Evaluation Report CCMC 13102-R
Pieux Vissés Vistech / Postech Screw Piles

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "Pieux Vissés Vistech / Postech Screw Piles", 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.

Ruling No. 04-16-120 (13102-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 2009-11-30 (revised on 2012-07-27) 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 anchors come in seven pile types: P178, P238, P312, P400, P412, P512, and P658. Table 2.1 indicates the properties for each pile type.

Table 2.1 Properties of the Product Pile Type

Type	Exterior diameter of post	Wall thickness of post	Diameter of helix blades	Thickness of blade
Pile P178	48 mm	3.7 mm	200 mm	8 mm
			255 mm	
Pile P238	60 mm	3.9 mm	200 mm	8 mm
			255 mm	
			300 mm	
			355 mm	9.5 mm
			405 mm	12.7 mm
Pile P312	89 mm	5.5 mm	255 mm	9.5 mm
			300 mm	
			355 mm	
			405 mm	12.7 mm
			455 mm	

Type	Exterior diameter of post	Wall thickness of post	Diameter of helix blades	Thickness of blade
Pile P400	101 mm	5.7 mm	255 mm	9.5 mm
			300 mm	
			355 mm	
			405 mm	12.7 mm
			455 mm	
			505 mm	
Pile P412	114 mm	6.0 mm	300 mm	9.5 mm
			355 mm	
			405 mm	12.7 mm
			455 mm	
			505 mm	
			555 mm	
Pile P512	140 mm	6.5 mm	355 mm	12.7 mm
			405 mm	
			455 mm	
			505 mm	
			555 mm	
			610 mm	
Pile P658	168 mm	7.1 mm	355 mm	12.7 mm
			405 mm	
			455 mm	
			505 mm	
			555 mm	
			610 mm	
			660 mm	

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 plates to adapt to the building structure, extension shafts and connectors which conform to CAN/CSA G40.21-13/G40.21-13. All accessories with treaded rods conform to ASTM A325M.

The steel shaft, blades and accessories conform to the 350 MPa requirement of CAN/CSA G40.20-13/G40.21-13, “General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel” or ASTM A 500/A 500M-10a “Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.” They have a galvanic coating that meets the 610 g/m^3 requirement of ASTM A123M, “Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products”. All welders at Pieux Vistech / Postech Screw Pile Inc. are certified in accordance with the Canadian Welding Bureau to produce welds conforming to CSA W59-M1989, “Welded Steel Construction (Metal Arc Welding)”.

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

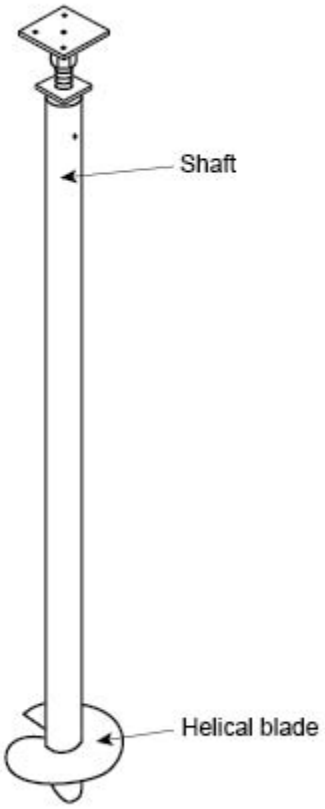

Figure 1. "Pieux Vissés Vistech / Postech Screw Piles"

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "Pieux Vissés Vistech / Postech Screw Piles" 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 product is installed in a cohesive soil, such as clay, there is a direct relationship between the applied torque and the allowable compressive and tensile loads. Table 3.2 indicates the allowable compressive and tensile loads as a function of the applied torque.
- When the auger-installed steel pile is installed in a soil 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 Tables 3.1 or 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 cases of piles supporting a building, 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 by a certified installer.

Table3.1 Allowable Compressive and Tensile Loads for the Product in Granular Soil or Silt[(1)]

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	(lbf)	kN	(lb)	kN	(lb)
1 017	750	15	3 375	–	–
1 356	1 000	21	4 725	2	450
1 695	1 250	26	5 850	7	1 575
2 034	1 500	31	6 975	12	2 700
2 373	1 750	36	8 100	16	3 600
2 712	2 000	42	9 450	21	4 725
3 051	2 250	47	10 575	26	5 850
3 390	2 500	52	11 700	31	6 975
3 728	2 750	57	12 825	35	7 875
4 068	3 000	63	14 175	40	9 000
4 407	3 250	68	15 300	44	9 900
4 746	3 500	73	16 425	48	10 800
5 085	3 750	78	17 550	50	11 250
5 424	4 000	84	18 900	52	11 700
5 763	4 250	89	20 025	54	12 150
6 102	4 500	94	21 150	56	12 600
6 441	4 750	99	22 275	58	13 050
6 780	5 000	105	23 625	60	13 500
7 119	5 250	110	24 750	62	13 950
7 458	5 500	115	25 875	64	14 400
7 797	5 750	121	27 225	66	14 850
8 136	6 000	126	28 350	68	15 300

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. In these cases, Table 3.1 does not apply and the allowable loads need to be determined by on-site confirmatory testing. In cohesive soils, the values in Table 3.2 apply.

Table 3.2 Allowable Compressive and Tensile Loads for the Product in Cohesive Soil[(1)]

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	(lbf)	kN	(lb)	kN	(lb)
1 017	750	5	1 125	4	900
1 356	1 000	8	1 800	5	1 125
1 695	1 250	11	2 475	6	1 350
2 034	1 500	14	3 150	8	1 800
2 373	1 750	17	3 825	11	2 475
2 712	2 000	19	4 275	14	3 150
3 051	2 250	22	4 950	16	3 600
3 390	2 500	25	5 625	19	4 275
3 728	2 750	28	6 300	21	4 725
4 068	3 000	31	6 975	24	5 400

Applied Torque		Allowable Loads			
		Compression		Tension	
Nm	(lbf)	kN	(lb)	kN	(lb)
4 407	3 250	34	7 650	27	6 075
4 746	3 500	37	8 325	29	6 525
5 085	3 750	39	8 775	32	7 200
5 424	4 000	42	9 450	34	7 650

Note to Table 3.2:

(1) The allowable loads identified in this Table are only valid when the product is installed in a cohesive soil. The applied torque is the average of the values attained within the last 600 mm of installation.

- The installation of the auger-installed steel pile must be carried out as per the manufacturer's instructions. The "Pieux Vissés Vistech / Postech Screw Piles" 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.
- The installer of the proposed auger-installed steel piles must be certified by Pieux Vistech – Postech Screw Piles 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 "Pieux Vissés Vistech / Postech Screw Pile" must be identified with a label containing the following information:
  - manufacturer's identification; and
  - the phrase "CCMC 13102-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/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 on five different sites across Canada. The first site had granular and clay soil; the second and third had only granular soil; and the fourth and fifth had only cohesive soil. A series of 68 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 soils and in the cohesive soils, there was a good correlation between the torque applied during installation and the allowable loads. In the granular and silt-based soils, 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 2.4. For the lateral loads, no correlation was possible. In cohesive soils, for the compressive loads noted in Table 3.2, the factor of safety varied from 2.0 to 2.8. For the tensile loads, the factor of safety varied from 2.0 to 2.9. For the lateral loads, no correlation was possible.

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