

Integration of BIM

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Article Information

ABSTRACT

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The BIM process makes use of advanced 3D computer models to coordinate the construction site survey, design, engineering, and construction of a building project. The BIM method enables better coordination and communication amongst all involved disciplines as well as improved monitoring and control of the building process. Using the data from the site survey, an intelligent 3D computer model of the future construction site is created. Engineers, architects, and project managers can utilise this computer model to plan and design the structure. During the design phase, the BIM process creates a virtual model of the intended building. This virtual representation may be used to assess a range of design components, such as structural soundness, fire safety, and energy efficiency. Another BIM tool that assists in identifying and resolving possible conflicts across several disciplines during the design phase is clash detection. Once the design is finished, the BIM process develops a schedule and keeps track of progress throughout the building phase. The BIM approach may also be used to create as-built drawings, which are used to document the completed work.

KEYWORDS: BIM, 3D Computer Model, Monitor & Control, Design phase, Clash detection

1. INTRODUCTION

BIM is a technique for creating and managing digital representations of a place's structural and functional aspects. To facilitate decision-making on a building or other built asset, building information models (BIMs) are files that may be extracted, transferred, or networked. These files typically, but not always, include proprietary data and are in exclusive file formats. BIM software is being used by people, businesses, and governmental bodies that organise, design, create, construct, operate, and manage a range of physical infrastructures.

1.1. What is BIM?

Building information modeling (BIM) is the digital depiction of a building's structural and functional details. When used as a solid basis for decisions throughout a facility's life cycle, which is defined as existing from the time of initial conceptualization through demolition, a BIM is a shared knowledge resource.

1.2. What is BIM?

- Enhance collaboration
- Reduce time and effort spent

- Maintain control over your work
- Prevent conflicts from arising
- Access it from any location; simulate and visualise
- Order your steps and capture the most precise images of the place.

1.3. Research Question

How does BIM help with construction industry?

1.4. Aim

The purpose of this topic is to research and advocate for BIM in order to improve project performance and yield superior results.

1.5. Objectives

- To effectively utilise the building project's data throughout construction.
- To provide better quality assurance and data exchange to the process in order to create designs that are more effective and efficient.
- Can be used to decide how to schedule a project's phases or to sequence planning.

- Explore the application of BIM and the reasons that each step of the building life cycle benefits from it.

1.6. Limitations

Refer to above objective of research, scope of this study focuses on how BIM can be used as innovative project management tool in every stage of building life cycle.

1.7. Need of the topic

- BIM is currently the top player in the construction industry. Despite the fact that the technology has only been around for around few years, BIM has recently generated a lot of excitement in the industry.
- The process of creating and preserving physical and functional information for a project is referred to as BIM.
- In spite of widespread perceptions to the contrary, BIM is more sophisticated than 3D modelling. More than only 3D (width, height, and depth), BIM and the subsets of BIM systems and related technologies may also contain additional dimensions like 4D (time), 5D (cost), and even 6D.

1.8. Methodology



2. LITERATURE REVIEW

2.1. Investigating the use of building information modeling in India and the need for more implementation

Findings:

- Cost estimation precision is within 3%.
- A time savings of up to 80% throughout the cost estimation procedure.
- By using collision detections, up to 10% of the contract's value might be preserved..
- A 7% maximum decrease in the project's duration.

2.2. Applicability of BIM in Indian Built Environment Sector

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Findings:

- Services can readily have their quantities and communal assets taken from them.
- The scope of the work may be clear.
- BIM may close the information gap that results from managing a project from the design team through the execution team and to the building's client by enabling each team to add all the information they obtain during their time of input to the BIM model.
- The scope of building information modelling includes all stages, from conception to possession.

2.3. Building information modelling (BIM) in India: its use

Finding:

- In India, the BIM is a novel and promising strategy that is progressively winning over owners, architects, engineers, and builders.
- The implementation of the model to assist the scheduling, planning, and monitoring of project site activities in India was the study's clear main point.
- The poll looks at how BIM may be used in the field to improve information sharing and integration amongst trades in the construction industry, leading to faster decision-making and more effective work processes.

2.4. BIM applications' operational viability in Indian building projects

Finding:

- A lot of issues in the construction business can be solved easily by employing the 4D and 5D BIM techniques.
- 4D BIM has a significant impact on construction projects compared to conventional methods.
- By identifying the flaws with the job at an earlier stage, it eliminates rework and conflicts that occur at construction sites, assisting Indian construction businesses in removing budget-related problems and increasing the economical element.
- BIM offers efficient and effective developing methods, which are intensely needed by every industry to improve the performance of project progress by lowering cost and budget issues, time issues, information issues, and challenges related to delayed project work.

3. CASE STUDY

3.1. Case Study 1:

1. BIM in Architectural Design

- BIM software was used in the design of the Three Gorges Project pharmaceutical amino acid manufacturing base building. The

parametric design actually makes use of the BIM technology that was previously discussed.

- Three-dimensional Revit visualisation was utilised to view the predetermined plant building plans. An industrial base owned by Gorges Pharmaceutical that seems primarily architectural.
- You can see how the view of the entire structure is shifting in each direction.
- A timeline was made using the project's building model and the final building from the BIM design.
- The data is taken from the project element properties and displayed in the list, which is a tabular representation of the drawing information.

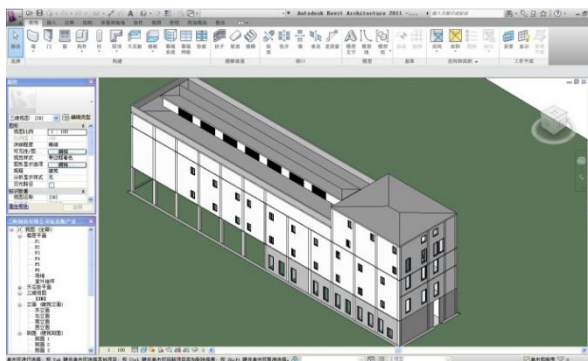


Fig.1. Views of the entire building's BIM model



Fig.2. BIM building view different perspectives

2. Applications of BIM in Structural Design

- To produce a three-dimensional structural model that takes into account the placement, arrangement, and other details of the drawing's beams and columns, the BIM structure model for this project uses the Revit programme.
- First, it is accomplished using the beam placement grids.
- After that, the pair of beams is positioned to specify both the elevation beam's endpoint and its starting point.
- Under the column layout, it is used here to conduct independent foundation.
- The analytical model was finally updated and amended based on the structural model.
- It was added to the load data, the boundary conditions, and the analytical software robot.

It was then included to the calculation and study of the structure's mechanical behaviour.

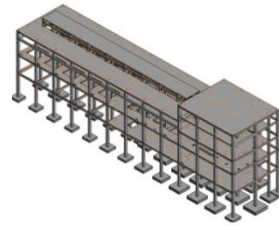


Fig.3. BIM structural model



Fig.4. Physical model structure

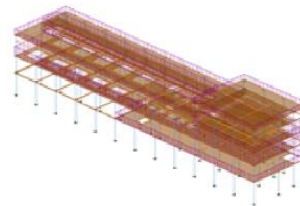


Fig.5. Modified structural model

3. Structure of the second plant's mechanical behavior analysis

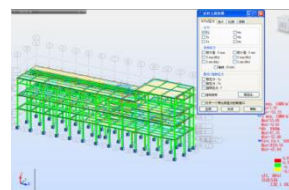


Fig.6.



Fig.7.



Fig. 8.



Fig. 9.



Fig. 10.

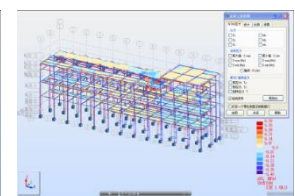


Fig. 11.

Fig.6. Structure housing the distribution power source's X force direction, Fig.7. Structural powerhouse for distribution The force's direction is Y, Fig.8. Force direction Z for the distribution powerhouse structure, Fig.9. Building law for stress maximum distribution plants, Fig.10. Emphasize building law for distribution plants of minimal value, Fig.11. Plant for distributing torsion stress

4. Results from case studies used in the plant's virtual construction

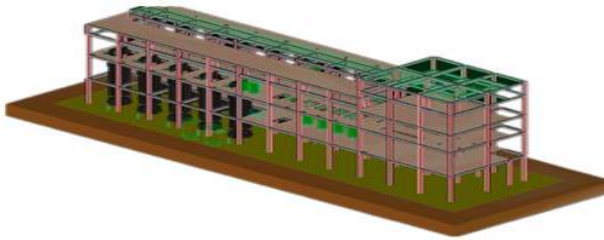


Fig.12. Infrastructure construction plant

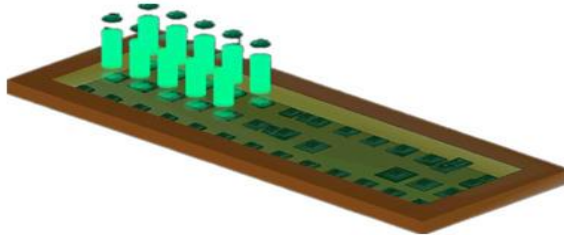


Fig.13. Amino acid fermentation tank construction

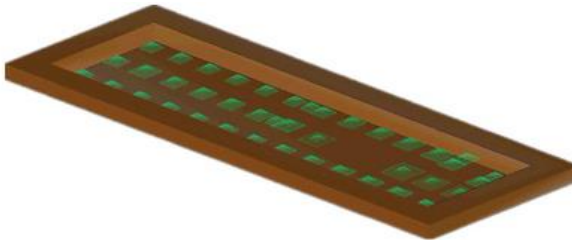


Fig.14. Fifth-floor slab plant construction

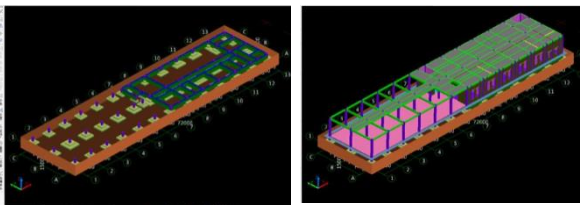


Fig.15. Cost model basis

Fig.16. Foundation -one cost model

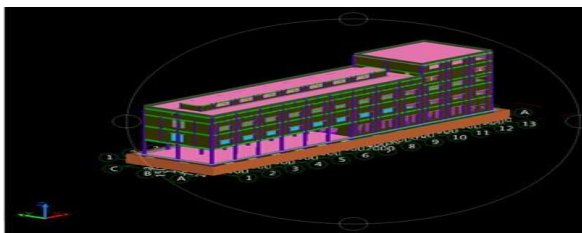


Fig.17. Basics – five cost model

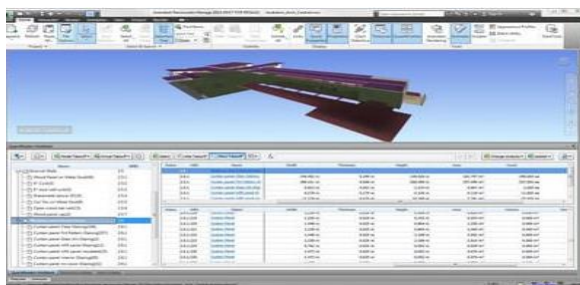


Fig.18. Cost Estimation

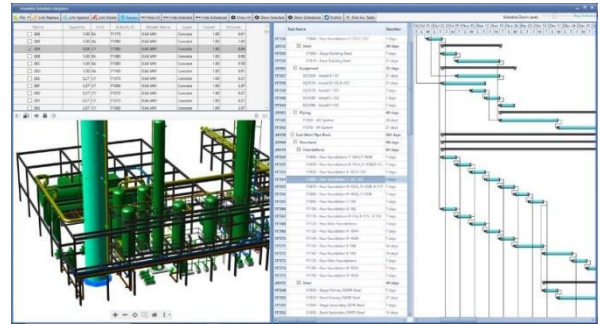


Fig.19. Scheduling

3.2. Case Study 2:

1. Introduction

- The 5D BIM employs a comprehensive design to deliver a graphic design evaluation with dynamic links to the model material and a base living cost plan that can be used for producing design and bidding activities.
- 3D CAD models are fairly popular in the BIM. However, 4D and 5D models are increasingly gaining popularity due to their unique futures.
- This study looked at Mid-Terrace house designs. The proposed homes were first turned into 3D CAD models with ArchiCAD, which were subsequently made public.

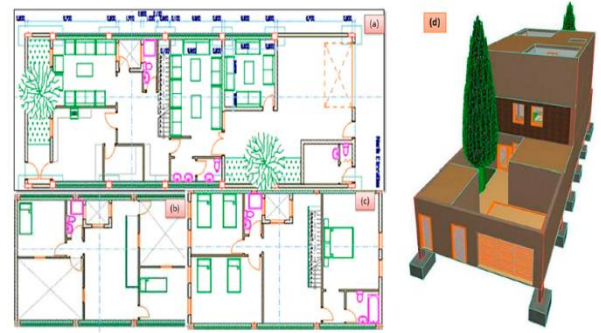


Fig.20. Floor plan and 3D view of the house.



Fig.21. Perspective view of mid-terrace houses

Fig.24. Schedule Planner-Flow line

Code	Description	Unit	Qty	Cost
01.00	SED HOUSE	1.00	1.0000	1.0000
01.01	SED HOUSE	1.00	1.0000	1.0000
01.01.01	Substructure	1.00	1.0000	1.0000
01.01.01.01	Concrete column	1.00	1.0000	1.0000
01.01.01.01.01	Concrete column	1.00	1.0000	1.0000
01.01.01.01.01.01	Concrete column	1.00	1.0000	1.0000
01.01.01.01.01.01.01	Concrete column	1.00	1.0000	1.0000

Fig.22. Bill of quantities (BOQ)

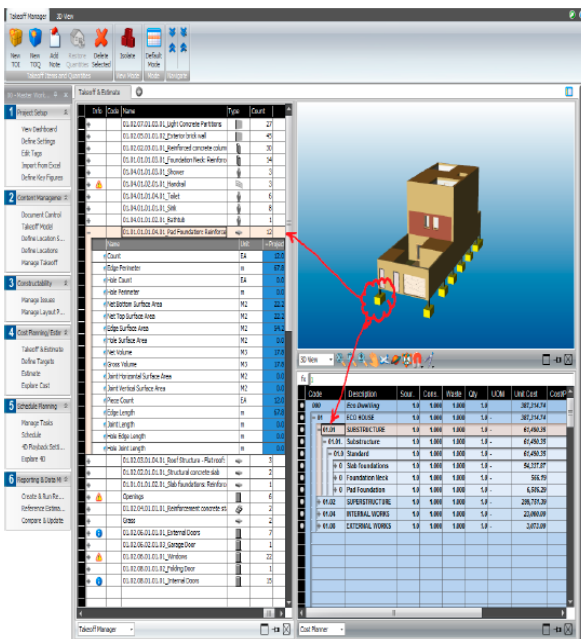


Fig.23. The 3D Model incorporates takeoff and cost estimation.

2. Time management and schedule

- The workplace group activity is better depicted by the flow-line timetable.
- The timetable is represented by the X-axis, while the locations of the operations at the job site are represented by the Y-axis.
- Each activity group is represented by a coloured line, and the slope of the line shows how productive each group is.

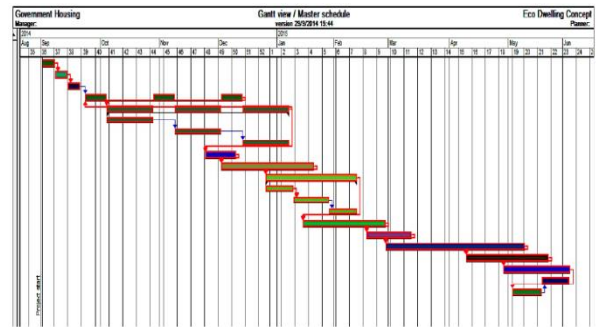
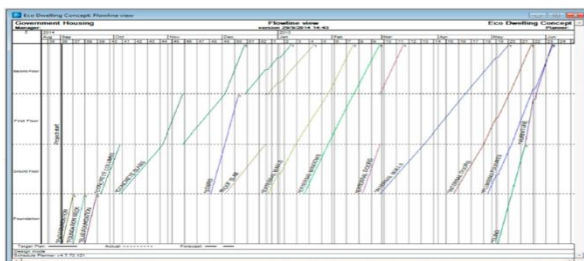


Fig.25. Project schedule Gantt chart

3. Clash Detection

- Data integrity and clash detection are essential features for project quality and quantity.
- With automatic clash analysis technologies and 3D BIM Models, any disagreement may be quickly identified and resolved.
- These technologies may be used to expedite on-site operations, enhance building quality, and monitor the bill of quantities' correctness.
- Utilising 3D modelling and automated conflict analysis technologies helps to cut down on material waste, time delays, and modifications that might occur both before and during the building phase.

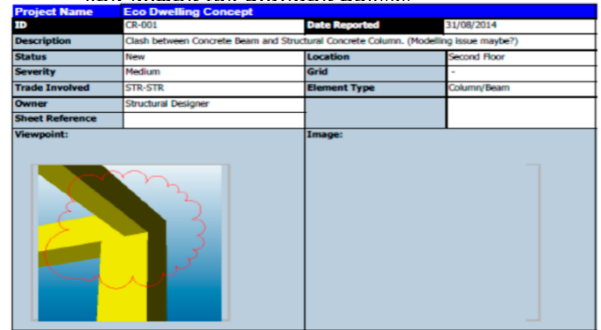


Fig.26. A picture showing how a column and a beam will collide

3.3. Case Study 3:

1. Introduction

- Rajarambapu Institute of Technology, Rajaramnagar, Islampur is the name of the proposed Ladies Hostel construction project.
- The research looks at how BIM is used in a construction facility for visualisation, 3D coordination, prefabrication, construction planning, and record models.

2. Use of BIM Tools

- The utilisation of a 3 Dimensional model, a 4 Dimensional model for time integrators, and a

5 Dimensional model for cost estimates was the main goal of this project.

- This section displays the results of applying BIM technologies. To do this, a workable building information model prototype must be created, after which the model must be made interoperable, integrated with the schedule, and scheduled using BIM.

3. 3D Modeling of a Hostel Building

- The creation of a 3D building model using Revit Architecture 2014 served as evidence of BIM's powerful attributes. When an element was created for a view like a floor plan, it translated appropriately for a view like an elevation view.
- Compared to drawing the design in a standard 2D perspective, this saved a tonne of time. The parametric modelling also picked up on elemental conflicts. Utilising this feature prevented items from being duplicated or overlapped.

4. 4D Modeling of a Hostel Building

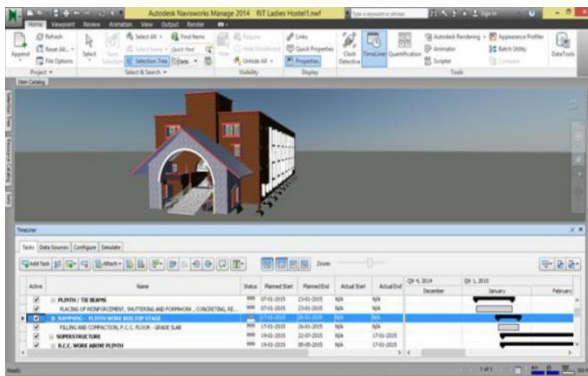


Fig.28. 4D model of RIT Proposed Hostel

- A 3D model has to be created as well as a timeline for 4D modelling. Revit Architecture was used to generate the 3D model.
- A simple schedule with 170 activities from MS Project was successfully imported into Navisworks Manage. The components of the model that are listed under resources have been successfully linked to the intended activities.
- A 4 Dimensional model was then seen when the connecting was finished. Dragging the timeline will improve the project's visualisation at any given point on the Gantt chart.

- This aids in preparing for sequencing with a better understanding. The critical route approach was utilised by Microsoft Project to build the timetable.

5. Estimating a hostel building using a 5 Dimensional BIM model

- For the effective estimate of architectural, structural, and service components, BIM generates precise quantities.
- These quantities can be collected at many stages, including the idea stage for developing budgets, the end of the design development stage for floating tenders, and the Good for Construction (GFC) stage for verifying contractor invoices.

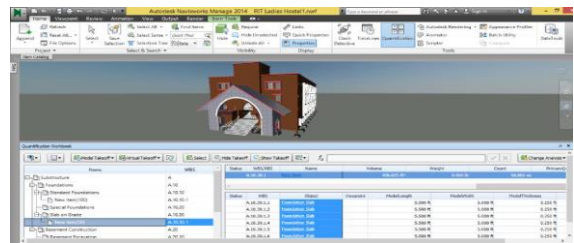


Fig.29. 5D model of RIT Proposed Hostel

5. FINDINGS

- BIM allows you to design and visualise the entire project before the first shovel is even pushed into the ground.
- Clients can make changes before construction has even begun by using space-use simulations and 3D visuals to see the space as it will be used.
- BIM reduces the need for rework by allowing estimators to focus on more valuable tasks like identifying building assemblies and taking care of risks by automating the time-consuming process of measuring and applying charges.
- You can avoid last-minute changes and unforeseen issues by making it straightforward for people from various disciplines to review and comment.
- Real-time communication and a single document repository, like BIM 360 Docs, lessen the danger of any organisation utilising out-of-date information given the growing number of team members using project data.
- It's essential to make sure that the right information is available when you need it in order to successfully finish a high-quality project. Clash detection and workaround prevention.
- BIM contributes to lowering physical risks and raising construction safety by recognising dangers before they become problems and anticipating site logistics.

Safety evaluations and visual risk analysis can help to ensure safety throughout project execution.

- Conflicts may be prevented, reducing the amount of rework needed for any given assignment. Before the actual construction on the site begins, you have the opportunity to plan it with BIM.

6. PROPOSALS

- Beginning with the sketch stage, BIM integration should be included.
- All stakeholders—equipment providers, subcontractors, various design units, buying departments, elementary project managers, etc.—must support the BIM process.
- The highest echelons should support the implementation in order to ensure that everyone will take part.

7. CONCLUSIONS

- An effort has been made in this work to comprehend and examine building information modelling. It has been noted that strong theoretical frameworks are offered for putting the building information modelling model into practise, and the overall scenario is favourable.
- Project managers may see issues before they become serious and endanger the security of construction workers with the use of a 3D virtual model.
- It should be employed since 3D models may be saved in the cloud and viewed on the job site from any digital device.
- Building information modelling should be utilised to prevent on-site mistakes and clash detection, according to the case study's findings.
- Less rework, cheaper construction costs, and a quicker return on investment are all benefits of BIM adoption.
- BIM helps with enhanced profitability, lower costs, quicker project completion, and better customer satisfaction.

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