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Implementation of BIM for R.C.C. Building: A Study on Quality Management

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ABSTRACT: This research examines at the use of Building Information Modelling (BIM) in Reinforced Concrete Construction (RCC) structures to improve quality management procedures. BIM transforms conventional building approaches by combining design, planning, and construction processes into a single collaborative digital platform. This study assesses the usefulness of BIM in enhancing quality management processes utilising a comprehensive approach that includes an investigation of quality management principles, BIM integration with project management techniques, and the use of software tools such as Revit. The research investigates conflict detection approaches, Microsoft Project scheduling, and Excel estimating work to see how BIM affects project efficiency, accuracy, and cost-effectiveness. Furthermore, case studies like the Pride Purple Square project give real-world insights into the practical use of BIM in R.C.C. construction. The study also contains experimental analytic findings, comparative examinations of BIM and traditional methodologies, and stakeholder comments collected via a Google Form survey. Overall, this research advances our knowledge of how BIM may optimise quality management procedures in R.C.C. building projects, providing significant insights for construction professionals, project managers, and stakeholders looking to enhance project outcomes and efficiency.

KEYWORDS: Building information modeling (BIM), construction manager (CM), construction management body of knowledge

I. INTRODUCTION

"Building Information Modelling" is written as "BIM." In the past, information was transferred between points using software for point-to-point exchange. BIM, an advanced digital platform, revolutionises traditional approaches through the integration of design, planning, and construction within a cohesive and cooperative structure. By constructing an electronic information platform, BIM disrupts the conventional method of information exchange by enabling all participants to exchange data via the platform. The implementation of parallel administration and collaborative operation in a project is made possible by BIM technology, which profoundly alters the mode of operation and management of construction. The utilization of Building Information Modelling (BIM) technology in architectural design offers several advantages over conventional methods. These include enhanced work quality and efficiency, decreased errors and risks, and substantial cost savings. In contrast to numerous established nations, study of BIM technology commenced relatively belatedly in India. The implementation of BIM technology is constrained by the degree and mode of management of projects in construction companies, and it continues to encounter a multitude of practical obstacles. India has consistently supported the advancement of BIM technology through its policies. The utilisation of Building Information Modelling (BIM) has become increasingly significant in contemporary construction practices as a means to enhance quality control processes for Reinforced Concrete Construction (RCC) buildings.

The purpose of quality control in building initiatives is to ensure that well-organized and coordinated attempts are made to achieve the required level of quality. An efficient quality management system is an absolute necessity for a construction company, as it facilitates the enhancement of customer satisfaction and grants the business a competitive edge over other firms operating in the same industry. Securing consumer satisfaction is critical for industries to ensure their long-term viability and competitiveness; therefore, construction activities must be conducted to a mandatory standard of quality. This study assesses the efficacy of Building Information Modelling (BIM) in enhancing quality management within RCC construction projects. By harnessing the functionalities of Building Information Modelling (BIM), project stakeholders have the ability to streamline processes, mitigate risks, and maximise the use of resources

throughout the entire duration of the endeavour.

1.1 Integration of BIM in project management

The process of incorporating Building Information Modelling (BIM) into Critical Path Method (CPM) project management provides many benefits. First off, BIM makes it easier for project stakeholders to collaborate and visualise information more effectively. Stakeholders may visualise the whole construction process, see possible disputes or confrontations, and make well-informed choices to reduce risks by building a complete 3D model of the project. This visual depiction facilitates improved collaboration and communication, which raises project efficiency and lowers mistakes and rework. Better task scheduling and sequencing inside the CPM framework is made possible by BIM, secondly. Project managers may reduce project length and costs by using BIM to model building sequences, analyse resource allocation, and optimize schedules. Managers may better understand job relationships and plan projects with more accuracy and proactivity by combining BIM data with CPM schedules.

Better cost estimates and budget management within the CPM paradigm are also made possible by BIM. Project managers may create precise quantity takeoffs, spot areas for cost savings, and keep track of project expenditures in real time by connecting visualizations of BIM with cost data. Throughout the course of a project, more accurate cost management and budget forecasting are made possible by the combination of BIM and CPM. To sum up, by enhancing scheduling, data management, visualization, and cost control, BIM integration with CPM project management greatly improves project results. Project managers may improve the way they plan, carry out, and oversee building projects by using technology known as BIM.

1.2 Building Information Modeling (BIM)

Construction project management has undergone a revolution thanks to Building Information Modelling (BIM), especially when combined with Critical Path Method (CPM) methodologies under the virtual design and construction (VDC) paradigm. The development and administration of digital models of a location's functional and physical attributes are included in BIM. BIM is an effective tool for data integration, collaboration, and visualisation in the context of CPM project management at every stage of the project's lifespan. Improving coordination and communication amongst project stakeholders is one of BIM's main benefits when it comes to CPM project management. BIM enhances decision-making and lowers the risk of mistakes and disputes throughout the building process by offering a centralised platform for sharing and accessing project data. Project teams are able to better visualise the finished result and detect any problems early on by creating 3D models that include precise information about Multiple project parts, including structural, architectural, and MEP (mechanical, electrical, and sewage) systems. Additionally, BIM makes it possible to simulate and analyse the building process, which gives project managers the ability to use CPM approaches to optimise timelines, resources, and logistics. Project teams may identify possible hazards and create mitigation plans to assure project success by modelling various building scenarios. Collision identification, which involves discovering and solving conflicts between different structures prior to build commencement, is another way in which BIM is advantageous. This prevents costly revisions and delays.

The seamless integration of scheduling, cost estimate, and resource allocation made possible by BIM's compliance with CPM software results in more precise project planning and management. Project managers may improve project performance and efficiency by using this connection to develop dynamic schedules that take into account changes in project circumstances in real time. In conclusion, there are several advantages to integrating BIM and CPM project management methods inside the Virtual Design and Build framework. These advantages include enhanced integration of data, teamwork, visualisation, and simulation. Project teams may improve decision-making, lower risks, and ultimately complete projects more quickly and affordably by using the potential of BIM.

1.3 Project Quality Management

Assuring that the project fulfils its intended objectives is the responsibility of the processes comprising Project Management of Quality. It executes quality policy, objectives, and responsibilities through quality planning, quality control, assurance of quality, and quality enhancement, among other activities, "as part of the larger leadership function." The subsequent main project quality management processes are summarized in Figure 1.1.

Standard planning, assurance of quality, and quality control are the three interdependent procedures that comprise quality control in the management of projects. Quality planning comprises establishing relevant quality criteria for the project and developing methods to satisfy them successfully. Quality assurance entails conducting frequent evaluations of overall project performance to develop confidence in attaining these criteria. Meanwhile, quality control examines

individual project outputs to verify they meet set quality standards and suggests ways to improve poor performance. These procedures are iterative, and they may include several persons or organisations throughout the project's stages. While displayed clearly, they often overlap and interact. This strategy fits with worldwide standards, such as ISO 9000, and accommodates both proprietary and non-proprietary quality management approaches, emphasising the necessity of controlling both project processes and outputs to avoid unwanted consequences for stakeholders.

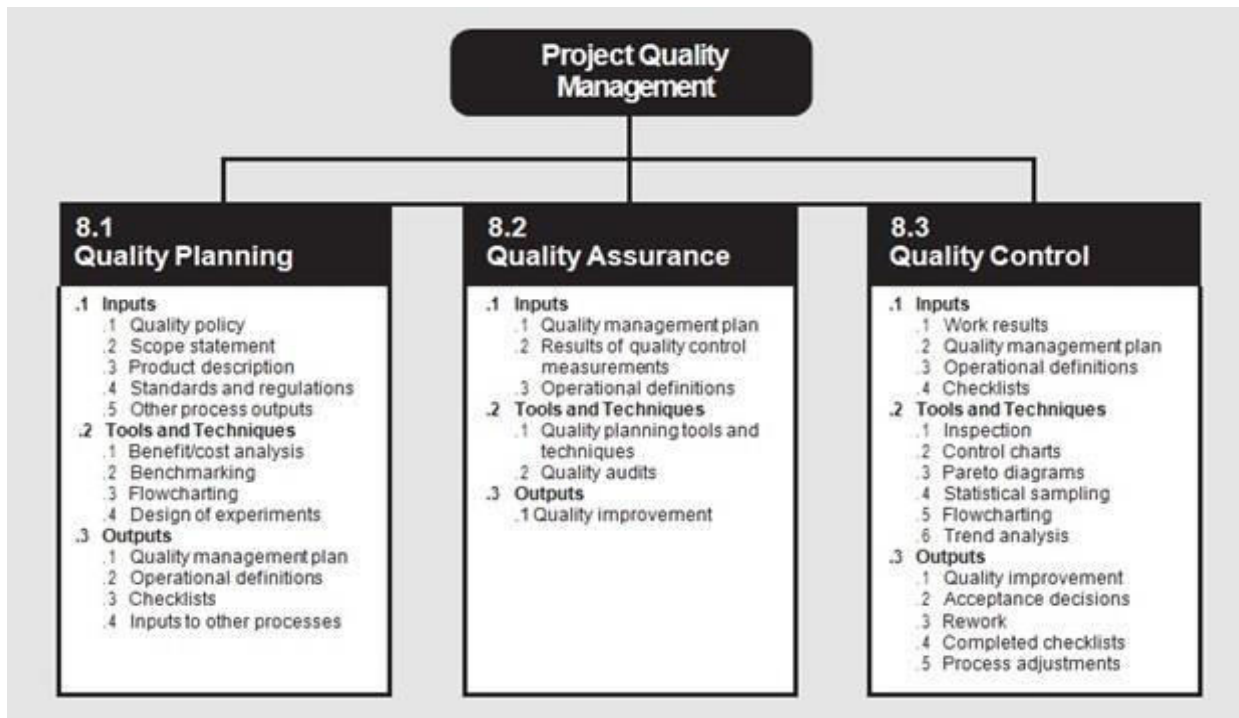


Fig.1.1 Project Quality Management Overview

II. RELATED WORK

Steve Rowlinson et.al (2010), examines the practical implications of Building Information Modelling (BIM) in the building sector by conducting case studies on the Cathy Pacific Cargo Terminal and the Venetian Casino projects in Macau and Hong Kong, respectively. By examining these cases, it explores how BIM influences In addition to planning and building procedures, expert duties. The Venetian Casino case highlights conflict resolution during design and procurement through BIM adoption, while the Cathy Pacific Cargo Terminal case illustrates how BIM transforms the roles of architects, contractors, and subcontractors. The findings underscore the need for strong support from ICT champions for integrated ICT strategies, emphasizing a cultural shift and relationship-oriented project delivery. There is support for combined buying systems, including alliance and design-build methodologies. This research illuminates the correlation between Building Information Modelling (BIM) and the construction sector, with a particular focus on the empirical effects on operational procedures and positions. J Z Wang et.al (2020), explores the pivotal role of quality management in building projects and its impact on safety and functionality. It highlights the efficacy of BIM-based technology in addressing quality issues throughout the project lifecycle, enhancing efficiency in labor, material, and equipment utilization. By transforming construction tasks into visual representations, BIM facilitates automation and intelligence, significantly improving quality management. Specifically, the study analyzes the application of BIM-based inspection positioning methods, emphasizing their ability to ensure strict adherence to regulations, minimize omissions, and streamline inspection processes for more accurate results in less time. However, limitations exist, notably in the rigidity of automatic schedule associations and the need for further customization of inspection checks, particularly for complex projects. Future research aims to enhance interoperability by integrating AR and VR technologies to augment BIM-based quality management functionalities. Ying-Mei Cheng et.al (2018), investigates the integration of Building Information Modeling (BIM) with quality management to enhance effectiveness in performance in building undertakings. A thorough application structure for Building Information Modelling (BIM) in the Architecture/Engineering/Construction (AEC) domain is presented, emphasizing different BIM models for various project phases and requirements. A Quality Control (QC) model system prototype, developed using Autodesk Revit API,

facilitates real-time recording and visualization of onsite quality defects. Additionally, it enables QC report generation and remote access to defect information via mobile devices. While the current focus is on wall defects, future studies may extend to other elements and infrastructure applications. The study underscores the potential of integrating BIM with construction management aspects like cost and safety, while also highlighting opportunities for leveraging emerging technologies like VR, AR, SR, and MR for realistic presentation of quality defect information in the virtual realm. **Hai'e Huo et.al (2023)**, Building Information Modelling (BIM) and Radio-Frequency Identification (RFID) are examined technology to solve issues in building quality inspection procedures. A unique BIM-RFID- integrated system is created to simplify multiparticipant information exchange while also improving quality defect identification and feedback in building projects. Using top BIM software and RFID handheld terminals, an intelligent positioning inspection system is created and validated on an actual project. The results show that the system can link BIM models with entity component information, correctly find quality concerns, and offer timely feedback. Existing technologies perform comparable roles, but they often suffer from durability difficulties and delayed response. The innovative approach overcomes these restrictions, resulting in efficient and long-lasting performance in construction conditions. It allows for real-time information sharing, visual interchange, and streamlined operation, consequently increasing construction quality management efficiency. **LiJuan Chen et.al (2014)**, examines the potential of Building Information Modeling (BIM) in revolutionizing construction quality management. By integrating BIM into quality control processes, it offers multi-dimensional data presentation, ensuring consistency and facilitating collaboration among project stakeholders. A case study at the The Wuhan International EXPO Centre verifies the efficacy of a proposed quality control 4D BIM application. The study proposes a BIM-based quality model that combines design information with standardized construction codes, facilitating clearer task requirements and timely inspections. The results suggest that BIM enhances quality compliance management by utilizing design information and aligning with industry standards. While the BIM-based approach improves project delivery, it also faces challenges such as the need for incorporating temporary structures and the convenience of onsite computing. Future improvements may involve utilizing mobile devices for data recording and transfer. **Hannes Lindblad et.al (2013)**, This article examines the decline in productivity within the Architecture, Engineering, and Construction (AEC) sector during the last forty years, blaming the fragmented character of the industry and its collaborative requirements. Proposed as a means to increase productivity by tackling these obstacles is Building Information Modelling (BIM). However, the adoption of BIM has been sluggish due to various barriers, none of which can be resolved independently to enable widespread adoption. BIM offers efficiency in managing project-related information compared to traditional 2D CAD systems, leading to streamlined construction processes. It emphasises that substantial changes in work processes are required for BIM implementation to effectively increase output. BIM is a means to enhance procedures and accomplish particular objectives; it is not the end in and of itself. **Namhun Lee et.al (2014)**, This statement underscores the growing prevalence of Building Information Modelling (BIM) in construction of infrastructure endeavours, similar to its extensive application in tall building projects. This highlights the importance of utilising model-driven technologies and procedures in the infrastructure industry, specifically in the context of major, civil, and transportation undertakings. The paper proposes the Product, Process, and Organisation (PPO) model as a means of overseeing high-quality planning elements in highway and bridge construction, with a specific emphasis on the role of BIM as an instrument for quality information integration. In addition to conducting a literature review on the model-driven approach to Quality Control (QC) and Quality Assurance (QA), this article presents the results of a pilot study. By proposing a research agenda that explores the application of BIM in quality management and identifies barriers to BIM implementation in the infrastructure sector, this study seeks to bridge the divide between research and industry within this area. By means of case studies and collaborations between industry and academic, it promotes the broader implementation of Building Information Modelling (BIM) in the construction of infrastructure, with the aim of improving the management of quality. **Saurabh Kumar et.al (2016)** delves into the use of BIM for reinforcement detailing and quantity takeoff, aiming to mitigate issues and optimize costs. By leveraging BIM, wastage in steel can be minimized, costs reduced, and clashes resolved efficiently, saving valuable time. Comparative analysis between BIM and non-BIM approaches underscores the accuracy and flexibility of BIM-generated Bar Bending Schedules. The research underscores that while BIM implementation may initially incur costs, its long-term benefits in waste reduction and cost-effectiveness are significant. Moreover, starting BIM implementation from project inception allows for better monitoring and optimization of resources, benefiting both contractors and clients. BIM emerges as a valuable tool for optimizing construction processes and ensuring accurate quantity management throughout project lifecycles. **Akbar Shah A.A et.al (2008)**, Quality management in construction is a complex yet vital task, and Building Information Modeling (BIM) emerges as a powerful tool to streamline this process. BIM facilitates modeling, planning, and visualization of projects, enabling better communication and understanding of quality requirements among project participants. This paper explores the benefits of BIM-based quality management through a case study

approach, highlighting improved visualization, communication, and database management. Despite some limitations, BIM proves to be a valuable tool for quality control, offering efficient decision-making capabilities and the ability to generate quality checklists. As technology advances, BIM is expected to become even more robust, further enhancing its effectiveness in construction quality management. **Sameer Ahmed et.al (2022)**, Focused on sustainability analysis within the Pakistani construction industry, this study highlights the transformative potential of Building Information Modeling (BIM) in revolutionizing traditional energy-intensive practices. By leveraging BIM's capabilities, stakeholders can visualize and mitigate design, construction, and operational issues in a virtual environment, driving sustainability. Utilizing 3D models created in Revit, the study conducts energy analysis to enhance building performance and design. Emphasizing factors such as orientation, window coverings, and material selection, the findings underscore the critical role of BIM-based systems in facilitating energy-efficient construction practices. The study identifies Autodesk Revit and Insight plugin as essential tools for assessing and optimizing energy usage, empowering designers to make informed decisions. The adoption of BIM and Insight recommendations promises to significantly reduce energy consumption during construction, contributing to a greener and more sustainable built environment. **Vinay Kushwaha et.al (2016)**, emphasises Building Information Modelling, or BIM, as a revolutionary innovation in the twenty-first century Architecture, Engineering, and Construction (AEC) sector. BIM facilitates efficient management of building characteristics throughout its lifecycle, enhancing productivity, quality, and cost-effectiveness. However, despite its transformative potential, the adoption of BIM faces significant hurdles, including limited awareness and initiative from government and educational institutions. Transitioning to BIM requires collaborative efforts from both public and private sectors. The paper advocates for increased awareness through seminars and case studies, emphasizing the benefits of BIM adoption. It calls for proactive involvement from government and educational institutes to maximize the potential benefits offered by BIM in the AEC industry. **Andrey Bogdanov et.al (2021)**, The relevance of integrating Building Information Modelling (BIM) technologies throughout the entire lifecycle of a structure is examined, encompassing decision-making processes concerning its eventual demolition as well as design. Analysing variants of the stress-strain state of buildings and structures, the paper proposes a method for informing decisions regarding significant restorations, rebuilding, or removal via analysis of incoming sensor data. It promotes the implementation of fiber-optic sensors for real-time detection of hazardous movements and structural condition monitoring. The incorporation of sensors during the construction phase streamlines quality control processes, resulting in time and cost savings. In addition, auditing of construction, design, and territorial planning is facilitated by techniques like laser scanning. By promoting opportune detection of hazards during building operation, the enumerated principles safeguard structure integrity.

III. METHODOLOGY

This study employs Building Information Modeling (BIM) to enhance quality management in Reinforced Concrete Construction (R.C.C.) buildings. It includes analyzing quality management and BIM, creating 3D models using Revit, conducting clash detection with Navisworks, and evaluating the effectiveness of BIM in project delivery through comparative analysis and case studies.

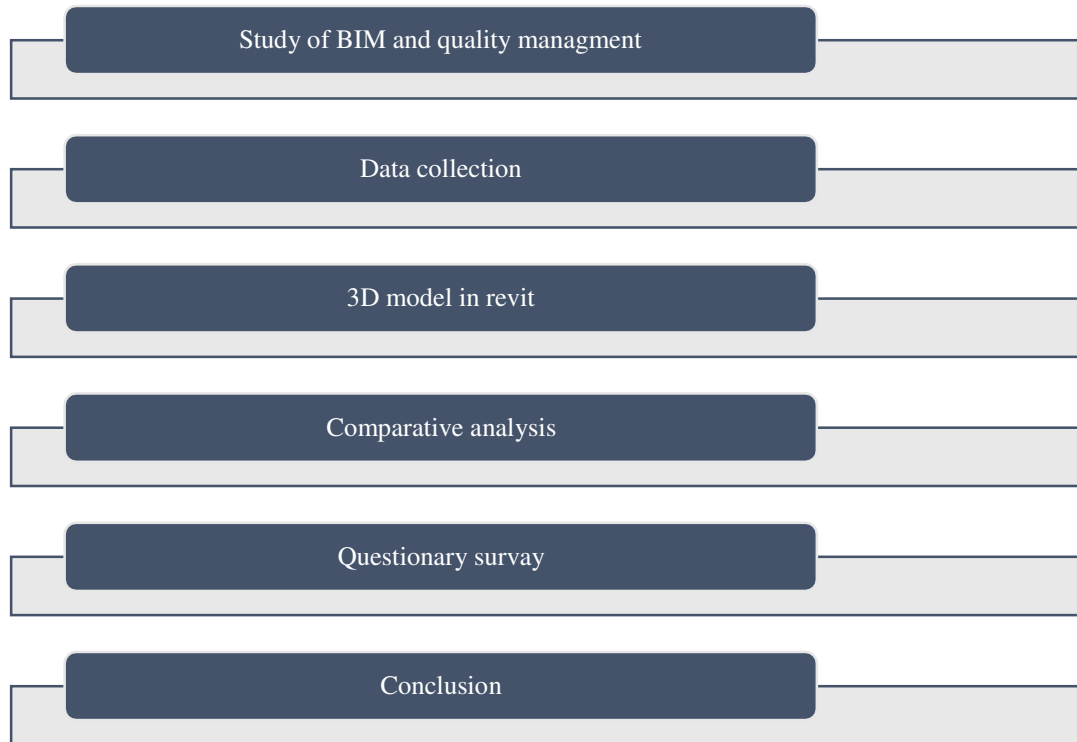


Fig 3.1 Flowchart

1.4 Clash Detection

There are 3 primary sorts of conflicts that conflict recognition searches out:

1. Hard Clash: the result of two objects passing through one another. The majority of BIM modelling coding eliminates the likelihood of this by using dispute resolution guidelines reliant on added component data.
2. Delicate Clash: endeavour to identify issues that arise when objects encroach over geometric opposition with different reasons (e.g., an excessively exhibited structure in close proximity to a high-strain wire).
3. 4D/Workflow Clash: Booking disputes, anomalies, and transference disputes are resolved via conflict resolution.

IV. CASE STUDY

PRIDE PURPLE SQUARE

We started our mission to reinvent Pune's premium and luxury home experience over 19 years ago. We were driven to create and provide Pune cutting-edge developments, and we concentrated on giving residents living areas that matched emerging norms and preferences. While being at it, we continued to come up with fresh ideas for incorporating a feeling of holistic community living into Pride Purple apartments. a solid basis in the worlds of flats, row homes, bungalows, commercial plazas, conference centres, and motels.

Specifications

- Large Floor
- Large Column Grid
- High Speed Elevators
- Designer Entrance Lobby
- 100% Power Back-up
- Fire and Smoke Detectors in parking and common area

- Ample Parking Space
- Ground and First Floor dedicated for Shops and Showrooms

Amenities



Large Floor



Large Column gride



High speed Elevators



Designer Entrance Lobby



100% Power Backup



Figure No.1 Case Study 3d eye view

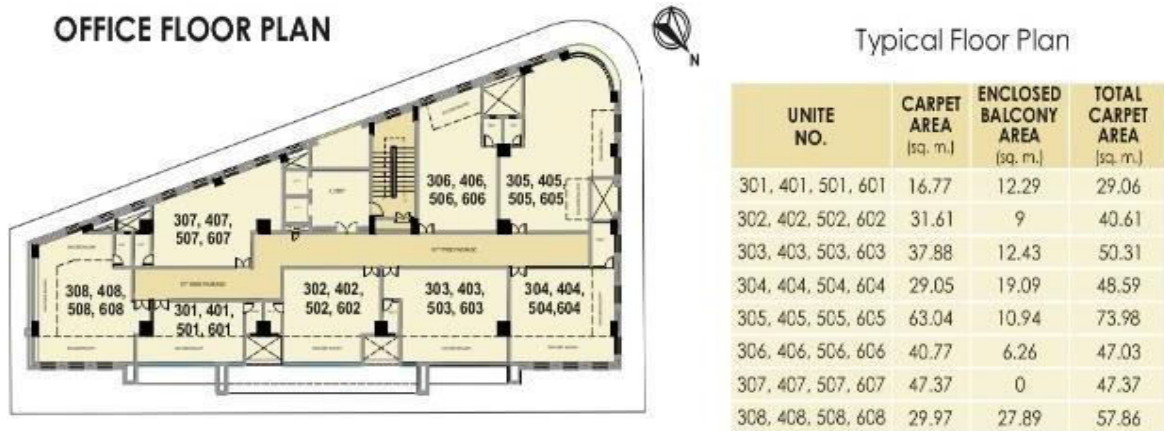


Figure No.2 Floor Plan of Pride Purple



Figure No.3 Shop Floor Plan of Pride Purple

V. EXPERIMENTAL ANALYSIS

5.1 BIM Implementation for Building Construction

The work we are doing is divided into two parts: first, we will renovate the city to make it more versatile, and moment, we will consider if BIM is sufficient for quality management in the development sector. We employ Navisworks, Inc scripting for scheduling and time estimates in conjunction with Revit software to progress our construction model.

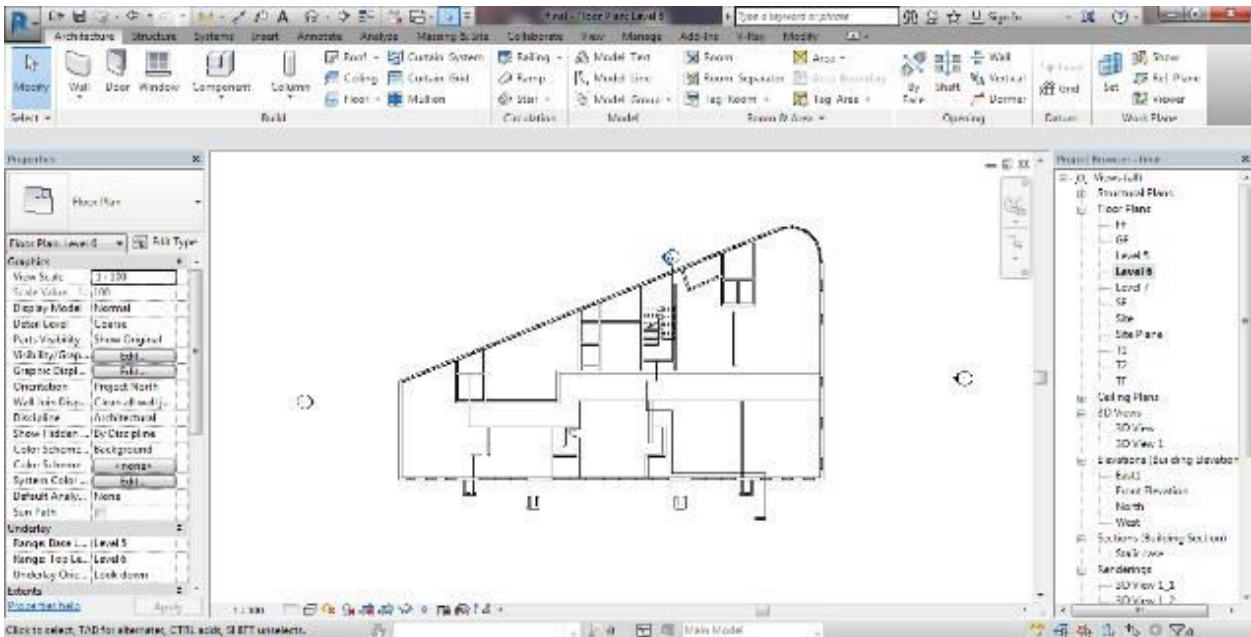


Figure No.4 Revit Layout Plan

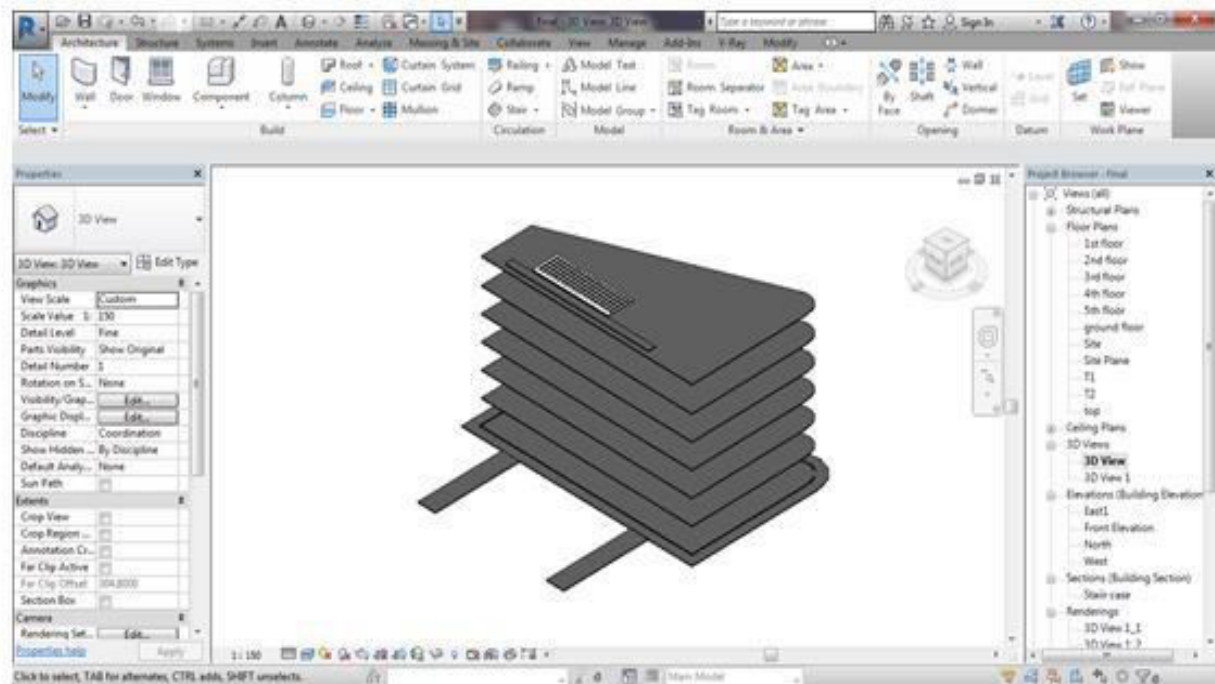


Figure No.5 Revit Floor Layout

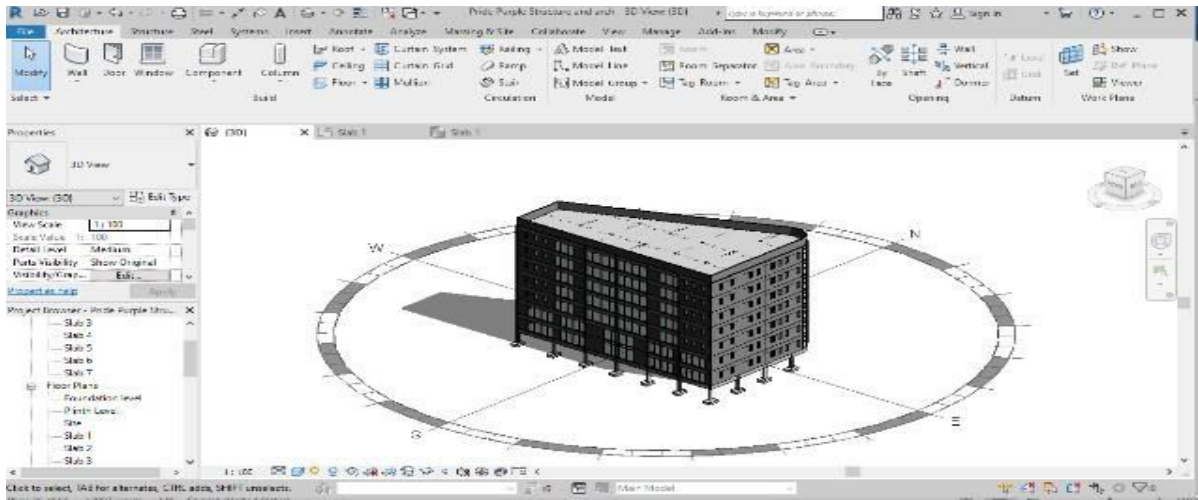


Figure No.6 3D View with Wall, Windows

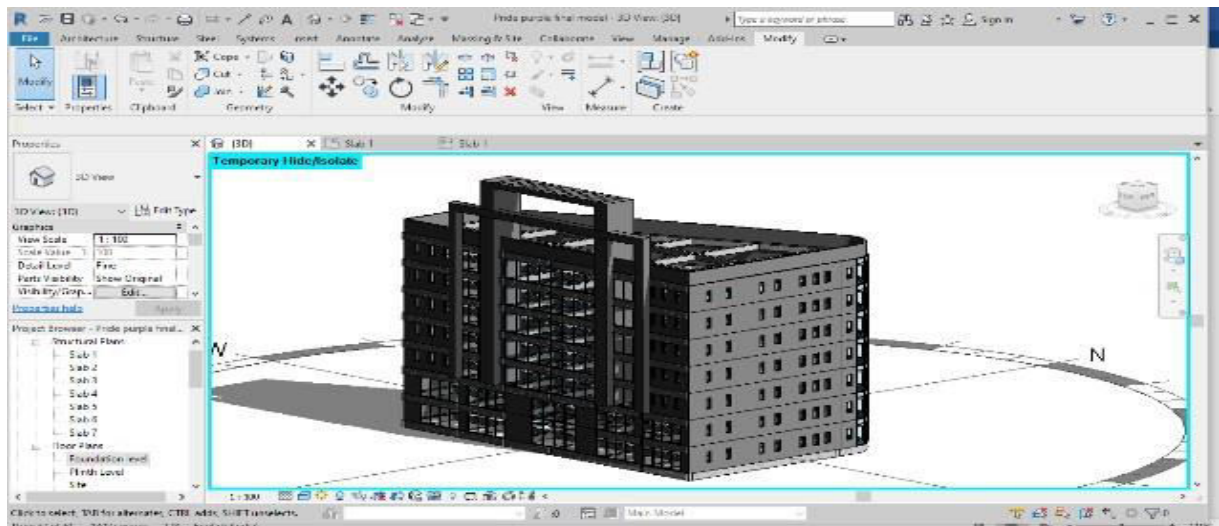


Figure No.7 Final Elevation



Figure No.8 Render 3D View



5.2 BIM for Quality Management

Combining a model-driven approach to quality assurance and control with BIM technology improves quality, as poor quality is the consequence of:

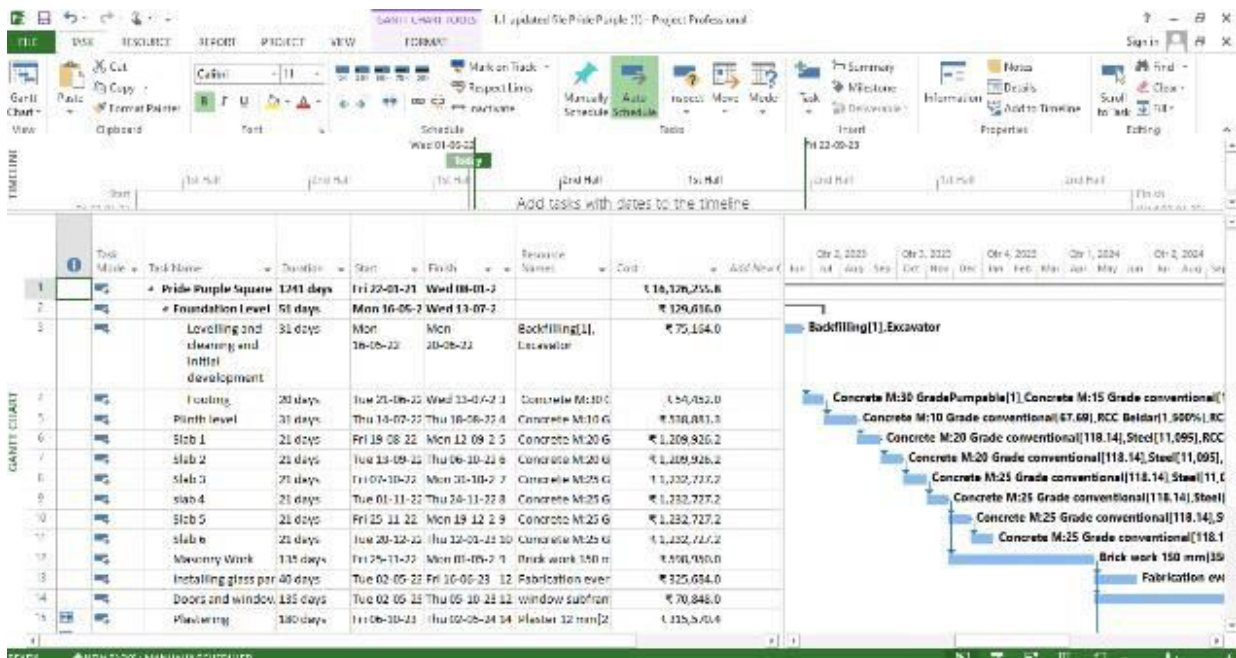
- (1) Misconception regarding control procedures and quality standards
- (2) Inconsistent liability for unconventional or incorrect workmanship.
- (3) disregard for ongoing quality development.

A 3D model can serve as a tangible representation of quality information integration when BIM technology is applied to quality management. Within a unified information platform, various strata of the three-dimensional model may furnish critical data pertaining to the quality of building parts, materials, and apparatus, standards of excellence, and management procedures.

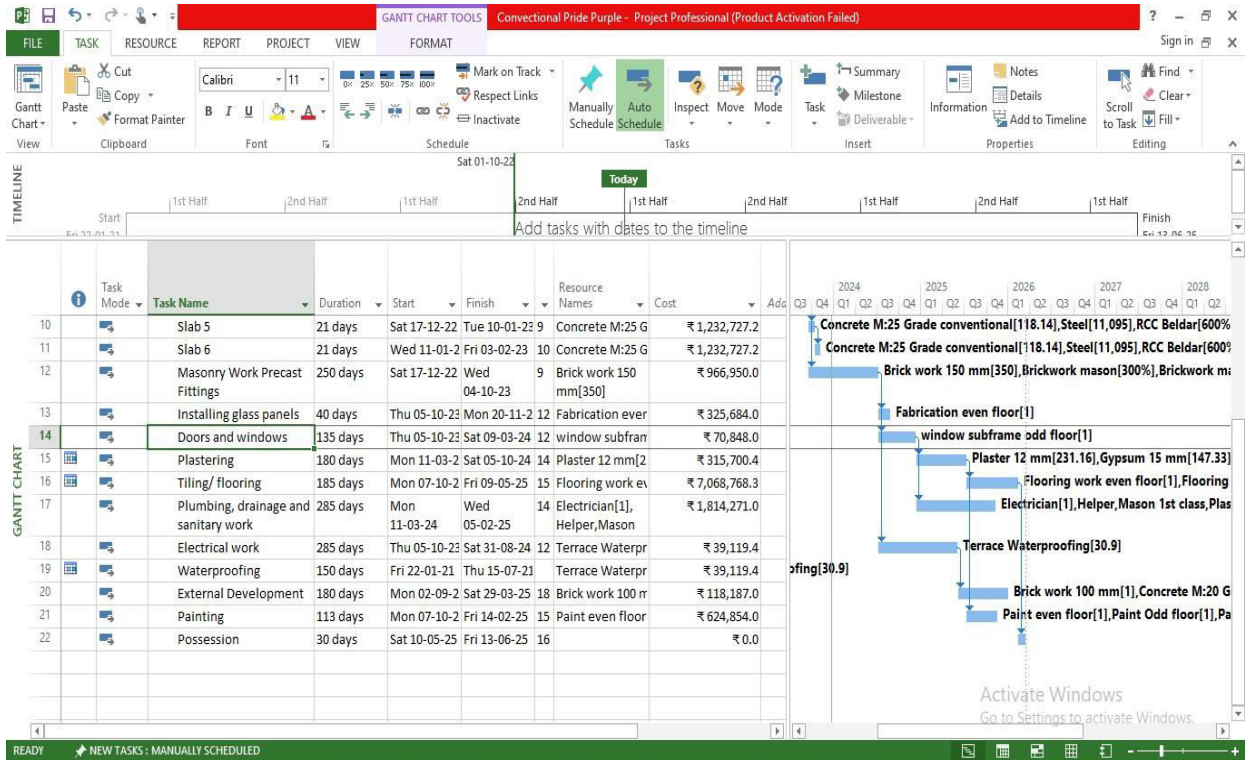
5.3 Scheduling Using Microsoft Project (MSP)

Standard and professional versions of Microsoft Project are available based on the needs of the endeavour and the degree of administration. A Microsoft Project file has the.mpp extension.

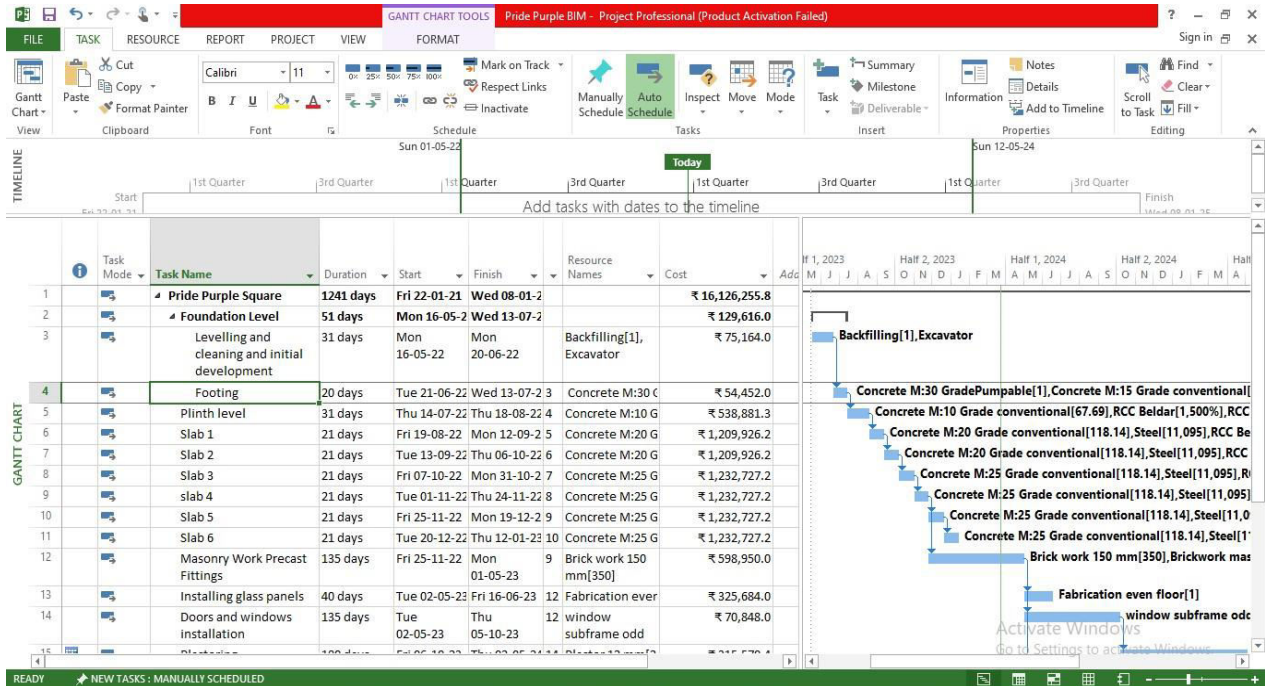
- Devising plans
- Setting realistic goals
- Defining resources
- Assigning tasks
- Recording progress and finances
- Monitoring workloads
- Scheduling meetings



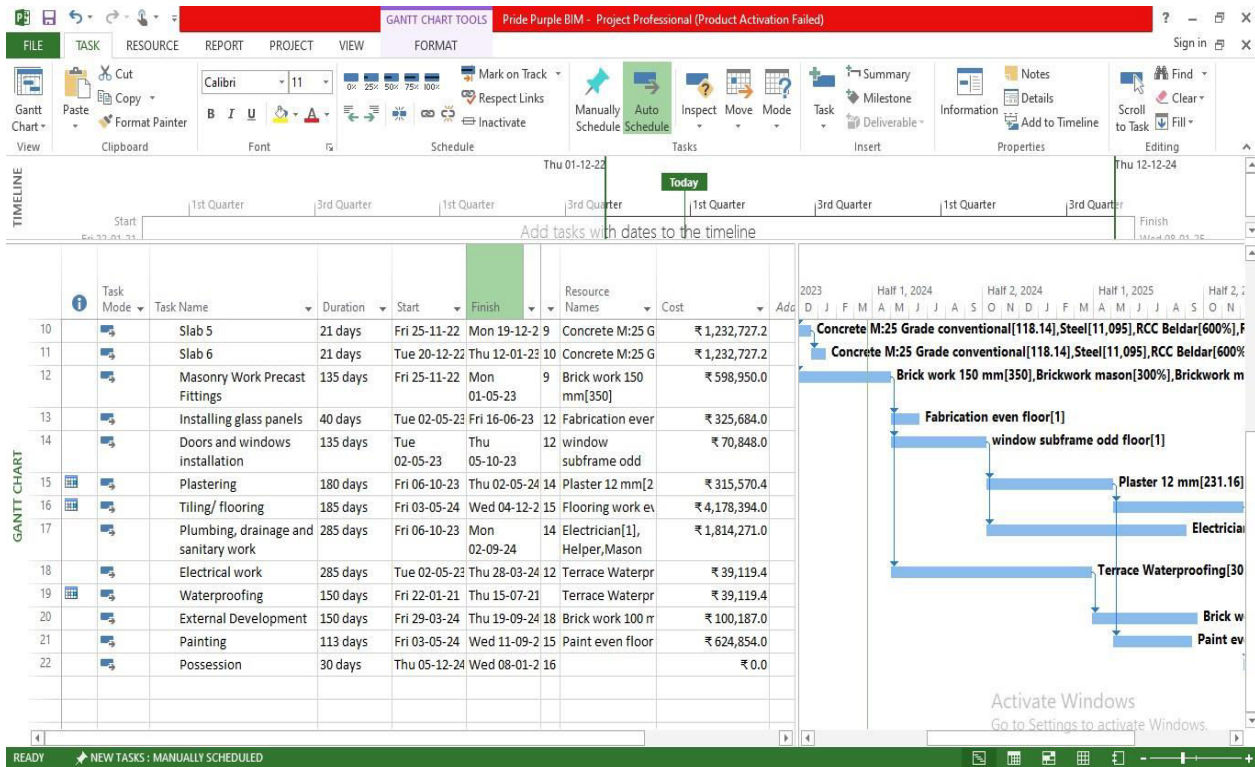
(a)



(b)



(c)



(d)
Figure No.9 (a), (b), (c) and (d) Preparing schedule in MSP

5.3 Development Of Model In 6d Using Naviswork

A complete review solution for information about projects investigation, a game, so and coordination is Autodesk Naviswork Manager programme. The integration of diverse information regarding design may result in a combined project model that is suitable for collision detection and interfering mitigation. Before construction, Naviswork Manage assists professionals in the design and construction industry in anticipating and avoiding possible issues.

5.3.1 Introduction of Autodesk Navisworks

Detailed 3D designs from different formats of files may be shared, combined, and reviewed with confidence using Autodesk Navisworks as By analysing interferences in a single model environment, Clash Detection technologies enable you to identify flaws before they become issues.

5.3.2 Architecture, Engineering & Construction Overview

The Navisworks assessment solutions allow a dynamic instantaneous fashion whole-project perspective for the following by merging morphology data and information from other design tools with the high-quality 3D visualisations of designs produced through the use of Revit-based applications, AutoCAD® software, and Autodesk®Inventor® software. Efficient 3D coordination, arrangement, training, and 4D analysis Accurate and realisticmodelling.

5.3.3 Autodesk Navisworks Manage

For professionals in the design, the field of engineering, & construction administration fields looking to increase efficiency and quality via superior insight and predictability, Autodesk Navisworks Managed Services software offers a full project monitoring platform.

5.3.4 Autodesk Navisworks Simulate

Autodesk Navisworks Simulate software enhances the Autodesk Navisworks Revie application with the dynamic capability of 4D sequencing and realism. In order to provide concise description that illustrates design purpose and simulates

building to promote understanding and stability, the importance of already-existing design data is expanded.

5.3.5 Autodesk Navisworks Manage

Regardless of file size or format, Navisworks by Autodesk Review technology expands access to current engineering information for group review with real-time visualisation.

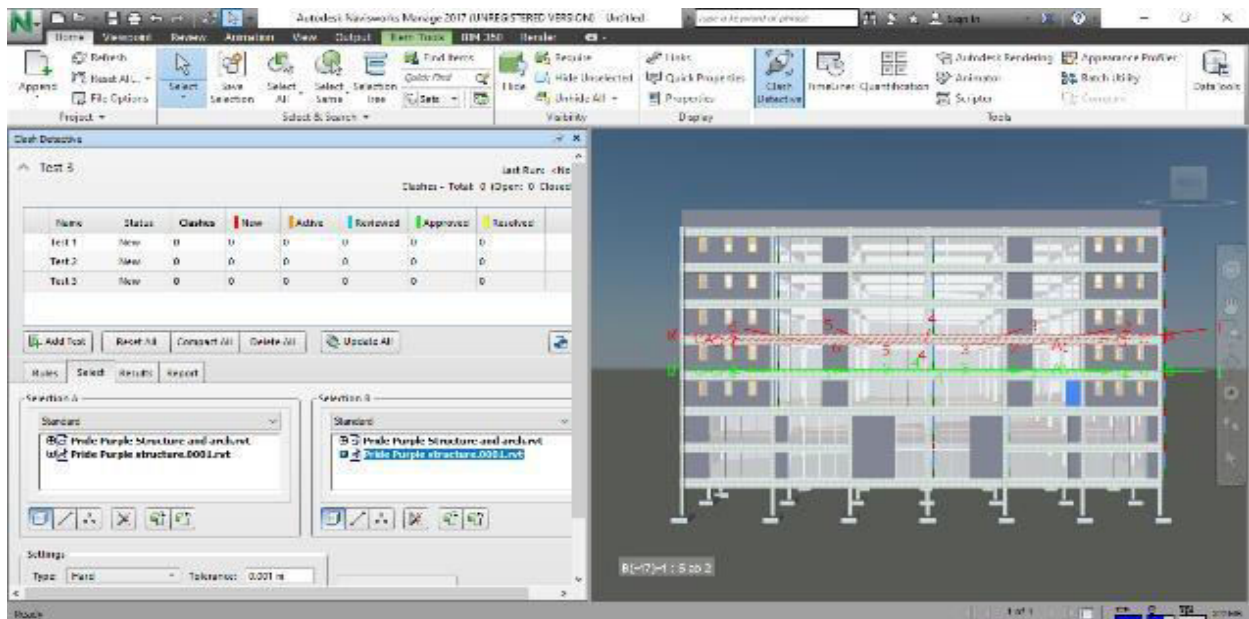


Figure No.10 Navisworks clash detection

5.4 Estimate Work in Excel

- In EXCEL quantity of concrete is measured, all concrete slab, beam, column, foundation is measured
- After calculating concrete quantity for external finishes door schedules, windows schedule and door schedules are worked out

Table 1: - Estimate Work in Excel

Sr. No	Description	No	B	W	D	Quantity
1	C1	1	1.95	2.15	0.15	0.628875
2	C2	1	2.2	2.75	0.15	0.9075
3	C3	1	2.8	3.2	0.15	1.344
4	C4,17	2	3.55	4	0.15	4.26
5	C5,18	2	3.5	4.4	0.15	4.62
6	C6,7	2	2.9	3.3	0.15	2.871
7	C8,62	2	2.75	3.2	0.15	2.64
8	C9	1	2.8	3.3	0.15	1.386
9	C10	1	3.5	3.5	0.15	1.8375



10	C11,22	2	2.9	2.9	0.15	2.523
11	C14,15	2	2.5	2.8	0.15	2.1
12	C16,45,66,63	4	2.6	3.1	0.15	4.836
13	C21	1	3.8	3.8	0.15	2.166
14	C23	1	3.1	3.1	0.15	1.4415
15	C24,43	2	3	3	0.15	2.7
16	C25,44,69,70	4	2.7	3	0.15	4.86
17	C26,35	2	2.6	2.6	0.15	2.028
18	C27,36	2	3.1	3.1	0.15	2.883
19	C28,29,37,38	4	2.6	2.6	0.15	4.056
20	C30,31,32,33,39,40,41,42	8	1.9	1.9	0.15	4.332
21	C34	1	2.9	2.9	0.15	1.2615
22	C46	1	3	3.6	0.15	1.62
23	C47	1	2.4	3.3	0.15	1.188
					Total	58.489875

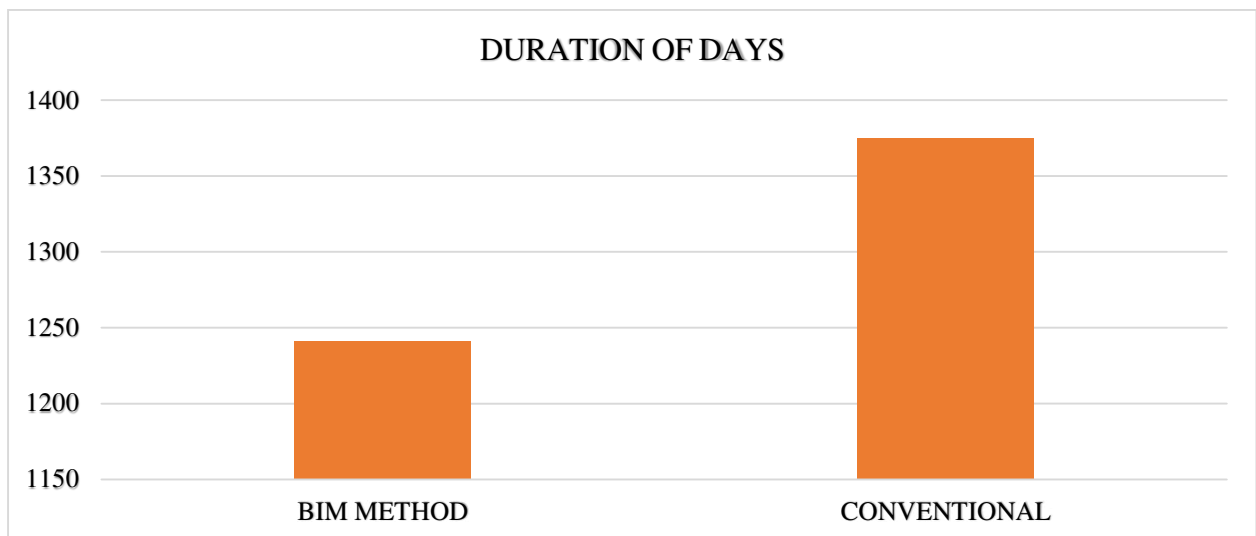


Figure No.11 No. of days BIM- Convectional Graph

The graph shows a comparison between the BIM method and the conventional method in terms of the number of days taken for the project. It is evident that the BIM method took 1241 days, whereas the conventional method took 1375 days, indicating a significant time-saving of 134 days with BIM.

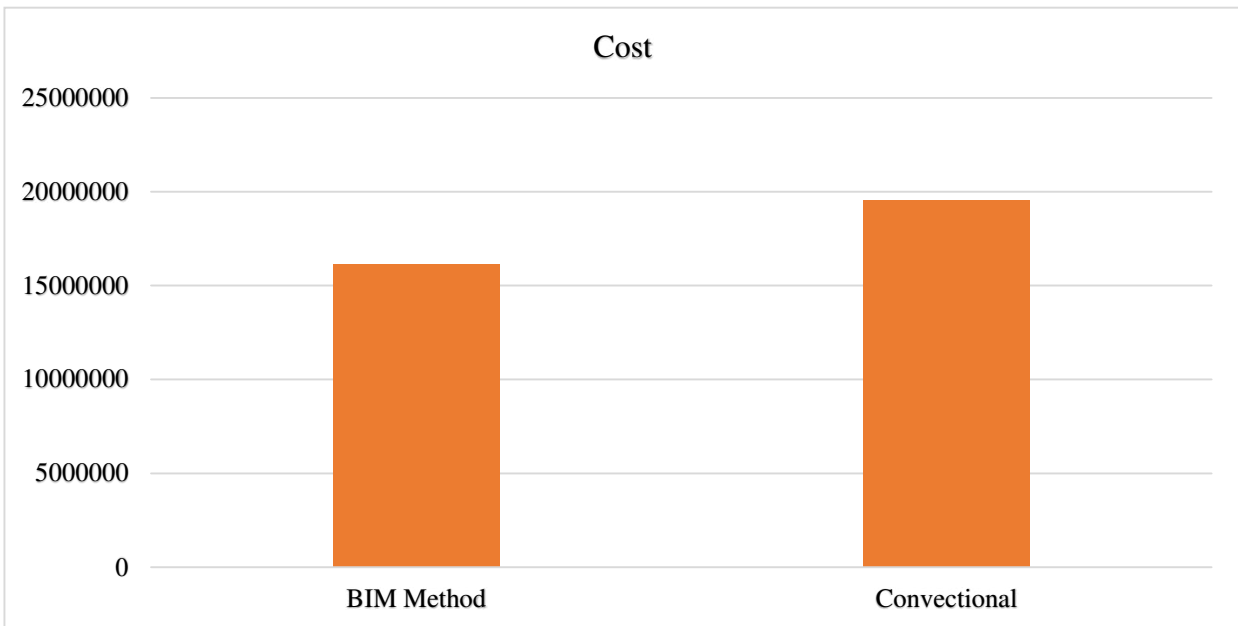


Figure No.12 Cost Comparison BIM and Convectional Graph

The graph illustrates a cost comparison between the BIM method, totaling \$16,126,255.8, and the conventional method, totaling \$19,539,320.1. This indicates a cost reduction of \$3,412,064.3 achieved through BIM implementation.

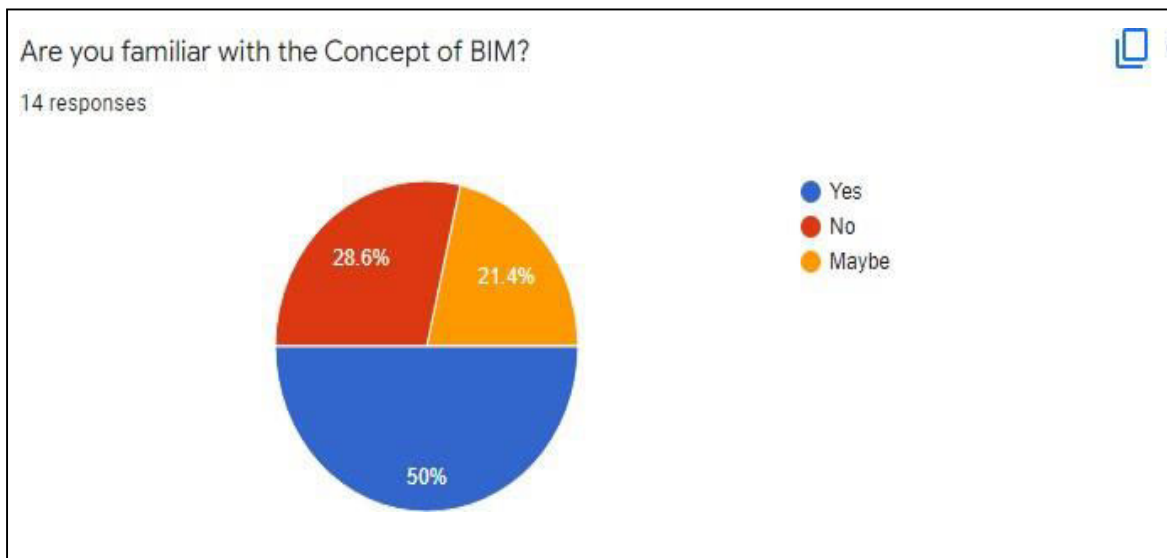


Figure No.13 Graph of questionnaire response 1

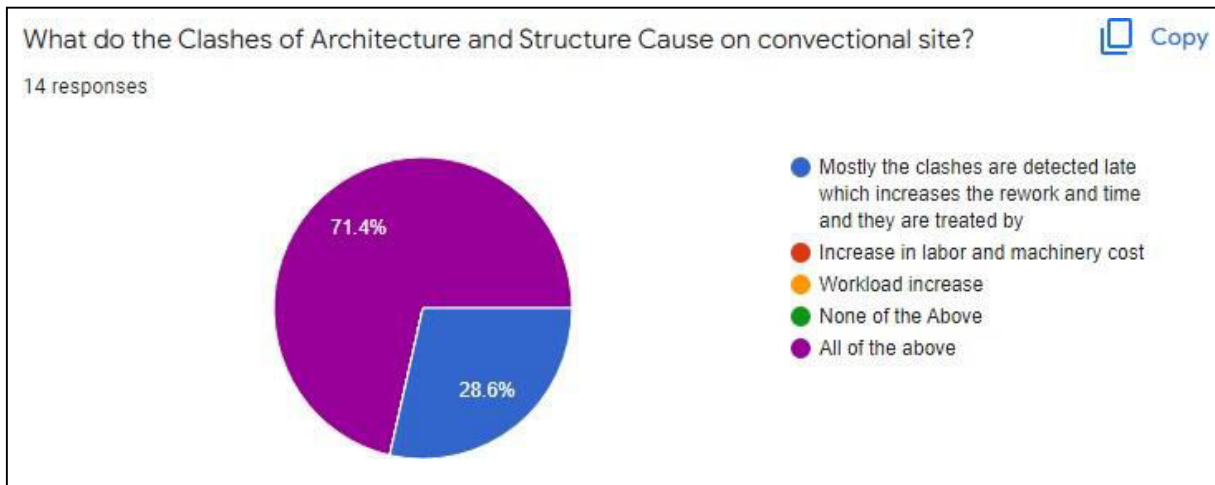


Figure No.14 Graph of questionnaire response 2

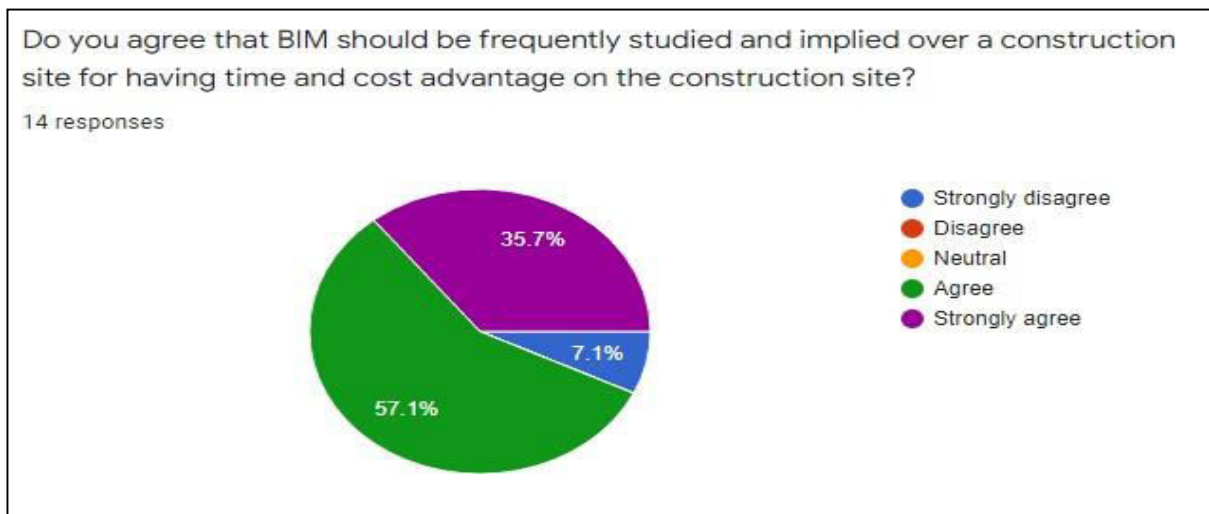


Figure No.15 Graph of questionnaire response 3

5.6 Quality Norms Satisfied from Using BIM

Virtual Design and Construction (VDC) employs Building Information Modelling (BIM) in conjunction with Critical Path Method (CPM) project management to improve accuracy and efficiency. Before project execution begins, VDC makes sure quality standards are followed by conducting conflict detection tests at the ground level and guaranteeing correct demarcation in accordance with layout plans. This methodical approach reduces mistakes, simplifies procedures, and maximises the use of available resources. Projects gain from better planning, coordination, and visualisation when BIM technology is used inside CPM frameworks. This eventually leads to higher-quality results and better project management techniques.

Quality Standards That BIM Is Not Able To Meet: Due to restrictions on how formwork and certain materials may be modelled in the programme, BIM cannot be used to verify ISO quality standards for concrete formwork and materials.

In brief: This chapter examines research and development on Virtual Design and Construction (VDC) in Critical Path Method (CPM) project management using Building Information Modelling (BIM) via questionnaire surveys and case studies. The following sections will provide further detail on the findings of this study.

VI. CONCLUSION

A paradigm shift in quality control within the construction industry occurs when Reinforced Concrete Construction (R.C.C.) structures adopt Building Information Modelling (BIM) application. BIM integration with Critical Path Method (CPM) project management improves stakeholder communication, visualisation, and decision-making. Through collision detection, BIM reduces disputes and simplifies construction processes, resulting in increased productivity, fewer mistakes, and cost savings. The study emphasises BIM's potential to transform conventional building techniques, particularly its role in improving project quality and sustainability. Despite hurdles such as limited acceptance and technical constraints, the research argues that ongoing efforts to raise BIM knowledge and education may drive wider use and maximise its advantages in the AEC sector. Overall, the research identifies BIM as a valuable tool for enhancing project results, assuring quality compliance, and encouraging innovation in building processes. As the construction industry evolves, BIM stays at the vanguard of technical breakthroughs, with the potential to transform the future of project management and quality assurance.

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