Analysis of Academic Building by Planning, Scheduling & Resource Allocation Using Oracle® Primavera P6

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ABSTRACT

The construction industry emphasizes vital part of a country's Infrastructure and modern construction. The construction industry is the second biggest industry in India still it's construction has been differential the country over. Here emerges the requirement for powerful Project management. Numerous issues are being confronted by the construction business, major of them are cost overwhelms and time invades because of lacking undertaking detailing, lack of foresight for usage and dishonorable management amid execution. Numerous Project Managers express that normal cost of the Project goes up by 30% as of the planned cost because of despicable Planning and scheduling.

The first and foremost thing which we can get by effective planning in primavera is Start date of the project and Finish date of the project i'e Start date is 08 December 2016, and Finish date is 29 November 2017. Primavera P6 helps in effectively scheduling the project by assigning two relationships at a time to each activity and considerably reduces the float. Resources allocated to activities can be visually assessed for each activity & can be managed and reassigned at point of time.

Keywords: Planning, Scheduling, Resource allocation, Construction management, Oracle® Primavera P6

I. INTRODUCTION

The construction engineering emphasizes vital part of a country's Infrastructure and modern construction. The construction industry is the second biggest industry in India still it's construction has been differential the country over. There is an immense distinction of advancement in the provincial and urban territories. To adapt up to the status of advancement in urban territories the country areas require instruments for financial improvement, arrive utilize and condition Planning.

Here emerges the requirement for powerful Project management. Numerous issues are being confronted by the construction business, major of them are cost overwhelms and time invades because of lacking undertaking detailing, lack of foresight for usage and dishonourable management amid execution. Numerous Project Managers express that normal cost of the Project goes up by 30% as of the planned cost because of despicable Planning and scheduling.

The utilization of resources allotment in Project control is not another issue. Creation and operation grouping management is the way toward controlling generation and managements the fundamental goal of which is to match endeavours with the use of resources and types of gear so as to finest deliver and supply. Here resource allotment is extraordinary significance. It decides the sort resource allotment and significance of different specifications in view of the way of a generation framework and sum, sort and significance of resources. Building up an arrangement contrasts from building up a curriculum on the issue resource distribution in the project.

II. LITERATURE REVIEW

[1] Unmesh Polekar et. al (2015) author portray about construction Planning and testing activities in management work amid the execution. The Scheduling is accomplished for time management of every occasion or activities in the Project. The following is
accomplished for real Project performing esteem. In any case, it’s a little private building having less activates. The significance of the Planning, scheduling and following of the private Project utilizing primavera is to know the correlation amongst plan and genuine executed calendar The essential issue experienced while executing a Project is an ascent in cost and augmentation in the finish time.

[2] Sushant Pradhan et al. (2016) has clarified companies in the past have confronted a considerable measure of issues particularly with regards to different activities. The information are over-burden, the span has broadened and the resources have been over-designated. In this mode bringing about ill-advised project management. Thus this study fills in as a source of perspective while overseeing such sort of numerous activities. There are three locales considered and the work is been done at the same time. Planning and scheduling helps in future reference and execution of the project.

III. METHODOLOGY

A. Objectives

a. To identify construction sequence for a Academic/School building construction.
b. To work out the practical durations required to conduct the activities.
c. To Schedule the various activities based on the total quantities of each activity.
d. Precise manage of time till the end of Project.
e. To allocate Resources for the various activities accordingly and adequately for better outcome.

B. Data Structure of Primavera

Figure 1. Figure showing data structure of primavera.

C. CPM Concept

The basic way through a planned system is the longest time span way through the system. “Critical” demonstrates that these errands can't be deferred in the general Project as the Project complete date is of incredible significance in the greater part of the tasks. As such, it is the way of the Project where both aggregate and free slack are zero for each basic assignment. This technique includes the utilization of a geometric portrayal of stream outline which delineates the priority between activities.

Figure 2. Figure Showing Critical Path in the Gantt Chart

D. Structuring of Project In Primavera P6

Figure 3. Figure showing structuring of project in primavera p6

Collecting the drawings from the organization
Abstract Of The Quantities
EFS (Enterprise Project Structure).
Add a Project to the EFS hierarchy.
Define OBS (Organizational breakdown Structure)
Generate Project Calendar
Creating WBS (Work breakdown structure)
Add activities to WBS
Defining Resources
Assign relationship to the activities of the Project
Allocate Resources to all the activities of the Project
1. Collecting the drawings.

The drawings pertaining to considered Project is gathered for the purpose of listing out of various activities involved in construction of particular structure. This will help to refer the drawings in case of any confusion related to data misleading and also help for the better data results pertaining to the end results of the study. Collection of drawings is the first and foremost part in data collection, this ensures an proper backup is maintained to reduce the confusions at any point of time and also help for the user to access the data whenever required at any sort of time.

2. Abstract of the Quantities

Abstract of Quantities is the quantity survey which is carried out before executing any task or any activity of the Project. Abstract of quantities includes the overall data of each activity involved in the construction of any Project considered. The quantities of each activity are worked out and this helps is setting out the original duration of the Project and hence this helps us to know the various resources required and various and we can effectively quantify them based upon the requirement. This proves to be effectively setting out of activities durations and according manages them with the best possible ways that a particular activity is handled. AOQ also determines a prominent role in cross verifying with the help of drawings available and helps to reduce the confusion and in turn saves times of the whole Project planning process.

3. Define EPS (Enterprise Project Structure)

Projects are organized in a pecking order called "Project extend structure". The EPS can be subdivided into the same number of levels or hubs as expected to parallel work in the association. Hubs at the most noteworthy or root level speak to divisions inside the organization, next level hubs speak to Zones, then Regional Offices, then Construction Supervisors, then development contracts; or they could be by other real groupings that reflect how or by whom Projects are assigned and entrusted.

4. Addition of Project to the E.P.S hierarchy.

We can sort out boundless number of Projects in EPS

5. Define OBS (Organizational breakdown structure)

The authoritative breakdown structure (OBS) is a worldwide pecking order that speaks to the directors in charge of the Projects in big business. The OBS more often than not mirrors the organization arrangement of association, from top-level faculty downward through different levels constituting your business. Connect dependable administrators with their regions of E.P.S both hubs/individual Projects. Connect the dependable directors with their territories of the endeavour extend structure with either an EPS hub or a Project. When you connect a dependable administrator with an EPS hub, any activities you add to that branch of the EPS are doled out that chief component of course. An OBS underpins expansive tasks that include a few Project directors with various regions of obligation.
6. Generate Project Calendar

Make and dole out schedules to every resource and every action. These schedules characterize the accessible work-hours in each logbook day (Figure 3.3). Additionally indicate national occasions, association's occasions, extend particular working or non-working days, and source get-away day. Date-book course work be utilized for movement planning, following, & resource levelling.

7. Creating W.B.S (Work breakdown structure)

A W.B.S is pecking order of working that should be expert to complete a mission, which characterizes an item/management be delivered. The W.B.S organized in levels of job feature, starting with the submitted itself, & is afterward isolated into identifiable work elements. W.B.S is a various levelled course of action of the items and managements created amid and by the Project. The Project is the most elevated amount while an individual movement (or an activity thing) to make an item or management is at the least level.

8. Add Activities to WBS

Otherwise called Projects, Events, or work bundles, activities are the least level sensible work components in a Project or WBS. Activities regularly have expected spans, expenses, and resource or part prerequisites. Point of reference activities, be that as it may, have no length or cost. On the whole, all activities frame the establishment of the whole Project, driving resource assignments, connections, limitations, costs, and lengths. Activities are in some cases additionally partitioned into any number of discrete strides.

9. Defining Resources

A resource is any quantifiable thing in constrained supply and of adequate incentive to legitimize following and allocating to particular activities for a Project. Resources incorporate general or concentrated work, non-work things, for example, hardware, and material...
things, for example, blocks. Resources perform parts, if characterized. Resources are in a roundabout way doled out to activities by first arranging the part required. It is additionally conceivable to specifically dole out resources to activities. An resource is anything used to finish an action. Resources are partitioned into three classifications:

Figure 10. Figure shows Types of Resources

10. Assign Relationship to the activities of the Project

A relationship characterizes how an action identifies with the begin or complete of another movement or task. A movement can have the same number of connections as important to show the work that must be finished. These connections are utilized together with action spans to decide plan dates. Connections can likewise exist between activities in various activities; this sort of relationship is alluded to as an outside relationship. Activities that are subject to each other are known as antecedents and successors, where the principal action is the forerunner and the second is the successor. Between these two sorts of activities, there are four conceivable relationship sorts: FF, FS, SS and SF

10.1 Finish to Start (FS)
The successor movement can't begin until the forerunner completes (for instance, Activity B begins after the finish of Activity A), the most generally utilized relationship.

10.2 Start to Start (SS)
The successor movement can't begin until the antecedent begins (for instance, Activity B can begin simply after the begin of Activity A).

10.3 Finish to Finish (FF)
The successor movement completes in the meantime as the ancestor (for instance, Activity B must complete in the meantime as Activity A completions).

10.4 Start to Finish (SF)
The successor action completes after begin of the forerunner (for instance, Activity B completes after the begin of Activity A), the slightest regularly utilized relationship.

Figure 11. Figure showing Assigning Relationship

11. Allocate the Resources to every one of the activities of the Project

In the wake of planning the activities the resource sheet is readied and they are assigned in every action. The resources in the software is partitioned in the process of Manpower, Machinery and Material.

Figure 12. Figure showing resource allocation
### E. Productivity Constants

<table>
<thead>
<tr>
<th>Item</th>
<th>Productivity Day</th>
<th>UOM</th>
<th>Skilled Labour</th>
<th>Ratio of Skilled/Unskilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTIQUE FILL</td>
<td>20</td>
<td>SQM</td>
<td>ANTIQUE MASON SK</td>
<td>1</td>
</tr>
<tr>
<td>BLINDING</td>
<td>10</td>
<td>SQM</td>
<td>BLINDING MASON SK</td>
<td>1</td>
</tr>
<tr>
<td>SCREEN</td>
<td>10</td>
<td>SQM</td>
<td>SCREEN MASON SK</td>
<td>1</td>
</tr>
<tr>
<td>REINFORCEMENT</td>
<td>100</td>
<td>KG</td>
<td>STEEL FIXERS SK</td>
<td>0.75</td>
</tr>
<tr>
<td>FORMWORK</td>
<td>4</td>
<td>SQM</td>
<td>CARPENTERS SK</td>
<td>0.75</td>
</tr>
<tr>
<td>CONCRETE</td>
<td>4</td>
<td>CU</td>
<td>CONCRETE MASON SK</td>
<td>0.75</td>
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<tr>
<td>WATERPROOFING</td>
<td>10</td>
<td>SQM</td>
<td>WATERPROOFING SPECIALIST SK</td>
<td>0.75</td>
</tr>
<tr>
<td>WELDED WIRE MESH</td>
<td>20</td>
<td>SQM</td>
<td>STEEL FIXERS SK</td>
<td>0.75</td>
</tr>
<tr>
<td>BLOCK</td>
<td>4</td>
<td>SQM</td>
<td>BLOCK MASON SK</td>
<td>0.560</td>
</tr>
<tr>
<td>PLASTER</td>
<td>5</td>
<td>SQM</td>
<td>PLASTER MASON SK</td>
<td>0.560</td>
</tr>
<tr>
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<tr>
<td>FIRST COAT PAINT</td>
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<td>PAINTERS SK</td>
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<tr>
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<tr>
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<td>GRANITE</td>
<td>2</td>
<td>SQM</td>
<td>GRANITE MASON SK</td>
<td>0.560</td>
</tr>
</tbody>
</table>

**Figure 13.** Figure Showing Resource Allocation

### F. Calculation For Original Duration And Resource Allocation

**Note**
- Total Working Hours in a day = 8 Hours.
- Total Working Days in a Week = 6 Days.

#### 1. Footing Excavation

Total Quantity of earth work in excavation = 1197.65 m³
Excavator Efficiency = 200 Cubic feet per hour

\[
\text{Excavator Efficiency} = 200 \times 8 = 1600 \text{ Cubic feet per day}
\]

\[
\text{Excavation depth is up to 1.5 m}
\]

\[
\text{Excavation quantity per day} = \frac{1197.65}{1.5} = 799 \text{ m}^3
\]

\[
\text{Antitermite quantity per day} = \frac{536}{14} = 38.28 \text{ m}^2
\]

Now, No of days = Total Quantity/ Excavator Efficiency

\[
= \frac{1197.65}{45.25} = 27 \text{ Days}
\]

No of Excavators available = 2
Original Duration = 27/2 = 14 Days

No of hours = 14*8 = 112 hours

**Resources**
- Excavator = 112*2 = 224 hrs
- Dumper = 224 hrs
- Loader = 224 hrs
- Equipment Operators = 224*3 = 672 hrs
- Labor = 112 hrs

### 4.3.2 Footing Antitermite

Footing Antitermite total Quantity = 536 m³
Productivity Per Day (1 Mason) = 20m²

2 Masons Employed Per Day

Now, No of days = Total Quantity/ Productivity Each Day

\[
= \frac{536}{20} = 14 \text{ Days}
\]

Now, Antitermite Skilled (Mason) = 2*Days*hrs/day

\[
= 2 \times 14 \times 8 = 224 \text{ hrs}
\]

Labour Hours (Unskilled) = 224*0.375 = 84 hrs.

### G. Calculations for Relationship Lag/Lead

**Note.**
Mostly Used Relationships are:

- START to START
- FINISH to FINISH

Excavation total quantity = 1197.65m³

Excavation depth is up to 1.5 m

Now, excavation quantity = \(\frac{1197.65}{1.5} = 799 \text{ m}^3\)

Antitermite total quantity = 536 m²

Now, excavation quantity per day = \(\frac{799}{14} = 57 \text{ m}^2\)

antitermite quantity per day = \(\frac{536}{14} = 38.28 \text{ m}^2\)
**Trial 1.** with one day lag

<table>
<thead>
<tr>
<th>Excavation Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
</tr>
<tr>
<td>SS1</td>
</tr>
</tbody>
</table>

**Antitermite Quantities**

Hence Trial 1. is satisfied

Now, START to START = 1 day lag.  
FINISH to FINISH = 1 day lag.

**IV. RESULTS AND INTERPRETATION**

**A. Planning**

a. The Total number of activities = 137  
b. Total No. of Resource types defined and used = 70 (Including Manpower, Machinery and Materials)  
c. Project Start Date is 08 December 2016  
d. Project Finish Date is 29 November 2017

**B. Scheduling**

Scheduling is assurance the planning of occasions in scheme that is while and which undertaking will be perform? Placing it within straightforward terms it is an impression of plan. At the end of the day we can state, arranging is How, What and Who though planning is when and why. Scheduling can be likewise characterized as the definite arrangement of the Project work errands as for time.

**C. Resource Allocation**

Subsequent to planning the activities the resource sheet is readied and they are allotted in every movement. The resources in the software is separated in the process of childbirth, non-work and material

**D. Resource Histograms**

The resource histogram is a device that is often used by the Project management team and or as a means of providing a pictorial representation to the team and to all of those interested parties. Exactly speaking, the resource histogram is exactly a bar chart that is cast-off for the purposes of exhibiting the specific sums of time that a particular resource is scheduled to be operated on over a predetermined and specific time period. Resource histograms may also contain the qualified feature of resource availability, used for evaluation on for devotions of contrast.
1. Labour Histogram and S-Curve

a. S-Curve represents the flow of resources against time.
b. The highest number of labor hours is interpreted in April 2017.
c. This signifies the highest amount of labor resource is used in the month of April 2017.
d. This helps for planning for the resource well in advance for the peak month resource requirement.

Chart 1: Labor Histogram and S-Curve

Chart 2: Resource Histogram for Excavation Quantity

Chart 3: Resource Histogram for Blinding Quantity.

Chart 4: Resource Histogram for Concrete Mason

Chart 5: Resource Histogram for Steel Fixer
V. CONCLUSION

- The first and foremost thing which we can get by effective planning in Primavera is Start date of the project and Finish date of the project i.e Start date is 08 December 2016, And Finish date is 29 November 2017.
- Primavera P6 helps in effectively scheduling the project by assigning two relationships at a time to each activity and considerably reduces the float.
- Resources allocated to activities can be visually assessed for each activity & can be managed and reassigned at point of time.
- The multiple resources required for the each activity can be allocated in effectively may it be in the form at Manpower, Machinery or Material.
- The S-Curve lets us know the flow of resources against time and lets us to manage the resources accordingly.
- Resource Histograms Show the Peak months for the each resource and lets us to plan in advance for the quantity of resource required to accomplish the task or an activity.
- Resource Histograms lets us to know that a particular resource is in need for a particular month or a duration of time, Later the resource is freed up or allocated at different working location
- Resource Histograms give the information about the Daily, monthly or yearly payments need to be made for each resource may it be Manpower, Machinery or Material.
- Overall, Precise manage of time till the end of Project.

VI. ACKNOWLEDGEMENT

My heart felt thanks to my beloved guide, Professor & Chairman Dr. Shreenivas Reddy Shahpur, Assistant professor Maneeth P. D, Assistant professor Brij Bhushan S, and my friend Muqtar Ahmed. I would like to extend my sincere gratitude to my family and friends for their constant support in publishing this article.

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BIOGRAPHIES

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