Project Scheduling of a High-rise Building using Primavera P6

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Abstract - *The main prospect of this study is to develop a planning approach in order to optimize the duration of construction planning and scheduling. The scheduling is carried out using Primavera P6 software and analyze the existing methods to identify the sequence and time (duration. start time, finish time, delay) of the construction project. Analyze and identify the dependencies of the tasks to track the project and update it on regular basis and to analyze the delays in the project. Suggesting the suitable and necessary methods and techniques for developing new alternative methods to optimize time and budget.*

Keywords: **Planning, Scheduling, Construction project, Primavera**

1. INTRODUCTION

Due to the vast developments in the construction industry in last decades, it takes a lot of paperwork to maintain schedule, budget and resources. With the advent of various software in the construction industry, has changed the way of working. The planning and scheduling is the basic and fundamental requirement to understand the construction project. Develop and determine an adequate use of time, cost and quality Appropriate and advance planning provides alternative directions and techniques for the success of a construction project

The present work guarantees a study on the G+10 residential building, where the analysis was performed using the Primavera P6 software. The efficient planning and scheduling using primavera software which controls and monitors work progress by reviewing and rebuilding under few changes so that work runs simultaneously with estimated time and budget. The need for planning is to allow predictability of activities and resources essential to the rapid completion of the project.

1.1 Planning

Planning is the primary activity in the management of any construction project. There are various aspects of planning which includes: data collection from previous records, analysis of implemented activities and choosing the alternative to perform the activities.

1.2 Scheduling

Scheduling is an important task because it helps to decide on the time frame within which tasks can be completed. The construction schedule can be defined as the duration of the task assigned in the project, including time, sequence, priority and level of dependencies. Planning includes: assignment of tasks, assignment of task sequence, assignment of tasks, assignment of durations, start and end times, assignment of resources, assignment and identifying dependencies.

2. METHODOLOGY

Methodologies used for this study are designed in four stages:

Stage 1:

Pre-Data Collection: This step includes gathering data from previous locations and schedules, gathering information about various constraints, and gathering information about problems that may arise in construction projects. Data can be collected at meetings and by senior engineers in the construction company.

Stage 2:

Analysis-Implementation-Analysis: When the data is collected analyze and sort out the necessary data based on requirement of the project. Sort the data according to the priority of the activity or on the priority basis.

Stage 3:

Progress Data Collection: Collect the data from the site on regular basis compare it from the schedule which is prepared in advance in order to track the schedule and update it on regular basis.

The data collection can be done through:

- Daily Progress Report.

- Labour work out

- Tasks with their time (start and finish time, duration).

Stage 4:

Post Data Collection: The data collected wiles tools and techniques. The software's used in the present work are Microsoft Project 2016 and Primavera P6 Professional 17. There are certain tools which are provided in these software that are used to schedule the project and make different reports as per need.

The functioning of both the software is explained below: -

Step 1: Setting up the Calendar

Setting up calendar is the primary task before starting the process of scheduling it includes:

- Define working hours along with working and non-working days

- Define Project Start Date and holidays.

- Define Calendar Shift i.e. 24 hours, night shift, standard (default).

Step 2: Enter Activities name with WBS

Work Breakdown Structure (WBS) enters the activities along with WBS in the task name field. WBS can be created as:

- Select the activities

- Click on indent task in task ribbon the selected activities comes under a specific WBS.

Figure 2.1

Step 3: Assign Duration

After Creating WBS and Activities next task is to provide the duration of the activities. It is required to collect the information from each activity duration, and then the

duration is assigned to the activity. The wrong assignment of duration will affect the overall time of the project completion and resources cannot be allocated easily.

Step 4: Assign Relationship

Along with type of relation, constraints, lag and lead, after assigning duration to the activities define the relationship between the activities. The relationship defines the start date and finish date. The relationship between activities will be of four types these are as follows:

Start to Start: it is a logical relationship in which successor activity cannot start until the predecessor activity has started.

Start to Finish: It is a logical relationship in which a successor activity cannot finish until a predecessor activity has started.

Finish to Finish: It is a logical relationship in which a successor activity cannot finish until a predecessor activity has finished.

Finish to Start: It is a logical relationship in which a successor activity cannot start until a predecessor activity has started.

Lag: To add lag time, assign a positive number; lag time create a delay between two activities.

Lead: To add lead time, assign a negative number; Lead time is an overlap between two tasks that share a dependency.

Primavera is the software of oracle and is used for planning, managing and executing the project and portfolios. Most of the project depends on Primavera P6 for several reasons such as:

Plan, schedule and manage the project.

Enhanced workflow and track the progress.

Figure 2.2

Creating OBS

OBS is maintaining the data of responsible managers for the project in the company. There is only one OBS of the entire organization.

To create OBS-
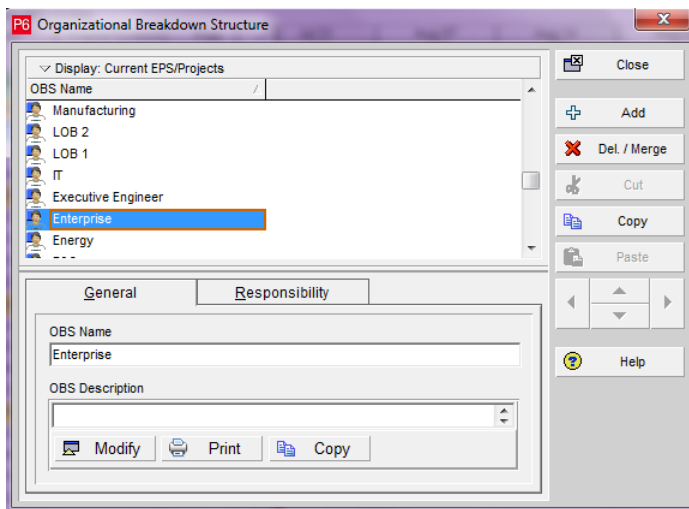
- click Enterprise > OBS.
- On OBS page click add

Figure 2.3

Creating EPS

It represents the breakdown of the project in a company. It maintains the enterprise project at various levels within the company. Maintain the phase of the project and the grouping that meet the needs of organization.

- To create EPS-
- click Enterprise > EPS.
- On EPS page click add
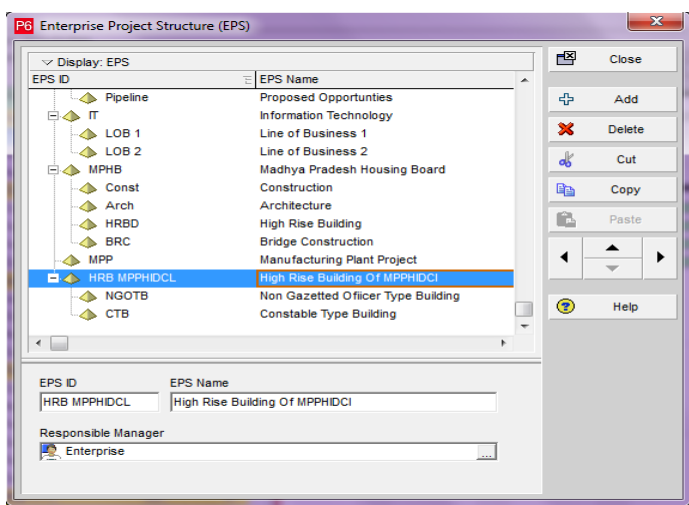
Figure 2.4

Creating Calendar

Creating calendar plays an important role in maintain the accuracy of the scheduling. Calendar contains various features such as working days, non-working days, working hours, non-working hours, list of holidays.

We can create three type of calendar these are: -

- Global Calendar,
- Project-Specific Calendar,
- Resource-Specific Calendar
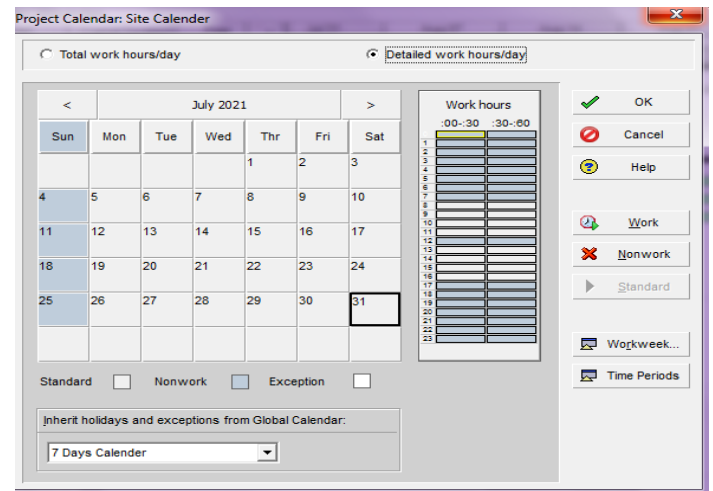
Figure 2.5

Create Resource

Sheet with unit and cost We can create resource sheet in hierarchy under three options that are:

- People,
- Material
- Equipment.

The unit and the cost to the resource based on the requirement either it may fixed unit rate or the unit rate per hours or per day can be provided.

Create WBS

The work breakdown system contains the project activity group as well as the duration and start and end times of the specific activity group. WBS is useful because it divides project activities into small groups to make planning and data management easier.

Create activities and assign durations with relationships and other details

Specify activities, dates and durations that define activities, and other details.

Figure 2.6

Collection of data and Specification of activities

The data which is required for the plan of the project was collected from various sites. The total numbers of activities that are required for the schedule are listed out. Specifications required for each item or activity is collected from site to prepare plan and schedule.

3. Study Area Characteristics

A residential building plan of MPPHIDCL has taken for planning and scheduling for the project and delay analysis. The project of this residential building is at finishing phase. Planning and Scheduling of residential building will be beneficial to the developer of this project.

The construction is for a residential purpose of Constables and NGO's having G+10 and the carpet area of the construction is 80.77 pr building sq.m. The number of flats on each floor is 4 with typical floor plan for each floor except for ground floor. The ground floor includes parking.
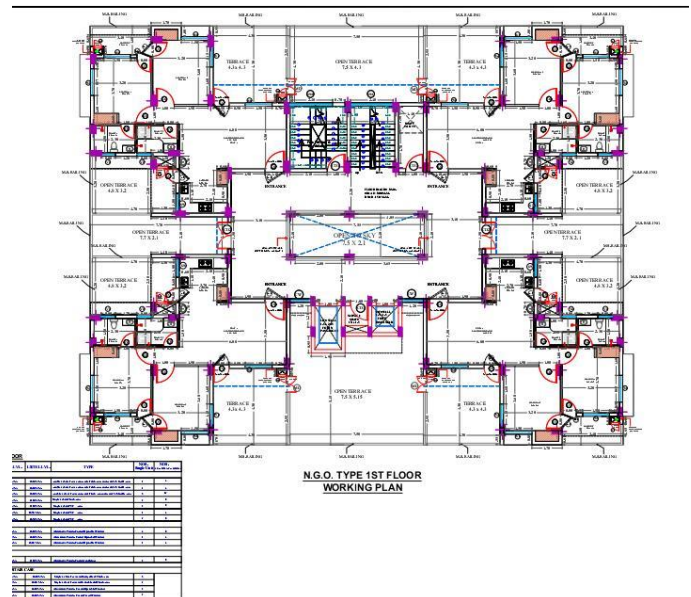

Figure 3.1

3.1 Identifying the Constraints

The current architecture of the residential building will take a long time for the project to complete the project. The long-term period of a single project will increase considerably that the project costs considerably. Therefore, it is necessary to reduce the project completion time to complete the project within the time and budget time. The completion of the project and the completion of the project budget project has completed two completed factors successfully. The reason for taking a long time of this project is identified in the Primavera Calendar report.

3.2 Preparing Plan and Schedule for the Project in Primavera

Actual schedule preparation process starts with the collection of data like project start date, activities involved in the construction of a G+10 residential building with activities sequences, duration taken for each and every activities, resources needed for each and every activities and its amount, cost spent for each and every activities. The collected data are entered in the software and the relations between the activities are given as per its sequence of activities collected. Project calendars are assigned to individual activities in the project. The process is started for planning and scheduling in primavera for this project.

3.3 Schedule of project with Gantt chart

Schedule for project is prepared by creating the EPS (Enterprise Project Structure), Calendar with a time period of 8 working hours per day excluding Sunday's, WBS (Work Breakdown Structure) and adding the total number of 710 activities that are required for the project with their original duration. Successors and predecessor are assigned for all the activities by the use of Gantt chart. Interdependencies of various activities for simultaneous independent work are assigned.

Finally activities are linked and ready to schedule.

3.4 Budgeting and allocation of resources

For every activity of the project Budget is prepared for each and every activity by allocating the resources to the activities. Budgeted project labour, Non labour, Expense, Material and total cost of all the activities are calculated.

BUGETING

RESOURCE ALLOCATION

Figure 3.2

4. EXPECTED OUTCOMES

- Reduces risk of schedule overruns and cost over runs.
- Optimizes management of all resource and reduces risk.
- Optimized Resources.
- Enhanced Visibility.
- Forecasting of Project Activities.
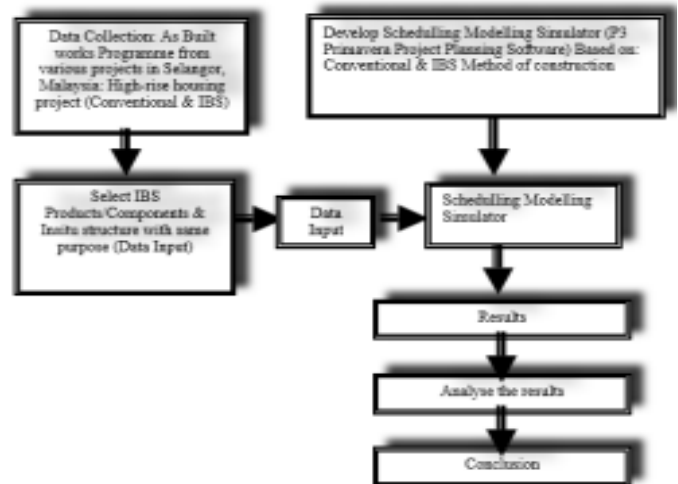
Figure 3.3

5. RESULTS:

Case study 1 considers a project network with low variability in activity time. The type of product family analyzed is TP- 140/33. The activity times are represented by triangular distribution. The effect of variability is assumed to show the multiple critical path scenarios for this experiment.

The target due date for the completion of this project is 128 days. Three types of resources are utilized during every activity. The simulation model is simulated for 500 replications to determine how many paths exceed the actual due day of completion and to calculate the CI. The duration estimates used to fit all the activities are shown below in Tables. The three estimates ofthe activity duration are given by X (minimum), Y (most likely), and Z (maximum). All the durations are in days.

The target completion time of project

The expected time for all the activities in the critical path, is calculated to determine the target completion time of a project. The expected time is the sum of all the activity duration alongthe critical path. The target completion time of all the critical paths is calculated using the formula:

$$Z = T_S - T_e / \sqrt{V}$$

where, T_S is the target completion time, T_e is the sum of all the activity durations in the critical path and V is the variances of all the activity in the critical path as mentioned by Johnand Herman (2012).

The target completion time determines the "highly likely" completion of the project within the due date. In this case study, we have assumed 95% confidence interval for calculating the probability of completion.

Cost associated due to the delay of the project

The delay in the project completion is determined by the difference between the expected time of completion and the target completion time of the activities in the critical path. The total delay time in the project is calculated as shown below. The delay in project completion is given by the formula:

Total delay (Ď) = Target completion – Expected time

As per the scheduling done on software the outcomes are as follows:

- The project completion date according to the planned schedule is 26 JAN-2018.

- The progress of the project and the estimated total duration is to be reported and updated.

- Total of 348 activities are involved with this project from its initiation to delivery of the project with various steps.

- Planned float at some activities starting or finish is been observed to execute the activity works smoothly without overshooting the budget and resources.

- The variance issues with respect to the start date or finish date of the project could not be reported, if the threshold variance of start date and finish date are properly monitored.

- It helps in comparison of baseline schedule with the revised schedule which notifies about the added activities or deleted activities from the project schedule.

- The report of allocation of resources helps in cost and time saving which results in increase of economy.

- It provides an idea of arranging the required resources for the upcoming activity.

6. REPORTS THROUGH PRIMAVERA

The reports generated through primavera p6 in this paper are:

1. Duration/ Delay Analysis

2. Cost Reports

3. Risk Scoring
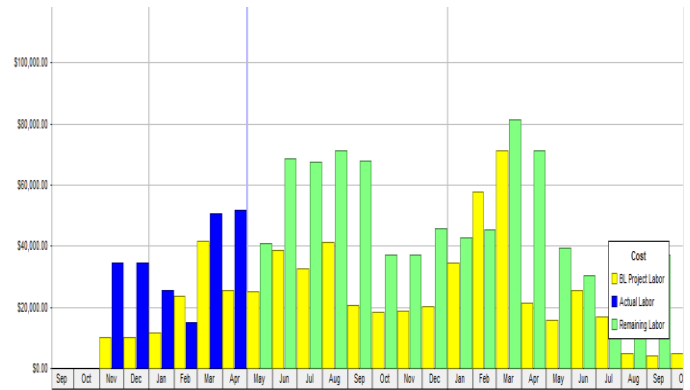
4. Tracking progress with respect to baseline
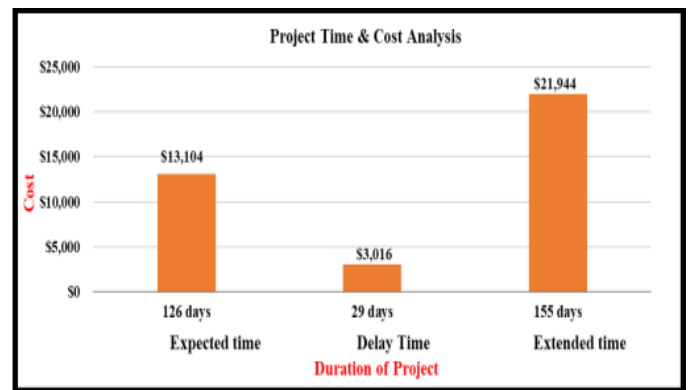

Figure 6.1

Figure 6.2

7. CONCLUSIONS

Primavera software serves as an effective tool for generating Gantt chart for schedule of G+ 10 residential building constructions. Effectively link all the activities involved in the construction of the project. Primavera gives the total duration required for the construction of the different phases involved. It determines the Critical Path of the schedule of the project. It determines the total float generated due to interdependency of activities. It keeps a track of the scheduled and the on-site construction. The use of project management software in a proper way reduces the cost and time of construction. Use of software gives a proper scheduled path which helps in setting a track for all the activities, to check if there is deviation from planned cost and schedule. It can investigate the defects in the planning, scheduling procedure of the client organization.

7.1 Future Scope and Enhancements

In the future, research could explore the possibility of integrating other knowledge areas into the development of project schedules, such as risk management and procurement management. MCPSA can be adapted to solve scheduling problems in multiple projects, thereby reducing delays and improving the completion rates of all projects in an organization.

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