

Planning, Scheduling and Optimization Of Resources In Construction Project

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Abstract: *Effective construction planning and scheduling is the first and crucial step towards a successful and efficient construction project. All succeeding tasks, or activities, should follow the planning stage. The planning and scheduling processes arduous, complex, and time-consuming. Even experienced construction planners find it impossible to construct a comprehensive and faultless master construction plan, and during construction operations make reviews and update a necessary. Planning, scheduling, and controlling are more important in the projects. Specialization requires more focused project planning and controlling techniques that prove to be better for certain types of projects. Planning leads to improved performance in terms of cost, schedule, and operations, balancing the competing needs of a project. Planning is used to tracking of work and cost control of the project. Resource management is the important feature of the construction project management in today's economy. Cost and time factors purely depend on the how the resources are effectively used in the construction project. Project manager faces the difficulties such as resource allocation and resource planning in construction projects due to large-scale projects. Thus, old method of resource management system cannot handle today's project. To overcome by the difficulties some software was introduced like primavera can manage the projects in proper way. This software will help in resource management process of the project and avoids cost and time over run.*

1. Introduction

Construction industry is an integral part of India, this industry is one of the largest industries in India. India is right now one of the fastest growing infrastructure countries, here is huge difference in development of rural and urban areas here need effective project management, many problems and issues arises in construction industry due to poor planning, improper management, non-availability of resource, climatic changes which will affects the project cost and project duration. In present days Construction projects are facing many challenges of administration project budget, scheduling, quality, safety, and health to assemble the requirements programmed by the customer. Antagonism in construction filed always increasing and projects are always required to be complete on time, within the budget, and with safety and quality. Accurate consumption of external and internal resources is obligatory, for which the construction projects have to implement greatest business decisions and maximized business goals for improved continued existence in the active aggressive environment. Construction projects are facing main factors are scheduling and budget". Scheduling and budget are mainly based on the expenditure of available resource like materials used in projects and efficient organization, and proper planning at the within in the time and right place. In construction industries mainly three resources like resources, equipment, manpower. The total construction project completely depends on proper

expenditure of available machinery and resource. If not appropriate expenditure of resource allocation and resource optimization the project budget and scheduling are increases. Present days. One of the easier said than done activities in the construction industries are management resource materials. The resources allocations are mostly manpower and resources. In construction projects the activities are different works will be executed every day, allotment of resource allocation for every activity is difficulty, from time to time it will be in overload of allocated, sometimes it will be a lesser amount of allocation all the above trouble construct optimization procedure is very problematical. Resource management purpose is mostly supplying and opinionated resource allocation to each performance of the project. Construction projects can successfully complete within the budget and scheduling mainly based on Resource. Project Resource preparation includes the resource allocation to different performance and levelling the resources. In projects resource allocation and resource levelling difficulty arises when there are adequate resources obtainable and it is necessary to decrease the fluctuations in the archetype of resource allocation practice. These fluctuations are very objectionable for the reason that they frequently consumption, nearby labor, and economic problems for the construction contractor. The project scheduling aim is to construct the resource allocation requirements as dependable make available as possible, or in various cases to formulate them competition attractive non-uniform resource levels in

construction projects. There are no resource boundaries and the procedure is accomplished by potholed only the noncritical performance contained by their available resources; the project time period of the innovative important path remainder permanent In construction projects is very complicated to do accurate planning and arrangement of resource allocation in this case number of performance is more hence it's very complicated, thus now days construction projects planning and arrangement will be done by software's PRIMAVERA and Microsoft project. PRIMAVERA software is highly developed software than Microsoft project software. it is comprehensively used software in the huge scale construction industries. PRIMAVERA software can administer hundreds of projects at a time.

1.1 Planning

It is the process of retrieving an organization's aim and generating a pragmatic, comprehensive plan of execution for the future project phases. In construction industry a project manager takes sole responsibility for maintaining cost, time and quality. Usually a construction industry lacks proper planning and hence ends up in bearing high cost, delay in time and low-quality work. The only solution for is to follow a proper management system for planning. In some cases, a project manager will be handling multiple projects and planning needs to be done properly especially for the allocation of resources.

1.2 Scheduling

It is the process of arranging a project's milestones, activities and outputs within a specified time. Every construction project has a start and a finish date. There will be a lot of activities to perform an event. Scheduling those activities in an efficient way can trigger better deliverables. The main intention in scheduling is to maintain a proper sequence of activity flow. One should not create a confusion in the activity by creating an improper sequence e.g.: - the foundation work should be completed before the superstructure starts. Here, there is no other possibility of starting the construction of the superstructure before the completion of the substructure. But one could start with the storing of raw materials at site to prevent delay at later stages. In case of multiple projects, the project manager should be aware of all the scenario in different project sites. If any constraints are present, then he should solve them tactfully.

1.3 Resource Optimization

Every construction project needs man, material, and money. These are the basic requirement to start any construction project. Along with them we also need machines and method to complete a task. These are the resources needed while commencing a project and during execution. The word optimization means to make the maximum possible positive use of an input. So, resource optimization is to use these available resources in a most efficient way to achieve

maximum efficiency. For instance, in a construction industry while allocating bricks of concrete blocks for a wall, the proper number should be estimated rather than simply moving on with thumb rule. For an excavation to be done it can be done both manually and mechanically but the cost in both the cases vary. Here, it depends on the project managers preference over the constraints which may be time or cost. In multiple projects resource allocation becomes more tedious. If the resources are a site constraint, then the execution work would be hampered accordingly.

2. Literature Review

Yong-Cheol Yang, Chan-Jung Park, Ju-Hyung Kim and Jae-Jim Kim (2007) in the paper "Management of Daily Progress in a Construction Project of Multiple Apartment Buildings" have mentioned about managing the daily progress in multiple apartment buildings in South Korea. It is **Sharyar Wani, Mutasim Elsadig Adam, Husein Osman Abdullahi, Jamludin Bin Ibrahim** (2012) have discussed about the problems faced by project managers while handling Parallel Projects. The aim of the paper reveals the impact of parallel project on one another and effects on project schedule, budget and the quality. They have conducted the survey by distributing project management related questionnaires to project managers from International Islamic University Malaysia. They have conducted interviews with project managers having experience in handling multiple projects. The interviews were mostly face to face and to get relevant and proper answers for the questions. All the questions were related to challenges and options of handling multiple projects in terms of cost, time and quality. From all the above-mentioned methodology they concluded that the basic problem faced by project managers were cost overrun, delay and low quality work. Also in some cases the co-ordination between projects does not match.

Rong-yau Huang and Kuo-Shun Sun (2006) have done a case study on Non-Unit Based Planning and Scheduling of Repetitive Construction Projects. They have performed a case study of a sewer system project and have discussed their views over it. They have considered repetitive activity groups rather than repetitive units for their approach which sounds rational and effective. The writers have focused on similar activities which may have different cost, time, construction conditions and resource usage. They have engaged labor resource as per the requirement to complete the activity rather than allotting them according to their skill as in traditional methods. So, here now it becomes compulsory for them to take a note of the time taken to complete each activity. They have performed it by maintaining proper sequence of activities, cost and time while assigning multiple crews for an activity. Finally they have concluded by conveying a non-unit based algorithm. This could be useful in case of planning and scheduling of repetitive project.

Unmesh.Y.Polekar and Rohit.R.Salgude (2015) have analysed Planning, Scheduling and Tracking of a residential building using Primavera Software. The basic problem encountered while executing a project is a rise in cost and extension in the completion time. This could be solved with

the help of proper management. The writers have thus suggested a better way for completing the project by planning, scheduling, and tracking the project using the primavera software. The study reveals the defects in planning and scheduling of activities. A comparison is done with the scheduled and actual progress of work. The importance of contractors in project has also been highlighted. Monitoring the project using the software proved to be more effective.

3. Methodology

In previous days construction Project management was being conventional away by Project Evaluation method and critical path method. Present day's construction project is maintained by software's like Primavera software and MSP. In that, Primavera software has been meticulous to administer the resource allocating which is used in the project and also optimized the obtainable resource the learning have been approved out in 2 stages, in first stage collecting the necessary information connected project and compute the quantities are assigned in Primavera with a number of definite interval to the requirement of assigned movement with high opinion to measure resource will be assigned to these performance and find out the over distribution resource and resource levelling will be performed. Fig. 1 shows the Overall methodology for the project.

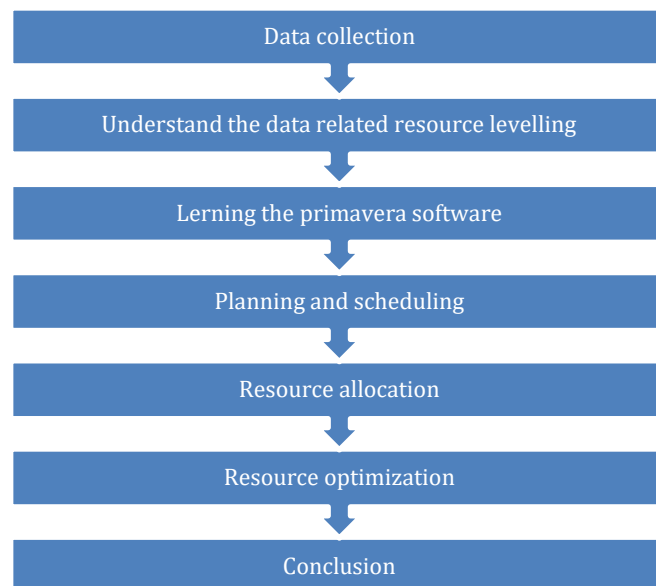


Fig 1: Flow chart for methodology

A. Data collection

Collecting the articles and research paper related to optimization of resources and same as to collecting the construction project details related resources used in that project. In that case collecting drawings of the project and Quantity survey of the project.

B. Understanding the data

After completion of data collection to understand the project resource and related software.

C. Learning the primavera software

Learning the Primavera software to understand its features, functions and step by step procedure which helps to identifying the status of the project about budget of project and scheduling of project required to complete the remaining project while its construction.

D. Planning

After collecting the data verifying the planning and quantities should be done.

E. Scheduling

Procedure had to be completed. It involves developing a work break down structure (WBS), calendar and allotting extent for each movement. The Calendar in my project is • Eight hour working per day of labour as of morning 9am to 6 pm with one-hour Lunch break • Sunday is as well operational day intended for eight hours. • Holiday's intended for labor is government holidays similar to Republic day.

a) The project Work Break-down Structure

The term Work Breakdown Structure is in short commonly called as WBS. It is a process of grouping different elements of the project with concerned to specific product and it organizes or impinges to define the overall intent of the project



Activity ID	Activity Name	Original/Start	Finish	Duration
1.00	CONVENTION CENTRE	01-Jun-20	01-Jul-20	0.00
1.01	GENERAL	01-Jun-20	01-Jul-20	0.00
1.02	PROJECT MILESTONES	01-Jun-20	01-Jul-20	0.00
1.03	DESIGN	01-Jun-20	01-Jul-20	0.00
1.04	APPROVAL	01-Jun-20	01-Jul-20	0.00
1.05	PROCUREMENT	01-Jun-20	01-Jul-20	0.00
1.06	IMPLEMENT PLAN	01-Jun-20	01-Jul-20	0.00
1.07	CONSTRUCTION	01-Jun-20	01-Jul-20	0.00
1.08	STRUCTURE WORKS	01-Jun-20	01-Jul-20	0.00
1.09	SUPERSTRUCTURE WORKS	01-Jun-20	01-Jul-20	0.00
1.10	STRUCTURAL WORKS	01-Jun-20	01-Jul-20	0.00
1.11	COLUMN	01-Jun-20	01-Jul-20	0.00
1.12	GROUND FLOOR	01-Jun-20	01-Jul-20	0.00
1.13	MEZZANINE FLOOR	01-Jun-20	01-Jul-20	0.00
1.14	FIRST FLOOR	01-Jun-20	01-Jul-20	0.00
1.15	BEAM	01-Jun-20	01-Jul-20	0.00
1.16	GROUND FLOOR	01-Jun-20	01-Jul-20	0.00
1.17	MEZZANINE FLOOR	01-Jun-20	01-Jul-20	0.00
1.18	FIRST FLOOR	01-Jun-20	01-Jul-20	0.00
1.19	SLAB	01-Jun-20	01-Jul-20	0.00
1.20	MEZZANINE FLOOR	01-Jun-20	01-Jul-20	0.00
1.21	ROOF WORKS	01-Jun-20	01-Jul-20	0.00
1.22	WATER STORAGE TANK WORKS	01-Jun-20	01-Jul-20	0.00
1.23	COLUMN	01-Jun-20	01-Jul-20	0.00
1.24	BEAM	01-Jun-20	01-Jul-20	0.00
1.25	MASONRY WORKS	01-Jun-20	01-Jul-20	0.00
1.26	GROUND FLOOR	01-Jun-20	01-Jul-20	0.00
1.27	MEZZANINE FLOOR	01-Jun-20	01-Jul-20	0.00
1.28	FIRST FLOOR	01-Jun-20	01-Jul-20	0.00
1.29	ROOF	01-Jun-20	01-Jul-20	0.00
1.30	FINISHING WORKS	01-Jun-20	01-Jul-20	0.00
1.31	GROUND FLOOR	01-Jun-20	01-Jul-20	0.00
1.32	MEZZANINE FLOOR	01-Jun-20	01-Jul-20	0.00
1.33	FIRST FLOOR	01-Jun-20	01-Jul-20	0.00

Figure-2.1: WBS layout of Project



Figure-2.2: WBS layout of Project

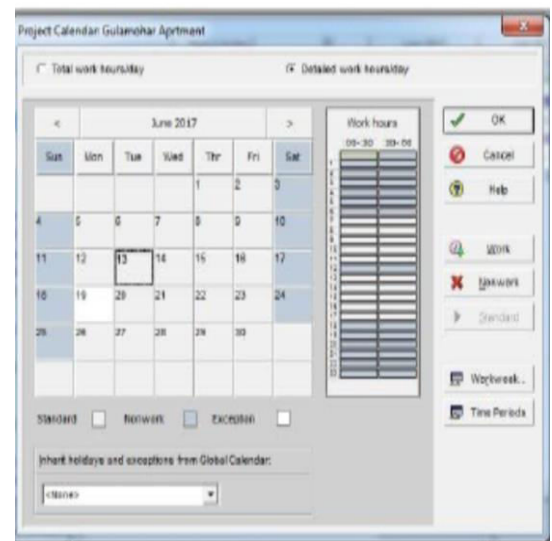


Figure-3: The Actual Project Calendar



Figure-2.3: WBS layout of Project

b) Creation of Project Calendar

Project calendars are the insignificant part of the project schedules. The project calendars exhibit the working days, exceptions, suspensions, non-working days, holidays any other days corresponding to that project when used it properly. Even though, the calendars are categorized depending upon the need, the type of organizations, country/state/region of the proposed project and other parameters.

F. Resource Allocation

Subsequent to development, the resource counter is prearranged, and this equipped resource are assigned to each performance of the project normally resource unconnected labor, UN skilled, and substance in the software. Possessions are designed based on the amount of the movement.

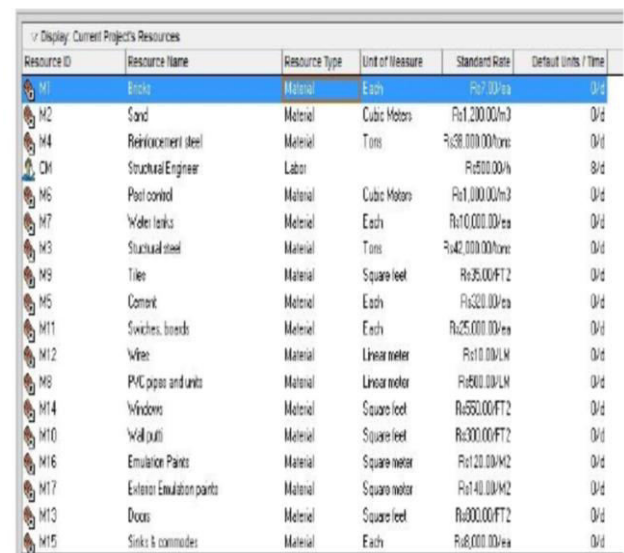


Figure-4: Typical screenshot of project resources sheet

G. Resource optimization and Results

We can't optimize or reduce the project material resource allocation other than we can optimize the manpower resource allocating while leveling the different resource allocations, there are some probabilities in which one can optimize the source. In this construction project dissimilar type probabilities are approved out are as follows

1. Level meticulous resource surrounded by hang

- Preserving planned near the beginning and not on time date
2. Level meticulous resource surrounded by hang preserving programmed near the beginning and not on time dates
3. Level all resource surrounded by hang conserved scheduled near the beginning and not on time dates
4. Level all the resource through Preserving scheduling near the beginning and most recent dates

Resource Assignments

Activities	Resource Assignments	Resources	WBS
Layout: Activity Resource Assignments			
Activity ID	Activity Name	Resource ID Name	Start Finish
44	2-3rd floor level	4100 Machine Operator	15-May-18 24-May-18
62	2-4th floor level	4100 Machine Operator	26-May-18 31-Jun-18
75	2-5th floor level	4100 Machine Operator	06-Jun-18 28-Jun-18
87	2-6th floor level	4100 Machine Operator	15-Jun-18 18-Jun-18
95	2-7th floor level	4100 Machine Operator	25-Jun-18 26-Jun-18
111	2-8th floor level	4100 Machine Operator	25-Jun-18 24-Jul-18
123	2-ND Floor for basement	4100 Machine Operator	25-Jul-18 25-Aug-18
125	Excavator operator	3 Excavator operator	05-Jun-17 30-Oct-17
147	Excavation	3 Excavator operator	05-Jun-17 30-Jul-17
149	Back filling	3 Excavator operator	25-Sep-17 30-Oct-17
151	Dumper driver	10 Dumper driver	05-Jun-17 30-Oct-17
153	Excavation	10 Dumper driver	05-Jun-17 30-Jul-17
155	Back filling	10 Dumper driver	25-Sep-17 30-Oct-17
157	Materials	10 Dumper driver	15-Jul-17 15-Nov-18
159	Electrical conduit	R-4 Electrical conduit	30-Oct-17 25-Aug-18
161	44 Electrical conduit at LB	R-4 Electrical conduit	30-Oct-17 30-Oct-17
163	62 Electrical conduit at UB	R-4 Electrical conduit	22-Dec-17 22-Dec-17
165	75 Electrical conduit at Ground floor	R-4 Electrical conduit	17-Jan-18 17-Jan-18
167	87 Electrical conduit at 1st floor	R-4 Electrical conduit	13-Feb-18 13-Feb-18
169	95 Electrical conduit at 2nd floor	R-4 Electrical conduit	12-Mar-18 12-Mar-18
171	111 Electrical conduit at 3rd floor	R-4 Electrical conduit	05-Apr-18 20-Apr-18
173	123 Electrical conduit at 4th floor	R-4 Electrical conduit	04-May-18 24-May-18
175	125 Electrical conduit at 5th floor	R-4 Electrical conduit	21-May-18 21-May-18
177	147 Electrical conduit at 6th floor	R-4 Electrical conduit	27-Jun-18 27-Jun-18

Figure-5: A typical sheet of Resource Assignment

4. Conclusion

The objective of this study on resource used in the construction industry is to plan, schedule and optimize or reduce or to avoid on wastages of the resource in construction project. Resource optimization has been done by using project management software like primavera p-6. here manpower resource like mason, mason helper, carpenter, carpenter helper, painter, painter helper have been taken in to consideration for optimization because they are most commonly used resources were found as an over allocated resources for some activities. Hence optimization was done to this resource and by modifying predecessors without affecting the duration of the project. These resources were levelled in such way that their allocation is well within maximum availability.

References

- [1]. Estimation and Costing in Civil Engineering by B.N Dutta, UBS Publishers Distributors Pvt Ltd (UBSPD).
- [2]. Unmesh.Y. Polekar and Rohit. R. Salgude on “Planning, Scheduling and Tracking of a residential Project using Primavera Software”. Volume 3, Issue 5, May 2015 International Journal of Advance Research in Computer Science and Management Studies.
- [3]. Rong-yau Huang and Kuo-Shun Sun on “Non-UnitBased Planning and Scheduling of Repetitive Construction Projects”. Journal of Construction Engineering and Management, ASCE , June 2006

- [4]. SharyarWani, MutasimElsadig Adam, Husein Osman Abdullahi, and Jamaludin Bin Ibrahim on “Impact of Parallel Projects Management”.International Journal of Humanities and Social Science Vol. 2 No. 23; December 2012
- [5]. Yong-Cheol Yang, Chan-Jung Park, Ju-Hyung Kim and Jae-Jun Kim on “Management of Daily Progress in a Construction Project of Multiple Apartment Buildings”. Journal of Construction Engineering and Management, American Society of Civil Engineers March 2007.
- [6]. Young HoonKwak, Frank T Anbari on “Analyzing Project Management Research: Perspective from top Management Journals”. International Journal of Project Management 27 (2009) 435–446.