www.ijarp.com ISSN 2456-9992 Page: 01-11

International Journal Advanced Research Publications

Research Article

Volume: 02
Issue: 05

" 3D BIM MODEL OF MULTISTOREY GREEN BUILDING "

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Article Received: 29 March 2026, Article Revised: 19 April 2026, Published on: 09 May 2026

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DOI: https://doi-doi.org/101555/ijarp.3141

ABSTRACT

This project focuses on the development of a 3D Building Information Modeling (BIM) model of a Multistorey green building, integrating sustainability principles with modern design and construction workflows. The 3D BIM model not only enhances design accuracy but also facilitates cost estimation using schedules in Revit software, Energy optimization, reducing construction waste and improving project efficiency. By merging BIM technology with sustainable design strategies, this project demonstrates an innovative approach to planning and executing modern multistorey green building that aligns with global sustainability goals.

KEYWORDS: 3D Modeling, Multistorey Building, Green Building, Sustainable Design, Energy Efficiency, Eco-friendly materials, Cost optimization.

1. INTRODUCTION

In today's construction industry, sustainability and technological advancement are the key driving forces behind innovative building design. The concept of green buildings has gained immense importance as the world faces challenges like climate change, energy crisis and rapid urbanization. A green building is designed, constructed, and operated to minimize its environmental impact while maximizing energy efficiency and occupant comfort. Buildings contribute nearly 30–40% of total global energy consumption and are responsible for a significant portion of greenhouse gas emissions. Therefore, the adoption of green building

strategies has become essential to reduce energy use, conserve water, and promote the use of sustainable materials.

The present study focuses on developing a 3D BIM model of a multistorey green building and performing a comparative analysis between new green buildings and existing buildings. The main parameters of comparison include cost, material use, and carbon emissions. The study utilizes Revit's Autodesk Insight for conducting energy simulations and lifecycle assessments.

In this project, titled "3D BIM Model of Multistorey Building," the main objective is to design and develop a complete 3D model of a multistorey structure using Autodesk Revit Architecture software. The project focuses on creating a digital representation that includes architectural design. Autodesk Revit provides a platform for integrating multiple disciplines within a single model, improving coordination and minimizing design errors. The developed model not only represents the visual design but also contains detailed information about building components, materials, quantities, and dimensions, which are essential for construction and cost estimation. The work in this project involves several key stages. Initially, the architectural layout of the multistorey building is planned according to standard building codes and functional requirements. Using Revit, the building's floors, walls, windows, doors, columns, and slabs are modeled in a 3D environment. This integration helps visualize how all systems fit together and detect potential clashes before construction begins. The Revit software also enables the creation of detailed floor plans, sections, elevations, and 3D visualizations that can be used for presentation and construction documentation

2. LITERATURE REVIEW

2.1 Building Information Modeling (BIM) in construction industry

Building information modeling (BIM) plays an important role in the construction industry as it provides a digital representation of the physical and functional characteristics of a building. Under BIM, different software is used, such as Autodesk AutoCAD, Autodesk Revit, Autodesk Navisworks, Tekla, Autodesk Insight, etc. Revit software is widely used for BIM modeling due to its accuracy, capability to generate detailed drawings, schedules of materials, and 3D visualizations. Researchers have found that BIM reduces rework, improves efficiency, improves cost estimation accuracy, reduces error, and is also used for clash detection, all of which are done before the construction of any project.

2.2 BIM for Sustainable and Green Buildings

The integration of BIM with sustainability concepts has led to the development of efficient green buildings. BIM allows designers to analyze building performance at early design stages, enabling better decision-making regarding energy use, materials, and environmental impact. Studies show that BIM can be effectively used for lifecycle assessment and sustainability analysis. By integrating BIM with tools like Autodesk Insight, engineers can evaluate different design alternatives and select the most energy-efficient solution. This approach helps in reducing the carbon footprint and improving overall building performance

2.3 Eco-Friendly and Sustainable Materials

The selection of materials for any construction plays a vital role in achieving sustainability in construction. Eco-friendly materials such as fly ash bricks, recycled steel, bamboo and low-VOC paints are widely used in green buildings. These materials reduce environmental impact and improve indoor air quality. Research indicates that sustainable materials not only reduce carbon emissions but also enhance the durability and efficiency of buildings. The use of such materials in BIM models allows the accuracy of the entire project and better management of construction

1.4 Energy Analysis and Optimization

Energy consumption in buildings accounts for a significant portion of global energy use. Therefore, optimizing energy performance is a key objective in green building design. Energy analysis helps in understanding how a building consumes energy and identifies areas for improvement.

Tools like Autodesk Insight enable simulation of building performance, including heating, cooling, lighting, and ventilation systems. Studies show that energy-efficient designs can significantly reduce operational costs and environmental impact.

2.5 Daylight Analysis in Buildings

Daylighting is an important aspect of sustainable building design. Proper utilization of natural light reduces the need for artificial lighting and improves occupant comfort and productivity.

BIM tools allow designers to simulate daylight conditions and optimize window placement, orientation, and shading devices. Research has shown that effective daylight design can reduce energy consumption and enhance indoor environmental quality.

2.6 Comparison Between Conventional(Existing) and Green Buildings

Several studies have compared traditional buildings with green buildings based on cost, energy consumption, and environmental impact. While green buildings may have slightly higher initial costs, they offer significant savings in operational costs over time.

Research findings indicate that green buildings consume less energy, produce less carbon emissions, and provide better indoor environmental conditions. This makes them more sustainable and economically viable in the long run.

2.7 Carbon Emissions in Buildings

Buildings contribute significantly to global carbon emissions through both embodied energy (materials and construction) and operational energy (heating, cooling, lighting). Reducing carbon emissions is a major goal of sustainable construction.

Studies suggest that the use of BIM and energy analysis tools can help in identifying high-emission components and optimizing building design to minimize environmental impact.

2.8 BIM for Quantity Takeoff and Cost Estimation

BIM enables automatic extraction of quantities directly from the model, improving accuracy in cost estimation. This reduces material wastage and enhances project efficiency.

Researchers have highlighted that BIM-based estimation is more reliable compared to traditional methods, as it is based on real-time model data.

2.9 Physical Model and Digital Model Integration

In addition to digital modeling, physical models are often used for better visualization and presentation. The combination of BIM and physical models provides a comprehensive understanding of the project.

Physical models help stakeholders visualize the design, while BIM provides detailed technical information. This integration improves communication and decision-making in construction projects.

2. METHDOLOGY

3.1 Project Overview

The methodology adopted for this study focuses on the development of a 3D BIM model of a G+5 multistorey residential building and its transformation into a green building using sustainable design strategies. The process involves modeling, material selection, energy analysis, and comparative evaluation using advanced BIM tools.

3.2 Data Collection and Study of Existing Building

Initially, the data of the existing G+5 residential building was collected. This included:

Architectural drawings (plans, elevations, sections)

Building dimensions and layout details,

Material used for the construction,

Site conditions and orientation, visit to the site.

The collected data was carefully analyzed to understand the existing building performance and identify areas for improvement in terms of sustainability.

3.3 Development of 3D BIM Model

The 3D model of the building was developed using Autodesk Revit. The modeling process included:

Creation of levels for all floors (G+5).

Modeling of all architectural elements such as walls, floors, windows, doors, roofs.

Preparation of detailed floor plans, elevations, and sections.

Assign properly all materials and make schedule of each material for quantity takeoff.

The BIM model provided an accurate digital representation of the building with all necessary information related to geometry and materials.

3.4 Conversion of existing building material to Green Building materials and Features

After developing the base model, green building concepts were incorporated into the design. The modifications included:

Use of eco-friendly materials such as fly ash bricks and low-VOC paints

Improved building orientation for maximum natural light and ventilation

Installation of energy-efficient lighting systems

Inclusion of renewable energy sources such as solar panels, rainwater harvesting.

These features were integrated into the BIM model to enhance overall building sustainability.

3.5 Energy Analysis Using Autodesk Insight

Energy performance analysis was carried out using Autodesk Insight, which is integrated with Revit. The following analyses were performed:

Energy consumption analysis

Daylight analysis

Energy Optimization

Carbon emission estimation

Different design alternatives were tested to identify the most energy-efficient configuration.

3.6 Daylight Analysis

Daylight analysis was conducted to evaluate the availability of natural light within the building. This included:

Analysis of window placement and size

Study of building orientation

Evaluation of daylight distribution across different floors

The results helped in optimizing the design to reduce dependence on artificial lighting and improve occupant comfort.

3.7 Comparative Analysis

A comparative study was carried out between:

Existing conventional building and Proposed green building model.The comparison was based on:

Energy consumption

Material usage

Cost estimation

Carbon emissions

This analysis helped in understanding the effectiveness of green building strategies.

3.8 Quantity Takeoff and Cost Estimation

Using BIM capabilities in Autodesk Revit:

Quantities of materials were extracted automatically

Cost estimation was performed based on material quantities

Comparison of costs between conventional and green building was done

This ensured accuracy and reduced estimation errors.

3.9 Physical Model Development

In addition to the digital model, a physical model of the building was created. The purpose of the physical model was:

To visualize the design in a tangible form

To demonstrate green features clearly

To improve presentation and understanding of the project.

3.10 Validation and Final Output

The final model and analysis results were reviewed and validated. The outputs generated from the study included:

3D BIM model

Cost and material comparison

Energy analysis reports

Daylight analysis results

Physical model representation.

Materials used for existing building and green building

Existing Building Materials

1. Clay Bricks
2. OPC Cement
3. Normal Paint
4. Natural Aggregate
5. Aluminum Silding Window
6. Wood doors

Green Building Materials

1. Fly Ash Bricks
2. PPC Cement
3. Low Voc Paint
4. Recycled Aggregate
5. Green Tinted Glass Sliding window
6. Green Tinted Toughened glass sliding door.

PROBLEM STATEMENT

This project amis to develop a 3D Model of a multistorey (G+5) green & existing building using Autodesk Revit to analyze and compare material cost, sustainability aspects of both approaches.

OBJECTIVES

- Identify eco-friendly, low-cost materials for new green buildings to reduce the material cost.
- To compare the cost and sustainability performance of a existing and same green multistorey (G+5)building using eco-friendly materials.

MATERIAL PROPERTIES

1.Fly Ash Bricks

It utilizes the industrial waste

It has good strength and reduces the dead load of structure.

It has low water absorption and reduces dampness.

It has better thermal insulation than clay bricks.

2.PPC Cement

Better durability and resistance to chemicals.

Reduced heat generation and prevents cracks.

It is Eco-friendly due to use of pozzolanic materials.

3.Low VOC Paint

It improves the indoor air quality.

It is non-toxic and safer for occupants.

It reduces the environmental pollution.

4.Recycled Aggregate

It reduces the construction waste.

Conserves the natural resources.

It is cost effective and sustainable.

5.Green Tinted Glass Sliding Window

It allows natural daylight and outside night light.

Reduces glare from strong sunlight.

It saves electricity because it reduces heat entering the room.

6.Green Tinted Toughened Glass sliding door

It has high durability and safety.

It reduces solar heat gain.

Suitable for large openings like doors.

3. RESULTS

<Window Schedule>

A	B	C	D
Family	Type	Count	Cost
M_Fixed	V	20	48000.00
Window-Awning-Single	W1 (green tinted glass)	7	91000.00
Window-Casement-Double	W (green tinted glass)	40	400000.00
Grand total: 67		67	539000.00

{3D} Door Schedule Window Schedule

<Window Schedule>

A	B	C	D
Family	Type	Count	Cost
M_Fixed	V	20	48000.00
Window-Awning-Single	W1	7	175000.00
Window-Casement-Double	W	60	1500000.00
Grand total: 87		87	1723000.00

Fig.1.cost comparision of window between green and existing building.

4. CONCLUSION

This study successfully demonstrates the application of BIM technology in transforming a conventional G+5 residential building into a sustainable green building. The use of Autodesk

Revit enabled the creation of a detailed 3D model, while Autodesk Insight facilitated energy and environmental analysis.

The results confirm that the adoption of green building strategies significantly reduces energy consumption, carbon emissions, and lifecycle costs. Although the initial investment is slightly higher, the long-term benefits make green buildings a practical and sustainable solution for modern construction.

The integration of BIM tools improves design accuracy, coordination, and decision-making, making it an essential approach for future construction projects.

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