Florida Department of Transportation Research

Evaluating Effect of Temporary Casing on Drilled Shaft Rock Socket Friction

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Current Situation

Many Florida structures are built on drilled shaft pilings that are usually cast in place by drilling a hole, placing a steel reinforcing structure, and then pouring concrete. The hole is often in soil, but it may be partly or completely in stone, a situation called a rock socket. In Florida, that means limestone, which provides more support than soil, but how much more depends in part on how the shaft is constructed. To preserve the integrity of soil walls, the hole is often lined with tubular steel casings, which are removed as soon as the concrete is poured. The casings are placed as deep as the soil layer and then a short way into the rock layer. However, installation and removal of the casings can damage the limestone socket and reduce the piling's ultimate supporting capacity. For example, during installation, a casing can be driven farther into the rock layer than intended and damage the rock walls. The effect this has on piling capacity can be partly compensated for at the design stage or in the field, but design factors based on systematic study and confirmation of current practices are needed.

This casing is equipped with cutting teeth to help it drill into rock layers.

Research Objectives

University of South Florida researchers quantified the effects of the use of temporary casing on piling capacity where the casing is embedded in limestone.

Project Activities

The research was conducted in two phases: the first using small-scale shafts, and the second using full-scale shafts. The use of small-scale shafts allowed the researchers to test a range of materials and methods that may be used in constructing drilled shafts, as well as the types of limestone they may be constructed in. Twenty-nine small-scale pilings just under 5 inches in diameter and 18 inches long were constructed in different limestone materials and using different casing installation and extraction procedures. Eleven of the pilings were poured in uncased holes for comparison with cased pourings. A range of limestone types simulating the strengths and porosities of Florida limestone was created using sand, coquina shells, calcium hydroxide, cement, and water. For full-scale testing, the researchers selected a site in Miami-Dade County where the limestone met the project's criteria. Two full-scale shafts, 2 feet in diameter and 8 feet in depth, were constructed; one was cased, and one uncased.

All shafts were tested by gradually increasing the weight applied to the piling and observing the response. They were also tested by pulling the piling out of its setting, which in the case of the small-scale pilings, was a limestone test bed, or in the case of the full-scale pilings, the ground. From these and other tests, it was possible to calculate the reduction in strength attributable to the casing. The researchers found that current FDOT design standards for drilled shaft pilings that are socketed in limestone are appropriate.

Project Benefits

This study provides a sound basis for drilled shaft construction practices and helps assure that structures will perform as designed. It also provides additional data and theory so that designs can be adjusted for special circumstances.

For more information, please see www.fdot.gov/research/.