CRITICAL CHAIN PROJECT MANAGEMENT IN CONSTRUCTION PROJECTS

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ABSTRACT - Many construction industries have been using Critical Path Method (CPM) scheduling for a very long time. However, due to the increasingly competitive business environment, tighter time constraints are becoming the norm of the industry. As a result, more projects are slipping behind schedule. This led some industries to call for more efficient means to plan and schedule projects. Following to the introduction of the theory of constraints (TOC), a new and innovative project scheduling paradigm has emerged, that is Critical Chain (CC). Critical Chain Project Management (CCPM) is rapidly becoming the new standard for project success introduced in 1997 as a new approach to plan and execute projects. A central driver for adopting CCPM is enabling more predictable and shorter project lead times. The argument being that this will not only enhance time related order winning criteria but also reduce cost and improve adherence to specification with appropriate buffer sizing techniques. Typically, CCPM case studies report 95% on-time and on-budget completion when CCPM is applied correctly.

A detailed literature survey was conducted on "Critical Chain Project Management in scheduling Construction projects". Through the literature review, the stability of the Critical chain method in project's organizational and operational environment, resource productivity under multi-tasking and overall performance of the project were analyzed and CCPM projects demonstrates completion with 10% to 50% in cost and duration.

GENERAL:

The Project Management is a process and activity of planning, organizing, motivating and controlling the resources, so as to achieve specific goal. There are number of approaches available for managing project activities.

Critical chain project management (CCPM) is one such new, popular project management paradigm for planning and managing projects. CCPM differs from the traditional methods namely 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 and feeding buffers protect the critical chain from non-critical path merging. Critical chain project management is adopted 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 uses critical chain project management have a greatly improved record of schedule, cost and scope performance. Projects experience critical chain project management demonstrate completion less than three-fourth the time of the project using previous planning and controlling methods.

OBJECT OF THE PROJECT:

The Project proposes the implementation of new and innovative Critical Chain Scheduling method as a solution to the problems faced in the Traditional Project Management Methods. The study also identifies the benefits and limitations associated with Critical Chain Project Management Method and its adoptability to the construction scenario.

NEED O FTHE PROJECT:

Despite this relative popularity in some industries worldwide, there was no documentation of applying CC (critical chain) in the construction industry in India. Admittedly, there have been attempts at applying CC in the international construction. Industry, yet CC not becoming a well proven industry practice. The study in hand was initiated as an effort to:

1. Gauge the level of awareness of construction industry practitioners about the CC technique.
2. Investigate the applicability of CC in construction projects, from the perspective of those industry practitioners. Also, investigate the types of construction projects convenient for its application.
3. Point out and possibly tackle an obstacle to its implementation.

ADVANTAGES OF CCPM:

The following are the merits of CCPM.

- It accumulates all safety buffers at the end of the project instead of building them into activity estimates, and protects the critical chain against insecurity.
- It focuses on the project constraint (the longest chain of dependent resources or activities).
- Uses average-case estimates (task estimates based on 50% probability of completion.
- Protects project with buffers
- Starts tasks as soon as predecessors are done, finishes tasks as quickly as Possible
- Team ownership of project completion
- Project health is based on days used from the project buffer
- Avoidance of Student's syndrome, Parkinson's law, Murphy's law, and Multitasking
- Relay race Scheduling
- Late start Scheduling of Non-critical activities.
- No rescheduling and thus less work-in-progress
- More chance of finishing on time.

BUFFER SIZING METHODS

SQUARE ROOT OF SUM OF SQUARES METHOD (SSQ)

In this method, the size of the buffer is set to the square root of the sum of the squares of the difference between the low risk duration and the mean duration for each task along the chain leading to the buffer. If the path branches upstream, the longest chain or the longest result considering each chain should be used. Specifically, when trying to account for the variation in task durations, adopting the largest result, considering each chain is probably the preferred approach, even though it will necessarily involve more computation. In this method, duration is with a probability greater than 90%. The advantage of this method is that it allows to account for known variation in task duration. The disadvantage is that it may lead to undersize the buffers for the long chain.

ADAPTIVE PROCEDURE WITH DENSITY (ADP)

In this method, for a given number of tasks the likelihood of a delay increases as the number of precedence relationships increases. Stated differently, there is a greater level of interdependence between the tasks and, if one task is delayed, all of its successors will be delayed. The number of precedence relationships as the density of the network. In this method, density effects through the application of this buffer sizing method are accounted. Again the buffer is set to the standard deviation of the path scaled by a factor. This time the factor is based on the network density, and is defined as:

K=1+ TOTPRE / NUM TASK

Where TOTPRE is the total number of precedence relationships on the sub-network under consideration, and NUMTASK is the number of tasks on that sub-network. The buffer size is then given by:

Buffer size = k x σ feeding path

Where 'K' is the standard deviation of the longest path on the sub-network under consideration.

WORK PROGRESS DETAILS OF A PROPOSED VILLA AT KANNANKURICHI, SALEM

The following data represents the activities performed in the construction of a single project (villa) done in a small-scale construction industry at Salem in the year 2019. The sequence of the work details are as given in the following table.

Sl. No.	Activity	Description	Duration
1.	A	Earthwork Excavation	2 days
2.	B	Column Erection, Mat Concrete, Taper Concrete, Column Concrete up to plinth level	2 days
3.	C	Curing for Foundation	14 days
4.	D	Pit Sand filling for Foundation Trench, Digging of Earth, River sand filling and P.C.C for plinth beam layout	4 days
5.	E	Shuttering, Centring, laying and Curing of Plinth beam	11 9days
6.	F	Brickwork and Curing upto Basement level	9 days
7.	G	Plastering of Brickwork at Basement level, curing and Pit sand-filling for Basement	10 days
8.	H	Flooring at ground level, Brickwork and Curing at Ground floor lintel level	9 days
9.	I	Shuttering, Centring, Laying of Concrete and Curing of Brickwork at Ground Floor Lintel Level	19 days
10.	J	Shuttering, Centring, Laying of concrete and Curing of Roof Slab and Beams continuing with decentring works	18 days
11.	K	Door, Window frame fixing, Electric pipes, Plumbing and Wall Plastering works, Curing of Walls	9 days
12.	L	Exterior wall Plastering and Curing, Weathering course works	6 days
13.	M	One coat white wash with white cement for all walls, ceilings	2 days
14.	N	Floor finish with Tiles	2 days
15.	O	Finishing (Enamel paintings to Doors and Windows, E.B Supply, Electrical fittings)	4 days

PROCEDURE IN CRITICAL CHAIN PROJECT MANAGEMENT

1. Build the project schedule without safety time, i.e. use 50th percentile estimates of task durations.
2. Drop the notion of due dates and accept the possibility of delays.
3. Identify and protect critical resources (and don't worry so much about noncritical resources).

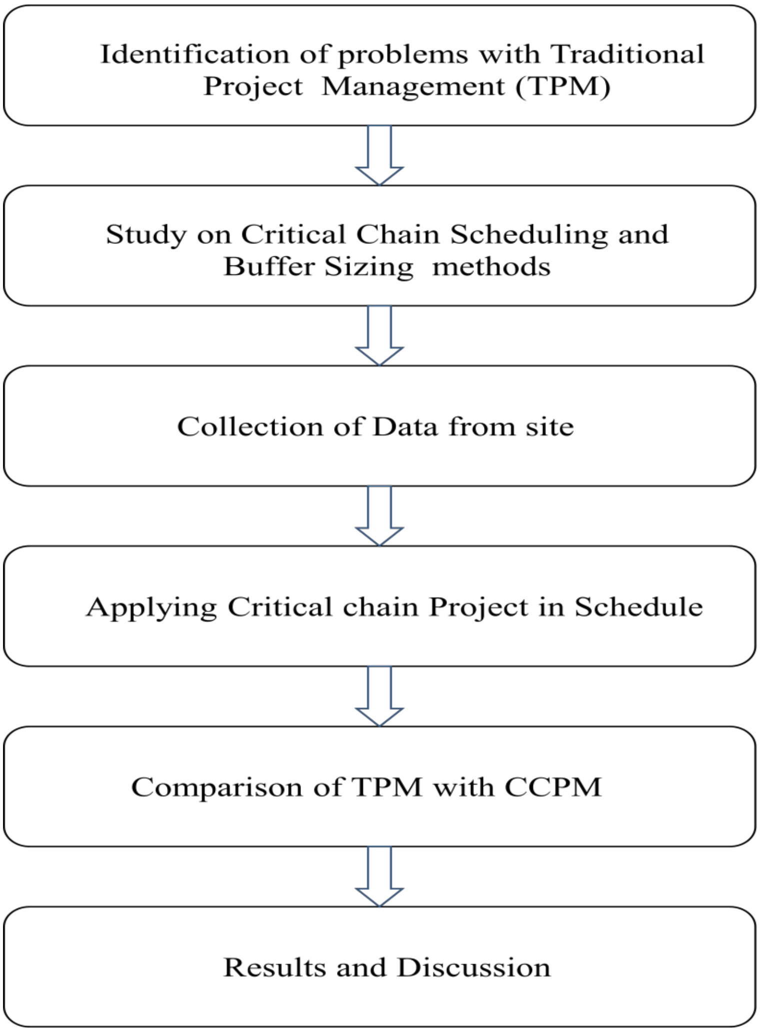
4. Aggregate all the required safety time in a project buffer at the end of the critical path.

5. For the critical resources, identify their lead (i.e., startup) times. This information defines resource buffers.

6. Fast and slow completion of tasks will tend to cancel out, at least in part, enabling a reduction (possibly better than 50%) in the project buffer size.

7. For noncritical activities, the only priority occurs where they feed into the critical chain. Protect these points with feeding buffers.

METHODOLOGY



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