Planning and Scheduling in Construction through Model Approach

Shivani sakre
Civil Engineering Department,
Imperial college of engineering and
Research, Wagholi, Pune- 412205, India
Shivani_sakre@hotmail.com

Prof.Abhijit .N. Bhirud
Civil Engineering Department,
Imperial college of engineering and
Research, Wagholi, Pune-412205, India
abhijitbhirud11@gmail.com

Abstract— The ambiguity, delays, and complexity of projects in construction industry in the present scenario makes it needed for proper planning a particularly when the difficulty arises in the task for project managers due to the need to visualize the forthcoming activities at the construction site. Ability to manage the risk factors being foreseen is an important criterion for the success of the project. Conventional computer-assisted technology through software can help but is often limited to the practical issues involved. Virtual model of the project gives an improved method through the visualisation of construction activities by computer simulation. This paper explains the methods of virtual model analysis to optimize construction planning schedules by analysing resource allocation and planning. Construction & resource models, construction planning schedules and site-layout plans are taken help to optimize the project objectives.

*****

I. INTRODUCTION:

Successful completion of projects is a result of careful planning and execution. As for example critical path method (CPM) and bar charts, are commonly used to enable this to be done in a systematic way. Proper allocation of resources logically and in a planned manner keeps a check on project delay and other delay factors. But, the project planners face many uncertain and complex tasks during construction period due to e.g., the lacunas during designing and the mismatch between what is needed and what is planned. Moreover, errors and mistakes in the construction planning schedule occur frequently to a large extent on the project team's limited knowledge and experience. The contractor's inability to predict if the project will result in a profit or a loss while construction can be very much a gamble.
Also, a case study is presented to demonstrate how the construction planning schedule is optimized. Future improvements to the related technology are discussed and concluded in the final section.

II. OBJECTIVE :

Basically this study will conduct an exploratory study on implementation of
Computer simulated model in construction related aspect of a project which comprise of Planning and Scheduling stage. In this regard the study is done for the objectives listed below:

1. Establish a pragmatic strategy for planning, scheduling, controlling, tracking, and monitoring a complex technical project.
2. To identify the problems and analyse resource allocation including equipment to provide a realistic approach to construction planning schedule

III. METHODOLOGY:

1. Initiating with describing the framework of integrated planning using the computer simulated technology using virtual computer models.
2. Studying the basics of framework to be implemented in the project planning through literature reviews, research papers.
3. Data collection through case study.
4. Discussion on future improvements to the Virtual Prototype technology are discussed and concluded.

IV. LITERATURE REVIEW:

Definition of the Construction Model

For digital mode, Construction Model consists of two types. The first type is a 3D model which relates with evaluation of the credits of the model. The key function in the construction field is to allow planners to view their static realistic images and check for design errors and collisions. Some critical factors include temporary works while planning and this way it can be developed for temporary works with model approach.
The purpose of this model is as a design check and is also closely associated with the construction planning schedule. This type of model decomposes serial assembly models to develop a detailed construction activity.

Definition of the Resources Model

Two resources models can be identified: an equipment-based model and an activity-based model.
Equipment-based Model – The output, frequency, consumption factor etc linked with equipment is a 3D-geometry model linked with the productivity rate of equipment in an Excel format database and physical database. Eg. The crane based equipment model contains graphical information that is the exact related to its geometry.
Activity-based Model – This model is a non-physical approach linked with the productivity rate prepared detail in an Excel database. The fixing TMT bars activity is one example.

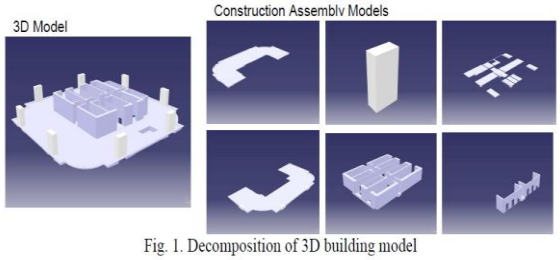

Fig. 1. Decomposition of 3D building model

V. TECHNICAL PAPERS:

- *Accuracy of the Contractor's Schedules*
  -Kris Mattila, P.E.

The main aim of the study was to examine the accuracy of the progress schedules. Increase in accuracy of the schedules when concurrent controlling operations are used was determined after studying eight constructions (four without concurrent controlling activities and four with concurrent controlling activities) and their progress schedule accuracy.

- *Construction-Scheduling :Principle, practices, case studies*
  -L. J. R. Cole

This paper establishes some needs for the planning and monitoring of work, the characteristics of site activities, the models or techniques available, the methods used by contractors in practice, and the results achieved by using some of these techniques on six industrial applications.

- *Planning of Project Planning process*
  - Niclas Andersson

This paper describes the current status of the project planning process in the Swedish construction company Skanska Syd AB. The purpose of the study is to identify and analyse important aspects of potential improvements of project planning. The study shows that re-engineering of the project planning process involves five improvement areas of concern; distinct demands, adequate education and support, quality assurance of the planning process, integrated project management systems, and experiential feed-back

- *Optimizing the project risk factors in construction industry*.
  - PEJMAN REZAKHANI

This paper is an investigation of different risks which may be involved in construction projects. Project management functions which have the most effect on risk management plan are categorized and an analysis of key risk factors in every category is described. Finally a hierarchical risk classification to cover all the effective key risk factors in construction projects is suggested. Case studies have shown that this classification covers the most key risks that should be taken into consideration in a risk management plan.

Resource Analysis

In the construction industry, the experience of the project managers is an important index for every estimating of project activities. The duration of activities is therefore often uncertain. Verifying and then adjusting the resource allocation is one of the major functions of this approach which utilizes real productivity data from the system database. Through the process simulation, resources, such as space, equipment and crew, can be analyzed. Dependence on tower cranes to perform lifting and related activities is very common in building projects. The tower crane is the most critical component of the construction planning schedule. Through 3D visualization and simulation of the tower cranes, the planner understands the planning in detail and is able to predict planning mistakes.

The following sections provide a case study to demonstrate how resource allocation is analyzed.

VI. CASE STUDY:

The case study involves two apartment building projects in Ranchi. At the time of Case study, the foundations of the two buildings were already completed. The site Layout planning had also taken place. During construction, the project managers encountered different types of critical problems while planning the typical construction cycle. They would like to have visualization, digital and mathematical method to measure the constructability of the construction planning schedule. They provided the researchers with a preliminary construction planning schedule of a typical floor construction, comprising a 6-day cycle time slot - planning schedule. The building had prefabricated concrete facades supported by in-situ concrete walls, a lift core and half an in-situ slab. The two buildings were named No.1 and No.2 respectively.

Research Method

The data collected is used to prepare construction model and resource model, analysis of resource allocation, allocation on tower crane. Further Preliminary Construction Planning was done including scheduling of work
Model approach in projects should be used with the help of site layout planning system. Safety equipment model productivity factors are helpful to increase the productivity. Construction management can be optimized with the discussed approach and factors. To design computer model through this approach of site planning layout, this paper is discussed.

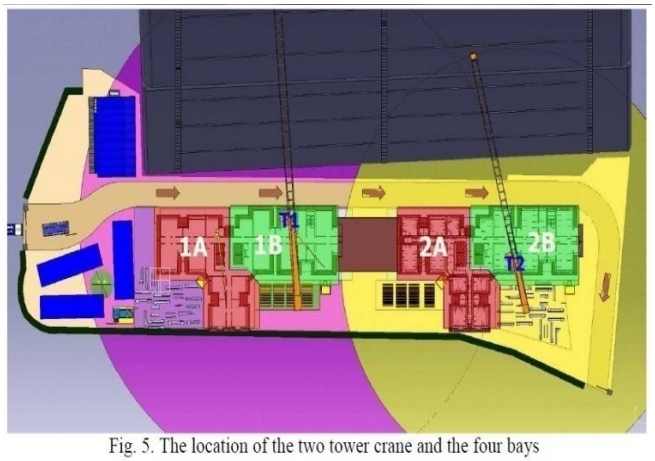

Fig. 5. The location of the two tower crane and the four bays

VII. CONCLUSION

The current ongoing project planners for project management can better forecast the process and output of the project activities through this computer model approach. The paper describes the construction planning & scheduling process through resource & equipment model. Optimizing and integrating the schedule can be done at starting and intermediate level of the project.

References

[1] H. Li, H.L. Guo, M. J. Skibniewski and M. Skitmore, Using the IKEA model and Virtual prototyping technology to improve construction process management, Journal of Construction Engineering and Economics 26 (2008), 991-1000

[2] A.F. Waly and W.Y. Thabet, A virtual construction environment for Preconstruction planning, Automation in Construction 12 (2002) 139–154

[3] B. Koo and M. Fischer, Feasibility study of 4D CAD in commercial construction, Journal of Construction Engineering and Management 126 (4) (2000) 251–260

[4] K.W. Chau, M. Anson and J.P. Zhang, Implementation of visualization as planning and scheduling tool in construction, Building and Environment

[5] W. Chan, D. K. H. Chua, and G. Kannan, Construction Resource Scheduling with Genetic Algorithms.

[6] T. Hegazy, Optimization of Resource Allocation and Leveling Using Genetic Algorithms, Journal of Construction Engineering and Management 125(3) (1999)167-175.

[7] S. S. Leu and C. H. Yang, GA-Based Multicriteria Optimal Model for Construction Scheduling, Journal of Construction Engineering andManagement

[8] H. Li, and P. Love, Using improved genetic algorithms to facilitate time-cost optimization, Journal of Construction Engineering and Management 123(3) (1997)

[9] T. Hegazy and M. Kassab, Resource Optimization Using Combined Simulatio and Genetic Algorithms, Journal of Construction Engineering andManagement 129(6) (2003) 698-705

[10] H. J. Wang, J.P. Zhang, K.W. Chau and M. Anson, 4D dynamic management for construction planning and resource utilization, Automation in Construction 13 (2004) 575-589

[11] H. Li, T. Huang, C.W. Kong, H.L. Guo, A. Baldwin and N. Chan, J. Wong, Integrating design and construction through virtual prototyping, Automation in Construction 17 (2008) 915–922

[12] H. Li, H.L. Guo, M. J. Skibniewski and M. Skitmore, Using the IKEA model and virtual prototyping technology to improve construction process management, Journal of Construction Engineering and Economics 26 (2008), 991-1000