

Ain Shams University
Faculty of Engineering
Department of Civil Engineering

INTERACTION OF PLANE FRAMES WITH ELASTIC FOUNDATION

BY

KHALED SAAD EL DIN MOHAMED RAGAB

B.Sc. Civil Eng. 1984

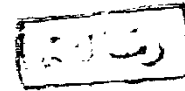
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SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

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IN

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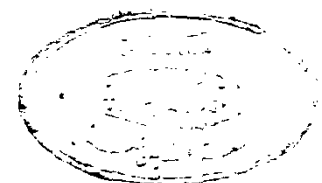
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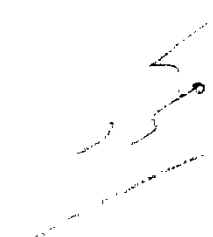
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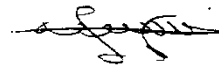
This dissertation is submitted to Ain Shams University for the Degree of M.SC. in Civil Engineering.

The work included in this thesis was carried out by the author in the Department Of Civil Engineering, Ain Shams University.

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

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Interaction of Plane Frames with Elastic Foundation

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Dept. of Structural Eng., Ain Shams University

By

Khaled Saad El Din Mohamed Ragab

Abstract

Analysis of statically indeterminate frames are influenced by the deformation of supporting foundation. This thesis presents an analytical procedure which can perform the following tasks.

- 1- Analysis of interaction of plane frames with elastic foundation having normal and shear moduli of subgrade reactions taking into consideration the nonlinearity of soil, axial flexural interactions of frame and the effect of presence of basement walls and variation of its heights on the internal forces of structure.
- 2- Study of the effect of framing action when the frame and soil are treated as one compatible unit and comparing this solution with the solution of the foundation alone as a beam on elastic foundation.
- 3- Study the effect of use of tie beams and varying their positions on the internal forces of structure.

A computer program is developed to analyze these tasks using Fortran 77. Three groups of the models are solved to show the capabilities of the program. In addition, the solution by elastic shear modulus of soil on the internal forces of structure is studied. Based on the results of these groups, the conclusions and recommendations are presented.

TO
MY FAMILY

Table of Contents

Notations

Chapter (1) Introduction

1.1 Interaction behaviour	1
1.2 Soil structure interaction	3
1.3 Soil nature behaviour	4
1.4 Behaviour of the soil foundation interface	4
1.5 Objective and scope	6

Chapter (2) Review of Previous Work

2.1 Introduction	10
2.2 Idealized soil models.	10
2.2.1 The Winkler model	11
2.2.1.1 Historical review concerning the analysis of finite beams on a Winkler model. —	11
2.2.2 The elastic continuum model (isotropic homogene- ous elastic half - space model).	14
2.2.2.1 Historical review concerning the analysis of finite beams on an isotropic elastic continuum model of soil	15
2.2.3 The two parameter elastic model.	17
2.3 Contact pressures by the theory of subgrade reaction –	18
2.4 Experimental determination of K_v , the subgrade modulus.	22
2.5 Factors affecting the magnitude of the coefficients of subgrade reaction.	23

2.5.1 The modulus of subgrade reaction, K_v .	24
2.5.2 The coefficient of horizontal soil reaction, K_h .	29
2.6 Influence of the rigidity of superstructure on the differential settlement of foundation.	33

Chapter (3) Mathematical Model

3.1 Introduction	37
3.2 Review of stiffness matrix for a plane frame element.	37
3.3 Stiffness matrix for a beam element on elastic foundation having normal subgrade reaction.	41
3.4 Stiffness matrix for a frame element on elastic foundation having normal and shear moduli.	46
3.5 Nodal load vector for beam on elastic foundation	51
3.6 Analysis of a beam on nonlinear Winkler foundation.	54
3.7 Modified stiffness matrix for the axial flexural interaction of the superstructure elements.	56

Chapter (4) Computer Program

4.1 Introduction	59
4.2 Explanation for computer implementation	59
4.3 Short notes about the main program and its subprogram	61
4.3.1 Main program	61
4.3.2 Subprogram Gtdata	61
4.3.3 subprogram Gtload	61
4.3.4 Subprogram Gtwrite	67
4.3.5 Subprogram step (1)	67

4.3.6 Subprogram step (2)	67
4.3.7 Subprogram step (3)	67
4.4 Description of the input and output data for the different uses of the program.	67
4.5 Verification problems	74
Chapter (5) Parametric Studies	
5.1 Introduction	84
5.2 Effect of basement walls	84
5.3 Effect of soil structure interaction	84
5.4 Effect of position of tie beam	98
5.5 Parameters that were not changed	98
5.6 Secondary parameters	102
Chapter (6) Results and Discussion	
6.1 Introduction	104
6.2 Buildings having basement walls and loading in the vertical and horizontal direction [Group (1)]	104
6.2.1 The elastic analysis (considering K_v and K_h) as a percentage from rigid analysis (neglecting K_v and K_h).	106
6.2.1.1 Effect of considering K_v and K_h (elastic analysis)	106
6.2.1.2 Effect of change the height of the retaining wall.	111
6.2.1.3 Effect of the number of floors	112
6.2.1.4 Effect of the number of spans	115

6.2.2	The elastic analysis (considering K_v and K_h) as a percentage from elastic analysis without including the shear modulus of subgrade reaction (K_h). —	116
6.2.3	Effect of existance of the basement walls. ———	119
6.2.4	Effect of the axial-flexural interaction for super-structure on the elastic analysis (considering K_v and K_h). —————	121
6.2.5	Effect of the nonlinear stress - strain curve of the soil on the elastic analysis(considering K_v and K_h). —	121
6.3	Buildings loading in the vertical direction only [Group (2)]. —————	124
6.3.1	The elastic analysis (considering K_v and K_h) with framing action as a percentage from rigid analysis (neglecting K_v and K_h). —————	126
6.3.1.1.	Effect of the number of floors. ———	126
6.3.1.2	Effect of the number of spans. ———	126
6.3.1.3	Effect of the type of foundations ———	126
6.3.2	The elastic analysis (considering K_v and K_h) as a percentage from elastic analysis without including the shear modulus of subgrade reaction (K_h). —	127
6.3.3	The elastic analysis (considering K_v and K_h) with framing action as a percentage from beam on elastic foundation analysis (considering K_v and K_h). —	127
6.3.3.1	Effect of the number of floors. ———	128
6.3.3.2	Effect of the number of spans. ———	128
6.3.3.3	Effect of type the foundations ———	128

6.3.4 The elastic analysis (considering K_v and K_h) with framing action as a percentage from beam on rigid foundation analysis (neglecting K_v and K_h).	129
6.3.4.1 Effect of the number of floors	129
6.3.4.2 Effect of the number of spans	129
6.3.4.3 Effect of the type foundations	129
6.4 Building having tie beams with varying their positions [group (3)].	130
6.4.1 Effect of the tie positions on the elastic analysis (considering K_v and K_h).	130
Chapter (7) Conclusions and Recommendations	
7.1 Conclusions.	134
References	138
Appendices	
(A) Listing for the computer program used in the study. —	145

Notations

The following symbols have been adopted for use in this study other symbols not listed below are defined where they are used.

W	Surface displacement.
K	Modulus of subgrade reaction.
P	Force applied at a point.
E_s	Young's modulus.
γ_s	Poisson's ratio.
EHS	Elastic half space (a semi-infinite continuous elastic solid).
FEM	Finite element methods.
K_v	Vertical subgrade reaction.
K_h	Horizontal soil reaction.
B, L	Width and length of foundation respectively.
D	Depth of embedment.
u	Horizontal displacement.
V	Vertical displacement.
θ	Rotation.
$\{P\}, \{S\}$	The external force and displacement vectors, respectively.
$[K]$	The total stiffness matrix.
EI	Flexural rigidity.
q	Represents the transverse distributed load per unit length.
y_o, θ_o	Initial condition for deflection and rotation, respectively.
M_o, Q_o	Initial condition for moment and shear, respectively.
σ_x	Stress

ε_x	Strain
A	Cross section area.
y_p, y_m, y_q	Particular solutions corresponding to concentrated force "P", concentrated moment "M" and uniformly distributed load "q".
V_i^P, V_i^M, V_i^q	Denote the nodal load vector components in the degree of freedom direction ($i = 2, 3, 5, 6$) due to concentrated "P", concentrated "M" and uniformly distributed load "q" respectively.
δ_A	Deflection of point (A).
γ	The member axes are rotated from the structural axes about the Z axis through the angle γ .
R_T	The rotation transformation matrix for a plane frame member,
C_x, C_y	The direction cosines and sines for the member.