

## Model 287 Helical Piles

**Project:** John McCrae High School

**Location:** Toronto, Ontario

**Date:** April 2013

### Challenge:

An approximate 510 square meter (55,000 square foot) building addition was proposed to create a ground floor for the southern two-thirds of the existing two-story elevated John McCrae High School in Toronto, Ontario. The original building was constructed in 1968 and essentially consisted of three interconnected structures supported on shear walls and drilled shaft foundations. Portions of the school were known to have been built over or near an abandoned landfill. Six geoprobes advanced during the geotechnical investigation identified very loose to loose uncontrolled sand fill with landfill debris to depths of 1.6 to 4.6 meters (5.3 to 15.1 feet). Medium dense to dense silt was generally observed below the fill. Methane gas release was reported from one open probe hole, which required venting prior to completion. The discovery of gas and landfill material prompted consideration of a deep foundation alternative that would not create spoils and could be sealed off after installation to prevent the upward migration of subsurface gases. The overhead clearance in some areas of the project was limited to 3.1 meters (10 feet). The construction schedule required completion of the building addition footings and floor slab within a three week timeframe.

### Solution:

Helical piles were chosen as the ideal deep foundation solution for this project given the limited overhead clearance and the ability to install the piles quickly without generating spoils. During pile installation, adjustments in location and installation angle had to be made for many of the piles after encountering unknown underground service lines including a five-foot diameter storm sewer. Six hundred twenty-three (623) Model 287 (2.875-inch OD by 0.203-inch wall) round shaft helical piles with an 8"-10"-12" helix blade configuration were installed to depths ranging from 3.1 to 5.5 meters (10 to 18 feet) to support the proposed footings and floor slab for the addition. The helical piles were designed in accordance with the Ontario Building Code using Limit State Design (LSD) methodology. The helical pile factored compression loads were 70 kN ( $\approx$  16 kips) and the required nominal resistance (ultimate pile capacity) was 175 kN ( $\approx$  40 kips) using a resistance factor of 0.4. Prior to the installation of the production piles, two compression load tests were performed on sacrificial piles to verify capacity and monitor any creep movement. The test and production piles were installed to a minimum final termination torque of 4,400 ft-lb for a torque-correlated ultimate capacity of at least 175 kN ( $\approx$  40 kips). The helical piles were grout filled prior to field welding the new construction pile caps. A methane gas barrier system was installed above the subgrade and around each helical pile prior to pouring the concrete floor slab. The 623 helical piles were installed within the allotted three week schedule.

## Project Summary

**Structural Engineer:** Blackwell Bowick

**Geotechnical Engineer:** SPL Consultants

**General Contractor:** Struct-Con Construction

**Certified Pile Installer:** Foundation Supportworks® of Ontario

**Products Installed:** (623) Foundation Supportworks® HP287 Helical Piles, 8"-10"-12" Lead Section, Installed to Depths of 3.1 to 5.5 meters (10 to 18 feet), LSD Factored Compression Load of 70 kN ( $\approx$  16 kips)



Compression field load testing prior to installation of production piles



Area of limited headroom; vertical and battered piles installed



Advancing helical pile lead section



New construction pile caps field welded in place



Methane gas barrier system being installed around helical piles