

# Developing an Appropriate Critical Chain Project Management System to MRTS Elevated Station Platform Structure at Adampakkam

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**ABSTRACT:** Critical chain project management is a new, popular project management paradigm for planning and managing the project. CCPM differs from the traditional methods that derives from critical path method (CPM) and program evaluation review technique (PERT) algorithms which emphasizes the task order and rigid scheduling. In critical chain project management, the uncertainty is aggregated into buffers at the end of the activity path. The project buffers protect the overall project completion on the critical path and feeding buffers protect the critical chain from path merging. Critical chain project management is adopted in these project to reduce the time duration of the project so that the time delay and cost incurred due to delay can be reduced and the project can be finished within the due date. Project that use critical chain project management have a greatly improved record of schedule, cost and scope performance. Experience with critical chain project management projects demonstrates completion is less than one half the time of the project using pervious planning and controlling methods.

**KEYWORDS:** Critical chain project management, Buffers.

## I. INTRODUCTION

Project management is a process and activity of planning, organizing, motivating and controlling the resource, procedures to achieve specific goal. There are number of approach available for managing project activities. Critical chain project management is one of the approach for managing project activities. Critical chain project management (CCPM) is a method of planning and managing project that emphasizes the resources (people, equipment, physical space) required to execute project tasks. A critical chain project network strives to keep resources levelled, and requires that they be flexible in start times. Critical chain project management is derived from the Theory of Constraint. The idea was introduced by Eliyahu M. Goldratt in 1997. Theory of Constraint is a tool for managing repetitive production system based on the principle that every system has a constraint and system performance can only be improved by enhancing the performance of constraining resource. critical chain project management is an extension of theory of constraint designed specially for project environment. To minimize constraints and work more efficiently toward accomplishing your goals by working through these steps:

1. Identify the constraint. 2. Manage the constraint. 3. Evaluate performance. These are the three steps to be followed to minimize the constraints and work more efficiently to achieve our goal.

## II. LITERATURE SURVEY

LarryLeach,P.(1999). critical chain project management improves the project performance explains critical chain project management provides a substantial step in the ongoing improvement to the project management body of knowledge. The critical chain differs from the critical path by including resource dependencies. CCPM improves the project plan by ensuring that it is feasible and immune from reasonable common cause variation. It does this by aggregating uncertainty into buffers at the end of the activity path. The project buffer protects the overall project completion on the critical chain path and feeding buffer protects the critical chain from path merging. Buffer

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management enhances measurement and decision making for project control. Eliyahu Goldratt, M. (1997). book titled. explains Critical chain project management is a methodology for planning, executing and managing project in single and multi-project environment. It was developed in response to many projects being dogged by poor performance manifested in longer than expected duration, frequently missed deadlines, increased cost in excess of budget and substantially less deliverables than original promised. Eliyahu Goldratt, M. (1997). problems with traditional project management” explains for a project, plan is taken, estimate is prepared. The accurate estimate give confidence that the project can finish within the schedule. The additional time or safety buffers in the task make the workers to feel following way Students syndrome means Not starting the task until the last moment. Parkinson law means delaying the completion of the task. Dropped Baton means the time gained from starting and completing an activity early could be wasted if the next group of workers who is responsible for receiving the output of the activity work is not ready. Eliyahu Goldratt, M. (1984). book titled. The Goal explains Critical chain project management is derived from Theory of Constraint. There is least one constraint that will stop in achieving the goal. Theory of constraint uses focusing process to identify the constraint and restructure the rest of the organization around it. The focusing process are Identify the system constraint, Exploit the system constraint Subordinate everything else to the system constraint, Evaluate the system constraint. If in previous step, a new constraint has been uncovered, repeat the process.

### III. AN OVERVIEW OF THE CRITICAL CHAIN PROJECT MANAGEMENT

The starting point for CCPM is a list of tasks along with their duration estimates and dependencies. The first step consists of developing an initial schedule for the project tasks. This is done while taking into account the dependencies among the tasks (as reflected in the project network) and the availability of resources. Since at least some of the resources have limited availability, the resulting schedule is likely to be longer than the schedule obtained with the basic Critical Path Method algorithm, as critical activities are delayed while waiting for the resources they require. At this point CCPM identifies the “Critical Chain” as the set of tasks that results in the longest path to project completion after resource leveling. The critical chain yields the expected project completion date. Those resources required by the tasks on the critical chain are defined as “Critical Resources”. So far CCPM is the same as conventional project management except for the terminology “Critical Chain”, which would otherwise be called the “Leveled Critical Path”.<sup>1</sup> The next step in CCPM planning consists of recalculating the project schedule based on shortened task duration estimates. The rationale of CCPM for shortening the original duration estimates is as follows: -1. All the tasks in the project are subject to some degree of uncertainty. 2. When asked to provide an estimate of the duration, the task owner adds a safety margin in order to be “almost certain” of completing the task on time. This means that task durations are, in general, overestimated. 3. In most cases the task will not require the entire amount of safety margin and so should complete sooner than scheduled. 4. However, since the safety margin is internal to the task, if it is not needed it is wasted. Wiest and Levy (1969 and 1977) have noticed way before the publication of Goldratt's book that "While a critical path of technologically connected jobs does not always exist in a limited resources schedule, under certain conditions a "critical sequence" of slack less jobs which span the length of the project can be identified. The jobs are continuous in time, if not in predecessor-successor relationship". In view of Wiest (1964) and Wiest and Levy early work on resource constrained scheduling, Globerson's (2000) assertion that "the main contribution of the critical chain notion is the addition of a new and relevant concept that states that the critical path does not remain the same under constrained resources" seems to be inappropriate. CCPM states that original duration estimates are such that the likelihood of completion is 95%, and that they should be reduced to the point where the likelihood of completion is 50%. The difference between the project duration based on the new estimates and the original project duration is called the Project Buffer, and should be displayed on the project Gantt chart as a separate task.

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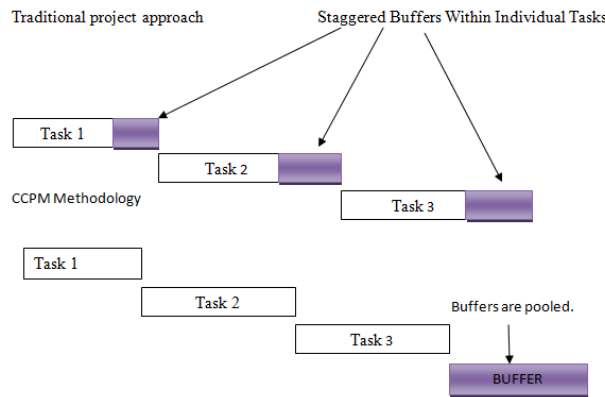


Figure 1 Explains the buffers of ccpm and traditional approach.

The buffers, which were previously hidden in each task, have been made explicit and pooled. This pooled buffer is called the “Project Buffer”. Note that by calculating the project buffer the total duration of the project did not increase: Under CCPM the project buffer is considered part of the project and as such must be scheduled and assigned resources. Also, a Gantt chart showing the project buffer serves to communicate the inherent uncertainty in the project, as opposed to a conventional Gantt chart that presents a spurious air of certainty. It is improbable that all the critical chain tasks will exceed their 50% likelihood duration estimates: under the assumption of statistical independence, about half will complete over while the other half will complete under. By pooling together the safety margins of the individual task, the protection against uncertainty is improved, so CCPM suggests that the combined project buffer can be less than the sum of the safety margins of the individual tasks. This argument is supported by statistical theory that states that the standard deviation of the sum of a number of mutually independent random variables (in this case, the actual durations of the tasks on the path) is less than the sum of the individual standard deviations. Although the assumption of statistical independence of tasks durations is questionable, in theory this justifies reducing the overall duration of the project. In practice, it may be easier to gain task owners’ acceptance of pooling their individual task buffers if the total is not reduced. The same process of making safety margins explicit and pooling them can be applied to non-critical paths. As before, the safety margin in each task is identified, taken out, and pooled at the end of the path. Because this buffer is placed where the path feeds back into the critical chain path, it is called “Feeding Buffer”.

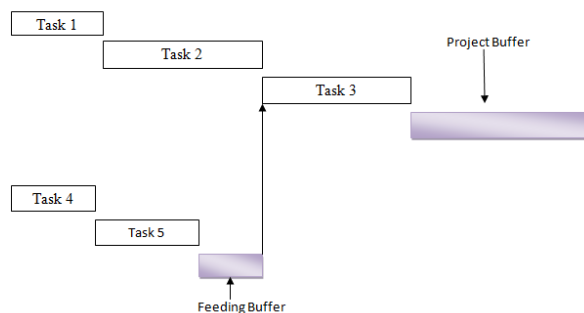


Figure 2 Explains the buffer is feeded in critical chain path.

According to CCPM, a feeding buffer represents the extent of protection of the critical chain against the uncertainty in the feeding non-critical chain, and its size may be adjusted as desired. Once the size of the feeding buffer has been determined, if there is still some slack on the feeding chain, then CCPM prescribes that the task be scheduled as late as possible. This is justified on the basis that it reduces waste of time and work in process on the non-critical tasks while preserving the desired degree of protection of the critical chain. The third type of buffer used by CCPM is called a “Resource Buffer”. A resource buffer is a virtual task that is inserted prior to critical chain tasks that require critical resources. Its purpose is to issue a signal to the critical resource to the effect that a critical chain task to which they are

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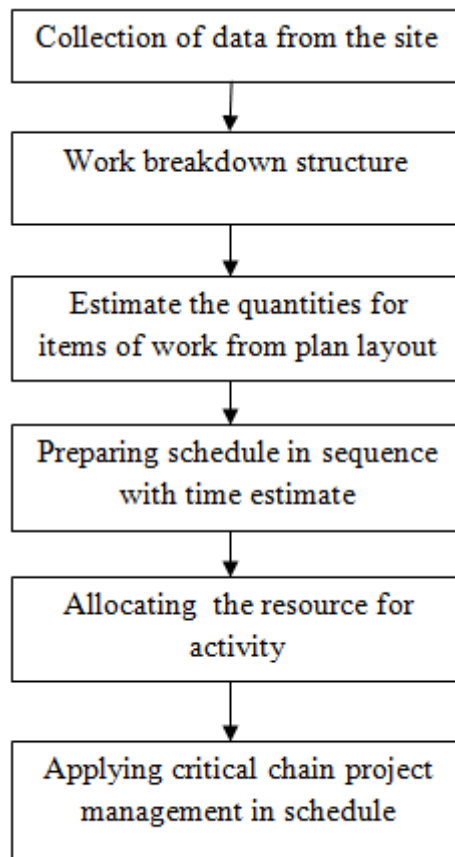
Vol. 5, Issue 3, March 2016

assigned is due to start shortly. According to CCPM, this “wakeup call” will cause the critical resource to wrap up any non-critical work that it is involved with, and to be ready to start work on the critical chain task as soon as its predecessors are completed. The resource buffer does not actually consume any resource, and it adds neither time nor cost to the project. At this point CCPM has created a new project schedule, which consists of the original tasks with reduced durations, and various types of buffers: the project buffer, the feeding buffers and the resource buffers. For the execution of the project plan, CCPM prescribes the following principles.

- Resources working on critical-chain tasks are expected to work continuously on a single task at a time. They do not work on several tasks in parallel, or suspend their critical tasks to do other work.
- Further, resources are to complete the task assigned as soon as possible, regardless of the dates on the schedule.
- If the task is completed ahead of schedule, then work on its successor is to begin immediately. If the task successor utilizes a critical resource for which a resource buffer has been defined, then advance warning is provided to that resource at the point in time where the resource buffer begins.
- If the task is completed past its planned completion date as shown on the CCPM schedule, then this is no reason for immediate concern, as the buffer on the chain on which the task is situated will absorb the delay.

As progress is reported the CCPM schedule is recalculated, keeping the final due date of the project constant by adjusting buffer sizes. Project control focuses on consumption of the buffer. If buffer consumption is out of proportion then this becomes a clear indication for implementing corrective actions, such as reassignment of resources to the tasks on the chains leading to the buffer in question. In this manner, the extent of buffer utilization serves to monitor the likelihood of project completion by its committed due date.

## IV. METHODOLOGY



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(An ISO 3297: 2007 Certified Organization)

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The methodology involved in collection of data from the site required for project. The data include general information about project, plan etc. after that work breakdown structure of activity or task is prepared. According to PMBOOK work break down structure is defined as deliverable orientated hierarchical decomposition of work to be executed by the project team. Next step is estimation. Estimation is done to find out how much quantity of work to be done. Next step is scheduling. In scheduling duration of the task, resources required for the activity or task which is arranged in sequence manner is determined. After that Using network diagram critical path is determined. Next critical chain project management technique is applied and compare the difference in time taken traditional approach and critical chain project management approach.

## V. APPLYING CCPM TECHNIQUE

Before applying critical chain project management, list of task along with their duration estimate and dependencies are determined. After that ccpm technique is applied. First step in ccpm technique is cut off the original time duration calculated in every task or activity by 20%. For example 10 hours duration is allocated to complete a activity. It should be cut off to 8hours. However due to complexity of particular task it may not possible to cut off the time estimate by 20%. In that situation time estimate should not be removed off. The difference between the original time and new cut off time duration is called as project buffer. For example excavation of pile cap ( where excavation is activity and pile cap is milestone) is delayed by 2 days means the delayed 2 days should be added to project buffer. CCPM adds on provide a useful feature to track the project in graphical manner. It is divided into three zones. The three zones are green, yellow, red. These chart signify the progress of the project by measuring the delay which is pooled into project buffer. The project is in green zone the project is under control. The project is in yellow zone the project is under control. However the manager should look for the issue that cause the delay. The project is in red zone means the project is not under control. so some necessary steps to be taken to bring back the project under control.

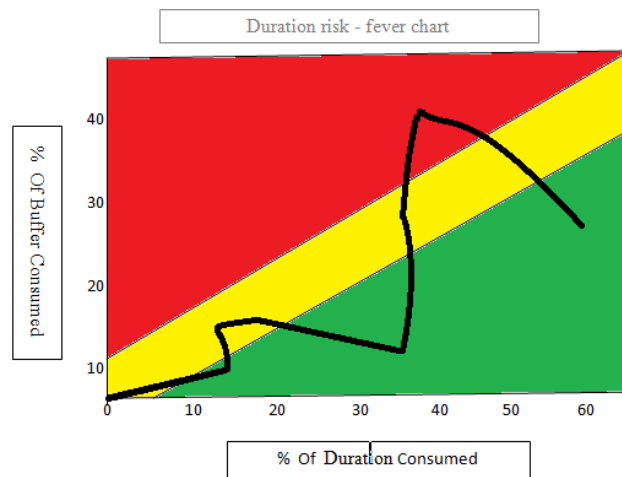


Fig 3 Explains duration risk chart

## VI. CONCLUSION

critical chain project management technique is applied to MRTS elevated station platform structure at adampakkam to find out the time difference in completion of project between traditional approach and critical chain management approach and also find out the effectiveness of critical chain project management.

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MILESTONE ACTIVITY	TRADITIONAL APPROCH (days)	CRITICAL CHAIN PROJECT MANAGEMENT(days)
Pile phase	1.2	1
pile cap pc1	9.5	7.7
Pile cap pc1e	9.5	7.7
pile cap pc2	9	7.3
pile cap pc2e	9.5	7.7
pile cap pc3	10.5	8.5
column first level	5	4
Mezzanine beam	17	13.5
column second level	5	4
platform floor beam	15	12
column third level	5	4
Total days	96.2	77.4

The essential changes introduced by Critical Chain Project Management are:

- Development of the Critical Chain, using both activity logic and resource constraints.
- Reduction of activity estimated times to 50% probability estimates to account for aggregation of
- The activity contingency times.
- Addition of a Project Buffer to protect completion of the Critical Chain.
- Addition of Critical Chain Feeding Buffers to immunize the Critical Chain from delays in the
- Feeding chains and merging effects.
- Using buffer management as the primary tool for project management and control.
- Using behaviors conducive to the global project optima, such as roadrunner activity performance

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