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Base Shear Analysis of RCC Structure for Various Column Cross Sections

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***Abstract*—**The object of this study is to assess the seismic behaviour of RCC Columns with different cross sections. In this paper, three different shapes are implemented as column cross section such L-shaped, Tee-shaped and Rectangular. The earthquake response of a symmetrical RCC framed Structure is studied with the ETABS software. For the analysis of G+10 RCC flat scheme structure, response spectrum method recommended by IS 1893:2002 was used and structure was assumed to be situated in earthquake zone V on a medium soil (type II). The parameter evaluated is mainly Base Shear.
Keywords*-*Base Shear, G+10 framed structure, RCC Columns, Response spectrum method, ETABS software.

I. Introduction

Buildings in many areas of the world are susceptible to damage from moderate to severe earthquakes. In the last few years, the widespread damage to RCC structures due to Earthquake generated demand for seismic evaluation in Indian Sub-Continent. No structure can be entirely immune to damage from earthquake. Currently, there are several design philosophies in earthquake engineering, making use of experimental results, computer simulations and observations from past earthquakes to offer the required performance for the seismic threat at the site of interest.

ETABS is one of the leading design software in the market. Many design company's use this software for their project design purpose. So, this paper mainly deals with the comparative analysis of the results obtained from the analysis of a multi storey building structure when analysed manually and using ETABS software separately. In this case, a 30.7m x 17.8m, 11 storey structure is modelled using ETABS software. The height of each storey is taken as 3 meter making the total height of the structure 33 meter. Analysis of the structure is done by Response spectrum method and then the results generated by this software are compared with manual analysis of the structure using IS 1893:2002.

In the response spectrum method, the response of a structure during an earthquake is obtained directly from the earthquake response (or design) spectrum. This procedure gives an approximate peak response, but this is quite accurate for structural design applications

II. Ease Of Use Formulation Of Work

The RCC framed G+10 symmetrical structure is considered for the study. Modelling and analysis of the structure is done on ETABS software. For seismic analysis, a well-known response spectrum method is used.

A. Methodology

The earthquake load is considered as per IS:1893(Part-I):2002, for the zone V and medium soil with importance factor 1.0 and Reduction factor 3.

Seismic zone factor Z for Zone V = 0.36

Scale factor = (Z/2) x (I/R) x g

The seismic load is calculated as per IS 1893(Part 1):2002. The building is analyzed in two principal horizontal directions.

Fundamental time period of building are calculated as per IS 1893(Part 1):2002 by using Response spectrum method.

Seismic coefficient A_h = (Sa/g) x (Z/2) x (I/R)

Base shear VB = A_h x W

For medium soil sites

Sa/g =1+15*T 0.00≤T≤0.10
=2.5 0.10≤T≤0.55
=1.36/T 0.55 ≤T≤4.00

B. Problem Statement

Table I

Sr. No.	Parameter	Sizes/ Values
1.	Length x Width	30.7m x 17.8m
2.	No. of Storey	11(G+10)
3.	Beam	300mm x 450mm
4.	Column	300mm x 500mm
5.	Slab Thickness	150mm
6.	Full Brick Wall	300mm
7.	Half Brick Wall	150mm
8.	Support Condition	Fixed
9.	Grade of Concrete & Steel	M25 & Fe500
10.	Live Load	3 kN/m^2
11.	Floor Finish	1 kN/m^2
12.	Damping	5 %

III. Modelling

C. Case I: RCC G+10 Framed structure with L-shaped column cross sections.

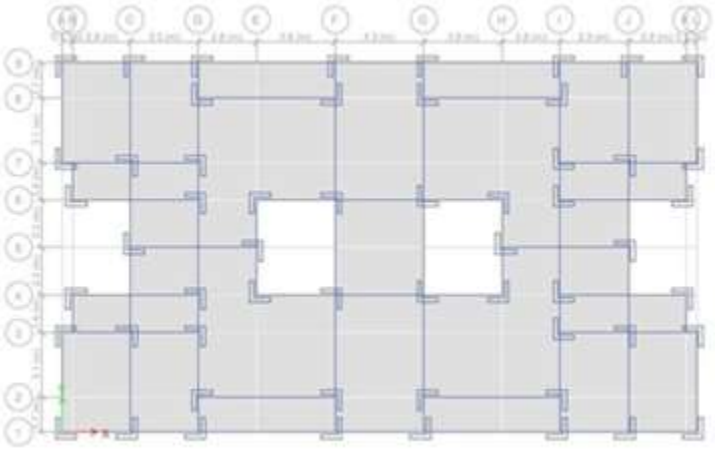

Fig. 1 Plan and 3D View of G+10 Building with L-shaped column c/s

D. Case II: RCC G+10 Framed structure with Tee-shaped column cross sections

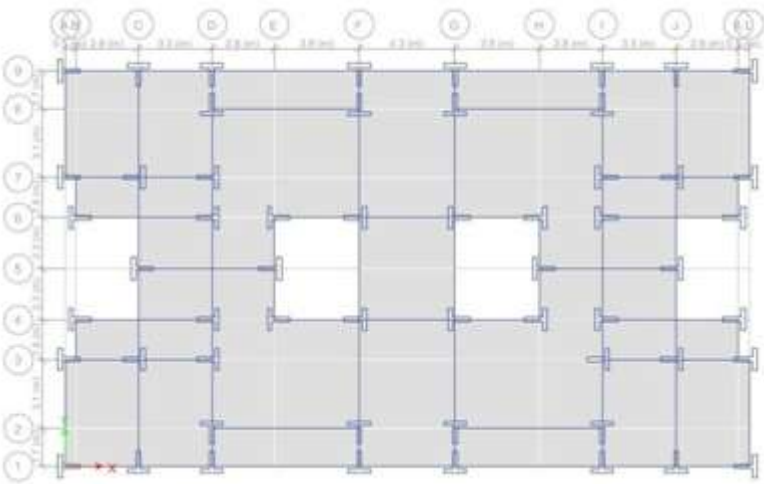

Fig. 1 Plan and 3D View of G+10 Building with Tee-shaped column c/s

E. Case III: RCC G+10 Framed structure with Rectangular column cross
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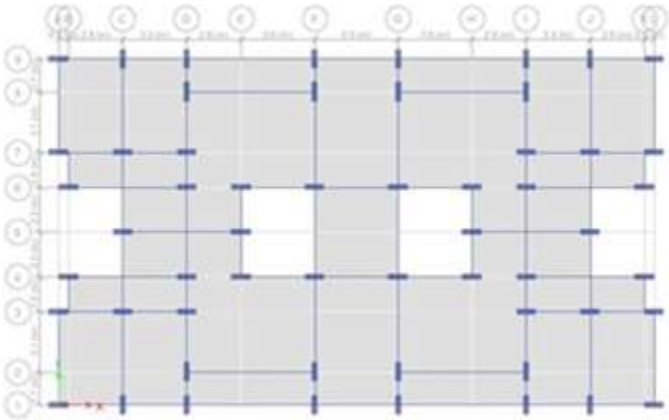

Fig. 3 Plan and 3D View of G+10 Building with rectangular column c/s

IV. Results

G. Base Shear Values

TABLE I BASE SHEAR VALUES OF RCC G+10 FRAMED STRUCTURE WITH L-SHAPED COLUMN C/S

Load Case/Combo	Fx (kN)	Fy (kN)	Fz (kN)
SWT	0	0	45232.2043
FBW	0	0	30294
HBW	0	0	7657.65
PPW	0	0	1442.16
FF	0	0	5252.94
LL	0	0	21489.3
RL	0	0	716.31
EQx	-5746.985	0	0
EQy	0	-5721.3509	0

TABLE II BASE SHEAR VALUES OF RCC G+10 FRAMED STRUCTURE WITH TEE-SHAPED COLUMN C/S.

Load Case/Combo	Fx (kN)	Fy (kN)	Fz (kN)
SWT	0	0	45232.2043
FBW	0	0	30294
HBW	0	0	7657.65
PPW	0	0	1442.16
FF	0	0	5252.94
LL	0	0	21489.3
RL	0	0	716.31
EQx	-5647.5733	0	0
EQy	0	-5549.6889	0

TABLE III BASE SHEAR VALUES OF RCC G+10 FRAMED STRUCTURE WITH RECTANGULAR COLUMN C/S

Load Case/Combo	Fx (kN)	Fy (kN)	Fz (kN)
SWT	0	0	43865.8079
FBW	0	0	30294
HBW	0	0	7657.65
PPW	0	0	1442.16
FF	0	0	5252.94
LL	0	0	21489.3
RL	0	0	716.31
EQx	-5096.0176	0	0
EQy	0	-4549.5625	0

H. Graph for Base Shear Values

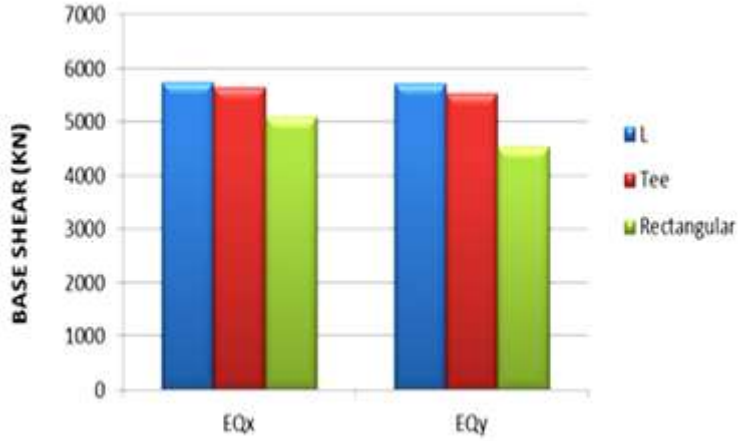

Fig.4 Base Shear Variation for Different column cross section along X and Y direction

V. Conclusions

From the data revealed by the manual as well as software analysis for the structures with response spectrum method using various loading combinations tried following conclusions are drawn:

1. Seismic analysis was done by using ETABS 2015 Ultimate 15.0.0 software and successfully verified manually as per IS 1893-2002.
2. There is a gradual increase in the value of lateral forces from bottom floor to top floor in both manual as well as software analysis.
3. There is slight variation in the values of base shear for three different column cross sections.
4. Scale factor for applied loading used in X and Y direction are 3.438 and 2.04 respectively.
5. Base shear values obtained by manual analysis are slightly higher than software analysis.
6. Results as compared and in case of base shear, L-shaped cross section has greater value and rectangular c/s has lowest value are obtained for 11-story building.
7. Complete guideline for the use of ETABS for response spectrum method analysis is made available by this paper.

To conclude a complete design involving several parameters so as to result the earthquake has been done and 3D prospective is shown for easy understanding and use

References

[1]. Mahesh N. Patil, Yogesh N. Sonawane, "Seismic Analysis of Multistoried Building", International Journal of Engineering and Innovative Technology (IJEIT), ISSN: 2277-3754, Vol. 4, Issue 9, March 2015

[2]. Kulkarni J.G., Kore P. N., S. B. Tanawade, "Analysis of Multi-storey Building Frames Subjected to Gravity and Seismic Loads with Varying Inertia" ISSN: 2277-3754 International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 10, April 2013

[3]. K. Rama Raju, M.I. Shereef, Nagesh R Iyer, S. Gopalakrishnan, "Analysis And Design of RC Tall Building Subjected to Wind and Earthquake Loads" The Eighth Asia-Pacific Conference on Wind Engineering, December 10–14, 2013, Chennai, India

[4]. Junting Jiao and Ronghua Yang, "Sensitivity Parameter Analysis of Bearing Capacity and Ductility of Reinforced Concrete Columns with Z-shaped Cross-section" ISSN: 1662-8985, VOL. 831, pp 158-163, 2014 Trans Tech Publications, Switzerland
[5]. Tiecheng Wang and Xuan Chen, "Non-linear Analysis of Z-Shaped Section Reinforced Concrete Column" ISSN: 1662-8985, VOL. 366, pp 276-280, 2012 Trans Tech Publications, Switzerland
[6]. IS : 875 (Part 1) – 1987 Code Of Practice For Design Loads (Other Than Earthquake) For Buildings And Structures, Part 1: Dead Loads-Unit Weights Of Building Materials And Stored Materials (Second Revision)
[7]. IS : 875 (Part 2) - 1987 Code Of Practice For Design Loads (Other Than earthquake) For Buildings And Structures, Part 2: Imposed Loads (Second Revision)
[8]. IS : 1893 (Part 1) – 2002 Indian Standard Criteria For Earthquake Resistant Design Of Structures Part 1 General Provisions And Buildings (Fifth Revision)