Evaluation Report CCMC 13691-R
Almita Helical Screw Pile

MasterFormat:	31 62 16.01
Evaluation issued:	2015-02-28
Re-evaluated:	2018-04-26
Revised:	2019-02-28

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that **"Almita Helical Screw Pile,"** when used as a 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 (NBC) of Canada 2015:

- Clause 1.2.1.1.(1)(a) of 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 the CCMC evaluation of the technical evidence in Section 4 provided by the Report Holder.

Ruling No. 16-05-335 (13691-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 2018-04-12 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 a helical screw pile constructed of helical-shaped circular steel plates that are welded to a steel shaft. The plates are constructed as a helix with a carefully controlled pitch, similar to the thread on a screw.

The helical piles tested are summarized in Table 2.1.

Table 2.1 Specifications of the Product

Product	Outside Diameter		Helix 1 Diameter × Thickness		Helix 2 Diameter × Thickness	
Pile Type	**in.**	**mm**	**in.**	**mm**	**in.**	**mm**
SP1	2.375	60	10 × 0.375	254 × 9.5	–	–
SP2	2.875	73	12 × 0.375	305 × 9.5	–	–
SP3	3.5	89	14 × 0.5	356 × 12.7	–	–
SP4	4.5	114	16 × 0.5	406 × 12.7	–	–
SP5	4.5	114	16 × 0.5	406 × 12.7	16 × 0.5	406 × 12.7
SP6	5.5	140	20 × 0.75	508 × 19.1	–	–

The pile type and helix diameter are chosen based on the bearing capacity of the soil and the load the rotary-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, plates 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. Where conditions are corrosive to steel, exposed steel shall be adequately protected with a galvanic coating that meets the requirements of ASTM A123/A123M-17, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," 610 g/m^2.

Figure 1 shows typical steel piles.

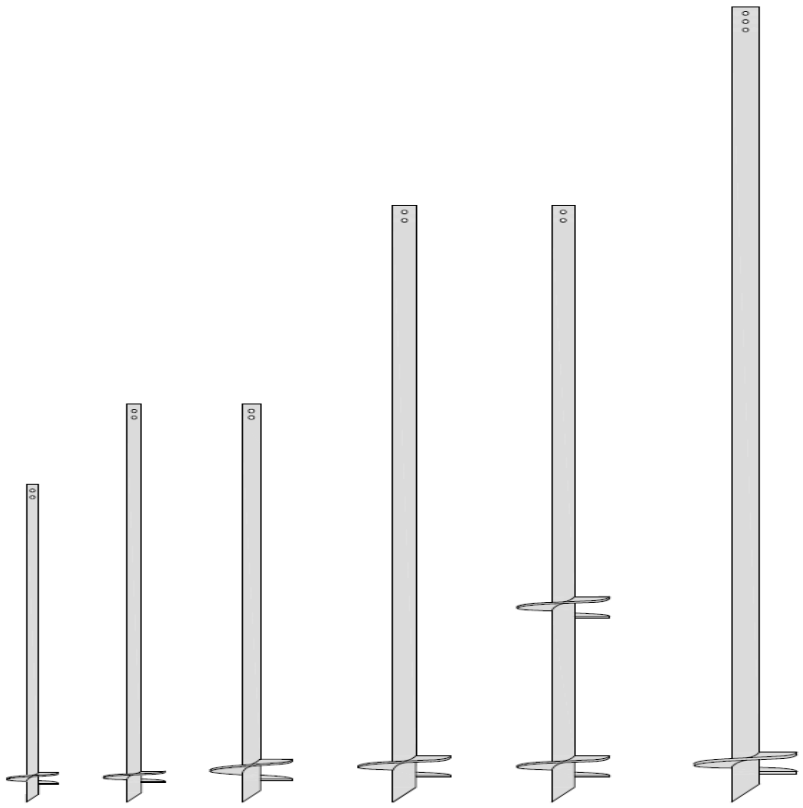

Figure 1. "Almita Helical Screw Piles, SP1, SP2, SP3, SP4, SP5, and SP6"

3. Conditions and Limitations

The CCMC 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.
- The structural application of these products shall be in strict accordance with the allowable load vs. applied torque tables prepared by the University of Alberta, which are reproduced in Tables 3.1 to 3.6.
- 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 3.1 to 3.6 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 3.1 to 3.6. 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 engineer skilled in such design and licensed to practice under the appropriate provincial or territorial legislation must determine the number and spacing of the rotary-installed steel piles required to carry all the loads. A certificate attesting to the conformity of the installation and the allowable loads for the piles must be provided.
- The installation of the rotary-installed steel pile must be carried out as per the manufacturer's instructions. The helical piles must be

screwed into the ground to below the frost line using mechanized equipment. The helical pile is rotated into the ground with sufficient applied downward pressure to advance the helical pile one pitch-distance per revolution. The helical pile 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. The piles are immediately ready for loading after installation.

- Where conditions (soil and environmental) are determined to be corrosive to steel, protection of the steel shall be provided. The determination of the presence of corrosive conditions and the specification of the corrosion protection shall be carried out by a registered professional engineer licensed to practice under the appropriate provincial or territorial legislation. If the determination of the presence of corrosive conditions is not completed before installation the product, including all its accessories, is required to be hot-dipped galvanized, meeting the requirements of CAN/CSA-G164 or ASTM A123/A123M -17 with a minimum thickness of 610 g/m^2, or subjected to another method that provides an equivalent level of protection and abrasion resistance deemed acceptable by CCMC.
- The installer of the proposed rotary-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.
- The Report Holder has proprietary interest in this Evaluation Report and any use must be authorized by Almita Piling.
- Each rotary-installed steel pile must be identified with a label that contains the manufacturer's identification and the phrase "CCMC 13691-R."

Table 3.1 Allowable Compressive and Tensile Loads for the SP1 Rotary-Installed Pile (2 3/8 in. thick, 60 mm diameter shaft) in Cohesive and Cohesion-less Soils

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	lbf	kN	lb	kN	lb
340	250	5.56	1 250	4.23	950
680	500	11.12	2 500	8.45	1 900
1 020	750	16.68	3 750	12.68	2 850
1 360	1 000	22.24	5 000	16.90	3 800
1 690	1 250	27.80	6 250	21.13	4 750
2 030	1 500	33.36	7 500	25.35	5 700
2 370	1 750	38.92	8 750	29.58	6 650
2 710	2 000	44.48	10 000	33.81	7 600
3 050	2 250	50.04	11 250	38.03	8 550
3 390	2 500	55.60	12 500	42.26	9 500
3 730	2 750	61.16	13 750	46.48	10 450
4 070	3 000	66.72	15 000	50.71	11 400
4 410	3 250	72.28	16 250	54.94	12 350
4 750	3 500	77.84	17 500	59.16	13 300
5 080	3 750	83.40	18 750	63.39	14 250
5 420	4 000	88.96	20 000	67.61	15 200
5 760	4 250	94.52	21 250	71.84	16 150
6 100	4 500	100.08	22 500	76.06	17 100
6 440	4 750	105.65	23 750	80.29	18 050
6 780	5 000	111.21	25 000	84.52	19 000

Table 3.2 Allowable Compressive and Tensile Loads for the SP2 Rotary-Installed Pile (2 7/8 in. thick, 73 mm diameter shaft) 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
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
8 813	6 500	92.5	20 799	81.2	18 256
9 491	7 000	98.8	22 209	86.4	19 430
10 169	7 500	105.1	23 618	91.6	20 603
10 847	8 000	111.3	25 028	96.9	21 777

Table 3.3 Allowable Compressive and Tensile Loads for the SP3 Rotary-Installed Pile (3 1/2 in. thick, 89 mm diameter shaft) in Cohesive and Cohesion-less Soils

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	lbf	kN	lb	kN	lb
678	500	9.7	2 187	9.7	2 187
1 356	1 000	19.5	4 374	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
8 813	6 500	89.5	20 129	82.2	18 488
9 491	7 000	94.7	21 279	86.4	19 433
10 169	7 500	99.8	22 430	90.6	20 378
10 847	8 000	104.9	23 581	94.8	21 323
11 524	8 500	110.0	24 731	99.1	22 268
12 202	9 000	115.1	25 882	103.3	23 213
12 880	9 500	120.2	27 032	107.5	24 157
13 558	10 000	125.4	28 183	111.7	25 102

Table 3.4 Allowable Compressive and Tensile Loads for the SP4 Rotary-Installed Pile (4 1/2 in. thick, 114 mm diameter shaft – single helix) 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
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
8 813	6 500	108.8	24 468	79.8	17 930
9 491	7 000	117.2	26 350	85.9	19 309
10 169	7 500	125.6	28 232	92.0	20 688
10 847	8 000	134.0	30 114	98.2	22 068
11 524	8 500	142.3	31 996	104.3	23 447
12 202	9 000	150.7	33 879	110.4	24 826
12 880	9 500	159.1	35 761	116.6	26 205
13 558	10 000	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

Table 3.5 Allowable Compressive and Tensile Loads for the SP5 Rotary-Installed Pile (4 1/2 in. thick, 114 mm diameter shaft – double helix)in Cohesive and Cohesion-less Soils

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	lbf	kN	lb	kN	lb
1 360	1 000	17.79	4 000	11.79	2 650
2 030	1 500	26.69	6 000	17.68	3 975
2 710	2 000	35.59	8 000	23.58	5 300
3.390	2 500	44.48	10 000	29.47	6 625
4 070	3 000	53.38	12 000	35.36	7 950
4 750	3 500	62.28	14 000	41.26	9 275
5 420	4 000	71.17	16 000	47.15	10 600
6 100	4 500	80.07	18 000	53.05	11 925
6 780	5 000	88.96	20 000	58.94	13 250
7 460	5 500	97.86	22 000	64.83	14 575
8.130	6 000	106.76	24 000	70.73	15 900
8 810	6 500	115.65	26 000	76.62	17 225
9 490	7 000	124.55	28 000	82.51	18 550
10 170	7 500	133.45	30 000	88.41	19 875
10 850	8 000	142.34	32 000	94.30	21 200
11 520	8 500	151.24	34 000	100.20	22 525
12 200	9 000	160.14	36 000	106.09	23 850
12 880	9 500	169.03	38 000	111.98	25 175
13 560	10 000	177.93	40 000	117.88	26 500
14 240	10 500	186.83	42 000	123.77	27 825
14 910	11 000	195.72	44 000	129.67	29 150
15 590	11 500	204.62	46 000	135.56	30 475
16 270	12 000	213.51	48 000	141.45	31 800
16 950	12 500	222.41	50 000	147.35	33 125
17 630	13 000	231.31	52 000	153.24	34 450
18 300	13 500	240.20	54 000	159.14	35 775
18 980	14 000	249.10	56 000	165.03	37 100
19 660	14 500	258.00	58 000	170.92	38 425
20 340	15 000	266.89	60 000	176.82	39 750
21 020	15 500	275.79	62 000	182.71	41 075
21 690	16 000	284.69	64 000	188.60	42 400
22 370	16 500	293.58	66 000	194.50	43 725
23 050	17 000	302.48	68 000	200.39	45 050
23 730	17 500	311.38	70 000	206.29	46 375
24 400	18 000	320.27	72 000	212.18	47 700

Table 3.6 Allowable Compressive and Tensile Loads for the SP6 Rotary-Installed Pile (5 1/2 in. thick, 140 mm diameter shaft)in Cohesive and Cohesion-less Soils

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	lbf	kN	lb	kN	lb
2 030	1 500	23.35	5 250	14.68	3 300
4 070	3 000	46.71	10 500	29.36	6 600
6 100	4 500	70.06	15 750	44.04	9 900
8 130	6 000	93.41	21 000	58.72	13 200
10 170	7 500	116.77	26 250	73.40	16 500
12 200	9 000	140.12	31 500	88.07	19 800
14 240	10 500	163.47	36 750	102.75	23 100
16 270	12 000	186.83	42 000	117.43	26 400
18 300	13 500	210.18	47 250	132.11	29 700
20 340	15 000	233.53	52 500	146.79	33 000
22 370	16 500	256.88	57 750	161.47	36 300
24 400	18 000	280.24	63 000	176.15	39 600
26 440	19 500	303.59	68 250	190.83	42 900
28 470	21 000	326.94	73 500	205.51	46 200
30 510	22 500	350.30	78 750	220.19	49 500
32 540	24 000	373.65	84 000	234.87	52 800
34 570	25 500	397.00	89 250	249.55	56 100
36 610	27 000	420.36	94 500	264.22	59 400
38 640	28 500	443.71	99 750	278.90	62 700
40 670	30 000	467.06	105 000	293.58	66 000
42 710	31 500	490.42	110 250	308.26	69 300
44 740	33 000	513.77	115 500	322.94	72 600
46 780	34 500	537.12	120 750	337.62	75 900
47 450	35 000	544.91	122 500	342.51	77 000

4. Technical Evidence

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

4.1 Performance Requirements

The rotary-installed steel piles were tested to ASTM D 1143/D 1143M-07, “Standard Test Methods for Deep Foundations Under Static Axial Compressive Load,” ASTM D3689, “Standard Test Methods for Deep Foundations Under Static Axial Tensile Load.”

Testing was conducted on four different sites selected because they represent typical soil profiles encountered in Canada. A series of more than 50 tests was performed covering a range of sandy, medium-stiff 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 3.1to 3.6, the factor of safety applied was 2.0.

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Date modified:
2019-02-28