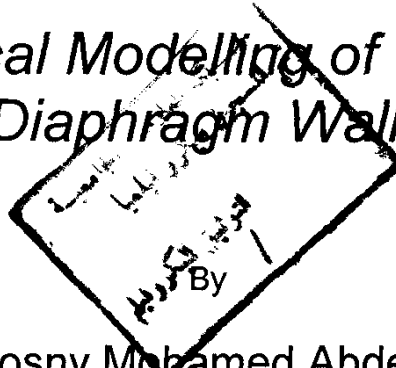


Ain Shams University  
Faculty of Engineering  
Structural Engineering Department

# *Numerical Modelling of Concrete Diaphragm Walls*



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B. Sc. Civil Eng. - Hon. (1989)  
Ain Shams University

A Thesis

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the Requirements of the Degree of Master of Science  
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Supervised By

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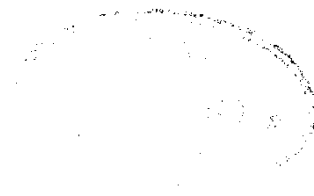
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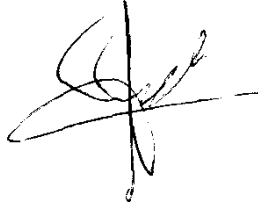


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### **STATEMENT**

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

This work included in the thesis was carried out by the author in the department of Structural Engineering, Ain Shams University, from April, 1992 to June 1993.

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

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Abstract for the M. Sc. thesis submitted by  
Eng. Ahmed Hosny Mohamed Abdel-Rahman

Title of the Thesis: Numerical Modelling of Concrete Diaphragm Walls

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ABSTRACT :

Implementation of subway systems became one of the effective solutions to overcome some of the environmental problems which face man's life especially in large highly populated cities.

Construction of subway stations and tunnels using the cut-and-cover technique employing reinforced concrete diaphragm walls is considered one of the most effective methods for controlling ground movements with minor effects on the adjacent existing structures. Analysis of such braced walls is considered one of the most sophisticated soil-structure interaction problems.

This research proposes a numerical modelling for analysis of diaphragm walls during the different construction stages of tunnels and subway stations. The associated variations in the soil stress field and deformations were investigated. In order to carry out such analysis, a computer program was specially upgraded using the Fortran language. Eight-node isoparametric finite elements were used to simulate the soil continuum and the diaphragm wall, the nonlinear stress-strain behaviour of the soil employing modified Duncan model (1984) were utilized. Spring type interface elements were also introduced to model the soil-diaphragm wall contact surface.

This thesis presents a comparative study between results of the nonlinear finite element analysis and the field measurements which had been compiled during construction of the Greater Cairo Underground Metro, Phase 1. Also, results of the analysis were compared with the predicted values from the commonly used empirical design rules of such walls.

An extensive parametric study was also carried out to evaluate the sensitivity of the utilized numerical model and the effect of different factors concerning the soil-wall interaction on the behaviour of the diaphragm wall and the associated soil deformations and stress field.

Key words: *Diaphragm walls, tunnels, braced excavation, nonlinear analysis, Fortran, Finite element, eight node element, interface elements, unloading increments.*

## TABLE OF CONTENTS

CHAPTER	PAGE
<b>1. INTRODUCTION</b>	
1.1 GENERAL.....	1
1.2 NATURE OF THE PROBLEM.....	2
1.3 OBJECTIVE OF THE RESEARCH.....	3
<b>2. LITERATURE SURVEY</b>	
2.1 INTRODUCTION.....	4
2.2 CONSTRUCTION OF BRACED EXCAVATION.....	4
2.3 DIFFERENT METHODS OF ANALYSIS.....	6
2.3.1 METHODS BASED ON THE EARTH PRESSURE THEORIES.....	6
2.3.1.1 THE WEDGE THEORY.....	7
2.3.1.2 RANKINE EARTH PRESSURE.....	7
2.3.1.3 SOIL PRESSURE ON BRACED SHEETING....	9
2.3.2 SUBGRADE REACTION METHOD.....	13
2.3.3 FINITE ELEMENT ANALYSIS METHOD.....	17
2.4 METHODS FOR THE PREDICTION OF THE GROUND LOSS AROUND THE EXCAVATION.....	20
2.4.1 MATHEMATICAL PRESENTATION FOR THE SETTLEMENT DISTRIBUTION.....	20
2.4.2 METHODS BASED ON THE DATA BASE RESULTS....	21
2.5 MISCELLANEOUS ASPECTS AND DIFFERENT CASE HISTORIES.....	23
2.5.1 BASIC MOVEMENT TREND.....	25
2.5.1.1 MAXIMUM MOVEMENTS - STIFF CLAYS, RESIDUAL SOILS AND SANDS.....	25



2.5.1.2	MAXIMUM MOVEMENTS - SOFT AND MEDIUM CLAYS.....	31
2.5.1.3	GENERAL PATTERN OF GROUND MOVEMENTS.....	33
2.5.1.4	SETTLEMENT PROFILES ADJACENT TO EXCAVATION.....	35
2.5.1.5	EFFECT OF THE DIAPHRAGM WALL INSTALLATION METHOD ON THE SETTLEMENT AROUND THE EXCAVATION.....	35
2.5.2	ACTUAL LATERAL STRESS DISTRIBUTION BEHIND THE BRACED EXCAVATION.....	38
2.5.2.1	DIFFICULTIES ASSOCIATED WITH THE USE OF PECK'S EARTH PRESSURE DISTRIBUTION, (1969).....	38
2.5.2.2	PROPOSED APPROACH FOR ESTIMATING THE ACTUAL EARTH PRESSURE DISTRIBUTION.....	39
 <b>3. METHOD OF ANALYSIS</b>		
3.1	INTRODUCTION.....	41
3.2	GENERAL DESCRIPTION OF THE ANALYSIS.....	42
3.3	IDEALIZATION OF THE PROBLEM.....	45
3.3.1	THE EIGHT-NODE ISOPARAMETRIC ELEMENT STIFFNESS MATRIX.....	46
3.3.1.1	THE EIGHT NODES ELEMENT CONFIGURATION.....	46
3.3.1.2	EIGHT NODES ELEMENT STRAIN AND DISPLACEMENT.....	49

3.3.1.3	THE CONSTITUTIVE MATRIX.....	52
3.3.1.4	THE EIGHT NODES ELEMENT STIFFNESS MATRIX FORMULATION.....	53
3.3.2	CONSTITUTIVE MODEL.....	55
3.3.2.1	NONLINEAR SOIL MODEL.....	55
3.3.2.2	HISTORY AND DESCRIPTION OF THE HYPERBOLIC STRESS-STRAIN MODEL.....	56
3.3.2.3	NONLINEAR INCREMENTAL FINITE ELEMENT METHODOLOGY.....	59
3.3.2.4	THE ORIGINAL DUNCAN MODEL, 1980....	60
3.3.2.5	THE MODIFIED HYPERBOLIC MODEL, DUNCAN, 1984.....	63
3.3.2.6	ANALYSIS PROCEDURES EMPLOYED IN THE PROGRAM.....	68
3.3.3	INTERFACE FINITE ELEMENT.....	71
3.3.3.1	INTERFACE ELEMENT STIFFNESS MATRIX.....	71
3.3.3.2	INTERFACE ELEMENT MODEL.....	73
3.4	NUMERICAL SIMULATION FOR BRACED EXCAVATION.....	77
3.4.1	SOIL EXCAVATION.....	77
3.4.2	INSTALLATION OF TEMPORARY STRUTS.....	79
3.4.3	DELETION OF TEMPORARY STRUTS.....	80
<b>4.</b>	<b>PARAMETRIC STUDY AND CASE HISTORY</b>	
4.1	INTRODUCTION.....	81
4.2	FINITE ELEMENT ANALYSIS FOR A CASE HISTORY.....	84
4.2.1	CONSTRUCTION PROCEDURE FOR THE RUNNING TUNNEL.....	84

4.2.2 MATERIAL PROPERTIES AND PARAMETERS USED IN THE ANALYSIS.....	87
4.2.3 FINITE ELEMENT MESH CONFIGURATION.....	90
4.2.4 PRESENTATION OF THE FINITE ELEMENT RESULTS.....	90
4.2.5 FINITE ELEMENT RESULTS OF THE CASE HISTORY.....	90
4.2.6 COMPARISON BETWEEN THE FIELD MEASUREMENTS AND THE RESULTS OF THE FINITE ELEMENT ANALYSIS.....	99
4.2.6.1 HORIZONTAL DEFORMATION OF THE WALL.....	100
4.2.6.2 SETTLEMENT TROUGH ADJACENT TO THE WALL AND HEAVE INSIDE THE EXCAVATION.....	100
4.2.7 COMPARISON BETWEEN THE COMMON DESIGN RULES OF THE BRACED WALLS AND THE RESULTS OF THE FINITE ELEMENT ANALYSIS.....	104
4.3 PARAMETRIC STUDY.....	108
4.3.1 EFFECT OF THE CONSTITUTIVE MODEL OF SOIL..	108
4.3.2 EFFECT OF NONLINEAR PARAMETERS.....	114
4.3.2.1 EFFECT OF MODULUS NUMBER (K).....	115
4.3.2.2 EFFECT OF BULK MODULUS NUMBER (Kb).....	125
4.3.3 EFFECT OF VARIATION OF THE WALL STIFFNESS.....	134
4.3.4 EFFECT OF THE PRESENCE OF THE BRACING SYSTEM.....	140

4.3.5 EFFECT OF VARIATION OF THE STRUT	
STIFFNESS.....	146
4.3.6 EFFECT OF VARYING THE NUMBER OF THE LOAD	
INCREMENTS USED IN THE ANALYSIS.....	147
4.4 PRECONSTRUCTION PREDICTION OF THE BEHAVIOUR OF	
UNDERGROUND STATIONS OF LINE 2 OF CAIRO METRO.....	153
4.4.1 STATION DIMENSIONS AND THE SOIL MODEL .....	153
4.4.2 CONSTRUCTION SEQUENCES FOR THE STATION .....	159
4.4.3 RESULTS OF THE FINITE ELEMENT ANALYSIS .....	161
 5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER	
STUDIES	
5.1 INTRODUCTION.....	165
5.2 SUMMARY.....	165
5.3 CONCLUSIONS.....	167
5.4 RECOMMENDATIONS FOR FURTHER STUDIES.....	172
 REFERENCES.....	174

## LIST OF FIGURES

FIG. NO.	PAGE
2.1 Wedge equilibrium.....	8
2.2 Illustration of active and passive pressures for cohesionless and cohesive soil. (After Bowels, 1982).....	10
2.3 Development of earth pressure on braced excavations..	12
2.4 Lateral earth pressure diagrams as suggested by Peck, 1969.....	14
2.5 Lateral earth pressure diagrams against braced sheeting as proposed by Tshebotarioff (1973).....	15
2.6 Determination of the modulus of subgrade reaction from insitu test results.....	16
2.7 Schematic diagram illustrates Caspe (1969) analytical method for estimating the sett. distribution adjacent to the excavation.....	22
2.8 Summary of soil settlements behind insitu walls (After Peck, 1969).....	24
2.9 Maximum lateral movement for the insitu walls and settlements in the soil retained by insitu walls in stiff clays, residual soils and sands (After Clough and O'Rourke, 1990.....	27
2.10 Summary of measured settlements and horizontal displacement adjacent to excavations in stiff to very hard clay (After Clough and O'Rourke, 1990)...	28
2.11 Predicted maximum lateral wall movement by finite	

element analysis modelling stiff soil conditions (After Clough and O'Rourke, 1990).....	30
2.12 Design curves to obtain maximum lateral wall movement and settlement for soft to medium clays (After Clough and O'Rourke, 1990).....	32
2.13 Typical profiles of movement for braced and tied back walls (After Clough and O'Rourke, 1990).....	34
2.14 Dimensionless settlement profiles recommended for estimating the distribution of settlement adjacent to excavations in different soil types (After Clough and O'Rourke, 1990).....	36
2.15 Summary of measured settlements caused by the installation of concrete diaphragm walls (After Clough and O'Rourke, 1990).....	37
 3.1 The program flow chart.....	43
3.2 Local coordinates system for the eight nodes element.....	47
3.3 Hyperbolic model for stress-strain behaviour (After Duncan et al., 1984).....	61
3.4 Modelling unloading-reloading moduli without introducing computational instability (After Duncan et al, 1984.....	66
3.5 Spring type interface element.....	72
3.6 Stress-deformation curves for the interface elements (After Dessouki, 1985).....	75
3.7 Hyperbolic simulation of the experimental direct shear test results.....	76

3.8 Simulation of the excavation process in the F.E. analysis.....	78
4.1 Cross-section details of the tunnel section and the soil profile at this location (After El-Nahhas et al, 1988).....	82
4.2 General layout of instrumentation at the tunnel test section (After Shalaby, 1989).....	83
4.3 Construction procedures steps for the running tunnel test section (After El-Nahhas et al., 1988)	85
4.4 Simulation of the construction stages in the finite element analysis.....	86
4.5 The finite element mesh used in the analysis of stages 3 to 7.....	91
4.6 The finite element mesh used in the analysis of stages 1 and 2.....	92
4.7 Propagation of the computed horizontal movement during the different construction stages.....	94
4.8 Propagation of the computed settlement adjacent to the wall during the different construction stages.	95
4.9 Propagation of the computed heave inside the excavation during the different construction stages.	96
4.10 Distribution of the lateral earth pressure on the diaphragm wall during the different construction stages.....	97
4.11 Comparison between the results of the finite element analysis and the field measurements for the horizontal deformation at stage No.6 .....	101