



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJIRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 11, November 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 8.524**

 9940 572 462

 6381 907 438

 [ijirset@gmail.com](mailto:ijirset@gmail.com)

 [www.ijirset.com](http://www.ijirset.com)

# Research Study on Influence of Constraints Analysis and Critical Chain Scheduling for the Improvement of Bridge Construction Projects

Mr. Rahul Gajanan Dighe<sup>1</sup>, Mr. Rahul D. Shinde<sup>2</sup>

Student, ME Construction and Management, Department of Civil Engineering, RMD Sinhgad School of Engineering, Warje, Pune, India<sup>1</sup>

Assistant Professor, Department of Civil Engineering, RMD Sinhgad School of Engineering, Warje, Pune, India<sup>2</sup>

**ABSTRACT:** Constraints are encountered in every working environment whether it may be manufacturing industry, supply chain, construction industry etc. Construction companies are time bound endeavours meant to be realized within stipulated time. They have a particular goal to be achieved in time but constraints in the project create imbalance of sources and form barrier in completion of the project. Theory of constraints has application in manufacturing, project management, marketing and sales, finance and accounting, supply chain distribution. Critical chain project management (CCPM) is utilized in project management. CCPM uses schedule network analysis technique. It focuses on those activities having longest chain. Buffers are used throughout the TOC. Buffers are placed before the governing constraints, to ensure that the constraint is never starved. Buffer are placed behind the constraint to prevent downstream failure from blocking the constraints output. This concept of identifying the constraints and eliminating by using CCPM scheduling will be conducted on selected projects. First and foremost field study and questionnaire survey is conducted for collection of basic information and to study current situation of the constraints in today's construction industry.

**KEYWORD:** Critical Chain Management, Scheduling, Delay, Constraints, Bridge Construction.

## I. INTRODUCTION

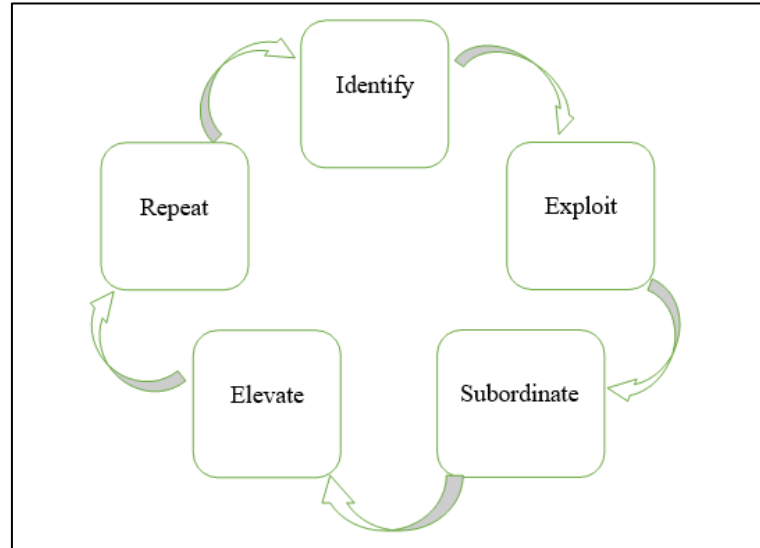
Construction project involves multi party participation. It may be a government project, or a private developer. Multi party participation brings numerous constraints as the needs are different. Different needs may lead to constraints in project resulting in delay of work which can ultimately result into new constraints as the project will not be on schedule, which can bring cost consequences. The constraints can be categorized into two types:

- (1) Internal constraint and
- (2) External constraints.

Internal constraints are inside the system and are usually more under control. This means that when the system cannot keep up with the demand, action needs to be taken to eliminate the constraint. But continuing such an action will in turn bring to a point where capacity exceeds demand and constraint exists in another form. Middle managers frequently encounter situations when a task is assigned by the top management with constraints. The middle managers then have to go over these constraints in order to complete the task. The consequence is that they may have to take more time or resources than what has been planned. If they face constraints that cannot be overcome, there is a possibility that they may have to do things outweighing their capability in order to accomplish the task. Some managers will have to take irregular actions such as illegal action, deceiving action, or force the others to comply without any redress. External constraints are outside the system and are less under control. This means that the system has slack capacity to handle external constraints and action taken can merely minimize the effect of undesirable consequence rather than breaking the constraints. However, constraints can never be permanently broken. They merely migrate from one place to another and TOC has to re-apply.

### i) Theory of constraints and Critical chain project management:

The Theory of Constraints (TOC) is a methodology for identifying the most important limiting factor (i.e. Constraint) that stands in the way of achieving a goal and then systematically improving that constraint until it is no longer the limiting factor. TOC has five focusing steps which helps to identify the constraint and restructure it as follows



*Fig 1 Five Focusing Steps of Theory of Constraints*

## II. PROBLEM STATEMENT

If the constraint is not eliminated at right time it will ultimately result in delay of work. TOC has its application in many areas. Critical chain project management (CCPM) is a tool of TOC which is based on methods and algorithms derived from TOC. Application of CCPM has been credited with achieving projects 10% to 50% faster and/or cheaper than the traditional methods (i.e., CPM, PERT, Gantt, etc).

### i) Kundevahal Viaduct (Case Study)

- **Project Name:** Construction of Kundevahal Viaduct at CH 15+140 for Western Dedicated Freight Corridor package CTP 11
- **Project actual budgeted Cost-** 19,87,87,075
- **Project spend cost still date-** 11,10,34,120
- **Start date of projects-** 03 September 2018
- **Planned completion period** - 21 months
- **Current work completion** - 62 percentage
- **No. Of Span** - 43
- **Span** - 26.21 MTR.
- **Foundation** - 44 Nos (10.5\*7.5\*2) approx.
- **Type** - Open foundation
- **Pier** - Twin Pier Dia - 2.5 MTR
- **Avg. Ht of Pier** - 12 MTR.
- **Pier cap** - 42 Nos (15x3.35x1.1)
- **Abutment cap** - 2 Nos
- **Super structure PSC I girder (Ht - 2.4 MTR and length 24.89 Meter)-** 172 Nos
- **Launching done** - By tandem lifting method
- **Deck slab** - 250mm thick and 6.4x2 MTR wide
- **Bearing type** - Elastomeric bearing for vertical load transfer
- **Bearing type for lateral movement** - Pin bearing and guided bearing
- **Expansion joint** - strip seal expansion joint with bitumen filler
- **Wearing coarse** – M25 (10mm down aggregate concrete)
- **Design Axle load** - 32.5 MT
- **Concrete volume** - 35000 Cu.M
- **Reinforcement steel** - 4800 MT



- HT strands - 395 MT
- Grade of concrete for PCC - M30
- For RCC - M35 to M45
- For PSC work - M55
- CPCC coated steel used



Fig 2 Kundevahal Viaduct (Site Photo Girder launching)

### III. RESULT AND ANALYSIS

#### i) Microsoft Project

Microsoft Project is really a computer database that uses two main tables of data to keep track of your project. Project uses one table to store information about the tasks of your project and the other for resource information. By using the many views available in Project, you can display your project data from these tables in many different ways

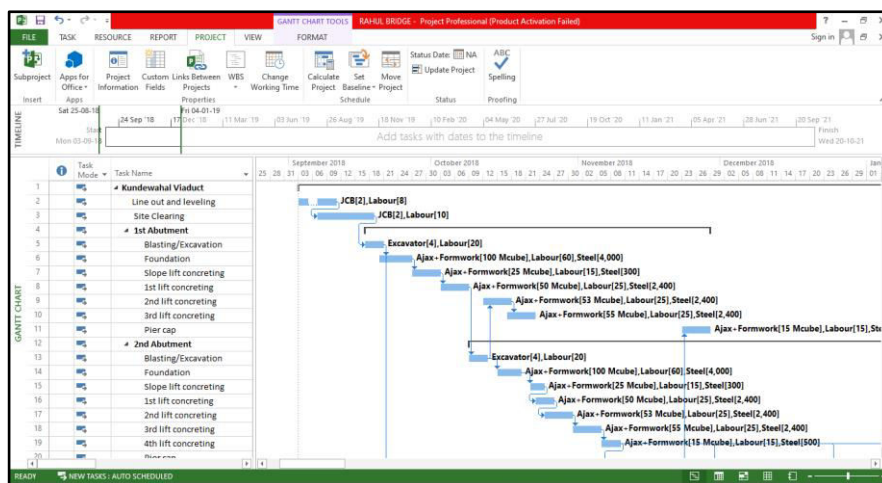


Fig 3 Project scheduling in MSP

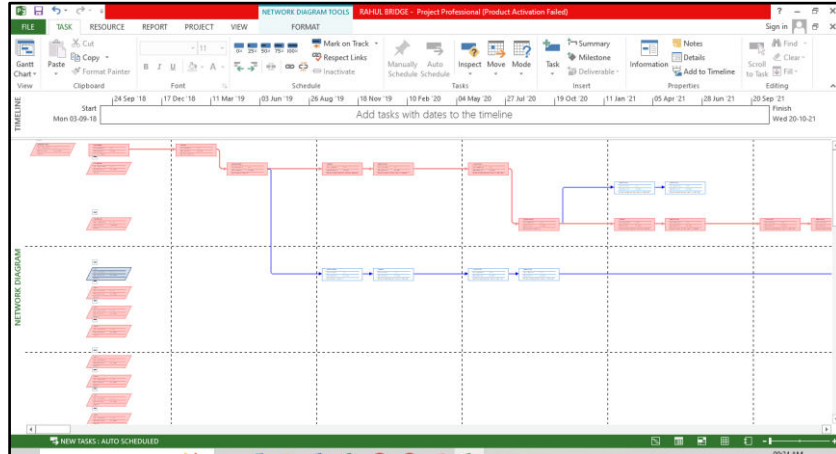


Fig 4 Critical Activity Path

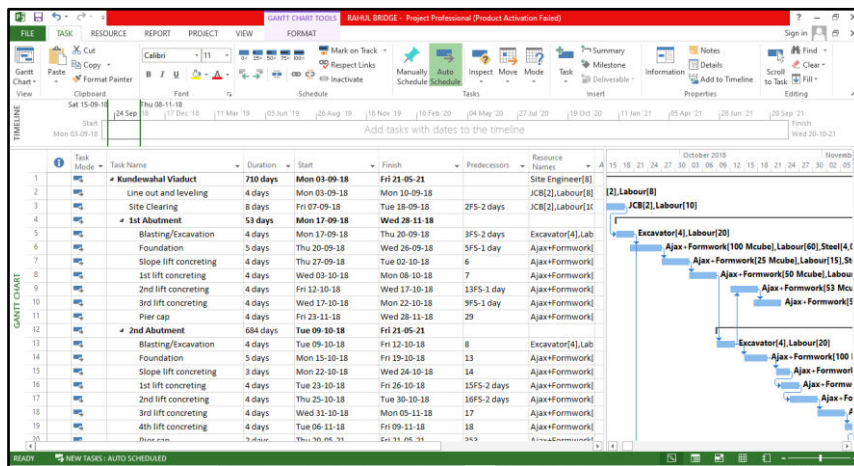
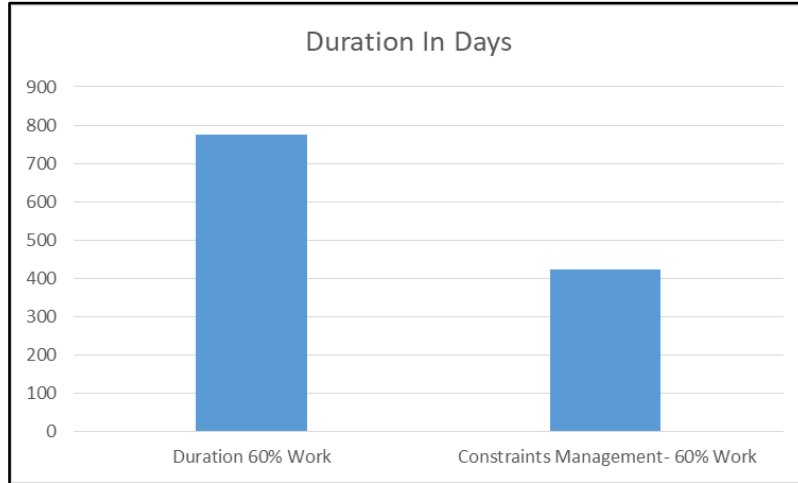


Fig 5 Total Duration

As shown in above fig Total Duration of the project by using CPM is 710 Days i.e. 23 Month for completion of project if follow the MSP schedules.

Table 1 Duration in Days

|                  | Duration 60% Work | Constraints Management- 60% Work |
|------------------|-------------------|----------------------------------|
| Duration In Days | 776               | 424                              |



Graph 1 Duration in Days

According to current site condition site is still completed only 60% till date i.e. 776 days approx. (Already Skipped 365 Days of COVID duration). That means Project Takes 776 Days for completion of the 60% of the project and according to MSP schedule project have to complete by 710 Days only. ie the 60% of project duration according to MSP is 424 Days.

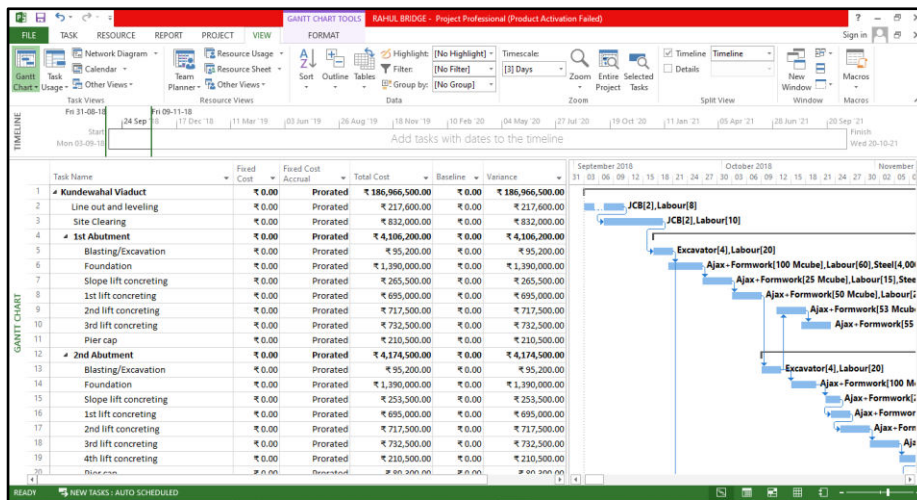
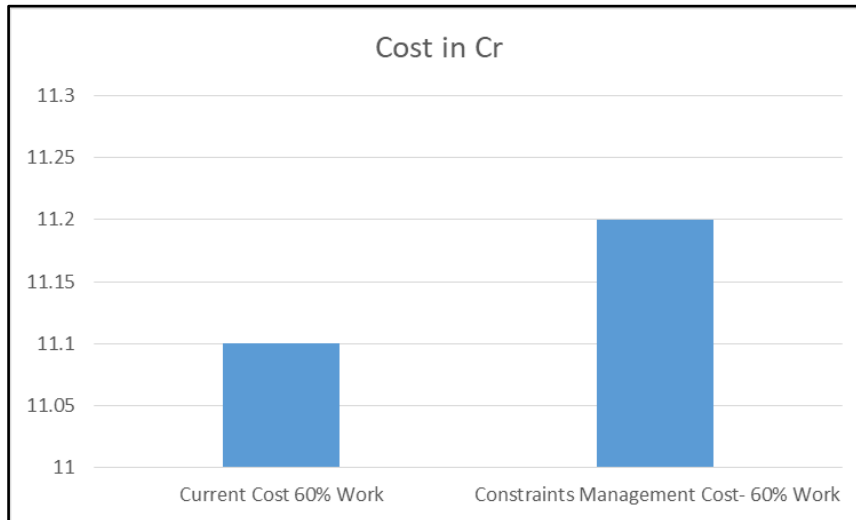


Fig 6 Actual Cost

As shown in above fig Total finishing cost of the project by using CPM is 18.69Cr for completion of 100% project if follow the MSP schedules.

Table 2 Cost in Cr

|            | Current Cost 60% Work | Constraints Management Cost- 60% Work |
|------------|-----------------------|---------------------------------------|
| Cost in Cr | 11.1                  | 11.2                                  |



Graph 1 Cost in Cr

According to current site condition site is still completed only 60% till date for 11.10 Cr approx. That means Project Takes 11.10 for completion of the 60% of the project and according to MSP schedule project have to complete 100% for 18.69Cr only and i.e. the 60% of project cost according to MSP is 11.2 Cr.

#### IV. CONCLUSION

The study's findings suggest that in the early days management of projects was of short duration with more stable environmental conditions. Quantitative techniques were used to analyse causes in order to give suggestive recommendations to reduce the delay problems by considering case study.

- We may shorten the project's time after we apply Constraints Management to the case study in accordance with CPM. As of right now, the site is only 60% finished, or roughly 776 days (365 days of the COVID length have already been skipped). This indicates that it takes 776 days to finish 60% of the project, and the MSP timeline states that the project must be finished in 710 days at most. That is, 424 days is 60% of the project period as determined by MSP.
- The project's cost is still within control. As of right now, the site is barely 60% finished, costing about 11.10 Cr. This indicates that the project takes 11.10 to finish 60% of the project, and the MSP schedule states that the project must be completed 100% for 18.69Cr only, meaning that the 60% project cost is 11.2 Cr

#### REFERENCES

1. Livia Anastasiu et al. (2023) "Boosting Construction Project Timeline: The Case of Critical Chain Project Management (CCPM)" Construction Management, and Computers & Digitization
2. Jun-long Peng et. al. (2022) "Buffer Sizing in Critical Chain Project Management by Brittle Risk Entropy" Construction Scheduling, Quality and Risk Management.
3. Anjay Kumar Mishra, Kailash Kumar Moktan (February 2021) "Identification Of Constraints In Project Schedule Management" International Journal of Research, Volume 7 Issue 2.
4. Avinash Adinath Chougule, Dr. D.N.Mudgal, Prof. S. B. Patil, (July 2019) "A review paper on quantify the different constraints for delay in infrastructure construction project work and recommending corrective measures for the same", International Research Journal of Engineering And Technology, ISSN: 2395-0056 , Volume 6 Issue 07 July 2019.
5. Azar Izmailova , Diana Kornevab , Artem Kozhemiakinc (2016) "Effective Project Management with Theory of Constraints" 5th International Conference on Leadership, Technology, Innovation and Business Management, Science Direct.
6. Harish R Rajmane, Dr. A. K. Gupta , Prof. D. B. Desai, ( 2017) "A review paper on To Identify the Various Constraints for Delays in Construction Work and Suggesting Remedial Measures for the Same" Imperial Journal of Interdisciplinary Research (IJIR) Vol-3, Issue-2, 2017.

7. Hemaloshinee Vasudevan, (August 2021), “Theory of constraint application on quality management and organizational performance in the construction industry” INTI JOURNAL eISSN:2600-7320 ,Vol.2021:003.
8. Marylin Mumbi, Michael Mundia (April 2020) “Influence of Management of Project Constraints on Completion of Building Construction Projects in Nakuru County, Kenya”, The International Journal of Business Management and Technology, Volume 4 Issue 2.
9. Priya Bhagdewani, Prof. A. K. Kanase, Prof. R.D.Shinde ( June 2017), “ Applying Theory Of Constraints in Project Management” International Journal Of engineering Science And Research Technology, ISSN: 2277-9655 June 2017.
10. Purva Pardeshi , Dr Nagesh Shelke , Ashish P. Waghmare (February 2020) “ Approach of Critical Chain Project Management in Residential Construction Project” Iconic Research And Engineering Journals, volume 3 Issue 8.
11. Saba Sultana, (March 2019) “Empirical Study On Theory Of Constraints In A Construction Project Management” Journal of Emerging Technologies and Innovative Research (JETIR) Volume 6, Issue 3.
12. Siddesh Pai, S.Giridharan, “Application Of Theory Of Constraints And Critical Chain Method For Project Management In Ultra Mega Power Projects (Umpp)” International Journal of Power System Operation and Energy Management ISSN:2231-4407, Volume-2, Issue-3.
13. Surbhi Rithe, Maithilee Thakare ( December 2020) “Theory of Constraints in Constructio Projects” International Research Journal of Engineering and Technology, ISSN:2395-0056 Volume 07 Issue 12 December 2020.





INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details