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BIM based Project Scheduling and Progress Monitoring in AEC Industry

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Abstract: ***Traditional scheduling and monitoring technique fail to provide a clear view of the ongoing actual work at the project site. Building Information Modeling (BIM) is Single file concept collaborating various database of the project at one platform. Various databases are simulated virtually and forth coming impediments can be known beforehand. In this paper, traditional and BIM methods of scheduling are explained taking 4th dimension as time. This paper explains the Software used & methodology used by which 4D model of a building can be created. This paper describes the model from the perspective of a construction manager and therefore database in model is restricted to civil work.***

Keywords: Building Information Modeling, Methodology, Digital Interface, Simulation

1. Introduction

The Architecture, Engi neering and C onstruction (AEC) industries have long sought t echniques t o decrease project cost, increase productivity a nd quality, and reduce project delivery time. Effective pl anning i s one of t he m ost important aspect s of a const ruction project and influences the success of a project. Recently, a quiet revolution has been taking place which will fundamentally change the very fabric of t he audi ovisual desi gn and integration business. This revolution is th e in creased u tilization o f Bu ilding Information Modeling (BIM). 4D modeling is the integration of a 3D m odel wi th a const ruction schedul e i n order t o visualize t he sequence of const ruction. 4D m odels can be created to various levels of det ail, from hi gh-level zone analysis duri ng t he desi gn phase, t o detailed subcontractor coordination duri ng const ruction. The sam e model can be updated and maintained throughout the project based on t he updated schedule and 3D m odel. Thi s paper gi ves t he information about the vari ous soft ware used, m ethodology adopted for the making a 4D model.

2. Literature Review

2.1 Two Dimensional Computer aided design (2D CAD)

Initial drafting tools in arch itecture are p encil; p aper etc. with t hese t ools Archi tects creat es di fferent support ing drawings for a project in multiple sheets. 2D applications are nothing more than "electronic draft ing boards" capabl e of providing only t wo-dimensional drawi ngs, wi thout t he capability for 3D models.

2.2 Three Dimensional Computer aided design (3D CAD)

3D CAD program s allow users to create a spatial model of the bui lding t ogether wi th t he necessary 2D documentation. Some drawi ngs (e.g. sect ions or el evations) can be part ially derived from t he 3D m odel but in most cases the documentation is kept in a sep arate file (or set of files) fro m the model. Most 3 D ap plications o ffer b uilt-in v isualization tools and basic quantity calculation features (e.g. floor areas, roof areas).

2.3 Current Design Methods

The t echnology devel opment form 2D C AD t o 4D simulation greatly i mproved t he desi gn process. 2D C AD developed i nto 3D m odeling. Thi s i nnovation changed the process of bui lding desi gn and t he rel ationship between the structural engi neer and t he archi tectural desi gner. It did not only change the way building designs are visualized, but also signaled a paradi gm dri ft i n desi gn t hinking from pure visualization to simulation.

2.4 Building Information Modeling (BIM)

Building i nformation m odeling i s a bui lding desi gn and documentation process. It enables you to create and m anage information about a bui lding project, usi ng t he i nformation about t he bui lding project whi ch i s st ored i n a 3D model. More im portantly, th e in telligent d ata in herent in th e building model allows you to experience your design before it is real, sim ulate and visualize design alternatives, analyze performance, and m ake bet ter i nformed desi gn deci sions earlier in the process.

3. Need of BIM in Project Scheduling and Progress Monitoring:

Due to th e d ifficulty o bserved in u sing th e trad itional scheduling and m onitoring m ethods, t he const ruction industry has acknowl edged t hat i ts current schedul ing and progress report ing pract ices are i n need of substantial improvements in q uality an d efficien cy. Research effo rts to incorporate vi sualization i nto schedul ing and monitoring have been motivated by the failure of traditional methods.

Building Information Modeling (B IM) al lows project managers and di fferent peopl e involved i n t he project with different backgrounds to get th e accurate inform ation of the project an d m onitoring o f activ ities. Th e project manager and client can use the visualization aspects at any stage of

the project to monitor the activities and cost flow. BIM improves the construction planning and design efficiency by integrating the 3D model and schedule of the project at one platform.

4 Methodology

Various software used for making a 4D model are AutoCAD 2013, Autodesk Revit 2013, Microsoft Project 2007, Autodesk Navisworks Manage 2013.Following are the steps for creating a 4D model.

4.1 Creating Architectural Design by using AutoCAD 2013.

4.2 Creating 3D model by using Autodesk Revit 2013 by starting using a new template file or importing 2D CAD file and then raising model on it.

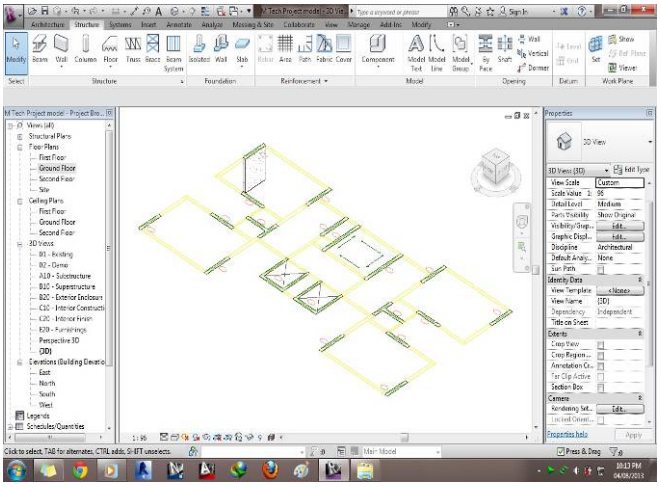

Figure 1: Creation of model in Autodesk Revit 2013

4.3 Creation of an orthographic 3D view by pressing a home shape button in the view tab. different 3D views can be viewed by rotating the cube.

4.4 Export the model from Autodesk Revit 2013 while it is opened in 3D view.

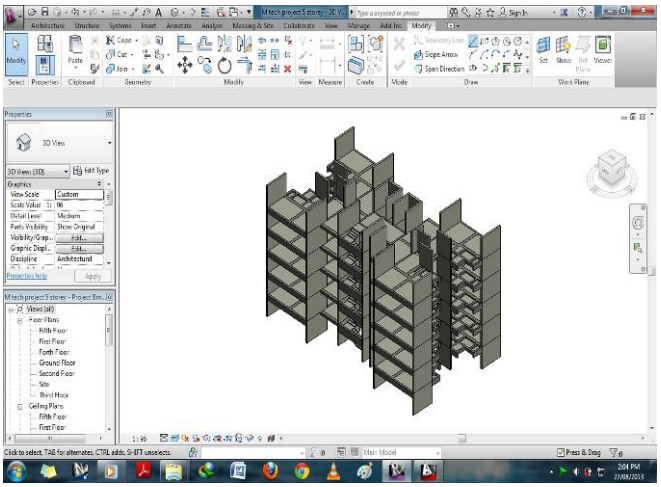

Figure 2: Creation of 3D model.

4.5 Create Work Breakdown Structure for the model and accordingly prepare schedule in Microsoft Project 2007.

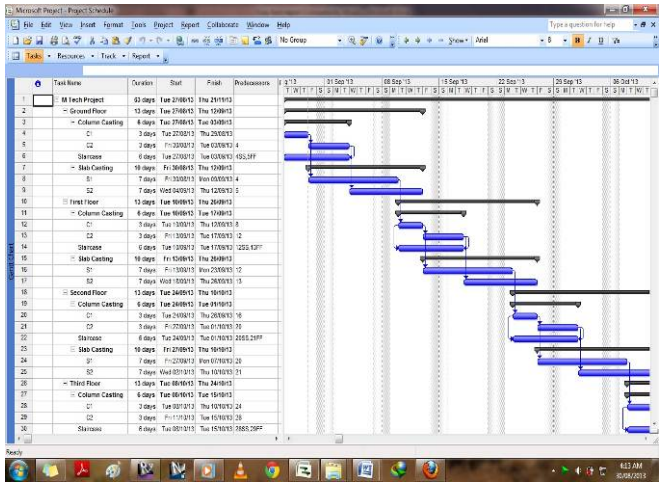

Figure 3: Creation of MSP schedule

4.6 Import 3D model file and construction schedule in Autodesk Navisworks.

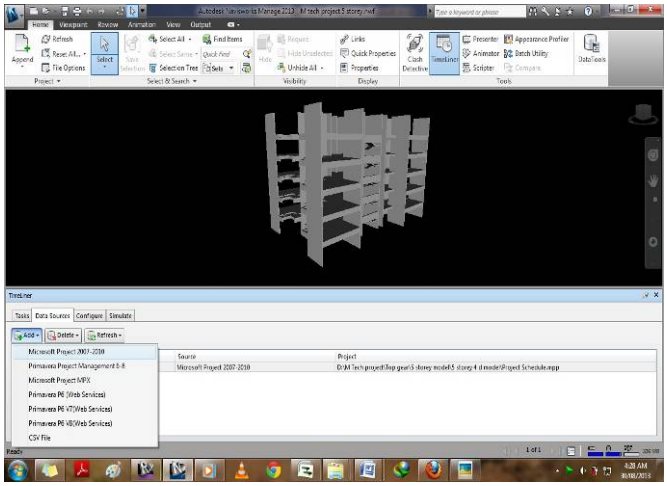

Figure 4: Importing 3D model and MSP schedule

4.7 Link various activities with 3D model.

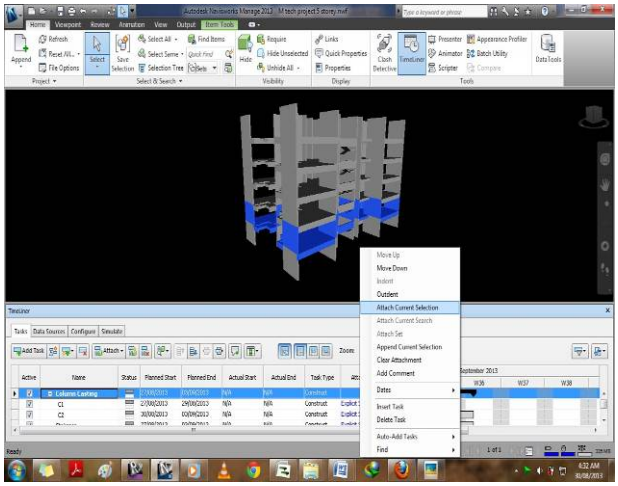

Figure 5: Linking activities with 3D model

4.8 Configure settings for the project in the simulation tab.

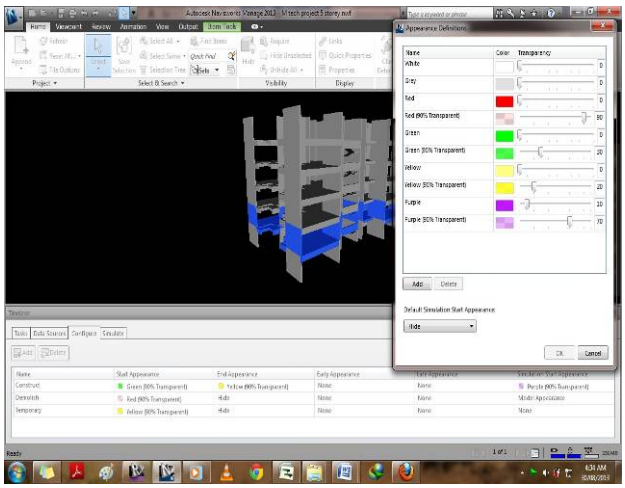

Figure 6: Configuring the settings for simulating the model

4.9 Start simulation for viewing the 4D model.

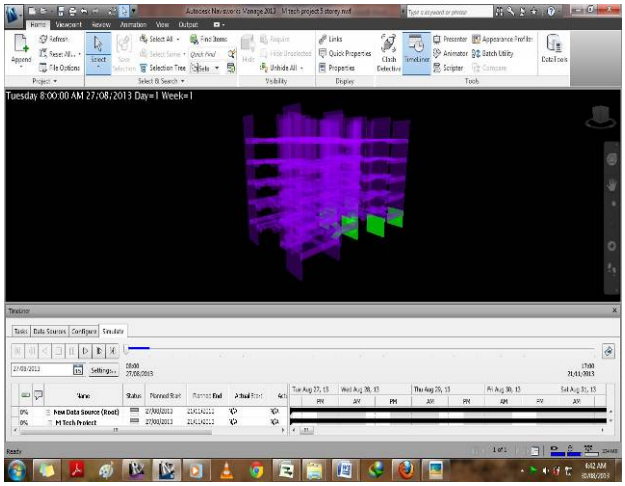

Figure 7: Simulation of the project.

5. Conclusion

The proposed methodology utilizes the dynamic linkage between the activities in the schedule and corresponding 3D components and helps to detect the incompleteness and logical errors in the schedule sequence. This is because, BIM provides the user with a real time representation of the project which may improve and speed up the construction planning as well as ensure data integrity and accuracy.BIM, thus is not only a visualization tool but can be utilized as a project scheduling and monitoring tool at any stage of the project in which the schedule and the 3D components can be manipulated in a single BIM environment. The schedule in BIM allows easier understanding of the project as well as helps to detect possible problems in it. Therefore, by integrating and displaying specification/recommendation and construction resource information, the schedule in BIM promotes interaction and collaboration among the project team members from different fields.

6. Future Scope

Building Information Modeling is a team based work; however in this dissertation study is restricted to civil engineering construction planning & scheduling. Current model can be further enhanced by adding various databases from other fields also like electrical, mechanical, plumbing etc. In this paper 4th dimension is considered as time, further other dimensions like cost, resources, materials etc. can be taken as nth dimensions and thus creating a 5D model.

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Author Profile

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