

DESIGN OF G+3 BUILDING USING BIM

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Abstract - Building Information Modeling (BIM) has emerged as a transformative technology in the Architecture, Engineering, and Construction (AEC) industry. This study focuses on the design and analysis of a G+3 (Ground + 3 floors) building using BIM tools such as Autodesk Revit and STAAD Pro. The research integrates architectural planning, structural analysis, and MEP systems within a unified digital environment. The BIM-based approach enables accurate 3D visualization, efficient clash detection, and improved coordination among different disciplines. The results indicate significant improvements in design accuracy, time efficiency, and cost reduction compared to traditional methods. The study concludes that BIM enhances project performance and supports sustainable construction practices.

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

1. INTRODUCTION

The construction industry is increasingly adopting digital technologies to improve efficiency, accuracy, and collaboration. Building Information Modeling (BIM) is a modern approach that enables the creation and management of a digital representation of a building throughout its lifecycle.

Traditional construction methods rely on 2D drawings, which often lead to:

- Miscommunication among stakeholders
- Design inconsistencies
- Increased project delays and costs

BIM overcomes these limitations by providing a centralized 3D model that integrates architectural, structural, and MEP components. Tools such as Autodesk Revit allow designers to visualize the entire building before construction begins, while STAAD Pro helps in performing precise structural analysis.

This research focuses on designing a G+3 building using BIM to demonstrate its advantages in planning, coordination, and execution. The study emphasizes how BIM improves productivity, reduces errors, and enhances decision-making.

2. METHODOLOGY

2.1. Data Collection

The initial step involves collecting essential data required for the design process:

- Site dimensions and location details
- Soil characteristics
- Building requirements (residential/commercial)
- Design standards and IS codes

2.2. Architectural Modelling

Using Autodesk Revit:

- Development of floor plans for G+3 structure
- Elevations and sectional views
- Space planning and room layouts
- 3D visualization of building

The design ensures proper ventilation, lighting, and space utilization.

2.3. Structural Modelling

- Modelling of beams, columns, slabs, and foundation
- Assignment of material properties (Concrete M20/M25, Steel Fe500)
- Load calculations:
 - Dead Load (DL): Self-weight of structural components
 - Live Load (LL): Imposed loads as per IS 875
 - Wind Load (WL): Based on building height and wind speed
 - Seismic Load (EQ): As per IS 1893

2.4 Structural Analysis

The analysis is performed in STAAD Pro:

- Load application and combinations
- Bending moment and shear force analysis
- Deflection checks
- Reinforcement detailing

2.5 MEP System Integration

- Electrical layout design
- Plumbing system planning
- HVAC modelling

2.6 Clash Detection

- Identification of conflicts between structural and MEP systems
- Correction of errors before construction

2.7 Quantity Take-off and Cost Estimation

- Automatic extraction of material quantities
- Cost estimation and budgeting

3.RESULTS AND APPLICATIONS

3.1 Enhanced Visualization

The 3D model developed using Autodesk Revit provides a realistic representation of the building, enabling better understanding of design elements.

3.2 Improved Coordination

Integration of architectural, structural, and MEP systems reduces miscommunication and ensures smooth collaboration among stakeholders.

3.3 Clash Detection

Early detection of clashes between structural and service components minimizes construction errors and rework.

3.4 Structural Efficiency

Analysis performed using STAAD Pro ensures:

- Safe load distribution
- Optimized member sizes
- Improved structural stability

3.5 Time and Cost Savings

- Reduction in project delays
- Efficient resource utilization
- Accurate cost estimation

3.6 Sustainability

- Reduction in material wastage

- Energy-efficient building design

Overall, BIM significantly enhances project quality and efficiency compared to traditional methods.

CONCLUSIONS

The design of a G+3 building using BIM demonstrates the effectiveness of digital technologies in modern construction. BIM provides an integrated platform that enables seamless coordination between architectural, structural, and MEP components.

The key conclusions of the study are:

- BIM improves design accuracy and reduces errors
- It enhances collaboration among project stakeholders
- It reduces construction time and cost
- It supports sustainable and efficient building practices

Thus, BIM is a powerful and essential tool for the future of the construction industry. Its adoption can lead to smarter, faster, and more reliable project execution.

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