

Softwares for Building Information Modeling (BIM) Project Management and Controlling

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Abstract— This paper is about BIM Building Information Modeling and most of Softwares used for construction project management and monitoring in construction industry. It's about BIM and Softwares used for Building Information Modeling and details of Softwares

Key words: Primavera, Ms Project, Revit

I. INTRODUCTION

The construction of a building involves different activities like Conception, Planning, Designing, Analysis, Scheduling, Documentation, Construction etc. After all these phases construction work is done but after that building maintenance and demolition phase is also coming in construction industry. These all phases can be integrated with Softwares and this technique is called Building Information Modeling.

Modeling and simulation (M&S) is getting information about how something will behave without actually testing it in real life.

II. SOFTWARES

A. Revit:

It is the software for 3D modelling and Building Information Modeling from conceptual studies through the most detailed construction drawing and schedules, applications built on Revit help provide immediate competitive advantage, better coordination and quality, and can contribute to higher profitability for architects and the rest of the building team.

At the heart of the Revit platform is the Revit parametric change engine, with automatically coordinates changes made anywhere-in model views or drawing sheets, schedules, section, plans. Autodesk Revit is Building information modelling software for architects, structural engineers, MEP engineers, designers and contractors. It allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements and access building information from the building models database. Revit is 4D BIM capable with tools to plan and track various stages in the building's lifecycle, from concept to construction and later demolition.

B. Primavera:

Primavera Systems is the brand name under which a range of software packages that collectively form a comprehensive enterprise project portfolio management (EPPM) solution are marketed. Primavera was launched in 1983 by Primavera Systems Inc. and was acquired by Oracle Corporation in 2008. Primavera software includes project management, collaboration and control capabilities and integrates with other Softwares such as oracle or SAP's ERP's systems.

In Construction management and monitoring there are many monitoring techniques available like. Critical Path

Method (CPM), Programme Evaluation and Review Technique (PERT), Precedence Diagramming Method (PDM). Each method has their own advantages but here primavera is using PDM technique of networking which is having very less disadvantages and can be overcome by software. So Primavera is using the best technique of activity networking. The schedules prepared by primavera can be linked to the other BIM Softwares also.

C. MS Project:

MS Project (MSP) is the software developed by Microsoft to assist managers to control and manage the project. Study has shown most of small to medium organisations are using MSP for construction project planning and monitoring.

It is a good software for scheduling the activities as it is having the feature of giving the relationships finish to start, start to finish, finish to finish, start to start. Etc. this makes it more effective in construction project activity scheduling and providing relationships

The schedules developed by MSP can be linked to the other BIM Softwares.

D. AUTOCAD:

AutoCAD is a commercial software application for 2D and 3D computer-aided design (CAD) and drafting available since 1982 as a desktop application and since 2010 as a mobile web- and cloud-based app marketed as AutoCAD 360.

Developed and marketed by Autodesk, Inc., AutoCAD was first released in December 1982, running on microcomputers with internal controllers. Prior to the introduction of AutoCAD, most commercial CAD programs ran on mainframe computers or minicomputers, with each CAD operator (user) working at a separate graphics.

AutoCAD is used across a wide range of industries, by architects, project managers, engineers, designers, and other professionals. It is supported by 750 training centres worldwide as of 1994. As Autodesk's flagship product, by March 1986 AutoCAD had become the most ubiquitous CAD program worldwide. As of 2014, AutoCAD is in its twenty-ninth generation, and collectively with all its variants, continues to be the most widely used CAD program throughout most of the world. AutoCAD can be told as the best drafting software available for civil engineers.

E. ArchiCAD BY GRAPHISOFT:

ArchiCAD started in the early 1980s for the Apple Macintosh platforms. ArchiCAD was the first computer-aided design (CAD) product designed to be used on a personal computer that had 2D / 3D capabilities. The Graphisoft product allows its users to create 3-D structures with "smart objects" such as walls, slabs, roofs, doors,

on construction type (e.g., new, temporary, existing, etc.), resources, start/finish dates, criticality, linked/unlinked tasks, and so on. This allows users to do things such as highlight potential installation issues (“show in red any building objects that are linked with two tasks on the same day”) or create installation sequences of building components that can be animated and saved, then played back like a movie to show project teams or clients how the project or a particular area will be built.

When firms begin to use 4D BIM, they usually start with the phasing capability inside of Revit – which can be used quite effectively for broadbrush construction visualization. As their expertise with 4D modeling grows, they tend towards direct links between the building information model and their scheduling system, using some variation of the approaches presented above.

Whatever the path taken or technology implemented, 4D building information models containing detailed schedule and resource data from the native project planning software are now a reality – and can lead to a more engaged team, more informed decision making, and better coordination between designers and builders.

A. What is Clash Detection?

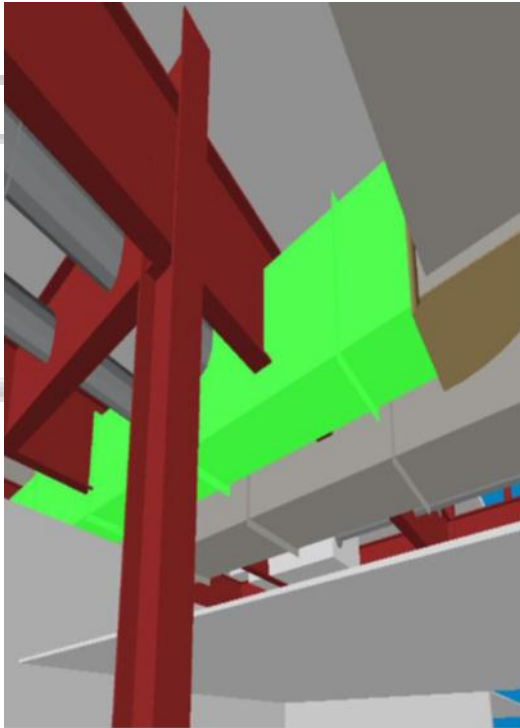


Fig. 4: Structural steel / ductwork conflict

As discussed earlier we have 3D models for different trades like Structural, Civil, and Architectural & MEP. When we combine all these different trades to create a complete BIM model there is a possibility of clashes between these trades. Figure 3.1 is a prime example of clash between Structure and Mechanical. Figure 4 shows a beam going through a duct.

Revit software provides clash detection capabilities where objects conflicting with other are highlighted for correction. This capability is however, limited in that it does not develop reports or track changes.

Navisworks software provides a Clash Detection module that checks your BIM and shows you any areas

where items interfere, or “clash”, with each other. This BIM tool will allow you to set up the rules and options for your clash tests, view the results, sort them, and produce a report as a text file or in HTML or XML formats.

Managing a series of clash tests can get very complicated, especially if you have a set of different layers you want to clash detect separately. Clash Detection in Navisworks is designed to help you control these clash tests and maintain an audit trail of clashes throughout the life of the project.

Setting up and running a clash test requires the following steps:

- (1) Select Groups and create folders for each group. The Select tab of the Clash Detective control bar allows you to refine your clash test by only testing sets of items at a time, rather than the whole model against itself. This will produce faster and more sensible results. For example Mechanical Ducts with Fire Sprinkler Lines.
- (2) Set the rules for the test.
- (3) Select the required items to be included in the test and set the test type options.
- (4) View the Results.
- (5) Produce a clash report.
- (6) Managing/Status clash tests for future use. Navisworks will update this status automatically, informing the current state of the clashes in the model.

1) Advantage Of Using Clash Detection In Navisworks:

- (1) Revit vs. Navisworks: Revit has its own clash detection process. Revit clash detection identifies the places where clashes occur. It does not create reports and does not have any tools to manage the clash detection process as design progresses. Navisworks provides greater flexibility for controlling the clash detection parameters and will identify clashes, generate reports which can help the design team to resolve the clashes, and track resolution with an automatic audit trail.
- (2) Managing the BIM Clash Detection Process: Managing clash tests for a big project can get complicated. One simple but timesaving way Navisworks does this is by remembering the names of clashes throughout the project’s life so you don’t have to go through each clash every time you run a test to figure out whether it’s a new clash or one you have already seen. Clash Detective also allows you to assign a status to a clash and can update this status automatically, informing you of the current state of the clashes in the model.
- (3) In conclusion see Table 1 below giving the comparison of clash detection features in Navisworks and Revit.

Things It Can Do	Navisworks	Revit
Identify clashes	Yes	Yes
Generate Reports	Yes	No
Trace Clashes	Yes	No
Status Clashes	Yes	No
Manage Clashes	Yes	No

Set Rules	Yes	No
Custom Clash Test	Yes	No
Clearance Tests	Yes	No
Time Based Clashing	Yes	No

Table 1: Clash detection feature comparison

IV. USE OF BIM

A. Preconstruction/Design Phase:

During the preconstruction phase of the project it would be fruitful for the CM to work in concert with the Architect/Engineer to ensure optimal design within the stipulated budget parameters. Utilization of 4D technology provides for improved communication and design productivity and quality in numerous ways:

1) Better Communication Of The Demolition And Construction Sequence:

- (1) Visually communicate project schedule to all project stakeholders.
- (2) Visually assess impact to ongoing facility operations.
- (3) Communicate and show flow of work.

2) Better Site Planning & Logistics:

- (1) Easily review site access, parking, staging areas, transportation routing etc.
- (2) Plan & review site work and interactively view site issues
- (3) Evaluate what-if scenarios and solicit feedback from tenants and occupants.

3) Better Analysis Of Move Management & Site Management:

- (1) Quickly view multiple perspectives.
- (2) Analyze different alternatives and view different options simultaneously.
- (3) Focus on specific flow and sequence of work.

B. Benefits/Risks Of Providing The BIM Model To Bidders:

The question of whether or not to provide the actual BIM model to all of the bidders is really a question of perceived vs. actual liability risk. As BIM is a relatively new technology, there is a lot of concern as to whether or not it presents new levels of liability for both the designer and the owner. These concerns will have to be largely addressed by legal counsel, but conceptually, BIM is a more accurate representation of the actual elements of the building than traditional CADD or manually drafted construction documents which should actually reduce liability risks over those traditional methods. Some of the key Benefits and risks are outlined below.

Benefits – Giving bidders the BIM model provides greater accuracy and consistency in material quantity take-offs resulting in:

- (1) More accurate estimates.
- (2) Less variability in bids.
- (3) Reduced need for the bidders to build in contingencies for the unknown Risks.

Increased dimensional responsibility for the design team may result in additional legal liability – as noted above, this is a perceived risk that can be reduced through language about reliance on the BIM model being the same as reliance on traditional 2D drawings and specifications.

C. Use Of BIM During Construction:

Construction Phase: During the construction phase the monitoring, analysis and evaluation of the project schedule are critical to the ability of the CM to understand and interpret project progress, current status, and pending schedule developments. With 4D scheduling, this capability will be enhanced and refined as per the following points.

Schedule Development:

- (1) Assist in development of the initial project construction sequence
- (2) Improve trade coordination, less interference and congestion areas
- (3) Visualize multiple construction sequence options (optimization)
- (4) Anticipate hazards and improve safety
- (5) Analyze scenarios and compare alternatives.

V. CONCLUSION

- (1) It can be concluded that BIM is an efficient and reliable tool of project management. Project management can be done more effectively by using this type of tool.
- (2) Primavera is the best suited software for scheduling a construction project as it is giving all the details of project.
- (3) By using primavera tracking of the project can be done easily.
- (4) MS Project is a good software for preparing scheduling and baseline but tracking of project cannot be done for tracking other tool of syncing data is required which can be a third party tool.
- (5) Use Clash Detection during constructability process. In current practice, many conflicts (steel, ductwork, conduits, piping, etc.) are not discovered until the shop drawing and coordination process has been initiated by the contractor. At this point, these conflicts could result in design changes which may ultimately lead to claims due to field required re-work. In addition, and as is current practice, many of the designers who for months maintained intimate knowledge of the project, may have been assigned to new projects and are not available months down the road to assist when these issues come up.
- (6) Provide BIM files to bidders for estimation purposes. By so doing, quantity variation will be lessened as all bidders would be basing their costs off the same information. The BIM files should be better able to represent the intent of the design and by reducing misunderstandings of this nature and therefore lower contractor contingencies should result.
- (7) Provide BIM files to construction contractor for scheduling and RFI (Request for Information) process. By so doing, the RFI process can be improved as actual BIM sections could be produced which more fully outlines the question being asked in the RFI. The A/E can “see” what the contractor “sees” rather than relying on RFI alone.

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