Ain Shams University
Faculty of Engineering
Structural Engineering Department

Behavior of Sand Under Seismic Effect

(Densification and liquefaction)

By

Mohamed Ahmed Abdel-Motaal
B. Sc. Civil Eng. - Hon. (1991)
Ain Shams University

A Thesis

Submitted in Partial Fulfillment for
the Requirements of the Degree of Master of Science
in Civil Engineering

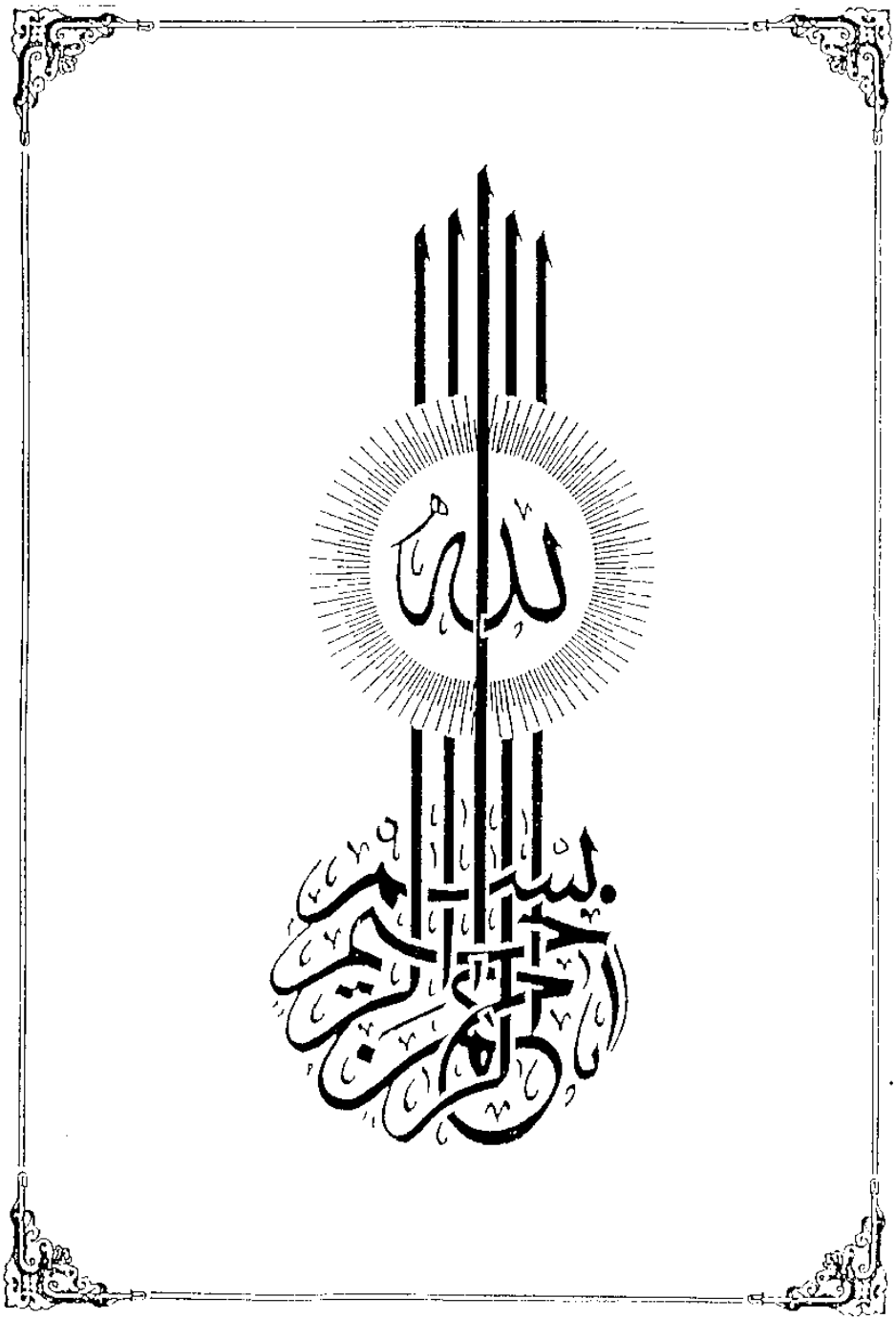
Supervised By

Prof. Dr. Ing.
Farouk Ibrahiem. El-Kadi
Prof. of Soil Mech. and Foundation
Structural Engineering Department
Faculty of Engineering
Ain Shams University

Prof. Dr. Eng.
Tarek Ahmed Macky
Prof. of Soil Mech. and Foundation
Structural Engineering Department
Faculty of Engineering
Ain Shams University

Cairo - Jan., 1995

اللهم علمنا ما ينفعنا و انفعنا بما علمتنا



EXAMINER COMMITTEE **SIGNATURE**

1- Prof. Dr. Eng. Mohamed Ezzat Sobeh
Prof. of Theory of Structure
Faculty of Engineering - Cairo University

2- Prof. Dr. Eng. Ezzat Abdel-Fattah Emera
Prof. of Soil Mech. and Foundation
Faculty of Engineering - Ain Shams University

3- Prof. Dr. Ing. Farouk Ibrahiem El-Kadi
Prof. of Soil Mech. and Foundation
Faculty of Engineering - Ain Shams University

4- Prof. Dr. Eng. Tarek Ahmed Macky
Prof. of Soil Mech. and Foundation
Faculty of Engineering - Ain Shams University

Date: / 01 / 1995

STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master in Structural Engineering.

The work included in this thesis was carried out by the author in the Department of Structural Engineering, Ain Shams University, from January, 1993 to November, 1994.

No part of this thesis has been submitted for a degree of qualification at any University or Institution.

Date : 18/1/1995

Signature : Abdelmotaal

Name : *Mohamed Ahmed Abdel-Motaal*

Ain Shams University
Faculty of Engineering
Department of Structural Engineering

Abstract of M.Sc. thesis submitted by :
Mohamed Ahmed Abdel-Motaal

Title of thesis :
Behavior of Sand Under Seismic Effect
(Densification and Liquefaction)

Supervisors : **1) Prof. Dr. Ing. Farouk Ibrahiem El-Kadi.**
2) Prof. Dr. Eng. Tarek Ahmed Macky

Registration date : /01/1993 Examination date : /01/1995

ABSTRACT

During the Earthquake of October 12, 1992, in Dahshour, near Cairo, Egypt, extensive damage to engineering structures occured as a results of liquefaction and densification of the sandy soil on which they were supported. At El-Aiiat and the surrounding villages, liquefaction had taken place in a form of "sand fountains" and excessive settlement in a major highway.

In this search, laboratory test programme was prepared to perform the laboratory tests and the exprimental studies concerning the behavior of sand under seismic effect (cyclic loading effect). a simple shear device and a shaking table were locally fabricated and used for this experimental study. Different parameters, such as relative density, base acceleration, frequency, percentage of fine, and shear strain amplitude, were changed to study its effect on both liquefaction and densification of three different soil samples. Conclusions and recommendations were listed at the end of this search.

ACKNOWLEDGEMENT

The author wishes to express his deep gratitude and sincere appreciation to **Professor Dr. Ing. Farouk I. El-Kadi**, Professor of Soil Mechanics and Foundation, Faculty of Engineering, Ain Shams University, for his guidance, supervision and review of this work.

The author is also very grateful to **Professor Dr. Eng. Tarek A. Macky**, Professor of Soil Mechanics and Foundation, Faculty of Engineering, Ain Shams University, for his helpful and constructive suggestions, and for continuous encouragement he generously offered during this work. Also, he devoted much of his precious time and effort in order to achieve this work in a successful form.

The author is very thankful to the technicians of Soil Mechanics Laboratory, Faculty of Engineering, Ain Shams University, for their valuable help which have greatly contributed in presenting this work.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure No. **Page**