigation. Advances in radar, sonar equipment and other shipboard electronics continue to progress. All will assist in the safer navigation of larger ships.

Advances in shore based navigational aids continue to progress in the two main areas – visibility and reliability. The essential shore based navigational aid used at Deltaport is the range lights
marking the centerline of the approach channel. Floating buoys are used to delineate the entrance to the channel and the extremities of the turning basin.

Communications equipment such as VHF radio and cellular phone technology continues to improve in the fields of simplicity and reliability. The Canadian Coast Guard realigned the reporting areas for MCTS with Victoria MCTS now covering the Roberts Bank area.

**Marine Traffic Impacts**

The impacts of the forecasted marine operations associated with the Project are described in each of the respective areas of study (i.e. marine, air quality, etc.). In terms of navigational impacts, the Project will have minimal impact due to the limited increase in ship movements to Roberts Bank and the ability of existing traffic lanes to accommodate more ship movements in the region.

### 2.10  **Capital Costs**

Project costs have been determined with input from AMEC on all construction components of the project and from TSI for equipment-related requirements for the expansion. The following summarises the major costs ($ millions) associated with the Project and includes applicable provincial sales tax, which is estimated at $8.7 million.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dredging and fill</td>
<td>$77.3</td>
</tr>
<tr>
<td>Wharf Construction</td>
<td>$44.0</td>
</tr>
<tr>
<td>Container Yard</td>
<td>$29.2</td>
</tr>
<tr>
<td>Truck gate and Buildings</td>
<td>$1.7</td>
</tr>
<tr>
<td>On-site Roads and Services</td>
<td>$6.9</td>
</tr>
<tr>
<td>Power/Lighting</td>
<td>$18.7</td>
</tr>
<tr>
<td>Off-site Road and Rail</td>
<td>$9.3</td>
</tr>
<tr>
<td>Container Cranes and Terminal Equipment</td>
<td>$71.0</td>
</tr>
<tr>
<td>Planning and Engineering</td>
<td>$14.0</td>
</tr>
<tr>
<td><strong>TOTAL COST</strong></td>
<td><strong>$272.1</strong></td>
</tr>
</tbody>
</table>
Although VPA is not subject to BC content purchasing requirements, VPA will undertake best efforts to source within BC and to encourage contractors and suppliers to use local companies where possible.

2.11 Labour Force

Labour requirements for the project are based primarily on historical contractor data from similar projects developed as a percentage of the capital cost. The labour component relative to capital cost in each area of work was estimated. In addition, as a check to the above, an approximate manpower loading was developed for each labour discipline based on per diem labour estimates for major work activities and the duration estimates based on the overall project schedule. Site manpower includes contractor(s) labour (both direct and indirect) and project site staff, engineering and project and construction management.

<table>
<thead>
<tr>
<th>Table 2.21 Total Construction Labour Force</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
</tr>
<tr>
<td>Dredging and Fill</td>
</tr>
<tr>
<td>Caisson Dock</td>
</tr>
<tr>
<td>Terminal Infrastructure</td>
</tr>
<tr>
<td>Habitat Compensation (not including planting)</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

A summary of the employment expected to be created during new terminal operations of the Third Berth Project is provided below.

<table>
<thead>
<tr>
<th>Table 2.22 Operational Phase Employment Creation (full time equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
</tr>
<tr>
<td>Total Full Time Equivalents (FTE’s)</td>
</tr>
</tbody>
</table>

Note: 360 FTE’s average over 20 years.

While the new employment estimates in Table 2.23 are shown for the first five years of operations only, the positions created will continue indefinitely.

Further discussion and analysis on the labour force associated with the Project is provided in Chapter 17 Socio-Community and Economics.