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A Comparative Study on Different Type of Management Techniques for a Residential Building

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***Abstract*: "Construction" is the word always refers to term and activities of Civil Engineering, which actually means creation or formation, or it is a process or action taken to bring something into reality/ existence. The development business is crucial for the improvement of the economy of any country. "An undertaking is named as a concise undertaking endeavored to frame a stand-out thing, advantage or result". Undertaking is named as temporary since it incorporates a portrayed start and an end timeframe and is named as interesting in nature since no two ventures have 100% resemblance between them. Implementation was done on a live project, in order to compare the functioning of the two processes (CPM & CCM). The first approach was to create a series of tasks and the second was to take into account the number of days each activity would require.**

The next step was to load all the events with their respective durations into MSP, a project management software. This is done to find the critical path and critical chain to know the total completion time of the project, as it would be a difficult task to do this manually. Both Critical Path and Critical Chain Methods are networks of events, each linked to the following activities. Each activity is represented as a network node, and it draws interfacing lines to speak to the time plan to complete that activity.

***Keywords*: CCM (Critical chain Method), CPM (Critical Path Method), MSP (Microsoft Project).**

1. Introduction

The most imperative factors that administer the achievement of any development venture are arranging, booking, checking and controlling The arranging includes understanding the customer's perspective on the task and creating and structuring an arrangement likewise, which is pursued by assessing the amount of work and arrangement of an agreement. The scheduling includes the estimation of the total undertaking length and making a database for refreshing of actual development. In the observing stage the work is performed by the calendar arranged, slack and lead in action times is changed in accordance with keep the undertaking on track. Controlling stage includes applying extra assets on exercises that would something else represent out the undertaking. This specific report anyway manages the booking period of a venture.

A. Importance of planning

1. Provides direction: Planning deals with the predetermined course of activity. Planning gives the worker's efforts direction.
2. Decreases Vulnerability Chance: There are numerous vulnerabilities and unforeseen circumstances facing associations every day. Planning helps managers confront the vulnerability as organizers try to anticipate long haul by making some presumptions about keeping their past encounters in the intellect and filtering business situations in the future.
3. Decreases overlapping and inefficient activities: planning can be easily carried out to ensure clarity of considerations and activity and work.
4. Advances Imaginative Thoughts: Planning requires a great deal of consideration and is an intellectual preparation. There is an incredible scope to find superior thoughts, superior strategies and methods for performing a particular work.
5. Encourages selection: Planning helps supervisors make various choices. As with planning goals, progress is being made and future forecasts are being made. These predictions and objectives help the manger make quick choices.
6. Setting Benchmarks for Controlling: Controlling implies a comparison between planned and actual output and, in the event that there are variations at that point, find out the reasons for such deviations and take action to coordinate the actual output with the planned output.

B. Objectives of study

1. To suggest the significance and need for planning in the works of the construction project.
2. To study the application of a project's Critical Path Method (CPM) and Critical Chain Method (CCM).
3. Analyze the time estimates difference given by the method of critical path and the method of critical chain.
4. To advise and suggest the project scheduling procedures to contractors.
5. To present an ideal schedule for building (G+18) apartment buildings using CPM and CCM.

6. To propose a project layout to update the schedule using the MSP computer-based program.
7. To showcase the different features such as project tracking, updating, bar charts / Gantt charts, and primavera software uses in project management construction.
8. Develop a proper schedule of projects and allocate the necessary amount of resources without overuse or shortage.

C. Classification of project scheduling methods

The critical path method is a well-ordered venture management process for recognizing basic activities. It is a way of dealing with venture planning that breaks the undertaking into a few work assignments, shows us a streamline and then determines the task term for each errand in the light of the evaluated lengths. It essentially tells us the project's longest path / duration. It is used for deterministic events and for each activity it has only one estimate of time. It's shortened as CPM. Figure 1. shows a simple project's network diagram to understand how the method of critical path works.

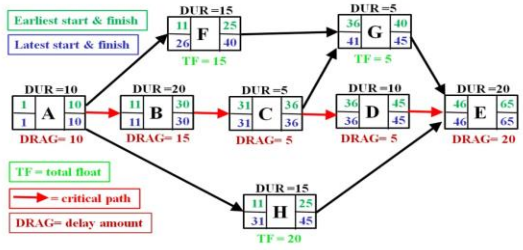

Fig. 1. Critical path method

The critical chain can be described as "the longest way in the chart of the network considering interdependence of activity and resource constraints." The critical path can be expected when the project has access to boundless resources that will never run out as a specific case of the critical chain. In other words, we can say that the critical chain strategy may be a change in the critical path strategy. Here, when making the project plan, the availability of resources is considered. Buffers are used instead of floating in critical chain project administration. These buffers are designed to completely dispose of the float or slack concept**.**

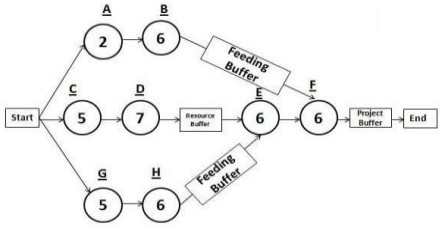

Fig. 2. Critical chain method

2. Data interpretation and analysis

A G+18 residential apartment building project located in Bangalore is considered for comparative study of activity scheduling using MSP (a project management tool).

The details of the project are mentioned as below:

Table 1
Details of the project

Location	Bangalore
Development type	Residential Apartments
Development size	G+18
Area of project	10200sq. ft

The fundamental intention was to compare the scheduled duration of the critical path methods with the scheduled duration of the critical chain methods. A live project has been taken up for this and the two methods have been implemented to find the total duration of the project. MSP was the simulation software used to schedule and identify the critical path.

A. Buffer calculation in CCM method

The main reason for applying buffers to the schedule was to reduce the project duration by using the buffer. Then it gives the idea how the buffers are applied.

Figure 3 shows the addition of feeding buffer to critical activities that are connected to critical activities that reduce the duration of critical activity by 0.8 %. Usually feeding buffers are created to avoid delays in critical activity due to delays in non-critical activity.

Therefore, feeding buffers are added to non-critical activities that feed critical activity depending on the quantity of contingencies removed from critical activity. In this study, however, an 8-day feeding buffer is added to a critical activity that connects another critical activity because the critical chain follows the same path at all project levels as well as the interdependence logic between non-critical and critical activities. Figure 3 predicts the same start and finish dates for beam and slab concreting, which is a critical activity and staircase concreting, which is a non-critical activity. Feeding buffer is therefore created for critical activity. This can be justified because if the critical activity is delayed, the feeding buffer can be used to maintain the same critical chain and if the feeding buffer was created for non-critical activity, any delay in non-critical activity changes the critical chain of the project. If 30 percent of FB is used then a project manager will be wake-up sign. If 30 percent -60 percent of FB is used, it is a warning sign for a project manager and if more than 60 percent of FB is used, it is said that the project is in a critical stage.

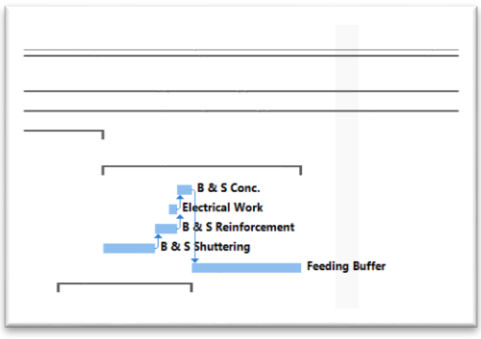

Fig. 3. Feeding buffer

Figure 3 shows the addition of the project buffer. A 72-day

project buffer is obtained when the overall project duration has been compared.

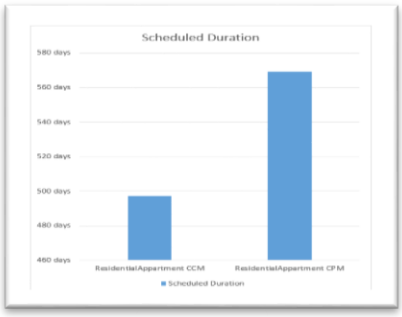

Fig. 4. Project buffer

Table 2 shows the available resource buffers. In this Beam and Slab Becoming activity study, Budget units are planned to be 10 masons and 10 helpers, but 7 masons and 6 helpers are enough to complete the activity, which clarifies that 3 masons and 4 helpers are resource buffers. Initially 10 masons and 10 helpers are planned as a security constraint, keeping resource availability or human behavior.

Table 2
Resource buffer

Resource Availability	Resource Required	Activity
Mason 10, Helper 10	Mason 6, Helper 7	Beam and Slab

3. Methodology

This chapter contains a brief description of the methodology used to develop a project schedule using the critical path method and the critical chain method.

- Creating sequence of activities
- Estimating duration and resource for each activity
- Data interpretation and analysis
- Loading activities in Microsoft project
- Results and conclusions

Implementation was done on a live project, in order to compare the functioning of the two processes (CPM & CCM). The first approach was to create a series of tasks and the second was to take into account the number of days each activity would require. The next step was to load all the events with their respective durations into MSP, a project management software. This is done to find the critical path and critical chain to know the total completion time of the project, as it would be a difficult task to do this manually.

Both Critical Path and Critical Chain Methods are networks of events, each linked to the following activities. Each activity is represented as a network node, and it draws interfacing lines to speak to the time plan to complete that activity.

A. To develop a schedule for a project in msp following steps must be followed

1. Identify the Activities
2. Determine the Sequence of the Activities:
3. Creating the Network:
4. Estimate Activity Completion Time

4. Results and discussions

The results were obtained by entering the activities in MSP and their respective duration. Basically the critical path was estimated from this software, which is the longest duration of the whole project. Once the critical path feeding buffer has been estimated, Project buffers and resource buffers have been added to critical activities to reduce the duration of the project and compare the results with the duration of the critical chain method.

- The total duration of the entire project was found to be 569 days, which is about 18 months, using Critical Path Method, the project was exercised to begin on March 6, 2019 and finish on August 18, 2020.
- The total duration of the project was found to be 497 days, which is approximately 16 months, using Critical Chain Method, the project was exercised to begin on 6 March 2019 and finish on 11 June 2020.
- It can be assessed that the difference between the two Strategy Plans is 72 days. This difference of 72 days can act as an extension buffer when carrying out the venture using the CCM method.
- In this research, the duration of the project was reduced by the CCM technique, while in the CPM technique, the duration was overestimated compared to the CCM technique as shown in figure 5
- Figure 6 shows that the use of resources is reduced in the Critical Chain Method compared to the Critical Path Method

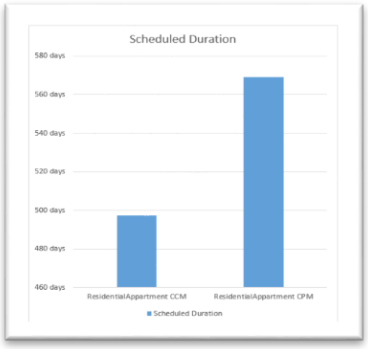

Fig. 5. Planned Duration Overview of the project

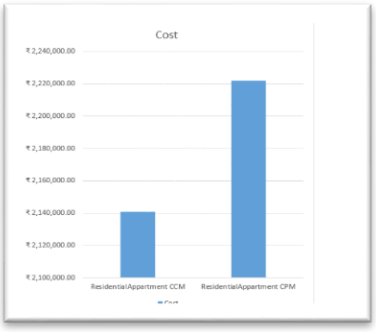

Fig. 6. Overall Cost

5. Conclusions

From the case study, it can be clearly indicated that the implementation of CCM in project management is the most reliable method in terms of schedule and resource utilization compared with the critical path method.

The Critical Path Method allows for a straightforward visualization of the task sequence and the estimated duration of individual tasks. Since the critical path does not have any overall buffers to be added, while estimating the duration of each task, conservatively add "implicit buffers" to each task to protect the overall schedule. This can result in "too many" buffers added to the critical path and not an efficient estimate. The progress of individual tasks need to be closely monitored as one task progresses at a pace slower than expected will adversely affect the entire project schedule.

On the other hand, the critical chain method simply puts the tasks together in a chain by taking into account the minimum time required for individual tasks. At the end of the chain is added an overall "project buffer" that provides some protection against the schedule of the project. This can result in higher buffer estimation efficiency by combining an explicit buffer with the individual implicit buffer. The overall buffer management will therefore be the focus of the execution and monitoring processes.

The traditional CPM technique faces a number of issues such as bad multitasking, Parkinson's law, student syndrome and deliberate padding, CCM blocks problems such as student syndrome, multitasking, Parkinson's law and deliberate padding.

There is no doubt that one of the most important recent developments in project management is the critical chain method. This method provides a realistic schedule, encourages efficient performance by team members, and enhances productivity. But CCM also has some restrictions. First, by shifting activities backwards, feeding buffers could change the critical chain. The feeding chain could begin earlier than the critical chain in this case. Second, feeding buffers could create gaps that are then wasted due to the Law of Parkinson and the syndrome of Student. Next, when delays in non-critical activities appear, feeding buffers may fail to protect. Lastly, feeding buffers can create conflicts of resources.

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