

Helical Piles and Tiebacks

Project: Ontario Science Centre - Wall Rehabilitation

Location: Toronto, Ontario

Date: November 2013

Challenge:

Inspection of several wood "dead man"-type retaining walls identified bowing and yielding with movement at the joints. The existing retaining walls create pedestrian walkways along the west and south slopes below the Ontario Science Centre campus, and range in exposed wall face heights of 0.8 to 1.4 meters (2.6 to 4.6 feet) and lengths from 10 to 24 meters (33 to 79 feet). The Toronto and Region Conservation Authority (TRCA), having jurisdiction over the land on which the Science Centre is located, specified the preservation and stabilization, or, if necessary, replacement of the failing timber walls. A geotechnical investigation determined that global slope instability was not a concern. Equipment and machinery used for the project would be limited by available access to the steep and wooded slopes and requirements of minimal site disturbance and noise during construction.

Solution:

Rehabilitation of existing timber walls included the construction of new poured concrete wall facing. The reinforced concrete walls would be framed with structural steel elements and supported vertically and laterally with helical piles and tiebacks. The project engineer specified an ultimate pile capacity of 110 kN (\approx 25 kips) in compression and ultimate tieback capacities of 110 to 128 kN (\approx 25 to 29 kips) in tension. Due to the equipment limitations, a hand held drive unit, powered by a remote hydraulic source, was used to install both the helical piles and tiebacks. Fifty-eight (58) Model 288 (2.875-inch OD by 0.276-inch wall) round shaft helical piles with an 8"-10" double-helix plate configuration were installed vertically to support the compression loads. The piles were advanced to depths from 16 to 28 feet and to final installation torque values to correlate to an ultimate pile capacity of at least 25 kips. The piles were fitted with new construction brackets which were welded to the steel framing of the concrete walls. Fifty-four (54) Model 150 (1.5-inch round corner square bar) helical tiebacks with an 8"-10" double-helix lead configuration were installed through carefully cut holes in the timber walls and connected to steel channels at the tops and bottoms of the cast-in-place walls. Thirty (30) tiebacks were installed at a batter angle of 30 degrees from vertical and 24 tiebacks were installed at a batter angle of 60 degrees from vertical. The tiebacks were advanced to lengths of 16 to 32 feet and to their respective torque-correlated ultimate capacities of 25 and 29 kips. Installation of both the helical piles and tiebacks was completed in 21 days.

Project Summary

Structural Engineer: Genivar

Geotechnical Engineer: Coffey Geotechnics

General Contractor: Tower Restoration, Inc.

Project Consultant: PERZIA GeoSolutions

Certified Installer: Foundation Supportworks® of Ontario

Products Installed: (58) Foundation Supportworks® HP288 Helical Piles, 8"-10" Lead Section, Installed to Depths of 16 to 28 feet, Ultimate Compression Capacity of 110 kN (25 kips); (54) HA150 Helical Tiebacks, 8"-10" Lead Section, 30-degree and 60-degree Installation Angles, Tieback Lengths from 16 to 32 feet, Ultimate Tension Capacities of 110 and 128 kN (25 and 29 kips)



Original wall section with safety fencing



Hand held unit; installation aided by platform and tripod



Helical piles and tiebacks installed



Wall corner detail



Finished cast-in-place wall face