Quality Management in Construction Industry Using Building Information Modelling (BIM)

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Abstract- *the potential of Building Information Modeling (BIM) is to support a change of the processes of design and construction has been evident in the construction industry. Although BIM is helpful for improving design quality by eliminating conflict also reduce rework, there has been very less research into using BIM throughout the project for construction for quality control and efficient information utilization. Due to the consistency of design data with quality and construction process with quality control and the potential of BIM implementation in quality management lies in its ability to present multi-dimensional data including design data and time sequence. This paper explains and discusses the benefit of 4D BIM for a quality management based on construction codes*

Keywords- Building information modeling (BIM), Quality Management, construction management

I. INTRODUCTION

Now days Building information modelling (BIM) and its related issues has been a subject of research and development, as reported in the recent some literature. In this Improvements in the competence of the planning and design processes, construction planning and control, design-construction addition, and facilities management have been analysed. Also benefits derived from BIM implementation have been defined based on improvements achieved throughout building-related processes. It is broadly accepted by experts and evidenced by previous research that BIM and 4D approach are able to offer faster and more successful communication of information between concerned project parties and yield improved and innovative solutions stemming from better design, along with many other profit. BIM is a process involving the generation and management of digital representations of substantial and functional characteristics of places. BIMs are files (often but not always in proprietary formats and containing proprietary data) which can be extracted, exchanged or networked to support decision-making regarding a building or other built asset. Current BIM software is used by construction companies, Consultants and government agencies that plan, design, construct, operate and maintain diverse physical infrastructures, such as water, refuse, electricity, gas, communication utilities, roads, bridges, ports, tunnels, etc

The aim of the paper are i) To understand BIM flow process for effective coordination with Builders, contractors, structural consultant and architects, ii) To prepare 5D model for G+6 commercial building model which include cost, quantity, schedule, iii) To check BIM process for quality management of construction industry and its verification with questionnaires survey.

This project describes the results of research focused on quality management in construction industry using BIM during the construction phase of the project as well as after completion of the project. To get effective outcome checklist for quality management as Per IS standard will be prepared and survey will be taken out. Also comparison with conventional method will be done. Commercial project is selected for study.

II. LITERATURE REVIEW

Several case studies, international journals are studied to understand BIM technology. Through literature survey it can be concluded that BIM technology should be implemented in construction industry

1) Mehmet F. Hergunsel has studied visualization, 3D coordination, cost estimation, prefabrication, construction planning and monitoring, and record model. The 3D management used to notice and get rid of deal clashes and conflict. BIM based 4D preparation helps understanding of the construction mechanism and schedule progress that in turn results improved construction planning. The record model can be generating as the final growth of the construction as the as-built are completely updated in the Building Information Model. Prototype 4D Building Information Model was created and studied. The BIM-based schedule was incorporated to the 4D model. The project concluded with an analysis on the use, advantages and setbacks of BIM and its tools.[1]

2) In research paper of P.M Diaz done analysis is intended to show the communication of BIM and project manager‘s roles on construction projects. It insists on the implication of proper information and understanding of project managers to get succeed in BIM, 3D, 4D BIM and BIM based scheduling techniques are examined. The use of the term 4D to refer to the fourth dimension time is also discussed. The paper also review the issue regarding the BIM performance, static design and intrinsic problems related with an attempt to assess the advantages in a purely quantitative way, The studies show both the BIM advantages and disadvantages. And BIM can be regarded as a decision-making tool in spite of it being technical equipment also BIM should be incorporated in the construction course [2]

3) Su-Ling Fan, Miroslaw J. Skibniewski, and Tsung Wei Hung, has written in paper , that BIM and 4D modelling have both freshly inward extensive attention from the architectural, engineering and construction (AEC) industries. Research efforts to engagement have established that BIM and 4D technologies are able to provide sooner and more efficient communication of information between involved project parties and yield improved and inventive solutions stemming from better design along with other benefits. These papers describe the results of research determined on capturing the effects of BIM during the construction phase of the project. Four factors counting requests for information, rework, change orders, and schedule compliance are discussed based on personal interviews with contractor employees experienced in the use of BIM. Eight case studies were conducted to discover the effect of BIM during the construction stage with respect of these four factors.[3]

III. METHODOLOGY

There are a variety of gears and techniques are available for the quality management of construction work. Up till now there are many difficulties to implement quality management system in construction firms. Conventional methods of quality management are quite mind-numbing and one way or another difficult to apply. To achieve the fulfilment of customer and quality objectives of construction firm need to use modern technologies and tools for the quality management. In this study How Revit , MSP and Naviswork like modern tool is effective for quality management is evaluate by comparative study is doing on traditional methods of quality management with the Naviswork modelling. For quality management and scheduling technique following case study from data collected is analyzed and compared in Naviswork.

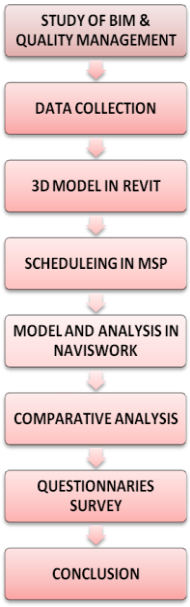


Fig 1: Flow chart of methodology

The objective of this research was to develop a complete, educational and sensible 4D BIM-based application for the purpose of construction quality management and to examine how it can fit into the current construction practice. Also, the research recognized possible problems with using Naviswork technology with current quality management methods, and proposes solutions. Throughout the research, quality models that controlled process, organization, and invention information were built using national, industrial and local quality standards and codes. Then, a scheduling model and the quality model were integrated into a virtualized 4D BIM-based application to identify quality control criteria and responsibility assignments in the construction process.

This application includes inspection and testing, analysis during the construction phase, and feedback of inspection results.

A case study approach was adopted to explain the dynamic quality control model that was developed from a complete review of the site investigation. In the case study, the inspection data was collected from the project general contractor and CAD drawings and the construction schedule were obtained from the project owner and from contractors.

STEPS FOR DESIGN OF BUILDING MODEL:

STEP1: Collection of AutoCAD 2D drawings of the project from site and project manager.
STEP 2: Creation of 3D model by importing 2D drawings in REVIT software.
STEP3: Conversion of the REVIT 3D model into Naviswork format by using an extension tool in REVIT.

STEP 4: Preparation of work breakdown structure for the project and creation of task schedule using the quantity data from REVIT in Microsoft project.
STEP 5: Creation of 5D model by importing and attaching 3D model and the MSP schedules (time and cost) in Naviswork software.
STEP6: Simulation and visualization of 5D model in Naviswork software.

DEVELOPMENT OF MODEL IN 3D USING REVIT:

Autodesk Revit Architecture is a credentials software application created by Autodesk for architects and building professionals. The tools and description that make up Revit Architecture are purposely designed to support building information modeling (BIM) workflows. With use of BIM as altered to computer-aided drafting (CAD), Revit Architecture is capable to provide active information in bright models also allows multifaceted building structures to be precisely designed and predictable in a short amount of time. Each quick model created with Revit Architecture represents an entire project and is stored in a single database file. This allows changes made in one part of the model to be automatically propagated to other parts of the model.

SCHEDULING USING MICROSOFT PROJECT (MSP):

Microsoft Project is accessible in standard and expert editions, depending upon the project needs and management level. The format of a Microsoft Project file is .mpp. It is one of the most commonly used PC-based project management equipment, and is designed to help managers in tasks such as: Devising plans, Setting practical goals, major resources, Assigning tasks, Recording progress and finances, monitor workloads, Scheduling meetings.

The software has an user-friendly help wizard that guides the user throughout the path of the assignment from formation to resource classification, assigning tasks and obtaining final results.

DEVELOPMENT OF MODEL IN 4D USING NAVISWORK:

Autodesk Naviswork Manage software is a broad review solution for analysis, simulation, and coordination of project information. Multidisciplinary design data can be combined into a single incorporated project model for interference management and clash detection. Naviswork Manage helps design and construction professionals predict and avoid possible problems before construction.

4D Scheduling Simulate building schedules and analyze project performance, and helps to decrease delays and sequencing problems. In project we used the scheduling for developing construction sequences that link model geometry to times and dates import times, dates, and other task data from project management software to actively link schedule with project models; and set up planned and actual times to visualize deviations from the project schedule.

With the use of cooperation Toolkit we communicated design intent and encourage teamwork with the ability to add mark-ups to viewpoints with advanced redlining tools. The software's object simulation character help you create animations of objects for clash and interference analysis. You can create communication scripts that link animations to specific events, triggers, or key comments, and link animations to tasks in a 4D schedule or improved construction planning.

CLASH DETECTION WITH NAVISWORK SOFTWARE:

Naviswork provides a stage for integrate all of the trades, even those with different 3D programs, into one system in order to build a comprehensive and interactive, three dimensional model of each project we perform.

Naviswork predict clashes by combine all of the trades in the virtual world, allowing us to revise plans and schedules to resolve conflicts before construction begin. This saves thousands of man hours that would be spent working through these issues in the field. Doing it right the first time, with a complete 3D representation of the project, preserves valuable resources of time and money.

With Naviswork, a 3D model of the entire project is given a virtual walk through.

QUALITY MANAGEMENT SYSTEM:

The quality of a invention is reflected in its ability to induce confirmed or oblique needs and internal characteristics of a finished product in addition to its external design. Therefore, construction product quality can be defined as: the degree to which the stated or implied needs and the internal characteristics are guaranteed during the process of construction. This research defines quality as compliance with construction codes and specifications.

During the last decades construction industry has been heavily criticized for its performance and productivity in relation to other industries, it appears that the construction

industry is going through an powerful stage of introspection, which is exacerbated by bigger industrial and social change. These changes are varying the stroke of the environment within which construction operate. in addition, such changes extensively affect the way business is carried. No organization operating in the construction industry, whether huge or tiny, personal or civic, can afford to disregard its altering environments if it is to stay alive.

lots of of the organization practice use to carry construction organization are being challenged. The industry's clients are moving ahead. Clients require better service quality, quicker buildings and innovation in technology. It is no disaster that the construction industry has turned to the manufacturing sector as a point of reference and source of innovation. Successful concepts derived from manufacturing, such as Total Quality Management (TQM), Reengineering and Lean (or Just-in-Time) Production, are being adopted and integrated into the construction industry. Implicitly, the successful execution of these concepts is deeply reliant on a society of teamwork and cooperation at both intra- and inter-organizational levels in construction.

Quality Management has more and more been adopt by construction companies as an initiative to solve quality evils and to meet the needs of the ultimate client, if yet an business wanted to take up the concept of QMS (Quality Management System) in the construction industry. on the other hand, implementing QMS ideology in construction industry is above all tricky because of the many parties involved.

IV. DATA COLLECTION

SITE DETAILS

- Name of site : 18 latitude
- Location of site : Punawale, Mulshi, Pune
- Site Engg: Manoj Gawade
- A proposed commercial building having 7 floor and102shops is taken for case study location is in Punawale.
- Design Team: Sanskrit construction
- Owner and Developer :G. D. Square and akshaychordiya
- Architect: Rajas Designers
- Cost of project : 16 Cr
- Structural Engineer : Structus Consultantss
- Builder :G. D. Square and akshay chordiya
- Area: 92000 sq.ft.
- Commercial building having No. of Towers: 1, No. of Floors: 7 Floors, No. of showroom:6.
- Present condition of the project : under construction
- No. of Towers: 1,No. of Floors: 7 Floors, No. of showroom: 6

Fig 2: 3rd eye view of actual site

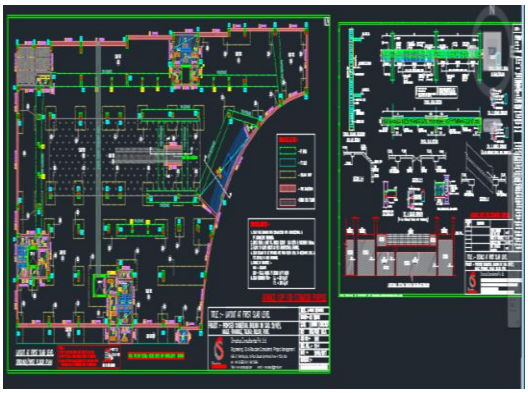


Fig 3: First floor slab

Fig .4: layout plan

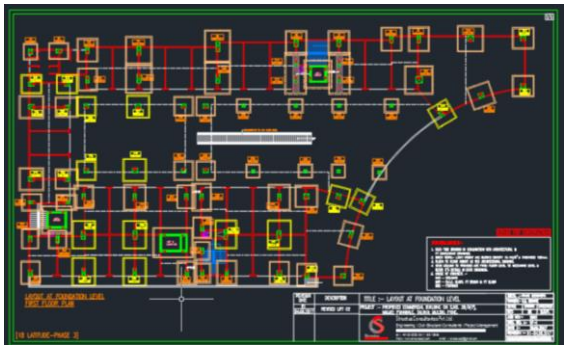


Fig 5: center line plan

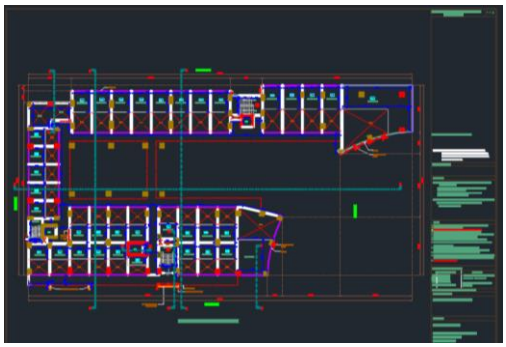


Fig 6: 2nd floor plan

Fig 7: plinth beam layout

18 latitude by G. D. Square and Akshay Chordiya

18 latitude is spread across beautiful 92000 sq.ft., of which nearly 50% is reserved for greenery and open spaces. The landscape is designed in a contemporary resort style, with the lush tropical planting to cool the environment and provide beauty.

Fig 8: Site Condition

V. RESULTS AND DISCUSSION

LOD 300 REVIT MODEL:

LOD 300 MODEL PREPARED IN REVIT SOFTWARE:
Using Autodesk Revit software 3D model of building is prepared in LOD 300.

Following are image of model, framing of model, development of model and final LOD 300 model.

After 3D modelling proceed to scheduling in Microsoft Project software. And then 4D model in Autodesk Navisworks will work out.

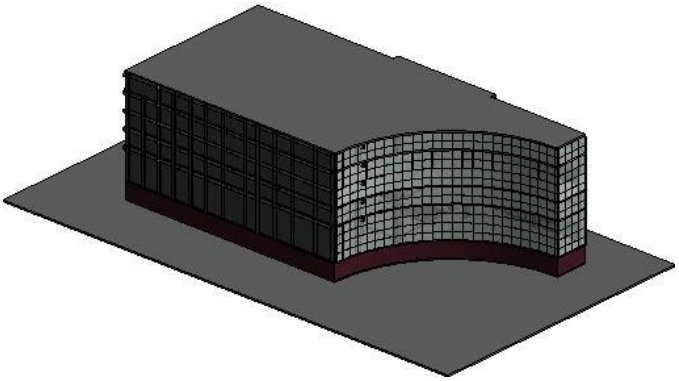


Fig 9: 3D Model

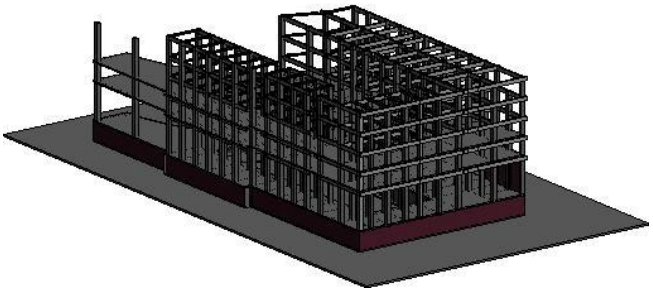
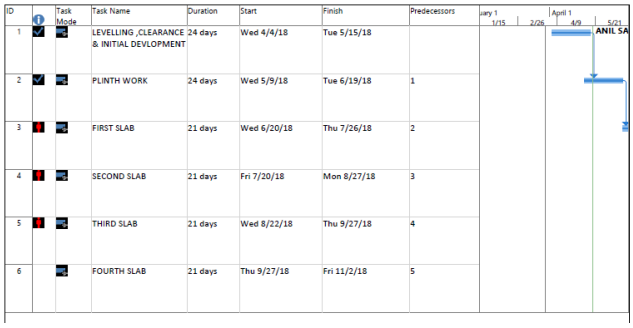


Fig 10 : 3D Model LOD 300

Naviswork modelling: LOD 400 MODEL

3D model from Revit software and Schedule from MSP is imported to the Naviswork and 4D model is done in Naviswoks. In this software simulation is workout



ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		LEVELLING ,CLEARANCE & INITIAL DEVLOPMENT	24 days	Wed 4/4/18	Tue 5/15/18	
2		PLINTH WORK	24 days	Wed 5/9/18	Tue 6/19/18	1
3		FIRST SLAB	21 days	Wed 6/20/18	Thu 7/26/18	2
4		SECOND SLAB	21 days	Fri 7/20/18	Mon 8/27/18	3
5		THIRD SLAB	21 days	Wed 8/22/18	Thu 9/27/18	4
6		FOURTH SLAB	21 days	Thu 9/27/18	Fri 11/2/18	5

Fig 11: SCHEDULING IN MSP

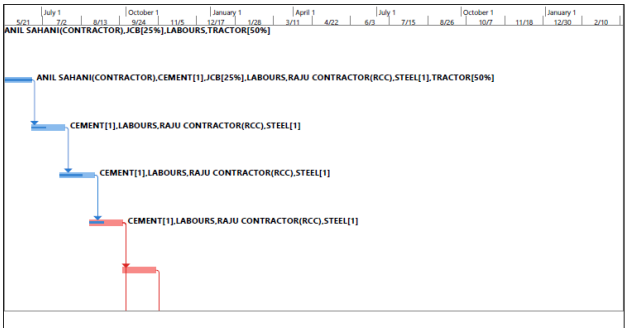


Fig 12: BAR CHART IN MSP

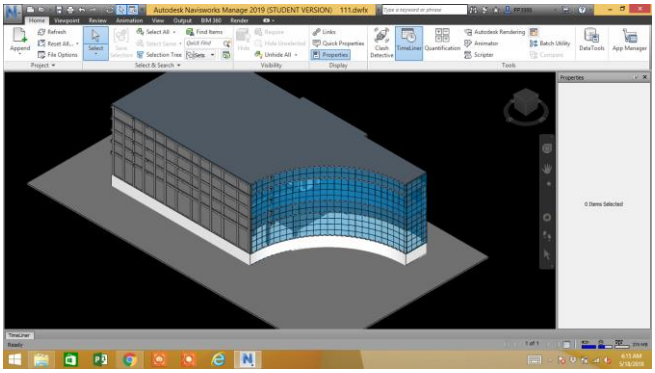


Fig 13: LOD 400 MODEL

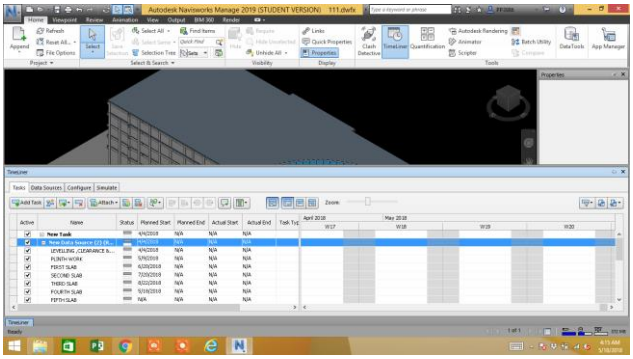


Fig14: LOD 400 MODEL+SCHEDULLING

GRAPHICAL REPRESENATATION:

It is observed that by using BIM technoogy we can save total 102 days of construction of building.

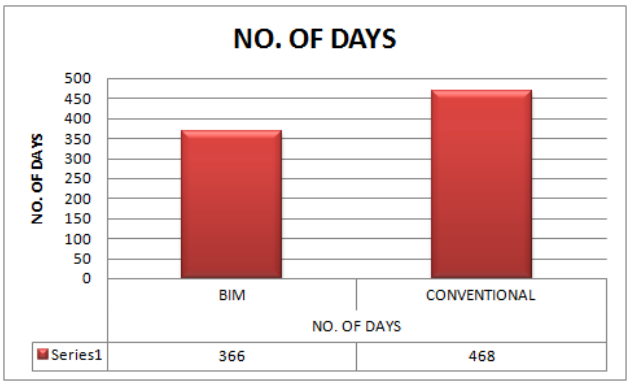


Fig 15: 4D PARAMETER

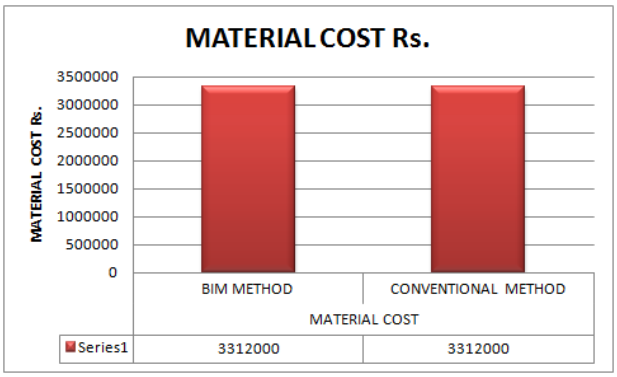


Fig 16: 5D PARAMETER

VI. CONCLUSION

In this paper the BIM method is used for effective construction management, the quality management improvement is studied and it is observed that using clash detection effective coordination of various parties can be maintained. Furthermore the number of schedule days can be reduced to 25-30% by reduction in planning, analysis and design days

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