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NRC·CNRC

06 November 2018

6508/13675-R

Mr. Julian Reusing
President & CEO
GoliathTech Inc.
175B, rue Peladeau
Magog, QC J1X 5G9

Dear Mr. Julian Reusing:

Please find attached the revised Evaluation Report, Number **13675-R**, for your product "**GoliathTech Inc.**" amended to reflect the revision of your Minister's Ruling authorizing the use of your product in Ontario.

CCMC will make the report available to the public immediately and proceed to post it on our CCMC Web Site "CCMC Registry of Construction Product Evaluations" (http://www.nrc-cnrc.gc.ca/eng/solutions/advisory/ccmc/ registry_product_evaluations.html) at the next quarterly update.

The continued validity of this report is subject to the terms and conditions of the evaluation contract.

You may refer to the report using the following phrase: **" CCMC # 13675-R "**.

We wish you every success with your building product.

Yours truly,

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Attach.

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Canada

Evaluation Report CCMC 13675-R
GoliathTech Inc.

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "GoliathTech Inc.," 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 (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. 16-08-338 (13675-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 2018-10-19 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 that are welded to a steel shaft. The blades are constructed as a helix with a carefully controlled pitch.

The anchor 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 plates and accessories conform to CSA G40.21 50W, "General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel," 350 MPa. The steel tubes conform to ASTM A 500/A 500M-13, "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," Grade C, 320 MPa.

Table 2.1 Anchor Types

Type	Exterior Pile Shaft Diameter	Pile Wall Thickness	Available Helical Blade Diameter	Helical Blade Thickness
Pile 1 7/8 in.	48 mm / 1.875 in.	3.9 mm / .154 in.	from 228 mm / 8 in. to 431 mm / 17 in.	9.5 mm / .375 in.
Pile 2 3/8 in.	60 mm / 2.375 in.	3.9 mm / .154 in.	from 228 mm / 9 in. to 431 mm / 17 in.	9.5 mm / .375 in.
			482 mm / 19 in.	12.7 mm / .500 in.
Pile 2 7/8 in.	73 mm / 2.875 in.	6.3 mm / .250 in.	from 228 mm / 9 in. to 431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 787 mm / 31 in.	12.7 mm / .500 in.
Pile 3 1/2 in.	89 mm / 3.5 in.	6.3 mm / .250 in.	from 228 mm / 9 in. to 431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 787 mm / 31 in.	12.7 mm / .500 in.
Pile 4 1/2 in.	114 mm / 4.5 in.	6.3 mm / ,250 in.	from 228 mm / 9 in. to 431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 787 mm / 31 in.	12.7 mm / .500 in.
Pile 5 9/16 in.	141 mm / 5.5625 in.	6.3 mm / .250 in.	from 333 mm / 13 in. to 431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 787 mm / 31 in.	12.7 mm / .500 in.
Pile 5 9/16 in.	141 mm / 5.5625 in.	9.5 mm / .375 in.	from 333 mm / 13 in. to 431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 787 mm / 31 in.	12.7 mm / .500 in.
Pile 6 5/8 in.	168 mm / 6.625 in.	6.3 mm / .250 in.	from 381 mm / 15 in. to 431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 787 mm / 31 in.	12.7 mm / .500 in.
Pile 6 5/8 in.	168 mm / 6.625 in.	9.5 mm / .375 in.	from 381 mm / 15 in. to 431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 787 mm / 31 in.	12.7 mm / .500 in.
Pile 8 5/8 in.	168 mm / 8.625 in.	6.3 mm / .250 in.	431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 787 mm / 31 in.	12.7 mm / .500 in.
Pile 8 5/8 in.	168 mm / 8.625 in.	9.5 mm / .375 in.	431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 787 mm / 31 in.	12.7 mm / .500 in.
Pile 10 3/4 in.	168 mm / 10.75 in.	6.3 mm / .250 in.	431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 990 mm / 39 in.	12.7 mm / .500 in.
Pile 10 3/4 in.	168 mm / 10.75 in.	9.5 mm / .375 in.	431 mm / 17 in.	9.5 mm / .375 in.
			from 482 mm / 19 in. to 990 mm / 39 in.	12.7 mm / .500 in.
Pile 12 3/4 in.	168 mm / 12.75 in.	6.3 mm / .250 in.	from 533 mm / 21 in. to 990 mm / 39 in.	12.7 mm / .500 in.
Pile 12 3/4 in.	168 mm / 12.75 in.	9.5 mm / .375 in.	from 533 mm / 21 in. to 990 mm / 39 in.	12.7 mm / .500 in.

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

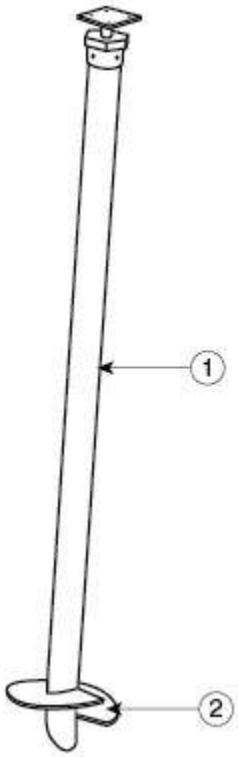

Figure 1. "GoliathTech Inc."

1. **tube**
2. **helical blade**

3. Conditions and Limitations

The CCMC compliance opinion in Section 1 is bound by "GoliathTech Inc." 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 granular soil or silt, there is a direct relationship between the applied torque and the allowable compressive and tensile loads. Table 3.1 indicates the allowable compressive and tensile loads as a function of the applied torque.
- When the auger-installed steel pile is installed with granular material that exceeds 200 mm in diameter, the relationship between the applied torque and the allowable compressive and tensile loads is not as predictable. When it is installed in such soils, the allowable compressive and tensile loads have to 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 and Table 3.2. 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 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 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.
- 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 (ASTM A123/A123M-17) with a minimum thickness of 610 g/m^2, or another method that provides an equivalent level of protection and abrasion resistance deemed acceptable by CCMC

- The installer of the proposed auger-installed steel piles must be certified by GoliathTech Inc. 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 manufacturer's identification and "CCMC 13675-R."

Table 3.1 Allowable Compressive and Tensile Loads for the Proposed Auger-installed Pile in Granular Soil or Silt(1)

Applied Torque		Allowable Load			
		Compression		Tension	
N·m	(lbf·ft)	kN	(lb)	kN	(lb)
678	500	20	4 500	12	2 700
1 017	750	23	5 175	15	3 375
1 356	1 000	27	6 075	18	4 050
1 695	1 250	30	6 750	20	4 500
2 034	1 500	33	7 425	23	5 175
2 373	1 750	37	8 325	26	5 850
2 712	2 000	40	9 000	29	6 525
3 051	2 250	44	9 900	32	7 200
3 390	2 500	47	10 575	34	7 650
3 728	2 750	51	11 475	37	8 325
4 067	3 000	54	12 150	40	9 000
4 406	3 250	57	12 825	42	9 450
4 745	3 500	61	13 725	45	10 125
5 084	3 750	64	14 400	48	10 800
5 423	4 000	68	15 300	51	11 475
5 762	4 250	71	15 975	54	12 150
6 101	4 500	74	16 650	57	12 825
6 440	4 750	78	17 550	59	13 275
6 779	5 000	81	18 225	62	13 950
7 457	5 500	88	19 800	67	15 075
8 135	6 000	95	21 375	72	16 200

Note to Table 3.1:

(1) The allowable loads identified in this table are only valid when the product is installed in granular soil or silt. The applied torque is the average of the values attained within the last 600 mm of installation. Special attention is required when the auger-installed steel piles are installed in a recently backfilled site or where the granular material exceeds 200 mm in diameter or in cohesive soils. In these cases, Table 3.1 does not apply and the allowable loads need to be determined by on-site confirmatory testing.

Table 3.2 Allowable Compressive and Tensile Loads for the Proposed Auger-installed Pile in Cohesive Soil(1)

Applied Torque		Allowable Load			
		Compression		Tension	
N·m	(lbf·ft)	kN	(lb)	kN	(lb)
1 017	750	7	1 574	3	674
1 356	1 000	10	2 248	5	1 124
1 695	1 250	13	2 922	8	1 798
2 034	1 500	16	3 597	11	2 473
2 373	1 750	20	4 496	14	3 147
2 712	2 000	23	5 171	16	3 597
3 051	2 250	26	5 845	19	4 271
3 390	2 500	29	6 519	22	4 946
3 728	2 750	33	7 419	24	5 395
4 067	3 000	36	8 093	27	6 070
4 406	3 250	39	8 767	30	6 744
4 745	3 500	42	9 442	33	7 419
5 084	3 750	45	10 116	35	7 868
5 423	4 000	49	11 015	38	8 543
5 762	4 250	52	11 690	41	9 217
6 101	4 500	55	12 364	44	9 891

Note to Table 3.2:

(1) The allowable loads identified in this table are only valid when the product is installed in cohesive soil. The applied torque is the average of the values attained within the last 50 cm of installation. Special attention is required when the auger-installed steel piles are installed in a recently backfilled site or where the granular material exceeds 200 mm in diameter. In these cases, Table 3.2 does not apply and the allowable loads need to be determined by on-site confirmatory testing.

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 proposed auger-installed steel piles were tested to ASTM D 1143/D 1143M-07(2013), “Standard Test Methods for Deep Foundations Under Static Axial Compressive Load,” ASTM D 3689/D 3689M-07(2013) e1, “Standard Test Methods for Deep Foundations Under Static Axial Tensile Load,” and ASTM D 3966/D 3966M-07(2013) e1, “Standard Test Methods for Deep Foundations Under Lateral Load.”

Testing was conducted at various sites that included granular and cohesive soils. A series of 51 tests were performed. The intent of the testing was to determine a correlation between the torque applied during installation and the allowable loads. In the granular and silt-based soil there was a good correlation between the torque applied during installation and the allowable loads. For the compressive loads noted in Table 3.1, the factor of safety varied from 2.0 to 3.0. For the tensile loads, the factor of safety varied from 2.0 to 2.7. In the cohesive soil in Table 3.2 there was a good correlation between the torque applied during installation and the allowable loads. A factor of safety of 2.0 was used. For lateral loads in each soil condition, no correlation was possible.

Report Holder

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