International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 13 Issue 12 ǁ December 2025 ǁ PP. 264-268

Seismic Analysis and Design of a Multistoried Building using ETABS

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Abstract—We have worked sincerely to plan, develop, and analyse a multi-story building for this project. For better design output, IS codes were used to guide the design process. In order to complete a given project successfully, the construction industry is now heavily dependent on digital approaches for quick analytical reports with higher accuracy. Strength, serviceability, stability, and human comfort are the design objectives for multi-story buildings. The structure's study was carried out utilising ETABS and code used for the plain reinforced cement conctrete is IS 456:2000.

Keywords— Etabs software, Seismic analysis, IS co-, Multi-storied building, Manual design

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Date of Submission: 14-12-2025 Date of acceptance: 26-12-2025

I. INTRODUCTION

Strength, serviceability, stability, and human comfort are design objectives for multi-story buildings. The most important load to take into account for the design is lateral load. Fe 500 grade steel and M30 grade concrete were used in the design. This project uses ETABS software to analyse and design a multi-story residential structure with lateral loading effects from an earthquake. The IS 1893-part2:2002 and IS 456:2000 Indian Codes were followed in the design of this project.

II. LITERATURE REVIEW

C V S Lavanya etal.(2017) had investigated analysis and design of G+4 residential building using etabs .It deals with offering earthquake-resistant structures that are also cost-effective.B230mmX450mm were the minimum sizes for the beams and columns. Following investigation, only the failing column axes and C 230mmX450mm is the new dimension, which falls under economic.

V. Lakshmi Shireen Banu, Sheikh Mohd Salar (2021) had studied about the analysis and design of structure residential building g+5 using etabs. For lower stories, differences between the displacement values produced by static and dynamic analysis are negligible, but as the stories rise, the differences become more noticeable, and static analysis consistently produces higher displacement values than dynamic analysis.

Atif Mehmood,Parveen Singh (2018) had studied about the seismic analysis of a multi-storeyed building. The multi-storey buildings' causes of failure are incorrect construction methods, a lack of structural integrity, a high mass, and a low mortar's strength, etc. There is a way to avoid multi-storey buildings failing, must adhere to the correct parameters established by Indian Standards and Codes etc

III. METHODOLOGY

Modelling a building after validation and analysing the whole structure using etabs.Then check the result and designing the structure. Comparing these with manual results.

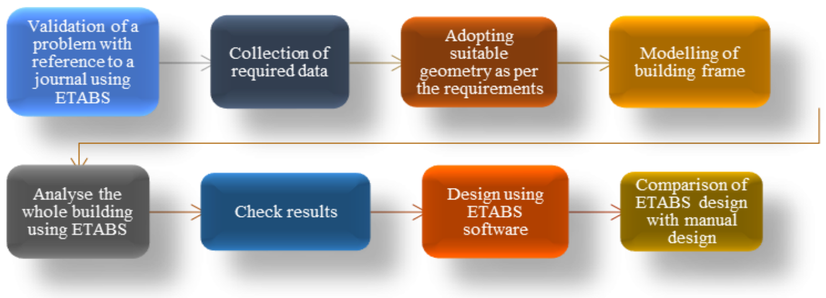

Fig 1 Overview of methodology

A. Validation

Collecting data's from a validating journal,then designing that building in etabs. Check the results and compare with the journal. Here analysed C V S Lavanya's publication on analysis and design of g+4 residential building.The comparative results are given below. The percentage error of these validation is 1.299%.

TABLE I

BENDING MOMENT VALUES OF A PARTICULAR BEAM ON EACH FLOOR

Storey No.	BMD Value from Journal	BMD Value from Etabs Analysis
6	10.91	15.4
5	5.20	7.54
4	6.19	8.59
3	5.94	8.02
2	5.17	7.719
1	1.2	2.33

IV. RESULT AND DISCUSSION

A. Structural Analysis

Structural analysis is the technique of estimating how a particular structure will perform under specific loading conditions. It is a crucial component of any engineering project.

We must first construct the geometry of model, state member characteristic, state geometric constants, and identify loads and supports in order to analyse in ETABS 2019.

B. Modelling in ETABS

Plotting the centre line in ETABS, member property specification, support condition, replication to other floors, and loading were the first steps in the modelling process.

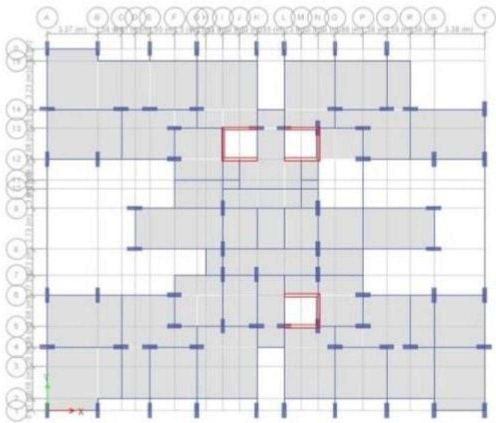

Fig. 2 Beam column layout in ground floor and typical floors

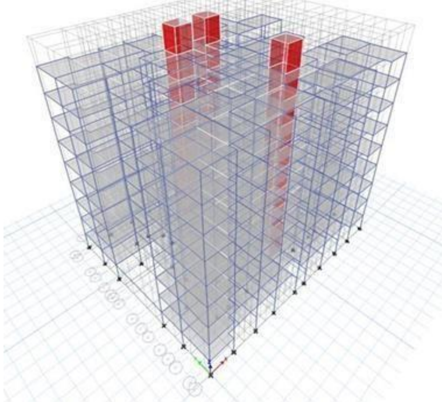

Fig. 3 Beam column layout in ground floor and typical floors

C. Structural Design

For the beams,slabs, columns, stairs, and foundations in this case, we have utilised the limit state approach of design. According to limit state technique,every buildings are built securely and bear every kinds of loads that might be placed on it over the course of its lifetime and to adhere to serviceability standards.

1) *Design of Beam*: For supporting slabs and walls or as auxiliary beams, beams are typically given. Single-reinforced beams are those in which steel reinforcement is only present in the tension zone. For a doubly reinforced beam to carry compressive forces, reinforcing is also provided in the compression zone.

TABLE 2
GEOMETRIC PROPERTIES

Beam Label	Section Property	Length m	Section Width mm	Section Depth mm	Distance to Top Rebar Center, mm	Distance to Bot Rebar Center, mm
382	BEAM	5.75	250	600	40	40

TABLE 3
SECTION PROPERTIES

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
250	600	250	0	40	40

TABLE 4
FLEXURAL REINFORCEMENT

	End-I Rebar Area mm^2	End-I Rebar %	Middle RebarArea mm^2	Middle Rebar %	End-J Rebar Area mm^2	End-J Rebar %
Top (+2 Axis)	742	0.49	368	0.25	368	0.25
Bot (-2 Axis)	371	0.25	456	0.3	377	0.25

TABLE 5
SHEAR REINFORCEMENT

End-I Rebar A_{sv} /s mm^2/m	Middle Rebar A_{sv} /s mm^2/m	End-J Rebar A_{sv} /s mm^2/m
1401.1	1008.95	940.62

2) *Design of Column:* In general, a part carrying direct axialload that results in such significant compressive stresses can be described as a column. There are two types of columns. When the lex/D and ley/b slenderness ratios are fewer than 12, a column may be deemed short. If not, it is a lengthy column.

TABLE 6
SECTION PROPERTIES

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
300	1000	52	30

TABLE 7
MATERIAL PROPERTIES

E_c (MPa)	f_{ck} (MPa)	LtWt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
27386.13	30	1	500	500

TABLE 8
DESIGN AXIAL FORCE AND BIAXIAL MOMENT

Column End	Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Station Loc mm	Controlling Combo
Top	3670.8939	-73.4179	138.4361	2400	DConS20
Bottom	3724.878	74.4976	-359.5192	0	DConS20

TABLE 9
LONGITUDINAL REINFORCEMENT

Column End	Rebar Area mm^2	Rebar %
Top	2400	0.8
Bottom	2622	0.87

TABLE 10
SHEAR REINFORCEMENT FOR MAJOR SHEAR

Column End	Rebar A_{sv} /s mm^2/m	Design V_{u2} kN	Station Loc mm	Controlling Combo
Top	332.53	87.7999	2400	DConS26
Bottom	332.53	87.7999	0	DConS26

TABLE 11
SHEAR REINFORCEMENT FOR MINOR SHEAR

Column End	Rebar A_{sv} /s mm^2/m	Design V_{u3} kN	Station Loc mm	Controlling Combo
Top	1108.43	119.6302	2400	DConS26
Bottom	1108.43	119.6302	0	DConS26

3) *Design of Sear Wall:* A shear wall is a vertical component of a system created to withstand in-plane lateral forces, most frequently earthquake and wind loads.

TABLE 12
PIER DETAILS

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
FIFTH	P5	14208.8	18480	8160	200	0.522

TABLE 1
FLEXURAL DESIGN

Station Location	Required Rebar Area (mm^2)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kN	M_{u2} kN-m	M_{u3} kN-m	Pier A_g mm^2
Top	4080	0.0025	0.0085	DWalS26	3075.0728	1092.5558	-186.0679	1632000
Bottom	4080	0.0025	0.0085	DWalS26	3525.5224	-94.9179	-74.6676	1632000

D. Findings from the manual result

Found approximately similar values of software result are get in the manual design.

V. CONCLUSIONS

The analysis was carried out utilising the ETABS 2019 software. Utilizing the ETABS programme, the design in this work was successfully manually verified in accordance with IS 456:2000. Utilizing ETABS software reduces the amount of time needed for analysis and design. The ideal software to use for analysis and design is ETABS because the floors of a ten-story building are comparable.

When compared to shorter spans, it has been found that greater spans of beams have higher shear forces and bending moments. As the storey height rises, shear forces and bending moments for both beams and columns increase. The diameters of the beam and column are enlarged to withstand seismic forces, or shear walls should be installed to withstand lateral stresses rather than masonry walls.

ACKNOWLEDGMENT

I want to say my heartfelt thanks and greatest appreciation to my project guide Mrs.Gayathri Thampi Assistant Professor, Dept. of Civil Engineering for execution of this project**.**

I want to covey my honest gratfulness to my project coordinator Mrs. Suji P, Assistant Professor, Dept. of Civil Engineering for the help and motivation.

I am awfully happy to bring up a great word of respect to Mrs. Priya Grace Itti Eipe, Head of the Department of Civil Engineering for giving all permissions and provisions for the project completion.

REFERENCES

[1]. Abay Guleria"Structural analysis of a multistoried building using etabs for different plan configuration", *IJERT*, May 2014.

[2]. C V S Lavanya,Emily P, etal."Analysis and design of g+4 residential building using etabs", *IJCIET*, April 2017.

[3]. Rohitkumar B R, Sachin P, etal. "Analysis and design of multistorey structure using etabs", *IRJET*, May 2017.

[4]. Rinkesh R Bhandarkar, Utsav M Ratanpara, Muhammed Qureshi "Seismic analysis of multistoried building using etabs", *IJEDR*, 2017