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Analysis and Design Of G+3 Storey Building by Using ETABS

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ABSTRACT

- In this project, the design of beam, column, etc. is calculated by "Limit state Method" using IS: 456-2000 code book. Different load active on the member are consider according to IS: 857-1987 (part 1, part2, part3). Hence residential building is properly planed in accordance with National Building Code of India. The materials were specified and cross-section of the beam and column members were assigned. The supports at the base of the structure were also specified as fixed. The codes of practice to be followed were also specified for design purpose with other important details. Then STAAD Pro was used to analyze the structure and design the members. Our results depend upon the seismic analysis of multistoried building (G+3) for seismic zone-III with the assistance of software STAAD Pro. IS: 1893-2002 (Part 1) mentions" that structure will normally experience more sever ground motion, than that given within the code for design purpose. It had been said that the designed as an Earthquake resistance has increase the value of construction. The statement it faithful to some extent

***Key Words*:** - Seismic, Analysis, Design, ETABS, P waves, S waves, Liquefaction, Live load, Dead load, G+3 Building Structure, Framework

1.INTRODUCTION

Earthquakes release seismic waves that shake the ground violently in all directions, mostly sideways. This intense movement can weaken soil and destabilize buildings.

If structures aren't designed properly, they can collapse under the stress. Damage depends on the earthquake's strength, soil type, and, most importantly, the quality of construction.

We can't prevent or accurately predict earthquakes, but we *can* build safer structures. Past quakes like Uttarkashi (1991) and Latur (1993) show the importance of strong, well-designed buildings.

2.METHODOLOG

We began the project by gathering all the essential details such as the building's dimensions, material strengths, and site conditions. Next, we calculated the different types of loads the structure would face, including its own weight, the weight of occupants, and the impact of earthquakes. With this data, we created a 3D model of the G+3 building using ETABS software. We then applied all the calculated loads to this model, especially focusing on earthquake forces relevant to Seismic Zone III. The software allowed us to analyze how the building would perform under these conditions. Based on this analysis, we designed the beams, columns, and slabs according to the IS 456:2000 code. To ensure accuracy, we also verified some of the design results manually

3.CASE STUDY

The structural analysis and design of a G+3 storey building were carried out using STAAD.Pro, with a 3D model incorporating dead, live, and seismic loads as per IS 875 and IS 1893 standards. After assigning appropriate cross-sections to beams and columns, seismic analysis was done for Zone III conditions. Manual calculations were performed to verify load distributions and member designs in line with IS 456:2000. The analysis results guided reinforcement detailing, ensuring the structure's safety, stability, and ductility under service and seismic loads, with an economical, code-compliant design.

3.1 Analysis and 3D View of G+3 building

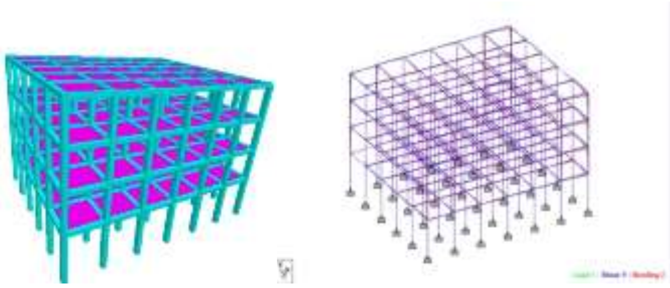

Fig 2.1 -3D view and shear bending

C O L U M N N O. 46 D E S I G N R E S U L T S

M30 Fe600 (Main) Fe600 (Sec.)

LENGTH: 3000.0 mm CROSS SECTION: 450.0 mm X 350.0 mm COVER: 40.0 mm

** GUIDING LOAD CASE: 4 END JOINT: 22 SHORT COLUMN

REQD. STEEL AREA : 182.05 Sq.mm.

REQD. CONCRETE AREA: 22756.65 Sq.mm.

MAIN REINFORCEMENT : Provide 8 - 12 dia. (0.57%, 904.78 Sq.mm.

(Equally distributed)

TIE REINFORCEMENT : Provide 8 mm dia. rectangular ties @ 190 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)

Puz : 2205.72 Muz1 : 56.99 Muy1 : 73.94

INTERACTION RATIO: 0.39 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)

WORST LOAD CASE: 6

END JOINT: 29 Puz : 2521.19 Muz : 98.44 Muy : 131.64 IR: 0.35

Column no.46

4.RESULT AND DISCUSSION

The analysis using ETABS revealed that the G+3 building meets all safety requirements under various load conditions, including dead, live, and seismic loads. The following key findings were observed:

Structural Stability: The building's response to seismic forces was within acceptable limits. Base shear and storey drift were found to comply with IS 1893:2016, ensuring earthquake resistance.

Material Optimization: The ETABS design resulted in the optimal usage of concrete and steel. The reinforcement required for beams, columns, and slabs was in line with manual design calculations, confirming the software's accuracy.

Efficiency and Time-Saving: ETABS enabled faster design iterations, reducing the overall time compared to manual methods. It also allowed for easy adjustments to design parameters, ensuring that the structure could be adapted to meet specific safety and budget constraints.

Comparison with Manual Design: The ETABS results showed a close match to manually calculated reinforcement details, highlighting the reliability and precision of the software. The design proved to be both cost-effective and structurally sound.

5. CONCLUSIONS

This study demonstrates that ETABS is a powerful tool for designing earthquake-resistant buildings efficiently and accurately. Compared to manual design, it enhances speed, minimizes errors, and allows for complex load analysis. For engineering students and professionals, mastering such tools is crucial in adapting to modern construction challenges.

6.REFERENCES

1 IS 456:2000 – Code of Practice for Plain and Reinforced Concrete

2 IS 1893:2016 – Criteria for Earthquake Resistant Design of Structures

3 IS 875 – Code of Practice for Design Loads

4 ETABS User Manual, CSI (Computers and Structures Inc.)