

Planning, Scheduling and Resource Optimization for A Villa by using Ms-Project 2010

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Abstract— One of the most challenging jobs that any manager can take on is the management of a large-scale project and it requires numerous activities throughout the project. A Modern project management has developed various techniques based on network techniques in order to plan the projects processes in time, their costs and resources. Critical Path Method (CPM) is one of the best procedures for the planning, scheduling and optimizing the resource usage. CPM scheduling is a basic project control tool hence it is using in the all type of project. Completing a project on time and within the budget is not an easy task. The project scheduling plays an important role in the time and cost aspects of a project. Each project managers have different systems in planning and scheduling, which is usually consists of Gantt chart or Bar chart. The development of Critical Path Method provides a basic and systematic approach to project managers. This results in the use of software's like Microsoft Project and Primavera.

Key words: Ms Project 2010, CPM, Planning, Software

I. INTRODUCTION

The construction industry is the second largest industry of the Indian country after the agriculture. It makes an important role in the contribution to the national economy and provides employment to large number of peoples. There is a growing need for project controls or project manager on today's construction projects.

The main objective of project planning is to prepare a time table of work for each task/job/activity and allocating a start date and finish date. The steps required to do such a good planning includes logic, timing, analysis and scheduling the inputs. For project planning and scheduling various methods are there such as bar chart, CPM and PERT.

The primary challenge of project manager is to achieve all the project goals and objectives within the project constraints [1]. The secondary challenge is to optimize the resource allocation and integration of inputs necessary to meet project objectives. The project managers are using Critical Path Method for their project monitoring. The project management software's are MS-Project and primavera. Both these software's are based on CPM.

A. Objectives of Study

Following are the objectives of the study

- 1) The main objective of planning and scheduling of a villa by using MS Project tool is to execute the project most economically.
- 2) To determine how much MS Project tool is effective in controlling cost and time.
- 3) The other objective of this project is to use the available resources in a most optimum way.

- 4) To identify the specific methodologies to adopt in project planning and resource optimization by using MS Project without affecting duration and cost.

II. CONSTRUCTION MANAGEMENT

Project is a temporary endeavor undertaken to create a unique product/service/result and it has definite beginning and end. Project management is an application of knowledge, tools, skills and techniques to project activities to meet the project requirements. Project management includes the scope, quality, budget, resources, and schedule. Construction project management is an application of knowledge, tools, skills and techniques to the construction project activities to meet their project requirements. The construction project management involves the planning, scheduling, executing and monitoring.

A. Planning

Planning is the part of the project management. Planning is the process of creating and maintaining plan and the psychological process of thinking about the activities to create a goal or to achieve a goal. Planning is a fundamental property of intelligent behavior. This planning process is required for the improving of a plan, or integration of it with other plans. Planning is also used for describing the procedure used such as creation of documents, diagrams, meeting to discuss on the important issues to be addressed, the objectives to meet, etc and strategy to be followed. In construction plan, it is common to adopt a primary importance on either cost control or schedule control.

Planning involves advance thinking like what is to be done, when it is to be done, what are the activities to be done, how it is to be done, where it is to be done, what are the requirements to do it, who has to do it and how to ensure that it is done. This entire action plan aim is to achieve the specified goals.

B. Scheduling

A schedule is a work program. Scheduling is a logical sequence which is set by date-wise. It is a time table for action. Time scheduling is the process of developing a work program. An activity progress schedule was probably prepared when the activity was estimated. The main purpose of scheduling is to determine the duration of project so that an estimate of general conditions or general requirements containing time related could be prepared. The project has become a reality, the activity progress can schedule needs to be reviewed and refined for further purposes. The commonly used scheduling techniques on network based project management methodology are Bar Chart, Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT).

The purposes of scheduling are Optimize time, Eliminate or reduce uncertainty. Improve efficiency of the operation, Optimize the resources, provide a basis for monitoring and controlling work.

C. Resource Optimization

A resource is a physical quantity such as manpower, money, material, equipment, time which are required for carrying out an activity/task/job. The main and primary objective of any organization is not to waste the resources. The resources should be utilized to maximum possible capacity as it is present on site. If the duration the completion of the project is fixed, then resource optimization should be applied without changing the total duration of the project. Resource Leveling is a function in Microsoft Project that allows optimizing the use of resources by delaying activities and adjusting resources to reduce the peaks in the histogram

III. MICROSOFT PROJECT 2010

MicroSoft Project (MSP) is a project management software program. It is developed by Microsoft, Microsoft project software released in 1998. Microsoft project software is used for planning, scheduling, monitoring, controlling and resource optimization of the project

Microsoft Project has its advantages

- 1) It is user friendly.
- 2) It is easy to start scheduling activities.
- 3) It produces decent default graphics and reports.
- 4) Most of the construction contractor for construction projects requires periodic schedule and updates which can be done by using Microsoft Project.
- 5) Project managers are able to perform risk and impact analysis. They can assign a probability to problem occurrences and simulate the schedule, resource and cost impact of those problems.
- 6) It enables general managers to execute and implement their strategies and they can achieve their goals.

IV. METHODOLOGY

The methodology adopted for this project was to first define the activities, duration, and their logical relationships among the various activities and prepare a schedule report. Following this the critical path will be obtained and then the resources availability is collected and assigned, analysis and leveling is done and results are concluded. The entire activity described below is integrated with the MS Project and report is generated. Construction Planning, Scheduling and Optimization of resource involve the following steps.

- 1) Planning
 - Data Collections
 - Quantity Surveying
- 2) Scheduling
- 3) Resource Optimization
 - Resource Allocation
 - Resource Leveling

A. Planning

1) Data Collections

Data collection involves the collection of drawings. All structural, architectural, plumbing, sanitary drawing etc should be collected and list of activities involved are listed.

2) Quantity Surveying

Quantity surveying involves calculation of quantities from the collected drawings for each and every item.

B. Scheduling

After collecting the drawings and preparing list of activities, quantity for each activity has been calculated. Now next procedure is scheduling the activities in the MS-Project Software. The scheduling procedure is as follows:

- Creating a new project plan
- Assigning calendar
- Setting project information
- Setting base line
- Scheduling activities in MS-Project.

1) Creating a new Project Plan

- Run the MS-Project
- On the screen at top of the right side of the computer screen click on file In that select new under that blank project

2) Assigning Calendar

Click on the project at the top of the screen and in that select sixth one change working time. Microsoft Project comes with three types of calendars they are Standard, 24 hours and Night shift.

3) Setting Project Information

Click on project at the top of the screen in that select the second one project information. Here we can give our project start date and we can assign the calendar. By changing the schedule from the project finish date we can schedule it by fixing a final deadline. Microsoft Project will calculate the duration of the project and it schedules as per given information in schedule from start date or finish date and as per assigned calendar.

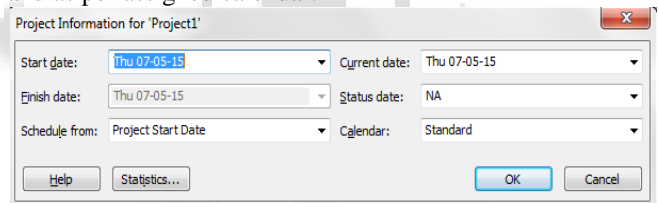


Fig. 1: Setting Project Information

4) Setting Baseline

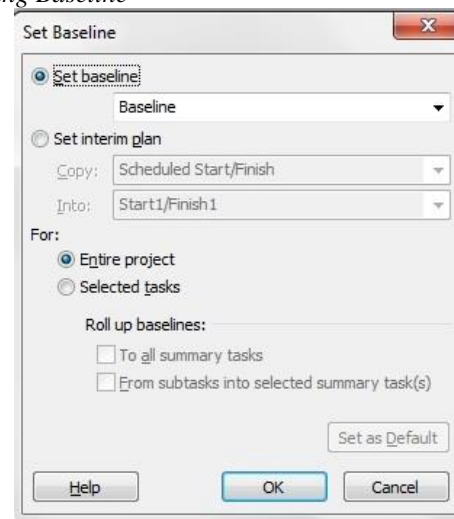


Fig 2: Setting baseline

Click on the project and select the eight one set baseline and in that once again set baseline. Make sure that entire project

In the Gantt chart assign the resources to each activity. Double click on the task/activity. A task information dialog box will appear in that select the resources tab, select the resources for that task and assign the number of units for the work type resource and quantity for the material type resource

2) Resource Levelling

Resource levelling helps in order to minimise the peaks in daily resource usage. If the duration of completion of project is constant, then resource levelling is applied without changing the total duration of the project. The periods of maximum demand of resource are allocated and the activities are shifted to the availability of float. Microsoft project shows that where resources are over allocated. It shows man symbol in the task sheet and red color to the resource in resource sheet.

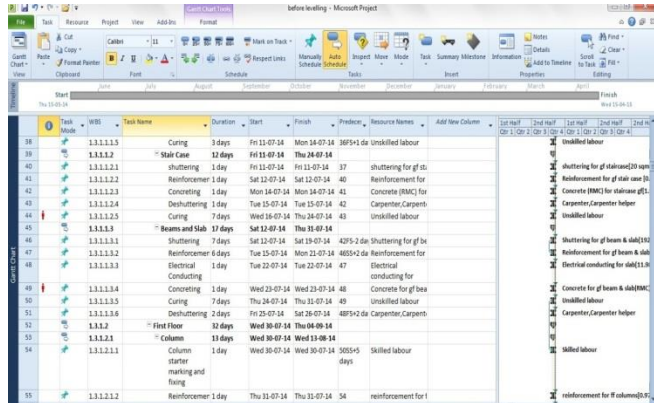


Fig. 8: A typical Task Sheet shows resource over allocated



Fig. 9: A typical Resource Graph showing resource over allocated

a) Levelling the Resource

Leveling is only for the work type resource not for material type resources. The leveling does not reassign any task or units or activity. It does not change work, only it balance the work load with the leveling feature, which adds delay and splits in a project plan according to the specifications that we set. By selecting leveling option we can do resource levelling for entire project.

V. RESULTS

A. Cost Analysis

The Microsoft Project calculates the cost for each activity, and it will give overall cost of the project at the top of the task sheet. The Microsoft Project software calculates the cost as same as we calculate by manually. From this client can know his final budget of the project. It helps to

contractor or owner or to client for their budget. It also helps to identify the cost of any item.

By adding cost column in the task sheet we can get the cost of the project and cost of the each activity. The typical scheduling and cost report is shown below.

Task Mode	WBS	Task Name	Duration	Start	Finish	Predecessors	Resource Names	Cost	Add New Column
1	1	RBD 40'x60 villas	288 days	Thu 15-05-14	Wed 15-04-15			₹ 1,156,811.52	
2	1.1	Project start date	1 day	Thu 15-05-14	Thu 15-05-14			₹ 0.00	
3	1.2	substructure	42 days	Fri 16-05-14	Thu 09-07-14			₹ 517,326.24	
4	1.2.1	footing	20 days	Fri 16-05-14	Sat 07-06-14			₹ 191,747.68	
5	1.2.1.1	siteclearance	1 day	Fri 16-05-14	Fri 16-05-14	2	Unskilled labour(2k	₹ 800.00	
6	1.2.1.2	markings for footing	1 day	Sat 17-05-14	Sat 17-05-14	5	Skilled labour,Unskilled labour,Unskilled	₹ 1,500.00	
7	1.2.1.3	mass excavation	2 days	Mon 19-05-14	Tue 20-05-14	6	mass excavation (j	₹ 10,000.00	
8	1.2.1.4	anti termite treatment	1 day	Wed 21-05-14	Wed 21-05-14	7	anti termite treatment(116.4	₹ 5,587.20	
9	1.2.1.5	compacting	1 day	Thu 22-05-14	Thu 22-05-14	8	Skilled labour,Unsk	₹ 1,100.00	
10	1.2.1.6	PCC	1 day	Fri 23-05-14	Fri 23-05-14	9	PCC(6.53 cum),Skill	₹ 26,834.50	
11	1.2.1.7	Reinforcement for footing & column	7 days	Sat 24-05-14	Sat 31-05-14	10	Reinforcement for footing &	₹ 167,050.00	
12	1.2.1.8	Shuttering	3 days	Mon 02-06-14	Wed 04-06-14	11	Shuttering of footc	₹ 14,076.00	
13	1.2.1.9	concreting	2 days	Fri 05-06-14	Fri 06-06-14	12	concrete(RMC) for f	₹ 11,100.00	
14	1.2.1.10	Des shuttering	1 day	Sat 07-06-14	Sat 07-06-14	13	Carpenter,Carpent	₹ 1,700.00	
15	1.2.2	Column footing below plinth beam	8 days	Mon 09-06-14	Tue 17-06-14			₹ 21,902.56	
16	1.2.2.1	Column and footing grid	1 day	Mon 09-06-14	Mon 09-06-14	14	Skilled labour,Unskilled	₹ 1,100.00	
17	1.2.2.2	Shuttering	1 day	Tue 10-06-14	Tue 10-06-14	16	shuttering for colou	₹ 8,046.56	

Fig. 10: A typical Cost Report.

B. After Levelling the Resources

Before levelling over allocated Task sheet and Resource graph are shown in Fig.9 & 10 respectively.

1) Task Sheet after levelling

Task Mode	WBS	Task Name	Duration	Start	Finish	Predecessors	Resource Names	Add New Column
37	1.3.1.1.1.4	Des shuttering	1 day	Thu 10-07-14	Thu 10-07-14	36	Carpenter,Carpenter h	
38	1.3.1.1.1.5	Curing	3 days	Fri 11-07-14	Mon 14-07-14	36P5+1 day	Unskilled labour	
39	1.3.1.1.2	Stair Case	12 days	Fri 11-07-14	Thu 24-07-14			
40	1.3.1.1.2.1	shuttering	1 day	Fri 11-07-14	Fri 11-07-14	37	shuttering for gf sta	
41	1.3.1.1.2.2	Reinforcement	1 day	Sat 12-07-14	Sat 12-07-14	40	Reinforcement for gf s	
42	1.3.1.1.2.3	Concreting	1 day	Mon 14-07-14	Mon 14-07-14	41	Concrete (RMC) for sta	
43	1.3.1.1.2.4	Des shuttering	1 day	Tue 15-07-14	Tue 15-07-14	42	Carpenter,Carpenter h	
44	1.3.1.1.2.5	Curing	7 days	Wed 16-07-14	Thu 24-07-14	43	Unskilled labour	
45	1.3.1.1.3	Beams and Slab	17 days	Sat 12-07-14	Thu 31-07-14			
46	1.3.1.1.3.1	Shuttering	7 days	Sat 12-07-14	Sat 19-07-14	42P5-2 days	Shuttering for gf beam	
47	1.3.1.1.3.2	Reinforcement	6 days	Tue 15-07-14	Mon 22-07-14	46P5+2 days	Reinforcement for gf c	
48	1.3.1.1.3.3	Electrical Conducing	1 day	Tue 22-07-14	Tue 22-07-14	47	Electrical conducing for slab(11.98 Nos)	
49	1.3.1.1.3.4	Concreting	1 day	Wed 23-07-14	Wed 23-07-14	48	Concrete for gf beam &	
50	1.3.1.1.3.5	Curing	7 days	Thu 24-07-14	Thu 31-07-14	49	Unskilled labour	
51	1.3.1.1.3.6	Des shuttering	2 days	Fri 25-07-14	Sat 26-07-14	48P5+2 days	Carpenter,Carpenter h	
52	1.3.1.2	First Floor	32 days	Wed 30-07-14	Thu 04-08-14			
53	1.3.1.2.1	Column	13 days	Wed 30-07-14	Wed 13-08-14			
54	1.3.1.2.1.1	Column starter marking and fixing	1 day	Wed 30-07-14	Wed 30-07-14	50P5+5 days	Skilled labour	
55	1.3.1.2.1.2	Reinforcement	1 day	Thu 31-07-14	Thu 31-07-14	54	reinforcement for floc	

Fig. 11: A typical Task Sheet after Resource Leveling

2) Resource Graph after levelling

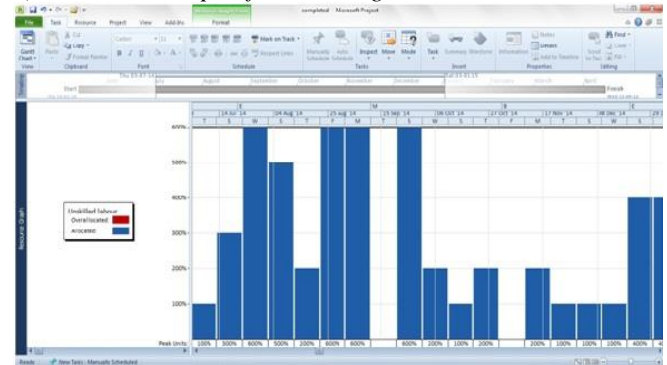


Fig. 12: A typical Resource Graph sheet after leveling

C. Resource Cost



Fig 13: A typical graph showing cost required for resource

MS-Project will give the cost required for any resource at any time interval of the project. So it will help the contractor to know the amount required for each work or each item. From this he will know the amount required for each day/week/month.

D. Network Diagram

It is a graphical representation of activities and their inter relationship. A network diagram shows the tasks of the project in the order they will be performed, in a sequential order. The network diagram allows visually constructing and linking the tasks and the way they should be worked. A network diagram can consist of subprojects, deliverables, mile-stones, or tasks. . It also shows the critical path. MS Project will give CPM network. The pink colored activities indicate the critical activity and others are not critical activity. The sequence of the critical activity is a critical path.

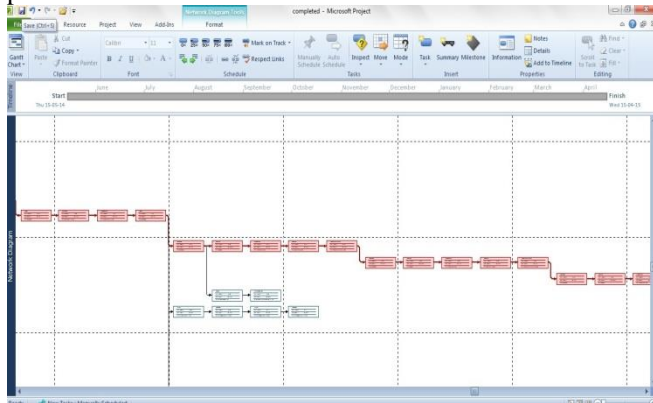


Fig. 14: Network diagram

VI. CONCLUSIONS

The following conclusions are made

- 1) Each and every activity of the project can be easily achieved with the help of MS-Project without making any delay.
- 2) With the help of MS Project planning and scheduling can be done economically.
- 3) Microsoft project is most effective tool in controlling the cost and time.
- 4) With the help of Resource levelling in Microsoft Project resources can be managed without effecting the total cost and duration of the project.
- 5) Storing the construction material in the site may lead to the wastage of resources so with the help of Microsoft Project the contractor can purchase the material when is required.
- 6) The contractor can manage material and money with the help of resource graph.
- 7) The entire project can be effectively managed with the help of Microsoft Project.

REFERENCES

- [1] S. S. Bhushanam "Project management for execution and implementation" International Journal of Earth Sciences and Engineering ISSN 0974-5904, Volume 04, No 06 SPL, October 2011, pp 785-788.
- [2] Ming Lu and S. M. AbouRizk "Simplified CPM/PERT Simulation Model" Journal of Construction Engineering

and Management @ASCE May/ June 2000 pg no 219-226.

- [3] Liu Jun-yan "Schedule uncertainty Control: A Literature review" 2012 International Conference on medical Physics and Biomedical Engineering, Physics Procedia 33 (2012) page no 1842-1848.
- [4] Patricia D. Galloway "Comparative Study of University Courses on Critical Path Method Scheduling" Journal of Construction Engineering and Management @ASCE July 2006 page no 712-722.
- [5] Daniel Castro Lacouture, A.M.ASCE; Gursel A. Suer; Julian Gonzalez-Joaqui; and J. K. Yates "Construction Project Scheduling with Time, Cost and Material Restrictions using Fuzzy Mathematical Models and Critical Path Method" Journal of Construction Engineering and Management @ ASCE October 2009, page no 1096 – 1104.
- [6] Jose Ramon San Cristobal "Critical Path Definition Using Multicriteria Decision Making: Promethee Method" Journal of Management in Engineering @ASCE April 2013, page no 158 – 163.
- [7] A guide to project management body of knowledge (PMBOK) Fourth edition at 2008 Project Management Institute (PMI) standards committee.