



CONSTRUCTION PROJECT SCHEDULING WITH THE HELP OF PRIMAVERA P6

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Project management, construction management, scheduling, controlling primavera p6, critical path method, optimization

ABSTRACT

Project management is key factor for successful completion of any project. Planning, scheduling, resource management and monitoring are fundamental parts of project management. Project scheduling requires deep knowledge about the project and its activities.

In present days construction projects require better management and planning to meet the market demand. Proper scheduling can save time and money. In the present research scheduling of construction projects is assessed and done by using primavera software. The scheduling was done for the project of 6JCO's building located in Risalpur KPK, Pakistan. The project was under Military Engineering Services (MES). The data was collected from MES office and site. Before scheduling a deep literature review was done and different requirements were also determined. OBS and EPS were created for organization. WBS for each element of project was done on software. Scheduling was done and critical path method was generated by software.

INTRODUCTION

Construction industry is one of the top industries in Pakistan. With the rapid growth of industry time and budget for every construction project is becoming crucial. Effective project management is key factor to achieve desired goal in every project. Time management is essential to complete project within projected time[1].

The main reason behind project cost over run is poor project scheduling which leads to delays and extra cost. Project scheduling is a way to allot specific time to every activity of project depending upon the resources available and nature of activity. Project is divided into different activities. Interlinked and depending activities are arranged in order to achieve overall goal in given duration[2-3].

Time is specified according to resources available and cost effectiveness, project duration allowed by client also plays prime role. If time is prolonged it may result in extra cost due to resources billable hours. The arrangement of activities depend on many factors including criticality of activity, dependences and nature of activity. Priority is given to most critical activities[3-4].

Small construction projects can be managed by simple schedules using simple computer aided tools but complex project require more skill and advance level software. There are many software available now a days but MS Project and primavera P6 are on top of list. Primavera is tremendous tool for this purpose and it can be used in any type of project specially to handle complex ones[6].

Primavera

Primavera is multifunctional computer aided tool used for project management in different fields. It is widely used in all over the world in the field civil engineering now a days. It can be used to schedule, monitor and planning of projects. Primavera can handle complex projects due to its capacity of organizing 100000 activities and assigning unlimited resources. It can handle more than one project at a time. Moreover, it allows users to arrange activities and allot resources in number of ways. It can also be used to control and manage the delays in project during execution of work. Figure 1 shows the application and different functions of Primavera P6[5].

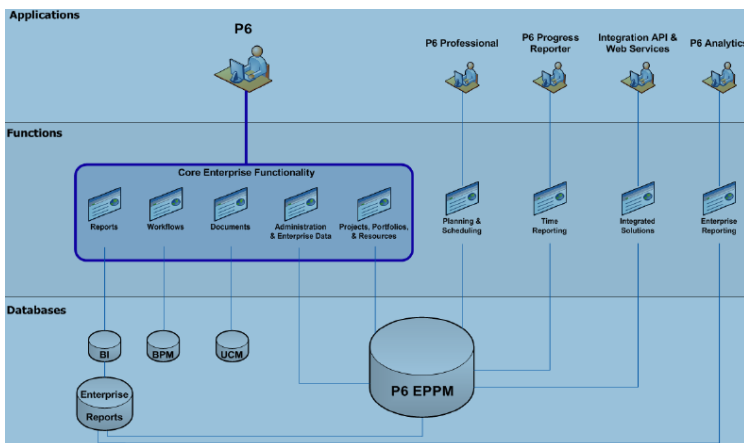


Figure 1 Application of primavera P6

LITERATURE REVIEW

In general a schedule is a time management tool which consist of tasks and event arranged against specific time in which they are supposed to occur. The process of determining activities, allotting resources to every activity or event and preparing schedule for expected time of occurrence is called as scheduling[3-6]. In case of heavy projects scheduling becomes more complicated due to large number of activities and their dependencies on each other. For such schedules possible time required to complete every activity and its dependent activities are determined first. Dependencies like an activity can only be started when other activity is complete for example renting machinery before using it[7-8].

The basic concept adopted by critical path method (CPM) is identification of every activity involved in project and it earliest completion time, a specific time known as float or schedule variance is set against unforeseen days. CPM is widely used technique in construction projects. Critical path is longest path required to complete project without making any delay. In other words it is the sequence of activities or events that sum up to longest duration to achieve all milestones. This determines the minimum time required to complete the project. When activities are arranged in order it may give number of paths to complete the project, other path near or parallel to critical path are called non-critical paths(9). CPM allows manager to determine critical activities and non-critical activities. Which activities can be delayed and which activities should be started and completed on time in order to achieve milestones on time [11]. Most of construction project managers and planners use CPM path method for scheduling and planning purposes as compare to other techniques [10-11].

Computer aided tools are widely used in construction industry for better planning. Professionals are very much interested in advanced software and improved techniques for project management. Most of the professionals prefer new software for scheduling, planning and monitoring purposes (12). Studies have shown that effective project management can be done by using computer aided management tools for complex construction projects [13]. Construction professionals are using project management software more than all other professionals. The construction projects are more complex and contain large number of activities which derives

the professionals towards the computer aided tools for ease and accuracy. They are using advanced techniques now more than ever before [14].

More than 50% of construction professionals are using primavera for management and are satisfied with its features. For complex projects they prefer primavera for scheduling, resource levelling and planning [15]. Primavera shows every step during project execution and every activity can be monitored separately which helps the user to control delays and level the resources if any activity goes off schedule or delay occurs [16].

METHODOLOGY

Material

The project selected for scheduling was 6 JCO's buildings located. All necessary data including drawing and bill of quantities was collected from military engineering services office located in Risalpur Garrison. All the resources available and other related data was collected from site. Primavera P 6 R 8.2 software was used for proper scheduling.

Methods

Based on data available activities involved were identified and listed down. Steps followed for schedule are

Make EPS.

Enterprise project structure is made first it is basically structure of company with its all branches involved in project

Create OBS

Organization break down structure is created for every section it is the hierarchical structure of organisation which demonstrates the responsibility of every individual.

Create new project

A project is a sum of different activities that create a deliverable and plan to execute these activities to achieve desired goal. In primavera a project can be created for relevant branch of EPS and allot the person responsible from OBS. For creating new project the project menu bar in main menu bar is used. The figure 2 shows the creation of new project for respect branch of EPS. Allocation of calendar, start and finish dates allocation was done at this stage.

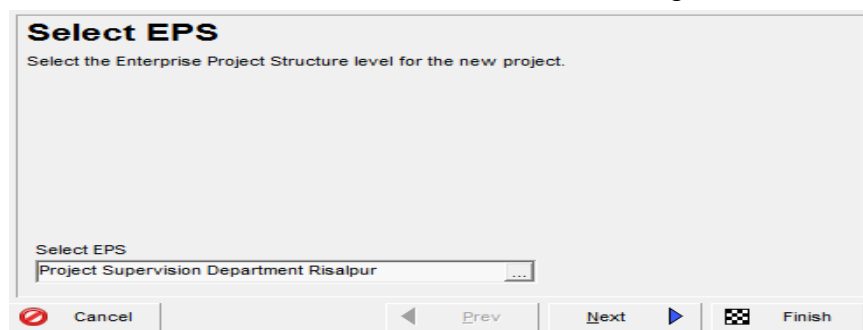


Figure 2 creating new project on primavera P6

Create WBS

Work breakdown structure (WBS) is main part of schedule it is hierarchical structure of work. WBS is different for every project. It mainly defines duration and constraints of activities. It subdivides a project into logical sections. The figure 3 shows generic WBS.

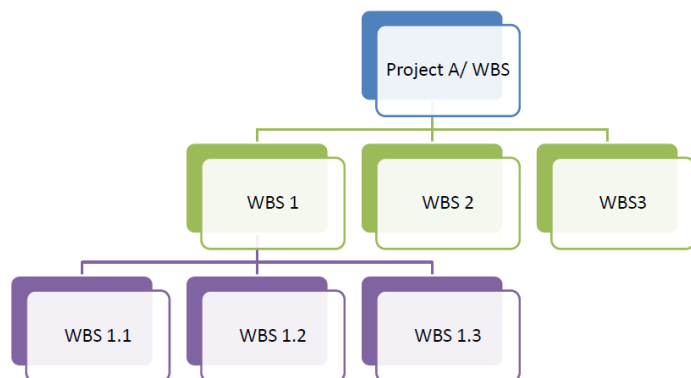


Figure 3 Generic WBS chart

Add activities

Activity is basic unit of project. All activities sum up to create a deliverable. An activity have its identification (ID), codes, name, constraints, calendar, start and ending dates, relationship with previous and former activities, cost and resources. An activity can be added to respective WBS element by using tab start scheduling and add its properties as shown in figure 4.

Figure 4 Addition of activities in primavera P6

Create relationship between activities

Different activities of any project depend on each other, these are linked and create a network. For this purpose dependencies of activities is determined and preceding and succeeding activities are linked. Relation of activities like start to start (SS), start to finish (SF), finish to start(FS) and finish to finish(FF) were also defined in this step.

Add duration and cost of activities

After planning work original duration to every activity was added. Actual duration can only be added to those activities which are complete. Activity cost is cost required to complete activity. Cost of each activity was added to it. As shown in figure 5.

Duration		Status		Labor Units	
Original	6	<input type="checkbox"/> Started	05-May-16 ...	Duration %	0%
Actual	0	<input type="checkbox"/> Finished	12-May-16 ...	Suspend	...
Remaining	6	<input type="checkbox"/> Exp Finish	...	Resume	...
				Budgeted	0
				Actual	0
				Remaining	0

Figure 5 Adding properties to an activity in primavera P6

RESULTS AND DISCUSSIONS

EPS of MES.

MES operates under the command of engineer in chief with distributed command over different departments like project monitoring department, project management department and project supervising department etc. complete EPS of organisation developed by using primavera is as follow

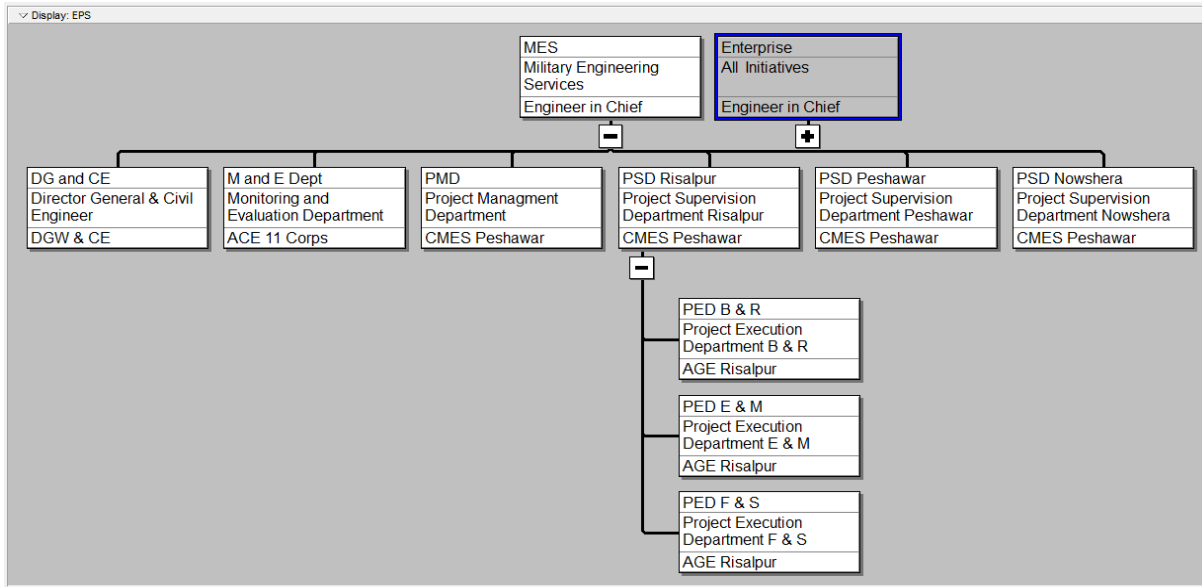


Figure 6 EPS of MES

OBS of MES

Organisation break down structure of MES created by using software is given below.

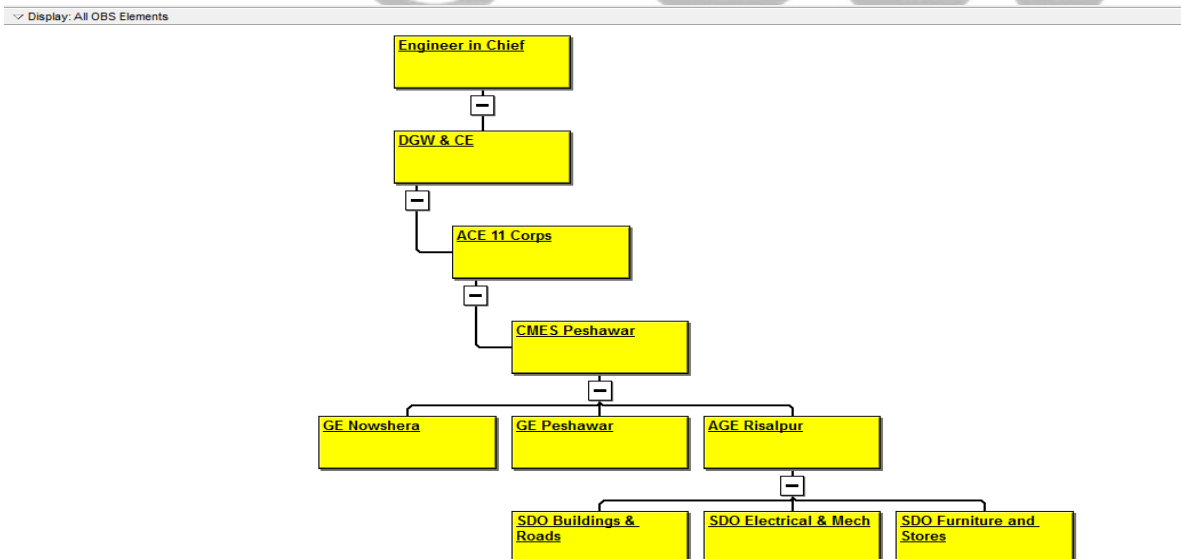


Figure 7 OBS created using Primavera P6

WBS of 6JCO's building

6JCO's building project was divided into different sub parts. Site surveys, design, sub structure, super structure etc. are first ranks divisions of work. The fig shows complete WBS of project.

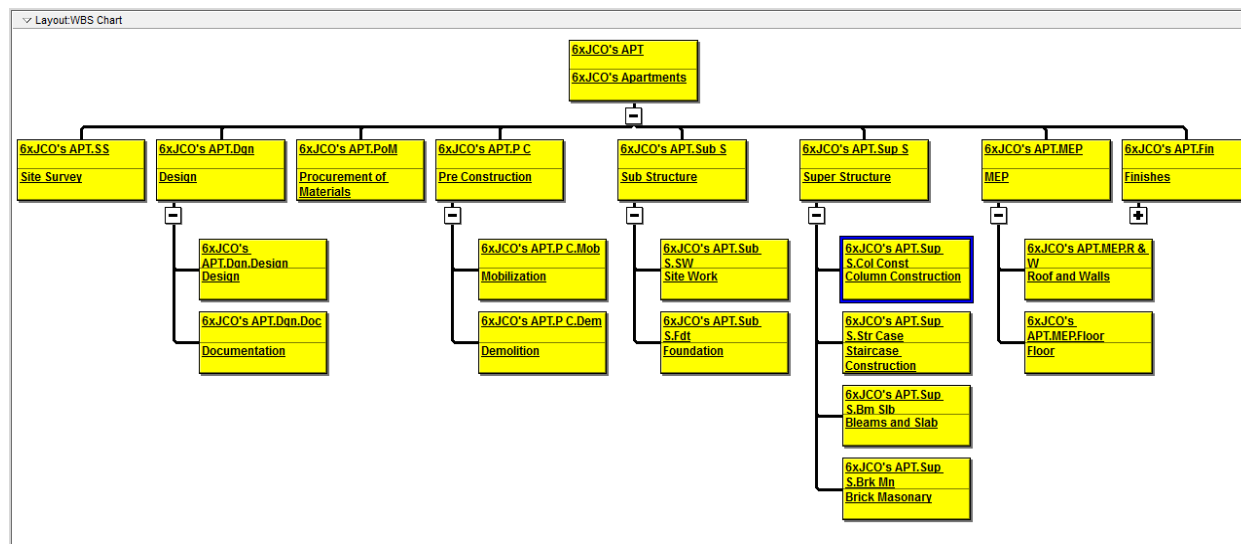


Figure 8 WBS chart by primavera P6

Final Schedule

After adding activities and their properties complete schedule was prepared as shown in fig. this schedule can easily be monitored and also allows us to change if required during execution. It shows every activity with its progress, estimated duration and preceding and succeeding activities.

Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	Predecessor	Successor	Start	Finish	Total Float
6xJCO's APT.Sub S Sub Structure									
6xJCO's APT.Sub S.SW Site Work									
A1110	Excavation	12	12	0%	A1100	A1130	03-Mar-16	21-Mar-16	0
A1100	Site Layout	1	1	0%	A1090	A1110, A1110	02-Mar-16	03-Mar-16	0
A1120	Underground MEP and Sewage lines	4	4	0%	A1100	A1130	03-Mar-16	09-Mar-16	8
6xJCO's APT.Sub S.Fdt Foundation									
A1150	Curing	6	6	0%	A1140	A1160, A1160	28-Mar-16	04-Apr-16	0
A1130	Formwork and Reinforcement	4	4	0%	A1120, A1120	A1140	21-Mar-16	25-Mar-16	0
A1170	Ground Floor Beam	8	8	0%	A1150, A1150	A1180	06-Apr-16	18-Apr-16	0
A1140	Pouring	1	1	0%	A1130	A1150	25-Mar-16	28-Mar-16	0
A1160	Removal of Formwork and Backfill	2	2	0%	A1150	A1170	04-Apr-16	06-Apr-16	0
6xJCO's APT.Sup S Super Structure									
6xJCO's APT.Sup S.Col Const Column Construction									
6xJCO's APT.Sup S.Str Case Staircase Construction									
A1240	Curing	6	6	0%	A1230	A1250	05-May-16	12-May-16	0
A1220	Formwork and Reinforcement	2	2	0%	A1210	A1230	02-May-16	04-May-16	0
A1230	Pouring	1	1	0%	A1220	A1240	04-May-16	05-May-16	0
A1250	Removal of Formwork	1	1	0%	A1240	A1260	12-May-16	13-May-16	0
6xJCO's APT.Sup S.Bm Slb Beams and Slab									
6xJCO's APT.Sup S.Brk Mn Brick Masonary									
6xJCO's APT.MEP MEP									
6xJCO's APT.MEP.R & W Roof and Walls									
6xJCO's APT.MEP.Floor Floor									
6xJCO's APT.Fin Finishes									

Figure 9 Final schedule of 6JCO's building project

Moreover it gives us a critical path for the completion of project as shown in fig



Figure 10 Critical path of project by primavera

Other features

Along with different scheduling advantages primavera also generates Gantt charts and other bar charts which make it easy to check project progress along with time. The bar charts created for our project are as

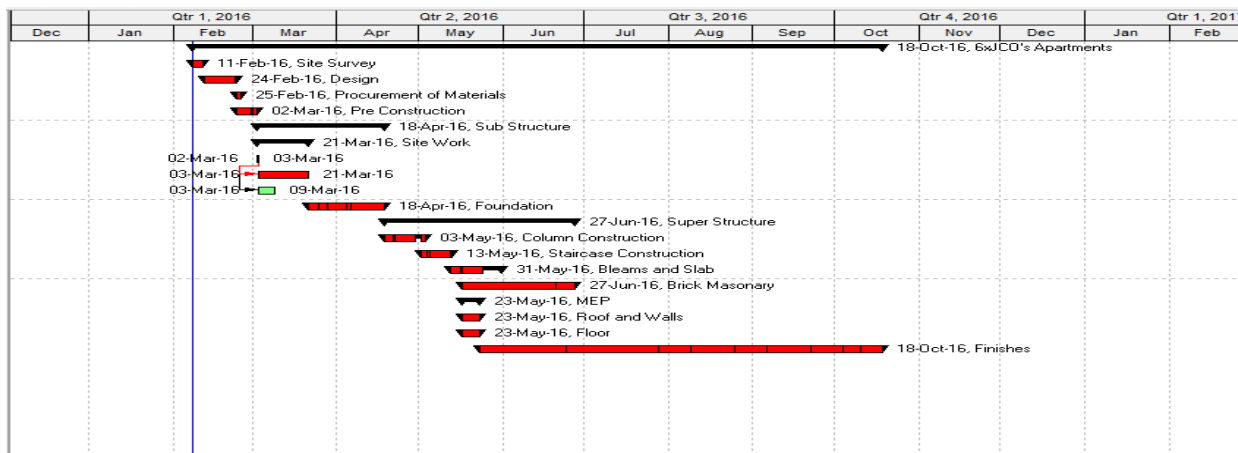


Figure 11 Gantt chart generated by Primavera P6

Conclusion

Project scheduling is compulsory prior to start any construction project. A well scheduled project helps to save time and money during the execution of project. Poor planning may lead towards delays and activities overlapping which results in extra cost. In developing countries like Pakistan construction industry is growing fast and every project requires minimum completion time. In order to meet the market demands usage modern days scheduling tools is necessary. Primavera P6 can be used for scheduling of any type of project. With the help of primavera creation OBS, EPS, WBS, generating activities and assigning duration and budget to them is very easy. Every activity can be followed during execution and variance can also be determined. Determination of critical and non-critical activities and generation of critical path can be done.

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