For seismic analysis of residential buildings, Etabs can be used.

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Abstract

In a burst of energy, seismic waves force the Earth to quake. Earthquakes cause structural damage because seismic waves flow through the soil. This affects the building, the foundation, the soil, and the whole system. The distribution of mass, strength, and stiffness in a building has an impact on the structure's response to an earthquake. Structures are subjected to a wide range of conditions during the course of their existence. A combination of dead and live loads, as well as earthquakes, may create both static and dynamic forces. To evaluate the seismic reaction of (G+15) residential structures in Zone III and Zone V, ETABS employs response spectra and time history methodologies. It is possible to quantify things like floor displacement and drift as well as floor shear, depending on the zone.
Here, you'll find terms like Response Spectrum, Response Spectrum Method, and Response Spectrum Scaling.

INTRODUCTION

Earthquake waves produce far larger ground vibrations on the surface of the soil than on the rock's base. Because of their proximity to the rock face, areas closer to the cliff face are more vulnerable to damage. cyclones, earthquakes, flooding and so on have all been a continual danger to human life and property. There has been progress in the development of a disaster warning system, the implementation of preventive measures, and so on. Low, medium, or catastrophic losses in lives and property may occur in a matter of seconds, depending on the earthquake magnitude. While it's doable, there's no way to completely avoid it. We know that preventing and reducing the effects of earthquakes is a global problem. New challenges are necessary before the competition can reach new heights. As the building climbs in height, the structural toughness becomes more critical. Increases in the height of tall structures result in an array of loading effects, including lateral loads like seismic forces, which may have very high loading values. A designer's capacity to deal with lateral loads is becoming more critical.
This research uses ETABS to analyse (G+15)story RC structures subjected to seismic stresses in Zone III and Zone V. IS 1893 (Part 1):2002 requires the monitoring of several loads. This study focuses on four different forms of dynamic analysis.

Different kinds of moments, forces, and displacements for diverse structures, such as rectangular and L-shape shapes. Structures in the form of a L [1] There is a big difference between the joint displacement values and the rectangular constructions. Buildings with several stories are now being studied for ETABS-based seismic analysis. Various building shapes, mass irregularity, and other factors were taken into account. Reduced storey height causes an increase in the torsional irregularity coefficients. At several levels of a structure, wind and seismic loads are evaluated. If lateral systems are implemented, the structure's stiffness is improved to better handle lateral stresses.

RESEARCH SIGNIFICANCE

The objective of this paper is to study the seismic analysisof residential building for Zone-III and Zone-V regions using ETABS. The modeling and analysis can be prepared for RC multi-storey building for various types of zones. With increase in time, population of India is increasing. So, there is a need for more housing and infrastructure facilities. In recent years, people were shifting to urban places due to jobs and for living purposes which results in large population in cities. So, number of structures and buildings required is very high in cities. This increases pressure on agriculture land near cities. The land becomes scarce which results in multi-storey structures in cities. Since the land is limited, there is a need for vertical improvement in the form of tall structures. This results in saving the agriculture land to grow food items. From this, multi-storied buildings are important to be considered.

METHODS CONSIDERED

Response Spectrum Method
It is linear dynamic analysis. It determines the response in each mode of vibration and overlay the responses in several modes toattain the total response. Response may be in the appearance of deformation, acceleration etc. A graph between maximum response and natural period is called response spectrum.

Time History Method

It is nonlinear dynamic analysis. In this method, the building is subjected to accelerations from earthquake records which represent the expected earthquake at the base of the structure. It gives the structural response through and after the time of application of load.

MODEL DESCRIPTION

The analysis is carried out for proposed building using ETABS. The plan of a residential building is shown in Fig. The elevation of the proposed building can be observed in Fig. 2. The plan consists of ground floor and followed by fifteen upper floors. The total height of building is 51m.

Number of Stories: (G+15)Grade of Concrete:
Beams, Columns and lift wall = M30
Slabs = M25Reinforcement:
Longitudinal bars = Fe500Stirrups ties = Fe250
Live load = 4KN/m^2 Height of each floor: 3.0m
Density of concrete: 25KN/m^3 Thickness of slab: 150mm
Damping: 0.05

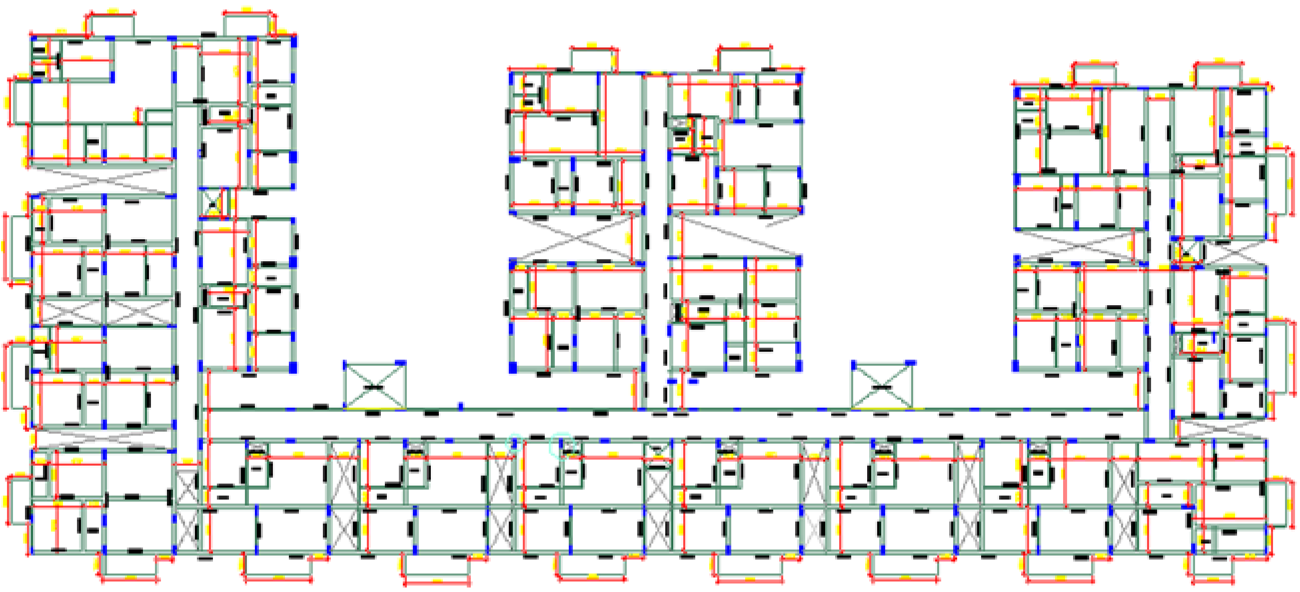

Fig.1: Plan of (G+15) multi-storied building.

Table I: Column sizes

Column	Size	Column	Size
C1	0.6×0.2	C6	0.75×0.2
C2	0.45×0.2	C7	0.75×0.285
C3	0.75×0.45	C8	0.2×0.6
C4	0.2×0.75	C9	0.2×0.45
C5	0.2×0.9	C10	0.9×0.2

Table II: Beam sizes

BEAM	SIZE
B1	0.2×0.375
B2	0.2×0.3
B3	0.15×0.3
B4	0.2×0.45
B5	0.2×0.6

SEISMIC CONDITIONS AND PARAMETERSTable III: Zone –III

CATEGORY	PARAMETER
Zone	3
Zone Factor	0.16
Importance Factor	1
Response Reduction Factor	5

Table IV: Zone –V

CATEGORY	PARAMETER
Zone	5
Zone Factor	0.36
Importance Factor	1
Response Reduction Factor	5

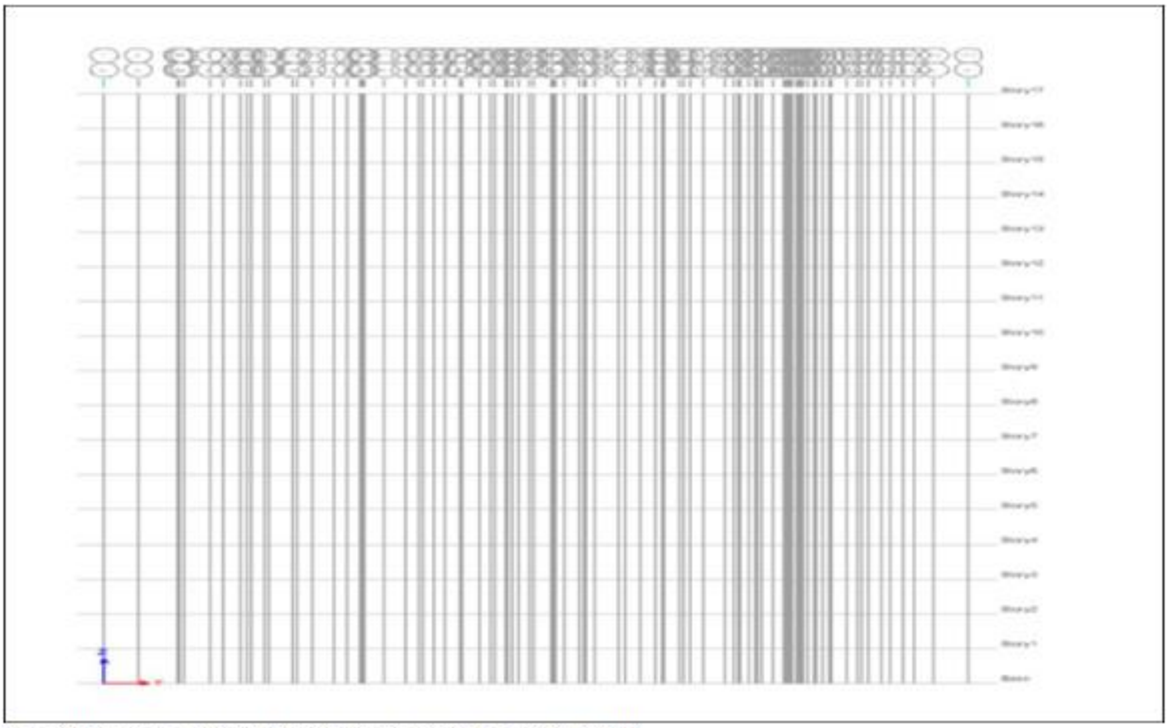

Fig. 2:Elevation of (G+15) multi-storied building in ETABS

Where storey 1 – Ground floor Storey 2 – Storey 1, and so on Storey 16 – Storey 15
Storey 17 - Terrace

MODELLING

(G+15) residential buildings in zones III and V are analysed using ETABS for earthquake forces.

Methods for assessing the structure of a system

To determine whether a building is seismically sound or not, a seismological assessment should be performed. As per IS: 1893-2002, the building is put through a dynamic analysis process at this phase (Part I). Time history or response spectrum methods may be used.

(G+15) multi-story building loads

A tall structure's loads are distinct from those of a lower-rise building in a number of respects, including gravity loads on each level from top to bottom and the importance of dynamic effects. For this reason, it is essential to accurately measure the loads of multi-story structures in order to ensure their safety and efficiency. It is possible to precisely measure dead loads, but it is impossible to accurately assess other loads. Live loads may be approximated to some degree based on past field observations and experience. seismic load cannot be predicted, and its calculation relies on the use of probabilistic methods.

RESULTS

Response spectrum analysis and time history analysis are compared for factors such as storey displacement, storey drift, and storey shear.

The storey has been moved.

A storey is a term used to describe the position of a floor relative to the structure's base. Consider storey displacement when a structure is exposed to seismic forces. It's based on the height of the structure. Towering constructions are more malleable than other kinds of buildings when it comes to lateral loads. The higher the floor, the bigger the displacement values. It is shown in Figure 3 that the Zone-III response spectrum and time-history approaches' storey displacement (right). Fig. 4 shows the storey displacement for Zone-V in response spectrum and time history techniques.

B. Storey's demise

When one level moves relative to another, this would be an illustration of this concept. A figure of 0.004 of the floor height is about as high as I'd go. The value of a tale is frequently at its peak in the middle of it. Zone –III's tree drifts may be seen in response spectra and time history approaches. Fig. 6 depicts the storey drifts of the Zone-V response spectrum and time history method.

Storey, Shear C.

Seismic stress on a building's foundation is known as base shear. In the event of an earthquake, lateral loads on different floors of a structure are called storey shear. While the upper floors have a lower market worth, the lower floors have a higher one. Zone –III shear response spectra and time histories are shown in Fig. 7. Zone-response V's spectrum and time history approaches' storey drifts are shown in Fig. 8.

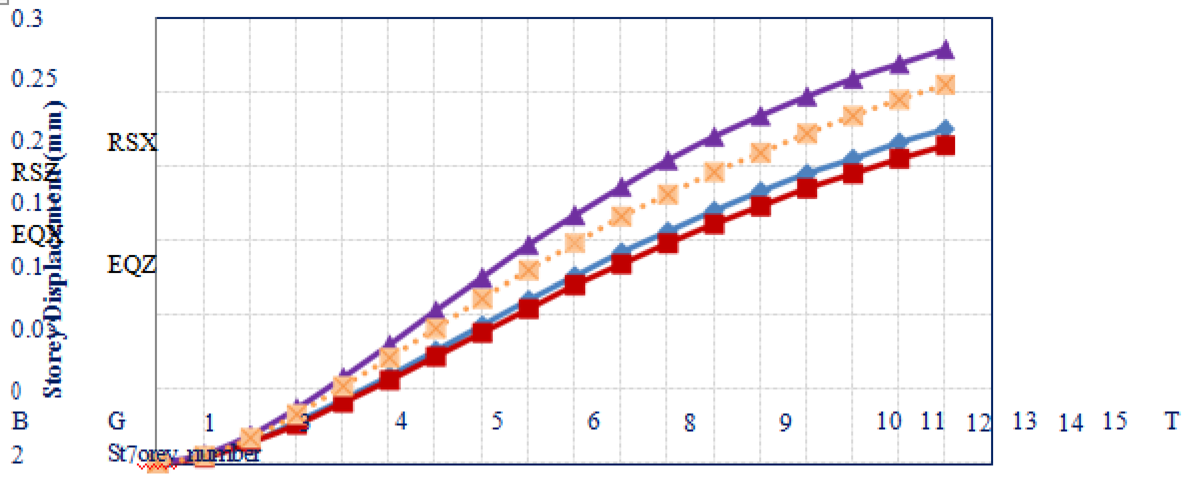

Fig. 3: Storey displacement for Zone-III in Response Spectrum method and Time History method

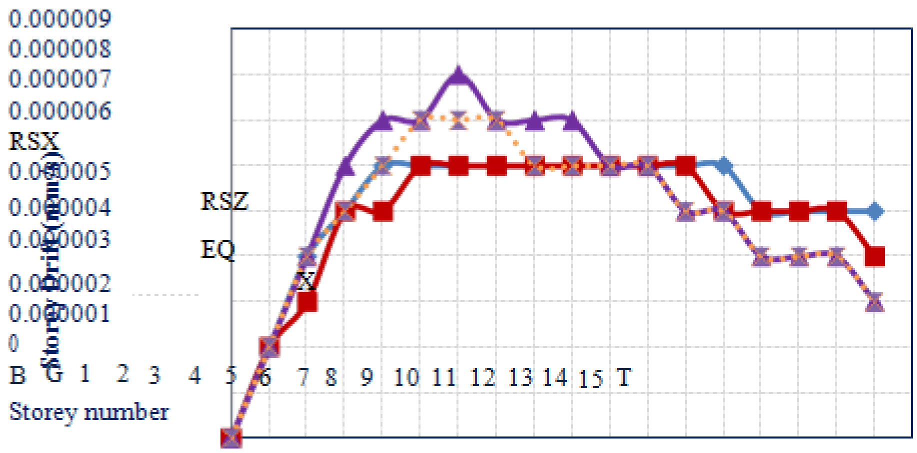

Fig. 4: Storey drift for Zone-V in Response Spectrum method and Time History method

CONCLUSIONS

Storey displacement values from the two analyses show that the top storey is more displaced in Zone-III and Zone-V. Zone-V has a bigger value of storey displacement than Zone-III.

Time history technique for the EQX load case in the fifth level has the greatest storey drift.

The 6th and 7th floors of Zone-III exhibit the greatest degree of storey drift when subjected to RSZ. It may be found at the fourth to ninth floors of the RSX building.

Maximum storey drift for Zone-V may be noticed in the 4th to 11thand 3rdto 12th storeys for Zone-X when using RSX and RSZ, respectively.

When using the response spectrum approach or the time history method, the ground experiences the greatest amount of shear. Zone-V has a higher value than Zone-III for this indicator..

REFERENCES

1. Heidebrecht, A. C, P. Henderson, N Naumoski, and J. W. Pappin,"Seismic Response and Design for Structures Located on Soft Clay Sites", Canadian Geotechnical Journal 27, No.3, 1990, pp. 330-341.
2. M B Vikram, Roopesh M, Sandeep, Sanjay Kumar, "Comparison and Analysis of Multi-Storey Building in Various Seismic Zones", International Journal of Emerging Trends in Engineering and Development, Issue 7, Vol. 3, 2017, pp.233-238.
3. AkashPanchal, Ravi Dwivedi, "Analysis and Design of G+6 Building in different Seismic Zones of India", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 6, Issue 7, 2017, pp.14331-14338.
4. R.Deccan Chronicle, Mohammed Anwarullah, Abdul Rashid, Dr.P.Siva Prasad, "Analysis and Design of High-Rise RC Structure in Different

Seismic Zones", International Research Journal of Engineering and Technology (IRJET), Vol. 05, Issue:03, 2018, pp.3336-3341.
5. J. ChiranjeeviYadav, L.Ramaprasad Reddy, "Dynamic Analysis of G + 20 Residential Building in Zone-2and Zone-5 By Using ETABS, " International Journal of Professional Engineering Studies, Vol. 8, Issue 3, 2017, pp. 333-348.
6. Sasidhar T, P. SaiAvinash, N. Janardan, "Analysis of Multistoried Building With and Without Floating Column Using ETABS," International Journal of Civil Engineering and Technology (IJCIET), Vol. 8, Issue 6, June 2017, pp. 91– 98.
7. PushkarRathod, Rahul Chandrasekhar,"Seismic Analysis of Multistoried Building for Different Plans Using ETAB 2015", International Research Journal of Engineering and Technology (IRJET),Vol. 04, Issue 10, 2017, pp.1101-1108.
8. Mayur R. Rethaliya, Nirav S. Patel, Dr.R.P.Rethaliya, "Seismic Analysis of Multistory Buildings Using ETABS-A Review," International Journal of Advance Engineering and Research Development, Vol. 4, Issue 12, 2017, pp.1167-1175.
9. B.Ajitha and M.NaveenNaik, "The Wind and Seismic Analysis on Different Heights of Building by Using ETABS", The Asian Review of Civil Engineering, Vol. 5, No.2, 2016, pp.19-26.
10. IS: 1893 (Part 1): 2002. Criteria for Earthquake Resistant Design of Structures. (Part 1: General Provisions and Buildings) (5th Revision).
11. IS: 875 (Part 2):1987 (Reaffirmed 1997). Indian Standard code of practice for design loads (other than earthquake) for buildings and structures, part 2, imposed loads (2ndRevision).

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