Integration of BIM in High-Rise Building Construction

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Building Information Modeling “BIM” is becoming a better known established collaboration process in the construction industry. Owners are increasingly requiring BIM services from construction managers, architects and engineering firms.

There are many definitions for BIM (Building Information Modeling). Wikipedia describes BIM as a process involving the generation and management of digital representations of physical and functional characteristics of a building. The final models become shared knowledge resources to support decision making about the building throughout its lifecycle including design stages, construction, operational life and eventual demolition. The BIM handbook (Eastman et al 2011) defines BIM as a modeling technology and associated set of processes to produce, communicate, and analyze building models. BIM comprises two main aspects: an intelligent model and an approach for integrated collaboration, with the focus on open information sharing and integration. Furthermore, BIM encompasses both framework and technology.

Firstly, BIM moved from 3D CAD (including 3 dimensions: place, size and shape) format to 4D format, added Time dimension to basic three dimensions. Fourth dimension leads to full construction coordination in design.

Afterwards, Cost dimension was added to 4D format, that brought BIM to a new improved 5D level. Fifth dimension makes possible the calculation of cost for the entire construction project as well as if it is necessary for project parts. The total cost of projects based on information about cost of labor, materials, etc. those currently could be set up manually or automatically with help of selected software tools.

The last development of BIM brought it to the new 6D...
The sixth dimension is about a life cycle of building, management of its facilities, and an environmental impact.

The theory of Building Information Modeling was developed by scholars at the Georgia Institute of Technology in the late 1970s. It progressed quickly. Construction teams have found value in using BIM to integrate the process of the construction industry. The term Building Information Modeling, first used in 2002 to describe virtual design, construction and facilities management, and gained traction with the release of several BIM authoring tools this decade. Today BIM is a moving target that is making progress daily and as users become more sophisticated in its applications; BIM has shown the ability to improve the planning, execution, and close-out phases of the construction process.

After the design is completed, construction is ready to begin. During the construction phase, when contractors typically document and submit detailed shop drawings, BIM is used by each building trade to create a virtual 3-D model of their work, potentially avoiding the traditional field changes necessary when “clashes” occur and building components must be rearranged. Building trades can prefabricate piping and other building assemblies off site with greater confidence, resulting in a higher quality installation.

The Construction Manager and field superintendent will work with the design team to make sure that the design intent is followed, and they will run their own Clash Detection on all models. With BIM software monitoring and workflow tools, identified problems can be reported and tracked through resolution. Construction can be simulated to make sure everything is being built on time. This process can be made easier by the fact that BIM was used early in the design phase. We would find that there are significantly less RFI’s when BIM is used correctly in all phases of a project. Along with that, the owner could actually see what he/ she is getting, with the aid of walkthroughs and accurate renderings.

BIM has created a solid connection between design and construction that had never been felt before. Instead of asking how we can get architects, engineers, and construction managers to collaborate efficiently, we are now asking how we can use BIM to make the process even faster and more efficient.

High Rise Projects

Mansycom Consultants have done couple of high rise
buildings projects using integrating 3D BIM/ Virtual Construction technology along with the leading players in architectural, engineering & construction industry. Studies carried out across the world show that this technology reduces project cost ranging from 3% to 5% by generating a project design, eliminating any scope of clashes or discrepancies; producing accurate bill of quantities; providing easy and effective project planning, scheduling, monitoring & control facilities. Project implementation time can be advanced by 8% to 20% as compared to that achieved using normal construction management methodologies. It is believed that in this time of expensive capital and intense competition, 3D BIM services will be able to provide companies with a competitive edge.

Mansycom Consultants have provided 3D BIM services for various high rise towers in India - Ahuja Towers, Prabhadevi, Mumbai (56 storey), Platinum Tower, Hebbal, Bengaluru (22 storey) & One Avighna Park, Curry Road, Mumbai (64 storey) etc. wherein BIM integration & even 4D-5D simulation for a project has been implemented over the last couple of years.

Case Study – One Avighna Park High Rise Towers

To help meet the ambitious goals set for the building, the One Avighna Park owners required the implementation of Building Information Modeling (BIM) process for the design integration, BOQ preparation and construction of the towers at Curry Road, Mumbai.

The 64-story twin residential towers convey a unique feeling of movement and growth, while reflecting the re-emergence of Indian built-up economic and cultural influences amid the rise of an increasingly modern India.

The extended architectural, structural & services design teams shared their design using 3D BIM platform, enabling them to collaborate and contribute insights about the design in the context of the project.

The towers iconic twisting shape and façade was extremely difficult to convey using traditional 2D approaches, making model-based design vital for the project’s success. BIM helped to visualize the tower in 3D and analyze the design for improved decision making.

The project team used the BIM software platform for early coordination of the major design disciplines. The team combined the 3D architectural & structural design models and the MEPF models for whole project coordination. Bill of Material was also derived from 3D model for the civil works & MEPF services.

Integration of BIM and Business Strategy

A successful implementation plan will integrate all functional levels. BIM is the platform to implement integration and provide a structure to communicate information. By integrating program controls, communication, and information, teams will be able to make business decisions with the correct updated information and manage assets from a central location. BIM is a tool for project management, but, management functions do not need to be limited to the construction industry. Rather, they could encompass any company’s strategy and be used as a strategic management tool.

Integrating Building Information Modeling and business strategy is the future of Building Information Technologies. BIM is the umbrella under which the network of information can be communicated. BIM can capture multiple dimensions of projects and programs, and integrate the information for all stakeholders resulting in implementation of projects within budget, scheduled time frame, avoiding stopstart cycles & with intended quality. BIM is the future, and the starting place of integrating information is now.

Author’s Bio

Suresh K Gupta, B Tech IITD, MBA FMS, is the President & Director of Mansycom Consultants Pvt Ltd, New Delhi. Mansycom Consultants pioneered the 3D BIM modeling services, as a third party consulting concept, in India in 2006 & has since then successfully executed +100 domestic & international assignments for variety of projects, including residential & commercial towers, hotels, hospitals, malls, airports etc. Mansycom Consultants is also partners & distributors of Vico Office 5D simulation solutions of Trimble Buildings GC/ CM Division USA & of Trimble SketchUp Pro, USA in India.