

Evaluation of Bearing Capacity of Piles from Cone Penetration Test

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Problem

Due to the soft nature of soil deposits in the state of Louisiana, pile foundations are used by the Louisiana Department of Transportation and Development (DOTD) to support highway bridges and other transportation infrastructure.

In the design of pile foundations, the number and size of piles are generally determined based on the value of the bearing capacity.

Therefore, in order to design pile foundations with optimum safety and minimum construction cost, the pile bearing capaci-

ty must be estimated within an acceptable margin of accuracy and reliability.

The cone penetration test (CPT) is among the popular in situ tests conducted by DOTD. Three cone trucks operate on DOTD projects. Two vehicles are managed by LTRC. Both the DOTD and LTRC 20-ton cone trucks are reaching ten years of service.

Cone penetration tests can provide valuable and continuous information regarding the soil strength with depth. Because cone penetration tests can be taken much faster and economically



The LTRC electronic cone penetrometer truck to be used in the evaluation of the bearing capacity of piles.



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than standard soil borings, the actual site characteristics will be available to the design engineer for each particular pile bent location. This will make a pile design method that can use the CPT data more accurately for the evaluation of pile bearing capacity. To be reliable for Louisiana soils, particularly silts and clays, the appropriate design method must be correlated with pile load tests.

The existing data acquisition systems are approaching obsolescence due primarily to the MS-DOS based applications required to operate the systems. The cost of repairing older hardware, in particular computers, rises because of the difficulty in locating parts that are not being manufactured anymore. Therefore, the data acquisition system and software needs to be updated to take advantage of newly available technologies.

Objectives

The objectives of this research are as follows:

- 1.) Collect a suitable number of pile load test reports which has CPT data from DOTD files
- 2.) Conduct a comprehensive literature review to investigate and evaluate methods of estimating bearing capacity of pile foundations using cone penetration test data

- 3.) Identify the most reliable interpretation methods based on their suitability for potential application to different soil types in Louisiana soils
- 4.) Identify (and improve, if required) a design method for implementation in the design and analysis of bearing capacity of pile foundations using the CPT test results
- 5.) Identify/develop software solutions for the interpretation of pile capacity and soil characterization using the CPT test results
- 6.) Conduct a verification scheme using other pile and cone data to evaluate the capabilities of the method
- 7.) Upgrade the data acquisition systems on the LTRC and DOTD cone trucks.

Description

The precast, prestressed concrete and steel pipe piles are the most common piles currently used in DOTD projects. DOTD spent about \$19 million on driven piles in 1995. A reliable design and analysis method needs to be identified to estimate the bearing capacity of these piles using the cone penetration test data.

The availability of cone penetration test systems at DOTD will make such a method easy to implement in the design and analysis of piles. Moreover, a small percentage cost reduction on expensive piling projects will result in significant financial savings.

This method will increase the confidence in pile design and will reduce the uncertainties and personal judgments associated with design and analysis of pile foundations.

Implementation Potential

The goal of this research is to use the cone penetration test data to evaluate and improve the available interpretation methods used to estimate the bearing capacity of pile foundations installed in Louisiana soils. An attempt will be made to establish empirical but databased correlations between the CPT data and pile capacity components.