

Cost Optimization by Resource Allocation of an Ongoing Project Using Primavera P6

Prof. M. C. Paliwal
M.Tech. Scholar

Department of Construction Technology and
Management Engineering
National Institute of Technical Teachers
Training and Research
Bhopal, M.P, India

Divya Chouriya
Professor

Department of Construction Technology and
Management Engineering
National Institute of Technical Teachers Training
and Research
Bhopal, M.P, India
divman.chouriya@gmail.com

Abstract: Implementation of construction project needs a proper planning and scheduling is of vital importance for the project to be executed and run smoothly. A best schedule has to be prepared in such a way that meets the primary objectives of the total project. Those essential destinations are to make a quality venture, finished on time, inside spending plan, and in a sheltered workplace. Consequently in this investigation a progressing development venture is taken and the execution of the undertaking is contrasted and the calendar with the assistance of Primavera. With the help of management tool like primavera, one can manage the scheduling, resource allocation and also time management in a proper and easy way.

Keywords: Primavera P6, Gantt Chart, Time-Cost Comparison, Cpm Network, Resource Allocation, Project Scheduling

I. INTRODUCTION

The development business assumes noteworthy part in the economy of creating nations. For instance, in numerous creating nations, significant development exercises represent around 80% of the aggregate capital resources, 10 % of their GDP, and over half of the riches put resources into settled resources. Moreover, the industry gives high business opportunity, most likely next after agribusiness. In spite of the development business' huge commitment to the economy of creating nations and the basic part it plays in those nations advancement, the execution of the business still remains by and large low. As noted, numerous ventures in creating nations

experience extensive time and cost invades neglects to understand their expected advantage or even completely ended and surrendered previously or after their finish. Also, the improvement of the development business in creating nations by and large falls a long ways behind from different ventures in those nations and their partners in created countries. The development business in creating nations neglected to meet desires for governments, customers and society overall.

The procedure of task administration is an integrative one—a move (or inability to make a move) in one territory will for the most part influence different zones. For instance, an extension change will quite often influence cost and timetable appraisals, yet it might likewise affect different factors as assorted as camaraderie and item quality. This cooperation regularly require exchange offs among venture destinations—execution in one territory might be improved just by yielding execution in another. Fruitful undertaking administration requires currently dealing with these connections. In this investigation, I am gathering information of an undertaking which is executing under government organization.



Fig 1: Project Management

A. Risk analysis

Hazard Analysis and Management is a key undertaking administration practice to guarantee that minimal number of astonishments happen while your venture is in progress. While we can never foresee the future with assurance, we can apply a basic and streamlined hazard administration procedure to anticipate the vulnerabilities in the ventures and limit the event or effect of these vulnerabilities. This enhances the possibility of effective venture fruition and lessens the outcomes of those dangers.

Task colleagues at different levels distinguish and handle chances in various flavors. Nonetheless, this will be incapable without an organized hazard administration system, as this prompts:

- Incomplete affect assessment
- Knowledge of the general effect on the venture goals, similar to scope, time, cost, and quality
- Identification of auxiliary or new dangers emerging from the officially recognized dangers
- Lack of straightforwardness and a correspondence hole inside and outside the group
Along these lines, it is essential for any undertaking association to set up a viable hazard administration structure. Organizing such a training as a task group culture guarantees.
- Conscious and centered hazard ID and administration.
- Project advance as wanted, with minimal measure of deviations or shock, and in accordance with venture and authoritative targets.
- Early and compelling correspondence of venture issues to association and undertaking partners.
- An compelling group building device, as group purchase in and acknowledgment is guaranteed.

B. Primavera P6

Primavera is an undertaking venture portfolio administration programming. It incorporates venture administration, item administration, cooperation and control capacities, and coordinates with other endeavor programming, for example, Oracle and SAP's ERP frameworks. Primavera was propelled in 1983 by Primavera Systems Inc. It can perceive principles for elite undertaking administration programming, is intended to deal with extensive scale, very advanced and multifaceted activities. P6 Professional can be utilized to sort out tasks up to 100,000 exercises, and it gives boundless assets and a boundless number of target designs. Huge

information requires complex yet very adaptable association apparatuses to give you a large number of approaches to arrange, channel and sort exercises, ventures, and assets.

C. Advantages:

- Balance resource capacity
- Plan, schedule, and control complex project
- Allocate best resources and track progress
- Monitor and visualize project performance versus plan
- Conduct what-if analysis and analyze alternative project plans

II. LITERATURE REVIEW

To provide a detailed review of the literature related to project management in its entirety would be difficult to address here. Although there has been a lot of work modeled as construction management considering resource allocation. A brief review on primavera a management technique and code provision of previous studies is presented here. This literature review focuses on project management system used in construction field will be addressed by area.

Bagadeet. al. (2018) [1] Explored that Planning, booking and Resource leveling assumes an imperative part in any development venture perhaps it is development of building or development of street. Without appropriate arranging, booking and asset leveling development industry does not get benefit over the venture. For this reason, legitimate programming's and methods must be use.

Ghadgeet. al. (2017)[2] Project cost is the one of the governing factor in project success. Project management is used to increase productivity in terms of human resource and materials. Earned value management (EVM) is a project performance evaluation technique which has been adapted for application in project management.

Nimbalet. al. (2017)[3] Considered that owing to an expanding setting of condition, Construction industry is ever forthright for the improvement and headway in instruments and gear highlights, apparatuses of correspondence, systems of effective administration, instructing the HR about it.

R. Kohli (2017)[4] Reasoned that Efficient task administration is the need of great importance and it is the sole duty of the undertaking director to guarantee the working of the venture as indicated by

its dispensed spending plan and due dates. For any development venture, legitimate arranging, booking, compelling asset allotment and refreshing the exercises is to a great degree basic to improve the task and build up most extreme spending augmentation. Dishonorable planning, sporadic checking and poor treatment of the continuous exercises builds the venture term and sum with a significant edge. Subsequently, it is fundamental to embrace expansive scale administration extends effectively with the assistance of PC helped programming

P.M. Wale et. al. (2015) [5] expressed that the undertaking may have a straightforward objectives that does not require numerous individuals or a lot of cash or it might be very perplexing, calling for different abilities and plenty of assets and furthermore gave similar examination between customary way and Microsoft venture arranging. They reasoned that Traditional route ends up being uneconomical and expends additional time with numerous complexity and gigantic mistake while Microsoft Project is the cutting edge apparatus of Project Management that guide to conquer the hindrances confronted attributable to conventional method for Planning and Management.

A.R. Nikumbh et. al. (2014) [6] suggested that the utilization of Project Management Consultancy (PMC) offers one of the compelling administration answer for increment and enhance the productivity and result of an undertaking in development and reasoned that the Project Management Consultants deal with the Project by use of their Knowledge, Skills, and Experience at different stages and is powerful and effective just when it is associated with Total Project Life Cycle from Conception to Closeout.

Shaik Mohammad Masood et al. (2014) [7] H.N represented that numerous development venture experience the ill effects of time and cost overwhelms because of various elements. EVM is an erformance of task assessment which is utilized for the application in venture administration. This method helps in examination of planned cost of work to real cost of work performed.

III.METHODOLOGY

A. General

By and large Primavera P6 do deals with the system of dynamic booking. Which surely furnishes the Project Management office with an unmistakable

course outline, is expected to set up the most ideal advanced arrangement of the undertaking by utilizing 'imagine a scenario where' situations hazard extenuation strategies. In spite of, the way that it show the Project Manager's capacity to create administration change potential outcomes for the Project Management group to choose from the when differences by the proposed venture Baseline are being taken note. The technique for dynamic planning outlines the base or the stages for the undertaking booking which is intended to help the group of Project Management with certain official rationalities, strategy, rules, phrasing, formats and strategies which could incorporate the instructing and preparing apparatus or stage through which a specific course of events of occasions, steps, and the venture turning points are refined.

1. Work/Budget Scope – Project Management Team/office
2. Strategic Planning -- Project Management Team/office
3. Project Work Breakdown Structure – Scheduler of the project
4. Focused of the geographical and the physical breakdown of the past completed

3.2 Site data:

Data of project is taken from an executing G+1 site located at Lalghati, Bhopal M.P. The construction work of the project is in progressing condition. This project is constructing at an area of 5300 square feet. The construction amount is 96lakh, and duration is 24 months including rainy season.

B. Methodology

Following steps are to be execute in a sequence are as follows:

Step-1 is to collect data of the site in which details of each activity and its quantity is required.

Step-2 is to prepare a scheduling using management tool primavera p6 to determine its actual running condition.

Step-3 to determine the manpower required for each activity by computing resources using I.S. 7272 using quantity analysis.

Step-4 to reschedule the project using primavera with providing lagging and links between various activities.

Step-5 to compare both the scheduling and resource allocation to determine cost variations.

Step-6 to prepare gantt chart and study both the planning

Table 1: Project Detail

Name of work	Government higher secondary school, lalghati, Bhopal M.P.
Salient Features	Rain waterharvesting, earthquake resistant structure, toilets, playground.
Name of Agency	Nagar Nigam ward 08, bhopal
LAND	5300 sq. ft.
Amount of contract	96lakh
Date of start	11-01-2016
Date of completion	10-01-2018

C. Problem formulation

Resource allocation: For resource allocation we need quantity of each activity, after determining quantity the very first step is to use constant labour provided in I.S.7272 To compare its resource allocation as per provided durations.

Formula for computation of resources in each activity:

No. of resource = (Quantity X Resource constant) / no. of days assigned

This equation is utilized as per I.S. 7272 central region to assign resource as per durations. The resource allocation is plotted in M.S. excel sheet in which each activity is analyzed for resources as per duration allotted.

IV.RESULT & DISCUSSION**A. Cost Variation in Rupees****Overall Cost**

The principal contribute of a contractor's costs and expenses result from the use of labors, materials, gear, and subcontractors. Extra broad overhead cost segments incorporate duties, premiums on securities and protection, and enthusiasm on advances. The aggregate of an undertaking's immediate expenses and its distributed aberrant expenses is named the Overall cost.

Table 2: Overall Costing

Overall Cost (In Lakh)		
S.no	Type	Cost
1	New scheduling	89.6
2	Old scheduling	96

Table 3: Labor costing

Over All Labour Cost (In Lakh.)		
S.No	Type	Cost
1	New scheduling	19.99
2	Old scheduling	20.84

Table 4: Indirect Costing

Indirect Cost (In Lakh)		
S. No	Type	Cost
1	New Scheduling	6.4
2	Old Scheduling	9.6

Table 5: Clearance of Site

Clearance		
S.No	Type	Labour Units
1	New Scheduling	23
2	Old Scheduling	21

Table 6: Cutting of Trees

Cutting Trees		
S.No	Type	Labour Units
1	New Scheduling	21
2	Old Scheduling	17

Table 7: Site Office

Site Office		
S.No	Type	Labour Units
1	New Scheduling	48
2	Old Scheduling	45

Table 8: Labor Room

Labour Room		
S.No	Type	Labour Units
1	New Scheduling	40
2	Old Scheduling	32

Table 9: Store Room

Store Room		
S.No	Type	Labour Units
1	New Scheduling	40
2	Old Scheduling	38

Table 10: Mobilization

Mobilization		
S.No	Type	Labor Units
1	New Scheduling	21
2	Old Scheduling	19

Table 11: Layout

Layout		
S.No	Type	Labour Units
1	New Scheduling	18
2	Old Scheduling	16

Table 12: Excavation

Excavation		
S.No	Type	Labour Units
1	New Scheduling	30
2	Old Scheduling	28

Table 13: PCC

PCC		
S.No	Type	Labour Units
1	New Scheduling	168
2	Old Scheduling	156

Table 14: Footing

Footing		
S.No	Type	Labour Units
1	New Scheduling	59
2	Old Scheduling	47

Table 15: Curtain Wall and Plinth

Curtain Wall & Plinth Beam		
S.No	Type	Labour Units
1	New Scheduling	153
2	Old Scheduling	128

Table 16: Earth filling

Earth Filling		
S.NO.	Type	Labour Units
1	New Scheduling	67
2	Old Scheduling	48

Table 17: Column Casting G.F. to F.F

Column G.F. To F.F		
S.NO.	Type	Labour Units
1	New Scheduling	78
2	Old Scheduling	63

Table 18: Slab & Beam Work

Slab & Beam Work		
S.NO.	Type	Labour Units
1	New Scheduling	48
2	Old Scheduling	32

Table 19: Column Casting

Column F.F. To Terrace		
S.NO.	Type	Labour Units
1	New Scheduling	79
2	Old Scheduling	65

Table 20: Terrace Level Beam and Casting

Beam & Slab Terrace		
S.NO.	Type	Labour Units
1	New Scheduling	50
2	Old Scheduling	36

Table 21: Brick Masonry Work

Brick Work		
S.NO.	Type	Labour Units
1	New Scheduling	57
2	Old Scheduling	52

Table 22: Electrification

Electrification		
S.NO.	Type	Labour Units
1	New Scheduling	35
2	Old Scheduling	33

Table 23: Sanitary and Plumbing

Sanitary Fixing		
S.NO.	Type	Labour Units
1	New Scheduling	35
2	Old Scheduling	30

Table 24: Plastering

Plaster		
S.NO.	Type	Labour Units
1	New Scheduling	65
2	Old Scheduling	58

Table 25: Tiles Fitting

Tiles		
S.NO.	Type	Labour Units
1	New Scheduling	45
2	Old Scheduling	43

Table 26: Painting Work

Paint		
S.NO.	Type	Labour Units
1	New Scheduling	50
2	Old Scheduling	47

V. CONCLUSION

In this work, planning and scheduling of an ongoing project is prepared using management tool primavera P6 and it is compared with the scheduling adopted by the government bodies in this project in terms of duration, resources and cost. The requirement of manpower for every activity of the project selected for this study i.e. Construction of government higher secondary school located at lalghati Bhopal M.P. is obtained using I.S. 7272 –I in which labour constants are selected according to activity and quantity of work.

The logical sequence of activities with constraints were determined and assigned on the basis of work involved and past experience. Based on data obtained, Gantt chart and network diagram is prepared and relations are assigned to activities. The duration of project were defined at different level like sub project level, work package level, activity level, operations level.

In construction project, the time duration is generally related to the quantum of resource employed. The software also help us to calculate the duration required to complete the project according to the planned schedule and actual performance of activity at any time and it gives the idea about project is on schedule, ahead of schedule, behind the schedule. The manpower & resources schedule is prepared which gives a clear picture of labour & materials requirement in exact number during the execution period of the project.

The date of commencement of project start was 11-01-2016 and estimated date of completion of project was 10-01-2018. Thus estimated project completion time is 24 months (Inclusive of rainy season) as per the contract between M.P. PWD & M/S. R.S. constructions PVT. LTD. bhopal (M.P.). Then in this study, manpower & resource planning, scheduling and tracking is done using Primavera P6. After preparing the schedule in Primavera Software, the total project duration is estimated and compared with ongoing site work. Now for tracking the percent completion of project in the software, the progress of individual activity is given according to their progress of work and compared with site work. After tracking, at status date of 11-09-2017, the project % complete should be 100%.

In this work we can conclude that with the help of management tool (primavera P-6) we are completing the project of 24 months before given

time in 20 months, saving indirect costs of 04 month such as employee salary, machinery rent, fooding, lodging, maintenance etc.

In terms of cost it is clearly observed in above chapter that overall cost is decreasing by 6.67%.

In this project the following benefits were obtained by scheduling it for 20 months instead of 24 months are as follows:

1. Here the most important benefit is that we completed the project within given time limit which will minimize the risk of natural calamities.
2. We minimize our indirect cost which includes salary of employees, machine repairing costs and other site expenses

REFERENCES

- [1] Piyush Pramod Bagade and Prof. Abhijit Bhirud, "Review on construction project management software primavera p6" International Journal of Engineering Sciences & Research Technology, ISSN: 2277-9655, January, 2018, PN (110-117).
- [2] Poonam Raykar and Ghadge A. N., "Analyzing the Critical Factors Influencing the Time Overrun and Cost Overrun in Construction Project" International Journal of Engineering Research, Volume No. 5, ISSN:2319-6890, 9 Jan 2016, PN (21-25).
- [3] A. Ray Chaudhuri, B. Sivakonda Reddy and S. K. nimbal, "Resource Management in Construction Projects – a case study" Engineering Science and Technology: An International Journal (ESTIJ), ISSN: 2250-3498, Vol. 2, No. 4, August 2017 PN (660 – 665).
- [4] A. R. Nikumbh and S. S. Pimpliker, "Planning and controlling of a National Highway Project- A case study", Journal of the Indian Road Congress Paper No. 613, April – June 2014 PN (91 – 102).
- [5] P M Wale1, N D. Jain, N R Godhani, S R Beniwal and A A Mir, «Planning and Scheduling of Project using Microsoft Project (Case Study of a building in India)», IOSR Journal of Mechanical and Civil Engineering, ISSN: 2320-334X, Volume 12, Issue 3 Ver. III (May. - Jun. 2015), PN 57-63.
- [6] Shaik Mohammad, Kunal B. Badgujar, B. A. Konnur and Amarsinh B. Landage "A Review of EVM Analysis with Primavera"; International Journal of Engineering Research ISSN:23196890(online),2347-5013 Volume No. 5, Issue Special 19 Jan 2014 PN: 164-167.
- [7] Hamid, R. Gupta, Parag S. Mahatme and Taran C. Bhagat "The cost controlling and monitoring of Construction project through earned Value management system" International Journal of Advanced Technology in Engineering and Science www.ijates.com Volume No 03, Special Issue No. 01, March 2013 ISSN (online): 2348 – 7550.
- [8] P. Dayakar and M. Udhayakumar, «Study on Project Management of an Ongoing Construction project Using MSP Sub Structure" Volume 2 Issue 5 Number 2–Oct 2012, PN 202-212.
- [9] Stephenson, P. and Fapohunda, J. A. "Optimal Construction Resources Utilization: Reflections of Site Managers' Attributes. The Pacific Journal of Science and Technology, Vol. 11, No. 2, November 2010 (Fall) PN 105-109.
- [10] Tranner, D. S. Stephan Jabasingh and J. Jayalakshmi "Analysis of Cost Controlling In Construction Industries by Earned Value Method Using Primavera"; Int. Journal of Engineering Research and Applications www. ijera.com ISSN: 2248-9622, Vol. 4, Issue 6(Version 1), June 2009, PN. 145-153.
- [11] Prabhakar, G. P. What is Project Success: A Literature Review. International Journal of Business and Management. September, 2008.
- [12] Kerzner, H. Project Management: A Systems Approach to Planning, and Controlling. New Dehli. CBS Publishers and Distributors Pvt. Ltd. 2003.
- [13] Lock, M. and Li, H., 2003. Resource-Activity Critical-Path Method for Construction Planning. Journal of Construction Engineering and Management © ASCE / July/August 2003. ISSN 3365, PN 13-19.
- [14] Sousenlue, K. and Christiansson, P. "Experiences from Implementing of ICT for Resource Management in Small Construction Companies» World Conference on IT in Design and Construction, INCITE/ITCSED 2006, 15 – 17 November 2006, New Delhi. (pp. 285-295, Vol. 1)
- [15] Project Management Institute (PMI), 2000. A Guide to Project Management Body of Knowledge (PMBOK Guide). Newtown Square: Project Management Institute, Inc
- [16] Construction Project at Rashtriya Sanskrit Sansthan, Bhopal"; International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 4, April 2014.
- [17] Rodriguez, S., Zhang. C., and Hammad, A. 2010. Feasibility of Location Tracking and Construction Resources Using UWB for Better Productivity. Proceedings of the International Conference on Computing in Civil and Building Engineering. Nottingham University Press.
- [18] Antony Prasanath MA, Thirumalai Raja K, "Analysis of cost & schedule Performance of Residential Building Projects by EVM technique", Journal of Construction Engineering, Technology and Management ISSN: 2347- 7253, Vol. 4, (2014) PN (1-7).
- [19] Tarek Hegazy, Wail Menesi, "Critical Path Segments Scheduling Technique" Journal of Construction Engineering and Management ASCE/ (Oct 2010) PN (1078-1085).
- [20] Awad Hanna, Aviad Shapira, Mounir Asmar and Craig Taylor, "Impact of crew scheduling on project performance", Practice Periodical on Structural Design and Construction ASCE (2013) PN (35 – 44).
- [21] Robert B. Harris, "Packing method for Resource Levelling", Journal of Construction Engineering and Management © ASCE, vol no 116, June 1990 PN (331 – 350).
- [22] Khaled El-Rayes and Dho Heon – "Optimizing Resource Leveling in Construction Projects", Journal of Construction Engineering and Management © ASCE, Vol. 135, No. 11, November 1, 2009, PN (1172 - 1180).
- [23] James E. Seibert and Gerald W. Evans, "Time Constrained Resource Leveling", Journal of Construction Engineering and Management, ASCE Vol. 117, No. 3, September, 1991. PN (503 – 520) [9] O. Shaked and A. Warszawski, "Conshed: Expert System for Scheduling of Modular Construction Projects", Journal of Construction Engineering and Management, ASCE/ vol 118, Sept. 1992 PN (488 – 506).
- [24] Piotr Jaskowski and Anna Sobotka, "Scheduling Construction Projects Using Evolutionary Algorithm", Journal of Construction Engineering and Management, ASCE/ Aug 2006 PN (861 – 870).