SUMMARY REPORT 125-5(S)

WAVE EQUATION PREDICTION OF PILE BEARING CAPACITY COMPARED WITH FIELD TEST RESULTS

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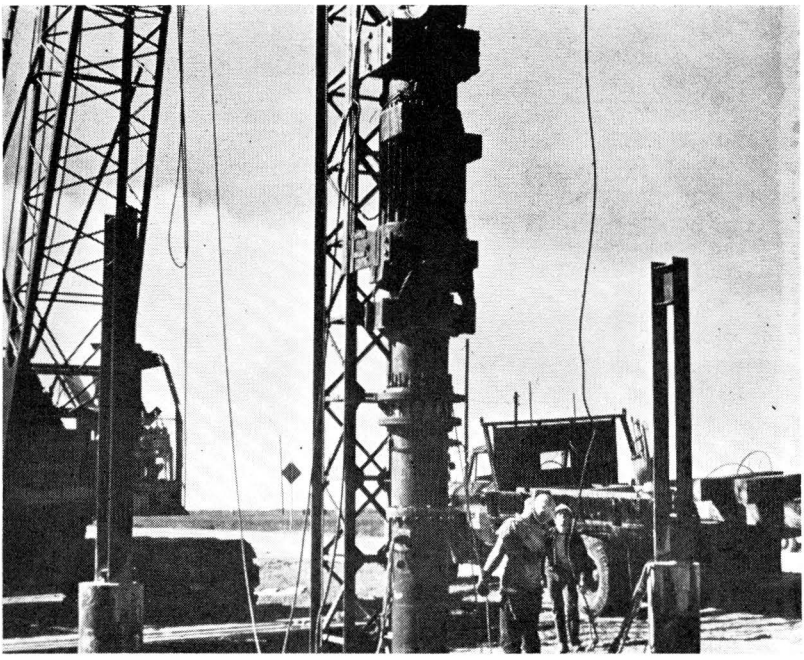

View of Link-Belt Speeder 520 diesel hammer, load cell, and 16-inch diameter steel pipe pile at Port Arthur field test location. Reaction piles for static load test are shown on left and right.

Cooperative Research Program of the
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Wave Equation Prediction of Pile Bearing Capacity Compared With Field Test Results

by

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This investigation was conducted under Research Study 2-5-67-125 entitled "Bearing Capacity for Axially Loaded Piles" which is a cooperative research endeavor sponsored jointly by the Texas Highway Department and the U. S. Department of Transportation, Federal Highway Administration. The broad objective of this study is to develop a procedure whereby the bearing capacity of an axially loaded pile can be determined for any combination of soil and driving conditions.

Research Report 125-5 presents the results of a test program conducted to develop soil parameters for a predominantly clay soil. The soil parameters are intended for use with the computer program which solves the one-dimensional wave equation for the purpose of predicting the bearing capacity of pile foundations.

The bearing capacities of full-scale instrumented friction piles in clay are predicted. The predicted capacities are compared with field data from static load tests. The results obtained by using currently accepted soil parameters, which characterize the dynamic response of a soil to impact loading, are compared to those attained by using soil parameters which were recently developed from model pile tests. A parameter study is made to determine the qualitative effects that the soil parameters have on the predicted capacity.

A method is proposed which may eliminate the necessity of conducting static load tests to determine soil set-up. The proposed method utilizes data obtained by re-driving a pile after a time interval has elapsed during which soil set-up has occurred.

Specific conclusions are made which are appropriate for the types of piles and soils which were considered. From the results of the parameter study that was made with the Beaumont test pile data, the following conclusions are made:

1. Predicted pile capacities obtained using a uniform distribution of static soil resistance do not differ substantially from those obtained by assuming a triangular distribution.

2. The ratio of point load to total load is a critical factor in predicting the bearing capacity of a pile.

3. The value of the soil quake, Q, does not have a significant effect on the predicted bearing capacity. A value of $Q = 0.10$ in. is recommended.

4. The accuracy of predicted pile bearing capacities is not significantly influenced by the point damping parameter J. A value of 0.15 seconds per foot will yield acceptable accuracy for friction piles in clay.

Based on the results from wave equation analyses of the Port Arthur, Beaumont, and Belleville data, the following conclusions are made:

1. There is no single value for the friction damping parameter J' which can be used for all types of clay.

2. There is an apparent relationship between the plasticity index and the friction damping characteristics of clay soils.

The following recommendations are made concerning future research on the subject:

1. There is an acute need for field test data obtained from fully instrumented piles driven into cohesionless materials. These field tests must be conducted in strictly cohesionless materials to eliminate the effect of cohesive soils on the dynamic response, thereby allowing an independent assessment of the tip and friction damping parameters for sands and silts.

2. Future studies should investigate the effects of different pile materials, such as concrete and wood, on the predicted pile capacities. In addition, the effect of pile geometry should be analyzed. Particular attention should be given to the influence of these variables on the friction-damping characteristics of the particular pile-soil system involved.

3. Future pile tests should include a measurement of the point-bearing load whenever possible.

4. Future pile tests should include a static load test as soon as possible after driving and at a minimum of 10 days after driving, with two weeks or more being the preferred time interval. This should be done concurrently with a redriving of the pile so that measured capacities after soil set-up has occurred can be correlated with wave equation predictions. Data should be obtained for a wide variety of pile and soil types.

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