International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 9 Issue 2, Mar-Apr 2025 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Analysis and Design of G+3 Commercial Building using ETABS

Mrs. Bhavya S

Assistant Professor, Department Civil Engineering, SJCIT, Chikkaballapur, Karnataka, India

ABSTRACT

The analysis and design of a commercial building using ETABS involves creating a detailed architectural and structural plan, developing a three-dimensional model of the building, analyzing the structure to determine internal forces and stresses, optimizing the design, and documenting the results. The process requires careful consideration of many factors, including building codes, materials, loads, and regulations. By using ETABS software, designers and engineers can accurately analyze and optimize the design of a commercial building to ensure its structural integrity and compliance with all requirements. The end result is a safe and efficient building that meets the needs of its occupants and stakeholders.

Overall, the design and analysis of a G+3 commercial building using ETABS involves a detailed and complex process that requires careful consideration of many different factors. It is crucial to work with a team of experienced professionals to ensure the best possible outcome for the project.

The use of Etabs in commercial building design and analysis is justified by its ability to handle complex geometries and load conditions, as well as its advanced analysis capabilities. It allows engineers to consider multiple design options and optimize the building structural performance while also ensuring compliance with relevant building codes and standards.

1. Analysis and Design of commercial building.
2. 3-D modelling.
3. Load conditions.
4. Building codes and standards.
5. Safety and stability.
6. Structural performance
7. Structural behavior

How to cite this paper: Mrs. Bhavya S "Analysis and Design of G+3 Commercial Building using ETABS" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-9 | Issue-2, April 2025, pp.1053-1057, URL: www.ijtsrd.com/papers/ijtsrd78571.pdf

IJTSRD78571

KEYWORDS: *ETABS, Design and Analysis, Three-dimensional model*

1. INTRODUCTION

The design and analysis of commercial buildings is a complex process that requires careful consideration of many factors. These factors include the building's intended use, location, materials, structural integrity, safety, and compliance with building codes and regulations. ETABS software is a powerful tool that can be used to design and analyze commercial buildings, allowing designers and engineers to create a detailed architectural and structural plan, develop a three-dimensional model of the building, and analyze its structural integrity.

The software can be used to model different types of structures, including G+3 commercial buildings, and can be used to optimize the design and ensure that the structure meets all requirements. By following a comprehensive process that includes architectural and structural design, three-dimensional modeling, and analysis of the structure using ETABS software, designers and engineers can create a safe, efficient, and structurally sound commercial building that meets the needs of its occupants and stakeholders.

In this context, this project aims to provide an overview of the design and analysis process for a G+3 commercial building using ETABS software. The project will cover the key steps involved in the process, including the architectural and structural design, modeling the building using ETABS software, analyzing the structure to determine internal forces and stresses, and optimizing the design to ensure structural integrity and safety. The project will also

address the importance of compliance with building codes and regulations and the documentation and reporting required to comply with them.

2. LITRATURE REVIEW

1. **Abhishek Kumar Ranjan-International journal for research in applied science and engineering technology-" Analysis and design of G+21 building using ETABS".- March-2022.**

The structure is a design based on the E-Tabs, which provides adequate serviceability, strength and also the work is economical. There is not much land available in urban areas so buildings are constructed in story's to utilize the vertical space.

2. **P Venu Mahadev, B Sandeep-Journal of engineering sciences-" Analysis and design of G+9 Commercial building using ETABS".- July-2022.**

The result of this project by manual and computerized analysis are nearly identical.The work is broadened for the nine-storey building (9-Storey Structure), and it is determined that the outcomes are consistent.

3. **Sanath Kumar K P -International journal of research in engineering and science-" Analysis and design of commercial building by using ETABS".-October-2021**

Usage of ETABS software minimizes the time required for analysis and design.This project is mainly concentrated with the analysis and design of multi-storied residential building with all possible cases of the loadings using ETAB software Meeting the design challenges are described in conceptual way.

4. **K Prabin Kumari-International journal of pure and applied mathematics-" DESIGN AND ANALYSIS OF COMMERCIAL BUILDING USING STAAD PRO".-2018**

Project deals with analysis and design of a G+8 Commercial building with wind effect using Staad Pro.Design of footings, beams, columns & slabs are done manually by limit state method as per IS456 – 2000, IS 875, and SP16

5. **HARSITHA MN, BINOD KUMAR DAS, SAURABH SINGH-International journal of research in engineering and science-"design and analysis of commercial building".-June-2017.**

In this building project we learnt to create the models by giving nodes and property to the structural elements using analysis. This project is very useful in making us learn the design by referring to the IS 456:2000 for each slab and beam. SP: 16 codes alone are used for easier design of columns yet we learned to design the columns

3. OBJECTIVES

1. Determine the loads: The first step in the design process is to determine the loads that the building will be subjected to. This includes gravity loads such as dead loads, live loads, and wind loads, as well as seismic loads.
2. Model the structure: Once the loads have been determined, the next step is to model the structure in ETABS. This involves creating a 3D model of the building, including all its components such as columns, beams, slabs, walls, and foundations.
3. Analyze the structure: Using ETABS, the model is analyzed to determine the response of the building under various load conditions. This includes calculating the stresses, strains, deflections, and other important parameters that indicate the structural behavior of the building.
4. Design the structure: Based on the analysis results, the building is designed to ensure that it meets the necessary safety and performance criteria. This includes selecting appropriate structural members, sizing them correctly, and providing adequate reinforcement to ensure that they can withstand the loads they will be subjected to.
5. Optimize the design: Finally, the design is optimized to ensure that it is efficient and cost-effective. This involves adjusting various design parameters such as member sizes, spacing's, and layouts to minimize material usage and construction costs while still meeting all safety and performance requirements.

4. SCOPE OF THE PRESENT STUDY

1. The study aims to explore the various steps involved in the design and analysis process, including developing a detailed architectural and structural plan, creating a three-dimensional model, analyzing the structure, optimizing the design, ensuring compliance with building codes and regulations, and documenting and reporting the design and analysis process.
2. The study further aims to provide insights into the use of ETABS software for designing and analyzing commercial buildings, including the software's capabilities and limitations.
3. The study also intends to highlight the importance of complying with building codes and regulations in the design and analysis of commercial buildings.
4. Overall, the present study's scope is to provide a comprehensive understanding of the methodology involved in designing and analyzing a commercial

building using ETABS software, with a specific focus on a G+3 commercial building.

5. METHODOLOGY

Designing a G+3 commercial building using ETABS involves the following methodology:

1. Building Geometry: The first step is to create a 3D model of the building in ETABS. This includes defining the geometry of the building such as the floor plan, elevation, columns, beams, slabs, and other structural elements.
2. Load Calculation: Next, the loads on the building must be calculated. This includes calculating the dead loads (weight of the building itself and permanent fixtures), live loads (weight of occupants and movable equipment), and other loads such as wind and seismic loads.
3. Structural Analysis: Once the loads are calculated, the structural analysis of the building can be carried out. This involves determining the internal forces and stresses on the building components due to the applied loads.
4. Design of Structural Elements: Based on the internal forces and stresses obtained from the structural analysis, the structural elements such as columns, beams, slabs, and footings can be designed to resist the loads.
5. Detailing and Construction Drawings: After the design of the structural elements is complete, the construction drawings and detailing can be prepared. These include detailed plans, sections, and elevations of the building, as well as detailed drawings of the reinforcement and connections for each structural element.
6. Code Compliance: Throughout the design process, it is important to ensure that the building meets the relevant building codes and standards. ETABS provides a variety of code checking tools to help ensure compliance with these standards.

6. LOAD AND LOAD COMBINATIONS

Dead load of columns, beams, Slabs are considered by software ETABS itself because we input material properties. With respect to unit weight and density and assigned Dead load pattern as self-weight multiplier 1 and property modifier of weight is 1.

DEAD LOAD
As per IS 875 part -1: 1987

LIVELOAD
As per IS 875 part -2: 1987

WIND LOAD
As per IS 875 part -3: 1987

SEISMIC LOAD
As per IS 1893 part -1 :2002

7. MATERIALS AND SECTIONAL DETAILS OF THE STRUCTURES

Grade of concrete: M30

Grade of Steel: Fe500

Column Sizes: 200 x 400, 200 x 600.

Beam Sizes: 500 x 500

No of Stories: 4

Total Height of Building: 10.3m

8. ARCHITECTURAL PLAN

For the below plan design and analysis has been done using ETABS.

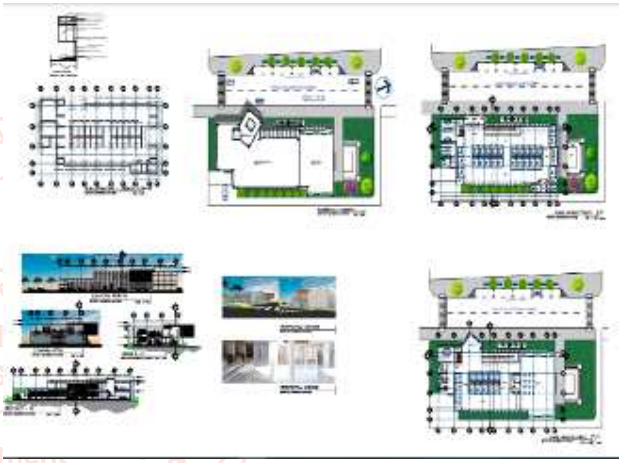

Fig 1: 2-D Plan of Structure

9. SKETCH UP PLAN VIEW

SketchUp is a 3D modeling software that allows users to create and edit 3D models quickly and easily. It was originally developed by @Last Software, but it is now owned by Trimble Inc. SketchUp is widely used in architecture, interior design, construction, engineering, and other related fields.

One of the key features of SketchUp is its user-friendly interface. It allows users to create 3D models using a variety of tools such as drawing, push/pull, and extrusion. SketchUp also includes a 3D warehouse where users can download pre-made 3D models or upload their own models to share with others.

Overall, Sketch Up is a powerful and easy-to-use 3D modeling software that is widely used in the architecture and design industries.

Fig 2: 3-D Plan of Structure

10. ETABS MODELLING AND ANALYSIS

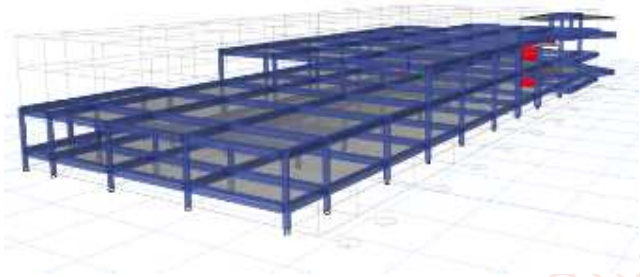

Fig 3: 3-D Modelling

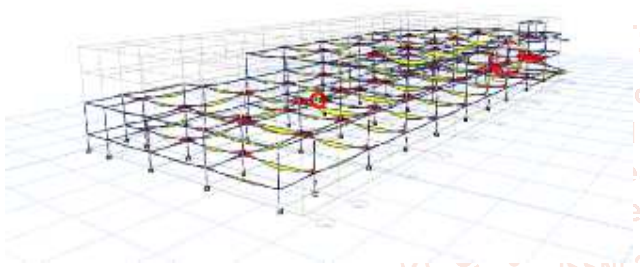

Fig 4: Bending Moment

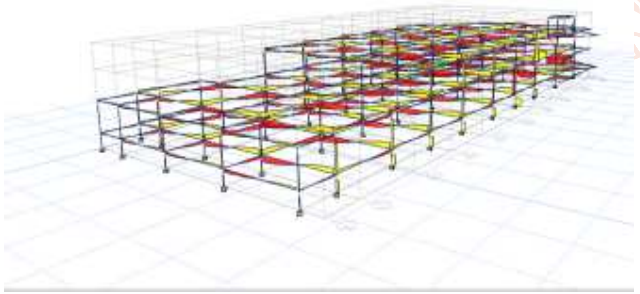

Fig 5: Shear Force

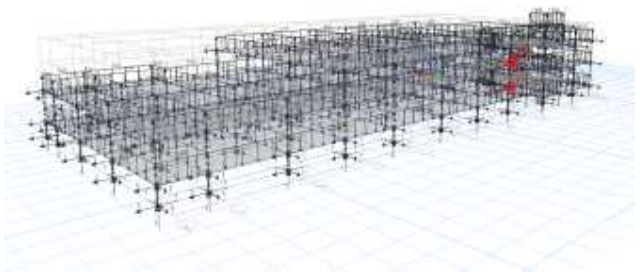

Fig 6: Dead Loads

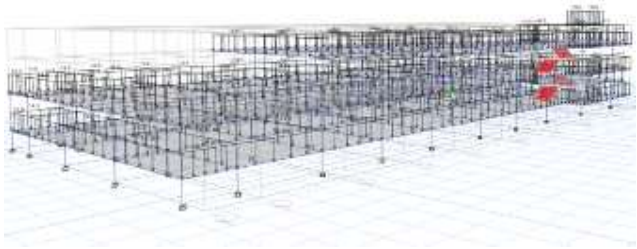

Fig 7: Wall loads

Name	Load Case/Combo	Scale Factor	Type	Auto
DCon1	Dead	1.5	Linear Add	☑
DCon1	Floor Finish	1.5		☐
DCon1	Wall Load	1.5		☐
DCon2	Dead	1.5	Linear Add	☑
DCon2	Live	1.5		☐
DCon2	Floor Finish	1.5		☐
DCon2	Wall Load	1.5		☐
DCon3	Dead	1.2	Linear Add	☑
DCon3	Live	1.2		☐
DCon3	Floor Finish	1.2		☐
DCon3	Wall Load	1.2		☐
DCon3	WX	1.2		☐
DCon4	Dead	1.2	Linear Add	☑
DCon4	Live	1.2		☐
DCon4	Floor Finish	1.2		☐
DCon4	Wall Load	1.2		☐
DCon4	WX	-1.2		☐
DCon5	Dead	1.2	Linear Add	☑
DCon5	Live	1.2		☐
DCon5	Floor Finish	1.2		☐
DCon5	Wall Load	1.2		☐
DCon5	WY	1.2		☐
DCon6	Dead	1.2	Linear Add	☑
DCon6	Live	1.2		☐
DCon6	Floor Finish	1.2		☐
DCon6	Wall Load	1.2		☐
DCon6	WY	-1.2		☐
DCon13	WY	1.5		☐
DCon14	Dead	0.9	Linear Add	☑
DCon14	Floor Finish	0.9		☐
DCon14	Wall Load	0.9		☐
DCon14	WY	-1.5		☐
DCon15	Dead	1.2	Linear Add	☑
DCon15	Live	1.2		☐
DCon15	Floor Finish	1.2		☐
DCon15	Wall Load	1.2		☐
DCon15	EQX	1.2		☐
DCon16	Dead	1.2	Linear Add	☑
DCon16	Live	1.2		☐
DCon16	Floor Finish	1.2		☐
DCon16	Wall Load	1.2		☐
DCon16	EQX	-1.2		☐
DCon17	Dead	1.2	Linear Add	☑
DCon17	Live	1.2		☐
DCon17	Floor Finish	1.2		☐
DCon17	Wall Load	1.2		☐
DCon17	EQY	1.2		☐
DCon18	Dead	1.2	Linear Add	☑
DCon18	Live	1.2		☐
DCon18	Floor Finish	1.2		☐
DCon18	Wall Load	1.2		☐
DCon18	EQY	-1.2		☐
DCon19	Dead	1.5	Linear Add	☑
DCon19	Floor Finish	1.5		☐

Fig 8: Load combinations

11. CONCLUSION

- Designing and analyzing a G+3 commercial building using ETABS is a complex process that requires significant expertise in structural engineering and the use of ETABS software. By following a comprehensive methodology that

includes building geometry, load calculation, structural analysis, design of structural elements, detailing and construction drawings, code compliance, and performance verification, a safe and efficient building can be designed and constructed.

- ETABS software provides a range of tools for modeling, analysis, and design of building structures. It allows structural engineers to perform complex structural analyses, including modeling of different loading conditions, non-linear material behavior, and dynamic response.
- The design of a G+3 commercial building using ETABS must also comply with relevant building codes and standards. These codes and standards ensure that the building is designed to withstand expected loads and environmental conditions and provide a safe and comfortable environment for its occupants.
- In conclusion, the design and analysis of a G+3 commercial building using ETABS is a crucial step in ensuring the safety and efficiency of the building. By following a comprehensive methodology and utilizing ETABS software, structural engineers can design buildings that are both functional and aesthetically pleasing while also meeting building code requirements

12. REEFERENCES

[1] Abhishek Kumar Ranjan-International journal for research in applied science and engineering technology-" Analysis and design of G+21 building using ETABS".- March-2022.

[2] P Venu Mahadev, B Sandeep-Journal of engineering sciences-" Analysis and design of G+9 Commercial building using ETABS".- July-2022.

[3] Sanath Kumar K P -International journal of research in engineering and science-" Analysis and design of commercial building by using ETABS".- October-2021

[4] K Prabin Kumari-International journal of pure and applied mathematics-" DESIGN AND ANALYSIS OF COMMERCIAL BUILDING USING STAAD PRO".- 2018

[5] HARSITHA MN, BINOD KUMAR DAS, SAURABH SINGH-International journal of research in engineering and science-"design and analysis of commercial building".- June-2017.