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BIM for Construction Industry in India

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Abstract :- The design communication is gradually being changed from 2D based to integrated 3D digital interface. Building Information Modeling (BIM) is a model-based design concept, in which buildings will be built virtually before they get built out in the field. Presently two dimensional drawings on which conventional construction is based is very much time taking and cumbersome. This is the source of some major shortcomings in the construction industry. By transforming the quality of information used in building industry, BIM aims to change construction practice completely. After describing and explaining these problems, the way in which BIM promises to provide solutions is examined in detail.

Keywords: - Building Information Modeling, Building Performance Analysis, Construction Industry.

I. INTRODUCTION

It is a new approach to building design, construction, and management which has changed the way industry professionals worldwide think about how technology can be applied to building design, construction, and management. Building information modeling supports the continuous and immediate availability of project design scope, schedule, and cost information that is high quality, reliable, integrated, and fully coordinated. BIM allows to fully and truly construct a building virtually, and in detail. During the BIM-design phase the materials not only can be selected and placed to model the finished structure including concrete slabs, rebar, steel structure, wall and ceiling components, plumbing and electrical fittings but also can be tested for all such parts of conflicts (clash detection) to ensure everything completed together perfectly.BIM is, essentially, the intersection of two critical ideas:1.Keeping critical design information in digital form makes it easier to update and share and more valuable to the firms creating and using it. Creating real-time, consistent relationships between digital design data with innovative parametric building modeling technology can save significant amounts of time and money and increase project productivity and quality. The National Institute of Standards and Technology (NIST), reported (NIST, 2004 (2)) that the lack of adequate interoperability cost the U.S facilities industry about $15.8 billion per year. In India, the BIM application is not widely practiced till now has scope to use this technology in a much wider scale

II. BUILDING INFORMATION MODELING

The building information model is a project as well as a process simulation. Drawings produced using BIM supported software's are not of manually coordinated lines, but interactive representations of a model. The changes made in this Model are automatically coordinated throughout the project, which eliminate the coordination mistakes, improve overall quality of the work.BIM simulates the construction project in a virtual environment. With the use of Software package, the simulation done is very close to actual space. Virtual building implies that it is possible to practice construction, to experiment, and to make adjustments in the project before it is actualized. Virtual mistakes generally do not have serious consequences, provided that they are identified and addressed early enough that they can be avoided "in the field" (the actual construction of the project). When a project is planned and built virtually, most of its relevant aspects can be considered and communicated before the instructions for construction are finalized. The use of computer simulations in the building construction field is revolutionary. Various manufacturing industries have been very successfully applying simulation techniques for decades.

Many construction companies have now also been successfully applied similar techniques to their building projects.

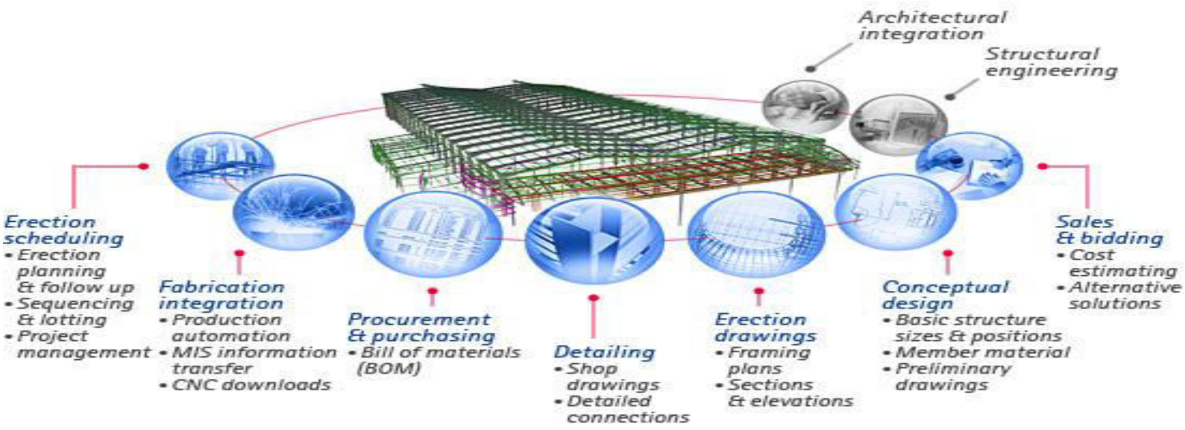


Fig. 1: Building Information Modeling

III. BIM & CAD

The main differences between BIM and Computer Aided Design (CAD) are that CAD system is usually 2D document, which are created separately and have no intelligent connection between separately created documents. In CAD, two lines represent a wall. In BIM, wall is created in the form of an interactive tool, which has its own properties like width, height, bearing or non load bearing virtue, demolished or new, interior or exterior, fire rating, and materials (such as boards or brick) etc. The BIM platform assembles all information into one location and cross-links that data among associated objects. There is no linkage between the data created by CAD. Efficiency of BIM in comparison to CAD is being referred in Table.

Table 1: Comparison between BIM & CAD

Task	CAD(hours)	BIM(hours)	Hours saved	Time saving
Schematic	190	90	100	53%
Design development	436	220	236	50%
Construction Documents	1023	815	208	20%
Checking and Coordination	175	16	159	91%
Totals	1824	1141	683	

Benefits of BIM implementation for infrastructure development projects include:

1. This supports an increased control over the project execution and management, further enabling clash detection and visual analysis
2. Costs and schedule risks can hence be mitigated with real time assessment of data and the interdependencies
3. Visual representations that are easy to understand and analyze, and an expedited delivery process enables fast approvals and better stakeholder coordination
4. Additionally BIM also enables and ensures detailed and positively better documentation for infrastructure projects for further maintenance, rework and repair.
5. BIM documentation, scheduling and cost estimation also supports supply chain management and logistics.
6. Improved communication and hence clarity of design intent for all the involved stakeholders, thus enabling them take better and informed decisions
7. BIM Highlights the importance of information and uses it across the project lifecycle. Accurate information, enables improve the quality of work and productivity of all teams and disciplines

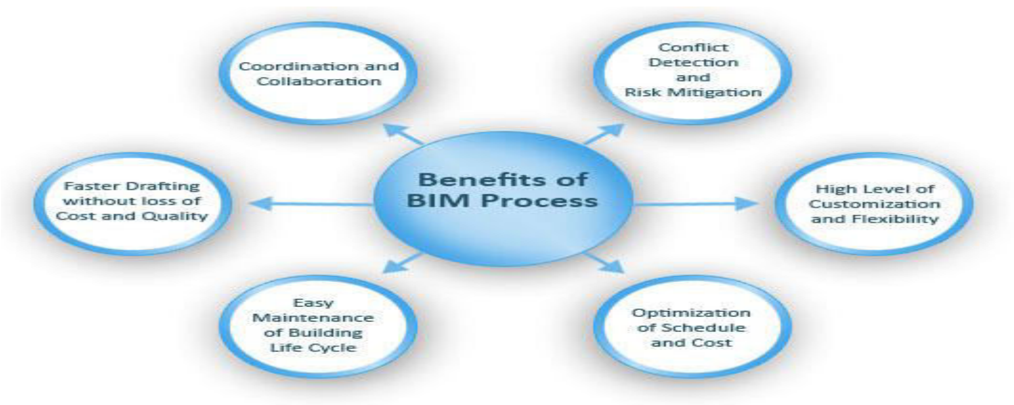
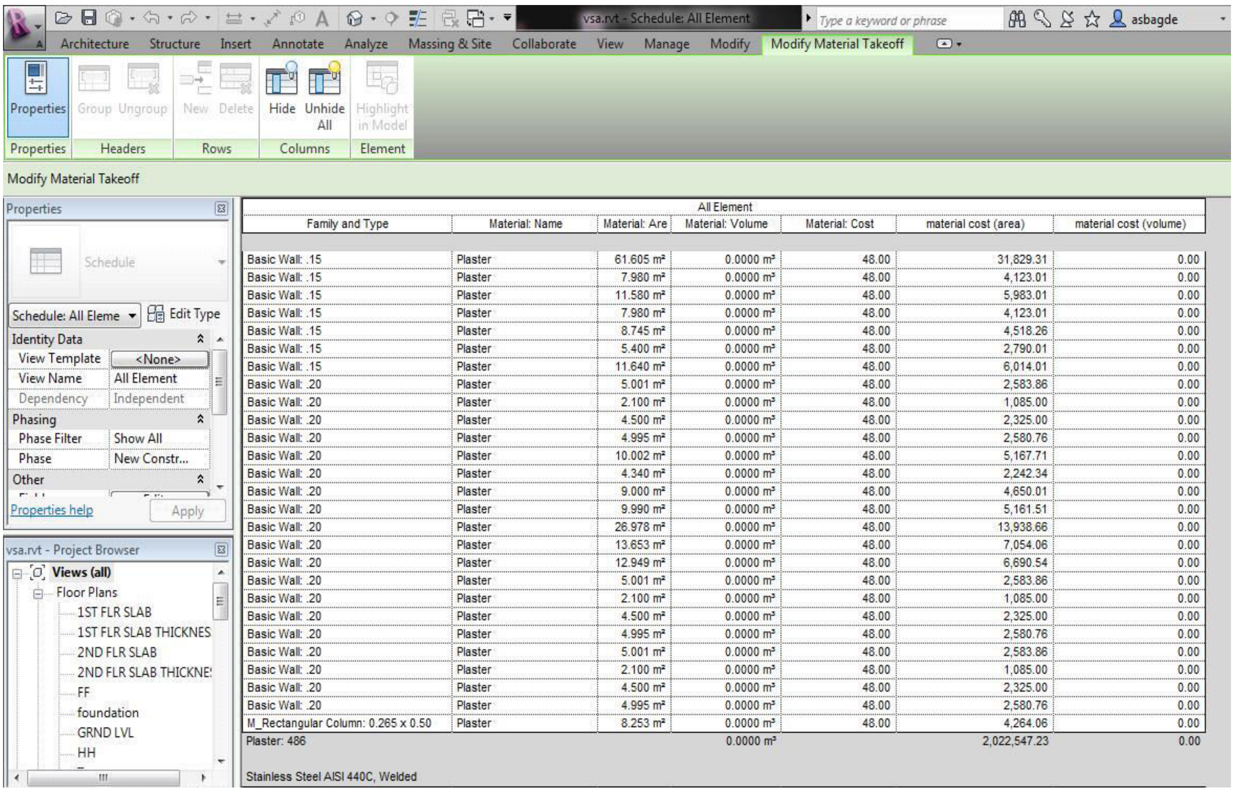


Fig.2: Benefits of BIM

IV. ESTIMATING AND COSTING



All Element						
Family and Type	Material: Name	Material: Are	Material: Volume	Material: Cost	material cost (area)	material cost (volume)
Basic Wall: .15	Plaster	61.605 m²	0.0000 m³	48.00	31,829.31	0.00
Basic Wall: .15	Plaster	7.980 m²	0.0000 m³	48.00	4,123.01	0.00
Basic Wall: .15	Plaster	11.580 m²	0.0000 m³	48.00	5,983.01	0.00
Basic Wall: .15	Plaster	7.980 m²	0.0000 m³	48.00	4,123.01	0.00
Basic Wall: .15	Plaster	8.745 m²	0.0000 m³	48.00	4,518.26	0.00
Basic Wall: .15	Plaster	5.400 m²	0.0000 m³	48.00	2,790.01	0.00
Basic Wall: .15	Plaster	11.640 m²	0.0000 m³	48.00	6,014.01	0.00
Basic Wall: .20	Plaster	5.001 m²	0.0000 m³	48.00	2,583.86	0.00
Basic Wall: .20	Plaster	2.100 m²	0.0000 m³	48.00	1,085.00	0.00
Basic Wall: .20	Plaster	4.500 m²	0.0000 m³	48.00	2,325.00	0.00
Basic Wall: .20	Plaster	4.995 m²	0.0000 m³	48.00	2,580.76	0.00
Basic Wall: .20	Plaster	10.002 m²	0.0000 m³	48.00	5,167.71	0.00
Basic Wall: .20	Plaster	4.340 m²	0.0000 m³	48.00	2,242.34	0.00
Basic Wall: .20	Plaster	9.000 m²	0.0000 m³	48.00	4,650.01	0.00
Basic Wall: .20	Plaster	9.990 m²	0.0000 m³	48.00	5,161.51	0.00
Basic Wall: .20	Plaster	26.978 m²	0.0000 m³	48.00	13,938.66	0.00
Basic Wall: .20	Plaster	13.653 m²	0.0000 m³	48.00	7,054.06	0.00
Basic Wall: .20	Plaster	12.949 m²	0.0000 m³	48.00	6,690.54	0.00
Basic Wall: .20	Plaster	5.001 m²	0.0000 m³	48.00	2,583.86	0.00
Basic Wall: .20	Plaster	2.100 m²	0.0000 m³	48.00	1,085.00	0.00
Basic Wall: .20	Plaster	4.500 m²	0.0000 m³	48.00	2,325.00	0.00
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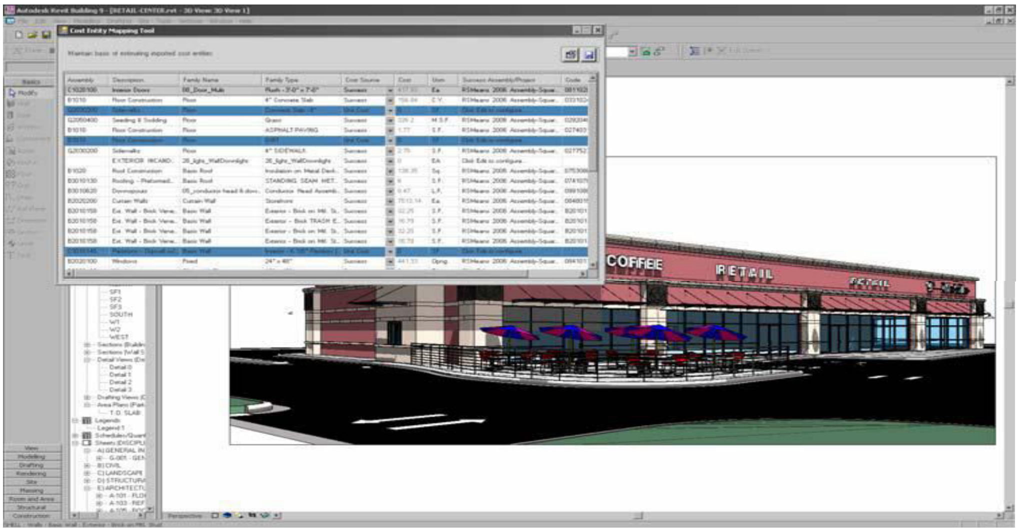
Basic Wall: .20	Plaster	4.500 m²	0.0000 m³	48.00	2,325.00	0.00
Basic Wall: .20	Plaster	4.995 m²	0.0000 m³	48.00	2,580.76	0.00
M_Rectangular Column: 0.265 x 0.50	Plaster	8.253 m²	0.0000 m³	48.00	4,264.06	0.00
Plaster: 486			0.0000 m³		2,022,547.23	0.00
Stainless Steel AISI 440C, Welded						

Fig.3: Software evaluating estimate of the building

The above image shows the estimate of the whole building. We only need to give the input of the cost of the material per square meter or cubic meter and it automatically calculates the cost of that material as a whole. The first step of cost estimating is quantification - and the computable information at the heart of a building information model makes quantification effortless. BIM solutions don't generate automatic cost estimates by any means, but they offer significant advantages over traditional drawing-based systems by minimizing manual takeoffs. More accurate quantities of materials results in more accurate cost estimates. Reducing the quantification effort means estimators can more effectively apply their time and knowledge to higher value estimating activities. And architects & engineers can use the information within their design model to easily double check estimating quantities - facilitating concurrent estimating during the design process.



(Source:© Autodesk Revit)

Fig. 4: The API integration between Revit and U.S. COST allows Oculus to develop their own cost estimates.

V. HEAT GAIN ANALYSIS

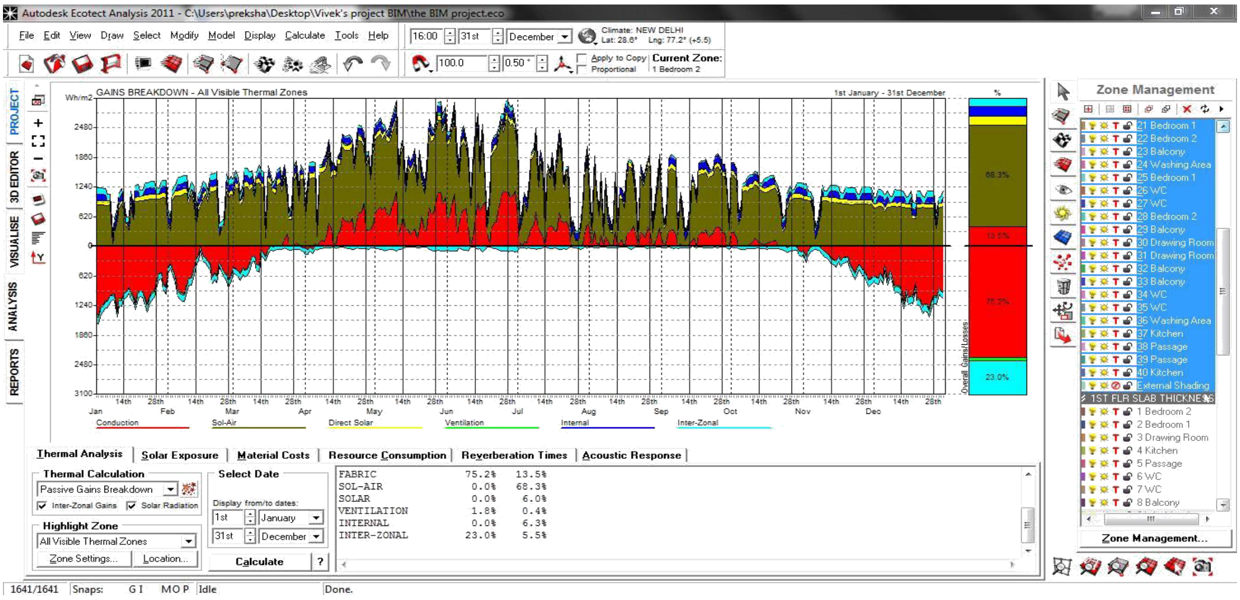


Fig.5: Heat Gain Analysis

The passive gains breakdown is presented in two ways - the graph itself shows the individual breakdowns, measured in Watts per hour per square meter. The passive gains breakdown graph shown above indicates that the majority of heat gains occur via Sol-Air heat transfer, or indirect solar gain. This suggests that changing the colour of the walls and roof to be lighter should reduce the sol-air gains.

VI. BIM ADOPTION FOR INFRASTRUCTURE AND CIVIL PROJECTS

One of the reasons for this slow adoption rate might be the long and tiring procedures that an infrastructure development project has to undergo before it is approved and budgets are sanctioned. Besides the common perception that BIM is only for buildings is also one of the reasons why it wasn't quickly accepted and implemented in such projects. However, now the scenario is changing and the adoption of BIM for infrastructure is rapidly increasing. This is because engineers, and infrastructure developers have started realizing the deep rooted benefits BIM can help execute a project in the most lean and efficient manner. The industry today has realized that BIM is beyond just 3D visualization and provides the most equipped and suitable approach to not only construction of buildings but also for development of infrastructure and civil projects

VII. CONCLUSION

The BIM is a new and promising approach in India which is gradually gaining acceptance by the owners, architects, engineers, and builders. The benefits are highly appreciated by architects and engineers in construction industry. The loss of time, materials and money can be highly minimized. BIM when used in the field to better communicate and integrate construction information across different trades, allows for efficient work processes and better decisions. More specifically, the study concentrated on the deployment of the model to support planning, scheduling and tracking of the job site operations in India. Analysis tools are not used to support the generation of design alternatives, or to make informed choices between different design options, and they are neither used for building and / or system optimization. The most effective decision regarding energy efficiency in a construction industry can be made early in the design and preconstruction stages.

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