Evaluation Report CCMC 13691-R
ALMITA HELICAL SCREW PILE

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "ALMITA HELICAL SCREW PILE", when used as an augered 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)(a), Division A, using the following acceptable solutions from Division B:
  - 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 provided by the Report Holder.

2. Description

The product is a screw pile constructed of helical-shaped circular steel blades that are welded to a steel shaft. The blades are constructed as a helix with a carefully controlled pitch.

The anchors come in three types: Type 1, 2 and 3. The Type 1 anchor has an outside diameter of 73 mm and a wall thickness of 5.5 mm. The helix blade has a diameter of 305 mm with a thickness of 9.5 mm. The Type 2 anchor has an outside diameter of 89 mm and a wall thickness of 6.3 mm. The helix blade has a diameter of 356 mm and a thickness of 12.7 mm. The Type 3 anchor has an outside diameter of 114 mm and a wall thickness of 6.3 mm. The helix blade has a diameter of 406 mm and a thickness of 12.7 mm.

The pile type and blade diameter are chosen based on the bearing capacity of the soil and the load the auger-installed steel pile is designed to support. The central shaft is used to transmit torque during installation and to transfer axial loads to the helical plates. The central shaft also provides most of the resistance to lateral loading. The foundation system comes with various other accessories, such as support plates to adapt to the building structure, extension shafts and connectors.

The steel shaft, blades and accessories conform to CSA G40.20-13/G40.21-13, "General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel," 300 MPa. They can have a galvanic coating that meets the requirements of ASTM A 123/A 123M-13, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," 610 g/m^3.

Figure 1 shows typical steel piles with a single helical blade.

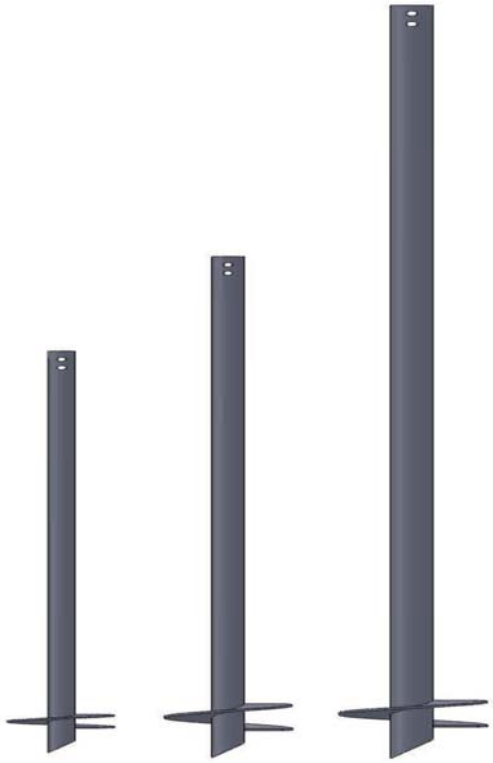

Figure 1. "ALMITA HELICAL SCREW PILE," Types 1, 2 and 3

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "ALMITA HELICAL SCREW PILE" being used in accordance with the conditions and limitations set out below.

- The product may be used as part of 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 Report.
- When the product is installed in cohesive and cohesion-less soils, there is a direct relationship between the applied torque and the allowable compressive and tensile loads. Tables 1, 2 and 3 indicate the allowable compressive and tensile loads as a function of the applied torque.
- Load tests are required if the allowable loads need to be greater than those stated in Tables 1, 2 and 3. The tests need to 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 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. A certificate attesting to the conformity of the installation and the allowable loads for the piles must be provided.

Table 1. Allowable Compressive and Tensile Loads for the Type 1 Auger-installed Pile in Cohesive and Cohesion-less Soils

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	(lbf)	kN	(lb)	kN	(lb)
678	500	11.6	2 614	11.6	2 614
1 356	1 000	23.0	5 227	23	5 227
2 034	1 500	29.8	6 702	29	6 522
2 712	2 000	36.1	8 112	34.2	7 695
3 390	2 500	42.4	9 521	39.4	8 869
4 067	3 000	48.6	10 931	44.7	10 042
4 745	3 500	54.9	12 341	49.9	11 216
5 423	4 000	61.2	13 750	55.1	12 389

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	(lbf)	kN	(lb)	kN	(lb)
6 101	4 500	67.4	15 160	60.3	13 563
6 779	5 000	73.7	16 570	65.5	14 736
7 457	5 500	80.0	17 980	70.8	15 909
8 135	6 000	86.2	19 389	76.0	17 083
8813	6500	92.5	20799	81.2	18256
9491	7000	98.8	22209	86.4	19430
10169	7500	105.1	23618	91.6	20603
10847	8000	111.3	25028	96.9	21777

Table 2. Allowable Compressive and Tensile Loads for the Type 2 Auger-installed Pile in Cohesive and Cohesion-less Soils

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	(lbf)	kN	(lb)	kN	(lb)
678	500	9.7	2187	9.7	2 187
1 356	1 000	19.5	4374	19.5	4 374
2 034	1 500	29.2	6 561	29.2	6 561
2 712	2 000	38.9	8 748	38.9	8 748
3 390	2 500	48.6	10 924	48.6	10 929
4 067	3 000	53.7	12 074	52.8	11 874
4 745	3 500	58.8	13 225	57.0	12 819
5 423	4 000	63.9	14 376	61.2	13 764
6 101	4 500	69.1	15 526	65.4	14 709
6 779	5 000	74.2	16 677	69.6	15 654
7 457	5 500	79.3	17 827	73.8	16 598
8 135	6 000	84.4	18 978	78.0	17 543
8813	6500	89.5	20 129	82.2	18 488
9491	7000	94.7	21 279	86.4	19 433
10169	7500	99.8	22 430	90.6	20 378
10847	8000	104.9	23 581	94.8	21 323
11 524	8500	110.0	24 731	99.1	22 268
12 202	9000	115.1	25 882	103.3	23 213
12 880	9500	120.2	27 032	107.5	24 157
13 558	10000	125.4	28 183	111.7	25 102

Table 3. Allowable Compressive and Tensile Loads for the Type 3 Auger-installed Pile in Cohesive and Cohesion-less soils

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	(lbf)	kN	(lb)	kN	(lb)
678	500	8.4	1 882	6.1	1 379
1 356	1 000	16.7	3 764	12.3	2 758
2 034	1 500	25.1	5 646	18.4	4 138
2 712	2 000	33.5	7 529	24.5	5 517
3 390	2 500	41.9	9 411	30.7	6 896

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	(lbf)	kN	(lb)	kN	(lb)
4 067	3 000	50.2	11 293	36.8	8 275
4 745	3 500	58.6	13 175	42.9	9 655
5 423	4 000	67.0	15 057	49.1	11 034
6 101	4 500	75.3	16 939	55.2	12 413
6 779	5 000	83.7	18 821	61.4	13 792
7 457	5 500	92.1	20 704	67.5	15 171
8 135	6 000	100.5	22 586	73.6	16 551
8813	6500	108.8	24 468	79.8	17 930
9491	7000	117.2	26 350	85.9	19 309
10169	7500	125.6	28 232	92.0	20 688
10847	8000	134.0	30 114	98.2	22 068
11 524	8500	142.3	31 996	104.3	23 447
12 202	9000	150.7	33 879	110.4	24 826
12 880	9500	159.1	35 761	116.6	26 205
13 558	10000	167.4	37 643	122.7	27 584
14 236	10 500	175.8	39 525	128.8	28 964
14 914	11 000	184.2	41 407	135.0	30 343
15 592	11 500	192.6	43 289	141.1	31 722
16 270	12 000	200.9	45 171	147.2	33 101
16 948	12 500	209.3	47 053	153.4	34 480
17 626	13 000	217.7	48 936	159.5	35 860
18 304	13 500	226.0	50 818	165.6	37 239
18 981	14 000	234.4	52 700	171.8	38 618
19 659	14 500	242.8	54 582	177.9	39 997
20 337	15 000	251.2	56 472	184.1	41 377
21 015	15 500	259.5	58 346	190.2	42 756
21 693	16 000	267.9	60 228	196.3	44 135

- The installation of the auger-installed steel pile must be carried out as per the manufacturer's instructions. The anchors must be screwed into the ground to below the frost line using mechanized equipment. The anchor is rotated into the ground with sufficient applied downward pressure (crowd) to advance the anchor one pitch distance per revolution. The anchor is advanced until the applied torque value attains a specified value. Extensions are added to the central shaft as needed. The applied loads may be tensile (uplift), compressive (bearing), shear (lateral), or a combination thereof. Helical anchors are rapidly installed in a wide variety of soil formations using a variety of readily available equipment. They are immediately ready for loading after installation.
- When the product is installed in a soil where the conditions are corrosive to steel, adequate protection to the exposed steel must be provided.
- The installer of the proposed auger-installed steel piles must be certified by Almita Piling using approved equipment. The installer must follow the manufacturer's installation instructions and the uses and limitations specified in this Report. Each installer must carry a certification card bearing their signature and photograph.
- Each auger-installed steel pile must be identified with a label containing the following information:
    - manufacturer's identification; and
    - the phrase "CCMC 13691-R."

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 to ASTM D 1143, "Standard Test Methods for Deep Foundations Under Static Axial Compressive Load," ASTM D 3689, "Standard Test Methods for Deep Foundations Under Static Axial Tensile Load."

Testing was conducted on three different sites selected because they represent typical soil profiles encountered in Alberta. A series of 28 tests were performed covering a range of sandy, medium stiff clay, to very stiff clay conditions. The intent of the testing was to determine a correlation between the torque applied during installation and the allowable loads. Testing showed a good correlation between the torque applied during installation and the allowable loads. For the loads identified in Tables 1, 2 and 3 the factor of safety applied was 2.0.

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