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Building Information Modeling (BIM) 4D Technique Implementation in Residential Building Construction

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ABSTRACT

In the construction industry, Building Information Modeling is mainly seen as a catalyst for productivity and innovation. Project planning in the construction industry plays a vital role in the advancement of the development industry. As projects have become increasingly complex, there is an increasing concern about the concept of project complexity. Understanding the complexity of projects and managing contractors should improve their level of management as building complexity increases. In the construction industry, contractors have faced many challenges, including headcount, rising costs, inadequate risk management, unrealistic expectations/poor forecasting, limited skills and delay issues. The case study research approach is used to analyze the BIM tools. It includes the BIM 3D/4D/5D tools as the new method to build visualization model, perform clash detection, take off quantity, simulate construction process, graphic work schedule and finish on time of the project. This study aims to investigate construction project management through the application of the BIM tool. The BIM platform optimizes design quality and improves construction work efficiency, such as conflict detection, work schedule, quantity decrease, etc. The results are also useful for identifying research clusters and topics in the BIM community.

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I. INTRODUCTION

1.1 General Introduction

Construction project management becomes more complex as the construction industry evolves. There are differences in the project management results with different man agreement methods. In general, the construction project has many subcontractors to cooperate, such as piling, structure, architecture, mechanical and electrical (M&E), landscape and others. It is a challenge to coordinate for each subcontractor. The lack of cooperation leads to a reduction in work efficiency.

The construction problems need more advanced technology to improve work accuracy and work efficiency. BIM has emerged as an opportunity to transfer various construction information. It contains the interaction of architecture, construction, mechanical and electrical (M&E) and construction information. This technology has been developed from three-dimensional (BIM 3D) to construction time (BIM 4D), quantity survey (BIM 5D) and life cycle management (BIM 6D). Some BIM applications were gradually adopted in the construction industry, such as structural analysis, construction simulation, cost management.

A 4D model associates part of the 3D modeling with the planning of the project. This allows owners to view the project before construction of the project. Usually, civil engineering students learn to analyze the design of the projects and plan the construction of the project by reviewing the paper drawings or 2D drawings and by using CPM (critical path method) diagrams. By combining 3D models with 4D models it becomes one visualization and gives information to the owners, stakeholders of the project. Thus, visualization of the project improves communication and coordination between owners and contractors. The relevance of price is very high in the construction industry

where the success of the project is highly dependent on the planning of the project.

1.2 BIM-DEFINITION

- □ BIM is defined as "a model-based technology linked to a database of project information and a three-dimensional", virtual representation of the project.
- □ It is a strong collaborative process that allows architects, engineers, real estate developers, contractors, fabricators and other construction professionals to plan, design and build a structure or building within a single 3D model.

□ It covers,

1.Geometry

- 2.Geographic information
- 3.Quantities
- 4. Properties of building components.

1.3 CONCEPT OF BIM

- □ The BIM concept helps us to understand the conditions and its effects when a particular building material like a wall, slabs, etc. are planned to introduce in the structure.
- □ The BIM concept also helps us to understand the alternative solution of a particular element by comparing it to various other factors.
- □ The BIM concept helps us to understand whether the constructed building is profitable or loss.
- □ The concept of BIM provides us a simulation of a 3D model by connecting all the given information related to planning, construction, operating of the project.

1.4 ADVANTAGES OF BIM

- □ Cost and Resource Savings.
- Greater Efficiency and Shorter Project Lifecycles.
- □ Improved Communications.
- More Opportunities for Prefabrication and Modular Construction.
- □ Higher Quality Results.
- □ Improved productivity and quality.
- □ Increased co-ordination and construction documents.
- □ It simplifies the take-off quantity of the material.
- □ The planning of alternatives can be done in a much easier way.
- □ The problems related to safety now can be easily resolved.
 - > Who can take advantage of BIM



1.5 APPLICATIONS OF BIM

- □ The major application of BIM is that helps in saving the cost and time of construction
- □ The other application is that the building model can be changed according to engineered preference
- □ The other application is that it helps in the tracking of progress of construction.

1.6 EXAMPLES OF BIM SOFTWARE

Revit by Autodesk



AutoCAD by Autodesk



Tekla Structures BIM Software



STAAD Pro V8i by Bentley Systems



Google sketch-up



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E-tabs by CSI



Autodesk BIM 360



MSP



1.7 PROBLEM STATEMENT

- This project shows how BIM is implemented in construction. In this project the planning, analysis and design of 2D and 3D floor plan on G+3 residential building. Execution of the interior by means of software.
- Planning the object and placing the material in the model must be done carefully during model creation. Analyze the model, apply loads to the structure and find out if it accepts.
- Own loads, active loads and wind loads are calculated or analyzed using BIM to apply to the structure. The MEP work, mechanical, electrical and plumbing, is designed and analyzed by BIM.
- □ Scheduling of the plan is also done by BIM. Then the last phase, namely rendering and checking the plan.



1.8 Aim of the Project:

Building Information Modeling (BIM) 4D Technique Implementation in Residential Building Construction.

1.9 Objectives:

Following is the objective of the Project Objectives

- □ To collect the construction site data and prepare the layout of the proposed building using AutoCAD.
- □ The collected data met the requirements of the project. This data includes the drawings & specification of a building.
- □ Make effective use of building project data during construction, operation and maintenance.
- □ To display and share design studies of construction and calculate the estimated cost of the building.
- □ The main purpose of BIM is to improve project performance and produce better results.
- Reduce delays and errors & increase efficiency and productivity.
- □ Higher quality of performed work & Better communication in the project.
- □ Towards higher productivity and more accurate planning for the use of BIM.
- □ To reduce construction costs or material waste.
- □ To reduce the construction time of the building.

II. LITERATURE SURVEY

1. Monica.U, Ravi Kumar"Contrivancing 4d-bim In Metro Rail Project Using Power Project Software" JETIR April 2021, Volume 8, Issue 4.

The aim of this project is to overcome all types of delays and risks in Metro Projects using the new 4D-BIM tool Power Project with the Critical Chain Project Management concept over the other traditional methods and tools. And the aim was satisfised by the application and analysis of the real time problems associated in construction and management of Metro Rail Projects with 2 cases that is addition of buffer before actuals and addition of delays fragnets after actuals. These two cases have given real time solutions and it is proven automatically by the software where no human errors can be done. The 3D model, BIM, Scheduling, and the application of two cases has proven by giving new and real solutions to all the new risks and delays occurring.

2.Nehad ali khan, Niyaz ahmed shareef, Syed mohd hyder moosvi, Syed nemath uddin, "Comparison and Analysis of a Building with 4D Modeling" (IOSR-JMCE) (Mar. - Apr.) 2017

The research showed 4D modeling as a promising tool for construction planning. It gives us the positive impact and

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also the advantages that aren't able to achieve by the usage of the traditional methods of construction planning. The most foremost benefits of 4D modeling are found to be visualization of better construction work, easv communication between the different parties working on a project and helps in the increment of efficiency of the project. Implementation of 4D modeling helps in detection of errors and problems which could come up after starting of the construction hence in the management of cost and time of the project, besides this 4D modeling helps in the detailed planning of the project and presents a comprehensive view of even small sections of the project. Therefore, a more dependable and detailed work plan allows us to complete the project in assumed time and cost.

3.Harsha Vardhan Tirunagari, Venkatesh Kone "Simulation of Construction Sequence using BIM 4d Techniques" (IJRTE) ISSN: 2277-3878, Volume-7, Issue-6C2, April 2019

Usually, scheduling is done by using management software like MS Project and Primavera even though, Construction Schedules don't have good eminence in the construction industry due to its complexity and uncertainties. This study identified that the 4d simulation is to improve the preconstruction planning by visualizing the construction process in a regular interval of time. BIM in construction industry supports to achieve Integrated project delivery which involves all the people and stakeholders from starting stage to finishing stage of the project to get optimized results and that increases the value of the owner

4.Sonali Pandit, Er. Bhupinder Kaur, Er. Sandeep Salohtra"Building Information Modeling (BIM)-4D Visualization" (IRJET) Volume: 05 Issue: 01 | Jan-2018 BIM 4D Visualization technologies provide highly advanced or construction or industrial management skills to monitoring environment, in project scheduling and also used by project team for project control. The given task properly executed with planned and accurate dates are defined by Gantt chart Performa. Comparing with each other plans and dates the given status bar shows progress of work to the project team in a simplest form. 4D BIM gave actual representation of construction work and also provide information about construction plan.4D model include all construction activities ad also provide safety measurement against risk mitigation or actions. Design of 4D modelling software i.e., Autodesk Navisworks 2017 found very easy to adopt or learn which help AEC and construction industry for better outcome of construction project. Duration of case study also create few shortcomings for e.g., it required adequate training staff, highly skilled people, software's cost and also cost of software training program. Therefore, this review paper implements that 4D BIM model act as a promising tool in construction industry. The main aim of BIM 4D models is to provide better visualization at construction site, it is also helpful achieving accurate work plan, details, increased planning efficiency, provide communication between project and project team and also improved safety aspects.

5.Amor R."Surveying The Extent And Use Of 4d BIM In The UK" May 2016 http://www.itcon.org/2016/4.

The conclusion that may be drawn from this is that the benefits of 4D BIM are those related to understanding and

communication, rather than the technical aspects of assessing, creating, validating and controlling project timescales. Indeed, there was evidence of a degree of suspicion that over-reliance on accessible 4D technology could mask a lack of planning skill and experience, arousing fears similar to those aired in other disciplines, such as education (see Bennett, et al., 2008) and medicine (Goodwin, 1995). For the purposes of this investigation, the planning and control function has been divided into sub-elements on the basis that an overall improvement in the delivery of construction projects will require an improvement in each, or at least, some of these elements. Whether 4D BIM has yet provided, or in the opinion of planners, has the potential to provide such improvements was also a major focus of the study

6.Piyush Sharma, Sakshi Gupta, Lalit Kumar "A Critical Appraisal of Integrating 4D and 5D BIM into Construction Practice" Advanced research Publicationsb2017.

BIM is a growing area of research, integrating multiple information sources within the engineering, construction, fabrication and manufacturing industry. Construction business is rising with proficiency and innovation. Principally, BIM and its all dimensions (3D, 4D, 5D, 6D and 7D) are becoming globally recognized.

Some of the methods that are used to study time overruns within a 4D model require full automation. • For the full command on 5D BIM, engineers and planners should synchronize methods to regulate building modules and the features related with those modules for cost estimation.

7.P. Farnood Ahmadi and M. Arashpour "An Analysis of 4D-BIM Construction Planning: Advantages, Risks and Challenges" ISARC 2020.

The study identified some noticeable advantages, risks and challenges of using BIM/4D-BIM in Construction Projects. The research concludes that the adoption of 4D-BIM in construction industry is highly recommended to improve and facilitate off-site and onsite construction works. Shortening and streamlining the procurement, design, prefabrication and construction duration and process in the project schedule are the significant advantages of 4D-BIM integration in the construction industry. Using BIM/4D-BIM can reduce coordination risks, the fabrication cycle time and risks of programing in construction industry.

8.P.C. Charlesraj and T. Dinesh "Status of 4D BIM Implementation in Indian Construction" ISARC 2020

The study aimed at assessing the extent of 4D BIM adoption and capture the perceived benefits, barriers and drivers for 4D BIM. The target population for this study was the clients and contractors in Indian construction. One third of the participants responded to the survey and the general pattern in the response revealed that there is high level of awareness on 4D BIM among the clients and contractors in India. Also, most of them plan to use 4D BIM later (after three years) than sooner. It has been found that there is no statistically significant difference between the clients & contractors on their responses.

III. METHODOLOGY



Fig 3.1 Steps of Design Building

IV. ACKNOWLEDGMENT

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