STABILITY ANALYSIS OF DEEP EXCAVATIONS IN CLAYS

By

Amr Mohamed Abd El-Samea Ahmed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
CIVIL ENGINEERING - PUBLIC WORKS

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA – EGYPT
2018

STABILITY ANALYSIS OF DEEP EXCAVATIONS IN CLAYS

By

Amr Mohamed Abd El-Samea Ahmed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
CIVIL ENGINEERING - PUBLIC WORKS

Under the Supervision of

Prof. Dr. Ashraf Kamal Hussein
Professor of Geotechnical Engineering
Faculty of Engineering
Cairo University

Dr. Sherif Adel Akl
Associate Professor of Geotechnical Engineering
Faculty of Engineering
Cairo University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA – EGYPT
2018

STABILITY ANALYSIS OF DEEP EXCAVATIONS IN CLAYS

By

Amr Mohamed Abd El-Samea Ahmed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
CIVIL ENGINEERING - PUBLIC WORKS

Approved by the
Examining Committee

Prof. Dr. Ashraf Kamal Hussein	Thesis Main Advisor
Dr. Sherif Adel Akl	Advisor
Prof. Dr. Mostafa Abd El-Hamid Abu Kiefa	Internal Examiner
Prof. Dr. Khaled Mohamed El-Zahaby Professor at Housing and Building National Research Center	External Examiner

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA – EGYPT
2018

Engineer's Name:	Amr Mohamed Abd El-Samea Ahmed
Date of Birth:	01/10/1989
Nationality:	Egyptian
E-mail:	amr.mohamed.odaa@gmail.com
Phone:	01007760980 - 01007779280
Address:	13th Shafik Ghaly St., El-Haram, Giza, Egypt

Registration Date:	01/03/2012
Awarding Date:	.../.../ 2018
Degree:	Master of Science
Department:	Civil Engineering - Public Works
Supervisors:	Prof. Dr. Ashraf Kamal Hussein Dr. Sherif Adel Akl

Examiners:

Prof. Dr. Ashraf Kamal Hussien (Thesis Main Advisor)
Dr. Sherif Adel Akl (Advisor)
Prof. Dr. Mostafa Abd El-Hamid Abu Kiefa (Internal Examiner)
Prof. Dr. Khaled Mohamed El-Zahaby (External Examiner)
(Professor at Housing and Building National Research Center)

Title of Thesis:

STABILITY ANALYSIS OF DEEP EXCAVATIONS IN CLAYS

Key Words:

Stability, Deep Excavation, Clay, Undrained Analysis, Retaining Walls

Summary

In this research, the stability of deep excavations in clays is discussed. This thesis also introduces how the input parameters used to represent the soil properties affect the excavation stability in undrained conditions. The soil properties are represented in undrained type (A) and undrained type (B) using Mohr-Coulomb total stress analysis (TSA), effective stress analysis (ESA), and the undrained strength analysis (USA) using SHANSEP concept. To capture this effect, serious of numerical models are carried out using 2D finite element PLAXIS. In these models, the concrete diaphragm wall is used as a support system with horizontal struts installed at different levels. The soil properties used in this research have the same properties of Northwest Sinai clay. Moreover, this study discusses different factors affect the excavation stability such as; excavation geometry and wall stiffness. For each numerical model, surface settlement, lateral wall deformations and straining actions on side supports are presented.

Acknowledgement

First, I thank Allah for accomplishment of this thesis, and I hope this work is a useful for different researchers.

It has been a great honor to work under the supervision of Professor Ashraf Kamal. He is a great teacher mentor and supervisor. I will forever remember his kindness, guidance, support, and precious comments.

In addition, I would like to express my deep thankfulness to Dr. Sherif Akl for supervising this research. Dr. Sherif spent major efforts during discussion to accomplish this research. Working with him has a memorable learning experience both technically and personally.

Dedication

I thank Allah for Allah has blesses me with the best family in the world. I dedicate this thesis to my parents who taught me the keys to success and happiness: honest, moral, ethics, hard work, education, and respect. My parents lead me to the university and always encouraging me to set and attain high goals. Deepest gratitude to my sister for setting an extremely high standard and making me sure that I have everything that I need want.

Last but not least, I dedicate this thesis to my wife, thank you for love, strength, and emotional support. I apologize you for spending a long time away from you to accomplish this research. I look forward to spending the rest of our lives together.

Amr Mohamed

Table of Contents

List of Tables

List of Figures