

A Review on Visualization of Construction Planning and Scheduling Using 4D CAD Modeling

Ms. Pallavi D. Kashid¹ Prof. G. N. Kanade²

¹M.E. Student ²Assistant Professor

^{1,2}Department of Civil Engineering

^{1,2}Tatyasaheb Kore Institute of Engineering and Technology, Warananagar, India

Abstract— This study presents on visualization of construction planning and scheduling using 4D CAD Modeling. Planning of construction activities is an important factor for development of construction industry. There are various tools available for planning of regular projects but complicated projects requires more accuracy in planning in order to save both time and money. Contractors and suppliers try to finish the project within schedule time of completion without any cost overruns. For that, they adopt various planning methodology. Still there is a vast difference between planning and actual site execution. This is mainly due to ineffective planning & visualization. Therefore, efficient visualization & planning of construction activities is required for better cost control and avoid time overruns. 4D CAD modeling is the better tool for visualization and planning of construction activities. In this paper applicability of 4D CAD tool for planning, visualization, monitoring of various important construction activities like RCC elements of frame structure and benefits of 4D CAD modeling are studied. 4D Models link components in 3D CAD models with activities from the design, procurement, and construction schedules. The resulting 4D production model of a project allows project stakeholders to view the planned construction of a facility over time on the screen and to review a 3D CAD model for any day, week, or month of the project. Use of 4D Model contributed in time saving and ultimately cost of construction by reducing the delay. 4D models help to improve construction plans as compared to traditional planning tools.

Key words: 2D CAD Drawing, Construction Planning and Scheduling, 3 D model, MSP Software, 4D CAD Model

I. INTRODUCTION

Planning and Scheduling are the very important part of every construction project. Conventional planning methods are not useful in the advancing construction industry. To overcome this problem there is a need of a better and more efficient tool such as 4D CAD modeling. 4D CAD model is developed at the time of planning in which 3D geometrical model is simulated with the construction schedule which is created by using Microsoft project or PRIMAVERA. By using the 4D CAD model, construction planner, engineer and designer can simulate the planned and actual sequence of construction activities with different color coding, which helps to distinguish the activity like early start, early finish, finished on time, late finish etc. It is helpful in monitoring the progress of construction project as well as clashes between two or more activities well in advance before actual construction, in order to make decision related to design, for planning and design of projects. 4D models can give a clear picture of project & idea to future possible impact while

planning which will occur during construction. The findings confirm that the 4D model is more rational, more convenient and efficient than the 2D model regarding all results of statistical and multi criteria analysis. 4D CAD minimize the cost overrunning & delays. 4D model is the promising tool for construction planning. If only converting this 2D drawing is a tedious task, combining these 2D drawings with safety. Planning creates more difficult tasks. In order to address the problems, this paper discusses our research in integrating construction scheduling and safety planning in a 4D environment. This method helps to measure level of application of constructability principles using 4D CAD on construction design. 4D models are linked with each design units with corresponding time schedule. The fourth dimension in the 4D CAD model is the time schedule. They must allocate right resources and adjust the schedule more effectively. Use of 4D Model contributed in time saving and ultimately cost of construction by reducing the delay. 4D models help to improve construction plans as compared to traditional planning tools. For which planner needs to estimate the location, timing & intensity of the impact that are caused by planned construction work. By implementing this model in actual practice, results were obtained and from these results they set conclusion.

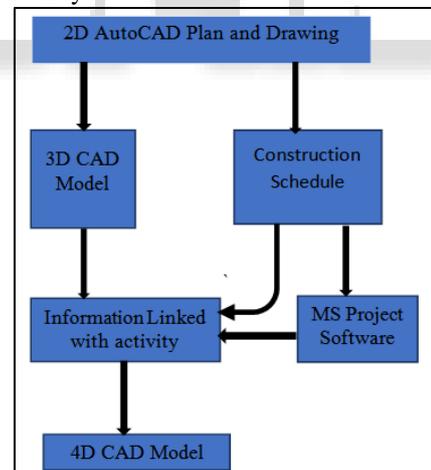


Fig. 1: Generation of 4D CAD Model

II. PROBLEM STATEMENT

The Indian construction industry has implemented a few steps of management systems like environmental management safety & health management system. Applying the construction management systems independently only, could improve few construction impacts but by integrating it with the current management system will open all the vital construction components widely, that need to be taken into consideration and will gains long term benefits. Still the end product delivered by the construction industry is not in the scheduled time given to the client. There are number of

reasons behind it, but lack of planning is one of the important reasons. If we improve the planning & scheduling of the construction activities then we can achieve success to deliver a project within time.

III. OBJECTIVE

To improve and visualize the planning and scheduling methods in construction industry. The following objectives listed below:

- 1) To study the present status of construction site required.
- 2) To develop a 4D CAD model for construction project.
- 3) To study the impact of 4D CAD model on planning and scheduling of the construction projects.
- 4) To compare the 4D CAD models for planning with traditional planning methods.

IV. RESEARCH METHODOLOGY

The research methodology includes the study of literature survey. The study of various papers, Journals of national and international project management and some points of concepts learned from websites, from these literatures review the concepts of generation and development 4D CAD model is understood.

A. Literature Review

1) 4D CAD Model

Katherine A. Liapi et al. studied TRIVERA: An Efficient Tool for Cost Integration Into 4D Models. He gives the applications in building design to allow visualization of construction sequence. Also he is designed to link cost of materials reports generated from 3D software with the cost of resources reports generated from this scheduling software and for display of cost at same time sequence as the construction schedule.

Vacharapoom Benjaoran (2009) et al. studied the 4D CAD Model with Fall Guard Boundary Visualization. He addressed that 4D CAD model accepted for better conceptualizing and also It helps to project manager for better comprehend and aware safety requirements of construction. It develops and implements the 4D CAD model with Fall Guard Boundary Visualization [23].

Harshal S. Shimpi et al. studied 4D BIM in Construction Planning and Scheduling. He addressed that the 4D BIM model has been useful and effective during construction. It is helpful in decision making, reduction in amount of rework in preconstruction, good visualization, easy resource management and avoid unnecessary delay [9].

Sai Yerrapathruni, John I. Messner, et al., (2003) studied the Improvement in Planning by using the 4D CAD and Immersive Virtual Environment (IVE). They investigated of the feasibility of using an immersive 3D virtual environment to view and generate the 4D models to improve the construction project [19].

2) Development of 4D CAD Model

Manish Goyal et al. studied the Development of 4D Model for Application in Construction Management. He established that to overcome the problems occurred in conventional construction planning methods. Author's analysis is leads to the improvement of project planning and execution of project strategy [34].

Akash A. Patel et al. studied the Simulation of Residential Project Using BIM Concept. He addressed that using BIM implements project management function also this method will be beneficial and practical to apply 4D scheduling in any construction project. It saves the lot of time and money over traditional methods [33].

3) GIS Based 4D CAD Development:

Gopal M. Naik et al. studied the GIS Based 4D Model Development for Planning and scheduling of A Construction Project. He was focused on ability of models, their visual and communication impact and also on impact of construction design. Author's goal is to improve design power of 4 D models and analysis of alternative schedule process [8].

Leaon L. OLDE SCHOOLTENHUIS et al. Comparing Mindfulness in Manual and 4D Supported Coordination Practices. He was investigates the role of 4D visualization in construction project. He addressed to reduce conflicts, delays, cost overruns and enhancing reliability of coordination of construction process.

4) Applications of 4D CAD model [13].

Leen – Seok Kang et al. studied Application of 4D CAD System for Civil Engineering Project. He states that the 4D model improves the configuration approaches to address issues in great demand. From this research new techniques introduced and development of 4D system applicable to civil engineering projects and also develop morphing techniques to realize earthwork activity such as filling and cutting [31].

Joong – Min Kwak et al. studied 4D CAD Application Examples and Directions for Development in Civil Engineering Project. He addressed for the successful implementation of construction projects. Authors study was to suggest extended function and future direction for 4D cad model [28].

T. Hartman et.al (2013) studied the applicability of 4D CAD model to visualize the impact of the highway construction on the public. This paper deals with the impacts of highway construction on the people around and some of the preventive measures on the impact taken, by improving planning methodology. This can be done by considering the impacts like traffic hindrances, noise pollution, dust and vibrations on residential, commercial, industrial surrounding. For obtaining results the case has been studied by author where 4D CAD model was implemented. The main aim of this research was, to reduce the effects or magnitude of these impacts. For which planner needs to estimate the location, timing & intensity of the impact that are caused by planned construction work [18].

B. Evaluation and Impact of 4D CAD:

Mr. Satish A. Pitake et al. studied the Visualization of Construction Progress by 4D Modeling Application. He established the visual methods of scheduling, application of better coordination and communication with project team members. He states that 4D models helps in effective visualization of construction schedule, saves time and money, reduces delay in construction and help to improve construction plan. 4D models useful in graphical presentation and communication of construction schedule. We develop the 4D model with the help of software's such as MS Office

Project, AUTOCAD 2D and 3D, Nevis work Manage, and Google Sketch up [21].

Ashwin Mahalingam (2010) studied the applicability of 4D CAD on construction projects. This paper deals with the maximization of implementation and usefulness of 4D CAD model in construction industry by introducing the positioned and implementation on construction site. It also deals with the application of 4D CAD models in the project planning and monitoring or controlling the various construction activities. There were two research aims, i.e. to understand the usage of 4D CAD model which will be beneficial for Construction. Second of them is in which manner 4D CAD models can be used in construction industry with the new technology to modify the construction process. To fulfill these aims they set a methodology in which they selected construction projects like two infrastructure projects and two commercial projects. Each project type represents different challenges with respect to complexity difficulties in organization. For analyzing the impact of 4D CAD model on each of the project type separately, 4D CAD model were developed for each of these projects [3].

V. CONCLUSION

It is concluded that 4D CAD modeling is one of the very efficient and useful tool for planning of any construction project helping the planner as well as the other construction personnel to visualize the project in details. Further it is also helpful in minimizing the time and cost of the project. Paper also discusses various techniques available for development of 4D CAD model. The use of 4D CAD is likely to be most beneficial. This study states that 4D CAD modeling is more useful at the initial stages like project planning, project design and for project monitoring or construction stage. 4D CAD is likely to be particularly useful in communicating the construction plans and processes to clients, who can then visualize the project and convey their suggestions or acceptance. This method saves the time and money at construction site. Also avoid delays in completion of work and avoid the accidents on construction site.

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