BIM BRIDGING THE GAP BETWEEN DESIGN, CONSTRUCTION & FACILITY MANAGEMENT FOR SUCCESS
BIM INVOLVES IN DESIGN, CONSTRUCTION & FM

- BIM helps in Tender, Design & Calculations
- BIM helps in Construction and FM stage
- Scan to BIM process
- BIM overall benefits
- Cobie and Asset management
- Conclusion
BIM INVOLVES IN DESIGN, CONSTRUCTION & FM
• LOD 100 - Concept Design

  The building 3D model is developed to represent the information on basic level. Thereby, only conceptual model creation is possible in this stage. Parameters like area, height, volume, location and orientation are defined.

• LOD 200 - Schematic Design

  General model where elements are modeled with approximate quantities, size, shape, location and orientation. We can also attach non-geometric information to the model elements.

• LOD 300 - Detailed Design

  Accurate modeling and shop drawings where elements are defined with specific assemblies, precise quantity, size, shape, location and orientation. Here too we can attach non-geometric information to the model elements.

• Concept 3d model GA

  3D model is a process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, Design, construct, and manage buildings and infrastructure.
**PRE DESIGN & DESIGN PHASE – BIM**

- **Cost Forecasting using BIM**

  Instead of using CAD as a digital drawing board, models can be created that are virtual representations of the actual building. By adding cost data to BIM models as the project progresses, historic cost information can be collected on a granular level that was previously very difficult to achieve using 2D drawing methods.

- **Design support & Validation**

  - Revit based heat load calculation
  - Sizing & Calculation of HVAC Ducts
  - Illumination Calculation, Generation of Light & Power Layout, cable tray sizing, Voltage drop calculation
  - Calculation & Creation of Fire Fighting Layout as per NFPA standards
  - Creation of sanitary & Water supply layouts based on fixture unit values & pipe sizing
  - Pressure Loss calculation
  - Other Analysis Report as per requirement
For Clients

Earlier design development and coordination means there are more upfront costs for the client in terms of fees. This, in turn, means there will be higher abortive costs if the project needs to be redesigned or abandoned. The client also needs to invest more of its own time in the early stages – to determine the brief, set up the project for BIM and make design decisions.

And Post implementation of BIM rework of design cost are reduced and benefits of BIM are for clients are mentioned below

Benefits

- Reduced risk and time in pricing tenders
- Saving in creation of maintenance manuals
- Reduced printing costs
- More robust post-contract contingency
- Increased quality control
- Potential programme savings
For Architects and consultants
Initially consultants & Architects are expected to face professional costs when they adopt BIM. However Post implementation of BIM the output and co-ordination results in a greatly reduced number of hours being spent on drawings

**Benefits**
- Reduced risk in pricing time
- Printing cost reduced
- Design Calculations are made more quickly & accurately
- Greater team coordination; surety of coordination process reduces potential for claims
CONSTRUCTION PHASE - BIM

- **LOD 350 - Construction Documentation**
  
  It includes model detail and element that represent how building elements interface with various systems and other building elements with graphics and written definitions.

- **LOD 400 - Fabrication & Assembly**
  
  Model elements are modeled as specific assemblies, with complete fabrication, assembly, and detailing information in addition to precise quantity, size, shape, location and orientation. Non-geometric information to the model elements can also be attached.
CONSTRUCTION PHASE - BIM

- Detailing, Shop drawing & Fabrication layout

The shop drawing is the manufacturer's or the contractor's drawn version of information shown in the construction documents. The shop drawing normally shows more detail than the construction documents.

[Diagrams of shop drawing and spool drawing]
CONSTRUCTION PHASE - BIM

- RFI Management
  - Create RFI
  - Configure workflow
  - Access RFIs on Web or mobile
  - Post RFIs to drawing/models
  - Track and manage RFI's
CONSTRUCTION PHASE - BIM

- Clash management

- The entire building is constructed virtually
- All elements with their precise geometry and properties
- Realistic construction sequences are recreated
- Clashes are detected and resolved before the actual construction starts
Constructability review
to review construction processes/methods during the design phase and identify potential obstacles and design flaws that might result in schedule delays, cost overruns, rework, etc. It is very important to identify and resolve any constructability issues that might pop up during the construction of any project.

Response received (or) Assumption made
a) Resized the duct
b) Shifted architectural wall

Query forwarded:
a) Clash between supply air duct and wall
b) 500 mm X 250 mm SAD is clashing with wall
CONSTRUCTION PHASE - BIM

- **4D modelling - Scheduling**

  4D-BIM (four-dimensional building information modeling) is used for construction site planning related activities. The fourth dimension of BIM allows participants to extract and visualize the progress of their activities through the lifetime of the project.

  The utilization of 4D-BIM technology can result in improved control over conflict detection or over the complexity of changes occurring during the course of a construction project. 4D BIM provides methods for managing and visualizing site status information, change impacts as well as supporting communication in various situations such as informing site staff or warning about risks.

- **Benefits**

  Integrating BIM with 4D CAD simulation models bring benefits to participants in terms of planning optimization. Builders and manufacturers can optimize their construction activities and team coordination.
5D modelling - Estimation

5D-BIM (fifth-dimensional building information modeling) is used for budget tracking and cost analysis related activities. The fifth dimension of BIM associated with 3D and 4D (Time) allows participants to visualize the progress of their activities and related costs over time.

The utilization of 5D-BIM technology can result in a greater accuracy and predictability of project's estimates, scope changes and materials, equipment or manpower changes. 5D BIM provides methods for extracting and analyzing costs, evaluating scenarios and changes impacts.

Benefits
Integrating BIM with 5D CAD simulation models enables the development of more efficient, cost-effective and sustainable constructions.
6D modelling - SUSTAINABILITY

6D-BIM (sixth-dimensional building information modeling) helps perform energy consumption analyses.

The utilization of 6D-BIM technology can result in more complete and accurate energy estimates earlier in the design process. It also allows for measurement and verification during building occupation, and improved processes for gathering lessons learned in high performance facilities.

Benefits
Integrating BIM with 6D CAD simulation models leads to an overall reduction in energy consumption.
CONSTRUCTION PHASE – BIM BENEFITS

- **For Contractors and sub-con**
  
  Perhaps all suppliers and contractors might get good benefits by adopting BIM for their projects. Drawing time and cost reduced, clash conflicts are reduced during the construction stage.

**Benefits**

- Hard copy documentations are avoided
- Printing cost reduced
- Procurement time saved
- Material & Labor cost are reduced
- Eliminates wastage at site
- Coordination and QC time is minimized
- Change orders will be minimized
FACILITY MANAGEMENT- BIM

BIM IN FACILITY MANAGEMENT AND OPERATIONS
Elements are modeled as constructed assemblies for Maintenance and operations. In addition to actual and accurate in size, shape, location, quantity, and orientation, non-geometric information is attached to modeled elements.
FACILITY MANAGEMENT - BIM

• **Improved space management**

BIM model allows fuller utilization of space as it is easier to visualize the entire building, even before a project is complete. This gives ample time to facility managers to plan things out and make the most out of the available space.

• **Cost efficiency**

BIM enables cost efficiency in maintenance and general building operations. As BIM incorporates sustainable practices and energy efficiency aspects, it brings down the general operating costs. BIM also improves the financial forecasting process associated with maintenance as everything is documented, beforehand.

• **End-to-end as-built documentation for future renovation and maintenance**

BIM allows facility managers to compare real equipment with 3D models and create a detailed plan of action. Be it maintenance or renovation plan, BIM can facilitate the future planning process owing to detailed as-built documentation.
FACILITY MANAGEMENT - BIM

- 7D- FACILITY MANAGEMENT

7D-BIM (seventh-dimensional building information modeling) is used by managers in the operation and maintenance of the facility throughout its life cycle. The seventh dimension of BIM allows participants to extract and track relevant asset data such as component status, specifications, maintenance/operation manuals, warranty data etc.

The utilization of 7D-BIM technology can result in easier and quicker parts replacements, optimized compliance and a streamlined asset life cycle management over time. 7D BIM provides processes for managing subcontractor/supplier data and facility component through the entire facility life cycle.

- Benefits
Integrating BIM with 7D CAD simulation models optimizes asset management from design to demolition.
FACILITY MANAGEMENT - BIM

- **Asset information model / breakdown structuring**

  Asset Information Model (AIM) is a model that compiles the data and information necessary to support asset management, that is, it provides all the data and information related to, or required for the operation of an asset.

- **2D drawings / Red line update**

  Red line drawing / as built markups shows the deviation or modification done at site during the construction.
"COBie" or "Construction Operations Building information exchange" is a standard, it's a data format that helps capture and record important project data at the point of origin, including equipment lists, product data sheets, warranties, spare parts list, and preventive maintenance schedules. This information is essential to support operations, maintenance and asset management once the building is in service.

- Setting up and Structuring COBie database (Excel sheet or other).
- Producing Data Drops at set stages of a project, through the design, construction and operation phases.
- Setting up the models for COBie compliance.
For FM / END USER

If after the construction any editing are willing to be made, this will turned to be easier because of the information collected in the system. For example, energy calculations can be run using the data of the building. Through the software many kind of simulations can be carried out, they can energize the model to show exhibit and how the model would be in different situations. Interoperability is a great component of BIM software.

**Benefits**

- Reduced maintenance time
- Better service to the client
- AMC is reduced and becomes more easy
- Vendors details are maintained electronically
- Breakdown Maintenance can be avoided
The CIFE (Centre for Integrated Facilities Engineering) of Stanford University run a survey on 32 big projects that use BIM and identified the advantages. Among those:
Elimination in budget change up to 40%;
Precision in costs estimation up to 3%;
Decrease up to 80% of the time needed to generate a expenditure quote;
Saving of up to 10% in the value of the contract trough clash detections;
Time saving up to 7%.
Conclusions

Bridging the Gap Between Needs of Facility Owners and Building Contractors. Building Information Model (BIM) is a powerful process that can take care of all the issues during the entire lifecycle. In fact, BIM bridges the need gap between architects, contractors and facility owners. Earlier, facility managers found it difficult to coordinate with different stakeholders to get hold of as-built documentation and developing various procedures. With a central BIM model, facility managers can easily manage everything without much effort.

Facility managers can improve the process of strategic maintenance planning and at the same time help architects in understanding the needs of facility managers, after project completion.
QUESTIONS?

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