AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING

APPROXIMATE ANALYSIS OF TALL-FRAMED BUILDINGS

BY

YOUSSEF HOUSSAM MOHAMED MOKHTAR EL-RAFEI

A THESIS

Submitted in partial fulfillment of
the requirements of the degree of Master in
Structural Engineering

SUPERVISED BY

Professor
MAHMOUD HASHISH

CAIRO - 1989

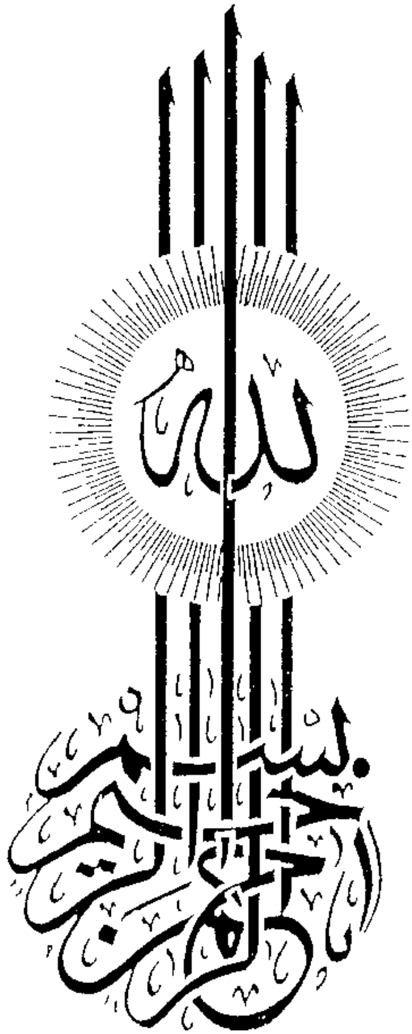
S T A T E M E N T

This dissertation is submitted to Ain Shams University for the degree of Master in Structural Engineering.

The work included in this thesis was carried out by the author in the Department of Structural Engineering, Ain Shams University, from October 1985 to June 1989.

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

Date	: 24/6/1989
Signature	: Yousef El-rafei
Name	: Youssef Hossam El-Rafei


الله
بسم الله الرحمن الرحيم

Examiners Committee

Name, Title & Affiliation	Signature
1 - Hassan Housny Professor El-Mattaria, Faculty of Engineering Helwan University	
2 - Ahmed Abd El-Moniem Korashy Professor Ain Shams University Faculty of Engineering	Ahmed Korashy
3 - Mahmoud Galal Hashish Professor Ain Shams University Faculty of Engineering	

Date : 24/6/1989

ACKNOWLEDGEMENTS

The author wishes to express his deepest appreciation and gratitude to Prof. Dr. **Mahmoud Galal Hashish**, Professor of Structural Engineering Department, Faculty of Engineering, Ain Shams University for his indispensable assistance and contributions during the course of development of the thesis.

The author also wishes to acknowledge the fruitful co-operation of the department of systems of the Engineering Consultant's Group. The author also extends his appreciation to **Eng. Ashraf H. Allouba**, President of the Engineering Consultant's Group for allowing the use of the computer facilities available at the company.

The author further wishes to thank **Dr. Ahmed Abdel-Motaleb Hashish**, Assistant Professor, Faculty of Engineering, Helwan University for his fruitful discussions during the early stages of this work.

TABLE OF CONTENTS

LIST OF NOTATIONS

A, Ac, Acn	Cross-sectional area of a member.
Ap	The plate area in span (d).
AXm, AYm	The distances of joint (m) in X and Y directions, respectively, from the center of gravity of all columns as a whole.
2b, 2c	The lengths of the normal and side panels.
E	Modulus of elasticity.
{ f }, { F }	The local and global forces vector, respectively.
F_n	The unknown vertical interactive force at corner joint (n).
G	Modulus of rigidity.
hn	Height of floor (n).
H	The total tube height.
Icxni, Icyni, Iczni	The second moment of area of column (i) in floor (n) about X, Y, and Z axes, respectively.
IXi, IYi	The distances to column (i) from the center of rigidity of columns as a whole.
Ix, Iy, Iz	The second moment of area of the element about its local axes X, Y, and Z, respectively.
Ibxn, Ibxzn	Second moment of area of a beam in Y-direction about X and Z axes, respectively, in global coordinates.
Ibyn, Ibyzn	Second moment of area of a beam in X-direction about Y and Z axes, respectively, in global coordinates.
ki	Stiffness of column (i).

k , K	The local and global stiffness matrix respectively.
Li	Span of bay (i).
M	The total overturning moment at floor mid-height due to lateral loads above and include this floor.
Mθxn,Mθyn	The summation of the applied moments at each joint, in floor (n), about X and Y axes, respectively.
Mθxni,Mθyni	The applied moments at joint (i), in floor (n), about X and Y axes, respectively.
Mbnk	The bending moment in each end of beam (k), in floor (n).
Mcnm	The bending moment in each end of column (m), in floor (n).
Mrn	Applied torsional moment about axis parallel to Z axis and passing through the floor C.G. .
Mθxn	Applied flexural moment about X-axis.
Mθyn	Applied flexural moment about Y-axis.
Nc	The number of columns per floor.
Nb	Number of bays.
Nnm	The applied vertical force at node (m).
Ncnm	The normal force in each end of column (m), in floor (n).
Nbx,Nby	Total number of beams, per floor, in X and Y directions, respectively.
Pxn	Applied horizontal force in X-direction.
Pyn	Applied horizontal force in Y-direction.
Qbnk	The shearing force in each end of beam (k), in

Qcnm	The shearing force in each end of column (m) in floor (n).
Rnm	The rotation about Z-axis of joint (m) in floor (n).
Rn	Single floor rotation about axis parallel to Z axis and passing through the floor C.G. .
t_1, t_2	The column length and the beam depth, respectively.
Tn	The rotation constant of floor (n), corresponding to floor rotation (Rn).
TMn	Applied moment of the flexural moments.
Txn	Applied overturning moment about X-axis.
Tyn	Applied overturning moment about Y-axis.
Vnm	The vertical displacement at joint (m) in floor (n).
x, y	The co-ordinates of the check point in (X) and (Y) directions, respectively, measured from center of geometry of the framed-tube.
Xn, Yn	The equal lateral displacements in X and Y directions, respectively, for floor (n).
Xe, Ye	The distances to the center of geometry of the floor plan from the center of gravity of the columns as a whole in X and Y directions, respectively.
{ y }, { Y }	The local and global displacements vector, respectively
Znm	The vertical displacement at joint (m) in floor (n).

z	The height measured from top
$\theta_{xnm}, \theta_{ynm}$	The rotations about X and Y axes, respectively, of joint (m) in floor (n).
θ_{xn}, θ_{yn}	The equal floor joint rotation about X and Y axes, respectively.
$\delta 1i_n$	The calculated vertical deflection at corner joint (n) in frame (1) due to applied vertical force at corner joint (i).
$\delta 2i_n$	The calculated vertical deflection at corner joint (n) in frame (2) due to applied unit vertical force at corner joint (i).
$\delta 2ip$	The calculated vertical deflection at corner joint (i) in frame (2) due to the applied lateral loads.
σb	The stress in the normal faces to load direction, assuming that the framed-tube behaves as a simple cantilevered beam.
$\sigma z, \sigma z'$	The vertical direct stresses in normal and side panels, respectively.
σb (H)	The stress (σb) at height equal (H).
$\tau yz, \tau xz$	The shear stresses in normal and side panels, respectively.
$\alpha xn, \alpha yn$	The single floor rotations about X and Y axes, respectively, for floor (n).
αxn	Single floor rotation about X-axis.
αyn	Single floor rotation about Y-axis.

LIST OF FIGURES

Page