بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

HANAA ALY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

شبكة المعلومات الجامعية
@ ASUNET

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENGINEERING DEPARTMENT

BEHAVIOR OF PILE GROUPS UNDER LATERAL LOADS

Thesis
Submitted in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE
In
CIVIL ENGINEERING
STRUCTURAL ENGINEERING DEPARTMENT
By

Essam Amr Mohamed Elgridly

Supervised by

Prof. Dr. Ali Abdel-Fattah Ali Ahmed
Professor of Geotechnical Engineering
Structural Engineering Department
Faculty of Engineering
Ain Shams University

Prof. Dr. Ayman Lotfy Fayed
Professor of Geotechnical Engineering
Structural Engineering Department
Faculty of Engineering
Ain Shams University

Cairo – 2021

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENGINEERING DEPARTMENT

Name : Essam Amr Mohamed Elgridly
Thesis : Behavior of pile groups under lateral loads
Degree : Master of Science in Civil Engineering (Structural Engineering)

EXAMINERS COMITEE

Name and Affiliation	Signature
Prof. Dr. Mohamed Elkhouly Professor of Geotechnical Engineering Faculty of Engineering Cairo University	
Prof. Dr. Mohamed Monir Professor of Geotechnical Engineering Faculty of Engineering Ain Shams University	
Prof. Dr. Ali Abd Al-Fattah Ali Professor of Geotechnical Engineering Faculty of Engineering Ain Shams University	
Prof. Dr. Ayman Lotfy Fayed Professor of Geotechnical Engineering Faculty of Engineering Ain Shams University	

Date: / / 2021

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENGINEERING DEPARTMENT

Name : Essam Amr Mohamed Elgridly

Thesis : Behavior of pile groups under lateral loads

Degree : Master of Science in Civil Engineering

SUPERVISORS COMITEE

Name and Affiliation	**Signature**
Prof. Dr. Ali Abd Al-Fattah Ali Ahmed Professor of Geotechnical Engineering Faculty of Engineering Ain Shams University **Prof. Dr. Ayman Lotfy Fayed** Professor of Geotechnical Engineering Faculty of Engineering Ain Shams University	

Date: / / 2021

Postgraduate Studies

Authorization stamp: The thesis is authorized at / / 2021

College Board approval / / 2021

University Board approval / / 2021

CURRICULUM VITAE

Name	Essam Amr Mohamed Elgridly
Date of Birth	09 May 1992
Place of Birth	Cairo, Egypt
Nationality	Egyptian
Scientific degree	B.Sc. of Structural Engineering, Faculty of Engineering, Shorouk Academy, 2016
Current Job	Structural Design Engineer, Structure Division, Enoia Consulting Engineers.

STATEMENT

This thesis is submitted to Ain Shams University for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author at the Department of Structural Engineering, Faculty of Engineering, Ain Shams University, Cairo, Egypt.

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

Name: Essam Amr Mohamed Elgridly

Signature:

Date: /   / 2021

ACKNOWLEDGMENT

First and foremost, thanks to GOD for his many graces and blessings.

I wish to express my deepest gratitude and appreciation to Dr. Ayman Lotfy Fayed, Professor of Geotechnical engineering, Structural Department, Faculty of Engineering, Ain Shams University for his patience, help, guidance, useful suggestions, dedication, encouragement, and kind supervision.

My grateful appreciation also extends to Dr. Ali Abdel-Fattah, Professor of Geotechnical engineering, Structural Department, Faculty of Engineering, Ain Shams University for his fruitful comments and valuable advice throughout this research till its completion which is gratefully acknowledged and sincerely appreciated.

Most importantly, my deepest thanks and love for my family, your constant and everlasting support is the reason for being able to finish this research.

ABSTRACT

In pile groups, pile-soil interaction between the piles reduces the pile's lateral resistance. To predict the pile group behavior under lateral loads the p-multiplier approach is commonly used, or the group reduction factors. Different experimental studies have been conducted on pile groups but due to the difficulty and the limited capacity of the loading equipment most of those studies were conducted on small pile groups with free-head condition and small spacing between piles. These drawbacks are the reason for using three-dimensional finite element numerical modeling to study the behavior of pile groups under lateral loads. This research studies the group reduction factor of pile groups with different sizes, spacing, and head conditions. A numerical model is formed to simulate the behavior of pile groups. The reliability of the model is first validated using a full-scale lateral load test on pile group in sand. The established models are used to calculate the group reduction factors of the pile groups. The computed group reduction factors are compared with previous experimental data. This research gives a greater insight of the lateral capacity of the piles in the group based on their row position in the group. The lateral deflection curve and bending moment profile of various piles of different rows are compared. This research finds that the design guidelines overestimated the pile group reduction factor especially for larger pile groups with larger spacing between piles and for pile groups with a fixed head condition such as AASHTO and FEMA P-751.

Keywords: Pile group reduction factor, P-multiplier, Soil-Pile interaction, Deep foundations, lateral loads.

TABLE OF CONTENTS

LIST OF FIGURES