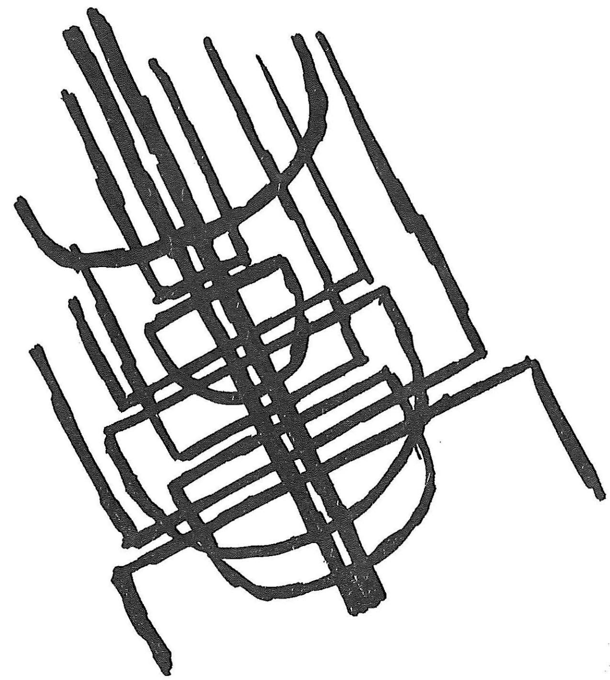
DYNAMIC STUDIES ON THE BEARING CAPACITY OF PILES



PHASE III VOLUME I

REPORT NO. 48

DIVISION OF
SOLID MECHANICS STRUCTURES AND MECHANICAL DESIGN
SCHOOL OF ENGINEERING CASE WESTERN RESERVE UNIVERSITY

DYNAMIC STUDIES ON THE BEARING CAPACITY OF PILES

Project Report of Phase III

August 1, 1970

by

G. G. Goble

F. Rausche

F. Moses

This research was sponsored by the Ohio Department of Highways and the Federal Highway Administration. The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the State or the Federal Highway Administration.

Case Western Reserve University
Division of Solid Mechanics,
Structures, and Mechanical Design
University Circle
Cleveland, Ohio 44106

ACKNOWLEDGEMENTS

The cooperation, assistance and advice on technical matters of R. Dowalter, and R. Grover all of the Ohio Department of Highways contributed substantially to the success of this project phase. In administrative matters the assistance of C. R. Hanes, Ohio Department of Highways, was appreciated.

ABSTRACT

An automated prediction scheme is presented which uses both measured top force and acceleration as an input and computes the soil resistance forces acting on the pile during driving. The distribution of these resistance forces acting along the pile is also determined. Shear and dynamic resistance forces are distinguished such that a prediction of total static bearing capacity is possible. Using the shear force prediction a static load versus penetration curve is computed for comparison with the result from a corresponding field static load test.

The method of analysis uses the traveling wave solution of the one-dimensional, linear wave equation. As a means of calculating the dynamic response a lumped mass pile model is used and solved by the Newmark β-method.

Using stress wave theory two simplified methods are developed for predicting static bearing capacity from acceleration and force measurements. These methods can be used during field operations for construction control when incorporated in a special purpose computer. The automated prediction scheme and simplified methods are applied to 24 different sets of data from full scale piles. The piles were all of 12 inches diameter steel pipe with lengths ranging from 33 to 83 feet. Also, 24 sets of data from reduced scale piles are analyzed by the simplified methods. All predictions are compared with results from static load tests. Correlation is very good for piles driven into non-cohesive soils. For cohesive soils better agreement with static load measurements are obtained than from existing methods.

As a check on the assumed soil response to both pile displacement and velocity results from measurements taken at the pile tip are investigated and discussed. Further, an approach to pile and hammer design is described using the results of stress wave theory.

TABLE OF CONTENTS

VOLUME I

TABLE OF CONTENTS (Continued)