Cairo University
Faculty of Engineering
Structural Engineering Department

EFFECT OF STIFFNESS AND MASS VARIATIONS ON THE SEISMIC RESPONSE OF REINFORCED CONCRETE FRAMES

A Thesis

Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Civil Engineering (Structural)

By

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Ain shams University, May 1995

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2000

بسم الله الرحمن الرحيم

ABSTRACT

Seismic code provisions restrict the use of equivalent static method for estimating earthquake loads to regular buildings, and provide a limiting value for variations in stiffness and mass beyond which dynamic analysis is required. In this research, the effect of stiffness and mass variations on frame-type reinforced concrete buildings is investigated using a non-linear dynamic analysis program IDARC 4.0 and using the equivalent static method as well as linear. The structures studied were two-dimensional building frames with 5, 7, and 10 stories. The parametric study included 6 groups of frames, each group consisted of three frames. The first three groups were used to investigate irregularities in stiffness and the second three groups were used to investigate irregularities in mass. The variation in stiffness resulted from transferring one column or two columns at the first floor. The variation in mass considered an increase in mass at specific stories due to variations in function/use. Each group was analyzed using five different earthquake records. The earthquakes used were three artificial records based on a design spectrum, as well as records from the November 22, 1995 Aqaba earthquake and the August 17, 1999 Izmmit, Turkey earthquake. The records were scaled for a peak ground acceleration of 0.12 g. seismic response was computed using both the equivalent static method and dynamic, nonlinear time-history analysis. Response parameters included story shear, drift, damage index and failure modes. Results of the dynamic analysis using the five different records are examined and compared to those obtained using the equivalent static force method.

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M. N. M. M

To My Parents And

To My Sister

CONTENTS

ABSTRACT i

AKNOWLEDGEMENT ii

CONTENTS iii

LIST OF FIGURES vii

LIST OF TABLES xx

LIST OF SYMBOLS xxii

CHAPTER 1 : INTRODUCTION

1.1 GENERAL 1

1.2 SCOPE AND OBJECTIVE 1

1.3 LITERATURE REVIEW 2

1.4 OUTLINE OF THE THESIS 7

CHAPTER 2 : SIESMIC ANALYSIS

2.1 EQUIVALENT STATIC LOAD ANALYSIS 9

2.1.1 Introduction 9

2.1.2 Egyptian Code (EC) 10

2.1.2.1 Equivalent static forces formula 10

2.1.2.2 Distribution of shear force among the different stories 11

2.1.3 1997- Uniform Building Code (UBC) 12

2.1.3.1 Equivalent static forces formula 13

2.1.3.2 Distribution of shear force among the different stories 15

2.2 DYNAMIC ANALYSIS 15

CHAPTER 3 : PROGRAM IDARC 2D VERSION 4.0

3.1 NONLINEAR STRUCTURE ANALYSIS SOFTWARE 24

3.2 THE IDARC COMPUTER PROGRAM SERIES 24

3.3 STRUCTURE IDEALIZATION 26

3.4 MODELLING STRUCTURAL COMPONENTS 27

3.4.1 Column elements 28

3.4.2 Beam elements 30

3.5 HYSTERETIC RULES 33

3.5.1 Three parameters Park model 33

3.6 ANALYSIS OPTIONS 36

3.6.1 Nonlinear Static Analysis 36

3.6.2 Nonlinear Pushover Analysis 36

3.6.3 Nonlinear Dynamic Analysis 37

3.7 DAMAGE ANALYSIS
38

3.8 STRUCTURAL COLLAPSE STATE 39