

# Evaluation of construction project using Building Information Modelling (BIM)

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**Abstract:** *BIM stands for 'Building Information Modelling,' and it is defined as a 'method of designing, constructing, or running a building or infrastructure asset utilizing electronic object-oriented information,' according to PAS 1192-2:20131.*

*As construction projects are huge and complicated, providing a contemporaneous construction process to BIM models with construction automation is critical. Clashes in architectural, structural, and MEP elements occur frequently in buildings, resulting in cost overruns and delays. Quantity surveying and building estimates with numerous inaccuracies and clashes result in erroneous estimates and cost overruns. Due to 2D planning and monitoring, there is no quality in construction. As a result, using 5-D BIM (Building Information Modelling) in the design and project management of construction projects saves not only cost and time but also detects clashes and eliminates future reworks. According to the conclusions of this case study, there are 15% variances in main civil quantities, which significantly impact the project cost. Since 70–80 percent of construction costs are influenced by designers' decisions in the early design stage, BIM deployment in construction projects can be used to support decision-making within the targeted schedule.*

**Keywords:** *Building information modelling, BIM implementation, Quantity survey, Clash detection.*

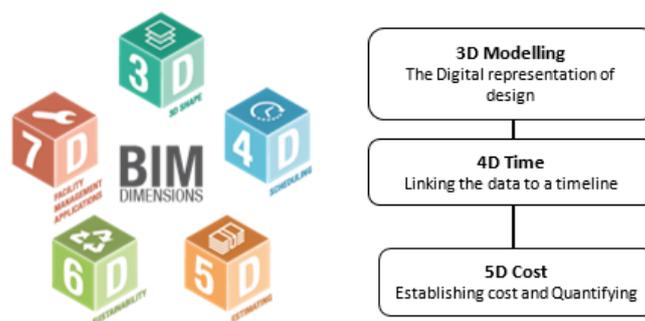
## 1. INTRODUCTION

Construction work has historically been the most prevalent activity, and for hundreds of years, it has been regarded as the most important of all the current industries and groups to emerge. The endless list of historical buildings that our ancestors left behind as a part of the kind of treasured heritage, such as the Taj Mahal, Sun Temple, Amer Palace, Pyramids of Egypt, and other masterpieces of Architectural, Engineering, and Construction (AEC) dispersed throughout the world, serves as a deserving example of that. The Building Information Modelling (BIM) application in the housing industry globally has reformed the way building project is delivered (Liao et al., 2018). According to several studies, BIM is used from project conception to construction, sustainable element monitoring, life cycle costing (LCC), LEED tracking, financial management, and decommissioning and demolition (Liao et al., 2017). However, it's been observed that not all the members of the industry are moving easily and rapidly from outdated Computer-Aided Design (CAD) drafting to modern techniques of working (Liao et al., 2018). The government of India is implementing programs like Digitize India, which aid in improved project execution by implementing cutting-edge technology like BIM. Early users of BIM with mandates include the United Kingdom, France, Singapore, and Germany. In the United Kingdom, Level-2 BIM is required for all government-funded building projects (Takim et al., 2013). According to a recent analysis by RICS India, BIM adoption in residential projects is far higher than in infrastructure projects. By 2020, there will be more than 44 million professionals working on BIM in India (Sawhney et al., 2017). To study the unmet benefits

of converting the Indian AEC sector from two-dimensional CAD to multidimensional BIM, 5-D, LOD-300, and Level-2 BIM models were built. A methodical process was used to produce the model, starting with the production of a Detail line plan and concluding with the creation of a BIM 5-D model. The results of the analysis of the 5-D model showed that adopting BIM in the AEC sector boosts productivity, lowers disputes and modifications during construction, eliminates rework, and decreases project fragmentation.

## 2. WHAT IS BIM?

In India, Revit is used for 49% of BIM work (Kumar and Mukherjee 2009), Revit is not BIM; it is merely a tool in BIM. So, what exactly BIM is? BIM (Building Information Modelling) is a smart 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools they need to plan, design, construct, and manage buildings and infrastructures more efficiently, according to Autodesk (www.autodesk.com/solutions/bim,2016).



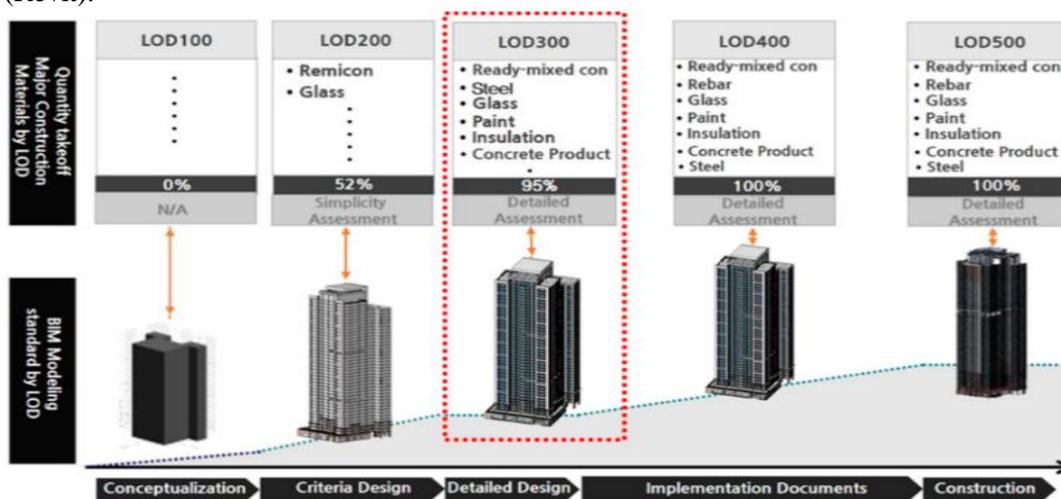
(Source: BibLus, 2018)

Fig1: BIM Dimensions

## 3. METHODOLOGY

### 3.1. Preparing 2D Drawings

The set drawings contain floor plans, sections, and various elevations, and are created using a traditional approach (AutoCAD). BIM was also used to create the same set of drawings (Revit).

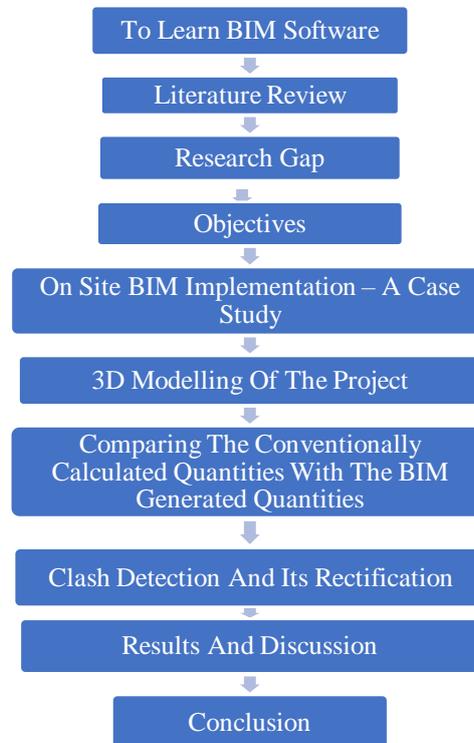


(Source: Lee et al., 2015)

Fig2: BIM Level of Development Units

### 3.2. Preparing 3D Drawings

The 3D architectural model was developed using conventional techniques, however, making a 3D model for structural and MEP models requires more time and are not frequently done in the construction industry. As a result, just an architectural model was created using the traditional method. The Architectural, Structural, and MEP models were created using BIM, and the model was built to LOD-300 requirements.



### 3.3. Preparing 4D Drawings

The 4D model may be constructed once the model's scheduling and clash detection have been completed. As a consequence, Microsoft Project (MSP) is used to schedule the model, and Navisworks is utilized to identify conflicts between the architectural, structural, and MEP models. The schedule is connected to the model in Navisworks through the Time Liner when scheduling and conflict detection are complete. With the completion of the 4-D model, Level-1 BIM is achieved, and Level-2 BIM is used for further development.

### 3.4. Preparing 5D Drawings

During the creation of the MSP schedule, resources are allotted for various project phases. Both manually and through BIM, where the QTO is automatically created based on the 3D, quantity take-offs (QTO) are made. The 4D model and resource scheduling have been combined, and the 5D model is now being created.

## 4. Research Gap

- Despite various advantages of BIM, its implementation is not seen on a large scale
- Mostly the research work is seen in the form of a theoretical manner and very less research is performed on live projects
- Many buildings had clashed in Architectural, Structural & MEP Elements which

leads to Cost Overruns and Delays

- Not quality in construction due to 2D drawings
- Quantity Surveying and Estimates were made on Buildings having many errors & clashes leading to inaccurate estimation & cost overruns

### 5. Results and Discussions

The Building Model consisting of Architecture, MEP, and Structural Design is prepared using REVIT Software shown below:

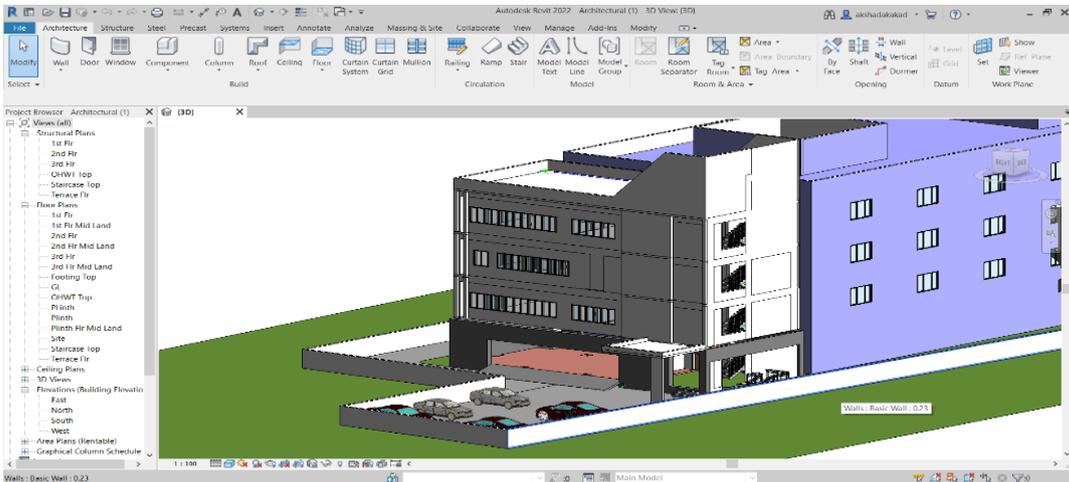


Fig3: Schematic of REVIT Architectural Model of G+3 Building

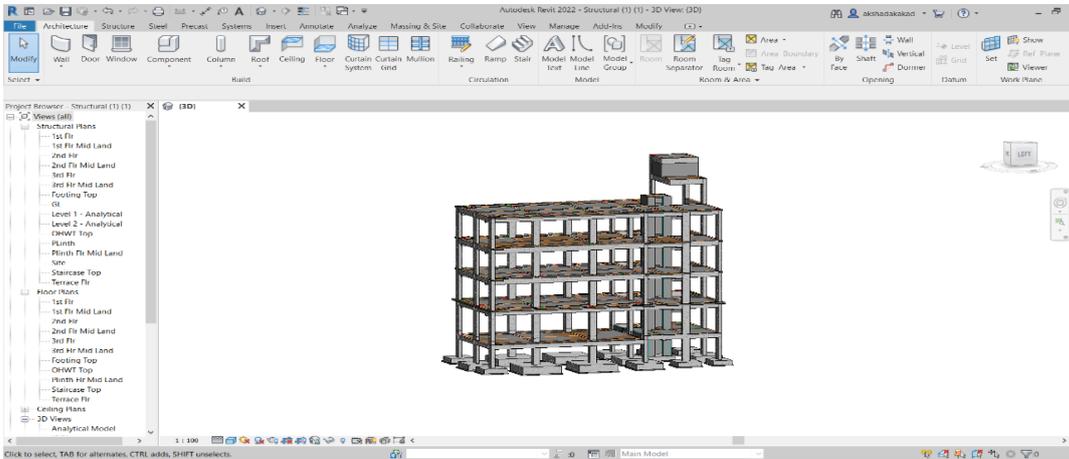


Fig4: Schematic of REVIT Structural Model of G+3 Building

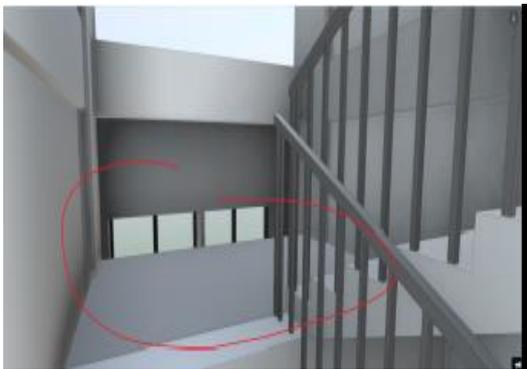


Fig5(a): Clash detection



Fig5(b): Clash detection

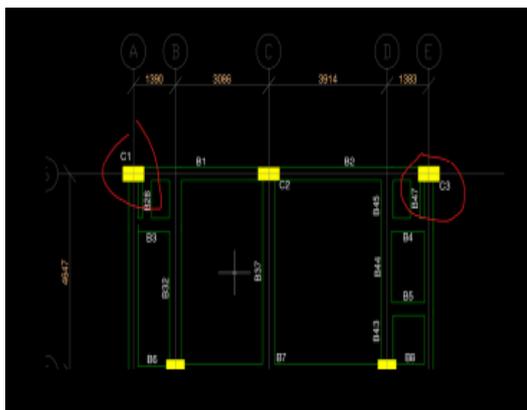


Fig5(C): Structural Clash detection

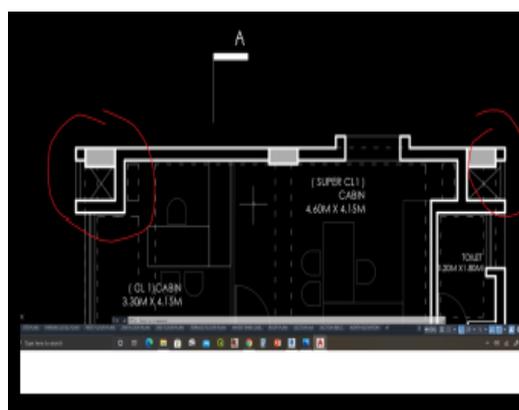


Fig5(d): Structural Clash detection

- For simpler understanding, I derived various quantities from BIM & found variations in the same
- After the data analysis, the result is interpreted concerning data collection. The result is generated after a comparative study of quantities obtained through traditional BOQ and BIM are shown below

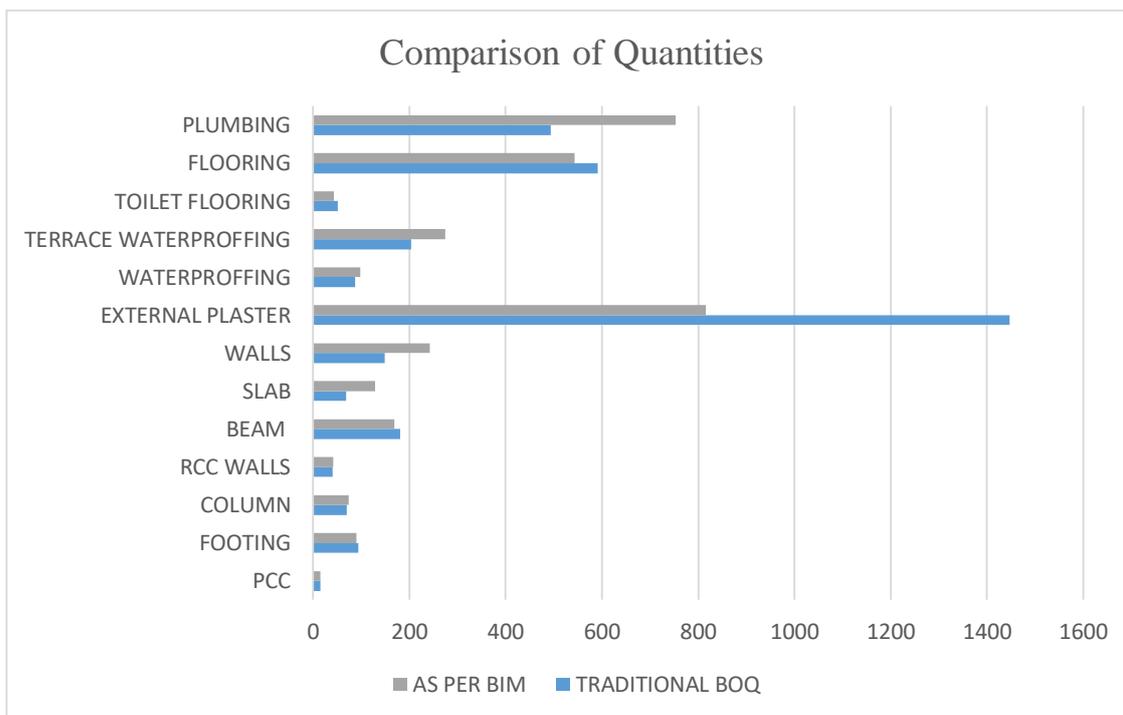


Fig5: Comparing the Conventionally Calculated Quantities with The BIM Generated Quantities

- 15% of variations in major Civil work quantities which are heavily affecting project cost

### 6. Conclusion

According to the study's findings, using the 5-D, BIM model instead of the more traditional BOQ approach significantly improves the accuracy of cost estimations. Additionally, using 5-D BIM would cut the amount of time needed for both the design and construction phases, making BIM useful for the lifecycle of a project. In a traditional method, even minor

corrections must be repeated more frequently, whereas, in BIM, changes made in one view are instantly updated in other views. As a result, no duplication is necessary for BIM, resulting in on-time project delivery and increased efficiency. The use of Navisworks (a BIM tool) to identify conflicts between various 3-D BIM models, including architectural, structural, and MEP, produces amazing results, preventing rework and removing the possibility of human mistakes during model investigations. Quantity take-offs (QTO) were previously made manually based on drawings and specifications, but in BIM, QTOs have been generated automatically. As a result, it saves a significant amount of time as compared to traditional methods, and it also gives high precision quantification. Additionally, This QTO will also assist with 5-D BIM real-time cost planning. The quality of the finished output is significantly improved by the BIM Collaboration. Therefore, it can be concluded that BIM's benefits will be essential for the expansion of the construction industry.

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