

Comparative study of Township Project by CPM & CCPM using Primavera P6

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Abstract - Critical Chain Project Management (CCPM) is a methodology for planning, executing and managing projects. Present thesis research is oriented and focuses to analyze construction project management technique and methodology for under construction buildings taken as a live practical case for research as a problem location. The research is identified to show offers and effect of CCPM technique to improve project performance and help decision for manager for improvement in existing method of construction and its planning. It is required to plan and design CPM and CCPM together, as CPM never offers execution methodology and must be subordinate to CCPM for execution of on time and under controlled cost project completion. The trends and original time and operational sequence records are collected for considered building construction cases to identify and trace overall activities on time scale. Primavera P6 software is used to record data and to find critical path for building construction. The aim is to reduce time and hence cost of project utilizing CCPM and Primavera P6 together. Suggestions are scientifically implemented for activity and sequence of activities to improve project time. Improved suggested project schedule is compared with existing schedule to show results in comparative format with graphs and charts to prove effectiveness of CCPM and Primavera P6 utility.

Index Terms - CCPM, Primavera P6, Project Management, Scheduling.

I. INTRODUCTION

Project management is a broad term in construction field which relates to the use of schedules such as Bar-Gantt charts to plan and accordingly report the progress of the project. Planning means a timely based planning of actions of various activities and resources to achieve specified objectives. It is also the process of developing any project development. The plan outlines about how a project needs to be directed to achieve the desired goals. It also specifies about

predetermined and committed future plans of action, based on the discussions and decisions made on the current knowledge and estimation about the future trends.

Planning, in its broader perspective, involves advance thinking as to what is to be done, what are the activities, how it is to be done, when it is to be done, where it is to be done what is needed to do it, who is to do it and how to ensure that it is done; all of this is channelized to generate and evaluate options for evolving an action plan aimed at achieving the specified goals.

II. PRIMAVERA

Primavera Systems, Inc was a private company providing Project Portfolio Management (PPM) software to help project-intensive organizations identify, prioritize, and select project investments and plan, manage, and control projects and project portfolios of all sizes. On January 1, 2009 Oracle Corporation took legal ownership of Primavera. Primavera Systems, Inc. was founded on May 1, 1983 by Joel Koppelman and Dick Faris. It traded as a private company based in Pennsylvania (USA), developing software for the Project Portfolio Management market. To help expand its product capabilities, Primavera acquired Eagle Ray Software Systems in 1999, Evolve Technologies (a professional services automation vendor) in 2003, Pro Sight (an IT portfolio management software vendor) in 2006, and, in the same year, Pert master (a project risk management).

III. OBJECTIVES OF THE STUDY

The objectives of this study are:

1. To identify construction sequence for a township project.

2. To work out the practical durations required to carry out the activities.
3. To identify scheduling technique used by the organization in developing plan and scheduling.
4. To develop scheduling using Primavera project planners software.
5. To track the project and analyze the reasons for delays, and increase in estimated budget etc.
6. To investigate defects in the planning and scheduling procedure of the organization and suggest suitable improvements in their methods.

IV. LITERATURE REVIEW

Anish et al 2017, in their research work uses the popular P6 (Primavera project planner) software tool for investigating the current practice of CPM scheduling and Budgeted cost. For implementing the method adopted for this thesis work, a medium level organization is being identified, which carry out multiple construction works. Relation and sequence of civil works have been identified with the aid of Primavera P6. Activities having float are distinguished. Total duration of all projects has been calculated by sequencing activities through precedence diagramming method. Usage of resources has been optimized as a result of proper resource allocation. By this systematic method of planning of project activities successful completion of projects within stipulated time and by estimated cost could be achieved.

Deepti Sahu et al 2017 in the study deals with the project monitoring process of "Residence Colony" which is collection of 5 blocks of five stories (G+5) each building, whose construction is in progress at Bhopal Madhya Pradesh. Using project management software Primavera P6 a comparison between the planned progresses of construction work and actual progress is performed. Primavera software provides enterprise project portfolio management solutions that help customer to manage their project, programs and resource. Over the last decade the way in which project monitoring tasks such as organization, planning and decision-making are executed and supported has certainly developed. Whereas a decade or so ago scheduling methods including PERT, CPM or using spreadsheets were well-known and widely used, the current standard is software with integrated support for display of activity duration, resource analysis, risk

analysis, communication between project participants etc. Apart from advanced network software solutions (EPM, PPM), their less sophisticated versions such as MS Project and Primavera are also well received by users.

CRITIQUE

The previous studies shows that there were few solution methods and computer applications which were developed and led to a number of heuristics, models and computer programs in order to solve, in a second stage, scheduling problems of none repetitive construction.

There is a need of a powerful information platform system for dynamic management and project resources optimization to link new technology to the full spectrum of construction management work. The integration of a model, resource templates other design and developing strategies has been taken well beyond its original scheduling utility. Also it is required that simultaneously the concept of dynamic management, scheduling and resources optimization should be accounted so that a complex problem like a Township Project can be effectively concluded. It is observed that:

Scheduling and Resource management theories and practices are few solutions were developed with systematic especially in construction project but lacks in common practices.

For construction project planning, problems are identified and listed as major issues:

1. Planning does not meet actual due dates.
2. Mostly rework issues.
3. Unavailability of resources when required immediately.
4. Delays, documentation and procedural problems in a project.
5. Lack of clear specifications and authorized designs.
6. Frequent customer changes problems.

V. METHODOLOGY

Major Construction projects are so complex in the nature there are various things involved in the project to be managed in order to complete the project successfully. Now days there are various project management software's available to manage the whole

project, most used among industry is Primavera P6. In this study involves monitoring and controlling the project using Primavera P6. Steps involve in the

Primavera P6 are:

- Create Project
- Define WBS
- Creating Calendar
- Define Activity
- Appoint Activity Durations
- Assign Logic Links
- Perform Scheduling
- Allocating Resources / budgeting
- Creating Baselines
- Updating Schedule
- Earned value analysis
- Publishing Reports

Basics about Scheduling:

Scheduling is determination the timing of events in the project that is when and which task will be performed? Putting it in simple words it is a reflection of plan. In other words, we can say, planning is How, What and Who whereas scheduling is when and why. Scheduling can be also defined as the detailed plan of the project work tasks with respect to time. A schedule is also a good communication tool between all the stakeholders of the project. Schedule gives an overall sense of expected progress of the project without schedule it is very difficult to explain someone unfamiliar with the project what is going on and what is expected to take place.

Basics about Primavera

Primavera Systems, Inc was a private company providing Project Portfolio Management (PPM) software to help project-intensive organizations identify, prioritize, and select project investments and plan, manage, and control projects and project portfolios of all sizes. On January 1, 2009 Oracle Corporation took legal ownership of Primavera. Primavera Systems, Inc. was founded on May 1, 1983 by Joel Koppelman and Dick Faris. It traded as a private company based in Pennsylvania (USA), developing software for the Project Portfolio Management market. To help expand its product capabilities, Primavera acquired Eagle Ray Software Systems in 1999, Evolve Technologies (a professional services automation vendor) in 2003, Pro Sight (an IT

portfolio management software vendor) in 2006, and, in the same year, Pert master (a project risk management.

Before implementing Primavera to schedule projects, team members and other project participants should understand the processes involved in project management and the associated recommendations that help smooth the Primavera implementation that supports your corporate mission. If you were driving to a place you had never seen, would you get in the car without directions or a map probably not. More than likely you take the time to plan your trip, consider alternate routes, and estimate your time of arrival. Planning the drive before you even left would help your trip be more successful. And, along the way, should you encounter road blocks or traffic delays, you would have already identified alternate ways to reach your destination.

Basics about planning

Construction planning is a fundamental and challenging activity in management and execution of construction projects. It includes the selection of technology, the definition of work task, the estimation of required durations and resources of individual task and identify the interactions between different work tasks.

In developing a construction plan the importance is given either cost or schedule.

VI. RESULTS AND SIMULATIONS

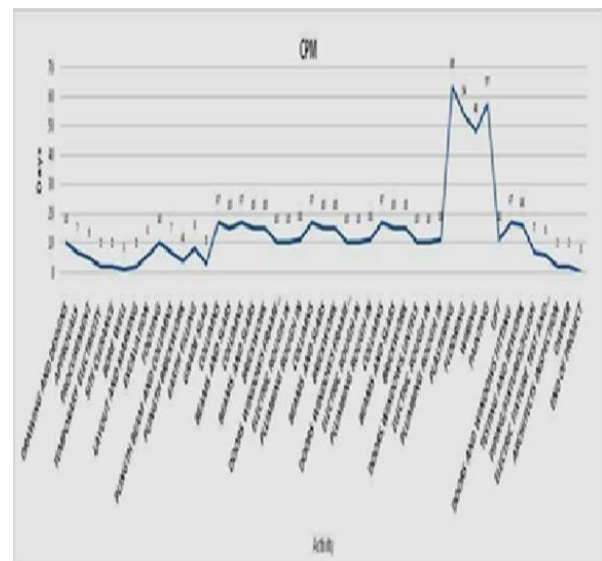


Figure 6.1: Graph for duration of activities using CPM for existing building case.

The graph represents the duration taken to complete the different activities which are obtained by the Primavera P6 software. From these durations the critical path of the project is calculated.

Results for existing building (G+3) (CCPM)

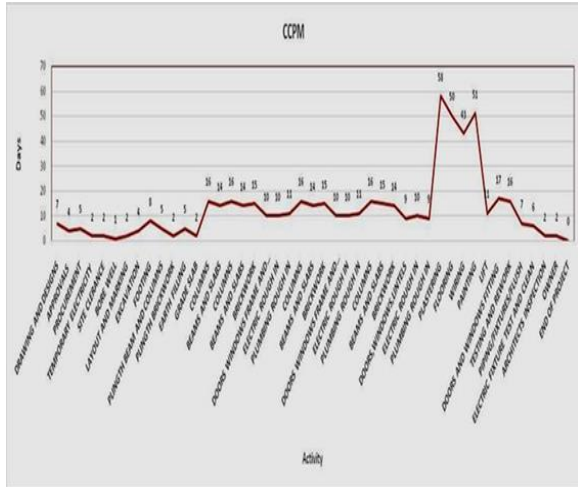


Figure 6.2: Graph for duration of activities using CCPM for existing building case.

The graph represents that the durations of the activities can be reduced by significant amount where ever it is possible. These durations are reduced by calculating the Buffer duration of the project by using Root Squared Error Method (RSEM).

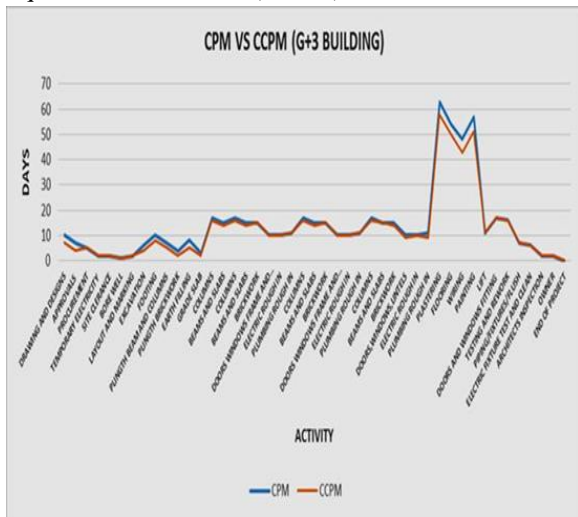


Figure 6.3: Comparison graph for duration of activities using CPM and CCPM for existing building case.

This graph represents the difference between the actual durations and the reduced durations and it shows that the duration can be reduced for the activities which come in Critical path of the project.

Comparison

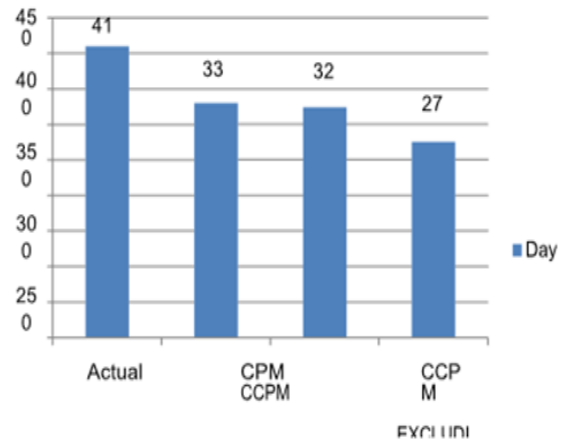


Figure 6.4: Comparison graph for different methods for existing building case

The bar graph shows the total time taken in days by using different methods. As per the data collected the existing building took 410 days to complete. By using Primavera P6 which plans using critical path method gives the project duration of 330 days. By applying concepts of critical chain project management (CCPM) the buffer is calculated using RSEM, which is of 49 days for the project. So, the project duration could be reduced to 324 days which includes 49 days as a buffer in it.

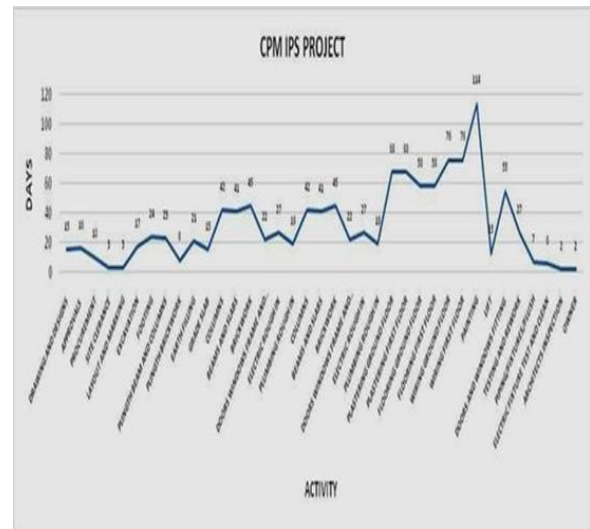


Figure 6.5: Graph for duration of activities using CPM for TOWNSHIP new building case.

The graph represents the duration taken to complete the different activities which are obtained by the Primavera P6 software. From these durations the critical path of the project is calculated.

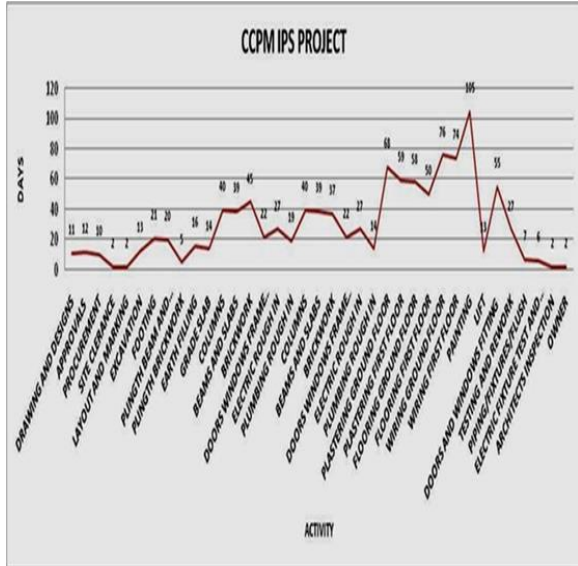


Figure 6.6: Graph for duration of activities using CCPM for TOWNSHIP new building case.

The graph represents that the durations of the activities can be reduced by significant amount where ever it is possible. These durations are reduced by calculating the Buffer duration of the project by using Root Squared Error Method (RSEM).

Comparison Results for TOWNSHIP New Building Project (CPM vs CCPM)

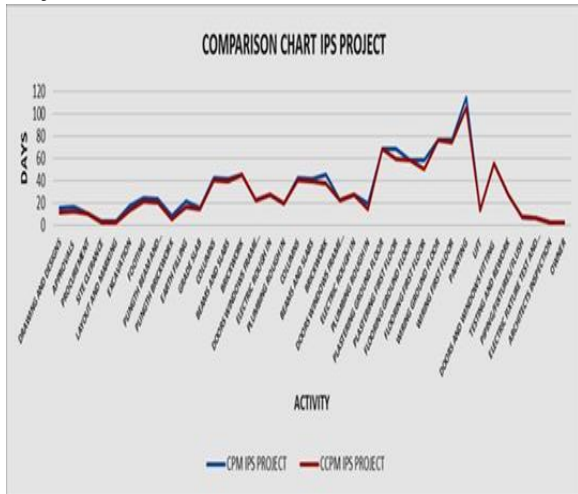


Figure 6.7: Comparison graph for duration of activities using CPM and CCPM for TOWNSHIP new building case.

This graph represents the difference between the actual durations and the reduced durations and it shows that the duration can be reduced for the activities which come in Critical path of the project.

Method Comparison for All Methods (TOWNSHIP Project)

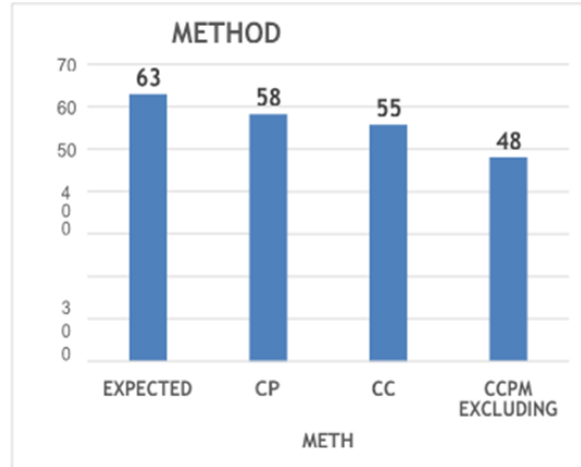


Figure 6.8: Comparison graph for different methods for TOWNSHIP new building case

The bar graph shows the total time taken in days by using different methods. As per the data collected the TOWNSHIP new building is expected to take 630 days to complete the project. As the building is under construction the planning is done by using Primavera P6 which plans using critical path method for scheduling of project.

The duration of the project is found to be 583 days by using CPM and by applying concepts of critical chain project management (CCPM) the buffer is calculated using RSEM, which is found to be 78 days for the project. So the project duration could be reduced to 558 days which includes 78 days as a buffer in it. If the planning is done using CCPM then the project can be completed in 480 days, if the buffer durations are not consumed .

VII. CONCLUSIONS

The main objective of this study was to understand the role of monitoring and control in the progress and timely completion of a construction project. This objective was achieved through revision of literatures and methodologies involved in monitoring and control. For efficient recourse management planning and controlling of a construction project it is very necessary to use project management software. This study represents the importance of resource management in a large construction project. Only because of efficient resource management by Primavera P6 overall cost of a construction which sometimes increases due to wastage of recourse is controlled delay in time also decrease.

The case study proved to be a guideline in understanding the progress of a residential colony construction project. The companies which do not use primavera software tools efficiently have to increase their investments in training and educating their employed project teams. In large construction project efficient resource management reduce the unwanted wastage of resource also cost of overall project. The use of such software's helps to complete the project on schedule time and cost.

- The construction project under research problem was completed in 410 days, as the contractor nowhere performed any scientific planning or scheduling method before executing construction works and for the construction project under research problem is going on since last nine months i.e. 270 days and it is expected that it will take total 630 days to complete.
- CPM applied using Primavera P6 for existing construction project reduces duration from 410 days to 330 days and for TOWNSHIP ongoing project the duration is reduced from 630 days to 583 days.
- CCPM applied after CPM using RSEM, reduces duration of the project by 55 more days (275 days) in case of existing building and 103 more days (480 days) in case of TOWNSHIP building project.
- 49 days and 78 days are considered as buffer safety duration which are considered with project duration for existing building case and for TOWNSHIP new building case respectively.
- Total of 135 days are reduced from actual time taken for G+3 building project after performing CPM and CCPM technique, for the ongoing TOWNSHIP building project if these methods are used then total of 150 days can be reduced from the actual expected time.
- By using CCPM, the duration of the existing project is reduced by 32.92 % that means the project could have been be completed 32.92 % faster than the actual schedule.

FUTURE SCOPE

- A combined study of Critical chain project management methodology and critical path method can be studied.

- Methods of Buffer calculation can be further studied for specific construction industry projects.
- CCPM can be applied in the organisation and further the results can be recorded regarding the project time and cost.

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