



RESEARCH PROJECT CAPSULE [18-1GT]

October 2017

TECHNOLOGY TRANSFER PROGRAM

Analysis of Driven Pile Capacity within Pre-Bored Soil

JUST THE FACTS:

Start Date:
September 1, 2017

Duration:
18 months

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Funding:
TT-Fed/TT-Reg

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POINTS OF INTEREST:

Problem Addressed / Objective of
Research / Methodology Used
Implementation Potential

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PROBLEM

Pre-boring is a method used to facilitate large displacement pile driving in hard/dense soils (see Figure 1). By pre-boring a pilot hole, the end bearing and side friction within the pre-bored zone are reduced, thus aiding pile driving installation. However, pre-boring complicates the prediction of pile drivability and long-term pile capacity within the pre-bored zone (specifically side friction).

In general, there are two major unknowns associated with the pre-bored zone: reduction of end bearing and reduction of side friction. It is assumed that long-term end bearing within the pre-bored zone will not be an issue, as specifications prohibit predrilling to the tip elevation. However, it is expected that the strength of the soil and the diameter of the pilot hole relative to the pile diameter will have an impact on pile drivability and long-term capacity. Quantifying this impact will help geotechnical design engineers to better understand the pile/pre-bored soil interactions and improve the design and construction of pile foundations in hard/dense soils.

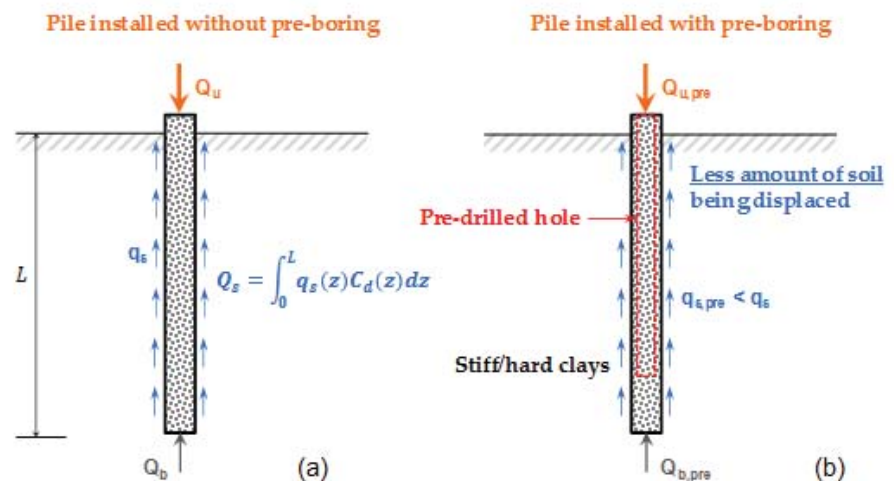


Figure 1
Pile driven (a) without pre-boring; (b) with pre-boring method

OBJECTIVE

The objective of this project is to develop a feasible protocol for determining reduction factors for side friction and long-term pile capacity within pre-bored soil.

METHODOLOGY

Although the effects of pile driving have been well explored in the context of routine installation, counterpart analyses for pre-bored piles are somewhat scarce. Recently, researchers compiled the nationwide best practices for pre-bored piles and provided a rough guideline for examination of pre-bored pile capacity, although no experimental results were available for quantifying the effect of pre-boring.

Given the objective of this study, the research team will work closely with DOTD geotechnical personnel to develop appropriate analytical models. Important soil properties from two representative sites (one located north of I-10, one located south of I-10) will be used as input for the analytical models.

A general numerical approach, based on the ABAQUS finite element program, will be used to evaluate the shaft resistance for pre-bored piles. The effects of pre-bored hole size and soil conditions will be the particular emphasis of the parametric numerical analysis to be conducted. A set of reduction factor curves will be generated for various combinations of hole size and soil conditions.

The analytical models can be recalibrated and improved through comparisons with field data. Recommendations and guidelines for the design and construction of pre-bored pile foundations will be provided.

IMPLEMENTATION POTENTIAL

This study will advance understanding of driven pile capacity within pre-bored soil. Charts or formulas will be presented for quantifying the effects of pre-bored hole size and soil conditions. Knowledge will be advanced on the quantitative prediction of driven pile capacity within pre-bored soil, with resultant improvements to construction quality of pile foundations.