

## 1 GENERAL REQUIREMENTS

- 1.1 The work covered by this section includes the furnishing of all labour, materials, and equipment for the construction of the helical piles/anchors as specified within the Contract Documents.

## 2 APPROVED HELICAL PILE/ANCHOR MANUFACTURER

- 2.1 Due to the special requirements for design and manufacturing of helical piles/anchors, the manufacture of proposed piles to be installed are to meet the following criteria:
- 2.1.1 Documentation of at least five (5) years of production experience manufacturing helical piles,
  - 2.1.2 Documentation that the manufacturer's helical piles have been used successfully in at least five engineered construction projects within the last three years,
  - 2.1.3 Certificate that the helical pile/anchor components shall be manufactured by a facility whose quality systems comply with ISO (International Organization of Standards) 9001 requirements, and
  - 2.1.4 Documentation that the helical pile/anchor components shall be hot-dipped galvanized in accordance with ASTM A153
  - 2.1.5 Design drawings sealed by a professional engineer of Ontario **stating the proposed helical pile and associated geotechnical resistance factor**. It is recommended that the geotechnical resistance factor be taken from the most recent version of the Canadian Foundation Engineering manual.
  - 2.1.6 Documentation that all materials meet the requirements specified elsewhere within the contract documents.
- 2.2 Helical Pile/Anchor Installer Qualifications
- 2.2.1 Installation shall be completed by a contractor who is certified by the chosen manufacturer.

## 3 SUBMITTALS

- 3.1 In accordance with the General Conditions of the Contract and Division 1 Submittal Procedures Section.
- 3.2 One (1) set of site specific shop drawings sealed by a registered Professional Engineer in the province of Ontario. Shop drawings shall include:
- a. Helical Pile/Anchor number, location, and pattern by assigned identification number
  - b. Helical Pile/Anchor design load
  - c. Assumed geotechnical resistance factor
  - d. Type and Size of Helical Pile/Anchor shaft
  - e. Helical configuration (number and diameter of helical plates)
  - f. Minimum effective torque requirement
  - g. Grout column diameter and length
  - h. Connection details

- 3.3 Calibration reports for installation equipment utilized on the project. The calibration tests shall have been completed within one year of the date submitted.
- 3.4 The Contractor shall submit plans for pre-production test(s) for the helical piles/anchors to the Owner for review and acceptance prior to beginning load tests, as specified elsewhere within this specification. The purpose of the test is to determine the load versus displacement response of the helical pile/anchor in general conformance with ASTM D1143 Quick Test Method and provide an estimation of ultimate capacity.
- 3.5 After completion of the test(s) piles/anchors the Contractor shall submit the results to the Owner for approval to begin production helical pile/anchor installation.
- 3.6 After completion of the installation of the helical piles/anchors, the Contractor shall provide the Owner with a report of all helical piles/anchors installed on the project certifying the ultimate load capacity of the piles/anchors installed, sealed by a Professional Engineer registered in the province of Ontario.

## **4 MATERIALS**

### **4.1 Helical Piles**

- 4.1.1 SS5 1-1/2" (38 mm) Material: Hot rolled Round-Cornered-Square (RCS) solid steel bars meeting dimensional and workmanship requirements of ASTM A29. The bar is a modified medium carbon steel grade (similar to AISI 1044) with improved strength due to fine grain size. Torque strength rating = 5,700 ft-lb (7730 N-m); Minimum yield strength = 70 ksi (483 MPa).
- 4.1.2 SS175 1-3/4" (44 mm); SS200 2" (51 mm); SS225 2-1/4" (57 mm) Material: Hot rolled Round-Cornered-Square (RCS) solid steel bars meeting the dimensional and workmanship requirements of ASTM A29. The bar is a High Strength Low Alloy (HSLA), low to medium carbon steel grade with improved strength due to fine grain size. Torque strength rating: SS175 = 11,000 ft-lb (14,900 N-m); SS200 = 16,000 ft-lb (21,700 N-m); SS225 = 21,000 ft-lb (28,475 N-m); Minimum yield strength = 90 ksi (621 MPa).
- 4.1.3 Type RS2875 2-7/8" (73 mm) OD Material: Structural steel tube or pipe, welded or seamless, in compliance with ASTM A500 or A618. Wall thickness is 0.203" (5.2 mm) or 0.276" (7 mm). Torque strength rating: RS2875.203 = 5,500 ft-lb (7,500 N-m); RS2875.276 = 8,000 ft-lb (10,850 N-m). Minimum yield strength = 50 ksi (345 MPa).
- 4.1.4 Type RS3500 3-1/2" (89 mm) OD Material: Structural steel tube or pipe, seamless or straight-seam welded, per ASTM A500, or ASTM A618. Wall thickness is 0.300" (7.6 mm). Torque strength rating = 13,000 ft-lb (17,600 N-m). Minimum yield strength = 50 ksi (345 MPa).

### **4.2 Corrosion Protection**

- 4.2.1 All helical pile shafts and helices shall be hot-dipped galvanized in accordance with ASTM A153 after fabrication.

#### 4.3 Grouting Material

- 4.3.1 Cement for Helical Pulldown Micropile grout shall be Type G Portland cement conforming to CSA A3000 Cementitious Material Compendium.
- 4.3.2 Water for mixing grout shall be potable, clean and free from impurities, which may be detrimental to grout or steel. Potable water shall be available in quantities sufficient to mix grout and for equipment clean-up.
- 4.3.3 Sand fillers may be used in the grout mix as an extender with large diameter grout columns, subject to the approval of the engineer. Use fine sand only. Medium or coarse sand not be permitted. Small diameter grout columns shall not include aggregate.

### 5 EXAMINATION AND ACCEPTANCE OF SITE CONDITIONS

- 5.1 General Contractor shall inspect, accept and certify in writing to the helical pile/anchor subcontractor that site conditions meet specifications for the following items prior to installation of the helical piles/anchors;
  - 5.1.1 Verify sub-grade preparation and elevations conform to the specified requirement.
  - 5.1.2 Verify location, alignment, and elevations of helical piles/anchors.
  - 5.1.3 Verify location, alignment, and elevations of any services within work area.
  - 5.1.4 The General Contractor shall verify that all helical piles/anchors may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc.
  - 5.1.5 In the event of a discrepancy, the General Contractor shall notify the Owner. The General Contractor shall not proceed with helical pile/anchor installation in areas of discrepancies until said discrepancies have been resolved. All costs associated with unresolved discrepancies shall be the responsibility of the Owner.
  - 5.1.6 Do not proceed with installation of helical piles/anchors until sub-grade soil conditions are corrected by the General Contractor.

**6 INSTALLATION**

- 6.1 A torque indicator shall be used during helical pile/anchor installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-line with the installation tooling. Torque indicators shall meet requirements set forth by helical pile/anchor manufacturer.
- 6.2 If the helical pile/anchor is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. The obstruction shall be removed, if feasible, and the helical pile/anchor re-installed. If the obstruction cannot be removed, the helical pile/anchor shall be installed at an adjacent location, subject to review and acceptance of the owner.
- 6.3 If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to proper positioning of the last plain extension section relative to the final elevation, the contractor may remove the last plain extension and replace it with a shorter length extension. If it is not feasible to remove the last plain extension, the Contractor may cut said extension shaft to the correct elevation. The Contractor shall not reverse (back-out) the helical pile/anchor to facilitate extension removal.
- 6.4 The Contractor shall record the torque values for each individual helical pile/anchor at 300mm (1 foot) increments during installation. These records shall be available to the Owner at their request.

**7 PRE-PRODUCTION LOAD TEST**

- 7.1 Perform **(two)** of load test(s) in compression and **(two)** of load test(s) in tension. All load tests shall be completed according to ASTM D1143 and ASTM D3689.
  - 7.1.1 Tested helical piles shall not exceed 25 mm of total movement when loaded to ULS capacity, and no more than 40 mm total movement when loaded to ultimate resistance capacity.

**8 FIELD QUALITY CONTROL**

- 8.1 Centerline of helical pile/anchor shall not be more than 75 mm (3 inches) from indicated plan location.
- 8.2 Helical pile/anchor plumbness shall be within 2° of design alignment
- 8.3 Top elevation of helical pile/anchor shall be within ±50mm (2 inches) of the design vertical elevation.

**END OF SPECIFICATION**