بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــسـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

Ain Shams University
Faculty of Engineering
Structural Engineering Department

Analysis of the Behavior of Pile Group Taking Into Account the Method of Installation and its Effect on the Single Pile and the Group

By

Hisham Arafat Mahdi
B.Sc.1985, M.Sc. (Structural Division) 1991
Ain Shams University

A Thesis

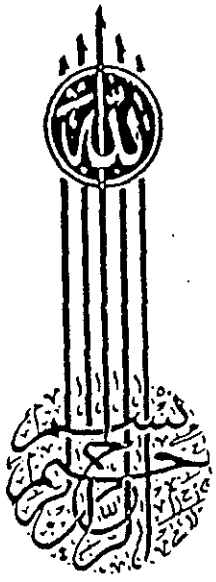
Submitted in Partial Fulfillment for
the Requirements of the Degree of Philosophy of Doctor
in Civil Engineering
Department of Structural Engineering

Supervised by

Prof. Dr. Eng.
Farouk Ibrahim El-Kadi
Prof. of Soil Mech. and Foundations
Structural Engineering Department
Faculty of Engineering
Ain Shams University

Prof. Dr. Eng.
Tarek Ahmed Macky
Prof. of Soil Mech. and Foundations
StructuralEngineeringDepartment
Faculty of Engineering
Ain Shams University

Cairo - 1998



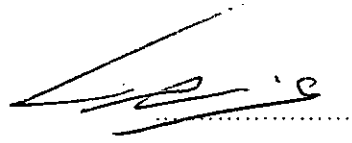
قَالُوا سُبْحَانَكَ لا عِلْمَ لَنَا إِلاَّ مَا
عَلَّمْتَنَا إِنَّكَ أَنتَ
الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم
(سورة البقرة)
الآية «٣٢»

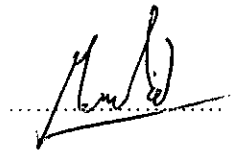
EXAMINER COMMITTEE

Name, Title & Affiliation | **Signature**

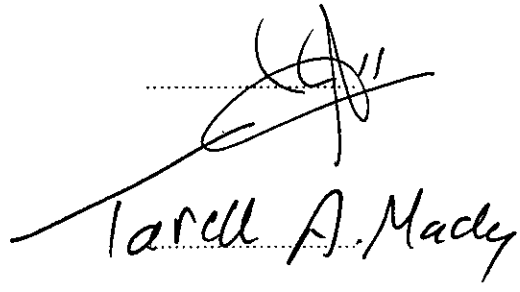
1- **Prof. Dr. Eng. A. Helmi El-Ramly**
Prof. of Geotechnical Engineering,
Faculty of Engineering - Cairo University



2- **Prof. Dr. Eng. Mona M. Eid**
Prof. of Geotechnical Engineering,
Faculty of Engineering - Ain Shams University



3- **Prof. Dr. Eng. Farouk Ibrahim El-Kadi**
Prof. of Geotechnical Engineering,
Faculty of Engineering - Ain Shams University



4- **Prof. Dr. Eng. Tarek Ahmed Macky**
Prof. of Soil Mechanics & Foundations,
Faculty of Engineering - Ain Shams University

Date : ...../..07..../1998

STATEMENT

This dissretation is submitted to Ain Shams University for the degree of **DOCTOR OF PHILOSOPHY** in Civil Engineering. The work included in this thesis was carried out by the author in the department of Structural Engineering, Ain Shams University from June 1992 to 1998. No part of this thesis has been submitted for a degree or a qualification at any other University or Institution.

Date : 27 / 5 / 1998

Signature :

Name : Hisham Arafat Mahdi

ABSTRACT

Eng. Hisham Arafat Mahdi. Analysis of the Behavior of pile Groups Taking into Account the Method of Construction and its Effect on the Single Pile and the Group. Unpublished Doctor of Philosophy dissertation. ***Ain Shams University - Faculty of Engineering - Structural Engineering Department.***

Pile performance is perceived as an art of construction which must be accomplished with the utmost care and at the highest professional undertaking. To assure constant evolution of the new innovated piling systems and to preserve safe and economic design, full implementation and understanding of the installation parameters are highly crucial. Nevertheless, the designers always face the problem that the same pile installed in the same subsurface conditions even using the same machine, originate different load-settlement curves for the same geometry of the pile "length and diameter" . Such phenomenon sheds an obscure atmosphere and obliges the designers to choose the conservatism trend in assigning the pile bearing capacity, it might distracts the foundation engineer to the point that overestimation of pile capacity can occur. This phenomenon was mainly attributed to the method of pile installation and to the experience and skill of the operating crew which was regarded before as a subsidiary parameter.

The aim of this research is directed towards investigating, through in-situ testing, observations and analytical modeling, the behavior of piles during installation and the associated influence degree in the surrounding soil, how much enhancement in the soil properties can be attained, and how far is improper installation can emerge related to the single pile and the whole pile group. The research focuses mainly on bored piles, continuos flight auger piles "CFA" and new screw piles of large stem diameter recently developed in the last ten years.

The research was founded on two main parts, the first part is in-situ work, which involved a numerous sounding test using cone penetration tests prior and after pile installation, besides, it involves undertaking of pile loading tests on piles which the author of this research was involved as an inspector and supervisor. Complete in-situ observations were recorded for subsequent analysis.

The second part is a numerical implementation of the pile-soil interaction problem, it has been undertaken by establishing an analytical model using an axi-symmetrical finite element

program and idealizing the interface between the soil and the pile employing joint interface element. The model simulates in a phased step-wise procedure the detailed installation of bored and screw piles. Moreover, comparison between assembled in-situ testing results, observation records and the numerical modeling results had been conducted where a consistent matching are substantiated.

Eventually, a parametric study has been conducted to accentuate the influence of the constructional parameters on the single pile and the global group of piles. The analytical model was implemented to reveal the substantiality of good performance of piles reflecting the consequences incurred from professional and improper installation.

Keywords: Screw piles, Bored piles, Mohr-Coulomb Model, Coulomb friction model, Isoparametric element, Interface element, CPT, DMT, Parametric study, Stem diameter, Drilling bucket, Drilling fluid, Screwing-in and Screwing-out, Concreting, Shrinkage.