5.1 Introduction to construction Planning-Scheduling for activities

Planning, scheduling is an important part of the construction management. Planning and scheduling of construction activities helps engineers to complete the project in time and within the budget. The term 'Construction' does not only denotes physical activities involving men, materials and machinery but also covers the entire gamut of activities from conception to realization of a construction project. Thus, management of resources such as men, materials, machinery requires effective planning and scheduling of each activity.

Objectives of Construction Management:

The main objectives of construction management are,

- Completing the work within estimated budget and specified time.
- Maintaining a reputation for high quality workmanship
- Taking sound decisions and delegation of authority
- Developing an organization that works as a team

Functions of Construction Management:

The functions of construction Management are

(a) Planning

(b) Scheduling

(c) Organizing

(d) Staffing

(e) Directing

(f) Controlling

(g) Coordinating

.

(a) Planning in Construction Management:

It is the process of selecting a particular method and the order of work to be adopted for a project from all the possible ways and sequences in which it could be done. It essentially covers the aspects of 'What to do' and 'How to do it'.

- Planning helps to minimize the cost by optimum utilization of available resources.
- Planning reduces irrational approaches, duplication of works and inter departmental conflicts.
- Planning encourages innovation and creativity among the construction managers.
- Planning imparts competitive strength to the enterprise.

b) Scheduling in Construction Management:

Scheduling is the fitting of the final work plan to a time scale. It shows the duration and order of various construction activities. It deals with the aspect of 'when to do it'. Scheduling of the programming, planning and construction process is a vital tool in both the daily management and reporting of the project progress

c) Organizing: Organizing is concerned with decision of the total construction work into manageable departments/sections and systematically managing various operations by delegating specific tasks to individuals.

d) Staffing: Staffing is the provision of right people to each section / department created for successful completion of a construction project.

e) Directing: It is concerned with training sub ordinates to carryout assigned tasks, supervising their work and guiding their efforts. It also involves motivating staff to achieve desired results.

f) Controlling: It involves a constant review of the work plan to check on actual achievements and to discover and rectify deviation through appropriate corrective measures.

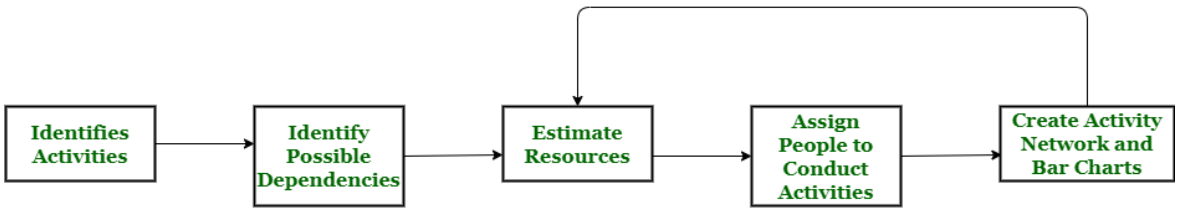
g) Coordinating: It involves bringing together and coordinating the work of various departments and sections so as to have good communication. It is necessary for each section to aware of its role and the assistance to be expected from others.

Importance of Construction Management:

- Construction management practices invariably lead to "maximum production at least cost". A good construction management, results in completion of a construction project with in the stipulated budget.
- Construction management provides importance for optimum utilization of resources. In other words, it results in completion of a construction project with judicious use of available resources.
- Construction management provides necessary leadership, motivates employees to complete the difficult tasks well in time and extracts potential talents of its employees.
- Construction management is beneficial to society as the effective and efficient management of construction projects will avoid, escalation of costs, time overrun, wastage of resources, unlawful exploitation of labor and pollution of environment.

Scheduling

All formal scheduling procedures rely upon estimates of the durations of the various project activities as well as the definitions of the predecessor relationships among tasks. The variability of an activity's duration may also be considered.



Project Scheduling Process

- Maximizing productivity in construction is essential for any construction business's success, and it requires a combination of tips and tools to be successful. Construction productivity is defined as the efficiency with which construction activities are completed

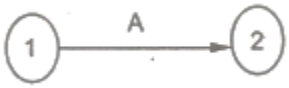
- Time management is one of the most important and necessary skills for success in any industry. This is especially true in construction, where project teams must manage complex tasks with tight deadlines, budgets, and often-sensitive safety considerations
- Good scheduling can eliminate problems due to production bottlenecks, facilitate the timely procurement of necessary materials, and otherwise insure the completion of a project as soon as possible. In contrast, poor scheduling can result in considerable waste as laborers and equipment wait for the availability of needed resources or the completion of preceding tasks.
- Delays in the completion of an entire project due to poor scheduling can also create havoc for owners who are eager to start using the constructed facilities.
- Attitudes toward the formal scheduling of projects are often extreme. Many owners require detailed construction schedules to be submitted by contractors as a means of monitoring the work progress.
- The actual work performed is commonly compared to the schedule to determine if construction is proceeding satisfactorily. After the completion of construction, similar comparisons between the planned schedule and the actual accomplishments may be performed to allocate the liability for project delays due to changes requested by the owner, worker strikes or other unforeseen circumstances.
- In contrast to these instances of reliance upon formal schedules, many field supervisors disdain and dislike formal scheduling procedures.
- In particular, the *critical path method* of scheduling is commonly required by owners and has been taught in universities for over two decades, but is often regarded in the field as irrelevant to actual operations and a time consuming distraction. The result is "seat-of-the-pants" scheduling that can be good or that can result in grossly inefficient schedules and poor productivity.
- Progressive construction firms use formal scheduling procedures whenever the complexity of work tasks is high and the coordination of different workers is required.
- Formal scheduling procedures have become much more common with the advent of personal computers on construction sites and easy-to-use software programs.
- Sharing schedule information via the Internet has also provided a greater incentive to use formal scheduling methods. Savvy construction supervisors often carry schedule and budget information around with wearable or handheld computers.

- As a result, the continued development of easy to use computer programs and improved methods of presenting schedules have overcome the practical problems associated with formal scheduling mechanisms. But problems with the use of scheduling techniques will continue until managers understand their proper use and limitations.

NETWORK DIAGRAM REPRESENTATION

In a network representation of a project the following representations are used:

Activity: Any individual operation which utilizes resources and has an end and a beginning is called activity. An arrow is commonly used to represent an activity with its head indicating the direction of progress in the project.



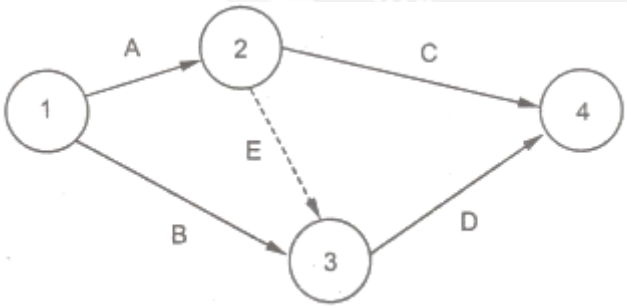
Here 'A' is the activity. These are classified into four categories:

(i) Predecessor activity - Activities that must be completed immediately prior to the start of another activity are called predecessor activities**.**

(ii) Successor activity - Activities that cannot be started until one or more of other activities are completed but immediately succeed them are called successor activities.

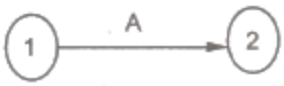
(iii) Concurrent activity - Activities which can be accomplished concurrently are known as concurrent activities. It may be noted that an activity can be a predecessor or a successor to an event or it may be concurrent with one or more of other activities.

(iv) Dummy activity An activity which does not consume any kind of resource and time is called a dummy activity. Dummy activities are simply used to represent a connection between events in order to maintain logic in the network. It is represented by a dotted line in a network.



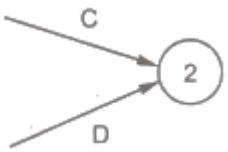
In the above example, A and B are preceding activities. C is dependent on activity A and D is dependent on activity B. Also A and B are concurring activities, since they are starting at the same time. Activity E is the dummy activity and it is marked as dotted line.

❖ **Event:** An event represents a point in time signifying the completion of some activities and the beginning of new ones. This is usually represented by a circle in a network which is also called a node or connector.

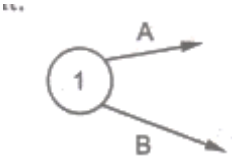


Here '1' and '2' are called events. 1 is the tail event and 2 is the head event. The events are classified in to three categories:

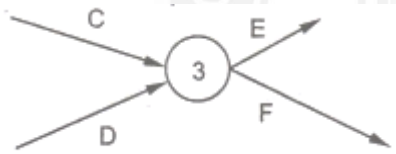
(i) Merge event - When more than one activity comes and joins an event such an event is known as merge event.



(ii) Burst event - When more than one activity leaves an event such an event is known as burst event.



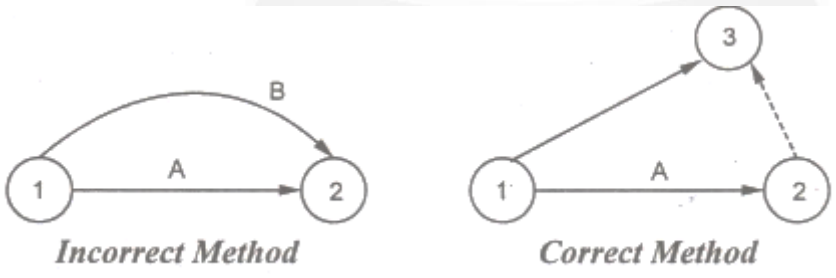
(iii) Merge and Burst event - An event may be merge and burst event at the same time as with respect to some activities it can be a merge event and with viorespect to some other activities it may be a burst event.b



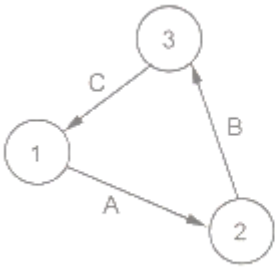
ERRORS TO BE AVOIDED IN A NETWORK DIAGRAM

While drawing a network diagram, the following representations should be avoided:

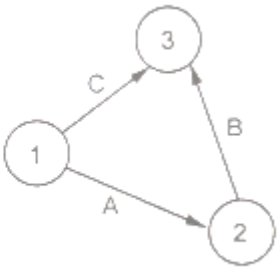
(i) Two activities starting from a tail event must not have a same end event. To ensure this, it is absolutely necessary to introduce a dummy activity.



(ii) Looping error should not be formed in a network, as it represents performance of activities repeatedly in a cyclic manner.

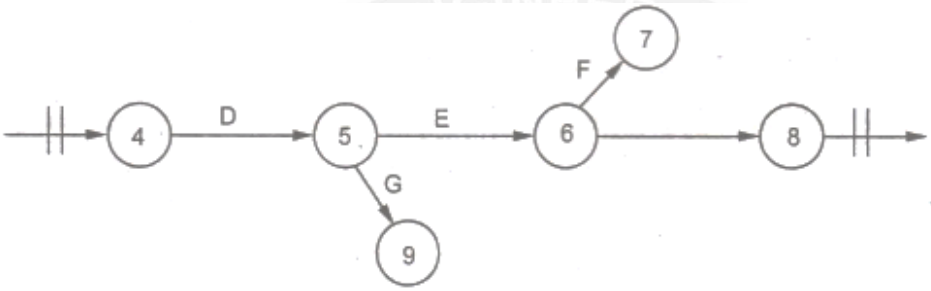


Incorrect Method



Correct Method

(iii) Dangling: To disconnect an activity before the completion of all activities in a network diagram is known as dangling. As shown in the figure activities (59) and (6-7) are not the last activities in the network. So the diagram is wrong and indicates the error of dangling



RULES FOR DRAWING NETWORK DIAGRAM

For a perfect network diagram, the following rules should be followed:

❖ Each activity is represented by one and only one arrow in the network

❖ No two activities can be identified by the same end events

❖ Ensure the correct precedence relationship in the arrow diagram and check for hierarchy whenever any activity is added to the network

❖ Try to avoid arrows which cross each other and Use straight arrows

❖ Do not attempt to represent duration of activity by its arrow length

❖ Use arrows from left to right. Avoid mixing two directions, vertical and standing arrows may be used if necessary.

❖ Use dummies freely in rough draft but final network should not have any redundant dummies.

❖ The network has only one entry point called start event and one point of emergence called the end event.

BASIC STEPS IN PERT / CPM

In general construction project scheduling by PERT / CPM consists of the following four main steps:

(i) Planning: The planning phase is started by splitting the total project in to small projects. These smaller projects in turn are divided into activities and are analyzed by the department or section. The relationship of each activity with respect to other activities are defined and established and the corresponding responsibilities and the authority are also stated. Thus the possibility of overlooking any task necessary for the completion of the project is reduced substantially.

(ii) Scheduling: The ultimate objective of the scheduling phase is to prepare a time chart showing the start and finish times for each activity as well as its relationship to other activities of the project. Moreover the schedule must pinpoint the critical path activities which require special attention if the project is to be completed in time. For non-critical activities, the schedule must show the amount of slack or float times which can be used advantageously when such activities are delayed or when limited resources are to be utilized effectively.

(iii) Resource allocation: Allocation of resources is performed to achieve the desired objective. A resource is a physical variable such as labour, finance, equipment and space which will impose a limitation on time for the project. When resources are limited and conflicting, demands are made for the same type of resources a systematic method for allocation of resources become essential. Resource allocation usually incurs a compromise and the choice of this compromise depends on the judgment of managers.

(iv) Controlling: The final phase in project management is controlling. Critical path methods facilitate the application of the principle of management by expectation to identify areas that are critical to the completion of the project. By having progress reports from time to time and updating the network continuously, a better financial as well as technical control over the project is exercised. Arrow diagrams and time charts are used for making periodic progress reports. If required, a new course of action is determined for the remaining portion of the project.

In addition to these basic steps essentially, there are six steps which are common to both the CPM and PERT techniques. They are listed as follows:

(i) Define the Project and all of its significant activities or tasks. The Project (made up of several tasks) should have only a single start activity and a single finish activity.

(ii) Develop the relationships among the activities. Decide which activities must precede and which must follow others.

(iii) Draw the "Network" connecting all the activities. Each Activity should have unique event numbers. Dummy arrows are used where required to avoid giving the same numbering to two activities.

(iv) Assign time and/or cost estimates to each activity

(v) Compute the longest time path through the network. This is called the critical path.

(vi) Use the Network to help plan, schedule, and monitor and control the sonog project.