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THE SUPPORTWORKS NEWSLETTER FOR DESIGN PROFESSIONALS

AC358: The Standard for Determining Helical Pile Capacities

Building products are commonly evaluated by third-party evaluation services to show compliance to existing building codes. These evaluations are particularly useful for code officials and design professionals to verify suitability of a manufactured product for a building project. If you work with manufacturers of helical piles, you've likely heard of the International Code Council Evaluation Service (ICC-ES) AC358, Acceptance Criteria for Helical Pile Systems and Devices. But have you ever wondered where this document came from and why it is important to you?

Regional Code Agencies

For many years, helical foundation systems were evaluated under regional building codes and evaluation agencies. The Southern Building Code Congress International (SBCCI) had the Standard Building Code (SBC), the International Conference of Building Officials (ICBO) had the Uniform Building Code (UBC) and the Building Officials Code Administrators International (BOCA) had the BOCA National Building Code.

Move to One Code

Recognizing the need for a single national code, regional code agencies formed the ICC and ICC-ES in 1994. Three years later, the ICC published the first International Building Code (IBC). In 2003, the regional code agencies and evaluation services were consolidated into the ICC and ICC-ES, respectively. They grandfathered in the evaluation reports from the former code agencies (calling them legacy reports) and established the IBC as the national model code for all regions of the United States.

The Road to AC358

In 2003, the ICC required the development of an acceptance criteria for evaluation of helical pile systems in accordance with the requirements of the IBC. To meet this objective, nine helical foundation manufacturers came together to form the Committee of Helical Foundation Manufacturers (CHFM) in 2005. They considered decades of helical pile research before submitting draft recommendations and subsequent revisions. The research was limited to systems that met certain dimensional criteria, including shaft size and shape, helix plate diameter, helix plate geometry and helix plate spacing. The Committee also reviewed the pile installation processes used in the industry and evaluated research regarding the empirical relationship between installation torque and pile capacity. The CHFM's work culminated in the creation of Acceptance Criteria AC358. It was reviewed, edited and adopted by the ICC-ES in 2007. Since then, there have been seven revisions. The current version was published in September 2017.

Present-Day Evaluation

Today, helical systems are evaluated following submittal of both structural calculations and physical testing. AC358 provides design and/or testing criteria for the four components of a helical foundation: the bracket, shaft, helix plate(s) and even the soil, from which component capacities and system capacities are determined.

ICC-ES requires compliance with AC358 for any new product evaluations. ICC also required legacy reports to be evaluated under AC358 prior to renewal. Therefore, legacy reports for helical products evaluated under the former regional building codes should not be used for project submittals and are no longer valid.

What it Means to You

There are certainly more details about AC358 than one article can cover. But understanding how it evolved and the research put into its creation underscores the most important takeaway: AC358 is an extremely important document for the industry and specifying engineers. Knowing that your helical pile manufacturer utilizes these criteria to establish system capacities should provide you with confidence that the systems are designed and represented appropriately.

Even after 10 years, many manufacturers still do not design or test their products in accordance with AC358. The upside: Supportworks utilizes AC358 criteria to establish capacities for our entire line of helical products. In fact, two of the highest volume Supportworks products have been evaluated by the ICC-ES and published in Evaluation Report ESR-3074. ESR-3074 shows compliance to the 2006, 2009, 2012 and 2015 IBC along with the 2014 Florida Building Code.

DONALD A. DEARDORFF, P.E., SENIOR APPLICATION ENGINEER

Project: Private Boat Harbor
Location: Naples, FL
Pile Installer: NSquare, Inc.

Challenge: A 216-foot long by 60-foot wide, L-shaped inlet waterway was planned at the site of a bayside residence. The proposed dredging would allow water from the adjacent bay to flow along the north side of the property to wrap around the front of the home and create a 42-foot by 65-foot boat harbor. The private waterway would also be bound to the north by an existing detached parking garage.

Prior to constructing the waterway, the residence and garage were built and the dense vegetation between the two structures was removed. Composite sheet pile walls were proposed for the waterway's perimeter. The sheet piles would need to be driven approximately 20 feet below grade and the walls anchored at the tops to allow for up to 12 feet of dredging. The wall anchor system would also have to avoid the auger-cast deep foundations and utilities of the newly-built home and garage.

A geotechnical investigation conducted for the residence identified loose to medium dense sand to approximately 12 feet over very loose to loose sand and organics to a depth of 32 feet. Five feet of medium dense to dense sand was observed to the bottoms of the test borings at 37 feet. The groundwater table was encountered at a depth of 2.5 feet below grade at the boring location, corresponding with the water level of the bay.

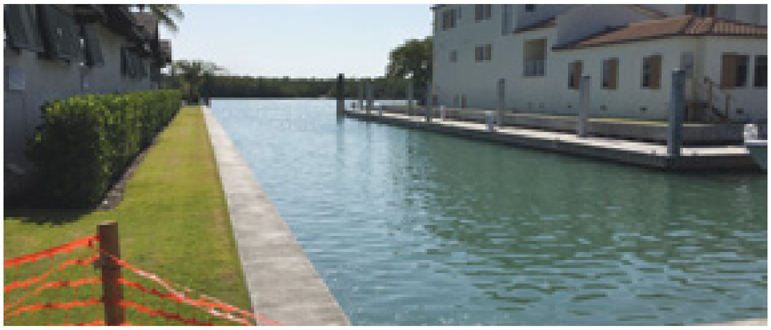
Solution: Helical tiebacks were chosen as the preferred solution to support the sheet pile walls. The tieback system design included 79 helical tiebacks to be advanced from the top of the installed sheet pile wall at a 30-degree angle (from horizontal) with typical spacing from six to ten feet to avoid known obstructions. Both the anchor heads and the top of the sheet pile wall would be encased within a two-foot wide by two-foot deep concrete seawall cap. Thirty (30) Model 150 (1.5-inch round corner square bar) and forty-nine (49) Model 175 (1.75-inch round corner square bar) tiebacks, both with an 8"-10"-12"-14" helix plate configuration, were installed to support design working tension loads from 13 kips to 50 kips. The tiebacks were advanced to lengths from 44 to 94 feet beyond the sheet pile walls to achieve torque-correlated ultimate capacities of at least twice the design working tension loads (FOS ≥ 2). All of the tieback components were hot-dip galvanized for corrosion protection.

Sheet pile wall installed behind parking garage

Installing tiebacks from top of sheet pile wall

Tieback installed, ready to be cut and fitted with standard new construction bracket

Seawall caps poured and inlet dredged



Completed project

Upcoming Webinar Opportunities

- **An Introduction to Helical Foundation Systems**

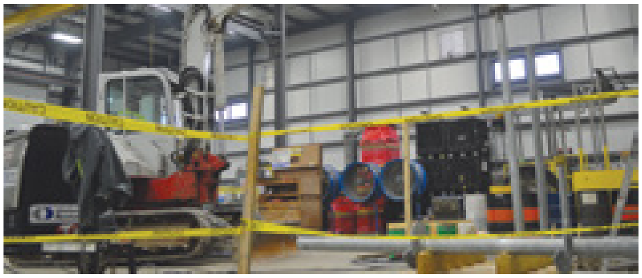
  1st Wednesday of every month 11:30 am (CT) and 1:30 pm (CT)

- **An Introduction to Polyurethane Foam Injection**

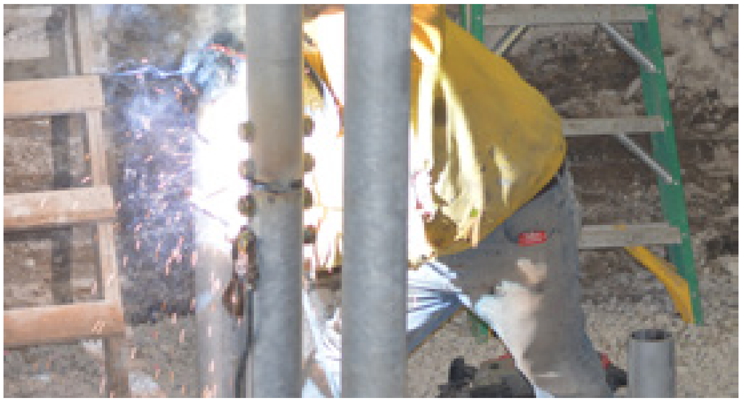
  2nd Wednesday of every month 11:30 am (CT) and 1:30 pm (CT)

- **An Introduction to Hydraulically Driven Push Pier Systems**

  3rd Wednesday of every month 11:30 am (CT) and 1:30 pm (CT)



Installing HP450 helical piles with small excavator



Welding connections

Advancing lead section

New construction caps welded to installed piles to be cast in new equipment footings

Project: Crane and Furnace Equipment Foundations
Location: Aurora, IL
Pier Installer: MidAmerica Basement Systems

Challenge: Additions planned for an existing manufacturing facility included a large furnace and a 30-ton crane. Each addition would require its own foundation system, separate from the existing structure's foundations. All work would have to be done within the building without interrupting daily operations on the other end of the shop.

The general soil profile anticipated in the area of the proposed work included stiff to hard lean clay and medium dense silty sand. Sporadic pockets/layers of weak organic soils were also known to exist within the anticipated profile. Deep foundations were therefore proposed to support the new equipment and reduce risk of potential movement under both compression and tension loading. Access and allowable working space would be limited inside the building.

Solution: Helical piles were selected to support the proposed furnace and crane equipment given their ability to be installed within the confined space of the existing building using relatively small equipment. Forty-two (42) Model 450 (4.50-inch OD by 0.337-inch wall) hollow round shaft helical piles with a 10"-12"-14"-14"-14"-14" helix plate configuration were selected to support design working loads of 60 kips in compression and 30 kips in tension. The piles were installed to depths on the order of 30 feet to achieve torque-correlated ultimate capacities of at least twice the design working compression load (FOS ≥ 2).

The engineer specified strict pile deflection criteria to avoid differential movement between the equipment and existing foundations. However, a load test was unable to be performed within the building; therefore, the helical piles were grout-filled to add rigidity and limit deflections. Additionally, the connections were factory modified and field welded to prevent movement in the couplers due to load reversal. Plates were welded to the tops of the installed helical piles to be cast within the concrete pile caps.

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with the following information:

- Name of the firm
- Location of firm
- Approximate number of engineers/architects/GCs that will be in attendance

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