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# Earthquake Resistant Design Of G+5 Building Using E-Tabs Software

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***ABSTRACT:*** *E-TABS stands for Extended Three Dimensional Analysis Of Building Systems. This software's primary objective is to design multi-story buildings in a methodical manner. In addition to creativity and conceptual thinking, the design process for structural planning and design also calls for a solid understanding of the science of structural engineering as well as practical knowledge of elements like current design codes and bye laws, supported by a wealth of experience, intuition, and judgment. A structure's effective design and construction are of utmost significance anywhere in the world. This project uses E-TABS to analyse and design a multi-story residential building that will be subject to lateral earthquake loading. The design of this project complies with Indian Codes IS 1893-parts2:2002 and IS 456:2000. Severe earthquake zones are taken into consideration throughout this analysis.*

***Keywords:*** *Structural Designing, E-Tabs Software Tool, Seismic Analysis, Multi-Stories Residential Buildings.*

## I.INTRODUCTION:

Buildings occur in a wide variety of shapes and applications, and they have been modified throughout history for a wide range of causes, including the availability of building materials, weather, land costs, ground conditions, particular usage, and aesthetic considerations. A building with several storeys above ground is referred to as multi-stored. Multi-story structures strive to expand the building's floor area without increasing the amount of land they are built on, saving land and, in most cases, money in the process (depending on material used and land prices in the area). In addition to creativity and imaginative thought, designing a multi-story building necessitates a solid understanding of structural engineering science. The market's top design software at the moment is E-Tabs. This programme is used extensively by design firms for project design. So, this project compares the results of an investigation of a multi-story building construction that used braces and those that did not.

A. Design Philosophies

A design philosophy is a set of assumptions and procedures used to meet the maintainability, safety, economy, and functionality requirements of a structure. Several design philosophies are introduced from different parts of the world. Some of the design philosophies that have been used by engineers are:

1. Working Stress Method(WSM)/ Allowable Stress Design (ASD)
2. Ultimate Load Method (ULM)
3. Limit State Method(LSM)

B. Assumption Regarding Design

When designing a building, there are several assumptions that must be taken into consideration to ensure that the final product meets the desired standards of safety, functionality, and aesthetics. Some of the key assumptions include:

1. Purpose and function of the building: The design of the building must be based on its intended purpose and function, taking into consideration factors such as occupancy type, use, and anticipated traffic flow.
2. Building codes and regulations: Compliance with local building codes and regulations is essential to ensure that the building is safe, structurally sound, and meets the required standards of fire safety, accessibility, and energy efficiency.
3. Structural design: The structural design of the building must take into account anticipated loads and forces, including wind, seismic, and snow loads, and must be able to withstand these forces over time.
4. Building materials: The selection of building materials must be based on their ability to provide adequate support and stability, as well as their durability, resistance to fire and other hazards, and compatibility with the building's intended use.
5. Aesthetics: The appearance of the building is an important consideration, and the design must take into account factors such as proportion, scale, texture, and color, to create a visually appealing and harmonious structure.
6. Mechanical, electrical, and plumbing systems: The design of these systems must be integrated with the overall design of the building, taking into account factors such as energy efficiency, safety, and ease of maintenance.
7. Environmental sustainability: Designers must consider the environmental impact of the building, including its energy and water usage, as well as its potential to contribute to air and water pollution, and take steps to minimize these impacts.
8. Cost and feasibility: The design of the building must be feasible within the constraints of the available budget and the existing site conditions, and must be able to be constructed using available materials and techniques.

## II. OBJECTIVE

The objectives of an earthquake-resistant design of a G+5 building using E-Tabs software include:

1. To ensure the safety of the building occupants during an earthquake by designing the building to resist seismic forces.
2. To minimize damage to the building and its contents during an earthquake.
3. To comply with building codes and regulations related to earthquake-resistant design.
4. To optimize the design for cost and constructability while maintaining the required level of seismic performance.
5. To achieve an aesthetically pleasing design that meets the needs of the building occupants.
6. To use advanced analytical tools and techniques to accurately model the behavior of the building under seismic loads.
7. To design a foundation system that is appropriate for the site conditions and can resist the anticipated seismic forces.
8. To ensure that the building is designed to perform well in a range of seismic hazard scenarios, including ground shaking, fault rupture, and soil liquefaction.

## III. LITERATURE REVIEW

**Sayyed A.Ahad, Hashmi S Afzal, Pathan Tabrej, Shaikh Ammar, Shaikh Vikhar, Shivaji Bidve [1]**, This work deals with the analysis and design of (G+10) residential buildings. Analyzes were performed using ETABS software version 15.2. It has proven well enough in design for construction, including analysis of all sections. All structural elements such as concrete walls are in place. According to soil survey reports, they provided an insulated foundation. Sectional and structural analyzes were performed using STAAD-PRO and the results were compared.

**C.V.S. Lavanya, Emily.P.Pailey, Md. Mansha Sabreen [2]**, This paper deals with the analysis and design of (G+4) residential buildings using ETABS software. They acquired a territory in medium soil type Panaji. They displayed plans under Zone IV with a zone factor of 0.24. They defined the properties of materials such as concrete and steel in his ETABS software. The building should have a regular moment-bearing frame.

**Sayyed Feroz Sikandar, Shaikh Zameeroddin. S, Prof. Agrawal. A. S3BE Student, Gudie [3],** This paper deals with the analysis and design of multistory building using Etabs software. They took into consideration of dead loads, live loads, wall loads, earthquake forced, earthquake loading etc. They took the load consideration as per IS 456:2000, IS 875:1987 (Part-V) and IS 1893(part-I):2002. They checked for one way shear, two way shear, development length, bearing stress. According to soil investigation report they provided an isolated footing. They also provided structural elements like RCC frame, shear walls and retaining walls.

**Ayush Chandrakar, Manas Rathore [4],** This paper deals with the analysis and design of multistoried residential building (G+5) using ETABS software. They assumed continuous slabs over interior supports and beams were also assumed to be continuous. They considered dead load, live load, wind load, imposed load, earthquake load. The shape of building was regularly (rectangular). Grade of the concrete used is M25 and Unit weight of concrete is 25KN)/m3. They considered the load combination for seismic and wind load analysis of the building.

**Shaikh Ibrahim, Md Arifuzzaman, Jisan Ali Mondal, Md Taukir Alam, Sanuwar Biswas, Sagar Biswas [5],** This work deals with residential design and analysis. The type of structure is a five-story multi-layer rigid composite frame. After analyzing G+'s four-story

building structure, they found that the structure was subjected to dead load, live load, wind load, and seismic load. Dimensional elements (beams, columns, slabs) were assigned by calculating the type of load and the amount applied to it.

**S Abhishek, Manoj S K, Roopa B D, Bhagyashree M S, Guruprasad C H M [6],** They considered the style of housing (G+1) and used ETABS to perform the analysis. This has resulted in productive results by gaining a large industrial presence and further saving time in analysis. They considered the worst case scenario for stress within the structure. They designed the components after comparison, both software and manually.

## Conclusion:

1. The design of an earthquake-resistant G+5 building using E-Tabs software is a critical process that involves multiple steps and considerations.

2. By using advanced analytical tools and techniques, designers can accurately model the behavior of the building under seismic loads and optimize the design for cost and constructability while maintaining the required level of seismic performance.

3. The foundation system must be appropriate for the site conditions and able to resist the anticipated seismic forces, and the building must be designed to perform well in a range of seismic hazard scenarios.

4. The objectives of an earthquake-resistant design are to ensure the safety of building occupants, minimize damage to the building and its contents, comply with building codes and regulations, achieve an aesthetically pleasing design, and use advanced analytical tools and techniques to accurately model the behavior of the building under seismic loads.

5. Overall, an earthquake-resistant design is essential for buildings located in seismically active areas to minimize the risk of damage and ensure the safety of occupants.

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