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A Study on the Impact of Seismic Performance on RCC Frames

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Abstract— *The ground shakes as a result of seismic waves generated by the abrupt release of energy during an earthquake. Seismic waves propagate through the ground during an earthquake, causing structural damage owing to changes inside the earth's crust. It influences the interaction between building, foundation, and underlying soils, as well as the behaviour of the entire system. The behaviour of a structure during an earthquake relies on its mass distribution, strength, and stiffness. Throughout their lifespan, structures are often exposed to a variety of factors. The forces may be static due to dead and living loads or dynamic due to an earthquake. In this work, the seismic response of (G+12) residential buildings in zones I, II, and III is analysed in ETABS using the response spectrum approach and the time history method. For defined zones, metrics such as storey displacement, storey drift, and storey shear are monitored.*

Keyword: RCC, ETABS, IS 1893, G+12 storied, Earthquake, *displacement*

1. INTRODUCTION

The reaction of structures to earthquakes is a dynamic phenomena dependent on the dynamic properties of structures and the strength, duration, and frequency content of the stimulating ground motion. Despite the dynamic nature of seismic activity, building regulations frequently prescribe comparable static load analysis for earthquake-resistant building design due to its simplicity. This is accomplished by concentrating on the prevalent first mode response and creating similar Seismic analysis is a subset of structural analysis that calculates the seismic reaction of a building (or other structure). In earthquake-prone locations, it is a component of structural design, earthquake engineering, or structural evaluation and retrofit (see structural engineering). As seen in the diagram, a structure has the ability to 'wave' during an earthquake (or even a severe wind storm). This is referred to as the "basic mode" and corresponds to the lowest frequency of building response. However, the majority of structures have higher modes of reaction that are specifically engaged by earthquakes. The image only depicts the second mode of'shimmy' (abnormal vibration), however there is a higher mode. In most instances, though, the first and second modes inflict the greatest harm.

2. LITRATURE SURVEY

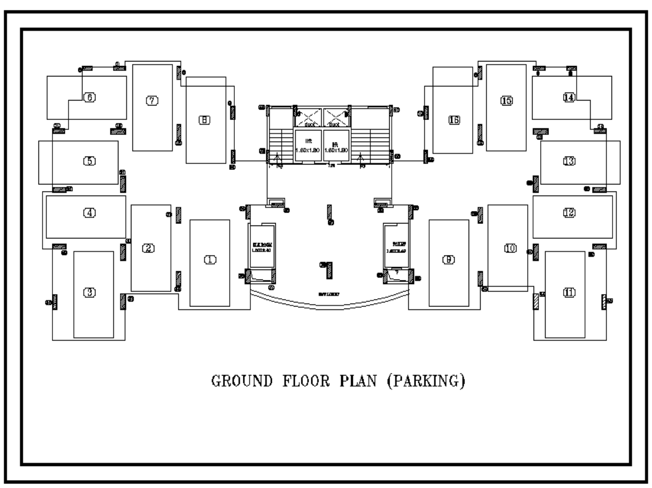
Tondon, Brajesh Kumar, and others As a result of an earthquake, a building's structural reaction may be seen by the movement of its stories, as well as the movement of its foundation. STAAD Pro software was used to perform a seismic study on the (G+8) building, which is located in zones 2 and 4. According to IS 1893 PART 1, an investigation has been carried out (2002). Mr. Mahesh and others Multiple wind loads and earthquake loads are expected to act simultaneously on the behaviour of G+11 multi-story buildings in regular and irregular configurations under earthquakes. ETABS and STAAS PRO V8i are used in this work to analyse a G+11 multi-story structure for earth quake and wind loads. For a linear material, static and dynamic analyses are conducted. M. B. Vikram and colleagues In order to do these linear static assessments, severe seismic zones (zone-II, zone-III, zone-IV, and zone-V) are taken into consideration, and the soil type is taken into account. Different load combinations and zones are examined for different responses, such as bending moments and axial forces. The bending moment and axial force are significantly impacted by the seismic stress. Rakshith G M and others In the simulation, a twenty-one-story structure has a constant storey height of three metres. It is examined how lateral loads affect moments, axial forces, the shear force, the base shearing, maximum storey drift, and tensile forces on the structural system. The results are interpreted in light of the consequences of various values of the seismic zone factor. MajidRaza and others During this project, we examined the (G+10) structure to determine the shear forces, bending moments and deflections, as well as the reinforcing details for the building's structural components (such as beams, columns, and slabs). Finally, we used the ETABS Software programme to conduct seismic analysis on a (G+10) residential building utilising both static (Equivalent Lateral) and dynamic (Response Spectrum Analysis) methods.

3. METHODOLOGY

The project research was divided into two parts. The primary data was acquired through a literature research that included web searches and an examination of eBooks, manuals, codes, and journal papers. After evaluating, the issue statement is formulated, and model construction begins for detailed study and analysis. This project's execution follows the flow chart shown below.

The investigation is being carried out for the behaviour of G+12 storey R.C frame structures with a regular plan with rectangular, square, and circular plan changing geometry. The provided floor height is 3.2 m. Additionally, characteristics for the frame structure are defined. Models are built using the ETABS programme. Various types of loads are considered. For static behaviour, the building's dead load is considered per IS 875 Part 1 and its live load is considered per IS 875 Part III, with lateral load verifying IS 1893(part 1)2016. Response spectrum analysis was used on three-dimensional reinforced concrete structures with G+12 storeys. The analysis results will indicate a comparison of the seismic response of structures in terms of storey shear, storey drift, storey displacement, time period, base shear, base moments, storey displacement, and so on within the studied configuration.

In this study, a G+12-story rectangular building with a floor-to-floor height of 3 m was studied using ETABS software in several seismic zones. The plan chosen is rectangular in shape. It is not the design of any current or projected structure, but rather an architectural plan. The structure has been tested for both static and dynamic wind and earthquake forces. The building will be built on hard soil.



4. RESULTS AND DISCUSSION

4.1. Prepare Modeling In ETABS For Zone I, II, III, IV

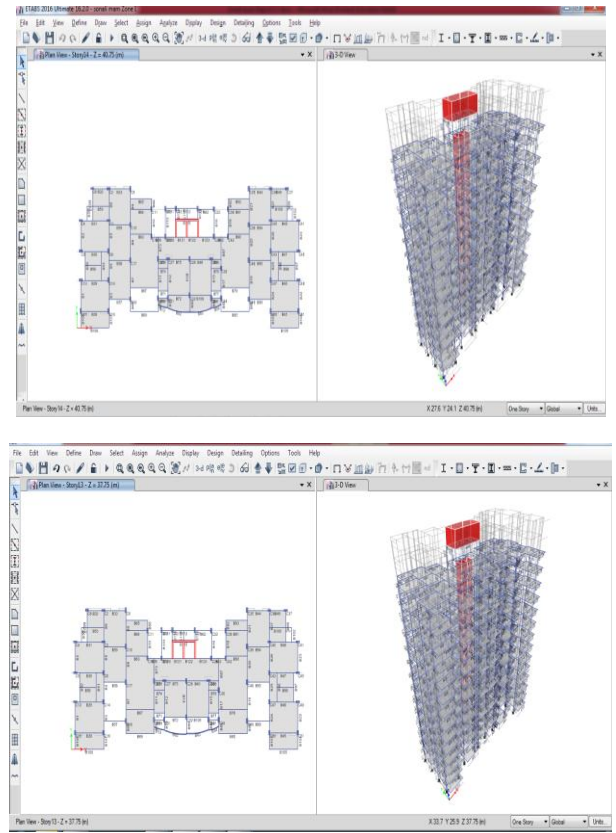
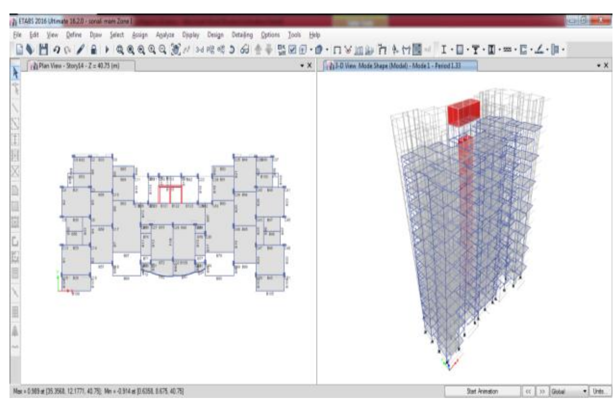
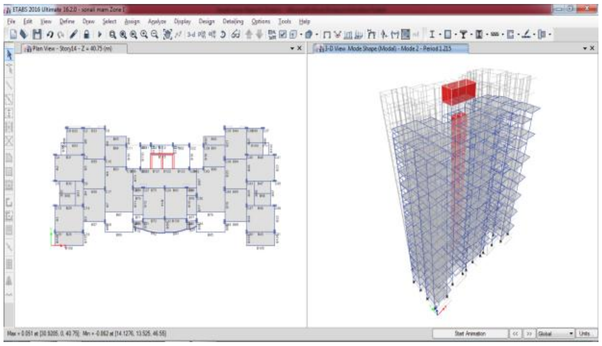


Fig 1 Prepare Model in ETABS

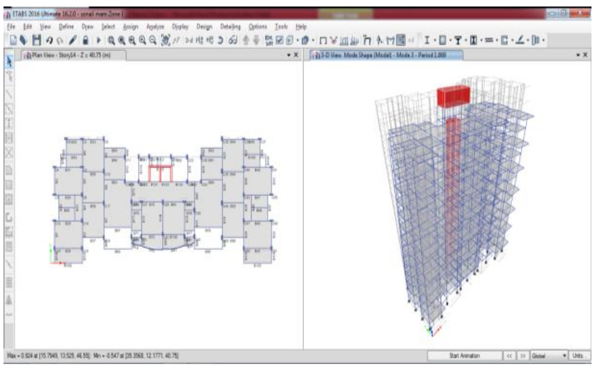
4.2 Time Period For Zone I, II, III, IV



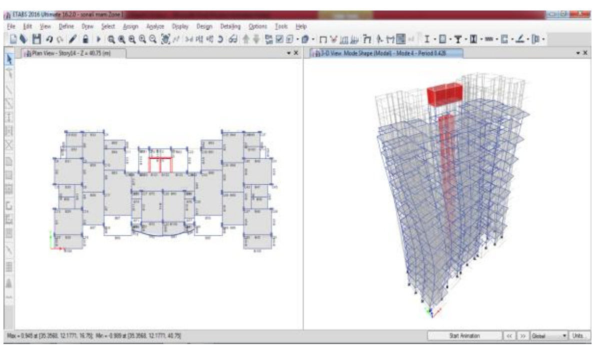
Mode Shape 1 for zone I,II, III, IV



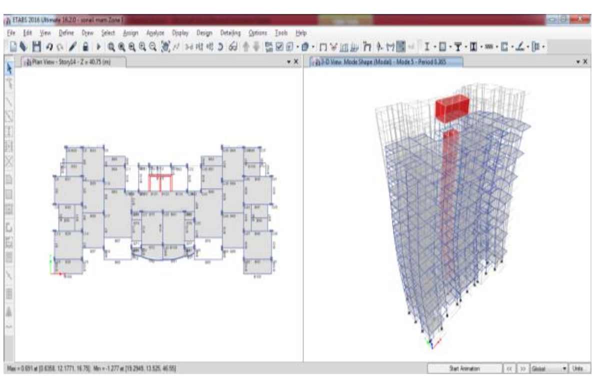
Mode Shape 2 for zone I,II, III, IV



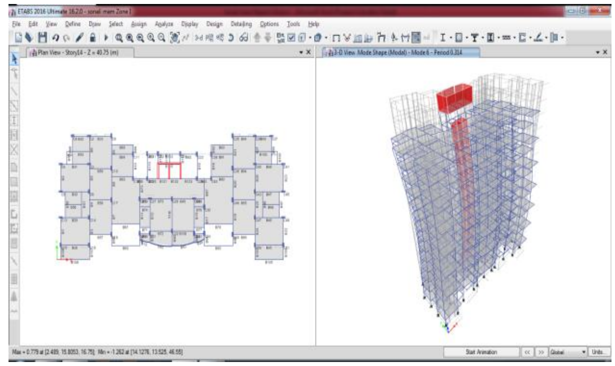
Mode Shape 3 for zone I, II, III, IV



Mode Shape 4 for zone I, II, III, IV



Mode Shape 5 for zone I, II, III, IV

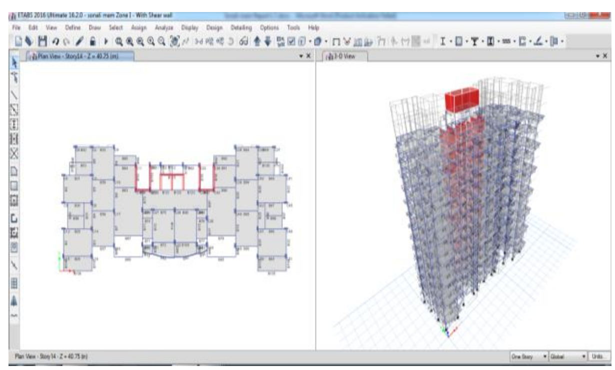


Mode Shape 6 for zone I, II, III, IV

MODE	TIME PERIOD
1	1.33
2	1.215
3	1.069
4	0.428
5	0.365
6	0.314

4.3 Results after Providing Shear Wall For Zone I

Because the largest results for storey displacement, storey drift, and base shear occur in Zone I, we give extra shear walls in the same model to lower those same outcomes.



Provide more shear walls for zone I

DISPLACEMENT EQX		
STOREY	NORMAL	SHEAR WALL
14	42.793	33.37
13	40.758	30.866
12	37.952	29.422
11	36.074	27.191
10	31.735	24.484
9	30.113	22.608
8	24.515	18.775
7	23.215	17.321
6	16.848	12.723
5	15.907	11.727
4	9.382	6.893
3	8.815	6.348
2	2.93	2.068
1	2.733	1.906
0	0	0

5. CONCLUSION

- After analysing G+12 RCC buildings for Zones I, II, III, and IV, the results show that Zone I required a heavier design than Zones IV, III, and II. Additionally, the maximum results for storey displacement, storey drift, and base shear are in Zone I, so in the same model, we provide more shear walls to reduce those same results.
- The findings for the Displacement for Earthquake Forces from X Direction for Zone I for Normal Model and Shear Wall Model from the above graph show that the building after giving additional share wall reduces the displacements by 25-30%.

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