SEISMIC ANALYSIS OF AN EXISTING BUILDING

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Abstract: In this thesis a G+6 storey building is evaluated and analysed for its seismic resistance. Indian Standard IS-1893:2002 (Part-1) has been followed for the analysis procedure. Building has been modelled in commercial software ETABS. The principle objective of this project is to analyse a multi-storeyed building using ETABS. The innovative and revolutionary new ETABS is the ultimate integrated software package for the structural analysis and design of buildings. The primary parameters of the seismic investigation of structures are load carrying capacity, ductility, stiffness, damping and mass. The different parameters like base shear, story drift, forces and so on are figured.

The story drift was found to be within permissible limits as per IS 1893:2002. The base shear and Storey forces showed a change of -37%.50% and more than 100% increase for zone II, IV and V respectively. The maximum Storey Drift for zone II, IV & V was found to be 0.01211, 0.09985 & 0.10253.The frame was found to be adequately designed for seismic loads in zone II and III. However, needs a little variation in design for zone IV and V.

Keywords: ETABS, Base shear, story drift.

Introduction: The analysis of existing buildings has become a necessity as the buildings should be resistant towards the earthquake loads in addition to the gravity loads. It is seen that for past earthquakes many buildings have undergone damages despite of being properly designed. Thus it becomes need of the hour to evaluate and analyse the buildings for earthquake loads. There are many methods available for analysis of a building. In India about 60% of area is susceptible to serious damage due to large shocks. The earthquakes can neither be stopped nor predicted, which makes the structures more liable to damage, however, the intensity and other parameters can be assumed to a great precision. For the safety and serviceability of a structute it is important to analyse it for seismicity and to determne its seismic reactions. such an analysis can be done based on various activities of the structure and material used. There are a number of methods available for seismic analysis namely:

Equivalent static methodLinear static analysis or equivalent static method can be utilized for general structure with restricted tallness. Linear dynamic analysis can be performed by reaction range strategy. The critical distinction between direct static and linear dynamic analysis is the level of the powers and their conveyance along the stature of structure. Nonlinear static analysis is a change over linear static or dynamic investigation as in it permits inelastic conduct of structure. A nonlinear dynamic analysis is the main technique to portray the genuine conduct of a structure amid a tremor. The technique depends on the direct numerical combination of the differential conditions of movement by considering the elasto-plastic deformation of the basic component.

LITERATURE REVIEW:

S.no.	Author	Methodology		Result	Conclusion
		Building property	Method used for analysis		
1	Prathibha. S and MeherPrasad. 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.

METHODOLOGY: The building into consideration is a residential apartment RC frame building situated in Manner town of Alappuzha District in Kerela. This building is G+ 6 stories with irregular plan and a height of 19 m. It is a framed building with a simple lift core wall. For analysis a G+6 storey existing RC frame building located in Zone III was taken into consideration. First the building was analysed under gravity loads and seismic loads. Then comparison of the critical forces, moments of beams and columns and storey drift at each storey level was done. The modelling and analysis was carried out in ETABS.

RESULTS:

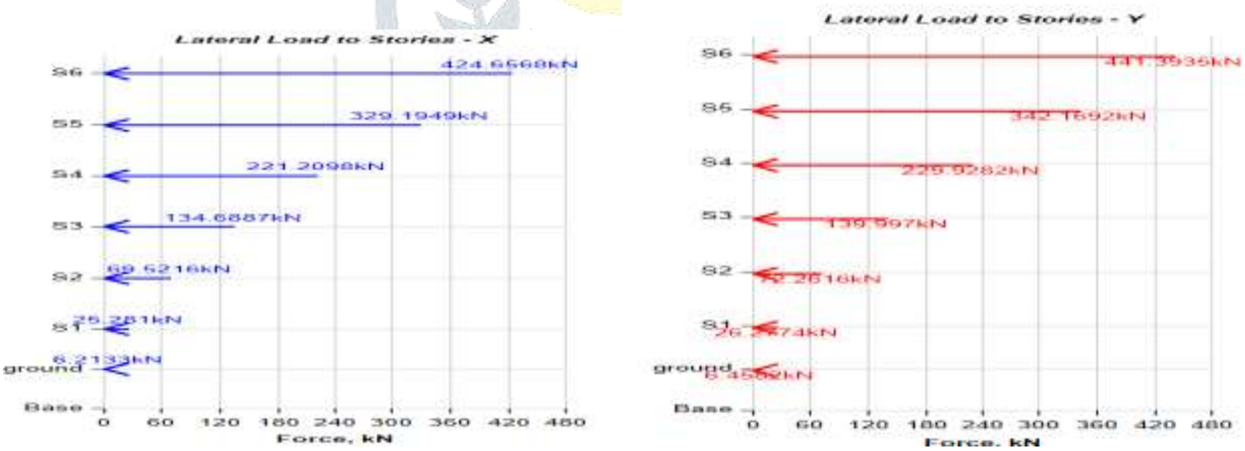

Figure 3.9: Lateral load at each storey level in X & Y direction

Table 4.1: Modal Periods and Frequencies

Case	Mode	Period sec	Frequency cyc/sec	Circular Frequency rad/sec	Eigenvalue rad^2/sec^2
Modal	1	0.965	1.036	6.5096	42.3748
Modal	2	0.638	1.567	9.8429	96.8828
Modal	3	0.614	1.628	10.2308	104.67
Modal	4	0.289	3.466	21.7777	474.2673
Modal	5	0.16	6.251	39.2731	1542.3755
Modal	6	0.159	6.298	39.5745	1566.1407
Modal	7	0.15	6.687	42.0139	1765.1711
Modal	8	0.112	8.951	56.2418	3163.1403
Modal	9	0.086	11.665	73.293	5371.8622
Modal	10	0.083	12.036	75.6248	5719.116
Modal	11	0.071	14	87.9654	7737.9149
Modal	12	0.07	14.348	90.1498	8126.9795

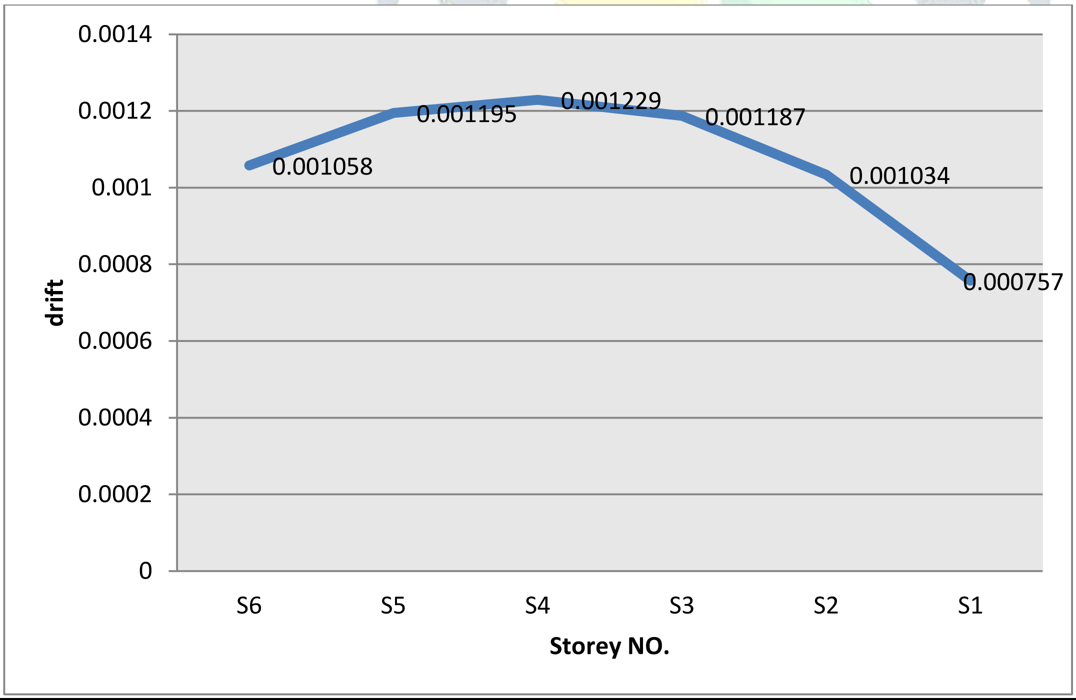

Figure 4.6: Storey drift at each storey level

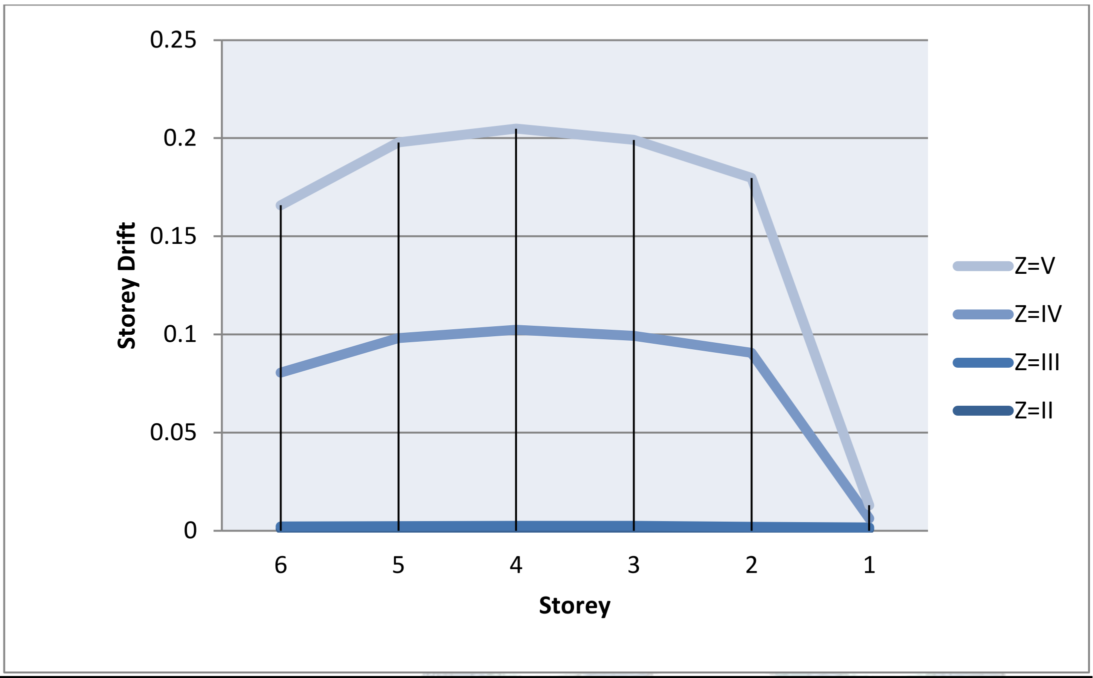

Figure 4.7: Comparison of Storey drift at each storey level

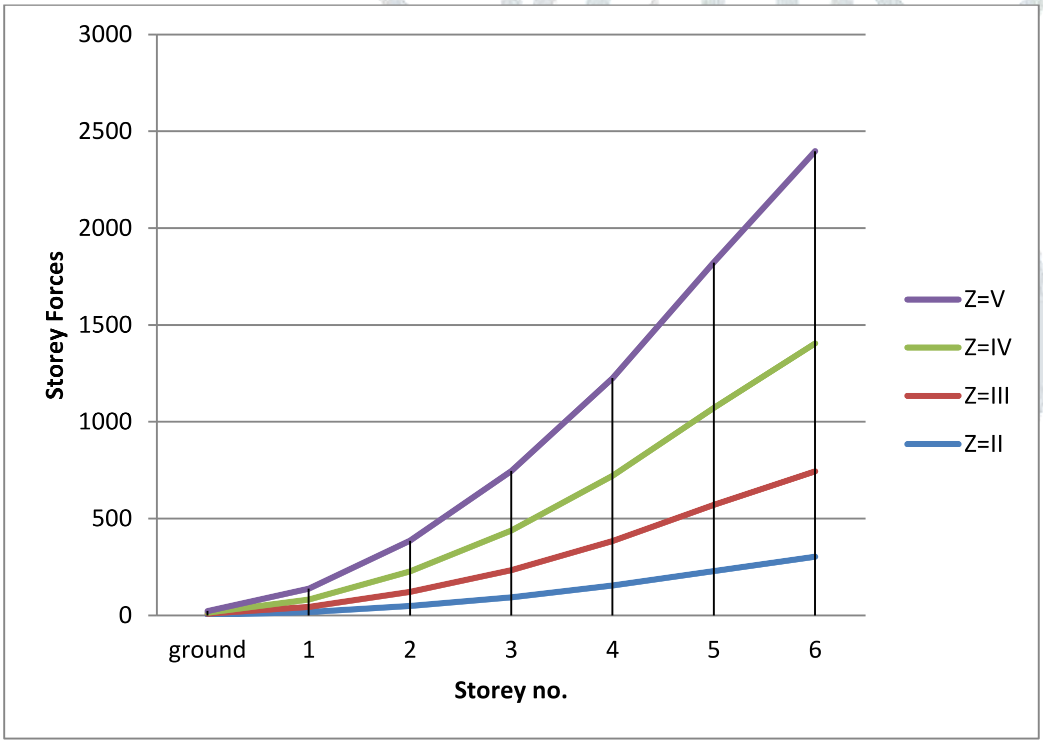

Figure 4.8: Comparison of Storey forces at each storey level

Table 4.2: Base shear comparison table

Zone	Period used	W(kN)	Vb (kN)
II	1.068	36371.2914	771.92
III	1.068	36371.2914	1235.072
IV	1.068	36371.2914	1852.608
V	1.068	36371.2914	2777.9299

CONCLUSION: The maximum storey drift was found to be 0.001229 at 4th storey which is less then permissible drift of 0.0116 (0.004h) specified by IS 1893-2002. The building under consideration is safe under seismic loads for Zone III. The results show considerable increase with zone change. The storey drift was found to have high values above permissible limits (0.004h) in case of zone IV & V. The base shear and Storey forces showed a change of -37%.50% and more than 100% increase for zone II, IV and V respectively. The maximum Storey Drift for zone II , IV & V was found to be 0.01211, 0.09985 & 0.10253.The frame was found to be adequately designed for seismic loads in zone II and III. However, needs a little variation in design for zone IV and V. The frame was found to be adequately designed for seismic loads of zone III. However, in case of zone IV & V it needs to be re-designed adequately.