



Centerm Expansion Project

2023 AAPA Facilities Engineering Award Application

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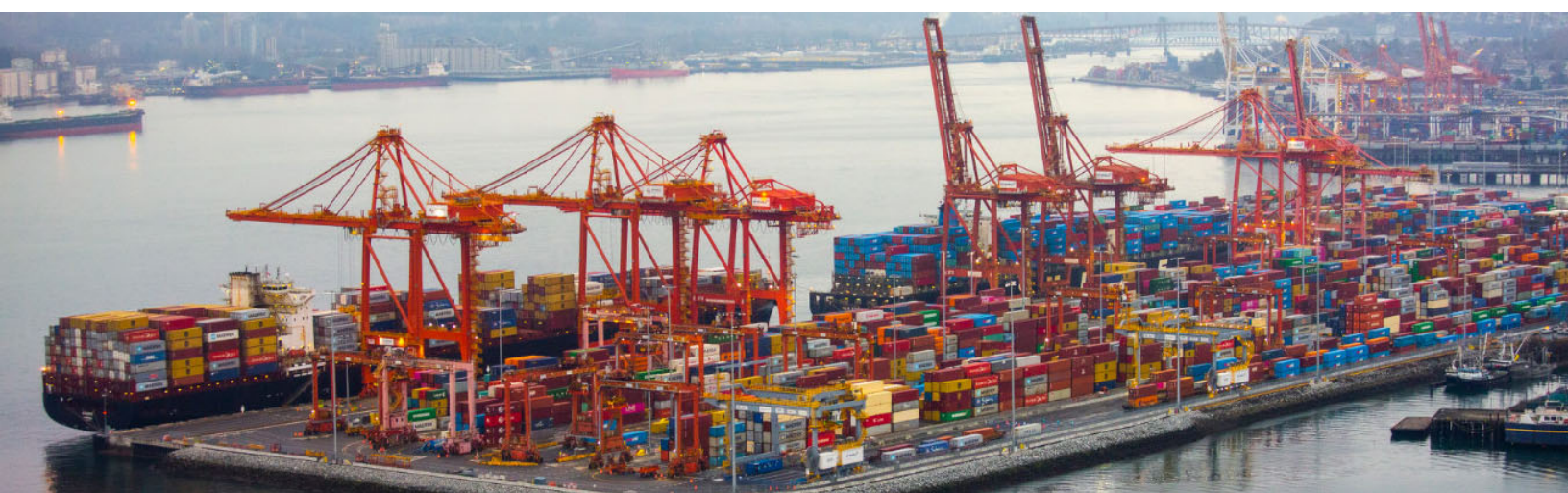
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1. Project Description

The Vancouver Fraser Port Authority (VFPA), responsible for overseeing the Port of Vancouver, initiated expansions and upgrades to the Centerm container ship terminal in Vancouver, BC starting in 2015. The project, which is referred to as the Centerm Expansion Project (CEP), reached substantial completion in January 2023. The CEP has been built to help meet anticipated near-term demand for containers shipped through the Port of Vancouver. The project was undertaken by Centennial Expansion Partners (CXP), an unincorporated joint venture between Dragados Canada Inc., Jacob Bros Construction Inc., and Fraser River Pile & Dredge Inc.

The expansion involved on-terminal and off-terminal improvements, all of which were completed while maintaining Centerm terminal operations during unprecedented demand for goods movement during the COVID-19 pandemic.

1.1. On-Terminal Improvements

The on-terminal works increased the Centerm terminal's annual container capacity from 900,000 twenty-foot equivalent units (TEUs) to 1,500,000 TEUs annual capacity. These improvements included the reclamation of land to increase available container storage, expansion of the terminal berth face, the reorganization of existing container storage areas, construction of a modern truck gate, and expansion of the intermodal yard resulting in shortened truck and train travel times and reduced port-related traffic in the surrounding communities. All of this was achieved while maintaining Centerm terminal operations.

1.2. Off-Terminal Improvements

The off-terminal works consisted of improvements to the port lands road and rail network. Roadway additions and the creation of a new 500 meter overpass structure (the Centennial Road Overpass) created a continuous port road, for goods and industry, from downtown Vancouver to Canada's Highway 1. The off-terminal activities are grouped under the South Shore Access Project (SSAP) title.

2. Introduction – Project Highlights

2.1. On-Terminal Improvements

2.1.1. Western Expansion

The Western Expansion component of the CEP created new port lands by way of marine infill. The western expansion is a critical piece of the 60% increase in the terminal's annual container capacity.

The Western Expansion provided the space required for several of the terminal upgrades. The intermodal yard (the expansion of which is described further in section 2.1.5) extends approximately 130m into the Western Expansion. The terminal's berth face was extended by approximately 80m; this allowed for the addition of two new quay cranes and provides the room needed to accommodate larger vessels. This additional berth face has also been equipped with a shore power system. The central area of the Western expansion created space for much needed additional container storage.

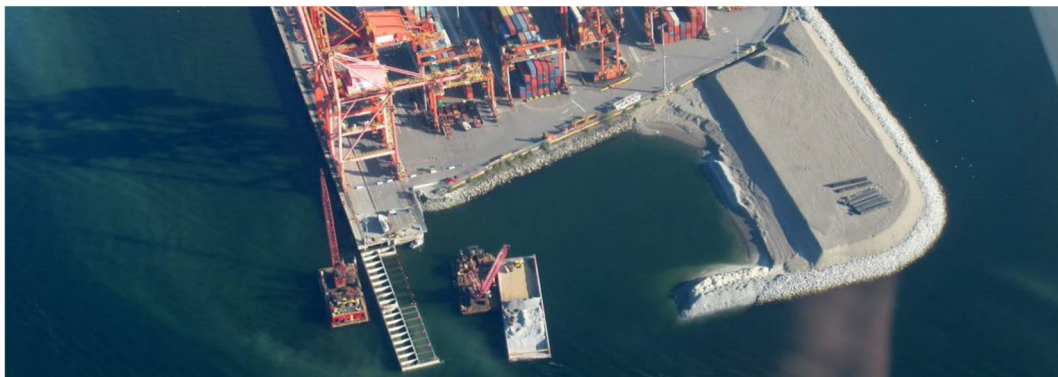


Figure 1: Western Expansion infilling underway (July 2020). The two new caisson structures are visible.

2.1.2. Eastern Expansion

The Eastern Expansion component of the CEP repurposed the existing Ballantyne Pier and created new land by infilling the adjacent bay. The eastern expansion is a critical piece of the 60% increase in the terminal's annual container capacity.

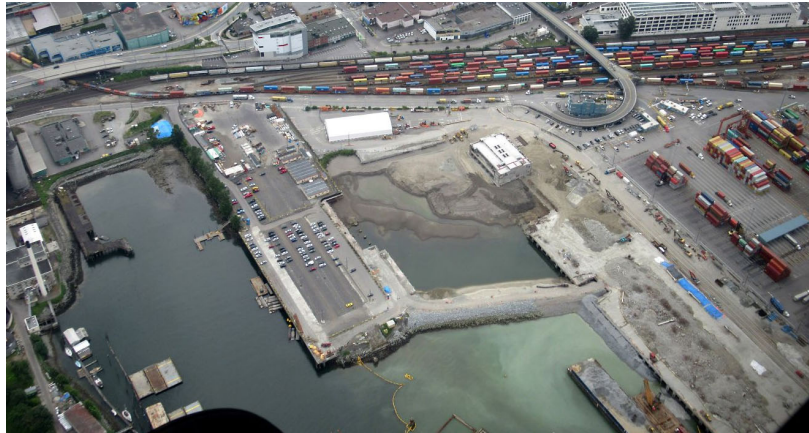


Figure 2: Eastern Expansion infilling underway (May 2020).

Areas created by the Eastern Expansion provided the land needed for terminal equipment parking (top picks and internal transfer vehicles), a new container terminal maintenance warehouse, as well as staff and longshore worker parking.

2.1.3. **Maplewood Marine Restoration Project**

Marine habitat impacts caused by the infilling activities were offset by the Maplewood Marine Restoration Project (MMRP). A recipient of the Innovation in Sustainability Award from Engineers and Geoscientists of BC, the MMRP is located on the north shore of Burrard Inlet, near the Ironworkers Memorial Bridge, in a marine site that was identified as a restoration priority by the Tsleil-Waututh Nation. A significant component of the project involved transplanting eelgrass from donor sites into the Maplewood basin. Crews transplanted ~125,000 eelgrass shoots to create a 1.5-hectare eelgrass bed, the largest eelgrass transplant ever performed in Burrard Inlet.

2.1.4. **Reconfiguration of the Container Yard**

In coordination with the Western and Eastern Expansion, the existing terminal container yard was reconfigured and optimized as part of the project. This reconfiguration is a critical piece of the 60% increase in the terminal's annual container capacity. Reconfiguration works included:

- Implementing a consistent container orientation across the terminal.
- Building new intra-terminal roadways.

- Building a new terminal fuel facility in a different location.
- Moving and upgrading the terminal's existing reefer towers and building two completely new reefer units in order to increase the capacity to plug refrigerated containers while on terminal.
- Overhauling site utilities including communications, electrical, water, storm and sewage systems.

2.1.5. Expansion of the Intermodal Yard

The Centerm Intermodal Yard (IY) was completely overhauled as part of the CEP. The IY was extended to the east and west, and a fifth rail track was added. This additional track necessitated the transition from the existing Rubber Tire Gantry cranes (RTG) to more modern and fully electric Rail Mounted Gantry (RMG) cranes. These new cranes are fully electric replacing diesel powered cranes, more efficient and can be operated from the COF.

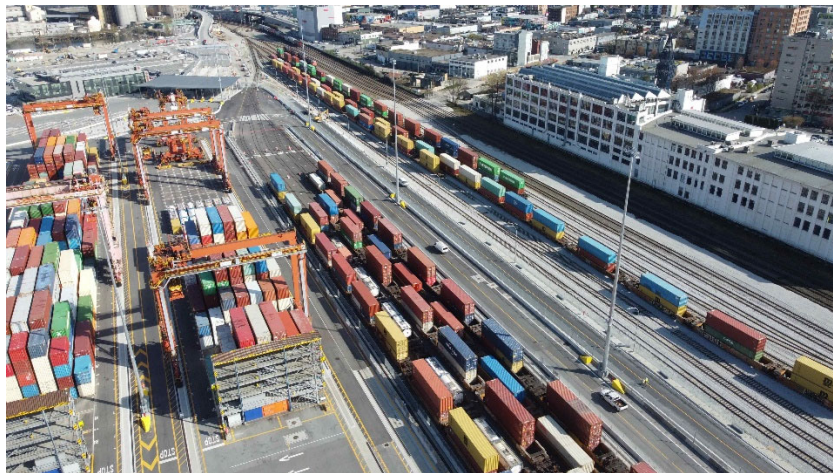


Figure 3: Intermodal Yard expansion completed (April 2023).

2.1.6. New Truck Gates

A modernized Truck Gate system was installed. This new system offers improved security, increased efficiency, and more staging area for inbound trucks. This system decreases truck wait times, which reduces congestion and idling of trucks on the terminal and greater port lands.



Figure 4: Truck gate completed (July 2022).

2.1.7. New Container Operations Facility (COF)

To make way for the expanded intermodal yard, the existing terminal operations center (the Container Main Office or “CMO”) needed to be demolished. Before this could happen, a new operations center needed to be built. The Container Operations Facility (COF) was created from the historic 1920’s Ballantyne Shed 1 building. Heritage components of the existing building were retained including the façade and mass concrete elements that are now exposed to view within the new building. A new steel frame portion of the building was also built. Mini piles were installed under the heritage structure to replace the failing historic foundations. The COF now hosts state of the art technology, and serves as the Command-and-Control Centre for the terminal operator.

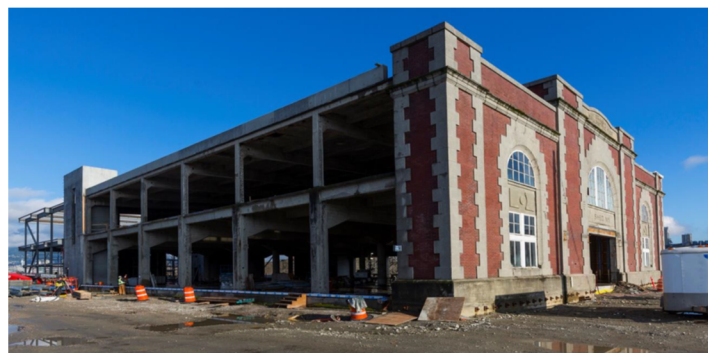


Figure 5: Container Operations Facility (COF)

2.2. Off-Terminal Improvements

2.2.1. Centennial Road Overpass (CROP)

The Centennial Road Overpass (CROP) was built between the Clark Drive port gates and the Centerm terminal. This overpass streamlines Centerm truck traffic by reducing the number of at-grade rail crossings that must be navigated.



Figure 6: The Centennial Road Overpass being used by Centerm container trucks.

2.2.2. Waterfront Road Extension

Waterfront Road, an existing port land roadway to the west of Centerm, was extended to connect to the road network on the east side of the terminal. This extension provides direct access to Canada's Highway 1 for all of the port authority's south shore lands, helping reduce port related traffic on Vancouver's city streets.

2.2.3. Rail Yard Reconfiguration

The rail yard immediately south of the Centerm Terminal, the M-Yard, has been reconfigured to accommodate the Waterfront Road extension, and the expanded terminal IY. A new at-grade rail crossing was built to service the new IY gate. Rail yard operations were maintained during this work, with all activities occurring during short duration outages.

2.2.4. Vehicle Access Control System (VACS) Gates

As part of the Project, two new security gates were installed at the Clark Drive and Main Street port entrances. These gates provide improved security for the port lands while allowing for increases to vehicle traffic on the port lands. The Clark Drive VACS also received a new roundabout intersection; this was selected as a safer alternative to a traditional intersection to manage the flow of traffic through the area.

2.2.5. Heatley Demolition

The Heatley Overpass used to be the main access point for trucks coming in and out of the Centerm terminal. The overpass was demolished to make room for the expanded IY, new Truck Gates and the Waterfront Road Extension. The city side of the Heatley Overpass is being restored to present day City of Vancouver standards.

3. Goals and Objectives

3.1. Enabling Canada's Trade

As a Canada Port Authority, the Port of Vancouver is mandated to enable Canada's trade while protecting the environment and considering local communities. Trade through the Port of Vancouver connects Canadian businesses and consumers with the variety of products that Canadians use every day from markets across the globe. As Canada's largest port, the Port of Vancouver handles \$1 in every \$3 of Canada's trade in goods outside of North America.

Container terminals on Canada's west coast are projected to run out of space for new container traffic by the mid-to-late 2020s. As part of its response to this problem, the Port of Vancouver completed the Centerm Expansion Project and South Shore Access Project. The added storage and improved efficiency created by these projects will help the Port of Vancouver in its efforts to meet the increasing demand for goods shipped by container.

3.2. Sustainability

The Port of Vancouver’s vision is to become the world’s most sustainable port. A sustainable port delivers economic prosperity through trade, maintains a healthy environment, and enables thriving communities through collective accountability, meaningful dialogue, and shared aspirations.



The Centerm Expansion Project was designed to support the Port of Vancouver’s sustainability goals from the outset. Some of the project’s sustainability achievements are summarized in Table 1 CEP Sustainability Achievements.

Economic prosperity through trade	Healthy environments	Thriving communities
<p>A 60% increase in terminal capacity.</p> <p>350 full-time equivalent jobs per year during construction period.</p> <p>800-900 new jobs for ongoing operations related to the expansion.</p> <p>1700-1900 jobs estimated to be created in the greater port economy (logistics, supply chain, transloading, and distribution).</p>	<p>Received the Envision Platinum Award. Envision is a sustainable infrastructure rating system that uses a comprehensive framework of 60 sustainability criteria that address a full range of environmental, social, and economic impacts.</p> <p>Pursuing LEED Gold certification for the new Centerm operations and administration building (in process).</p> <p>Environmental mitigation efforts based on air quality, noise, and marine and terrestrial environmental studies to minimize anticipated environmental effects.</p> <p>Creation of Maplewood Marine Restoration Project (MMRP) on the North Shore to create high-grade marine habitat as an offset. The MMRP was the recipient of the Innovation in Sustainability Award from Engineers and Geoscientists of BC.</p>	<p>Remove port-related traffic from city roads.</p> <p>Mitigated construction impacts (noise, traffic).</p> <p>Providing a financial contribution to support the wellbeing of the local community, with recipients based on feedback through public engagement. Contributions include:</p> <ul style="list-style-type: none"> • \$125,000 to Ray-Cam Community Centre • \$125,000 to Strathcona Community Centre • \$250,000 to local First Nations • \$1 million to CRAB Park improvements to be made by the Vancouver Park Board <p>Created the Centerm Community Fund, a \$500,000 fund to be allocated over a three-year period to help support communities that border on south shore port lands.</p>

	<p>The use of recycled concrete material for fill reduced the need for the manufacture and transport of new fill materials.</p> <p>Implementation of a shore power system to reduce docked ship emissions.</p> <p>Electrification of certain on-terminal equipment to reduce emissions.</p>	
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Table 1 CEP Sustainability Achievements

4. Discussion

4.1. Background

The Centerm Terminal, situated on the south shore port lands, serves as a crucial hub responsible for approximately 20% of the containerized cargo flow in the Gateway. The terminal was projected to reach its full capacity by the mid-2020s. However, the underlying historic pier at Ballantyne had deteriorated and was no longer fit for service by the late 2000s.

The Centerm Expansion Project (CEPSSAP) at the Port of Vancouver encompasses a comprehensive set of improvements targeted at the terminal itself and the port's surrounding road infrastructure. The primary objectives of these enhancements are to address the anticipated near-term surge in container demand passing through Vancouver and enhance the overall efficiency of the transportation network supporting the port operations.

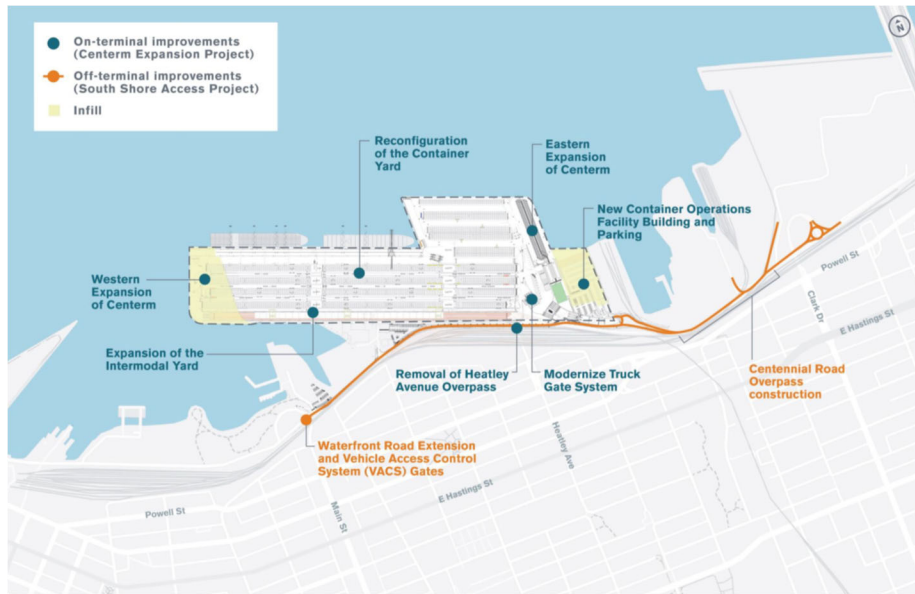


Figure 7: CEP and SSAP Project Overview

4.2. Objectives and Methodology

The Centerm Expansion Project (“CEP”) was aimed at increasing the Port’s container handling capacity by 60% by increasing the terminal footprint by 15% and reconfiguring the existing container terminal. The existing rail tracks and crossing were upgraded to decrease the congestion within the terminal. The south shore port lands are an economic engine for Canada, and a key component of the region’s trade capacity; the Centerm Terminal and other south shore port land tenant operations were maintained throughout the construction process.

The construction was undertaken via a Design Build procurement methodology to facilitate the coordination of the work on various areas, and manage the project interfaces efficiently.

4.3. Hardware and Software Used

The project was managed using industry standard software tools. Drones were used at least weekly to document and review progress in all areas.

4.4. Project Cost

The overall total project cost is approximately \$580 million (Canadian dollars) with the On-Terminal portion representing 80% of the cost.

4.5. Performance Measures

- 1 million TEUs capacity reached within months of completion of the project,
- Full intermodal yard rail capacity achieved,
- Reduction of truck processing at the gates from several minutes to less than a minute (there are between 1000 to 2000 trucks per day),
- Berth 6 shore power successful connection,
- Project awarded Envision Platinum award,
- 1.8 million hours with no lost time incident.

4.6. How the Project Fulfills the Award Criteria

The Port of Vancouver asks that the AAPA consider the Centerm Expansion Project for a Facilities Engineering Award based on the merits listed in the following sections.

4.6.1. Engineering Innovation

By modernizing terminal equipment, optimizing the terminal layout, and increasing the terminal land mass by only 15%, the Centerm Expansion Project was able to drastically increase the capacity of an existing container terminal in the heart of downtown Vancouver. This required the coordination of engineering efforts by the Owner, the Design Builder and the Terminal Operator.

4.6.2. Unique Solutions

The CEP was able to implement unique solutions throughout the project. These include:

- Reuse of the Ballantyne Shed (Heritage building) for the Container Operations Facility.

- Installation of mini-piles as a component of the new foundations for the Container Operations Facility.
- The use of recycled concrete material throughout the project to minimize the need for new fill material.
- The use of dredge material which would have otherwise been disposed at sea.
- Electrification of handling equipment for the rail yard.
- State of the art truck gates.

4.6.3. **Exceptional Measures**

The CEP and SSAP were completed in the Port of Vancouver's south shore port lands. Maintaining the continuity of port land operations throughout the project duration was required. Highlights of these efforts include:

- Coordinating the establishment of new work fronts with the handover of completed components to maintain Centerm terminal operations and a minimum of 3,850 TGS during terminal construction activities. It was achieved during COVID while working on accelerated schedules.
- Working in and around an active rail yard including reconfiguring said rail yard and demolishing a bridge that spanned the full rail yard width.
- Design and sequencing of construction activities to satisfy the requirements of multiple stakeholders.

5. Conclusion

The highly complex project (due to the need to maintain full operations during construction, the existing ground conditions, the sheer volume of stakeholders, the complicated schedule interdependencies between components, not to mention historic weather events and a pandemic) was successfully delivered to the satisfaction of the terminal operator and rail and road users. The terminal has been able to use the new capacity and additional volume is now transiting through the terminal helping to relieve some supply

chain congestion. Several container vessels have plugged into shore power and stopped their engines while at berth.

This project demonstrates the port authority ability to facilitate trade while protecting the environment and considering the communities in which we operate.