Implementation of BIM in Residential Buildings For The Optimization of Time, Cost And Quality

Mayuri H. Shirsath[1], Col B. K. Bhonde[2], Mrs. Ashwini R. Patil[3]
[1]Dept of Civil Engineering
[2, 3]Assistant Professor, Dept of Civil Engineering
[1, 2, 3] Dr. D Y Patil College of Engg. Akurdi, Pune

Abstract- *One of the most promising developments which the architecture, engineering and construction industries have achieved in the past few years is Building Information Modelling (BIM). BIM is used to construct virtual models of a building digitally. Every project is unique in the construction industry and each project is expected to be completed on time within the budget and defined scope. The overall planning, control and coordination of the project from the beginning to the end aims to meet the demands of clients and ensure the completion is reached on time within required quality standards and budget, integrated project design. Integrated project approach helps to improve bonding between different parties involved in a project and Visualization design approach improves project understanding and helps for clash detection at early stage of a project. The common issues can be faced by construction industry are time delays & cost overruns. This problem is mainly because of incorrect and insufficient inputs and lack of information sharing. BIM will definitely help to overcome these conditions in construction industry. This paper is going to concentrate on the influence of the BIM over time cost and the quality of the residential building project.*

Keywords- BIM, Delays, Visualization, Construction Project, Cost overrun

I. INTRODUCTION

BIM as an emerging technology has developed very rapidly in the past decade, and BIM technology has already started to benefit the designers with intelligent and model-based design and owners with a more feasible and accessible project, as inter-media between designers and owners, also start to deliver the project with BIM model. As stated in the previous section, the LOD will be increased as the project progresses, which means each involved party in the project needs to add information to the model based on its own preference. The perspective, two dimensions—time and cost will be added by after the models are completed. Since cost and schedule are two key parameters for the construction management process, it is essential to know if the information in BIM model can help the cost and schedule controls and the potential developments can be made on BIM technology for contractors.

The conception of Building Information Modelling (BIM) has existed since the 1997s while the comparable research and development happened throughout the late 1970s and early 1980s in UK and Europe. However, during the early 1980s, this method was described as "Building Product Model" and "Product Information Models" until the mid-to-late 1980 this method is renamed as Building Information modelling and is widely promote in the sector of Architecture, Engineering, and Construction (AEC) industry[1]. Building Information modelling (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decision during its life-cycle, defined as existing from earliest conception to demolition. BIM is an integrated process that allows professionals to explore a projects key physical and functional characteristic digitally before it is built. The characteristics of BIM are the components found in BIM model include data that described how they behave. For example, taking-off, energy analysis and specifications. In addition, data in BIM model are consistent and non-redundant such as changes to the components data are represented in all views of the components. Coordinated data also one of the characteristics in BIM model due to the model in BIM system are represented in a coordinated way.

II. LITERATURE REVIEW

The integration of 4D technology (3D + time) in the BIM for a better project implementation and planning is the base of the present work. After analysis of general theoretical requirements, the different possibilities of 4D BIM tools as well as the required are implemented, paying special attention to the opportunities, limitations and future scope. The workflow from the practical part is completed with the use of the following software: Autodesk Revit ® 2017, Microsoft ® Office Project 2013 and Autodesk Navis works Manage ® 2017 and Microsoft excel. These tools, which allow implementing the BIM methodology in the construction project, turn out to be really beneficial to satisfy and facilitate

many of the project management functions, both in theplanning and construction phase stated by Mr. Vineeth Raphael, Mrs. Jenifer Priyanka [1]

Many construction projects suffer from poor design and from inconsistent time and cost management from the industry. This situation has led to rethinking of the industry's performance and how it could be improved. Technology is breaking through design and management practices. Earned value management (EVM) enables better management of time and cost constraints. Building Information Modelling (BIM) is recognized to improve the planning and realization of a construction project stated by Ahmad Jrade and Julien Lessard[2].

The complete life cycle of the projects is visually modelled in BIM from the pre-construction phase, construction to the post construction such as operations and maintenance. Due to its advanced technology of 3D visualization and effective communication which results in accurate constructional procedure saving time and costs states by Thamilselvi P.1, Siva A.2, Abubakkar Siddiq [3].

It can be concluded that despite there are many improvements in implementation of BIM in environmental and economicaspects of sustainability, its potential impact on social dimension has not been explicitly explored hence further studies need to be undertaken in this area stated by Sahar Soltan[4].

Integrated project approach helps to improve bonding between different parties involved in a project and Visualization design approach improves project understanding and helps for clash detection at early stage of a project. The common issues faced by construction industry are time delays & cost overruns. This problem is mainly because of the inappropriate and insufficient inputs and lack of information sharing or communication. This tool facilitate with different cost related activities such as scheduling & monitoring of cost of a project**.** Shraddha Kulkarni [5].

Overall, the study found that the three most important drivers for BIM implementation are "Clash Detection", "Government Pressure" and "Competitive Pressure". The top drivers for non-users of BIM could be grouped under pressure from external sources while operational drivers were more important for users of BIM. States by Mike Browne, Clare McKeown,,Michael,Yohanis.[6]

III. THEORY ON BIM

A. INTRODUCTION OF BIM

BIM it gives a digital view. Models can be created also for visualization. 3D models help clients to understand project better and they can get realistic appreciation from the projects with visualization feature of BIM. On the other hand, possible design changes can be done at the designing stage of construction projects and since clients can understand project better with 3D models, necessary changes can be done before construction starts at field so that reworks, possible design changes and extension of project duration can be minimized.

B. Benefits of BIM

Benefits of BIM with the classification of its stages

Pre-construction	**During construction**	**Post construction**
1.Visualization-a.4dsimulation b.Design c.collaboration 2.Accurate and consistent 2d drawing 3.Quantity take offs or bill off quantities	1.Construction planning a.Construction documents b.Cost estimation 2.Clash detection Rework 3.Waste management	1.sustainability 2.Facilities and maintenance a.Management Maintenance scheduling information b.Replacement parts order information

C. Challenges of BIM

1. Hesitancy to adopt the new technology in the industry
2. BIM experts are not available.
3. Less interest of clients in the BIM
4. Return on investments
5. Lack of BIM knowledge
6. Installation cost
7. Software's and training
8. Lack of supply chain buy-in

IV. CASE STUDY

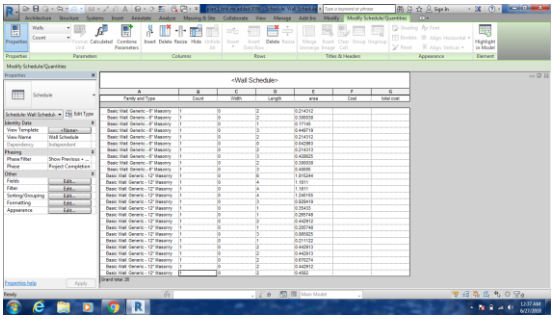
For the research the first case study was undertaken with the information :the project is actually placed in sus gaon, Mulshi, Pune. It's 10 storey residential building. It consist of 1000 sq. m area of each flat. Framing RCC and wall structure by using tradition method of construction

And in second case study the project was taken from My World My Pride Gut. No. 708 Opp. Airport Chikhalthana, Auranagabad.

In this thesis, a reinforced concrete structure of 9 storey apartment of residential building which has 1000+ flats and the . Each apartment has the floors having 4 flats. Each flat is having cost of about 50 lacs an. Each flat is having the approximate 1000 sq. feet area. As they have used the conventional method for the execution of the project work.

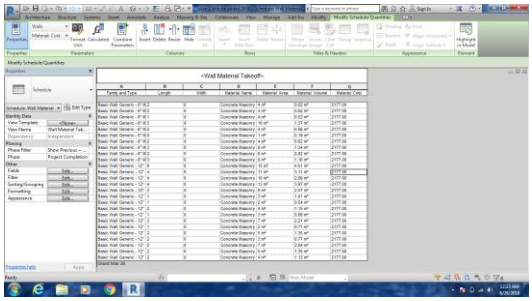
1. 4D

For the 4d scheduling all details are transferred to the excel sheets like some building items are taken in to the consideration for the research study of the BIM. The time factor is compared with actual site scheduling time.



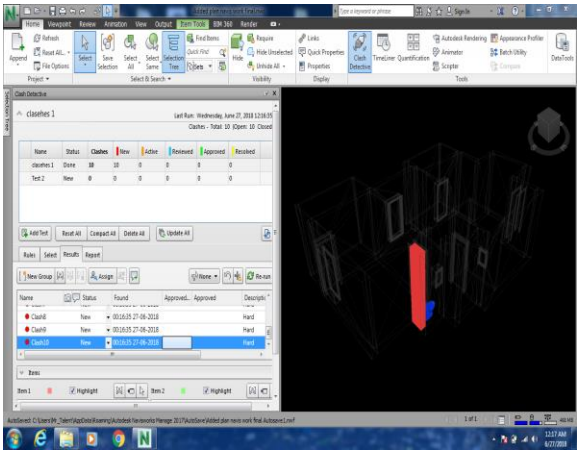
1. *QUANTITY TAKEOFFS by 5D MODEL*

The material take offs in the BIM we required the details of the materials required for the item.Some items are considered from the site to do the research study on the BIM use in material take offs. The cost added in BIM and the actual cost are considered to comparison purpose.



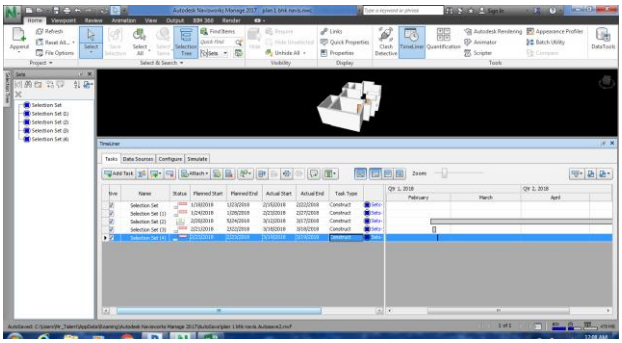
2. *Clash detection*

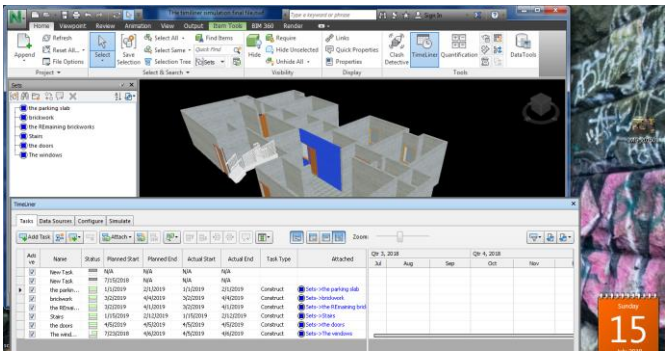
The two models are merged though the NAVISWORK 2017 to get clash detection between. The clashes found between the plumbing fixtures and the architectural model. The rework and the wastage costs are added to the total cost of the project which is identifies through the BIM process.



3. *Time liner and 4Dsimulation*

The details and the tasks are inserted according to the information in the NAVISWORK 201, to get the scheduling in the time liner and to get the simulation view to understand the phases of the site as per the time schedule to be completed.





V. COMPARISION BETWEEN THE TRADITIONAL METHOD AND BIM

Sr no	Traditional Method	BIM
1	Time consume	Quick
2	Human error	Accurate
3	No visuals	Digital view
4	Management issues	JIT works due to scheduling
5	No simulation	Simulation
6	Waste	No waste (JIT)
7	Schedule Overlaps	No overlaps
8	No material management	Material management
9	No Communication	Communication (assign work)
10	No Client satisfaction	Client satisfaction
11	Labour work	Less labour work
12	Rework	Less rework
13	Staff required	Less staff

VI. LIMITATIONS

For small scale projects BIM is not beneficial because the initial cost involved with usage of BIM is high. But, if used for large complicated projects BIM incurs heavy chunk of profit because of increased productivity. The qualitative benefits of reduced time overruns and lower change order cost are appreciable.[8]

$$\frac{\left(B-\left(\frac{B}{1+E}\right)\right)*(12-C)}{A+(B*C*D)} = first\ year\ ROI$$

a.
b. A= Cost of the hardware and the software (rupees)
c. B=Monthly labour cost
d. C=training time (months)
e. D=productivity lost during training (%)
f. E=productivity gain after training (%)

VII. CONCLUSIONS

The BIM model with cost expensive and minor time expensive it holds many benefits, but then cost control process is very much beneficial with BIM than a traditional method throughout the project cycle. The material holds the maximum cost in construction, the material take offs helps to reduce the cost in this project for some items about 10- 21 % and wastage of the material. The time liner Simulation proves to be a better application to find out critical areas of project with respect to time and cost, so it helps in decision making in cost control. It gives a clear view that how much work is to be carried out and client gets the clear view of the project. The clash detection helps to detect clashes in the design process where rework also holds about 2.2 to 12.4% of the total cost. BIM and also reduces the time because on site the execution will carry out with the recovered design.

REFERENCES

[1] Mr. Vineeth Raphael, [2]Mrs. Jenifer Priyanka International Journal On Engineering Technology and Sciences – IJETS™ ISSN (P): 2349-3968, ISSN (O): 2349-3976 Volume 2 - Issue 5, May 2015
[2] An Integrated BIM System to Track the Time and Cost of Construction Projects: A Case Study Ahmad Jrade and Julien Lessard Received 25 June 2015; Revised 28 September 2015; Accepted 27 October 2015
[3] BIM – Evolution and Emerging Research Trends Thamilselvi P.1, Siva A.2, Abubakkar Siddiq A.1 International Journal of Advanced in Management, Technology and Engineering Sciences Volume 7, Issue 11, 2017 ISSN NO: 2249
[4] Sahar Soltani : World Journal of Engineering and Technology, 2016, 4, 193-199 Published Online May 2016 in SciRes. http://www.scirp.org/journal/wjet http://dx.doi.org/10.4236/wjet.2016.42018
[5] Shradha B. Kulkarni1 .International Journal of Engineering Research and Technology. ISSN 0974-3154 Volume 10, Number 1 (2017) © International Research Publication House http://www.irphouse.com
[6] Mike Browne, Clare McKeown, Michael Yohanis www.itcon.org - Journal of Information Technology in Construction - ISSN 1874-4753