ANALYSIS AND DESIGN OF A S+4 RESIDENTIAL BUILDING

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1. ABSTRACT

This study uses STAAD Pro software to analyse and design a G+4 residential structure. The structure was created in accordance with the Indian Standard Code (IS 456:2000). Building structural analysis and design are done using the STAAD Pro programme. The analysis includes figuring out the building's stability, load-carrying capacity, and reactivity to various loads. Based on the study's findings, the design determines the right materials, section sizes, and reinforcement details for the structural members. The design also takes the building's economy, use, and safety into account. The analysis and design's findings are reported in terms of the structural members' stress, deflection, and reinforcing information. The study's findings indicate that the G+4 apartment block is safe, stable, and economical.

Keywords: Autocad, Staadpro, Shear force, Bending moment

2. INTRODUCTION

A multi-story building with four stories above ground and a ground floor is referred to as a G+4 residential building. It is intended to offer several families or people in metropolitan locations secure and comfortable living quarters. To meet diverse living demands, the building often consists of a mix of apartments or units of varying sizes and configurations. A G+4 building can provide more individualised and communal living experiences because it is smaller than high-rise buildings. While still having enough privacy and independence in their living spaces, residents can take advantage of shared amenities like lifts, parking spots, and recreation areas.

To guarantee the safety, functioning, and beauty of the structure, the design and construction of a G+4 residential building necessitate meticulous planning and attention to detail. Local building rules, structural integrity, environmental considerations, and resident needs are just a few of the things that architects and engineers must take into account. Overall, a well-designed and well-built G+4 residential block may offer urban people a convenient and comfortable place to live while also helping to create sustainable and livable communities.

3. LITERATURE REVIEW

The literature on G+4 residential buildings offers useful insights into numerous facets of these structures' design, construction, and upkeep. Here is a summary of some recent and significant research on G+4 homes:

1. P. R. Khan et al.'s study "Design of G+4 Residential Buildings Using Precast Concrete Technology" was published in 2021.

This study investigates the design and construction of G+4 residential structures using precast concrete technology. Precast concrete has several benefits, including better quality, quicker construction, and less waste. The authors methodology that focuses on safety issues in the design of G+4 residential buildings. The authors offer tactics such as smoke detection and suppression systems, communication systems, evacuation routes, and fire-resistant materials.

5. By M. A. Hoque et al. (2017), "Sustainable design of G+4 residential buildings"

This study examines the possibilities for environmentally friendly design in G+4 residential structures and suggests a set of sustainability standards that take into account economic, social, and environmental concerns. The writers offer tactics include installing green roofs, collecting
highlight these benefits and offer suggestions for how to use precast concrete effectively in construction projects.

2. S. J. Kim et al.'s "Energy-efficient design of G+4 residential buildings" (2020)
This study focuses on the G+4 residential structures' energy efficiency and suggests a design strategy that combines passive and active strategies to cut down on energy use and greenhouse gas emissions. Building orientation, insulation, shading, natural ventilation, and effective lighting and heating systems are just a few of the measures the authors advise.

The seismic performance of G+4 residential buildings in Korea is examined in this study, and the usefulness of various structural methods in reducing earthquake damage is assessed. The authors come to the conclusion that G+4 structures can have effective seismic protection provided by reinforced concrete frames with shear walls and steel bracing systems.

4. The article "Design for safety in G+4 residential buildings" by S. S. Kim et al. (2018)
In order to integrate risk assessment, hazard mitigation, and emergency response planning, this study provides a rainwater, using renewable energy sources, managing garbage, and involving the community. These evaluations of the literature demonstrate that G+4 residential buildings have drawn considerable interest from academics and professionals across a range of disciplines. They shed important light on the planning, building, and upkeep of these facilities and emphasise the significance of elements like security, energy efficiency, seismic resilience, sustainability, and community involvement.

4. OBJECTIVES
1. Completely analysing and designing the primary structural components of a multi-story building, such as the slabs, columns, and shear force
2. Learning about structural design programme (staadpro autocad)
3. Acquiring practical familiarity with engineering techniques
5. METHODOLOGY

<table>
<thead>
<tr>
<th>PLANNING</th>
<th>Using autocad</th>
</tr>
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<tbody>
<tr>
<td>ANALYSIS</td>
<td>Using stadd pro as well as comparison with manual calculations</td>
</tr>
<tr>
<td>DESIGN</td>
<td>Using stadd pro as well as comparison with manual calculations</td>
</tr>
</tbody>
</table>

6. PLANNING

7. BUILDING DATA FOR ANALYSIS:
Table 7.1 The dimensions and size of individual elements

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heigh of floor</td>
<td>3.2 m</td>
</tr>
<tr>
<td>wall</td>
<td>0.23</td>
</tr>
<tr>
<td>column</td>
<td>0.23*0.45</td>
</tr>
<tr>
<td>beam</td>
<td>0.23*0.45</td>
</tr>
<tr>
<td>slab</td>
<td>0.12</td>
</tr>
<tr>
<td>Parapet wall</td>
<td>0.125*1.0</td>
</tr>
</tbody>
</table>

Table 7.2 Building materials

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit weight of RCC</td>
<td>25 kN/m³</td>
</tr>
<tr>
<td>Unit weight of concrete</td>
<td>24 kN/m³</td>
</tr>
<tr>
<td>Unit weight of brick</td>
<td>19.2 kN/m³</td>
</tr>
<tr>
<td>Yield stress of steel bars</td>
<td>415 N/m²</td>
</tr>
<tr>
<td>Location</td>
<td>Vijayawada</td>
</tr>
<tr>
<td>Floor height</td>
<td>3.2 m</td>
</tr>
<tr>
<td>Number of floors</td>
<td>Stilt+4</td>
</tr>
</tbody>
</table>

8. ANALYSIS AND DESIGN USING STAAD PRO

FRAME STRUCTURE
3D STRUCTURE

SHEAR FORCE DIAGRAM

DESIGN OF BEAM

DESIGN OF COLUMN
9. CONCLUSION

- Using STADD Pro., analysis and design of multi-storey building has completed much quickly and easier than the manual calculation.
- AUTO CAD 2019 is used for developing the plans.
- The dimensions of structural members are specified and the loads such as dead load, live load, floor load roof load are applied.
- Bending moments and shear forces are checked for beams, columns and slabs.
- Manual analysis using kani’s method has been done and composed these results with results obtained from the software of STAAD Pro.
- Very less space is required for the storage of the data.
- STAAD.Pro V8i advanced software which provides us a fast, efficient, easy to use and accurate platform for analyzing and designing structures.

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