International Journal of Research in Engineering, Science and Management
Volume-2, Issue-12, December-2019
www.ijresm.com | ISSN (Online): 2581-5792

Earthquake Analysis of a Building with ETABS

Faiza Manzoor[1], Sabreena Muhammad[2]
[1]*Faculty, Department of Civil Engineering, NIT Srinagar, Srinagar, India*
[2]*Ph.D. Scholar, Department of Civil Engineering, NIT Srinagar, Srinagar, India*

***Abstract*: The thesis mainly highlights the seismic analysis and evaluation of a six storey building with ground floor. A software named ETABS was used for the purpose following IS- 1893:2002 (part-1). The main motive of this thesis is to use ETABS as an analysis tool for a multi-storeyed building. ETABS is the most appropriate and innovative tool that is economical and easy to use for the analysis as well as design purposes. This thesis highlights the earthquake parameters such as load carrying capacity, ductility, stiffness, damping, mass, etc. The buildings story drift was seen to be permissible under the recommendations of IS 1893:2002 which was found to be maximum in zone V. The change in base shear and storey forces for different zones was seen maximum for zone V while minimum of 37% for zone II. Thus the analysed building was exhibited to be properly designed for zone V.**

***Keywords*: ETABS, Base shear, story drift.**

1. Introduction

Earthquake is one of the main disasters proven fatal in today's world. With the growing need for multistoried building, it is becoming more and more essential to analyse a building for earthquake resistance. In India most of the residential buildings are being built on the bais of mere experience which can sometimes prove fatal and inconvenient. This, it is essential to analyse a building with respect to some standard codes. IS codes have been specified for the same purpose which is being modified as the technology advances making buildings more and more resistant towards the natural calamities. There are numerous methods available for seismic analysis including a number of software's like staad pro, etabs, sap etc.

2. Methodology

In this particular paper a building has been analysed which is located in a zone III region of India. This particular building is a multistoried building with a ground floor along with six stories having an overall height of 18.2 m and an irregular plan (32mx22m). This is a framed building built with reinforced concrete and has a simple lift core wall. The building was modelled in ETABS and was first analysed for Gravity and seismic loads and then gravity and wind loads. The values of forces and storey drifts were compared for different zones at each storey level.

3. Results

It was seen that the maximum value for wind load was 334.320 kN while for seismic load the value was higher 1235.072 kN. Hence, the building had to be analysed for earthquake.

Table 1
Literature review

S. No.	Author	Methodology		Result		Conclusion
		Building property	Method used for analysis			
1	Prathibha. S and Meher Prasad. A. (2004)	a 4 storey RC MRF structure	pushover analysis	Vb =1276 kN Dmax= 0.121m		Retrofit for RC MRF structures is required.
2	Kadid. A and Boumrkik. A (2008)	3 framed RCC structures with 5, 8 and 12 stories	linear pushover analysis	Vb =9835 KN Dmax= 0.28m		Proper design should be provided.
3	Rajaram. P, Murugesan. A and Thirugnanam. G. S (2010)	A 2 bay 5 storey RCC MRF building	STAAD Pro and ANSYS	Energy absorbed1 =1.676 KNmm Energy absorbed7=123.75 kNmm		the seismic behavior of the beam column joint was determined.
4	Jancar J., Dujic B. (2010)	three-storey reinforced concrete building	Modal analysis and linear dynamic analysis			combined steel frame with Xlam timber wall infill was seen to be most promising.
5	Wakchaure M.R, Ped S. P. (2012)	G+9 R.C.C. framed building	ETABS	Vb=294.69 kN with infill Vb=781.27 kN without		infill walls should be taken into consideration
6	Srikanth B., Ramesh V. (2013)	20 storied building	seismic coefficient method and response spectrum method	SCM Vb=480.36 kN	RSM Vb=341.517 kN	response spectrum method was recomended for analysis purposes.

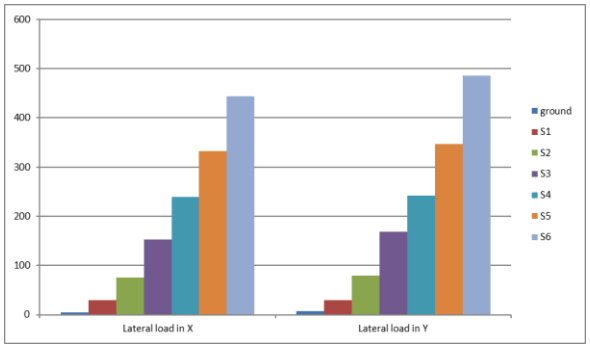

Fig. 1. Comparison of forces in X and Y direction at each story level.

As can be retrieved from figure 1 that there is a consequent increase in force at each storey level with maximum at the last storey.

The load combination to be considered are specified in IS 456:2000 & IS 1893:2002 for analysis of a building. IS 456:2000 and IS 1893(Part-1):2002 gives various load combinations to be considered in analysis of a building. The different combinations used were:

1) 1.5 DL + 1.5 LL
2) DL + 1.2 LL + 1.2 EQX
3) 1.2 DL + 1.2 LL + 1.2 EQ (-X)
4) 1.2 DL + 1.2 LL + 1.2 EQZ
5) 1.2 DL + 1.2 LL + 1.2 EQ (-Z)
6) 1.5 DL + 1.5 EQX
7) 1.5 DL + 1.5 EQ (-X)
8) 1.5 DL + 1.5 EQZ
9) 1.5 DL + 1.5 EQ (-Z)
10) 0.9 DL + 1.5 EQX
11) 0.9 DL + 1.5 EQ (-X)
12) 0.9 DL + 1.5 EQZ
13) 0.9 DL + 1.5 EQ (-Z)

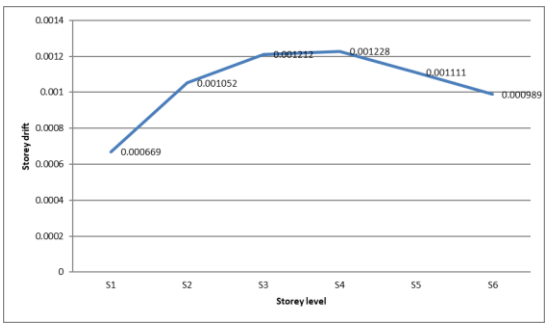

Fig. 2. Drift of building corresponding to each level

The figure 2 highlights that the maximum storey drift was found to be 0.001212 which is below the permissible value of 0.004h as recommended by IS 1893-2002.

The values of storey drift, base shear and storey forces at each level confirmed that the values increase from zone II to Zone V with max at zone V as shown in Figure3, table 1 and figure 4 respectively.

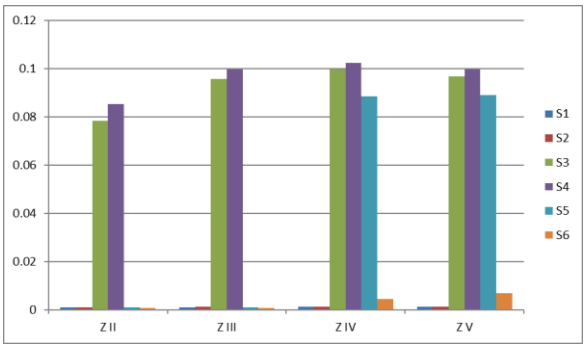

Fig. 3. Comparison of Storey drift with zones

Table 2
Comparison of base shear for different zones

Zone	W (kN)	Base shear(kN)
II	30682.41	650.5
III	30682.41	1041.89
IV	30682.41	1562.9619
V	30682.41	2343.523

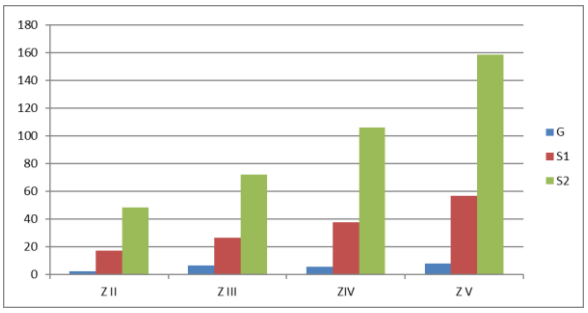

Fig. 4. Comparison of forces in different zones

4. Conclusion

In this paper, it was concluded that the building taken into consideration is adequately designed as per the revised standard codes. The values of storey drift, forces, base shear was found to be under recommended values for zone III. However, in case of Zone IV & V the values were above this limit and hence will need to be re designed for these zones. Etabs proved to be time saving tool for the analysis purpose. The value of drift was seen to be maximum at sixth storey which was found to be 0.001228 and is under the prescribed value of 0.004h. As per the results it was seen that with increasing the value of Z i.e, change the zone from II to V the values of each parameter increased. The base shear and Storey forces showed a change of -44%. 54% and more than 100% increase for zone II, IV and V respectively.

References

[1] Kamasani Chandrasekhar Reddy and Kumar G. (2019). Seismic Analysis of High-Rise Buildings (G+30) by Using ETABS.