NYC Buildings Department
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Robert D. LiMandri, Commissioner

**PROSPECTIVELY RESCINDINGS BY BUILDINGS BULLETIN 2014-023**

# BUILDINGS BULLETIN 2011-011
**OTCR**



**Supersedes:** OTCR Technical Bulletin number BC 18.01.08 issued 3/24/2008, titled "The use of Helical Piles per the 1968 and 2008 NYC Building Code"

**Issuer:** Fatma M. Amer, P.E.
First Deputy Commissioner

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**Purpose:** This bulletin establishes acceptance criteria for the use of helical pile foundation systems as alternative materials in accordance with 2008 New York City Construction Codes.

**Related Code Section(s):**

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|---|---|---|---|---|---|---|---|
| BC | 1704.3 | BC | 1802 | BC | 1814 | BC | 1905 |
| BC | 1704.8 | BC | 1808 | BC | 1903 | BC | 1906 |
| BC | 1704.19.1 | BC | 1813 | BC | 1904 | | |

**Subject(s):** Foundation, helical pile foundation system; Pile, helical; Foundations, piers, helical piles

**Background** The Office of Technical Certification and Research (OTCR) issued a Technical Bulletin on March 24, 2008 prohibiting the installation of helical pile foundations. The OTCR has since reviewed and evaluated helical piles for equivalency in quality, strength, effectiveness, durability and safety. The OTCR's review is now complete. This bulletin provides the conditions in which helical pile may be used as foundations.

**Description:** Helical piles are manufactured deep foundation steel elements consisting of a shaft and one or more helical bearing plates (helices) screwed into the ground by application of torque on the shaft. The various products marketed as screw piles, torque anchors, and helical piers are considered helical piles. Helical piles are not addressed in the 1968 Building Code or the 2008 Code.

**Uses:** Helical piles may be used to support axial compression, or resist axial tension and lateral loads.

**Evaluation Scope:** 2008 NYC Construction Codes

**Evaluation Criteria:** Pursuant to section AC 28-113, the OTCR recognizes helical pile foundation systems tested and evaluated in accordance with ICC-ES AC358, "*Acceptance Criteria for Helical Foundation Systems and Devices*"[1]. Acceptable helical pile foundation systems shall have an ICC-ES Evaluation Service Report (ESR) issued in accordance with ICC-ES AC358 and shall comply with the conditions of this bulletin.

**Conditions of Acceptance:** Helical piles shall be designed and installed in accordance with the 2008 NYC Construction Codes and other applicable provisions including but not limited to the following:





*SEE BUILDINGS BULLETIN 2014-020

**A. Design**

1. Design of helical pile foundations shall be based on a foundation investigation in accordance with sections BC 1802 and 1808.2 with the following additional conditions:
   1.1. The scope of the soil investigation shall include a minimum of three borings on any jobsite. Should section BC 1802.4.1 require more borings, the greater number of borings shall be performed.
      1.1.1. **Exception:** For the residential repair of porches, stoops and slab on grades, helical test probes may be used to substitute test borings provided the following:
         1.1.1.1. The manufacturer shall have an ICC-ES Evaluation Service Report (ESR) issued in accordance with ICC-ES AC358 that includes a correlation between final installation torque and ultimate capacity as stated in ICC-ES AC358 section 3.13.2, and
         1.1.1.2. The shaft diameter, number of helices and diameter of helices shall be the same as the production helical piles.
   1.2. Design of helical piles shall be in accordance with section BC 1808.2.17 (Protection of pile materials). In addition:
      1.2.1. Where helical piles are proposed, tests shall be performed for soil resistivity, soil pH, organic content and sulphate concentration in each soil layer. If the values of these parameters determined from the tests are in accordance with the limits prescribed in ICC-ES AC358 for non-corrosive situations, the pile design shall conform to ICC-ES AC358. For corrosive or other situations (such as soils located in landfills, soil containing mine waste, etc.) special corrosion mitigation shall be provided.
      1.2.2. The helical pile design shall consider the abrasive action inherent in the installation process when protective exterior treatment is specified as pile protection.
2. The allowable design load of helical piles shall be in accordance with applicable sections of BC 1808.2.8. In addition:
   2.1. The maximum allowable axial tension and compression load shall not exceed 30 tons.
   2.2. The maximum allowable lateral load resisted by a helical pile shall not exceed 3 tons.
   2.3. The axial compression load capacity of a helical pile shall be verified with a minimum of one load test performed in accordance with ASTM D1143, "*Standard Test Methods for Deep Foundations Under Static Axial Compressive Load*"[2], using the Quick Load Test Loading Procedure, except that the test load shall be two times the design compression load. Following the compression load test, each test pile shall be removed by unscrewing and inspected for any deformations to the helices, and to verify the structural integrity of the shaft and its connections.
      2.3.1. **Exception:** For the support of new one and two-family dwellings not more than three stories in height or the repair or horizontal enlargement of a one or two-family dwelling not more than three stories in height, the registered design professional of record may substitute installation torque for the axial compression pile load tests required by 2.3 of this bulletin provided all of the following conditions are met:
         2.3.1.1. The helical pile manufacturer verified torque correlations in accordance with ICC-ES AC 358 section 3.13.2 and the correlation between final installation torque and ultimate axial capacity is stated in the evaluation report.
         2.3.1.2. The torque correlation shall demonstrate a factor of safety (FS) of 2.5 on the working load, and
         2.3.1.3. The maximum allowable axial compression load on the helical pile shall be 15 tons for one- and two-family dwellings that substitute

installation torque for pile load testing.

2.4. The number of axial compression load tests shall satisfy section BC 1808.2.8.3.1.2.

2.5. The allowable pile load shall be the lesser of the two values computed as follows:

2.5.1. Fifty-percent of the applied load causing a net deflection that exceeds 10 percent of the helix plate diameter. Net deflection in this paragraph is defined as the total deflection minus the shaft elastic shortening or lengthening. For multiple helix configurations, the average helix diameter shall be used in this criteria.

2.5.2. Fifty-percent of the applied load causing a net settlement of the pile of ¾ inch. Net settlement in this paragraph is defined as the gross settlement due to the total test load less the amount of elastic shortening in the pile section due to total test load.

2.6. Additional axial compression, axial tension and lateral load tests shall be required for all of the following:

2.6.1. Each area of uniform subsoil condition.

2.6.2. Each planned variation in bearing stratum type or elevation, and

2.6.3. Each variation in helical pile configuration.

2.7. The axial tension load capacity of a helical element shall be verified with a minimum of one load test performed in accordance with ASTM D3689, "*Standard Test Methods for Deep Foundations Under Static Axial Tensile Load*"[3], using the Quick Test Loading Procedure. The test load shall be two times the design tension load on the pile. Following the tension load test the pile shall be removed by unscrewing and inspected for any deformations to the helices, and to verify the structural integrity of the shaft and connections. The allowable pile load shall be determined in accordance with section 2.5 of this bulletin.

2.8. The lateral load capacity of a helical element shall be verified with a minimum of one load test performed in accordance with ASTM D3966 "*Standard Test Methods for Deep Foundations Under Lateral Load*"[4], using the Quick Test Loading Procedure. The test load shall be two times the design lateral load on the pile. Following the lateral load test the pile shall be removed by unscrewing and inspected for any deformations to the helices, and to verify the structural integrity of the shaft and connections. The allowable pile load shall be determined in accordance with section 2.5 of this bulletin.

3. Load tests performed in accordance with the requirements of this document shall be used to determine a site specific torque to capacity relationship as discussed in ICC-ES AC358 section 3.13.2 or similar procedure. This developed relationship may be used for verification of load capacity during production provided the installation equipment, installation procedure, helical pile materials and configuration, installation depth and soil profile match that of the successfully load tested pile(s).
4. Where bracket assemblies or structural eccentric forces cause bending, the resulting moment pile design shall ensure stability in accordance with section BC 1808.2.5 and general engineering practice. Where side-mount brackets are used and a stability analysis indicates that there is insufficient internal stability to resist overturning and translation, helical piles shall be installed staggered or other means shall be designed to provide stability and prevent rotation of the foundation.
5. When helical piles are embedded in NYC Soil Classes 6 and 7, a buckling analysis shall be performed by a recognized method of analysis to determine the allowable axial compressive load using a factor of safety = 1.5. The additional bending moments due to bracket assemblies, structural eccentric forces and coupling rigidity shall be appropriately included in the buckling analysis.
6. Where a moment is transmitted to a single helical pile, a structural analysis shall be conducted to verify that the shaft is capable of resisting the moment with acceptable deflection.
7. Where side-mount brackets are used, each bracket assembly shall be proof-tested to minimum 110% of working load to demonstrate that the bracket assembly is capable of

transferring the loads to the pile. The load shall be applied in six equal increments. The 110% test load shall be held for minimum 30 minutes without bracket assembly distortion or deformation. Side-mount brackets for permanent applications shall be encased in concrete with a minimum embedment of three inches. Concrete used to encase side mounted brackets shall meet the requirements of sections BC 1903, 1904, 1905 and 1906.

8. Minimum spacing between the center line of helical piles shall be four times the largest helix plate diameter.
9. For lateral support and buckling analysis, fluid soils shall include any soil with a Standard Penetration Test (SPT) N-value (blow count per foot of penetration) of zero (weight of hammer or weight of drill rods) determined in accordance with ASTM D1586, "*Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*"[5]. Soft material includes any soil with SPT N-value less than five. Firm ground includes any soil with SPT N-value of five or more.

**B. Installation Requirements:**

1. Equipment used for the installation of helical piles shall be as recommended by the helical pile manufacturer.
2. The installer of any helical pile shall be as recommended by the helical pile manufacturer and possess a minimum of three years experience in the installation of helical piles.
3. The installation of helical piles shall be subject to the special inspection requirements stated in section BC 1704.8.
4. The special inspector shall submit a TR-5 form to the Department of Buildings summarizing all helical piles installed. The following additional information shall be reported on the TR-5 (additional sheets may be attached as necessary):
   - 4.1. Helical pile type and product specification sheet for the each helical pile installed as published by the manufacturer.
   - 4.2. Make and model of the equipment used for installation.
   - 4.3. Make and model number of the torque indicator used to measure installation torque.
   - 4.4. Calibration records for the torque indicators used to install the helical piles.
   - 4.5. The installation speed (rpm) of the helical pile.
   - 4.6. From axial load tests and the site specific torque to capacity relationship, identify the minimum torque required to achieve the allowable pile load in tension or compression.
   - 4.7. For each helical pile, measure and log the installation torque for each foot of depth and the final torque in the helices soil bearing zone. The shaft advancement shall equal or exceed 85% of helix pitch per revolution at time of final torque measurement.
5. Field welds performed in the installation of a helical pile foundation system are additionally subject to the special inspection requirements of section BC 1704.3.

**Referenced Standards**

1. ICC-ES AC358 "*Acceptance Criteria for Helical Foundations Systems and Devices*", effective July 1, 2008 (http://www.icc-es.org/).
2. ASTM D1143 - 07 "*Standard Test Methods for Deep Foundations Under Static Axial Compressive Load*" (http://www.astm.org/).
3. ASTM D3689 - 07 "*Standard Test Methods for Deep Foundations Under Static Axial Tensile Load*" (http://www.astm.org).
4. ASTM D3966 - 07 "*Standard Test Methods for Deep Foundations Under Lateral Load*" (http://www.astm.org/).
5. ASTM D1586 – 08a "*Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*" (http://www.astm.org/).