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SMART CONSTRUCTION MANAGEMENT THROUGH INTEGRATION WITH NEW MODELLING TECHNIQUES

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ABSTRACT: - The construction Sector has advances in the integration of architectural information modeling (BIM) to improve the efficiency of projects. BIM technology provides accurate data and victory over the possibilities of 3D modeling and 3D displays. BIM integration into augmented reality (AR) provides greater transparency in design, cost and progress visualization, reducing field time lapse and obstacles. Integration of BIM and big data is increasingly used in intelligent construction projects that improve project management and budgeting. It focuses primarily on project phases and theoretical integration. This article explores the research history and methods of BIM to identify three research topics: smart structure, smart operations and bridge information. BIM technology is integrated into construction management during the construction phase, improving efficiency and visualization. This integration of BIM technology and intelligent construction sites combined with Cloud Platform - Information Technology creates a comprehensive digital systems platform for efficient and intelligent construction management. It can be used to create 3D models of transportation Centre centers to optimize space usage and security. Its helps create improve the design, structure.

Keywords: BIM 3D, BIM Technology, BIM Implementation, 3D Modeling, BIM.

INTRODUCTION:

- The construction Sector, a productive industry around the world, has experienced a decline in productivity compared to its development. However, countries such as China and South Africa are rapidly increasing their building productivity, while Brazil and Saudi Arabia are retreating. To increase businesses building information modeling (BIM) and digital tools, which function as follows: Construction performance and development monitoring is extremely important for timely and inexpensive project distribution.
- The introduction of information and communications technology (ICT) has had a major impact on the productivity and economic growth of the construction industry, but the use of ICT to automate processes is relatively low compared to other industries. Problems such as project delays cross -costs and safety risks contribute to sustainable development and optimization of resources in the industry.
- However, managing construction operations can be a challenge due to uncontrolled and irregular changes. The main goal is to regulate progress, effectively ensure agreement and counsel compatibility, mitigate risk and ensure stakeholder interaction.
- BIM technology ensures stable and coordinated structural processes using collaborative workflows, data interior opera, component-based modeling, parametric design, consumer awareness, IoT, sensor integration, and cloud-based collaboration.

- **What is Building Information Modeling (BIM) in Civil Engineering?**

BIM Building Modeling (BIM) is a digital representation of the physical and functional properties of a building or infrastructure. This is a general knowledge resource for information about facilities that provide a reliable foundation for decisions during the lifecycle from start to demolition. The software improves the overall outcome by examining several

scenarios, providing data-controlled security, and ensuring that the project can be achieved at a good time within budgets and persuasive results. Additionally, engineers, contractors and other stakeholders can work together in a virtual environment, identify competitions and support in-depth analysis and simulation.

- **Where did BIM Originate?**

There are two ways to think about the origins of BIM. BIM is one of the rare practices in which technology actually precedes a conceptual framework. In 1957, Dr. Patrick J. HANRATTI used IBM to create a CAD program (first computer design). The first digital model was born because there was no BIM without CAD. Just six years later, Ivan Sutherland ran Sketch Pad, one of the first design systems to use a graphical interface.

- **What is History of BIM?**

The modelling information (BIM) for the building (BIM) has changed the construction, engineering, and construction industries (AEC) since its founding in the 1970s. Early software such as the Chuck Eastman building description system made shifts easier, but technical limitations overridden widespread acceptance. Advances in computing power have led to the development of complex CAD software with database capabilities and integration of concepts. The term "building model" was created in 1992, and in the 2000s the acronym "BIM" was shaped, shaping the affordability of the powerful computers that drove BIM into the mainstream.

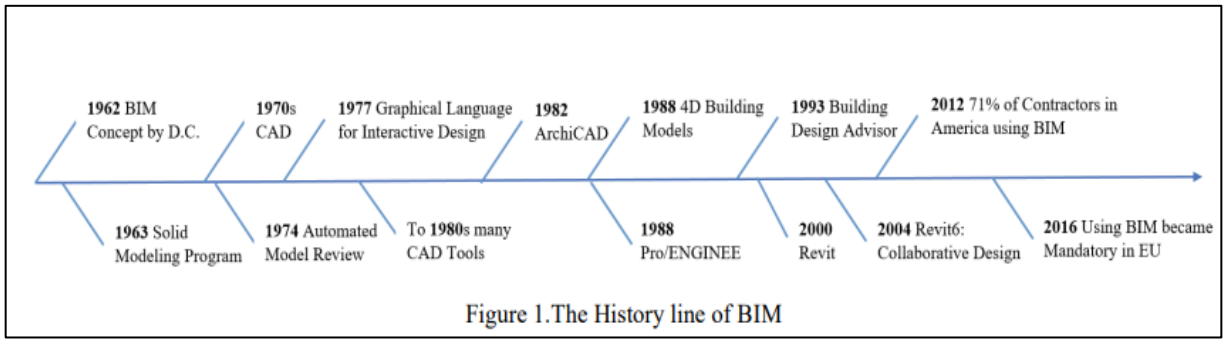


Figure 1.The History line of BIM

PROBLEM STATEMENT

- What are the barriers to construction Industry in India before BIM?

Some of the key issues that contribute to the problem include:

1. Cost Overrun: The poor estimates, approximation or dependence on the speed of inaccurate regional construction are the main reasons for revealing costs. This can be changed in employees and materials costs. This affects the budget costs of the project and can be used to set up parties for many financial difficulties.
2. Delays: Projects often face delays in factors that are out of control and management issues. The delay is based due to improper project's planning, planning and budget plans, which increases costs and potential financial losses as a major issue in the private construction industry. Additionally, it can lead to a lack of deadlines that affect customer satisfaction and the general reputation of the construction company.
3. Slow Adaptation to Emerging Technologies: Perhaps one of the main issues in the construction industry is reluctant to introduce new methods, such as technologies that could make work more efficient. Nevertheless, construction companies use the old ways that don't create efficient work and productivity levels. Resistance to change not only hinders innovation; it also puts these companies at a competitive disadvantage in increasingly faster markets.
4. Poor planning, forecasting, and budgeting**:** If the project is not planned properly, if you provide a plan for the work process and have a budget for a specific stage, the overall efficiency and effect of the company will be affected. The project may then be at risk due to delays, increased spending, and reduced Team moral.
5. End to End Solution**:** One of the daily problems of architecture is inappropriate connections. Because the project requires many professionals and many contractors in the workplace during the planning stage. There is often a separation between the office and local workers. Communication gaps are associated with a high percentage of construction problems.

AIM

1. Improve coordination: For Samruddhi Heights, BIM helps improve cooperation and interaction between contractors, project stakeholders and other team members.
2. Reduce waste: With a more accurate plan from the Tree Manager, BIM helps prevent surprises throughout the Samruddhi Heights development process.
3. Improve quality: By ensuring that the construction meets the design specifications of the G+7 residential building, BIM can improve the quality of the final product.
4. Reduce design errors: BIM helps reduce design errors by checking and modifying the 3D virtual model of your project before working on a G+7 residential building.
5. Monitor construction in real time: BIM allows for real-time monitoring of construction work on site.
6. Visualize the state of construction: The visualisation of Samruddhi

Heights construction progress made feasible via BIM may be useful in quality control and obstruction detection.

OBJECTIVES

1) Productivity: This can automate many tasks and improve performance and efficiency. In addition, engineers can use the design components and data of the previous project.
2) Cost management: This software can be used to control the total cost of G+7 Residential Building.
3) Building performance analysis: It's allows users to analyze building performance earlier in the design process, when design changes can be easier and less expensive.
4) Accuracy: It can increase the accuracy of construction documentation. Its helps identify design and construction issues early, minimizing delays and enhancing efficiency.

SCOPE OF WORK

1. Provides accurate data-driven approach at all project phases.
2. Engineers use BIM for detailed 3D models and functional checks.
3. Detects problems and ensures structural and electrical system alignment.
4. Facilitates accurate estimate takeoffs, safety planning, and precision scheduling during construction.
5. Controls expenditures and ensures project completion on time.
6. Private firms integrate and promote BIM despite government support.

Literature Review

BACKGROUND

A BIM-based information system is extremely important for managing drawings during the document stage of a building and improving project quality and efficiency through dynamic 3D models. It improves building modeling and energy consumption, allowing for several design options. 72% of the company uses Revit and 50% AutoCAD to model the building. 40%of industry experts believe that BIM is very important in the design and documentation stage. BIM also helps contractors reduce waste and save costs by improving plans and enabling new forms of light materials and construction methods. BIM also helps contractors to reduce waste and costs, improve their plans, and allow the following new lighting materials and construction methods. According to the report, BIM has successfully introduced 80% (16-50) of average practical and 78% (51) of large-scale practices. Both the Government and the private sector are very interesting BIM.

The Rail Metro Nagpur project is the best example of how 5D BIM technology was used in the public sector to successfully complete the project. In India, BIM is widespread in both state and private sectors. The Nagpur Metro Rail project is a great example of how 5D BIM technology is used in the public sector and how to complete the project.

Mohsen Kameli, et al.2021 BIM/RFID-based computer system. The RFID system enhances productivity by recording, distributing, and sharing information on staff queries, enhancing efficiency and maintaining processes, despite challenges like confidentiality and complexity.

Sun, Hailing, Miao Fan, And Ashutosh Sharma.2021 Building information modeling and three-dimensional simulation technology in industry. In a short amount of time, the system achieved excellent performance, achieving efficiency values of 20% and 40%, significantly improving the engineering cost ratio and construction prediction in industries.

De Gaetani, Carlo Iapige, Mertkan Mert, 2020 Understanding BIM factors the paper argues that interoperability issues prevail As the key practical barrier to BIM implementation.

Kristyna Pruskova , JiriKaiser 2019 Implementation of BIM Technology in to the Design Process Using the Scheme of BIM Execution Plan For proper usage of BIM Technology, many key Issues still need to be solved, like, technical standards, content of BIM documentation, which may halt the process.

Sepehr Alizadeh Salehi, İbrahim Yitmen 2018 Analysis of the impact of BIM The project's progress has been significantly improved through automated monitoring, resulting in a high-quality outcome that surpasses traditional methods of manual data collection.

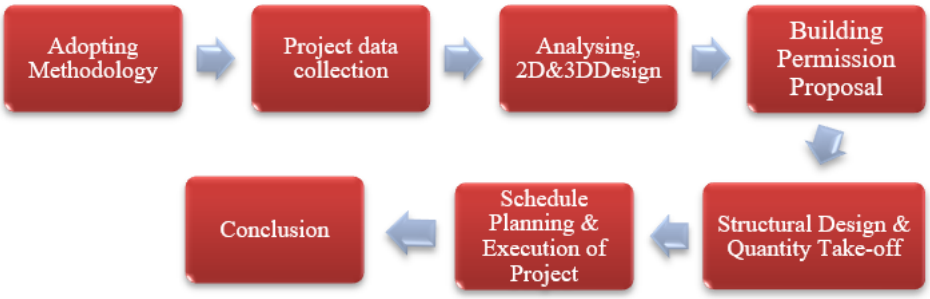
Jin, Ruoyu, et al 2017 A Questionnaire-based survey based on BIM implementation The survey revealed that BIM investment prioritizes internal and external collaborations, enhancing interoperability among BIM software tools, and enhancing multiparty communication for the highest recognized return.

Eissa Alreshidi, Monjur Mourshed, Yacine Rezgui 2016 BIM solution in construction projects BIM, a collaborative approach to design and construction, has the potential to significantly enhance the current level of ICT and collaboration practices in the industry.

Research Methodology

- This methods and powerful tools are important for effective analysis of competition by integrating all areas into a 3D/BIM integrated model. This improved visualization greatly improves stakeholder collaboration and improves the design process.
- Our initial study showed the actual benefits of BIM to resolve conflicts between construction services such as water supply and drainage systems and structural structures. 3D/BIM model for integration of all these components and effective identification of conflicts between fields. BIM includes strategic definitions of roles, scalable approach plans, and decisions for employees with corporate goals.

- Success requires careful corporate analysis, redefine BIM destinations, assess assumptions of assumptions, identify implementation gaps, and define solid planning and monitoring strategies. This comprehensive methodology ensures a smooth transition and positions businesses for long-term success in construction.



Summarize Information of Software's used for G+7 Residential Building

❖ **For 2D Drawing AUTOCAD (Computer Aid Design)**

- Enhances productivity and design process.
- Features line drawings, dimensions, layers and object wrappers.
- It makes design communication and understanding easier.
- Adopted by BIS for global understanding.
- Crucial in manufacturing, civil engineering, and architecture.
- Improves efficiency and precision through CAD.
- The Master Sign feature is extremely important for innovation and cooperation.

❖ **For 3D Modeling Autodesk Revit Architecture**

Autodesk Revit Architecture: BIM Software

- Enhances architectural practice.
- Enables intelligent 3D models creation.
- Improves collaboration.
- Produces detailed design documentation.
- Integrates parametric 3D modelling with 2D drafting.
- Enhances project efficiency.

❖ **For Structural Design Autodesk Revit Structure**

- Allows users to create intelligent 3D models.
- Featuring parametric modelling, analytical tools, enhanced details and collaboration features.
- Supports design and documentation through project planning, drawing and schedule.
- Provides instant access to design, range, quantity and phases.
- Ensures uniformity across all project representations.
- Automatic updates and synchronization via Revit parametric change engine.
- Acts as a central database for design.
- Streamlines workflow and enhances design experience.

❖ **For Quantification Autodesk Naviswork**

- Complements Autodesk Revit, AutoCAD, and Micro Station.
- Enables real-time 3D model navigation.
- Includes plugins for publications like interference recognition, 4D time simulation, photorealistic rendering, and efficient PDF.
- Quantification feature aids in material estimation, area measurement, and building component count.
- Provides tools for comments, shelves and measurements.
- This reduces the calculation and measurement time and provides more time to analyse the project.

❖ **For Planning and Scheduling MSP (Microsoft) Project**

- Streamlines planning, scheduling, and tracking.
- Enhances collaboration and efficient project execution.
- Detailed time frames, resource distribution, budget management and progress monitoring are allowed.
- Streamlines budgeting by accurately calculating costs.
- Enhances collaboration through a centralized resource pool and dedicated calendars.
- Enables flexible resource allocation through several tasks or projects.

- To achieve specific goals Planning, organization, motivation and resource controls is necessary.

❖ **Project Detail:-**
Project Name: - G+7 Residential Building
Project Location: - Navali Palghar (E)
Building Total Built-up Area: - 4161.22 Sq.mt
Software used for Project: - BIM 5D

❖ **Technical Person Detail:-**
Architect: - Kiran Kashinath Shivde (Creative Associates)
Technical Person (Engineer):- Siddharth Nilesh Dandekar (Samruddhi Infrastructure)
Structural Engineer: - Yogesh Damijbhai Vaja (Darsh Consultant)
Quantity Surveyor & Planning Engineer: - Siddharth Nilesh Dandekar (Samruddhi Construction)

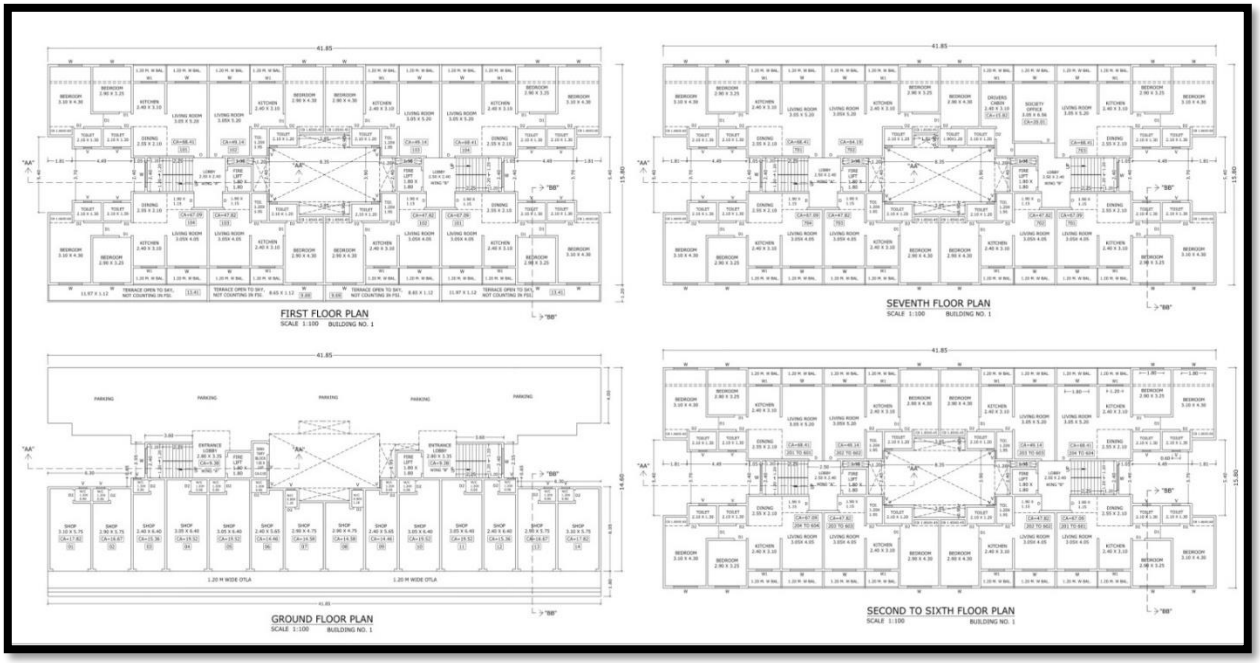


Fig no.2:- Floor Plan of G+7 Residential Building

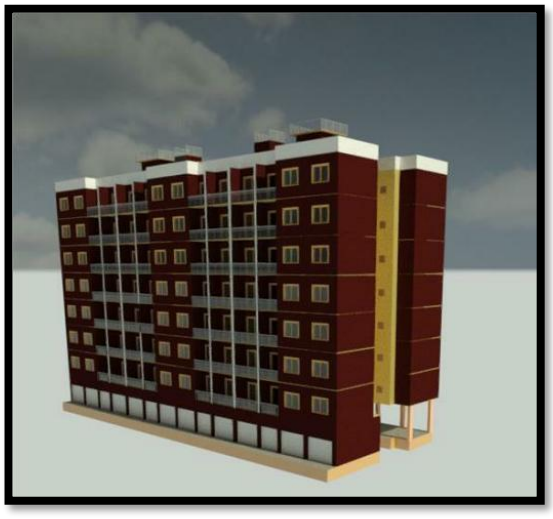


Fig no.3:- 3D view of G+7 Residential Building

Stepwise Cost Sheet For Residentional Buliding Slit+7		
Sr No	**Description Of Item**	**Amount**
1	FOUNDATION	₹ 41,84,014.35
2	PLINTH	₹ 19,90,561.50
3	FIRST SLAB	₹ 12,10,989.72
4	SECOND SLAB	₹ 18,50,873.66
5	THIRD SLAB	₹ 19,90,000.71
6	FOURTH SLAB	₹ 19,90,000.71
7	FIFTH SLAB	₹ 19,90,000.71
8	SIXTH SLAB	₹ 19,90,000.71
9	SEVENTH SLAB	₹ 19,90,000.71
10	LIFT AND OHT	₹ 10,00,000.00
11	BRICKWORK & PLASTERWORK	₹ 1,05,62,466.00
12	LABOUR COST (1 TO 11)	₹ 2,24,00,000.00
13	Interior work	₹ 1,10,00,000.00
14	10% Profit of contractor	₹ 65,14,891.70
	TOTAL	₹ 7,06,63,800.48
	Rate Per Sq.ft	₹ 1,578.00

Table no.1:- Stepwise Cost sheet for G+7 Residential Building

Practical Benefits of Tools of Building Information Modeling (BIM)

Cost Comparsion (Industrial Buliding G+2)					
Sr.No.	Description of item	Traditional Method		Building Information Modeling	
		STEEL (Kg)	CONCRETE (m^3)	STEEL (Kg)	CONCRETE (m^3)
1	FFL Beam	16931	65.51	16930	65.5
2	FFL SLAB	10563	95.39	5044	90.86
Total		27494	160.9	21974	156.36
Cost		₹ 18,86,323.86	₹ 11,20,185.80	₹ 15,04,811.37	₹ 10,88,578.32
Total Cost		₹ 30,00,000.00		₹ 25,00,000.00	
Cost Variance		₹ 5,00,000.00			
Material Saved (steel)		5,520 Kg (5.52 Ton)			
Material Saved (Concrete)		4.54 m^3			

Table no.2:- Cost Comparison for Industrial Building G+1

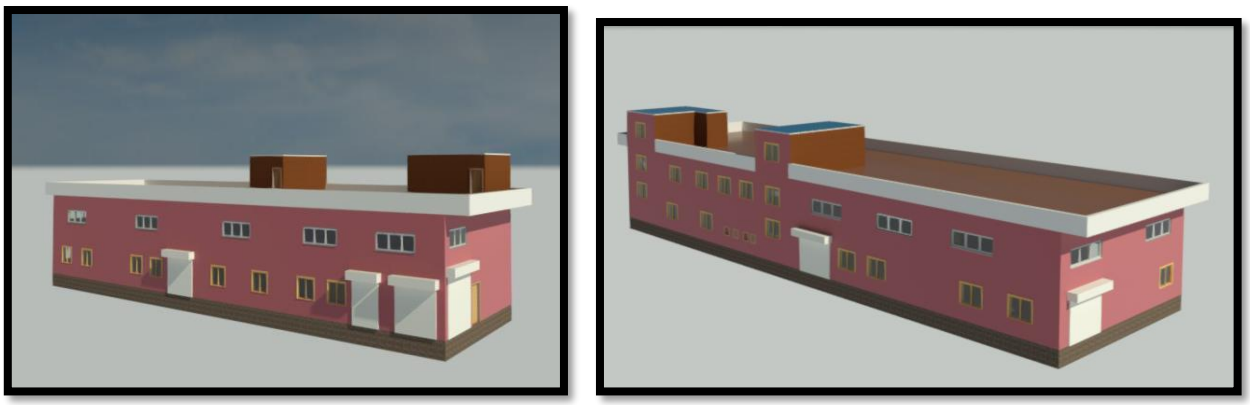
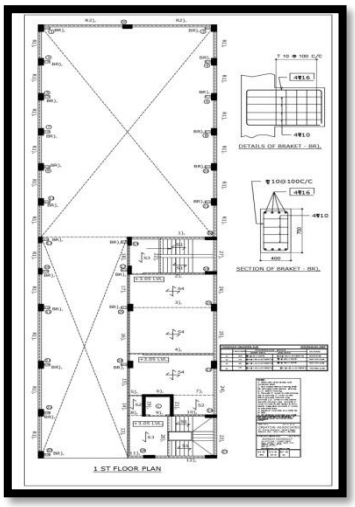
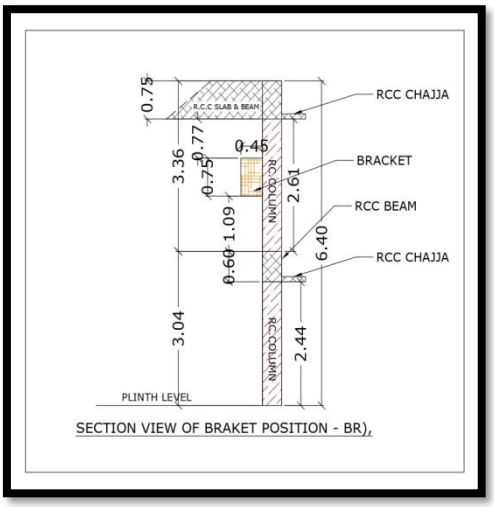


Fig no.4:- 3D view of Industrial Building G+1

Actual End to End Solution by Building Information Modeling (BIM)



Bracket plan & Section Drawing share by RCC Consultant to Project



After Studying Project engineer simplify drawing by drafting Section view of Bracket Position for better understanding and share to Contractor

Output: It's reducing miscommunication and procedural gaps between RCC Engineer and Contractor which smoothen

Conclusion

The integration of Architectural Information Modeling (BIM) in smart construction practices is a groundbreaking advancement in the industry. Our research highlights the success and challenges of this integration, and the need to address obstacles to effective implementation. BIM has changed the planning, implementation and management of construction projects, driving innovation and efficiency. This highlights that BIM technology revolutionizes Slabs Design, and that construction practices make construction practices more efficient, sustainable and collaborative. Structure - The engineering sector did not fully embrace BIM. Many engineers contradict traditional design methods that hinder progress. The transition to an innovative and integrated BIM approach is essential to developing its transformational potential in this field. The time to adapt is now. In Studies show that the use of 4D and 5D models greatly increases the accuracy of estimation time and cost. By introducing 5D Building Information Modeling (BIM), the project can streamline both the design and construction stages, resulting in faster final times. Embracing BIM is not

just an intelligent choice; it is a transformational approach that can provide immense value at every stage of the project's lifecycle.

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