April 2009 MEETING

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TECHNICAL PROGRAM

Design, Installation and Testing of Helical Piles & Anchors

Speaker: Don Deardorff with Chance Civil Construction, Lees Summitt, MO, Tel: 816-886-0497

PRESENTATION SUMMARY

To an audience of about 55 at the HESS Club, Mr. Don Deardorff presented information on the design, testing, and installation of helical piles. Mr. Deardorff is Senior Engineer with Chance Civil Construction, a subsidiary of Hubbell Power Systems where his duties include preliminary design assistance, and research and development of helical and resistance pier foundation systems. Mr. Deardorff is a licensed professional engineer in Wisconsin and Missouri, earned his BS in Civil Engineering in 1993 and his MS in Civil Engineering in 2007 from the University of Missouri - Rolla, where he is currently in the dissertation phase of his Ph.D. studies performing research on the bearing capacity of helical piles.

The information presented by Mr. Deardorff indicates that helical anchors and piles are a versatile foundation system for compression and tension loading applications. They primarily work in axial loading and take advantage of the bearing capacity of helical screw plates (helix) located along either round or square steel shafts. Fundamental steps to design with helical anchors and piles were presented along with installation and load testing protocol.

Helical piles were shown to be used as early as the 1800's for the support of coastal lighthouses. The capacity of the helical piles is based on bearing capacity only and does not use skin friction as a load resistance factor. A variety of methods are used to determine bearing capacity including torque gauges, soil resistance, measured shaft torque, etc. Medium dense sand is the optimum material for driving and axial capacity development of this system. A rule of thumb for maximum axial deflection is 8 percent of the largest helix diameter used.

The screws or "helix" come in a variety of sizes and strengths, with diameters ranging from 6" to 16". The piles may be used vertically, on a batter, or horizontally, for either permanent or temporary support. The pile design is based on a number of factors including soil strength, site conditions, bearing requirements etc. Typical piles strengths achieve ultimate capacities of 200 kips. Special cases can achieve ultimate capacities of 300 kips. Advantages of helical piles include no spoils, no concrete, less site disturbance, use in any weather, independent of water table location, etc. A disadvantage is cost relative to concrete piers.

Mr. Deardorff said the most common method of monitoring installation torque is by measuring the differential pressure on the equipment, though shaft twist can be checked when square shafts are used (look for 1.5 diameter rotation) and shear pins or dial indicators are also used. He said that a square shaft can be torqued up to 75 degrees per foot.

Mr. Deardorff said that column buckling of the shafts in compression are a concern for soils where the Standard Penetration Testing (SPT) is 2 or less. For those cases the soil can be augered out and a PVC pipe with a grout column can be installed to brace the pile shaft throughout the soft strata. Shafts are typically 1.5" square solid steel or steel piping of variable sizes. While Chance will assist the engineer of record in designing their product, they do not seal the work. They do provide free software for the engineer to use.

Mr. Deardorff cautioned the design engineer to use only one half of the bearing capacities computed from Meyerhoff or other traditional bearing capacity equations, otherwise the piles may be under-designed.

To download Mr. Deardorff's slide presentation, click here.