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SAFETY IN PROTOTYPE CONSTRUCTION USING BIM

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Abstract— Building Information Modelling (BIM) is a advance technological tool that allows a project to be built virtually before being built physically. It creates and uses, coordinated, computable information, collaborate, about a building project. The use of digital information for a building can be used for production of high-quality construction documents, design decision-making, cost-estimating, construction planning and eventually for managing and operating the facility. The purpose of this project is to see the impact of BIM implementation on the traditional conventional building design methods. The BIM is extends this methodology into three dimensional (3D) drawings in the three primary dimensional width, height and depth with the time as the fourth dimension (4D) and cost as the fifth (5D.The case study presented in this project suggests that visualization of safety at site work becomes more powerful that the 2D documentary work

Keywords— BIM, Communication, Visualization, Safety, AEC

I. INTRODUCTION

Construction sites are becoming more dangerous day by day because of involvement of more use of equipment and tools in working site. Safety is one of the mean factors in the construction industry worldwide. Construction work is a dangerous land-based job. BIM is a computational branch in civil engineer as it comes under design research, which is considered to be high profile in current decades. Some construction site jobs include: building houses, roads, workplaces and repair and maintain infrastructures. This work includes many hazardous task and conditions such as working with height, excavation, noise, dust, power tools and equipment. The most common fatalities are caused by the fatal four: falls, struck by object, electrocutions and caught-in/between. Construction work has been increasing in developing and undeveloped countries over the past few years. With an increase in this type of work occupational fatalities have increased. Occupational fatalities are individuals that pass way while on the job or performing work related tasks. [3] Within the field of construction it is important to have safe construction sites.

"Everyone who is involved in the construction activity should shoulder the responsibility of identifying the potential hazards and make all efforts to eliminate them from the construction sites." – R. R. Nair

In ancient days safety was not given any priority because there was less use of equipment and the stories of building was not much implemented (build). In the modern development of a countries, it has been seen that high rise of building is become much more advances and it is also been seen that there is use of heavy and high range of equipment used .So, safety is becoming more important (vital) in current generation. Safety planning is carried out separately to improve the scheduling and controlling of work site. Now a day, it has been seen that safety planning and designing process is carried out to a certain extent separately from other project for planning and controlling tasks. Currently, there have been involving interests in improving safety at worksite through safer design, safer planning and work method statement using Building Information Modelling (BIM).Building Information Modelling (BIM) is a core of management. BIM tool is that software which is becoming more powerful tool in safety. Because Building Information Modelling (BIM) gives more visualizing than the others tools used in Civil engineering field. In drafting work or 2D-CAD work it becomes documentary work, visualizing becomes weak for site safety. Building Information Modelling (BIM) allows Engineers, constructor to visualise the job (work) site condition and recognize hazards safety. The use of Building Information Modelling (BIM) is considered in vital development in Architecture, Engineer and Construction (ACE). Using Building Information Modelling (BIM) updates can be done in plan, site status information, site layout, safety plan, work method of managing and visualization. Building Information Modelling (BIM) improves communication between employer and worker or vice-versa. The use of Building Information Modelling (BIM) and related software products as a tool, which would, amongst other things, assists in the review process and increase the level of safety on the jobsite and the surrounding area.

II. AIM & OBJECTIVES

A. AIM

The aim of this study is to develop a site safety plan on Prototype building using Building Information Modeling (BIM) in construction site work.

B. Objectives

1. To study the building information models tools and various factors affecting safety.
2. To identify the type of hazards on the site.
3. To develop the prototype building model in context of safety.
4. To implement the safety plan on sites.
5. To identify potential safety issues.

The above points will be studied by considering suitable case study.

C. SCOPE OF THE RESEARCH

The scope of the study is limited to visualization of study on Implementing Site Safety plan Using BIM in Construction project work. To develop the prototype building model to identify the safety measures and to visualizes both as static view and dynamic view.

D. PHASES OF METHODOLOGY

1. Phase 1- Study of Conceptual planning.
2. Phase 2- Hazards Assessment and Safety planning using BIM models with respect to suitable case study.
3. Phase 3- Implementation and validation application of BIM techniques.
4. Phase 4- Comparison of result obtained from case study and find out the Conclusion.

III. FLOW CHART FOR STRUCTURE OF THE PROJECT

The research process for this project is split into various phases, as presented in figure 1 each phase of the research is described in detail in this section.

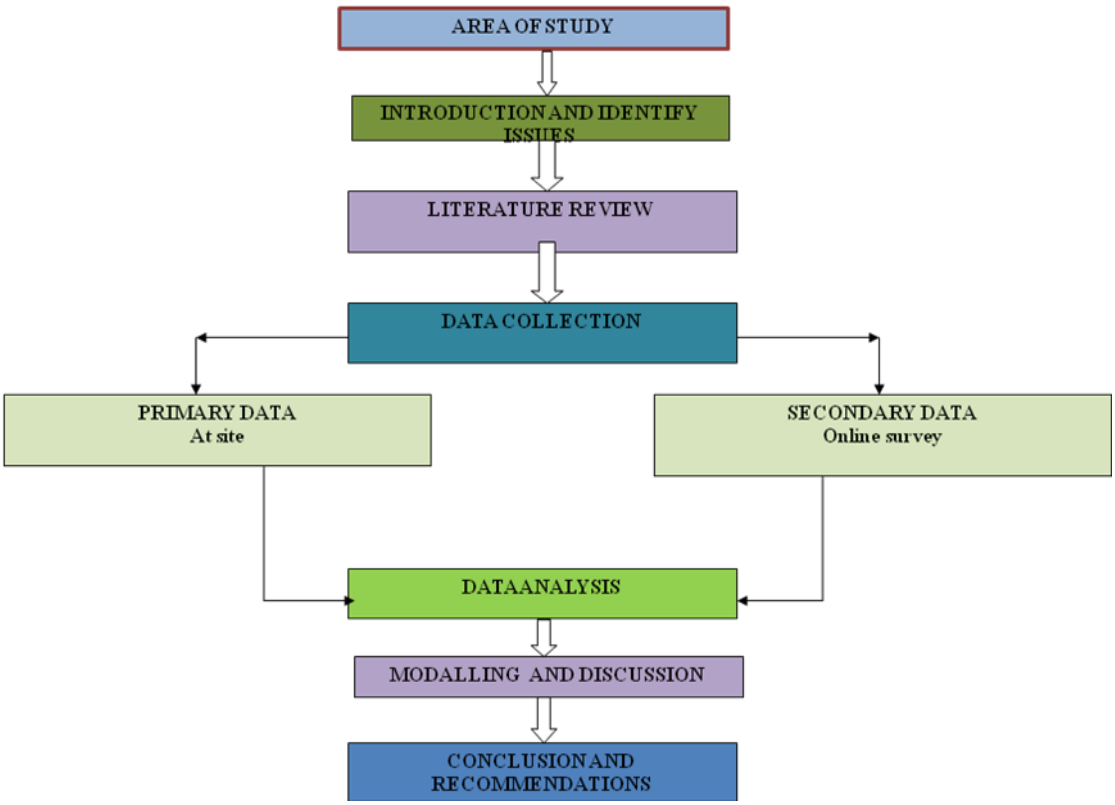
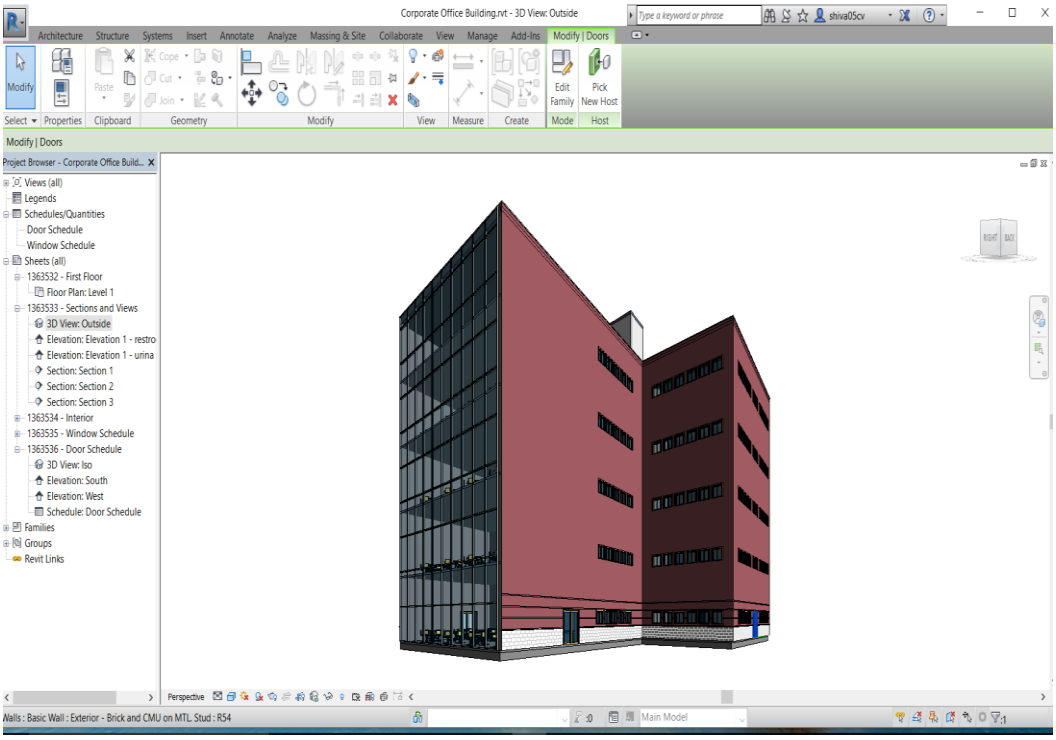


Fig. 1 Flow chart for structure of the project

IV. **AREA OF STUDY**

A. BIM in BIM Associate, Surat

The company in BIM Associate, Surat started to use building information modelling recently. The first architectural model of the 6th storey apartment house was made according to the existing drawings from the project documentation and used for volume calculation by estimation department as shown in figure 2.



Fig, 2 Prototype Revit building model of 6th storey apartment house created for this project"BIM Associate", Building Information Model of the object)

B. Prototype Building

Prototype building models are of product build to test a concept or process or to act a things to be replicated or real. There are various types of prototypes building such as Visual prototype building, Proof -of -principles, Forms study, uses experience and functional type building. But mostly visual prototype building is used in Building information model. Visuals Prototype building are those which captures the size and appearance but not the functionality of the intended design.

V. MODELING AND ANALYSIS

A. *3D Model*

The details model is been exported in the 3D Revit structure 2017 model. After the completion of floor and wall, the next step was to show the safety railing in the level. From the 2m and above floors plan railing safety was added to the levels. The safety prevention to been taken while execution of building to avoid the accident caused at work site. Safety railing is to safe guard the people working from high height/ higher working platform. The model the safety railing is created by the required parameter while execution of the work. The 3D visualization becomes more efficiency to analysis the safety while higher working platform as shown in figure 3.

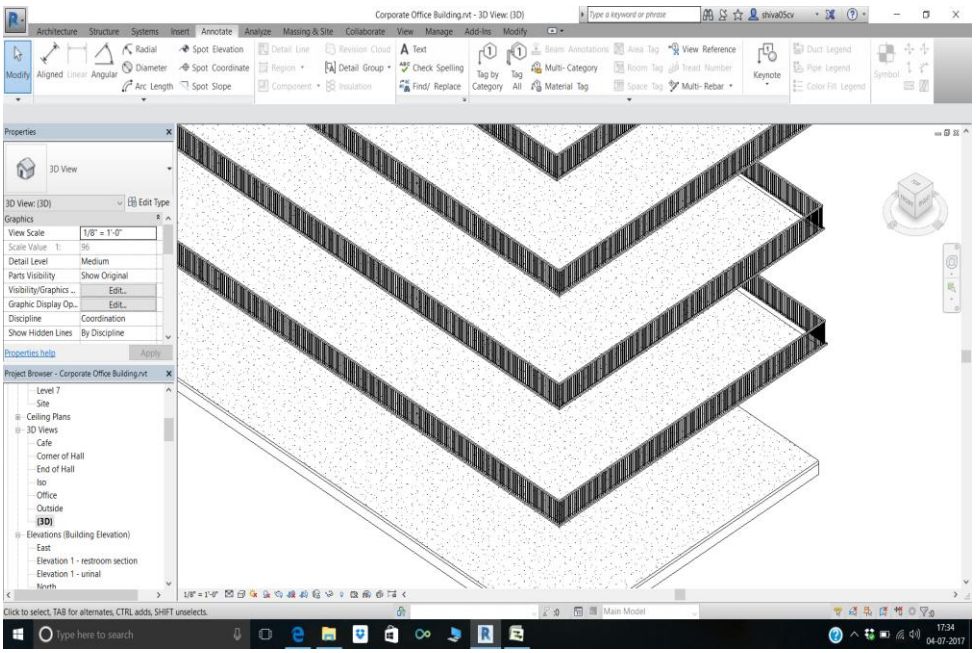


Fig 3 Safety railings added to all floors during construction

B. *Accurate Quantity Calculation, Schedule of Activities and Cost Calculation (4D &5D)*

Rectify the safety railing in Autodesk Revit to get error free design model for accurate quantity calculation is essential. After the 3D model created and added railings parameters, now the next process to estimate the model/ prototype building and there valuation has been done as shown in figure 4 and also time required to complete the project work as 4D and 5 D model as shown in figure 5. This process is carried out in Management software called as MS project. The difference of 3D modelling and 2D drafting were reviews. Furthermore, the granularity of objects including the decomposition of the elements was explored.

The workflow of AUTOCAD and REVIT BIM models were comparison, analyzed and validated the revit is more efficient then the documentary work done by AutoCAD work as shown in Table 1 and it Delivers projects on times and on budgets. Drafting Floor plans gives 10X speed(times) and Generating Interior Elevations of REVIT software works gives 5X speed(time) then the AutoCAD work.

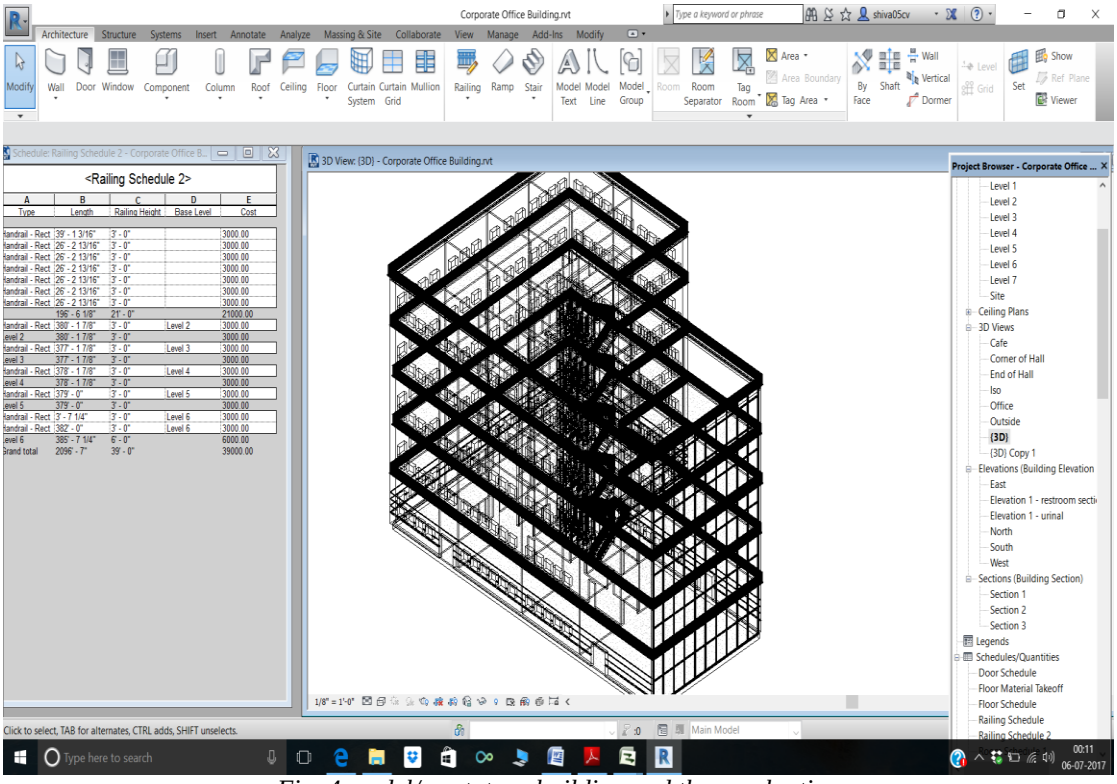


Fig. 4 model/ prototype building and there valuation

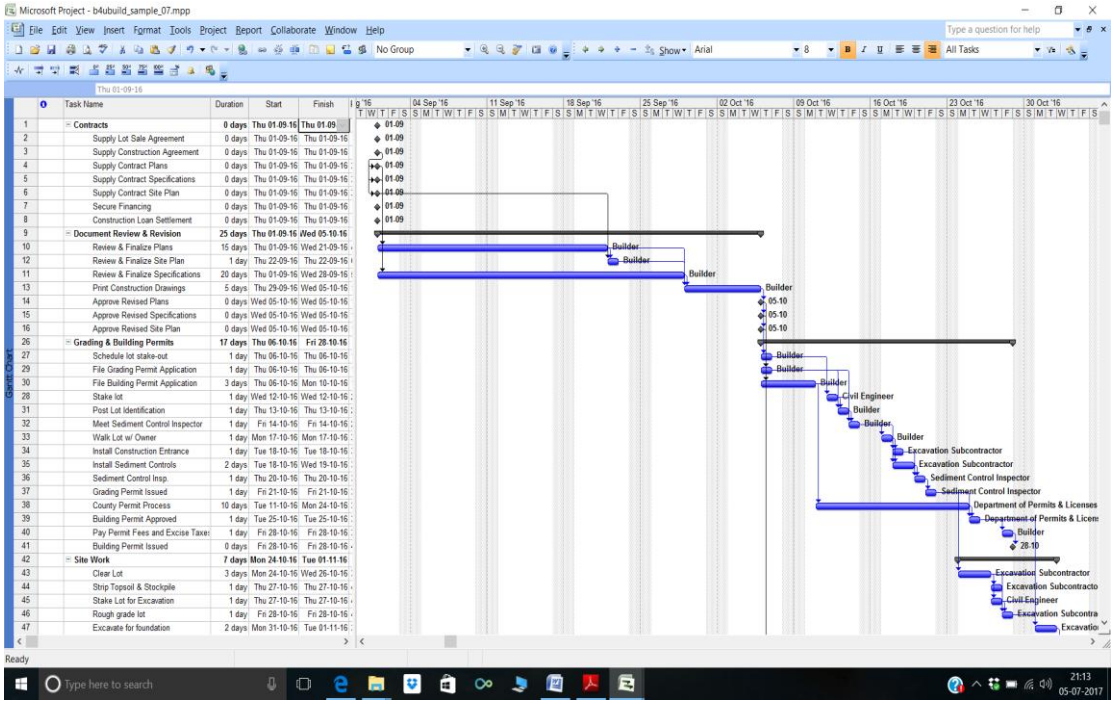


Fig. 5 Schedule of Activities and Cost Calculation

TABLE 2 .OBSERVATION ON 5D BUILDING INFORMATION MODELLING PRACTICABILITY

Stage	Process	Criteria	Observation
1	Collection and Input of Building Information into 3D model	Modelling effort Inter-operability Information output Limitation	Neutral Poor Good Non BIM-capable stakeholders will face obstacles to proceed to stage 2.
2	Input of information cost estimation	Modelling effort Inter-operability Information output Limitation	Good Neutral Good Cost information cannot be automatically updated by suppliers.
3	Input of information for Time Scheduling	Modelling effort Inter-operability Information output Limitation	Neutral Good Good Requires site knowledge and localized experience to have realistic output.
4.	Virtualisation of 5D Building Information Modelling	Modelling effort Inter-operability Information output Limitation	Neutral Good Good Modelling process still difficult when handling large amount of information

VI. CONCLUSIONS

In India the safety management is lacking in all forms, to get the better output in the construction site work, BIM should be implemented. Building Information Modeling is a modern tool which can improve the quality of the building projects on all stages.BIM helps to: reduce rework, reduce overall project duration, and reduce mistakes and errors Reduce cost of the project. BIM has quickly gained momentum as the technology brings greater collaboration and communication between project participants. To conclude, a critical review has been undertaken to summarise the existing literature, highlight the inadequacies and provide future research directions.

The stated goal of this research was to answer the questions when should BIM be implemented and why, what level of information is needed at each stage and who is responsible for it, and how to work collaboratively on a model(s) on construction projects and facilities. Although no exact dollar figure or project size is established for maximizing the benefits of BIM use, BIM is clearly intended to be used as a tool for Facility management, though there are few post-occupancy applications currently in practice.

As conclude in the modeling we have gone through the 3D, 4D and 5D model analysis, it shows that the model is better than the documentary work. In this model we also have gone through safety in construction work site. Cost has been calculated in the given model. We can conclude the economically reliable. During the construction better understand and communicate project risk, intent and options before a project is built. Streamline design tasks with discipline-specific tools that incorporate parametric controls, support engineering standards, and provide design validation rules. Evaluate constructability and identify design conflicts before construction begins. In the building construction project in sequencing and planning can also produce a 4D visualization simulation. By using BIM method 80% reduction in time to generate estimates. 10% saving on construction cost through clash detection. 20% saving through construction process simulation

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