



Optimal Planning and Scheduling in Multistoreyed Building

KEYWORDS

eliminate waste, effective material management, flexible planning and scheduling sequencing.

R.PRABHAHAR

M.Tech (CEM), Department of Civil Engineering,
Periyar Maniammai University, Thanjavur, India

G.RAVICHANDRAN

Assistant Professor, Department of Civil Engineering,
Periyar Maniammai University

ABSTRACT

Construction planning is an important part of the overall management process. The planning and management includes planning the work, doing the work, correlating plan and progress information and controlling the work, the three inter-related factors of time, money and quality need to be controlled in a proper way. Completion of many of the projects nowadays is not in time. This will lead to an increase in overheads as well as various other factors. It will not only reduce the expected revenues but also will affect the reputation of the contractor. Scheduling is one of the making functions in construction project to determine the sequence of activities necessary to complete a project. The scheduling techniques provide important crucial to a project success, it indicates which activities must be complete "as planned" if the project has to be "on time" and which activities have some flexibility. The problems inherent in the detailed design-to-construction process and describe an integrated system that incorporates the technology of computer-based scheduling software. A planning method is presented which needs little detailed information about Productivities and work volumes and may be rapidly produced. The plan brings an overall view of the project by grouping the main activities that are highly interdependent. The concept of the best rhythm for each group of activities focuses on the sequence of work, continuity of labor team working and completeness rather than on pure schedule goals. Many characteristics of this method are to eliminate waste, flexible planning and scheduling sequencing.

INTRODUCTION

Multi-storied buildings aim to increase the area of the building without increasing the area of the land the building is built on, hence saving land and, in most cases, money depending on material used and land prices in the area, of course. Large scale industrialization and prohibitive land cost in India have resulted in a vast expansion in the building programme stage has reached when multi-storeyed construction is becoming essential and inevitable. A common concept of Multi-storied buildings in India is a building having over five or six stories. This kind of buildings are under construction in the metropolitan cities like Calcutta, Delhi, Chennai, etc.,

Planning involves the listing of jobs or activities that have to be done to complete the project. The requirements of men, material, equipment, estimate of cost as also the duration of each of the activities are part of planning. Scheduling, on other hand, deals with the time order in which these activities are to take place, as also the manpower, materials, etc required at every stage of production should shown in the scheduling.

Most construction projects are schedule based on some sort of critical path planning method (CPM). A number of versions of this technique have been developed and is used as the basis for many of the popular project management software packages. Many researchers discussed the suitability of CPM for construction projects, mainly those Repetitive projects, such as railroads and Multi-storied buildings, usually such master schedules cannot be accurately detailed too far into the future because of lack of information about actual duration and deliveries. Other important disadvantage relies on the main idea of the CPM method which is focused on finding the path which is critical. The schedule is developed based on this premise and the resource capacity and material requirements are input for the project simulation. The emphasis is on project duration shortage and resource leveling. The fact of having a "critical path" implies having non critical ones, which have float time.

The construction procedures included:

1. Crew composition

1. Daily construction volume
1. Crew sizes
1. Required tools and equipment

OBJECTIVES

- To budget the Cost of Construction.
- To reduce the Cost of materials.
- To initiate the corrective action wherever necessary.
- To reduce the time by scheduling of activities.
- Maintaining the standard.

METHODOLOGY

1. Study the scope of work in detail from tender drawings and decide on the sequence of construction including methods to be adopted and equipments to be used. If available drawings do not give adequate information, obtain as much as possible from clients/consultants/design office.
2. Subdivide the construction project into "construction phases" everyone having dependent activities which may be executed into a unique production rate. The use of a unique production rate intends to simplify the planning process but it is not a fixed rule;
3. Determine the construction phase "rhythm": Based on the overall project strategy work rhythm was determined for each "construction phase"

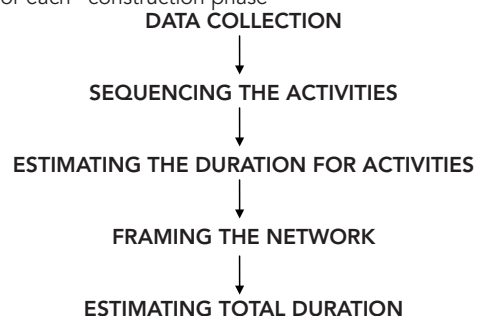


Fig 1: Project Control Methodology

PLANNING

Development of Project Plan Objectives

Construction planning is a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual work tasks. A good construction plan is the basis for developing the budget and the schedule for work. Developing the construction plan is a critical task in the management of construction, even if the plan is not written or otherwise formally recorded. In addition to these technical aspects of construction planning, it may also be necessary to make organizational decisions about the relationships between project participants and even which organizations to include in a project.

Planning involves the process of selecting construction methods and order of work to be used on a project from among all the various methods and sequences possible. It also involves making decisions about what tasks, will be performed, how the tasks will be performed, who will perform the tasks, and when and in what sequence the tasks will be performed. Exceptional planning usually involves documentation of the assumptions and analysis made in arriving at a final ordering and identification of the work activities. This documentation includes the assumptions made about alternatives, resources, costs, and the decision criteria used in selecting the plan. Planning is performed by various parties (e.g. owner, contractor,) at various levels (e.g. project level, process level) at various times (e.g. preconstruction, on site) during the execution of a project.

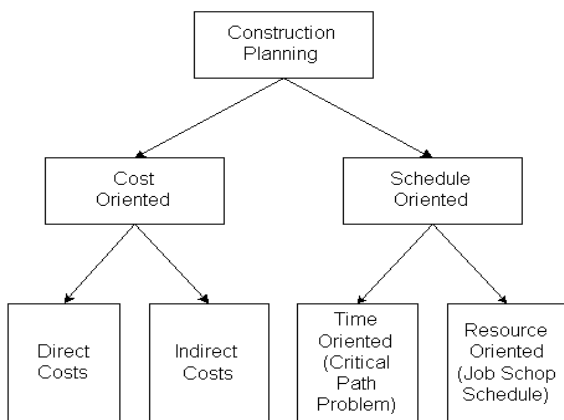


Fig 2: Emphases in Construction Planning

Pre-Design Estimating of Project Duration

Pre-design estimating of construction duration is important. That pre-contract determination of the construction duration is essential for proper cash flow forecasting by both the contractor and the client. It can facilitate optimal resource allocation, financial planning, profitability and efficiency of capital flow within a pre-determined Time Limit.

Based on the inputs required for scheduling, all the current methods of scheduling seem to be efficiently applied only when the detailed design is completed. Normally, the contractor must complete this planning prior to bidding for the project. Without sufficient information, the schedule can be prepared based on only the best guess, i.e. using experience of similar projects in estimating the construction duration.

Manpower Planning

The construction manpower planning is estimating the manpower required to complete the project in time, establishing productivity manpower standards

- Scheduling construction site workers
- Grouping project manpower

- Designing workers financial incentive schemes

The basic equation for determining the workers required for accomplishing a specific activity is given by

$$\text{Workers required} = (\text{Work Quantity} \times \text{Workers Productivity Standards}) / \text{Completion Period}$$

$$\text{Workers Productivity Standards} = \text{Worker Output Norms} \times \text{Efficiency Factor}$$

SCHEDULING

Definition

The project schedule is a calendar that links the tasks to be done with the resources that will do them. Before a project schedule and can be created, the project manager must have a work breakdown structure (WBS), an effort estimate for each task, and a resource list with availability for each resource

Scope

A project manager's time is better spent on working the team to create a WBS and estimates than on trying to build a project schedule without them. The project schedule is the core of the project plan. It is used by the project manager to commit people to the project and show the organization how the work will be performed. Schedules are used to communicate, final deadlines and, in some cases, to determine resource needs. They are also used as a kind of check list to make sure that every task necessary is performed. If a task is on the schedule, the team is committed to doing it. In other words, the project schedule is the means by which the project manager brings the team and the project under control.

Purpose of Scheduling

- Schedule is a reflection of the plan, but the plan must come first.
- It is the determination of the timing and sequence of operations in the project and their assembly to given the overall completion time.
- The process of scheduling may uncover flaws in the plan, leading to revisions to the plan.

PERT Method

PERT is like CPM scheduling. It uses logical diagram to analyze performance time. It overcomes difficulties associated with duration of activities which could not be estimated reliably. PERT enables the scheduler to estimate the most probable project duration and the probability that the project or any portion of the project will complete at particular time. PERT focuses on events or nodes, called event-oriented. Unlike the CPM, it requires three estimates of duration for each activity:

- Optimistic (high productivity)
- Pessimistic (low productivity)
- Most likely duration.

Network Based Scheduling Techniques

Network based scheduling techniques have evolved due to overcome the limitations of traditional scheduling techniques. Two most important problems to be addressed were

- Emphasis on logical relationship
- Divisions of planning and scheduling into two separate phases

The heart of network based scheduling technique is always a graph, a set of nodes and connected arrows. Figure represents the logic network for a Nine-Activity Project Example

Basic Steps in Network Based Scheduling Technique

The Network based project management methodology embodies the following steps in order of appearance: Planning and scheduling is a dynamic process and iterative process. If

result obtained is not satisfactory, one may have to go back to previous steps

Table: Basic Steps in Network Based Scheduling Technique

Planning phase	Step 1	Defining activities
	Step 2	Defining activity interdependencies
	Step 3	Drawing the network
	Step 4	Time and resource estimation
Scheduling phase	Step 5	Basic calculation
	Step 6	Advanced calculation
Control phase	Step 7	Project control
	Step 8	Project review

SCHEDULE OF CONSTRUCTION PROGRAM

In this schedule, the execution of the project is detailed according to work sequence and forms the basis of day-to-day action plan. It also forms a major input for other schedules. Hence this is of vital importance.

The procedure to be followed in preparation of the construction programme is,

1. Study the scope of work in detail from tender drawings and decide on the sequence of construction including methods to be adopted and equipments to be used.
2. If available drawings do not give adequate information, obtain as much as possible from clients/consultants/design office.
3. Subdivide the construction project into "construction phases" everyone having dependent activities which may be executed into a unique production rate. The use of a unique production rate intends to simplify the planning process but it is not a fixed rule;
4. Determine the construction phase "rhythm": Based on the overall project strategy a work rhythm was determined for each "construction phase";
5. List all the activities, along with their crews. Verify possible dependencies between activities on different construction phases. These ones may be grouped together or being changed from one phase to another.
6. Design optimum crews: It is necessary to consider the selected construction technology and methods, as well as site constraints. Considering this as well as the productivity measurements and the detailed methods information obtained during initial case studies;
7. Divide all the activities into two groups: the main activities for each "construction phase" and a second group of secondary or complementary activities which usually are very fast with low labor consumption, and hence small duration.
8. Calculate construction volumes for each construction area and the main activities: Construction volumes were

calculated or each area (i.e., basement, floor 1, etc.).

CONCLUSION

Communicating the project schedule is a vital ingredient in successful project management. A good presentation will greatly ease the manager's problem of understanding the multitude of activities and their inter-relationships. Moreover, numerous individuals and parties are involved in any project, and they have to understand their assignments.

Presentations of project schedules are particularly useful since it is much easier to comprehend a display of numerous pieces of information than to sift through a large table of numbers. Early computer scheduling systems were particularly poor in this regard since they produced pages and pages of numbers without aids to the manager for understanding them.

In practice, a project summary table would be much longer. It is extremely tedious to read a table of activity numbers, durations, schedule times, and floats and thereby gain an understanding and appreciation of a project schedule. In practice, producing diagrams manually has been a common prescription to the lack of automated drafting facilities. With the availability of computer graphics (using ms project software), the cost and effort of producing graphical presentations has been significantly reduced and the production of presentation aids can be automated.

The cost of the project will be reduced by selecting the suitable material, which is less in cost with same character of the standard material. The overall cost of the project will be estimated. So it is beneficial for the owner and also the contractor. The owner saves money and the contractor get benefits in time and also in cost. By working in proper schedule the overhead cost will be reduced.

OPTIMAL PLANNING IS TO BE DONE FOR THE FOLLOWING USING MS PROJECT SOFTWARE EFFECTIVE MATERIAL MANAGEMENT

Type of material	
Full Masonry	Brick work
	Hollow block(200 mm tk)
	Fly ash brick
Half brick Masonry	Half brick masonry
	Hollow Block (100 mm tk.)
	Fly Ash Brick (115 mm tk.)

Type of material	
Windows	Padauk Wood
	Aluminum Window

Type of material	
Concrete	RMC
	SMC

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