

World-class port ge



Two views showing construction in close proximity to active shipping and container traffic.

A lot of things have changed since 1975 when Ole Jensen, then superintendent at Dillingham Construction, worked on the construction of the original Vanterm container terminal in Vancouver.

The Port of Vancouver is Canada's largest port and the top port in North America for freight export

tonnage. A total of 71.2 million tonnes of cargo were handled in 1999 at the three container terminals which service thousands of vessels annually and facilitate trade with more than 90 nations.

The Port currently manages about one million TEU's (20 foot equivalent units or 20 foot containers) through-

put annually, about 400,000 of which is handled at Vanterm. The existing facility is a 31 hectare (76 acre) site with two container berths that can handle two Panamax ships, or alternatively one Post or Super-Panamax ship and a smaller ship. There are five gantry cranes, four of which have post-Panamax capacity, 12 rubber tire gantries and an on-dock intermodal railyard.

The original pier was constructed using concrete caissons, or big hollow boxes about 43 m long by 14 m wide with heights from the prepared sea bottom to about 19 m. They were partially built at Dillingham's drydock in North Vancouver and completed on site using slipform construction methods. Once in place, the back half of the box was filled to the top with fill and the front half was filled about half way to the top to facilitate drainage, the area behind the culvert caissons was then filled in.

Twenty five years later and Ole Jensen, now project manager with Vancouver Pile Driving Ltd. out of

ts makeover

By Correspondent Tonia Jurbin



North Vancouver, (the successor company of Dillingham) is back on the job building a 55 m by 74 m extension using pile and deck construction so that the facility can accommodate two Post-Panamax ships. This contract gave the bidder a choice of building the deck using piles and cast in place or precast decking.

The pile and deck design was chosen by the Port over the earlier box culvert caisson construction to reduce the environmental impact caused by the permanent loss of habitat under the original structure.

VPDL had the best price based on using a precast deck. The contract is worth about \$7.5 million which does

not include the price of the piling as that was supplied by the Port. Duration of the project is about eight months. The contract includes:

soil improvement behind the existing pier (including removing and re-establishing the existing surface), partial demolition of the existing pier to facilitate the tie in of the new structure, placing about 10 000 m³ of crushed limestone to prepare and

stabilize the seabed under the extension, pile driving, building the deck and extending the existing gantry rails. The Vanterm terminal remained operational during the expansion with the contractor required to work around the container traffic.

Prior to building the extension, soil improvement work was required within the existing fill material behind the boxed caissons to improve drainage during a seismic event. 146 gravel drains were installed using a 500 mm diameter pipe casing driven at depths of up to 36 m, filled to the top with drain stone and then extracted. 1100 m³ of drain stone were placed under the original pier.

A total of 131 closed ended 914 mm x 19 mm piles were driven on average 40 m. 50 of the piles were vertical load bearing piles and 44 were battered at 1:20. The remaining 37 were battered at 1:3 and had 2, 17 m-long, two Dywidag thread bars installed that were drilled 12 m below the pile tips. The battered

piles were filled to the top using about 2500 m³ of concrete.

The major challenge on this job was the pile driving itself as all of the piles were driven full length using an offshore derrick and a Delmag D62 diesel hammer.

In 2001, environmental requirements were much less forgiving than they were in 1975 with a 'zero fish kill' requirement during the pile driving.

The main species of fish that are being protected during this construction are the salmon and herring because of their commercial value, but there are also considerable tomcod and perch in this location.

The major environmental concerns on this site were concrete falling into the water in between the

precast decks during the upper decking pours, and the pressure waves caused by the pile driving which is lethal to fish. The concept of using a 'bubble curtain' to reduce the pressure waves caused by the pile driving was first used in Vancouver at the Canada Place expansion.

Vancouver Pile Driving has adapted the system to handle the longer piles at the Vanterm expansion, and while the details are a trade secret, the concept is simple. One or more plastic rings with lots of holes are placed in the water at varying depths around the pile after it is set. During the pile driving, a compressor blows air into the tubing that creates a curtain of bubbles which encompasses the pile from the mudline up as it is being driven thus considerably reducing the full impact of the pressure wave from the pile driving.

"By far the biggest challenge on this job was driving the piles at full length and delivering sufficient energy to the pile tips," says Jensen. "Not only was it tough to set and drive 50 metre plus piles, but on the piles with the 3:1 batter, we had to make sure that there were no holes in the bubble curtain. Any fish kill and we would have been shut down."

Two environmental officers using hydrophones monitored the pressure waves while the fish kill was monitored visually.

To make the old and new decks work together as one unit, the gantry rails had to be seamless. A thermite weld was used to do this by forming a mould around the joint.

The piling was brought to VPDL's yard in North Vancouver in 12 m and 19 m lengths where they were shop welded to specifications then barged to site. The precast decking built by Con-Force out of Richmond, BC as well as the limestone was transported to site by barge, and the drain stone was hauled to site by road. ♦



One of the job's more challenging aspects was building the extended gantry rails designed to handle massive loads