

Detailed Design of Marine Terminal in Edward's Cove, Labrador

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ABSTRACT

In 2003, Westmar Consultants Inc. undertook the detailed design of Voisey's Bay Nickel Company's marine terminal in Edward's Cove in northern Labrador. To facilitate year-round shipping, the design had to withstand the harsh ice conditions at the site. The design was complicated by environmental regulations which limited dredging of the weak seabed clay layer, resulting in difficult foundation conditions. The construction of the terminal was completed in July 2005 and the first ship arrived in November 2005. The terminal serves as a transportation hub for re-supply cargo and nickel concentrate export from mine operations.

KEY WORDS: VBNC; SSPC; cell; interlock; monitor; instrumentation; ice strengthening.

NOMENCLATURE

B = effective width of section
 k_{01} = basic subgrade modulus
 k_h = horizontal subgrade modulus
 k_v = size corrected subgrade modulus
L = centre-to-centre distance of main cell and arc cell
 n_h = constant
P = lateral earth pressure inside cell
r = radius of cell
t = interlock stress in main cell
 t_{cw} = interlock stress in cross wall
Z = depth
 θ = angle from SSPC axis to connecting pile

INTRODUCTION

Voisey's Bay Nickel Company's (VBNC) marine terminal is located in Edward's Cove, Anaktalak Bay, on the northern coast of Labrador. The terminal serves as the transportation hub for re-supply cargo and nickel concentrate export for VBNC's mine operations. The terminal is used for year-round shipping and the bay is subject to ice conditions.

As is the case for many Arctic locations, the terminal is located in an environmentally sensitive area. The resulting limitations on the scope of the in-water work proved to be challenging for the design of the wharf structure; in addition, the existing seabed comprises soft sediments which provide low bearing capacity for foundations.

Construction of the VBNC wharf structure incorporated conventional, proven structural solutions with innovative design and analysis to realize an effective solution for this difficult site. Analysis results were coupled with a monitoring program to assist in the construction process.

SITE CONDITIONS

Geotechnical Conditions

The geotechnical site investigation was carried out by Jacques Whitford Company Inc. (JWC) of St. John's, NL (formerly Newfoundland Geosciences Ltd.). The investigation showed that the seabed consisted of the following stratification:

- Clayey sand (1.0 m to 6.5 m) overlying;
- Clay (1.0 m to 3.8 m) overlying;
- Sand with gravel (2.5 m to 8.9 m) overlying;
- Bedrock.

Basic soil properties were provided by JWC (presented in Table 1).