REAL TIME 4D AND 5D ANALYSIS BY USING BUILDING INFORMATION MODELLING

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Abstract - *Building Information Modelling (BIM) is a method consisting creating, processing, handling and using a computerised visualization of physical and functional characteristics of building. The term 4D is intended to refer to the fourth dimension: time, means, 4D is 3D + schedule (time). The BIM extends this technique into 3 dimensional (3D) drawings in the three basic dimensional breadth (b), height (h) and thickness (d) with time as 4th dimension and cost as 5th dimension. BIM is a process of the development and use of computer-generated multi-dimensional models to simulate the planning, design, construction and operation of a facility. BIM ia an intelligent 3D model based process plays an important role in AEC industry. BIM in terms of modelling saves a lot of time and money comparing to traditional scheduling process.*

Key Words: **Real time analysis, 4D, 5D, BIM, Rendering, Simulation, Scheduling, Time and Cost overrun**

1. INTRODUCTION

Construction planning and scheduling are considered as integral and significant units of all construction project. The interpretation of a design to a construction schedule consist users interpretation and requires variations of data in different stages. The present planning methods are completely manual and time-consuming process. Current practices of construction project planning involve a number of approaches/skills that model dependencies and sequencing of project activities. There are some manual approaches like bar charts, CPM based network diagrams, and time-changes diagram. None of these techniques have the capability of modelling and visualizing both the sequencing and finishing the pattern of activities.

Building Information Modeling (BIM) is the documentation interaction including of data about various periods of any undertaking like plan, development, arranging, managing, office the executives and activity. It is one comprehensive documentation process gainful for functional representation, and development application, for example, assessing, planning and plan coordination. Principal benefit of carrying out BIM application is the visual coordination of the structure frameworks like preparing three dimensional models and it additionally recognizes the potential struggles between the structure frameworks such as clash detection work. By identifying the struggles, issues can be settled before sincere development which sets aside cost and time contributed.

1.1 BIM Software

Building plan and building data displaying (BIM) programming includes computer aided plan (CAD programming), items utilized normally inside the design and development enterprises. BIM software offers a model-based process for planning and supervision structures and frameworks, going past development drawings to produce a computerized representation of the useful properties of the workplace. Different items in this classification might be utilized for a scope of CAD purposes past structural plan, modelling of plan to get three dimensional structure etc.

1.2 Cost Overrun

A cost overrun, also known as a cost increase or budget overrun, involves unexpected incurred costs. When these costs are in excess of budgeted amounts due to a value engineering underestimation of the actual cost during budgeting, they are known by these terms called cost overrun.

Cost overrun= Actual Cost – Expected Cost

1.3 Time Overrun

It is the phenomenon in which the project gets delayed beyond its expected completion time due to certain difficulties i.e. more time is required to finish the project than initially planned. Causes:- Plans, specifications etc. are not received by the contractor in time.

Time overrun= Actual Time – Expected Time

1.4 Objectives

- Explain the ideologies of Building Information Modeling (BIM).

- Describe the features of a BIM model.

- To compare total cost and time difference between manual and BIM based estimation approach outcome.

- Explain applications for BIM in Commercial and Residential architecture.

- Explain the common tools and processes used in software design.

- To enhance project performance and produce better outcomes.

- To display and share design and viability studies for construction.

- To offer improved quality assurance and data exchange to process for more effective and inefficient design.

- To make effective use of data of the building project during construction, operation, maintenance.

2. METHODOLY

2.1 General

The typical work flow diagram of the real time analysis has been shown in the figure below
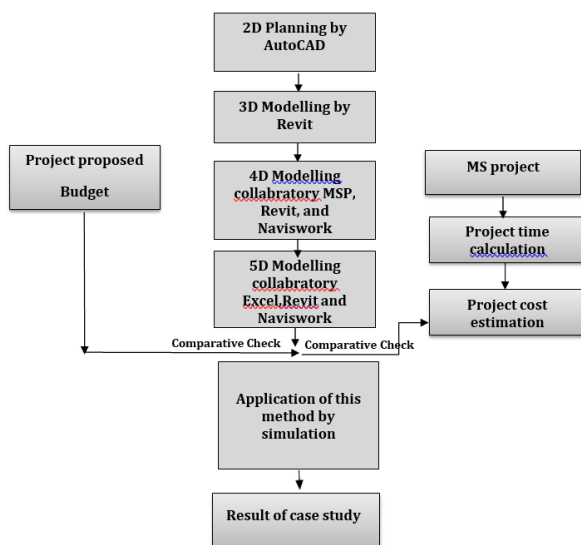
Fig -2.1: Methodology Flow chart

For this study of time and cost overrun, following software's were used in order to create an intellectual 3D model with detailed design, analysis and planning: -

- Autodesk AutoCAD
- Revit Architecture
- Microsoft Excel
- Microsoft Project

- Autodesk Naviswork

2.2 Autodesk AutoCAD

AutoCAD allows you to design and explore your theoretical design ideas, modify your designs using Autodesk AutoCAD tools and generate intelligent model documentation, transform your designs into 3D renderings.

Following are the works carried out in Autodesk AutoCAD

- Data collection from site

- 2D design using AutoCAD

The common structure plan is gathered and similar has been drawn utilizing AutoCAD software are shown below
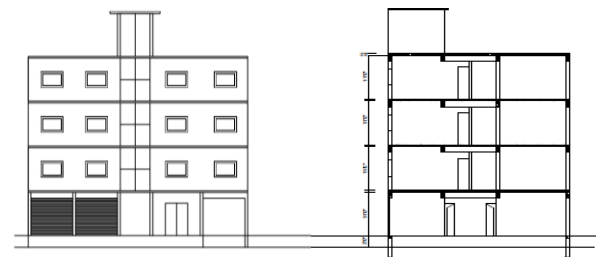

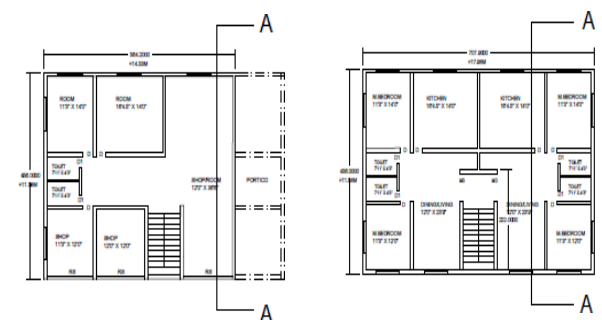**Fig -2.2:** Elevation of the building

Fig -2.3: Plan of the building

2.3 Revit Architecture

- Referring AutoCAD Plan

- Design 3D Modelling

➢ The plans are exported in DXF formats from AutoCAD to Revit

➢ The sketch of the building is made as per the plan

➢ Material of construction is selected from the material library

➢ Building visuals are created to check with the architectural visuals

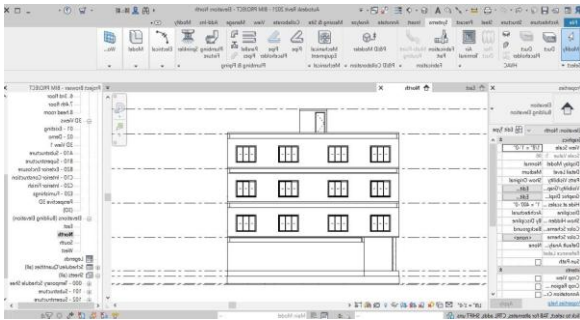➢ Further rendering of the Revit is carried out to produce a photorealistic image of the 3D model

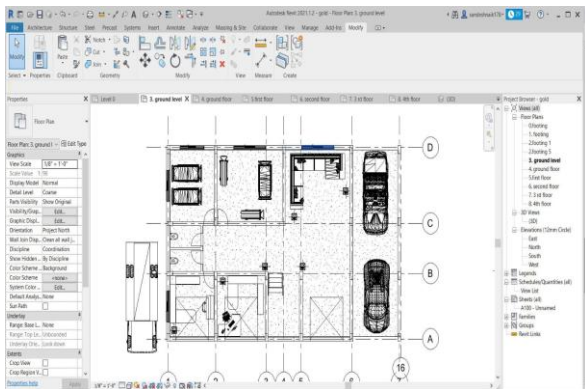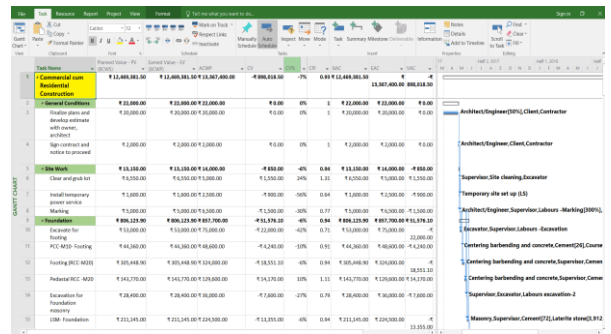**Fig -2.4:** Revit work Sheet-Front View

Fig -2.5: Revit work Sheet-Top View

2.4 Microsoft Excel

• Utilizing Microsoft Excel information has been inserted as CSV.

• By referring the data from Microsoft Excel further work used to be done.

• By classifying data using programming like Excel, data specialists and various clients can simplify information to see as data is added or changed.

2.5 Microsoft Project

• Using MSP budgets based on assignment work and resource rates are carried out. As resources are assigned to tasks and assignment work.

• The MSP gave us the program that calculates the cost, equal to the work times the rate up to the next level.

Fig -2.6: Microsoft Project Worksheet

2.6 Autodesk Naviswork

• The 3D plan from Revit which is in the (*.ifc) format is imported to Naviswork

• After schedule file is taken in the form of MSP, it is imported in Autodesk Naviswork and tasks are linked with building objects to get construction orders.

• With the Timeliner tool in Naviswork, linked model to an external construction program and saw a more accurate simulation of all construction tasks in a sequenced animation.
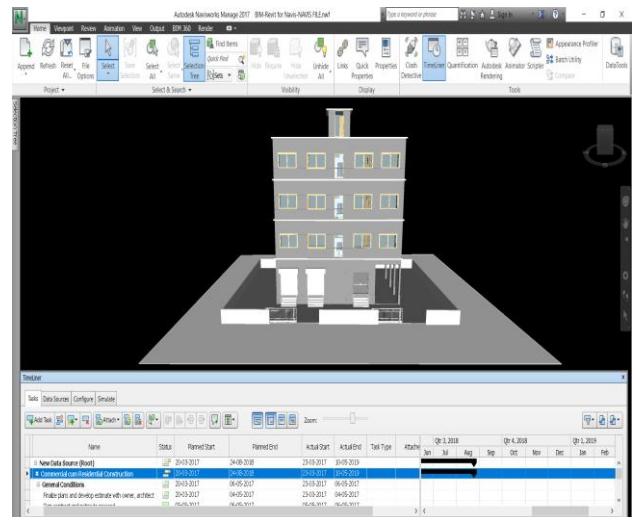

Fig -2.7: Autodesk Naviswork Worksheet

3. Results and Discussion

To complete the project and obtain the objectives various software are used such as Revit is used   such as Revit is used   for presentation, rendered views and quantification. For planning and scheduling the project Microsoft project is used, it is also used for resource allocation outputs in the form of graph and charts. Navisworks manage is used to trace the project planned vs

actual and Individual activities are analyzed with BIM software for both cost and time
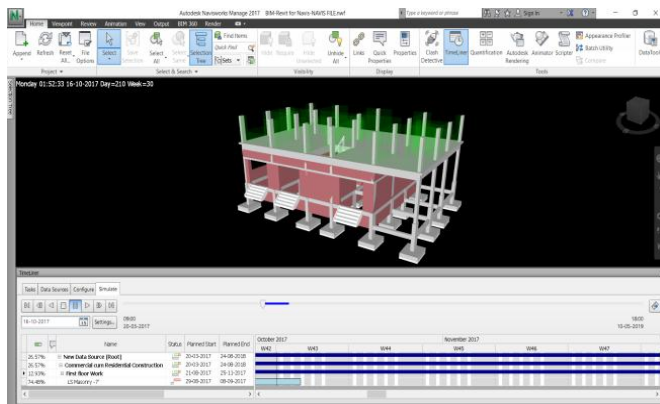
Fig -3.1: Tracing of project on date 08/09/2017

According to planned schedule at 08-09-2017 the 1st floor RCC work of column should be completed (1st slab to 2nd slab) including staircase but on this same day actually slab work of 1st floor (parking to1st slab) excluding staircase is completed and RCC work of 1st floor slab and beam is in progress. The overriding green color to identify structural elements in the project.

It is observed that this construction experienced cost and time overrun. If the construction was properly managed than 7.7 month and above 9 lakhs may be saved in case study construction project.

4. CONCLUSION

Project management plays an important role for the even completion of project. Now a day's selecting proper project management tool for the project is key of accomplishment to complete the project in specified time and in standard way. Building Information modeling has provided a new approach towards project management. It is an developing tool for project management which makes use of various tools for visualization, 2D planning, 3D modelling, quantification, cost estimation, resource distribution, and monitoring these tools results in to accelerating the construction process, effective resource management, 4D visualization of the construction schedule, identification of unexpected conditions and the resultant cost and securing more profit. These benefits made BIM a successful project management tool. These tools definitely improve each stage of the construction project.

In this case study the concept of BIM is simulated through 3D modeling, scheduling and cost estimation using BIM supporting software such as Revit, Microsoft Project and Navisworks Manage. Although developing 5D (cost) - BIM model with slight details is very time expensive, but then cost control process is very much beneficial with BIM than a manual approaches throughout the project succession. Simulation proves to be a powerful tool to find out critical areas of project with respect to time and cost, so it helps in decision making.

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