

# **Planning and Resource Scheduling of Residential (G+7) Project Using Primavera**

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**ABSTRACT:** It is fair to assume that the ultimate object of an Enterprise is to make profits and to satisfy the consumption needs of the community. This involves a wide range of economic resources. At the heart of using resources deployed to produce the desired outputs is Productivity.

In its widest sense, the productivity concept refers to the relationship between the economic resources used in production and the resultant output of goods and services. To be more productive is to obtain a larger output from a given input of resources. In this sense, productivity signifies economic performance or efficiency. An increase in productivity means higher incomes for shareholders, managers, workers and the community. Through its effects on cost of production, productivity determines the competitive capacity of the firm, industry and economy as a whole.

There is consensus on the need to improve productivity but little agreement on the causes and problems and what to do about it. Two common sources of confusion about productivity may be referred to here briefly. One relates to the meaning of productivity for the firm as distinct from productivity of individual inputs - labour, machines etc; and the other concerns the measurement of productivity.

Productivity in the economic sense does not refer to any combination of resources but essentially to that combination which conforms most closely to a firm's desired outputs. , say from plant to labour, or from one project to another, could result in an increase in the physical volume of output, or in technical efficiency of production, but the economic performance of the firm may deteriorate. That could not be called productivity. Productivity therefore, refers to the collective output of all individual resources of a firm.

**KEYWORDS:** CPM, PRIMAVERA P6, basics of CPM scheduling, EPS, Gantt chart

## **I. INTRODUCTION**

Construction industry is an integral component of a nation's infrastructure and industrial growth. Even though construction industry is the second largest industry in India, the growth of this industry has been differential across the nation. The rural regions need tools for economic development, land use and environment planning to cope with the status of development in urban areas. The time available to achieve this goal is shrinking. Here arises the need for effective project management. Many issues are being faced by construction industry that must be taken care of. They include time and cost overruns due to inadequate project formulation, poor planning for implementation, lack of proper contract planning and management and lack of proper management during execution. It has been estimated by analysts that average cost of a project goes up by 30 percentage compared to the budgeted cost. Observations show that proper skillful management is imperative for the timely completion of the project within estimated budget and with allocated resources. Projects with good planning, adequate organizational machinery and sufficient flow of resources cannot automatically achieve the desired result. There must be some warning mechanism, which can alert the organization about its possible success and failures, off and on.

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Project monitoring is the process of collecting, recording, and reporting information concerning project performance that project manager and others wish to know. Monitoring involves watching the progress of the project against time, resources and performance schedule during execution of the project and identifying lagging areas requiring timely attention and action whereas project controlling uses data from monitor activity to bring actual performance to planned performance.

The objective of this study is to plan, schedule and to budget a Residential project with help of primavera software, study the results generated, it is possible to suggest which method is suitable for the selected G+7. Residential Building project and also to recommend measures to the organization for enhancing their project planning skills for similar projects in future.

The traditional project management system cannot meet the demands of today's projects, as tremendous amount of information and data on a project are always changing. Project managers from construction industry state that their 70-80% time is spent on communication and 70% of project documentation is paper based. The main objectives of this study are to plan, schedule, and track a residential project with help of primavera software, study the results generated, it is possible to suggest which method is suitable for the selected residential project. Also to recommend measures to the organization for enhancing their project planning for similar projects in future.

The contract scheduling specifications mandate the use of critical path method (CPM) schedules for the management of many of the construction projects. An understanding of the underlying mathematics that form the basis of critical path methodology is a necessary prerequisite to use of Oracle Primavera® P6™ Project Management software (P6) for creation or review of schedules.

Elements of project planning, including the creation and use of work breakdown structures. This chapter additionally discusses standardschedule requirements, so an understanding of what the contract requires can be gained. The different types of scheduling methods, and then teaches the basic terminology associated with CPM scheduling.

## II. LITERATURE REVIEW

**Subramani and Chinnadurai** (2015) discusses although the long-introduced Industrialized Building System (IBS) has promised to solve and improve the current construction method and scenario in our country, but the IBS method has not gained enough popularity. One of the reasons is due to lack of research works done to quantifying the benefit of IBS especially in construction time saving. In lieu with such scenario, this study conducted to quantify evidence of time saving in IBS application. Primavera P6 is amazing software, which is used not just by planners, but also managers, engineers, schedulers, and anyone else involved in planning, management, reporting of a project. Primavera P6 has benefited every industry from aerospace to manufacturing, electronics to IT, Telecom to Civil, any more. Primavera is an amazing project management software tool which is not just used by project managers. Designed to make managing large or complex projects a piece of cake, Primavera is the ideal tool for anyone who is involved in planning, monitoring and reporting on the progress of any big task, development or venture. The project management software tool of choice in industries such as construction, engineering, aerospace, transport and security, as well as in many other industry sectors. Primavera allows for top level planning as well as being ideal for managing the intricate details. This enables project managers, planners, planning controllers and other associated professionals to have instant access to all the project information they require at the touch of a button. Also from this study shown not all IBS components can improved to the overall construction duration, however by adopting IBS components can improve and expedite the construction of 18 stories residential building from the point of departure of the project throughout of the whole of project's with a total 405 days or 42% the time saving.

**Prabhat Kumar Sinha et.al.** (2013) aims in providingtime and schedule management by using primavera is a useful technique for modeling and analyzing project management. This paper is a conceptual paper that Projects are expected to be completion in schedule and help to project manager to control schedule while achieving performance, quality and cost goals by proper planning and execution. The benefits of primavera are using quantified data, allowing project managers to justify and communicate their arguments when senior management is pushing for unrealistic project expectations. Proper risk management education, training, and advancements in computing technology combined allow project managers to implement the method easily. In the field of project management, primavera can quantify the

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effects of risk and uncertainty in project schedules and budgets, giving the project manager a statistical indicator of project performance such as target project completion date and budget.

**Satinder Chopra and Arvind Dewangan** (2014) presents a project is a collaboration to plan and achieve a particular aim. Project involves several tasks to be completed from start to the final aim of project completion. A schedule of tasks is developed in the planning phase by the project planning and scheduling team that clearly states the various project milestones and activities in detail from project start to project finish. The quality of the schedule generated from Primavera P6, one of the mostly used software for Project planning, and scheduling should confirm with industry standards as in the western countries. Lack of the knowledge of various aspects of schedule development often results in a schedule which is not understandable by the majority of people involved in the project and hence not useable. The ignorance on the part of scheduler generally results in such type of schedule which is not understandable by other people, clients working on site. So, it is an effort by the Author to demonstrate and improvise on the schedule development by highlighting various fields that are often ignored in the development of a good construction schedule.

**Regina Mary and Rathinakumar** (2015) study deals with the methods that reduce time and cost constraints and resource management. A construction of residential apartment is taken for this study which is undergoing a time and cost overrun. The constraints are reduced by using techniques interconnecting activities properly and increasing the resources, schedules are prepared by means of Primavera software. The cost constraints can also be reduced by managing labour resources of different categories. The actual schedule of the project is considered as base schedule. The base schedule is compared with the modified schedule using techniques which helps to reduce constraints. Schedule made by the technique interconnecting activities properly gives a time difference for the completion of the project of about 5 months from the base schedule of the project. Schedule made by the combination of the both techniques shows the result of 7 months prior completion from the base schedule of the project. This study supports project manager to guide himself to control the constraints in the planning, execution process and shows the importance of proper allocation of labours of different categories.

## III. PROJECT PLANNING AND SCHEDULING

Time management can be broken down into two major categories: planning and implementation. Proper planning of the project schedule, effective use of team members and resources, and managing risks and delays are crucial to a good outcome. For construction projects, ultimate success depends on the continuous balance of a project's resources, cost, and schedule.

### Project Life Cycle

The project manager and project team have one shared goal: to carry out the work of the project for the purpose of meeting the project's objectives. Every project has a beginning, a middle period during which activities move the project toward completion, and an ending (either successful or unsuccessful). A standard project typically has the following four major phases (each with its own agenda of tasks and issues): initiation, planning, implementation, and closure. Taken together, these phases represent the path a project takes from the beginning to its end and are generally referred to as the project life cycle.



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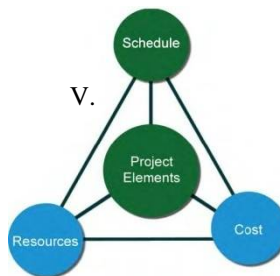
## Project Schedule:

The project schedule needs as accurate input as possible representing how the field work will proceed. Identifies interface points between contractors and subcontractors as well as milestones. Represents a work plan in progress, completed, and future in a systematic and coordinated manner. Provides team leaders with an effective tool to manage the project. Schedule management is critical for three main reasons

1. Time has no flexibility; it passes, no matter what.
2. Delivering projects on time is a challenge and a priority.
3. Project claims often center on schedule issues.

## Project Elements:

Project scheduling is one of the key factors that affect and contribute to a project's success or failure. The interrelated and delicate balance of cost, resources, and schedule will affect all aspects of a construction project. If one of the key elements is affected, over budget, shortage of resources, or delayed, the other two elements may be affected.



## PROJECT ELEMENTS

The resident engineer needs to understand the problem, realize the impact to the project schedule, and review any modifications to the schedule to ensure that the impact isn't represented in the updated schedule as a caused delay.

## Scheduling Cycle:

The project schedule is a living document that, once created and executed, must continue to be monitored and updated to reflect the true conditions of a project at all times. The scheduling cycle is, therefore, continuous. The four stages of a scheduling cycle are plan, perform, monitor and modify. After modification, the schedule may need to be re-planned, thus starting the cycle again

## Work Breakdown Structure:

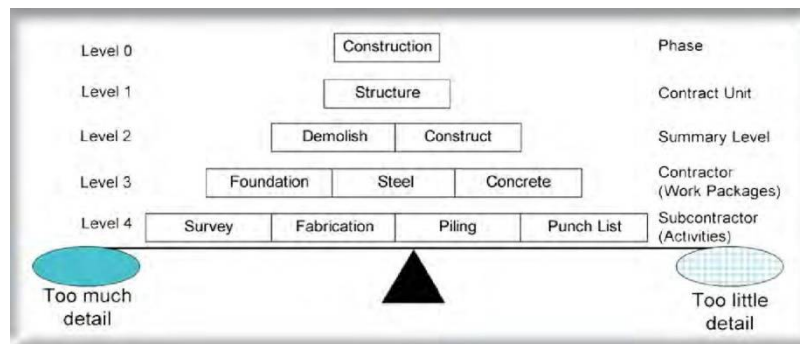
Work breakdown structure (WBS) is a product-oriented grouping of project elements that organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services.

WBS work elements are discrete components of the total work. They represent only work and are largely independent of schedule, sequence, precedence, cost, resources, and quality. A unique, numerical identifier is attached to each work element so that computers can recognize it.

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## Scheduling fundamentals and Benefits:

Critical path method (CPM) is a project planning and scheduling technique that defines the project activities, activity duration, and relationships between activities. The schedule connects activities through relationships and calculates the total time required to complete the project. Almost every industry uses CPM principles in schedule management.

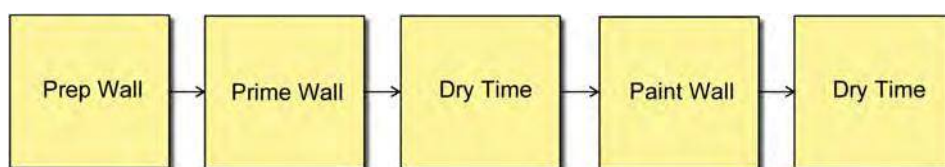
Using CPM for scheduling is very beneficial to the overall project objectives. The benefits of scheduling using CPM techniques are Promotes logical thinking, Helps in evaluating options, Improves communications, Tracks progress, Identifies delays and Facilitates recovery.

## Scheduling Methods:

Industry uses various scheduling methods today. The scheduling method shows how the activities and relationships relate to one another. The types are:

Bar chart , Fenced bar chart (time-scaled) , Arrow diagram method ,Precedence diagram method

Although industries use fenced bar chart method for Level 1 projects and the precedence diagram method for Level 2 and Level 3 projects, among these we will use Precedence diagram method for scheduling. In a precedence diagram method (PDM) schedule, each activity duration is a box or block, and each relationship is graphically shown as an arrow. The relationship arrows show the direction of the schedule. A project typically travels along the path from left to right, from the start of a project to completion. Each activity is preceded by an activity logically along the schedule.



**Precedence diagram**

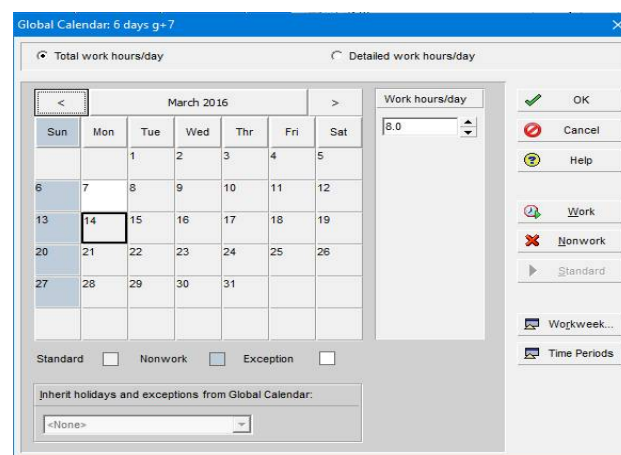
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## Calendars

Calendars are an important part of project schedules. When used properly by the contractor, the calendar will demonstrate all working and non-working days for the project, including suspensions, holidays, and more. Figure 3.3 is a sample calendar in Oracle's Primavera P6 Enterprise Management Portfolio (P6). In P6, calendars can be assigned globally to the project, (Global Calendar) as well as to each individual activity (Project Calendar). Project calendars are assigned to individual activities in the project. Global calendars affect all, open or will be opened, projects in that copy of P6.



**P6 6-day calendar**

## Relationship Types

Four relationship types exist that dictate the performance of a construction schedule. Finish-to-start (FS), Start-to-start (SS), Finish-to-finish (FF) and Start-to-finish (SF). By changing the relationship types between activities, project completion can be gained or lost.

## IV.METHODOLOGY

The scope of work was divided into the following steps:

- Collection of data and Specifications of activities.
- Study area characteristics.
- Identifying the Constraints
- Preparing Actual Schedule for the Project in Primavera
- Tracking the schedule of the project by using Primavera (P6)

### Collection of data and Specification of activities

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

### Study area characteristics

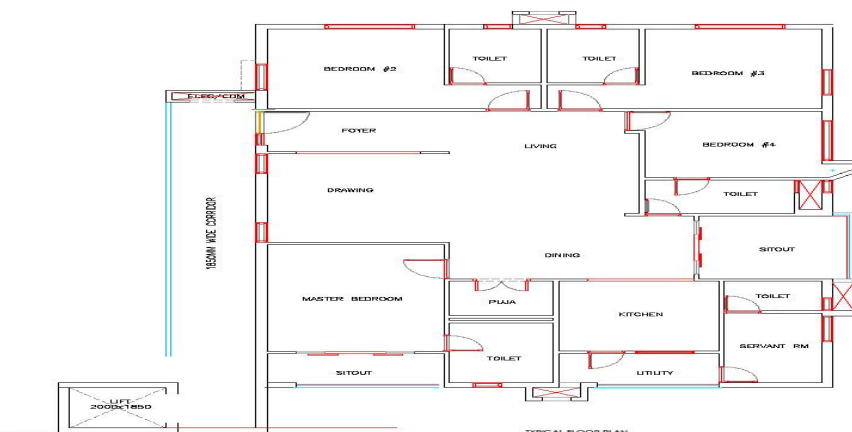
A real time residential apartment which is to be started has taken as a case study for the project. The construction is for a residential purpose having G+7 and the carpet area of the construction is 21120 sq. ft. The number of flats at each floor is one with typical floor plan of an area of 2640 sq. ft. for each flat.



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## Identifying the Constraints

The project was started on the month of January-2016 and will be finished on the month of April-2017. This actual construction of the residential apartment takes a long duration of two year for the completion of the project. The long duration of a single project will lead to a considerable increase in the cost of the project. Therefore reducing the project completion time is necessary for completing the project within the budgeted cost and budgeted time. This on time project completion and on budget completion of project is the two factors which state the project is a successfully completed. Reason for taking a long duration of this project is identified by means of the primavera schedule report.

## Preparing Actual 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+7 apartment 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. The process of scheduling in primavera for the actual progress of work and the report obtained for the actual schedule from the primavera software are prepared. This actual schedule and report is considered as a schedule for this project.

## Tracking the schedule of the project by using Primavera (P6)

The schedule that was prepared was tracked and updated from January 1st to April 2nd and actual costs are calculated based on the updated schedule. Record Actual Start date for those activities which started. Record Activity % Complete for ongoing or completed activities to determine how much of the work has been completed. This should be based on work-in-place relative to the total amount of work planned for the activity. Enter Remaining Duration for in-progress activities. Remaining duration will be the amount of time required to complete the activity as determined from the status date. Enter Actual Finish date for those activities which have finished. Cost variance was calculated by the difference between the earned value cost and the actual cost.

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## V. RESULTS AND DISCUSSIONS

### schedule of the project with gantt chart

Schedule for the project is prepared by creating the EPS (Enterprise Project Structure), Calendar with a time period of 9 working hours per day excluding Sundays, WBS (Work Breakdown Structure) and adding the total number of 119 activities that are required for the project with their original duration. Successors are assigned for all the activities by the use of Gantt chart.

### 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 labor, Non labor, Expense, Material and total cost of all the activities are calculated.

## VI.CONCLUSION

Schedule made by using techniques that reduce the constraints helps for the project to complete earlier of four to five months from the actual base schedule of the project and thereby increase the profit outcome from the project. Further, with the management on the labour resource of skilled, unskilled male worker and unskilled female worker in the construction activities, the cost spent on the labour resources reduces by 5% of the actual cost spent on the labor resources helps to manage the work easily and it reduces the information constraints and risks between the management and the site members which greatly contribute to the project success. Activities on the site with respect to execution of the Residential project are thoroughly observed and comparison is made between planned and actual executed schedule. This study gives brief explanation for preplanning project management, Pre planning helps to schedule the working period in a proper manner and also purchase the goods at the right time. Advantages of using this software is Centralized Project Repository. With all projects are in a centralized database, the robust security module protects project data and offers flexibility. CPM Scheduling provides Critical Path Method (CPM) Scheduling, which uses the activity durations, relationships between activities and calendars

This study concludes that by using the Primavera a time period of 4 months from the actual base schedule of the project was saved and also helps to prevent the cost overrun, thereby ensuring the successful completion of the project. It helps to manage the work easily and also helps to avoid constraints or risks that will delay the project by interconnecting and parallelizing the activities and mobilization of the resources from time to time for successful completion of the project within the estimated time.

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