



# PLANNING AND SCHEDULED OF CONSTRUCTION IN TALL BUILDING BY USING PRIMAVERA (P6)

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## INTRODUCTION

Project management is the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, cost, time and quality and participants satisfaction. The construction industry is usually very large, complex and different from other industries. The industry needs much investment and involves various types of participants.

One of the most common activities in the management is planning. Creating the project plan is the first thing you should do when undertaking any kind of project. However, many people fail to realize the value of a plan in saving time, money, and many problems. The project management techniques of planning and scheduling are tools and devices, which are used to compute the project.

The completion of a construction project requires the judicious scheduling and allocation of available resources. Man power, money, equipment, and material are important

project resources that require close management attention. The supply and availability of these resources close seldom be taken granted because of seasonal shortages, labor disputes, cash flow, equipment breakdowns, completing demands, delayed deliveries, and a host of associated uncertainties.

Construction planning is more difficult in some ways since the building process is dynamic as the site and the physical facility change over time as construction proceeds. The basic objective of resource planning and resource allocation is to supply and support the field operations so that established time objectives can be met and costs can be kept within the construction budget.

## 1.1 PROJECT PLANNING

Project planning is part of project management, which relates to the use of schedule such as Gantt charts to plan and subsequently report progress within the project environment. Initially, the project scope is defined and the appropriate methods for completing the project are determined. Project

planning is the process of identifying all the activities to successfully complete the project. At this stage, the project plan may be optimized balance between resource usage and project duration to comply with the project objectives.

Project planning involves a series of steps that determine how to achieve a particular community or organizational goal or set of related goals. This goal can be identified in a community plan or a strategic plan. Project plans can also be based on community goals or action strategies developed through community meetings and gatherings, tribal council or board meetings, or other planning processes. The planning process should occur before you write your application and submit it for funding.

## 1.2 PROJECT SCHEDULING

Scheduling is the laying out of the project activities along a time sequence in which they are to be performed so as to assign the starting and finishes dates to various activities and to allocate resources to them. The schedule is the final product of scope, definition, budgeting, planning and forms the base against which all activities are measured. Project tracking and control cannot be accomplished without a good plan and schedule.

By preparing construction project scheduling in advance, you, the owner builder, are able to schedule subcontractors and materials deliveries so that the proper sub and the necessary materials arrive when they are needed, which in turn will allow you to save time, money, and hassle. Construction project

scheduling could more aptly be called Construction Schedule Planning as this is where the plan is crafted. It simply shows the sequence of building activities (which activity follows which activity) and which ones can be going on at the same time.

## 1.3 OBJECTIVES OF THE STUDY

This work is undertaken to understand the uncertainties, planning and scheduling of the activities for the execution of the project.

This work includes

- To seek the basic requirements and the initial mobilization of the project.
- To select ongoing projects, and find out the deviation in scheduled.
  1. Case studies 1 - Commercial building
  2. Case studies 2 - Multistoyed Residential building
    - (i) A1 Block, (ii) A2 Block, (iii) A3 Block
  3. Case studies 3 - Multistoyed Residential framestructure
- To plan the micro level activities - micro planning.
- To evaluate and leveling of the resources using primavera software.
- To complete the project on scheduled date or to minimize the delay

## 1.4 NEED OF THE STUDY

Much of the project scheduling literature treats task durations as deterministic. In reality, however task durations are subject to considerable uncertainty and that uncertainty can be influenced by resources assigned.

Due to the complexity of projects, resource allocation and leveling are among the top challenges in project management. The purpose of this study is to optimally allocate the resources among individual tasks for a construction project.

## 1.5 SUMMARY

This chapter deals about the necessity of micro level planning, scheduling, resource planning, resource allocation and leveling of resources required for each activities involved in the construction of building.

## OVER ALL LITERATURE REVIEW

The main purpose of literature survey is to give an idea about the work conducted world over in the field of the project work. Several Studies have been conducted in the areas of project planning, project scheduling and uncertainty. The following are the some of the studies which describes the proper planning before the execution of the project, project scheduling under uncertainty and estimating the resource requirements for the project. Literature pertaining to occupational diseases and their prevailing conditions has been presented here.

## 2.2 STUDIES ON LITERATURE REVIEW

Abraham Warszawsi (2001) have reported the principles of the system, explains the structure of its knowledge and discusses various implementations. The building is represented by its zones, function and works.

this paper presents the principles of the system, explains the structure of its knowledge base, and discusses various implementation aspects.

Asharaf.M Ibrahim have reported in (2001) that can be used satisfactorily to estimate the construction resources requirements at the conceptual design stage. Estimations are prepared in practices primarily based on analogy with previous similar cases.

Tarek Hegazy (2002) reported as the proposed to resource allocation. Due to the complexity of projects, resources allocation and leveling have been dealt with as two distinct sub problems solved and selected tasks and their impact on the schedule is monitored.

MostafaM.Khattab have reported in (1996) research on limited allocation in construction projects to minimize project duration using resources available and increase the utilization of equipment and labour force available

Matthew J. (2001) is conducted a survey on project management in construction: software use and research directions. This study focuses on future research and the use of project management software in the construction industry. The results indicate that construction professionals have different characteristics, needs and preferences, as compared to the overall sample.

William IBBS (2007) this research presented here shows that delay analysis without resources allocation practice substantially affects results of schedule analysis. Some delay can cause unrealistic

resources allocation in downstream work, which in turn may further delay the project.

Peter E.D.Love this paper discussed in (2001)optimal planning of construction planning activities will lead to improved project performance, other research studies have indicated. A probable optimum planning that any additional planning input based on the sample studied was devied.

## METHODOLOGY

### 3.1 GENERAL

The methodology adopted includes a practical real- time work made to explore the general system followed in the construction industry and also different. The purpose is to explore the real-time approaches for resource planning and tracking the project.

It was then carried on by micro level planning, scheduling of activities and evaluate the resources required for the construction of the entire civil works of the building, using Primavera project planner.

### 3.2 WORK PROCEDURE

The procedure to be followed in this project is given as

1. Macro level are defined and also defined uncertainty.
2. Based on macro level, the project completion dates are to be calculated.
3. Macro level activities are divided into micro level.
4. Quantum of work in micro level activities.
5. Micro level activities using Primavera Software.

6. Resource planning is done with the duration and quantum of work found.

7. The resources are loaded for activities and leveled that assigned resources

## DESCRIPTION OF THE PROJECT

### 4.1 GENERAL

This work has been carried out for the building, Construction of Commercial building, Multistoyed Residential Building and Multistoyed Residential Frame Structure. Since it is a real-time project and has a large scope of work, and in three constructions building, is taken for my thesis work.

### 4.2 DETAIL OF THE PROJECT

#### 4.2.1 Case studies 1:

Name of the project	: Commercial Complex
Location	: Avadi, Chennai.
Floor	: Basement + G+ 9
Client	: FSO Foundations. Pvt.ltd
Contractor	: R.K Enterprises
Size of the Plot Area	: 55,242 Sq ft
Total Area	: 1, 85,578 Sq ft
Basement	: 17,248 Sq ft
Ground floor	: 16,896 Sq ft
1 <sup>st</sup> to 9 <sup>th</sup> Floor	: 16,826 Sq ft / Each Floor
Facing	: East
Type of structure	: RCC Framed structure

Case Studies 1 Building plans as shown in Figure 4.1 & 4.2

#### 4.2.2 Case studies 2:

Name of the project	: Multistoried Residential building
Location	: Ambattur, Chennai.

Floor	: G+ 9
Total area	: 3, 64,400 Sq.ft
A1 Block	:1, 14,250 Sq.ft
A2 Block	: 1, 15,977 Sq.ft
A3Block	:1, 16,164 Sq.ft

A1 Block

Ground Floor	: 10,750 Sq ft
1 <sup>st</sup> to 9 <sup>th</sup> floor	: 11,500 Sq ft/
Each Floor	

A2 Block

Ground Floor	: 11,325 Sq Ft
1 <sup>st</sup> To 9 <sup>th</sup> Floor	: 11,628 Sq Ft/
Each Floor	

A3 Block

Ground floor	: 11,215 Sq ft
1 <sup>st</sup> to 9 <sup>th</sup> floor	: 11,661 Sq
ft/Each Floor	
Facing	: East
Type of structure	: RCC Framed
structure	

Case Studies 2 Building plans as shown in Figure 4.3 & 4.4

**4.2.3 Case studies 3:**

Name of the project	: Multistoried building frame structure
Location	: Arumbakkam, Chennai.
Floor	: G+14
Architect	: FSO design Pvt ltd
Contractor	: Sun Nirman Private & ltd
Structural consultant	: A.SEN
Total Area	:2, 01,089 Sq ft
Ground floor	: 13,125 Sq ft
1 <sup>st</sup> to 14 <sup>th</sup> floor	: 13,426 Sq ft/
Each Floor	
Working time	: 10hrs/ day

Case Studies 3 Building plans as shown in Figure 4.5 & 4.6

**4.3 WORK**

1. Project schedule
2. Updating / monitoring
3. Reducing cost

4. Human resources allocation and optimization for all activities

**4.4 OUTPUT**

1. Scheduling of the project.
2. Unit of material resource till status date.
3. Unit of human resource till status date.
4. Unit of Staff resource till status date
5. Comparison between practical and theoretical work (optimization)
6. Result & conclusion

## PLANNING AND SCHEDULE OF THE PROJECT

**5.1 GENERAL**

Planning is an important phase during which are set the plans and categories of project execution, keeping in mind the policies, procedures and rules of the organization. Time scheduling is the progress of developing a work programme. The scheduling methodology varies the planning technique and the nature of task to be performed. Since the project is planning under uncertainty.

The key to a successful project is in the planning. Creating a project plan is the first thing you should do when undertaking any kind of project. Often project planning is ignored in favour of getting on with the work. However, many people fail to realize the value of a project plan in saving time, money and many problems.

Time and cost are the two critical objectives of construction project management, are not independent but intricately related. Time cost trade off problem is one of the highly important issues in project

accomplishment and has been ever taken into consideration by project managers. Time most optimization is defined as a process to identify suitable construction activities of speeding up, and for deciding “by how much” so as to attain the best possible savings in both time and cost.

Scheduling is an inexact process in that it tries to predict the future. While it is not possible to know with certainty how long a project will take, there are techniques that can increase your likelihood of being close. If you are close in your planning and estimating, you can manage the project to achieve the schedule by accelerating some efforts or modifying approaches to meet required deadlines.

## 5.2 STEPS IN PRIMEVERA

### 5.2.1 Enterprise Project Structure (EPS)

It is a hierarchal structure that company- wide projects and enables organizing and management of those projects

### 5.2.2 Work Break Structure (WBS)

A WBS is a hierarchal arrangement of the products and services produced during and by a project. The project is the highest level while an individual activity is the lowest level. Each project in the EPS has its own WBS.

### 5.2.3 Creating a Calendar

The calendar can create and assign it to each activity. These calendars define the available work hours in each calendar days. Also specify national holidays, organizations, project- specific work/ non- work days, and resource vocation days.

### 5.2.4 Adding Activity.

Activities are the fundamental work elements of a project. They are the lowest level of a work break down structure. (WBS), and as such, are the smallest subdivision of a project that directly concerns the project manager.

### 5.2.5 Assigning Relationship.

A relationship defines how an activity relates to the start to finish of another activity or assignments. Add relationship between activities to create a path through the schedule from the first activity to the last activity.

### 5.2.6 Adding Resources.

Resources include the personnel and equipment that perform work on activities across all projects. Resources are generally reused between activities and /or projects. The project management also enables you to distinguish between labour, material and non- labour resources.

## 5.3 SCHEDULING OF THE PROJECT

The aimed to allocate resources to activities of a project in an attempt to determine the project duration and is to reduce the peak requirements and smooth out period-to period assignments within a constraint on the project duration. These three case studies are planned and scheduled using primavera in Table 5.1 and here the scheduling for the construction of building is tabulated in Table 5.2 to 5.10

## 5.4 BENEFITS OF USING SCHEDULES

1. Effectively monitor the site execution and will be revised for every month according to the site condition

2. Reduces time over run and cost over run.
3. Provides adequate lead time for procurement of material.
4. Proper procurement of materials at the right time at right places.
5. Effective supervision by the staff available.
6. No lack of availability of labourers during peak hours.
7. Tracking the progress is made easy

## **RESOURCE PLANNING AND CALCULATIONS**

### **6.1 GENERAL**

Resources allocation is one of the most important issues of construction management. Two two problems of resource allocation are of concerns: Traditionally the resources scheduling problem is solved using either heuristic methods or optimization techniques. In the construction companies they adopt a systematic scheduling process which enables to calculate the month-wise requirement of various resources

### **6.2 RESOURCE PLANNING**

#### **6.2.1 Planning Construction Labour**

The project manpower planning primarily focuses on determining the size of the project workforce, its structuring into functional groups and worker's team and scheduling the manpower. To determine the number of workers needed to perform a given job in the specified time, data-wise forecasting of the workers requirements for accomplishing the project work, and finally, organizing the planned work.

#### **6.2.2 Planning Construction Materials**

The construction materials involves identifying the material required, estimated quantities defining specifications, forecasting requirements, locating sources for procurement, getting material samples approved and designing materials inventory and development the procurement plan to ensure a smooth flow of materials till the connected construction works are completed at the project site.

#### **6.2.3 Planning Construction**

##### **Equipment**

Construction equipment is indispensable in the execution of modern high cost, time – bound massive construction projects. It saves manpower, which is becoming ever more costly and demanding. It improves productivity and quality. Equipment planning for a project aims at identifying the construction tasks to be undertaken by mechanical equipment

### **6.3 RESOURCE CALCULATIONS**

#### **6.3.1 Schedule of staff requirements**

This schedule assists the head quarters resource department, regional and project team in mobilization in time, required staff fir the project and if necessary in planning new recruitment. It also forms the basis of action plan for demobilization. Here the schedule of Labor requirement for three case studies is tabulated in Table 6.1 to 6.3

### 6.3.2 Schedule of Requirements for Plant and Machinery

This schedule will help in mobilizing in time required plant and machinery from his own/hire as also in planning and procurement of new items. It will also be the basis of the action plan for demobilizations. Here the schedule of plant & equipment requirement for three case studies is tabulated in Table 6.4 to 6.6

### 6.3.3 Schedule of Labour Requirements

This Schedule will help in stage wise mobilization of labour, particularly skilled workmen like Mason, Carpenter, Bar bender etc. and in ensuring that there are no abnormally high peaks or troughs in labour requirement resulting. The various labour required for the three case studies is tabulated in Table 6.7 to 6.9

### 6.3.4 Schedule of Material Requirement

This schedule will indicate approximately the total quantity of all essential materials (such as aggregates, cement, structural and reinforcement steel, formwork materials, timber etc) to be produced. Ensure sufficient lead-time for procurement of materials at best possible prices/terms and avoid emergency purchases. Complete material requirements month wise for

each item as per breakup of quantities. Here the schedule of material requirement for the three case studies is tabulated in Table 6.10 to 6.15

## 6.4 IDENTIFIED OF DELAYS

These three case studies identified 10 most important cause effects of delay.

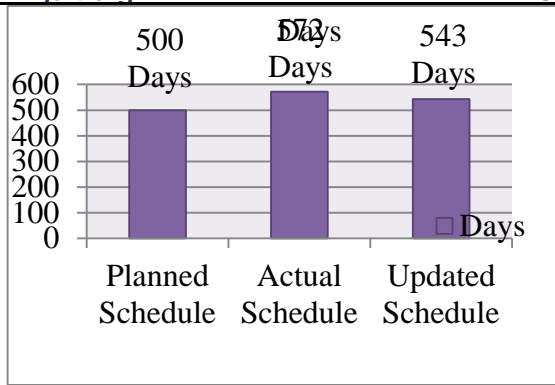
1. Contractors' improper planning
2. Contractor's poor site management
3. Inadequate contractor experience
4. Inadequate client's finance and payments for completed work
5. Problems with subcontractors
6. Shortage in material.
7. Labour supply
8. Equipment availability and failure
9. Lack of communication between parties
10. Mistake during the construction stage.

## RESULT AND DISCUSSIONS

### 7.1.1 Schedule Comparison for Duration (Case studies 1)

After updating, the schedule is compared with planned schedule and actual progress schedule. Totally 72 days delayed from the planned schedule, now the delayed duration is 45 days and the Maximum 27 days are crashed with the Actual Schedule.





**Figure 7.1 Schedule Comparison for Duration (Case studies 1)**

### 7.1.2 Schedule Comparison for Cost (Case studies 1)

Planned schedule cost is 2580.78 Lakhs. During execution of the work, the cost is increased 2976.20 Lakhs (15.32%). the updated cost is 2779.67 Lakhs (6.60%) compared with scheduled cost.

**Figure 7.2 Schedule Comparison for Cost (Case studies 1)**

### 7.1.3 Schedule Comparison for Duration (Case Studies 2, A1 Block)

After updating, the schedule is compared with planned schedule and actual progress schedule. Totally 54 days delayed from the planned schedule, now the delayed duration is 29 days and the Maximum 25 days are crashed with the Actual Schedule.

**Figure 7.3 Schedule Comparison for Duration (Case Studies 2, A1 Block)**

### 7.1.4 Schedule Comparison for Cost (Case Studies 2, A1 Block)

Planned schedule cost is 1823.00 Lakhs. During execution of the work, the cost is increased 2108.02 Lakhs (15.63%). The updated cost is 1971.87 Lakhs (6.46%) compared with scheduled cost.

**Figure 7.4 Schedule Comparison for Cost (Case Studies 2, A1 Block)**

### 7.1.5 Schedule Comparison for Duration (Case Studies 2, A2 Block)

After updating, the schedule is compared with planned schedule and actual progress schedule. Totally 51 days delayed from the planned schedule, now the delayed duration is 29 days and the Maximum 22 days are crashed with the Actual Schedule.

**Figure 7.5 Schedule Comparison for Duration (Case Studies 2, A2 Block)**

### 7.1.6 Schedule Comparison for Cost (Case Studies 2, A2 Block)

Planned schedule cost is 1977.81 Lakhs. During execution of the work, the cost is increased 2268.71 Lakhs (14.71%). The updated cost is 2127.95 Lakhs (6.21%) compared with scheduled cost.

**Figure 7.6 Schedule Comparison for Cost (Case Studies 2, A2 Block)**

### 7.1.7 Schedule Comparison for Duration (Case Studies 2, A3 Block)

After updating, the schedule is compared with planned schedule and actual progress schedule. Totally 49 days delayed from the planned schedule, now the delayed duration is 29 days and the Maximum 20 days are crashed with the Actual Schedule.

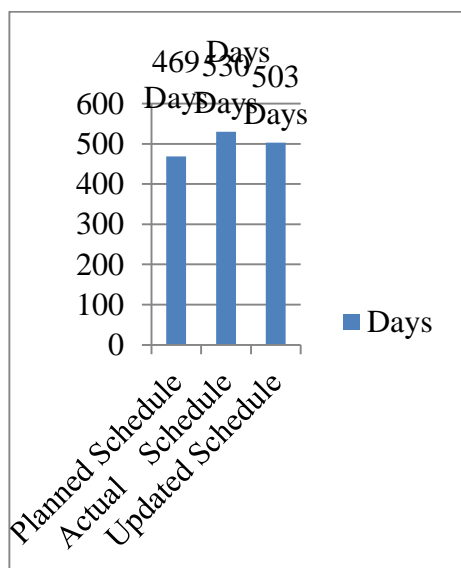
**Figure 7.7 Schedule Comparison for Duration (Case Studies 2, A3 Block)**

### 7.1.8 Schedule Comparison for Cost (Case Studies 2, A3 Block)

Planned schedule cost is 2058.35 Lakhs. During execution of the work, the cost is increased 2368.22 Lakhs (15.1%). The updated cost is 2224.52 Lakhs (6.07%) compared with scheduled cost.

### 7.1.9 Schedule Comparison for Duration (Case Studies 3)

After updating, the schedule is compared with planned schedule and actual progress schedule. Totally 61 days delayed from the planned schedule, now the delayed duration is 34 days and the Maximum 27 days are crashed with the Actual Schedule.



**Figure 7.9 Schedule Comparison for Duration  
(Case Studies 3)**

Planned schedule cost is 3139.02 Lakhs. During execution of the work, the cost is increased 3530.56 Lakhs (12.47%). The updated cost is 3296.52 Lakhs (6.63%) compared with scheduled cost.

## CONCLUSIONS

- The Project Study was carried out to have an overall view of the case study of project and find out the deviation in scheduled against Planned Schedule.
- The Planning, Scheduling and Updating was done for the remaining activities using Primavera P6 software.
- For the purpose of planning, the project were split up in to Macro level (i.e) work break down structure and Micro level, in this the activities were prepared under WBS and also defined a separate project calendar for this case study.
- The Predecessors and Successors were also defined for each activity.
- The Duration of the activities were calculated by considering the available limited of resources and quantity of work to be done, the quantum of work for each month was prepared with the help of Bill of Quantities (BOQ).
- After Creating the activities the resources were loaded and reduced the peak hour allocation of resources by smoothening i.e., called resource leveling.
- This Project helped me to have a comprehensive study about the project planning and resource planning for various construction activities to use the software Primavera P6

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