ANALYSIS OF G+3 BUILDING USING BIM

KHUSHI BODHARE[1], NIKITA NARNAVRE[2], DIVYA WADHICHAR[3], BHAVANA DHURVE[4], SACHIN NAVGHARE[5], DR. ASHISH MOON[6], BHAGYESH CHACHERE[7]

[1 2 3 4 5] Student, Civil Engineering & Smt. Radhikatai Pandav College of Engineering
[6 7] Assistant Professor, Civil Engineering & Smt. Radhikatai Pandav College of Engineering

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Abstract - The rapid evolution of digital technologies has transformed conventional building analysis methods into intelligent and data-driven processes. This study investigates the structural analysis of a G+3 building using Building Information Modeling (BIM) techniques. Advanced tools such as Autodesk Revit for modeling and STAAD Pro for analytical computation are utilized to create an integrated workflow. The research evaluates structural response under multiple loading scenarios, including gravity and lateral forces. BIM facilitates seamless data exchange between modeling and analysis platforms, ensuring accuracy and minimizing inconsistencies. The findings indicate improved analytical precision, reduced modeling time, and enhanced decision-making capability. The study confirms that BIM-based structural analysis is more efficient, reliable, and suitable for modern construction practices.

Key Words: BIM, G+3 Building, Structural Analysis, Revit, STAAD Pro, AutoCAD, Quantity Take-off

1.INTRODUCTION

The construction industry has traditionally relied on fragmented workflows where design and analysis are performed independently. This separation often results in discrepancies, delays, and increased project costs. With the introduction of BIM, the entire lifecycle of a building—from conceptual design to structural evaluation—can be managed within a unified digital environment.

BIM is not just a 3D modeling tool; it is an information-rich system that allows engineers to simulate real-world behavior of structures before construction. Software platforms like Autodesk Revit enable parametric modeling, while STAAD Pro supports advanced structural analysis.

This paper presents a detailed analysis of a G+3 reinforced concrete building using BIM methodology. The focus is on evaluating structural behavior, identifying critical stress zones, and optimizing design elements through an integrated approach.

2. METHODOLOGY

2.1. Model Development

A parametric 3D model of the G+3 structure is created using Autodesk Revit. The model includes:

- Structural framing (beams and columns)
- Floor slabs and foundations
- Material specifications and sectional properties

2.2 Data Integration

The BIM model is exported to STAAD Pro for analysis. The interoperability ensures that geometry and material data remain consistent.

2.3 Load Consideration

The structure is analyzed under the following loads:

- Permanent loads due to self-weight
- Imposed loads due to occupancy
- Lateral loads caused by wind
- Seismic forces based on relevant standards

2.4 Load Combinations

Various combinations of loads are applied to simulate real-life scenarios. Critical combinations are identified for safe design.

2.5 Structural Analysis Procedure

- Linear static analysis is performed
- Internal forces (axial, shear, bending) are calculated
- Nodal displacements and reactions are obtained

2.6 Validation and Optimization

Results are evaluated to check:

- Safety of members
- Serviceability limits
- Scope for material reduction

2.7 Building Specifications

- Building Type: RCC framed structure
- Number of Floors: G+3
- Storey Height: 3 m each
- Structural System: Beam-column frame
- Foundation Type: Isolated footing
- Materials Used:
  - Concrete: M25
  - Steel: Fe500

3.RESULTS AND APPLICATIONS

3.1 Structural Response

The analysis reveals that the structure behaves efficiently under all applied loads. Load transfer from slabs to beams and columns is consistent and stable.

3.2 Bending Behavior

- Maximum bending stresses are observed in beams at mid-span
- Edge beams show comparatively lower stress values
- Structural members are within permissible stress limits

5.3 Shear Distribution

- Peak shear forces occur near column supports
- Shear reinforcement requirements are calculated accordingly

5.4 Displacement Characteristics

- Lateral displacement due to wind and seismic loads is within acceptable limits
- No excessive deformation is observed

5.5 Critical Load Case

The governing load case includes a combination of gravity and lateral forces, which determines the design of major structural members.

5.6 BIM Efficiency

The use of BIM significantly improves:

- Model accuracy
- Data consistency
- Speed of analysis

5.7 Design Optimization

Through iterative analysis:

- Beam and column sizes are optimized
- Material usage is reduced without compromising safety

CONCLUSIONS

This study demonstrates that BIM-based analysis of a G+3 building offers a highly efficient and accurate approach to structural engineering. The integration of modeling and analysis tools results in improved coordination, reduced errors, and optimized structural performance.
The major conclusions are:

- BIM enables precise and reliable structural analysis
- It reduces time required for modeling and computation
- It enhances safety through better visualization and evaluation
- It supports cost-effective and sustainable design

Therefore, BIM-based structural analysis is a superior alternative to conventional methods and should be widely implemented in modern construction projects.

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