

## **Evaluation Report CCMC 13193-R**

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## ***Chance Helical Pile***

### ***1. Opinion***

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “Chance Helical Pile”, when used as an auger-installed steel pile in a foundation system in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2010:

- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Clause 4.2.3.8.(1)(e) Steel Piles
  - Sentence 4.2.3.10.(1) Corrosion of Steel
  - Sentence 4.2.4.1.(1) Design Basis
  - Subclause 9.4.1.1.(1)(c)(i) General (structural requirements)

This opinion is based on CCMC's evaluation of the technical evidence in Section 4.1 provided by the Report Holder.

Ruling No. 07-08-166 (13193-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2007-03-20 (revised on 2010-06-22) pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

### ***2. Description***

The product is an earth anchor constructed of helical-shaped, circular steel blades welded to a steel shaft. The blades are constructed as a helix with a carefully controlled pitch and are available in diameters of 203 mm, 254 mm, 305 mm, and 356 mm. The anchors come with one, two, three, or four helical blades. The spacing between the 203-mm and 254-mm blades is 610 mm, the spacing between the 254-mm and 305-mm blades is 760 mm, and the spacing between the 305-mm and 356-mm blades is 914 mm. The diameter and number of blades are chosen based on the bearing capacity of the soil and the load that the auger-installed steel pile is designed to support. The central shaft transmits torque during installation and transfers axial loads to the helical blades. The central shaft also provides most of the resistance to lateral loading. The shaft is a 44.5-mm

square solid steel bar. The foundation system comes with other accessories, such as support plates to anchor the pile to the building structure, extension shafts, and connectors.

The steel shaft, blades and accessories that make up the product have a galvanic coating and conform to CSA-G40.21-M98, “General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel”.

Figure 1 shows a typical steel pile with three helical bearing plates.

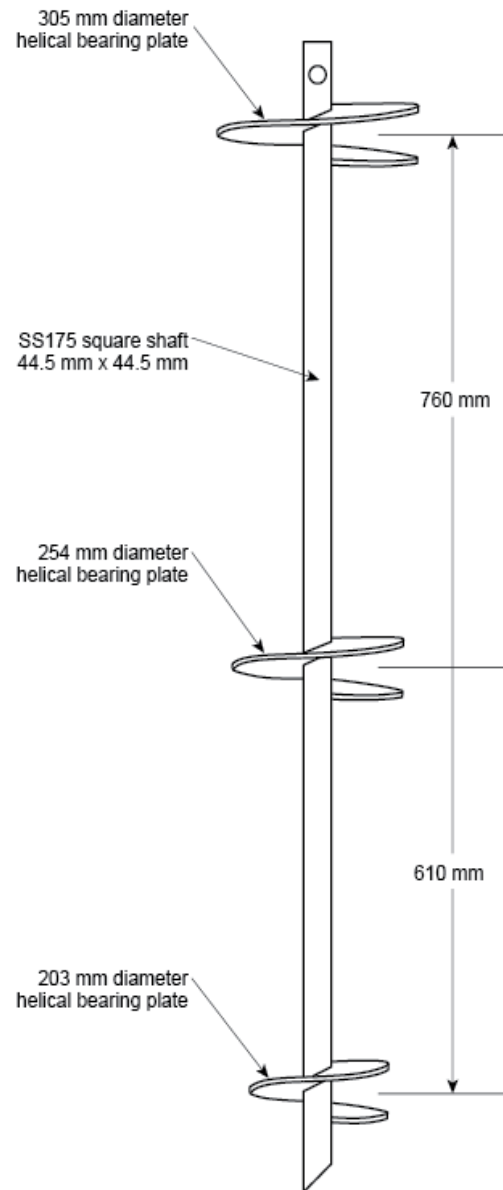


Figure 1. “Chance Helical Pile”

### 3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the “Chance Helical Pile” being used in accordance with the conditions and limitations set out below.

- When the product is installed as a deep helical foundation system in undisturbed soil, such as granular soil, silt, and some clays, there is a direct relationship between the applied torque and the allowable compressive

and tensile loads. Table 1 indicates the allowable compressive and tensile loads as a function of the applied torque.

- When the auger-installed steel pile is installed in disturbed or sensitive soil, such as uncontrolled fill and sensitive clays, the relationship between the applied torque and the allowable compressive and tensile loads is not as predictable as when the steel pile is installed in undisturbed soil. When it is installed in disturbed or sensitive soils, the allowable compressive and tensile loads must be confirmed by on-site load tests. These load tests are also required if the allowable loads need to be greater than those stated in Table 3.1. The tests must be conducted under the direct supervision of a professional geotechnical engineer skilled in such design and licensed to practice under the appropriate provincial or territorial legislation.
- In all cases, a registered professional structural engineer skilled in such design and licensed to practice under the appropriate provincial or territorial legislation must determine the number and spacing of the auger-installed steel piles required to carry the load.
- In all cases, the geotechnical engineer must provide a certificate attesting to the conformity of the installation and the allowable loads for the piles.

• **Table 3.1 Allowable compressive and tensile loads for the proposed auger-installed steel pile<sup>(1)(2)(3)</sup>**

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	lbf	kN	lb	kN	lb
678	500	11.2	2500	8.8	2000
1356	1000	22.4	5000	17.6	4000
2034	1500	33.6	7500	26.4	6000
2712	2000	44.7	10000	35.3	8000
3390	2500	55.9	12500	44.1	10000
4068	3000	67.1	15000	52.9	12000
4746	3500	78.3	17500	61.7	14000
5424	4000	89.5	20000	70.5	16000
6102	4500	100.7	22500	79.3	18000
6780	5000	111.9	25000	88.1	20000
7458	5500	123.1	27500	97.0	22000
8136	6000	134.2	30000	105.8	24000
8814	6500	145.4	32500	114.6	26000
9492	7000	156.6	35000	123.4	28000
10170	7500	167.8	37500	132.2	30000
10848	8000	179.0	40000	141.0	32000
11526	8500	190.2	42500	149.8	34000
12204	9000	201.4	45000	158.7	36000
12882	9500	212.6	47500	167.5	38000
13560	10000	223.7	50000	176.3	40000

**Notes to Table 3.1:**

- (1) The allowable loads identified in this table are only valid when the product is installed in undisturbed soils, such as granular soil, silt and some clays. Special attention is required when the auger-installed steel piles are installed in recently backfilled sites or in disturbed or sensitive soils, such as uncontrolled fill and sensitive clays. In these cases, Table 3.1 does not apply and the allowable loads need to be determined by on-site confirmatory testing.
  - (2) The allowable loads for uplift stated in Table 3.1 are applicable to deep helical foundation systems. A deep helical foundation system is a system whose top helix is embedded at a depth of at least 7 times its diameter.
  - (3) For shallow helical foundation systems, i.e. embedment depth is less than 7 times the diameter of the top helix, a larger safety factor should be used. It is recommended to use a safety factor of 3 on the ultimate load in order to determine the allowable uplift load. In addition, a pile load test may be necessary to determine the uplift capacity of the helical foundation system.
- The installation of the auger-installed steel pile must be carried out in accordance with the manufacturer's instructions. The anchors must be screwed into the ground using mechanized equipment. The anchor must be rotated into the ground with sufficient applied downward pressure (crowd) to advance the anchor one pitch distance per revolution. The anchor must be advanced until the applied torque value attains a specified value. Extensions must be added to the central shaft as needed. The applied loads may be tensile (uplift), compressive (bearing), shear (lateral), or a combination thereof. Helical anchors can be installed quickly in a wide variety of soil formations using a variety of readily available equipment. They are ready for loading immediately after installation.
  - When the product is installed in soil conditions that are corrosive to steel, adequate protection to the exposed steel must be provided.
  - Installers of the proposed auger-installed steel piles must be certified by Hubbell Power Systems, Inc. Using approved equipment, the installer must follow the manufacturer's installation instructions and the conditions and limitations specified in this Report. Each installer must carry a certification card bearing their signature.
  - Each proposed auger-installed steel pile must be identified with a label containing the following information:
    - manufacturer's identification; and
    - the phrase "CCMC 13193-R."
  - The product may be used as a foundation system to support various constructions, provided that it is installed according to the manufacturer's current instructions and within the scope of this Evaluation Report.

## **4. Technical Evidence**

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

### **4.1 Performance Requirements**

The proposed auger-installed steel piles were tested in accordance with ASTM D 1143-81(1994)e1, "Standard Test Method for Piles Under Static Axial Compressive Load," ASTM D 3689-90(1995), "Standard Test Method for Individual Piles Under Static Axial Tensile Load," and ASTM D 3966-90, "Standard Test Method for Piles Under Lateral Loads."

Testing was conducted on two different sites. The first site was composed of fine-grained material including layers of silty clay overlying layers of clayey and sandy silts. The second site was composed mainly of granular material including sand and gravelly sand. A series of 18 tests were performed. The intent of the testing was to determine a correlation between the torque applied during installation and the allowable loads. In all three soil types (granular soil, silt, and some clays), there was a good correlation between the torque applied during installation and the allowable loads. For the compressive and tensile loads noted in Table 3.1, the safety factor was 2. For the lateral loads, no correlation was possible.

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