Florida Department of Transportation Research

Assessing Axial Capacities of Auger Cast Piles from Measuring While Drilling

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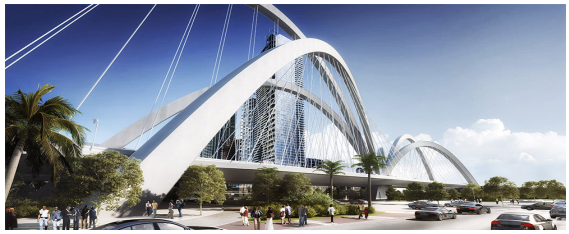
Project Manager
Rodrigo Herrera
FDOT Geotechnical Office

Principal Investigator
Michael Rodgers, Ph.D
University of Florida

Current Situation

Developing a comprehensive subsurface profile can be difficult, especially in certain areas in Florida where sandy soils with varying amounts of fines, clay, muck/peat and vuggy limestone formations add to the uncertainty of the overall response that can be expected from drilled-in-place deep foundations. Measuring while drilling (MWD) was developed to enhance quality assurance and quality control (QA/QC) for that type of construction technique. MWD continuously monitors the drilling process using sensors that measure and record subsurface information in real-time. The measurements include torque, crowd (downward force), penetration rate, rotational speed, volume of grout, grout pressure and cumulative grout volume. This allows designers to collect data during installation of piles that will be statically load tested, which can subsequently be used to evaluate the characteristics of production piles.



Rendering of the I-395 Signature Bridge in Miami, which will leverage MWD practices. Source: Connecting Miami

In previous studies involving MWD with drilled shafts, researchers found that specific energy – a compound drilling parameter obtained from MWD – strongly correlated to the strength of Florida limestone.

Florida DOT and the University of Florida developed a project that would evaluate previously formulated correlations, for use with auger cast-in-place piles to create effective QA/QC parameters and establish a solid background for the use of specific energy "e" during construction. A separate project will be implemented to evaluate the use of "e" during the geotechnical design phase.

Research Objectives

This research focused on developing MWD QA/QC procedures for auger cast-in-place (ACIP) piles socketed into Florida limestone and evaluating the strength of the correlation between specific energy and pile capacity, including the development of LRFD resistance factors.

Project Activities

Following a literature review, the research team created a large database of load test and production pile data from which a spreadsheet was developed for QA/QC.

The team found that the MWD data could be correlated with unconfined compressive strength and used to generate strength profiles of the rock layers with a high degree of accuracy. The data collected during load testing was also used to determine whether production piles required proof testing, which is a quality assurance method not previously available for ACIP. The team also performed load and resistance factor design (LRFD) analyses that included design methods using standard penetration test (SPT) data, conventional rock core data, and MWD data.

Project Conclusions and Benefits

The use of MWD during construction of ACIP piles provides a significant improvement to typical QA/QC procedures used for this foundation type. The work performed by the University showed that the correlation between specific energy and unit side friction is strong, that the parameters measured during installation of test piles can be used successfully in the evaluation of production piles, and that when used as outlined in the report, the current resistance factors used in design could be updated. capacity. Engineers can now be more certain of how ACIP piles will perform using these MWD QA/QC methods.

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