

Shippagan, New Brunswick, CANADA

Rehabilitation of an existing wharf

The existing "Old North Wharf" in Shippagan in the Canadian province of New Brunswick, where the St. Lawrence meets the Atlantic Ocean was scheduled for reconstruction. Due to the ever-increasing size of vessels, the dredge depth had to be increased in order to meet the requirements of the present fishing industry.

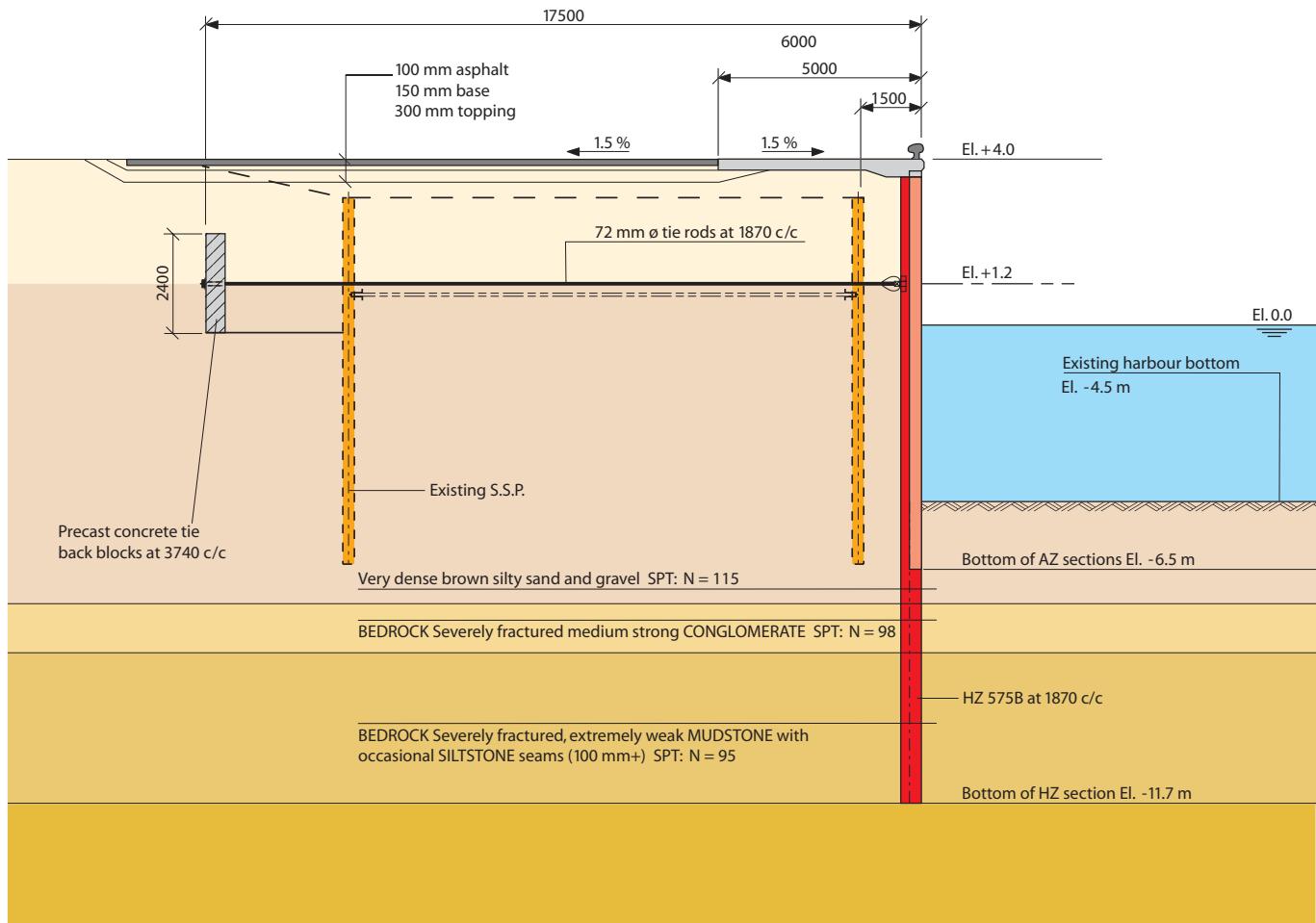
Soil investigation was assigned to AMEC Earth and Environmental Ltd who drilled five boreholes on the Old North Wharf property with a track-mounted diamond drill. The boreholes reached a depth of 7.5 m to 17.7 m below the harbour bottom.

The results of the investigations showed that the site is characterised by a two- to four-metre-thick layer of compact to dense silty sand with gravel, which overlies bedrock. The SPT-values (Standard Penetration Test) for the sand with gravel range from 20 to over 100 blows per 0.3-metre penetration. The bedrock with a strength comparable to pre-consolidated clay can be classified as extremely weak according to the Canadian Foundation Manual.

The proposed project comprised construction of a new quay wall, backfilling, and finishing of the deck.



Shippagan harbour showing the old and new north wharves on either side of the inner dock



Cross-section showing the existing and the new sheet pile wall



The owner (Public Works and Government Services, Canada) and the consulting engineer (Eastern Designers & Company Limited) both opted for a steel sheet pile solution. Several construction methods were analysed. Due to site conditions, i.e. shallow bedrock levels, and the expected lifetime of the wharf, the sheet pile solution turned out to be the most economical option. Difficult soil conditions with sandstone, mudstone, siltstone and bedrock led to the choice of an HZ/AZ combined-wall system.

Construction was scheduled to begin in July 2002 and was expected to last twelve months. The first step of the project was the removal of the existing concrete wharf deck, cope wall, wood fenders, guide rails and related hardware. Then the HZ 575 king piles and the AZ 13 intermediary sheet piles were driven 1.5 m in front of the existing structure. The space between the new and existing wharves was backfilled with dredge material. The demolished concrete deck of the old quay made way for dredged sand that was piled up to an elevation of +3.5 m behind the newly installed combined sheet pile wall. The shoreline area between the North and South wharves was also closed with a sheet pile structure.

New sheet pile wall installed 1.5 m in front of the existing wall

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The two-level template ensures the king piles are correctly positioned for driving

Owner:
Public Works and Government Services,
Canada

Contractor:
Comeau & Savoie Construction Ltd

Designer:
Eastern Designers & Company Limited

Sheet pile system:
HZ 575 B -12/AZ13 and
HZ 575 C -12/AZ 13

Length of HZ king piles:
15.75 m / 17.55 m

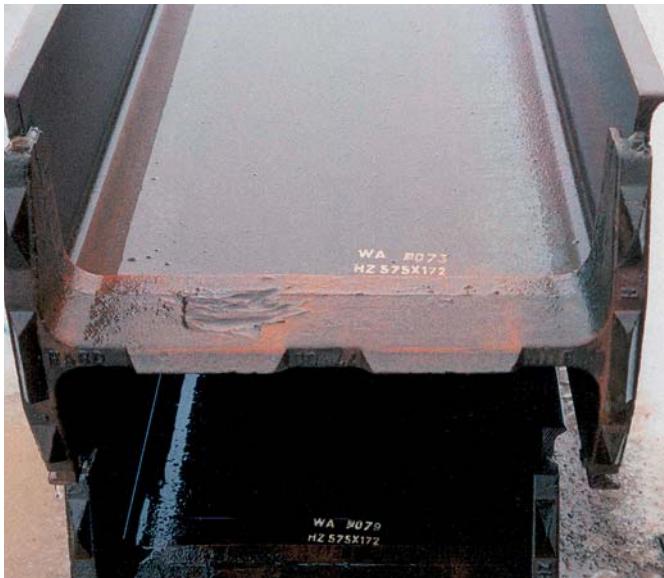
Length of AZ sheet piles:
10.55 m / 11.55 m

Steel grade:
CSA Gr 350 W, except HZ connectors
S 430 GP.

Total quantity of sheet piles:
800 metric tons

A Delmag D19-32 diesel impact hammer was placed on the existing wharf to drive the steel sheet piles through the top soil layers and into the hard mudstone. Pre-drilling was not necessary despite tough soil conditions. Special "driving shoes" produced by APF in New Jersey, USA protected the HZ piles from damage during the driving process. The contractor Comeau & Savoie Construction Ltd built a two-level template in their workshop to facilitate the installation of combined sheet pile walls. The design of the template was based on conceptual drawings supplied by Arcelor adapted to accommodate the driving shoes.

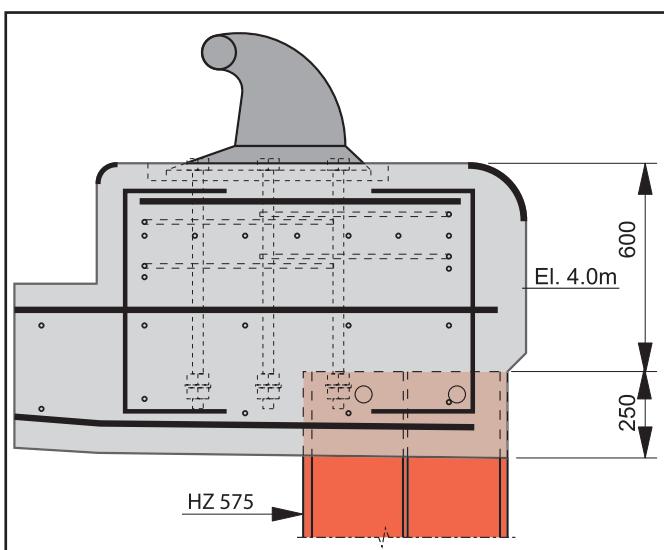
The installation of the sheet piles proceeded smoothly and was executed in accordance with recommendations of Arcelor's Canadian office Skyline Canada. Despite encountering hard driving conditions, only three HZ beams could not be driven to the desired depth. The embedment length of those king piles was reduced and the AZ sheet piles were driven until they encountered the rock layer. The contractor was able to drive five HZ king piles and five AZ sheet piles during a typical shift of ten hours. All driving was completed within seven weeks.



Driving shoes protect the pile toe from damage when hard soil layers are expected during driving



Eight guiding shoes – four per template level – guide each HZ king pile



Steel sheet pile – capping beam connection detail with bollard

After the installation of the combined-wall system, the contractor proceeded with placement of the concrete tie-back blocks, installation of the tie rods, backfilling between existing and new structures and, finally, installation of a concrete and asphalt wharf deck.

Skyline Canada delivered a complete solution to the contractor, including steel sheet piles and tie rods. The eye tie rods were produced by Anker Schroeder from Dortmund, Germany. The 3.75-inch tie rods are made of S 355 JO steel according to DIN EN 10025. Each tie rod linked an HZ king pile to the concrete tie-back blocks. ■