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3D, 4D and 5D of Buiding Information Modeling for Real Estate Projects

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Abstract – Now a day in India, Technology is changing rapidly in construction industry as well as Government is also forming new laws for real estate.

This paper tells about, How Building Information Modeling (BIM) is useful for implementing the RERA (real estate and regulation act). Under real estate and regulation act, builder or developers have to submit lot of information to government. This information we builder or developer have to preserve for future use but by use of BIM it is very easy to save data and to make virtual model of whole project which is to be executed. Project duration and cost are two major factors in execution of project. With the use of building information modeling, both of these factors can be optimized.

Keywords— RERA, Neviswork, Synergy

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INTRODUCTION

Building information modeling is a system of softwares which are combined for synergical process in construction industry. Normally in construction industry, we have project life cyclein which contains four phases these are Iniciation,Planning,Execution and closing.Building information modeling canbe used at every of phase of the construction.

At iniciation stage, we do all documentation work and feasibility study also we choose team for project. Building information modeling is use for all documentation saving and presenting authorities.As we know that Government of India passed Real Estate and Regulation act (RERA) in which builder or developer have to submitte each and every detail of the project.All sanction plan should have submite with details common amenties,with FSI details also structural drawing should be submited.Certificate from Charterd account submittion also made mandatory

By enforcement of Real estate regulation and development act it is clear that builder or developer have very much problem to save and document also if some changes done in project, those changes Builder have to submite to RERA. Building information modeling is one stop solution for all these problems, it is 3D virtual modeling of a building project which covers all aspects of the building architecture ,planning,execution and maintianance after construction.

Building information modeling covertes 2D model into 3D drawing. After coverting into 3D model,scheduling is done in management softwares like Microsoft project planinning, prime vera or Microsoft XL also quantities will be taken off from Quantity takeoff software then 3D model (architectural) model, 4D (schedule) and 5D (quantity take-off) are merged in Autodesk Neviswork software where Architectural model will be simulated with schedule and quantities. After merging in autodesk neviswork , if we do changes in architectural model then schedule will automatically changes and quatities also. Building information modeling (BIM) is an intelligent 3D model based process that gives in architecture engineer and construction professional the insite and tools to more efficient plan design construct and manage the building and infrastructure. BIM is a complex multiphase process that gathers input from team members to model the components and tools that will be used during the construction process to create a unique perspective of the building process. Building information modelingis very popular in various countries of the world. In United kingdom(UK) it is mandatory to submite Building information modeling data to

government.So that it will be easy for governmet to assese that submited data.

What is BIM

BIM is a complex multiphase process that gathers input from team members to model the components and tools that will be used during the construction process to create a unique perspective of the building process. One of the key yields of this procedure is the Building Information Model, the advanced portrayal of each part of the manufactured resource. This model draws on data collected cooperatively and refreshed at key phases of a venture. Making an advanced Building Information Model empowers the individuals who interface with the working to improve their activities, bringing about more noteworthy entire life esteem for the advantage.

LITERATURE REVIEW

1. "Solutions for Scalability in Building Information Modeling and Simulation-Based Design", - by Sixuan Wang, Gabriel Wainer, Rhys Goldstein, and AzamKhan. 2014.

In this paper it is deserved that the BIM technologies have widely adopted in the Architecture, Engineering, and Construction (AEC) industry. At present, there are numerous BIM software applications. The existing simulation processes are not fully integrated into the design life cycle. Various scalability issues have arisen when integrating standard BIM tools and simulation software. In fact, the building design and simulation are two independent domains. To solve the first two issues the authors introduced a concept of "3D to nD Modeling", encouraging designers using multi-issues (specific domains) of design information to reduce the uncertainties and realize true "what-if" analysis. One solution is to use Model View Definitions (MVD) to facilitate automated querying from the IFC model, which is a subset of IFC. However, MVD is dependent to its implementation, and an IFC model may not cover all needed simulation information. Most modelling and simulation methods run on single user workstations which normally require too much time for installation and configuration of all the software and dependencies needed for simulation. It is better to remotely access simulation resources with web services, improving scalability (e.g. accessibility, availability and interoperability). With distributed simulation technologies, simulations can be executed on distributed computers via communication networks, which can further speed up the execution time.

2. Advantages and Challenges of Using BIM: a Cost Consultant's Perspective", 49th ASC Annual International Conference Proceedings - by Niraj Thurairajah, DanGoucher. 2013.

The introduction of BIM has been brought about due to a requirement for increased sustainability and productivity within the construction industry. BIM is considered as a means of providing this through an interoperable model, serving as "an integrated and coherent information management strategy.

It is hoped that this will work to reduce industry fragmentation and provide a smooth flow of information throughout the planning, design, construction and operation phases. BIM as a tool can be used throughout the lifecycle with the intention to improve collaboration between stakeholders. Design models overlaid in software that can detect clashes and encourage quick and easy sharing of information, by bringing together the work of various disciplines, through a centralized model. This resulting model is a three dimensional digital representation of a facility, which should allow for reliable decision making throughout its life time. BIM represents a move away from traditional two dimensional design practices, as models are developed through the combination of 3D graphical modeling, 4D time modeling and 5D cost modelling.

3. Building Information Modelling: How it can Benefit a Modern Construction Project in a University Setting - by William Michael Duke, Philip W. Johnson,Committee Chair Gary P. Moynihan Timothy A. Leopard, 2013.

This Paper focuses on the current literature dealing with multiple aspects of the construction industry. More specifically, the literature review centres on the evolution of the construction industry, the interpretation of trends compiled from historical construction data, and the inefficiencies of current industry practices. Construction has always played a vital role inthe advancement of human civilization. While the first structures were very simple shelters to protect humans from the elements, they likely required minimal collaboration. The earliest large-scale structure that would "require organization and capacities beyond the handicraft and physical strength of a few men" is that of a massive round Neolithic tower discovered in Jericho. The 10'x10' stone tower would have required a preliminary building plan, organized labour force, and skills in transporting such massive boulders. This tower is the earliest evidence of an evolved construction process.

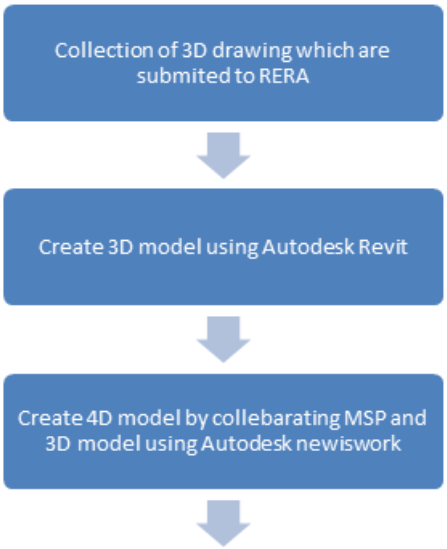
Due to the increasing complexity of modern construction projects, what were small deficiencies in the past have now compounded into even larger problems. These problems have not gone unnoticed, and six numerous studies have been performed with proposals to address the declining performance of the construction industry. One such analysis was performed by the U.S Department of Commerce, Bureau of Labor Statistics and compares the

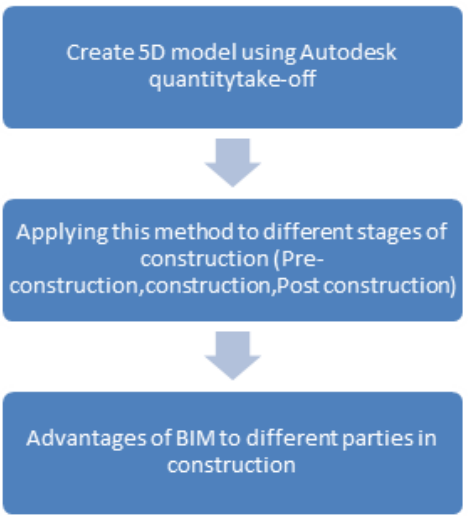
efficiency of the construction industry to the efficiency of all other nonfarm manufacturing U.S. industries from 1964-2003. This study reveals an obvious flaw in the construction industry. While all non-farming manufacturing industries more than doubled their productivity during the duration of this study, construction actually declined to around 80% of its productivity in 1964. While various factors can be blamed for this occurrence, the concern and need for improved efficiency within the construction industry still remains.

4. RERA 2016- A Game Changing Step In The Real Estate Sector, Vasundhara Patil 2017

This papers discuss about the real estate Regulation and development act 2016 it also discuss about the important provisions of the RERA act 2016 and impact on the various stake holders Also it discuss about the limitations of the RERA. The act makes it mandatory on all to register projects above 500square meters or eight apartments inclusive of all phases with RERA. For on-going projects which have not received completion certificate on the date of commencement of the Act, will have to seek registration within 3 months. It will help establish state-level Real Estate Regulatory Authorities (RERAs) to regulate transactions related to both residential and commercial projects and ensure their timely completion and handover. Appellate Tribunals will now be required to adjudicate cases in 60 days .These are some key features of RERA which are discussed in this papers.

METHODOLOGY :-





Data collection

General Detail of case studies

Case study - I

1. Site location :- Narhe, Pune
2. Type of structure :- R.C.C (Residential)
3. Floors :- 21st floor
4. Plot Area :- 8146 Sq.ft
5. Built up area :- 44198 Sq.ft

Case study – II

1. Site location :- Kolkata
2. Type of structure :- R.C.C(Commercial)
3. Floors :- 31st floor
4. Built up area :- 26000 Sq.ft

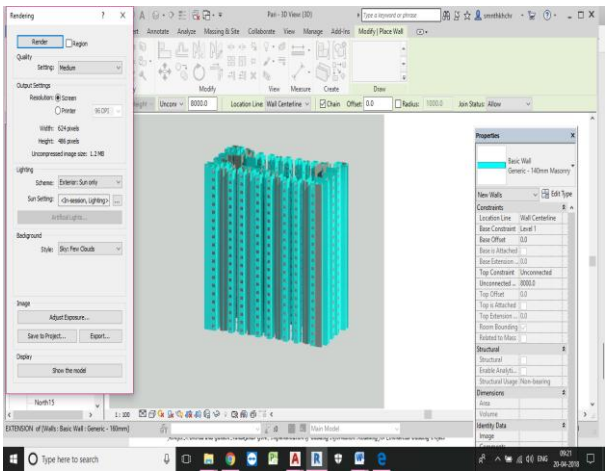
Following key data was collected for research

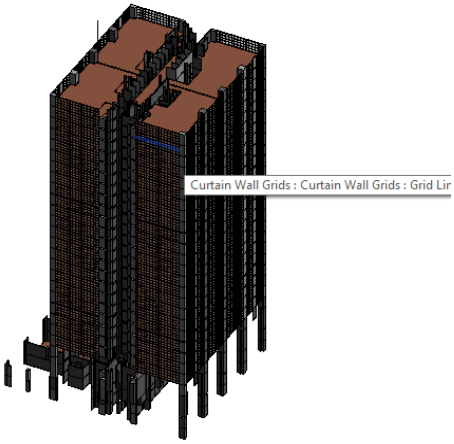
1. Architectural Plans
2. Structural Plans
3. Mechanical Electrical and Plumbing Plans
4. Tender Specifications
5. Microsoft Project
6. Monthly progress reports

Analysis of Data

3D Model (i.e. architectural model)

The 3D model was made by using Autodesk Revit 2016, view as follows





Observed necessity of BIM in construction project by different parties

1. **Clash Detection**: - One of the common problems of different disciplines plans for a construction project is the geometrical design inconsistencies. This issue happens when there is an overlap between the plans of different disciplines. Using BIM, it would be possible to bring the plans together and detect the clashes. Modifying the aesthetic problems is another possibility of this visual checking.

2. **Constructability**: - Using BIM, it would be possible for teammates in a project to review and handle constructability issues and (if needed) promote issues into RFIs. In addition, visual information can be provided from a vantage point to show the problems. This visual information accompanying markup allows further investigation for finding solutions and, thus, mitigates the risks.

3. **Analysis**: - Helping the project managers, designers and engineers in doing more analyses and enabling better decision making is another aspect of BIM. By linking the building information models to appropriate tools, it would be possible to analyze the energy consumption of a construction project and then find better solutions such as changing materials and orientation, mass and space, etc. Moreover, light, mechanical and acoustics analyses are also available to be performed by BIM.

4. **Time & Cost Estimation (4D & 5D)**:estimation are other features of BIM which enable project managers to visualize the construction project at any point in time and have a clear understanding of project phases. Time and cost estimation, which are generally called 4D be properly utilized in the first stages of a project and facilitate the decision making process with minimum cost and time needed. Furthermore, BIM has the capability to simulate the various alternatives for a construction project and hence he project managers and executives to reliably predict the consequences of their decisions.

5. **Integration**: - The project team can deal and interact with a unified model when a composite model is built from an amalgam of various disciplines' models. Having and through the different phases of a construction project, BIM can coordinate the design, analysis, and construction activities on a project and, therefore, results in integrity of projects.

6. **Quantity Take-off**: - Quantity takeoffs in a BI very helpful for the project teams and managers to analyze their decision and have a clear and reliable insight to various alternatives in the design phase or even throughout the project lifecycle. Since there is a possibility of integration BIM model and a database containing cost estimation, an accurate estimation can be obtained faster. Moreover, these takeoff items can be used easily in procurement procedure.

7. **Element Based Models**: - Since the BIM models generally are composed of objects- and not geometries, such as line, surface, etc.-the whole model can be divided into a specific number of smaller objects. This breakdown makes it possible to have a defined and clear scope of projects. The distinction between the elements will result

in a better management design, estimation and construction.

8. **Collaboration and Team Building**: - Collaboration and team building is another key factor for BIM success on construction projects. All efforts made by various specialties on a project are unified and applied to one model. This results in direct correspondence and team building. All discipl on a unified model as a team and have an effective collaboration during a project using the BIM concept.

9. **Communication** :- The Nature of a unified model to input, modify and analyze the data in BIM models will improve communication and collaboration between all parties involved on the construction project including project managers, architects, engineers, and contractors. These unique building models facilitate the communication throughout the project and lessen the disputes between different parties

The Benefits of BIM

When we consider BIM, we frequently consider better outline coordination and enhanced constructability. Be that as it may, the genuine esteem can come after handover, when the proprietor or office chief gets an entire and precise arrangement of data. Significantly more than that, BIM gives an arrangement of interrelated and cross-referenced data. For instance, protests in the model are connected to related data including manuals, determinations, appointing information, photographs, and guarantee points of interest. This enables the proprietor or office director to effectively and precisely deal with the benefit. Since 75% of the cost of an office is brought about after handover, unmistakably the advantages of BIM keep on occurring after outline and development have been finished. In India, the BIM application is not widely practiced till now has scope to use this technology in a much wider scale. In near future BIM is expected to change the whole scenario of Architecture, Engineering and Construction (AEC) industry. The existing infrastructure at present is sufficient to cater to the needs of only two-third of India's population and the quality of this existing infrastructure is too poor to withstand natural calamities. So, there is a greater need for better and more infrastructure facilities in near future. BIM is likely to emerge as one of the most revolutionary advancements that would transform the Indian real estate and construction sector. According to a recent McGraw-Hill Construction Report (2012), BIM adoption in the USA expanded from 49% in 2009 to over 71% in 2012. In the UK, the government introduced a progressive program for mandated use of fully collaborative BIM for government projects by 2016 to reduce project delays and cost overruns as part of the overall economic development (UK Government, 2011). In Singapore, the government provides BIM funds to promote a broader usage of BIM technology (Singapore Government, 2013).

Building Information Modeling (BIM) is the documentation process consisting of information about different phases of any project like design, construction planning, construction, facility management and operation. It is one holistic documentation process beneficial for operational visualization, and construction application such as estimating, scheduling and design coordination. Main advantage of implementing BIM application is the visual coordination of the building systems such as MEP (Mechanical, Electrical, and Plumbing) systems and it also identifies the possible conflicts between the building systems. By detecting the conflicts, problems can be resolved before actual construction which in turn saves money and time invested.

To compare BIM and conventional methods :-

Sr. No.	Point of Focus	Conventional Method	BIM
1	General Project management approach	Huge amount of data hence mistakes, duplication, losing data and wasting time	Just nice and easy for getting desired data
2	Claim analysis and dispute resolution	Very hard to prove who is responsible for the delay and required so much time and money.	Very easy to prove who is responsible for the delay and what is the expected outcomes in the future
3	Baseline Vs Actual analysis	Bar-chart comparison is tedious	Visual comparisons in few minutes video
4	Planning and scheduling	Only schedule and bar-chart	Link your schedule to the 3D model, for better understanding of the project
5	Cost of operation	Low initial cost but can lead to heavy constructional cost.	High initial cost but can recover cost in first few months.
6	Construction progress tracking and control	Inaccurate layout colouring and progress representation	Accurate layout colouring Dynamic progress representation

CONCLUSION

Building information modeling compile data received from various sources and gives the appropriate information at a desired level, as it improves accuracy, Increase Efficiency, Better visualization and documentation, Single and integrated information resource, saves time and energy, reduces collisions but on the other hand the cost of hardware, software and training is high, Transition from Drafting to Modeling and compatibility pushes it to the back foot. Construction projects are getting more complex day by day and it is difficult to manage

them with the traditional methods, hence Building information modeling is becoming need of the hour for large numbers of projects, so as to the Commercial Building Project. The comparison between BIM and conventional methods were done on following aspects and BIM stands at better position, Planning and scheduling, Baseline Vs Actual analysis, construction progress tracking and control, Claim analysis and dispute resolution, General Project management approach, Cost of operation. 3D Model (i.e. architectural model), 4D Model (i.e. 3D + Scheduling) and 5D Model (i.e. 4D + Quantity Takeoff) were successfully prepared and was helpful to observe the different aspects of the subject Commercial Building Project. The necessity of BIM in construction project for different parties were discussed which are Clash Detection, Constructability, Analysis, Time & Cost Estimation (4D & 5D), Integration, Quantity Take-off, Element Based Models, Collaboration and Team Building and Communication.

Later the use of BIM was analyse at various stages of construction which were pre-construction, construction and post-construction stages and received various outcomes such as improper consideration of column cap, difference in the planned quantities and the actual quantity, clash between the electrical, firefighting and plumbing lines, large number of RFI (Request for Information), material procurement as there was alteration and modification.

Finally we can conclude at present stage it hold a large numbers of solution ahead and its importations spreads day by day and with more parties accepting the building information modeling as an integral part of project.

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