

**BHUBANANANDA ORISSA SCHOOL OF ENGINEERING, CUTTACK**



**DEPARTMENT OF CIVIL ENGINEERING**  
**LECTURE NOTE ON: CONSTRUCTION MANAGEMENT**

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# **1 Introduction to Construction Management**

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1.2 Functions of construction management.

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11.5 Landslides, Tsunamis and Thunderstorm hazards and vulnerability, Landslide & Thunderstorm incidence maps, Measures against Tsunami hazards.

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# **CHAPTER-1 INTRODUCTION**

- Aims and objective of construction management
- Functions of construction management
- The construction team components
- Resources for construction management

## **Concept Of Management**

- The term management has different senses of use. Sometimes it is used in the sense of an organisation in which different class of people work together to provide qualitative and economical product by the use of human beings and other resources like machine, money and material.
- Or sometimes it may be defined as the process consisting of planning, organising, activating and controlling the performance to determine and accomplish the objective by the use of men, machines, materials and money.

## **1.1 Aim & Objectives of Construction Management**

The following are the main objectives of the construction management.

- The work should be completed within estimated budget and specified time.
- There should be the motivation to working people to give their level best within their capacities to complete the work.
- There should be qualified and trained staff to supervise the work properly.
- The execution of work should be done as per specification.
- The execution of work should be done as most economically.
- The working quality and workmanship should be good.
- There should be a proper plan of work and it should be organised properly.
- There should be an awareness of creating an organisation that works as a team.
- The workers should have been provided with safe and satisfactory working condition.

## **Necessity Of Construction Management**

Construction management is necessary for the following causes.

- There can be proper co-ordination between agencies and categories of persons using the modern technique of equipment.
- The working quality and speed of work can be improved by using modern equipments of construction.
- The completion of work can be done in the minimum possible time duration

## **1.2 Functions Of Construction Management**

The following are the functions of construction management.

- Planning
- Organising
- Staffing.
- Directing
- Controlling
- Co-ordinating
- Communicating.

### **Planning**

- It is done in the office.
  - Planning is a process which involves “Thinking before doing”.
  - Time needed to complete the whole construction project.
  - Type, quantity and exact time for delivery of materials of construction.
  - Type, number and duration of use of different machines and equipments.
  - Category of staff i.e., Managers, skilled and unskilled workers required.
  - Type of uncertainties likely to cause delays such as weather conditions, shortage of supply, labour unrest and sub-judice land matter etc.
- WHAT TO DO
  - WHEN TO DO
  - HOW TO DO
  - WHO TO DO

## **Organising**

After the planning is in place, a manager needs to organize her team and materials according to her plan. This process involves:

- To identify the work to perform.
- To classify or group the work.
- To assign these group of activities to individuals.
- To delegate authority and fix responsibility.

The organisation structure should be simple and flexible.

## **Staffing**

- Staffing is filling the position in the organisation structure for defining recruitments.
- It is a very important responsibility to select right person for right jobs in a construction organisation.
- Staffing is not only about the recruitment but also their training and developing activities.

## **Directing**

- A manager needs to do more than just plan, organize, and staff her team to achieve a goal.
- She must also lead.
- Leading involves motivating, communicating, guiding, and encouraging.
- It requires the manager to coach, assist, and problem solve with employees.

## **Controlling**

- After the other elements are in place, a manager's job is not finished.
- He needs to continuously check results against goals and take any corrective actions necessary to make sure that his area's plans remain on track.
- It is an important action for ensuring effective and efficient working.
- It reviews the work plan to check and rectify the deviation.

## **Co-ordinating**

- It means developing harmony between employees and group of employees for smooth and efficient functioning of construction work.
- The work is divided into different departments in the large organisation. So there is a great importance for good coordination.

## **Communicating**

- It is a process of transmitting receiving and understanding the ideas by others for the purpose of effective desired results.
- There are various methods of communication like verbal, written orders, reports etc.
- Ineffective communication leads to confusion and misunderstanding etc.

## **1.3 The Construction Team Components**

### **Owner**

- The owner of a construction project may be an individual, group of individuals or public body.
- The owner finances the project and also recognises the need for a project.
- In view of all aspects the owner has the power to take major decisions regarding managerial, financial and administrative aspects.

### **Contractor**

- The contractor executes various types of works and also makes necessary arrangements for labour, machinery, materials, in order to complete the project in the limited scheduled time.
- In some projects, the contractor may appoint sub-contractor.
- There is a rate or bid between Contractor & owner before starting any project.

### **Engineer & Architect**

- Architecture is to assess the clients fundamental requirements.
- Architecture/Engineer supervises the construction of the project.
- He then prepares plans and designs the project for the owner.



- He deals with the contractor on behalf of the owner.
- He estimates the cost of the work to be done & quantity surveys.
- He prepared the bill of quantity (BOQ) and tender documents before tendering.
- He works as an advisor and helps in solving problems which arise during the progress of work.
- He prepares the final account on completion of the project.

## **1.4 Resources For Construction Management**

### **Money**

- Money is the first and foremost requirement for any project.
- It should be arranged before starting any construction project for smooth implementation of a project.
- If the financial resources are insufficient then the project will not be completed within the specified time.

### **Material**

- Sufficient quantity of materials required for the completion of any project and should also be available at the site.
- Materials required for project are estimated before starting the project.
- For example- bricks , cement ,stones ,timber ,water supply, electrical fitting etc.

### **Machine**

- Different types of machineries and equipments are required for any construction work.
- Although the cost of machinery is high but it works continuously under any adverse situation & it also reduces the high requirement of manpower.
- For example: Mixers, tractors, pumps, cranes, generators etc.

### **Manpower**

- Manpower is an important factor for successful completion of any project.
- It may be both skilled and unskilled.
- Man power deals with engineers, architects, supervisors, repair technicians, skilled or unskilled labour etc.

## **CHAPTER-2 CONSTRUCTION PLANNING**

- Objective of Construction Planning
- Work Breakdown Structure
- Construction Scheduling
- Classification of Construction Scheduling
- Methods of Construction Scheduling
- Bar Chart
- Bar Chart of a Residential Building

### **2.1 Importance of Construction Planning**

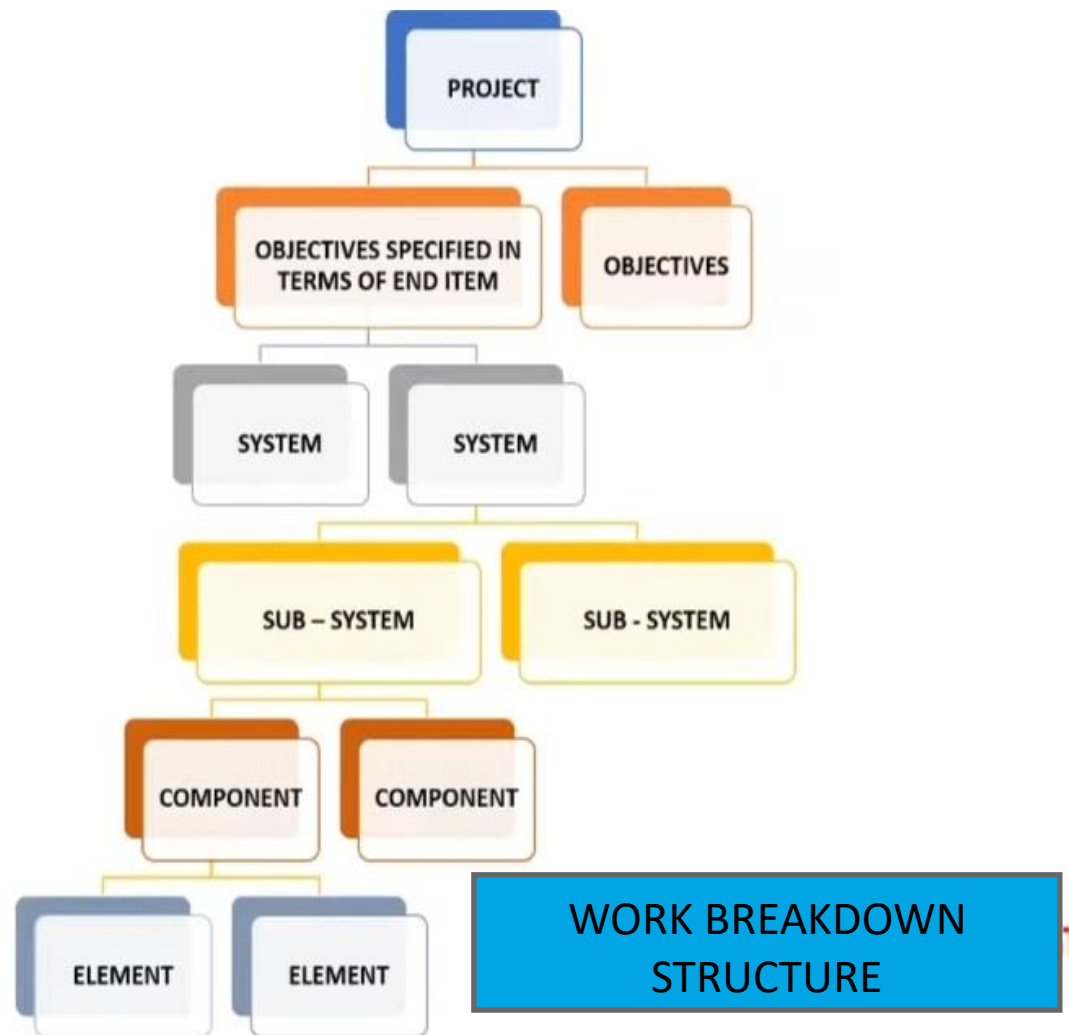
Importances of construction planning are as follows.

- The work may be completed within the scheduled time.
- The work may be executed most economically.
- The work will be both qualitative & quantitative.
- There shall be minimum wastage during construction work.
- The work should be completed as per specification.
- There will be a minimum cost of maintenance of machinery & equipment.
- There will be optimum use of available resources.
- Controlling of construction activities can be possible.

### **2.2 Work Breakdown Structure(WBS)**

- It is the preliminary diagram which showing the breaking down a project into sub-systems and each sub-systems into major components and discrete activities.
- In WBS, top-down approach to planning is adopted. Such an approach ensures that the total project is fully planned and all derivative plan contribute directly to the desired end objectives.
- WBS aids in the identification of objectives and allows the planner to see the total picture of the project.

- WBS is developed by considering the end objective and breaking it into smaller manageable units on the basis of size, duration and responsibility.



## **2.3 Stages of Construction Planning**

Construction planning can be divided in the two following stages.

1. Pre-tender stage
2. Post-tender stage/contract stage

### **1. Pre-tender stage**

- The pre tender planning is carried out by the contractor after the receipt of tender notice and before submitting the tender paper.

- In this stage, the contractor plans his best method of construction for the future contract & also makes plans & programmes for carrying out the work.
- At this stage, contractor prepares himself for completing the work in the stipulated time.
- This is an important stage for a contractor to see whether the contract is profitable or not.
- The first part of pre-tender planning is to visit to the site before a contract is undertaken.
- The pre-tender planning report by visiting to the site of construction works represents total information about the site such as geography of the area, local weather records & availability of resources.

### **Steps:**

- At first, there should be a careful study of tender documents, drawing and specifications to identify the quantities of each item of work.
- Also there should be a careful study of tender document about the time limit, i.e. the project should be completed within the stipulated period of time.
- There should be a site investigation and survey to determine the rate and availability of resources.
- The availability of required materials near site of work should be determined & if not, also how these can be procured economically.
- The selection of most suitable and economical method should be carefully determined for executing the work.
- The quantities of different items should be estimated.
- The overhead and the margin of profit should be decided & tender price finalized for the completion of the work within the stipulated period of time.

### **Post-tender Stage**

- This stage is otherwise called as contract stage.
- This stage is starts after the acceptance of tender and extends till the completion of the contract.

- At this stage, contractor fully utilizes the pre-tender stage planning to organize the various activities of construction work so that the work may be completed within the scheduled time economically without delay & difficulties.
- Improper & inadequate planning at this stage may cause heavy loss of money & time.

### **Steps:**

- The selection of most suitable & economical method out of all the alternative methods considered at pre-tender stage should be carefully determined for execution of the work.
- The quantity of materials required at each stage of the work, locating sources of their supplies, their comparative cost from different sources should be worked out properly.
- Inter-relationship of various items of work should be studied and the proper sequence of operation is finalized.
- The requirement of construction labour, supervisory and managerial staffs should be finalized and their selection & recruitment should be arranged.
- Total number of requirement of machinery & equipments at various stages of work should be worked out & arranged.
- Repairing & maintenance of machinery & equipment should be properly arranged.
- Accommodation for labour & staff along with the facilities required for them , temporary camp, office etc. should be planned & arranged properly.
- The work programme of each work should be decided & its starting & completing date also be finalized.
- A good communication system between the members of construction team should be established for the smooth running of project work.

## **2.4 Construction Scheduling**

- Scheduling of a project is done after it is properly planned.
- A schedule for construction activity is a graphical representation which determines the time of starting and completing date of each activity in order to complete the whole construction project.
- In other words scheduling is the time table for executing each and every activity with its fixed starting and finishing date.

## **Preparation of construction schedule**

- At first the whole project is divided into a small number of operations.
- Then the inter-dependence among or between the operations are carefully studied and their sequence is decided.
- The quantity of work is to be determined which is to be done in each operation.
- The total time to complete each operation & total project is determined.

## **Classification of Scheduling**

Schedules can be classified into various groups such as;

- Material Schedule
- Labour Schedule
- Equipment Schedule
- Financial Schedule

### **Material Schedule**

- This type of schedule is prepared for moving and storing of material in advance before starting of construction schedule acts as a guide for preparing materials schedule.
- This schedule is done to avoid delay in the execution of the work.
- The materials should be delivered at site at least one week before its use.
- The materials at site should not remain unused for long.
- If the materials stored at site long before its use, it is likely to deteriorate in quality.
- For example cement made its strength by 50% if stored for 6 months and steel may be attacked by corrosion due to long storage at site.

### **Labour Schedule**

- The labour schedule is prepared for deciding the actual number of skilled and unskilled labour which is required for the construction work.
- With the help of this schedule required labour can be arranged in time.

- It helps in reducing labour cost.
- Labour schedule is important as it is difficult and costly to arrange skilled labour as and when required.

### **Equipment Schedule**

- This type of schedule is prepared to decide the type and quantity of equipments as also on which date the equipment will be needed. So that they can be arranged when requirement.
- The aim of this schedule is to derive maximum advantage of the equipment when it is required and remove it from the site when the job is over.

### **Financial Schedule**

- Financial schedule is prepared to estimate the amount of money that owner or contractor has to spend as finance for the project work.
- In maximum construction project the owner will pay a stated percentage of the value to the contractor for the completion of work in each month. it is about 90% of the cost at the completion of the work & rest 10% is retained.

### **Finance for small works:**

- The estimated amount of money, which the owner or contractor has to provide to finance the project can be obtained from construction schedule.
- In most of the cases of construction contracts, it is specified that the owner will pay about 90% cost of the completed work during each month for each job to the contractor.

## **2.5 Method of Scheduling**

Depending upon the size of the project, scheduling is done by different methods.

1. Bar chart or gnatt charts.
2. Network analysis (CPM ,PERT)

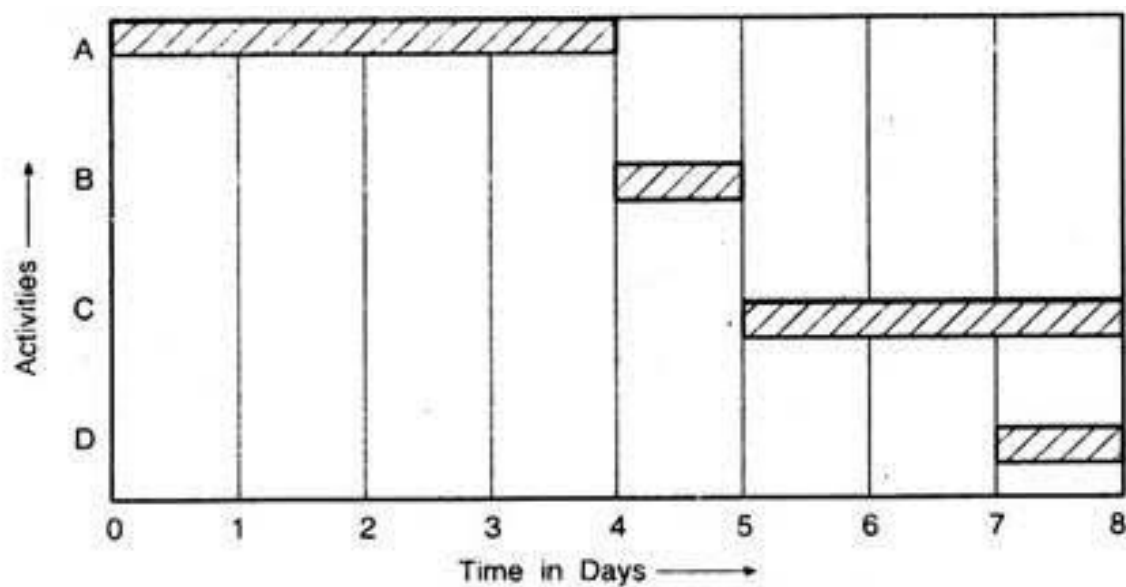
## **BAR CHARTS**

- Bar chart is a graphical representation of various activities , their duration, start and period of a project.
- This method was developed by Henry Gantt around 1900.
- In a bar chart, there are two co-ordinate axes, i.e. x-axis (Horizontal) & y-axis (Vertical).
- Along x-axis, time required for the completion of work is represented & along y-axis, the activities are represented.
- In a bar chart, the activities are represented by thick crossed horizontal lines.
- Time required for completion of the activity may be represented in days or weeks.
- This chart is known as bar chart because the activities are represented by number of parallel bars in it.
- The length of each bar indicate the duration of time required to complete a particular activity.
- The bar chart/gantt chart represents the schedule of a project.
- Also bar chart represents the actual progress of the work by thick dark bars.
- A daily record should be maintained by the supervisor about the progress of the work and handed over it to the sectional officer who in turn will handover it to chief-supervisor or engineer for finalizing it, so that the progress of the work can be completed within a particular period of time.
- So a bar chart gives a clearer picture of the progress of work without study any detailed report.
- We can also check the accuracy of work and can compare the actual progress of work with the schedule.



## Steps in preparing a bar chart

- In preparing a construction schedule by bar chart, at first the project is sub divided into various objectives.
- Name the various activities in a list.
- Determine the inter-relationship among the activities.
- Arranging the activities in a systematic manner one after another.
- Determine the quantity of work & requirement of time to complete the work.
- Then draw the bar chart.

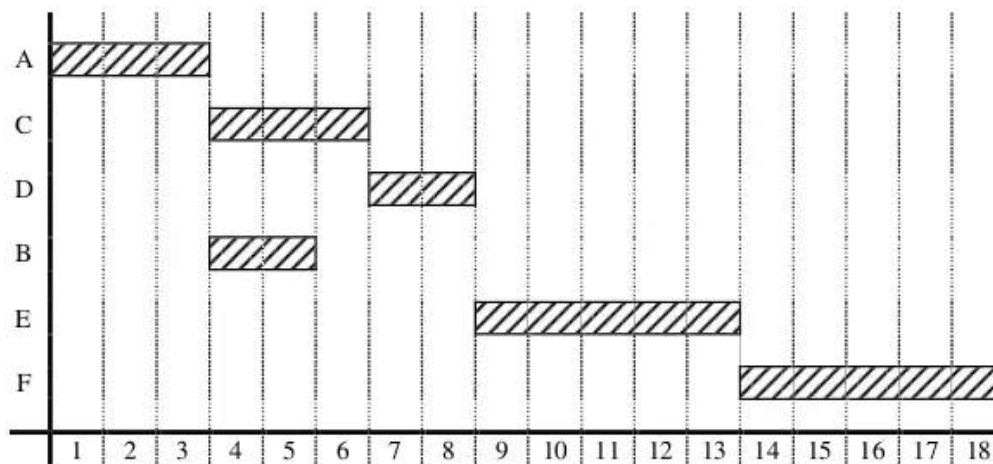


## Bar chart of a residential building

- Example:

Activity ID	Activity Description	Dependency	Duration
A	Excavation	–	3
C	Foundation	A	3
D	Column	B, C	2
B	Moving the soil out	A	2
E	Wall	C, D	5
F	Roof	E, D	5

## Solution



### Advantages of Bar Chart

- Very graphical.
- Easy to understand.
- Most widely used .
- There is no requirement of trained or skilled persons to draw this chart.

## **Disadvantages of Bar Chart**

- a) Difficult to update.
- b) Difficult to find the critical path.
- c) Difficult to setup and maintain a large project because it is essentially a manual graphical procedure.

## **2.6 Limitations of Bar Chart**

- a) If the time schedule is changed, then it is difficult to readjust the length & position of the bar.
- b) Bar chart can only be applicable for small projects but not suitable for large projects.
- c) The bar chart doesn't show clearly the inter-dependence among the various activities.
- d) The bar chart doesn't show the actual progress of the work as it only represents the estimate time. So the actual progress of the work can not be monitored.
- e) The bar chart gives no idea about the maximum progress necessary for its completion. It gives the information only about the rate of progress.
- f) The bar chart does not help the work of controlling, monitoring and updating the project.

These limitations of bar chart may be discussed under the following heads.

### **a) Inability to show interdependency of activities**

The bar charts fails to indicate clearly the interdependencies among such activities of course, simply drawing the bars of activities, parallel to each other, does not provide complete idea whether they are related/independent or completely independent. Interdependency means one work cannot be started before completing the previous work.

### **b) Inability to indicate the project progress**

A bar chart cannot be used as a control device since, it does not indicate the progress of the project.

### **c)Inability to accommodate uncertainties**

This is the most important limitation of bar chart because it cannot effect the uncertainties or tolerance in the time schedule of various activities of the project.

Example: Research work

## **2.7 NETWORK ANALYSIS(CPM,PERT)**

**Network:** symbolic representation of essential characteristic of a project. In other words, the phase diagram or sequential arrangement of various events and activities.

### **CPM(Critical Path Method)**

- CPM is an activity oriented network i.e. based on deterministic approach.
- Usually suitable for repetitive type projects like those of construction, manufacturing & maintenance.
- Example:
  - a) Manufacturing of a new car
  - b) Build a new bridge over a river
  - c) Construction of a multi-storey building
- With the help of CPM, a planning engineer comes to know the sequence to various activities of the project.

### **Different terms used in CPM**

#### **EVENT**

- An event is either start or completion of an activity.
- It doesn't require time or resources.
- It is represented by node usually circle.

#### **ACTIVITY**

- It is actual performance of a task required for completion of the project.
- It consumes time and resources.
- It is represented by an arrow on the network.

- The tail of the arrow indicating the start of the activities & head indicating the end of the activity.

### **DUMMY ACTIVITY**

- This activity neither uses any resource nor any time for its completion but is required in the logical sequence of network is called a dummy activity.
- It may be represented by a dotted arrow or solid arrow with zero time duration.

**Early Start Time(EST):-**The earliest possible time at which an activity may start is called its early start time.

**Early Finish Time(EFT):-**It is the sum of EST of an activity and time required for its completion i.e.  $EFT = EST + t$

**Late Start Time (LST):-**The latest possible time at which an activity may start without delaying the date of the project.

**Late Finish Time(LFT):-** The sum of LFT of an activity and the time required for its completion i.e.  $LFT = LST + t$ .

**Total Float:-**The difference between the maximum time allowed for an activity and estimated duration is called total float. It is the duration of time by which an activity can be start late , without disturbing the total project schedule.

**Free Float:-** The duration of time by which the completion of time of an activity can be delayed without affecting the start of the succeeding activity.

**Critical Activities:-** The activities with zero float are called critical activities, which are required to be completed on schedule.

**Critical Events:-** The start and end points of critical activities.

**Critical Path:-** The path of network joining the critical events along with no float is called critical path of network.

## **Programme Evaluation and Review Technique (PERT) :-**

- It is an event oriented network, developed by U.S. Navy
- It is more accurate than CPM.
- It is preferred for projects that are non-repetitive and in which time for various activities cannot be precisely pre-determined.
- It is a probabilistic model.
- It follows non deterministic approach.

### **Example:-**

- Launching of a satellite.
- Research & Development of a new project.

## **Different terms used in PERT:-**

### **1. Optimistic time:-**

- The minimum possible time which an activity requires for its completion under ideal condition is called optimistic time.
- It does not include any type of delay at any stage.
- It is denoted by " $t_o$ ".

### **2. Pessimistic time:-**

- The maximum time that may be taken by an activity if there is delay at every stage except natural calamities like earthquake, flood etc. is called pessimistic time.
- It is denoted by " $t_p$ ".

### **3. Most likely time:-**

- The most realistic estimate of time which an activity may take for its completion under normal condition is called most likely time.
- It is denoted by " $t_m$ ".

#### **4. Expected time:-**

It is taken as the weighted average of the time estimates i.e optimistic time, pessimistic time and most likely time.

- It is denoted by “ $t_e$ ”.

$$t_e = \frac{t_o + 4t_m + t_p}{6}$$

#### **5. Earliest expected time( $T_E$ )**

- The earliest expected completion time of event is equal to the sum of the expected times of the preceding activities.

#### **6. Latest allowable time( $T_L$ )**

- The latest possible time an event can take without delaying the final completion date of the project is called latest allowable time.

#### **7. Slack time**

$$\text{Slack} = T_L - T_E$$

#### **8. Length of the Project**

- The sum of the expected times of all the activities along the critical path of the network of a project.

#### **9. Variance of an activity**

$$V_i = \frac{(t_p - t_o)^2}{6}$$

#### **10. Standard deviation of an activity**

$$S_i = \frac{(t_p - t_o)}{6}$$

#### **11. Variance of the project**

- The sum of the variances of all the activities along the critical path is called the variance of the project.

#### **12. Standard deviation of the project**

- The square root of the total variance of a project which is calculated along the critical path of its network is called standard deviation of the project.

## **Difference between CPM & PERT**

<b>SL No.</b>	<b>PERT</b>	<b>CPM</b>
1.	Its full form is Project Evaluation and Review Technique.	Its full form is Critical Path Method.
2.	It is event oriented technique.	It is activity oriented technique.
3.	It is a probabilistic model.	It is a deterministic model.
4.	Based upon 3 time estimates to complete an activity.	Based upon single time estimate to complete an activity.
5.	Nature of the job is non-repetitive in nature.	Nature of the job is repetitive in nature
6.	It has Non-repetitive nature of job.	It has repetitive nature of job.
7.	There is no chance of crashing as there is no certainty of time.	There may be crashing because of certain time boundary.
8.	It doesn't use any dummy activities.	It uses dummy activities for representing sequence of activities.



## **CHAPTER-3 MATERIAL & STORE MANAGEMENT**

- Introduction and Objective
- Classification of store-storage of stock
- Issue of materials (indent, invoice , bin card)
- Stores accounting procedures
- Inspection of stores
- Procedure of write off

### **INTRODUCTION**

- Material management is an integral function of different sections of the organisation.
- It deals with the supply of material and other related activities and aims at minimum expenditure on materials.
- Material management deals with the overall activities of materials such as type, amount , movement, purchase ,location ,timing of various materials which are used in an organisation. So store and material management is an integral function of different sections of the organisation.

### **OBJECTIVES OF MATERIALS MANAGEMENT**

- To select the right quality
- To meet the production requirements
- Selection of suppliers
- Limit the wastages
- Product enhancement
- Standardization Process
- Minimizes the cost of production

#### **3.1 Classification of stores**

Stores can be divided into four categories according to public work department.

1. Stock
2. Tool and plants

3. Road metals

4. Material charged directly to works.

## **Stock**

- The stock is the store which is required for general work and kept under suspense head and finally issued for the work.
- The items which are in common use in the construction activity for the execution of different works are kept in stores.
- Such materials of general use such as cement, timber , bricks ,aggregates, steels, paints etc are kept in store are called as stock.

## **Reserve stock limit**

- The maximum amount of materials that can be kept in a stock in a division is fixed and is known as the reserve stock limit.
- The limit is fixed by the Government keeping into consideration the normal requirements of stock in the division.
- The reserve stock limit can be increased during the period of special urgency, This increased limit is termed as temporary reserve limit.

## **Subhead of stocks**

The various materials of similar nature grouped under different heads to facilitate the proper maintenance of stock account are known as sub-head of stock .

The following are some of various sub heads of stocks

1. Small stores (like nails, screws, hinges, bolts, etc.).
2. Building materials (like cement, aggregates, bricks, lime, etc.).
3. Timber (like deodar, chirr, plywood, sal, teak, plywood etc.).
4. Metals (like metal steel bars, rolled steel sections etc )
5. Fuel (like kerosene, fuel wood, fire wood, coal, etc.).

6. Painter's stores (like paints, varnishes, linseed oil, turpentine oil etc.).
7. House fittings (like bathroom fittings, wash basin, mirror etc.).
8. Miscellaneous stores (like basket, empty bags, drums etc.)
9. Lands, kilns, etc. (like coal, machinery sheets, moulds etc.)
10. Manufacture (i.e. manufacturing in Government workshops).
11. Storage (i.e. payment made to chokidar, rent of go down etc.)

### **3.2 Issue of materials**

- The store keeper can issue the materials to different departments upon the receipt of a withdrawal form with proper authority and it is called as material issue requisition form.
- Depending upon the nature and amount of material to be withdrawn from stores the material requisition is prepared in duplicate by the manager.
- Both the copies are sent to the store keeper who issues and records the materials distributed.

### **Indent and Invoice**

- Materials are issued from stock on demand in proper form called indent form.
- Indent form consist in triplicate of counter foil, indent and invoice.
- The counter foils and indents part of the indent form filled by the Indenting officer.
- Then this form with blank invoice sent to the issuing officer in charge of the stock who issues the stores as per availability of stock.
- Then the issuing officer corrects the indent and fills up the invoice.
- Then the issuing officer sends it back to the indenting officer to sign the invoice and they return it to him as an acknowledgement.

### **Rules for preparing indent and invoice**

- There should be description of unit of supply and quantity of material indented written clearly.

- The cost of materials of the head of account should be specified.
- The name of work should be given when the material is issued.
- Full details of department , division and any other person for which the material is issued should be given.

### **Bin Card**

- Bin card is a card which maintains the details of quantities of each type of material received, issued and on hand each day.
- The material and other items are kept in appropriate bins, drawers etc.
- The store keeper maintains the record on a Bin Card. A bin or shelf is attached to each bin card.
- Bin cards are made in duplicate. One is attached to the bin and another is for the store keeper.

### **Procedure for store accounting**

#### **Final head**

The cost of acquisition of stores is debited to the particular work for which they are required. This is known as final head of account.

#### **Suspense head**

- Suspense head includes the temporary booking of expenditure incurred for the purchasing of materials for the execution of work is debited to the minor head i.e. suspense expenditure.
- The procedure for store accounting is done separately for various classes of stores such as stock, tools and plants, road metals and other miscellaneous material.
- When the stock is placed then the store is debited to suspense head .When the stock material is issued for the execution of a particular work then it is debited to the final head.
- The supply of tools and plants in the division and its expenditure is debited to the minor head sometimes for general use special items of tools and plants are not required but for a specific work they are debited to that work.

- For certain road the road metal is required for the construction its cost is debited to the estimate of that road construction and once the road metal is required for the maintenance of the road it is debited to the sub head under minor head.
- Similarly for other materials if the materials are purchased for general requirement then the cost is debited to the suspense head.
- The initial account of all receipt and issues is maintained by the section officer.
- After closing the monthly account section officer forwards its to the sub divisional office.

## **Physical Verification And Inspection of stores**

### **Necessity**

Inspection of stores and its physical verification is essential for fulfilment of following.

- To ensure the correctness of stock held by comparing them with the balance shown in the store ledger or bin cards.
- To avoid shortage of materials in the stock.
- To check losses in inventory due to pilferage, improper storage or misplacement, deterioration etc.
- To correct and update store records.
- To calculate the values of the stock carried for the balance sheet and profit and loss account.
- To calculate the rate of turn-over of an item.
- To ensure maximum economy in stock carrying.

### **Method of Physical Stock Verification**

1. Annual physical Verification
2. Perpetual Inventory and Continuous Stock Taking System.

### **Annual physical verification**

The following procedure is adopted for carrying out the annual physical verification.

- i) By the end of the year, the stores are closed for a few days; no material etc. is issued to any project work/shop in the plant. In case it leads to plant shut down,

the activities such as repair and over hauling of equipment and machineries are resorted to.

- ii) A team of stores inspectors or stores verifying officers physically check and count each and every item lying in the entire store. It is tallied with the quantities marked on bin cards and store ledgers.
- iii) Step (ii) above may lead to the formation of a list of surplus and short items. Damaged and obsolete items may also be traced and recorded.
- iv) Inspectors check a number of items every day as per a pre planned schedule and finish the complete work within a few days.

Advantages in the sense that all the items are checked at one time so there is no confusion about any item being left unchecked.

### **Perpetual inventory and continuous stock taking**

Perpetual inventory and continuous stock taking system is a more appropriated method for large plant with huge inventories which records store balances after every receipt and issue and facilitates regular checking.

- i) Under this system, store items are checked continuously throughout the year; a number of items are counted daily or at frequent intervals and compared with the bin cards and stores ledger.
- ii) Discrepancies found if any, owing to in correct entries, breakage, pilferage, over issue, placing of items in the wrong bin etc. are investigated and corrected accordingly.
- iii) This method is less costly.
- iv) In this method only few items are required to check every day as compared to annual physical verification.

### **Procedure for write off**

- The articles of tools and plants get worn out by continuous use and become unserviceable. They can be written off only with the approval of the competent authority. A survey report of all the unserviceable articles is prepared on D.F.R. (P.W.)-15 giving full particulars of their value, date of purchase and reasons for their becoming unserviceable.

- The survey report is submitted to the competent authority for approval. As a general practice, the articles which are written off are destroyed in presence of a gazette officer.
- As regards the articles of stock, which get deteriorated, an estimate for the loss of stock is prepared. The tools and plants articles are written off after preparation of survey report.
- DFR- Document Filing and Retrieval Form

### **Example**

Prepare a Write off in respect of following Articles of tools and plants.

- Name of the sub division- Killamaidan
- Name of the Division and Circle-Cuttack
- 10 no's, of metallic tapes 30m purchased on 6.5.2004 for Rs. 5000/ 04 nos. of brass pad locks 7.5cm size purchased on 2.6.1999 for Rs. 1200/
- 1 time piece (Ajanta Make) purchased for rest house OMP square on 3.10.2006 400/ these articles became unserviceable through fair wear and tear.

### **NOTE:**

#### **What is Cost Index?**

- Cost index is a simple device which shows the relative changes in the cost of specific or group of items over a certain period of time.

#### **Difference between store ledger and bin card:-**

<b>Bin card</b>	<b>Store ledger</b>
It implies a quantity record of the receipts, issue & balance of materials in stores.	It implies to a subsidiary ledger, that keeps track of each and every transaction relating to the materials in the stores.
Kept inside the stock room.	Kept outside the stock room.
Contains quantitative details only.	Contains both quantitative and monetary details.
Transactions are recorded individually.	Summarized transactions are recorded.

## **CH-4 CONSTRUCTION SITE MANAGEMENT**

### **4.1 Job Layout:**

Job layout is drawing the prepared plan of construction site by the site engineer in-charge of the project. The arrangements made at the construction site for different camps and the area around it is known as job layout.

OR

Job layout is a scaled diagram of the proposed construction site showing all the relevant features such as, Entry point , Exit point Storage areas of materials, Temporary services Contractor's site office Areas for keeping equipments such as mixers Bar bending area , Labour Housing etc.

### **Objective of preparing job layout**

Following are the objective of job layout.

- It saves time in delivering the construction materials at the site.
- The best method of working may be adopted.
- It helps to complete the work within the minimum use of equipments.
- The maximum output from labour and machines can be taken.
- It provides safety to the workers.
- It helps to avoid damage to the nearby properties due to construction work.
- It plans for the construction materials to be placed as near as possible to the work.

### **Review Plan**

- Before preparing a job layout the details of different plans for the execution of the work should be studied carefully.
- Site plan
- Working drawing
- Specification



## **Site plan**

The site plan shows the following details.

- The boundaries of the site
- The adjacent area of the boundary of the construction site.
- Location of any existing building standing near site.
- Space left around the building to secure ventilation or free air condition.
- Space left around the building for cleaning and admission of light.
- Position of any natural drains, rivers, Wells located near the site.
- Any other information which are considered to be necessary.

## **Working drawing**

- The working drawing consists of the building plans and other works to be constructed at the site. The working drawing includes;
  - Floor plan of the building with covered area ,size of the room, opening of doors & windows, structural members, staircase ,lifts Etc.
  - Elevation of all sides are shown.
  - Indication of direction of North line in the plan of buildings.
  - Indication of rejected persons beyond the permissible building line.
  - Locating exactly of the essential services like Water closet ,sink , bath etc
  - Showing sectional details drawing of footing thickness of work current slabs with their material.

## **Specifications**

Specification indicates the details of the types and grade of the material to be used in construction work. It is an important document in the construction industry which helps the designer to communicate his thought and ideas to the other construction team members.

## **Types of Specifications:**

**Standard Specification:-**The Specification prepared for the general use of trade e.g. Indian standard specification.

**Outline Specification:-**These are the specifications used at the time of bidding & prepared usually to accompany the preliminary drawings of the work. It provides the basic information about the type & grade of the materials to be used for construction work.

**Project Specification:-** It is prepared for a particular project taking into account for the special requirement.

**Guide Specification:-** It is prepared to guide the specification which is prepared the project originally.

**Manufacturer's Specification:-** These are the specifications which are prepared by the manufacturers to specify the quality of the product manufactured by them.

## **Use Of Specification:**

- To prepare the estimate for submission of tender.
- It is useful for the contractor to order the materials for executing the work.

## **Factors influencing selection ,design& layout at construction site:**

- i. Nature of the project
- ii. Location of project
- iii. Services
- iv. Availability of material & equipments
- v. Availability of manpower
- vi. Medical facility
- vii. Availability of space
- viii. Other miscellaneous factors

### **I) Nature of the project**

The nature of the project plays an important role in its layout process. The camp layout depends on the nature and types of project. For example the layout of camp for a highway construction project will differ from that of a building.

### **II) Location of project**

Location of the project also plays an important role in job layout plans. The location of the project should be properly chosen such that there will be no difficulty for any type of transportation. So transportation facility to the construction site is an important factor for job layout.

### **III) Services**

There should be proper service of water supply , sanitation and electricity. If these services are not available then it will be badly affect the job layout.

### **IV) Availablity of Material & Equipments**

There should be sufficient availability of materials and equipments at the construction site. If the materials and equipments are not available locally then it will create problem in storage which will affect the shape of job layout.

### **V) Medical facility**

If the project is for a long time it is essential to have a field medical aid facility for the workers.

## **VI) Availability of man power**

Man power is an important resource in any construction site. The arrangement of manpower at construction site should be made locally otherwise it will be a great difficulty for their shelter . So labour should be arranged locally.

## **VII) Availability of Space**

If less space available at the construction site, then it will be difficult for job layout because the storage should have to be located nearest to the working site such that the regular supply of material & equipment is possible as required.

## **VIII) Other miscellaneous factors**

There should be availability of education facilities like schooling for the children of labours and staff , daily necessities of life and other welfare facilities for the workers. If these facilities are not available then it will also tend to change the layout of the project.

## **Layout of equipments**

These are some of the points which are to be considered at the time of preparing layout of equipments.

- The equipments should be placed as near as to the place of materials.
- The maintenance, repairing & fuel filling of equipments should be arranged at the construction site.
- There should be arrangement of security staff for the safety of machinery.
- For removal & shifting of equipments to work place, there should be availability of sufficient space.
- There should be adequate space available for parking of the transport vehicles.
- Temporary sheds should be provided to safe guard the costly equipments from any type of weather condition.
- The main entrance of the project work & the main office of the establishment should be nearer to each other ,so that no visitors have to cross the work site.
- No materials can pass out of the project work without the proper check by the security check posts.
- There should be provision of adequate safety measures and fire prevention equipments in the work site.

## **4.2 Locaton of Equipment**

### **Why equipments are required?**

- As there is a increased cost of labour, the use of more & more mechanical equipments becomes necessary for construction work because the availability of manpower is not sufficient for the completion of construction work within stipulated time, so it is essential to use mechanical equipments along with the available manpower for the construction activity.
- It is essential to choose correct and well operated equipments for a construction project.
- It is not possible for any owner or contractor to purchase all types of equipments which are needed for the job.
- So the owner or contractor may purchase some of the equipments and some other they will hire.

For location of the equipments following points are to be considered.

- (i) Equipments should be nearer to the construction work.
- (ii) Equipments should be near to the materials.
- (iii) The owned equipments may be provided near the entrance so that there will be no requirement of any additional guard.
- (iv) The hired equipments should be placed in suitable places.
- (v) There should be provision for the repair of the equipments.

### **Organising labour at site**

- Organizing labour properly at the working site is an important responsibility of the supervisory staffs.
- The labours are divided into different groups by the supervisor under the guidance of effective leader who has the quality to control the labours.
- In any construction work, the labours are divided into groups with the instructions for different works.
- So, labour organising should be done by the supervisor in such a way that there will be no wastage of manpower.

There are some points which are to be considered while organising labour at construction site.

- Supply of material should be sufficient as per requirement of labour.
- Labour supply should be uninterrupted.
- The materials should be taken once for the whole day from the godown. It reduces the frequent movement of labour.
- Increasing and decreasing of labour should be done as per necessity.
- To avoid wastage of time of labour, minimum facilities should be made available at the site.
- Drinking water facility should be made available at the site to save time of the labourers.
- A record should be maintained about the progress of the labour.
- Record maintenance will help to compare the progress of work with the completion of work at right time.

### **4.3 Job layout for different construction site**

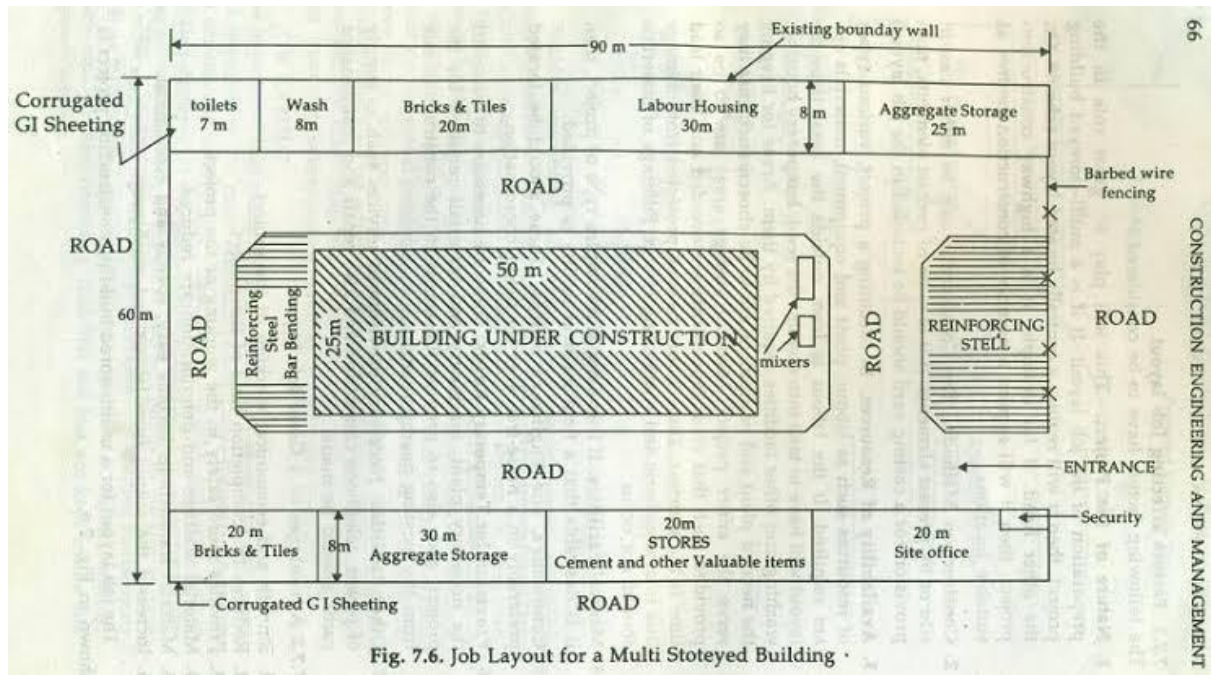
#### **Preparation of job layout:**

- The construction plans, specifications, contract documents and other available material describing the job should be studied carefully in order to get the idea of the nature and extent of the work.
- A scaled drawing with a scale of 1 in 100 should be prepared showing the outline of the work or job to be constructed.
- Also the position of entry and exit points as well as the areas of temporary facilities should be marked on it.

Moreover following information should be collected from the above study.

- Area needed for accommodation: This area includes the area required for office, stores and residential accommodation for officers, staff and labour.
- Area required for machines, sheds, repair shops and workshops etc.
- Area for security and fire fighting facilities.
- Area required for construction work.
- Area for miscellaneous amenities such as canteen, toilets, dispensary etc.
- Length of period for which area may be available.

## Job layout plans of multi-storeyed building



### 4.4 Principles of storing materials at site

The materials should be stored in proper manner at the construction site.

- Materials should be stored at construction site so as to prevent mixing of foreign matter.
- Materials should be stored in such a manner as to protect it from any weathering agent like rain, sun and wind.
- Materials which are suspected to get fire easily should be prevented from fire hazards i.e. the products like petroleum & explosives should be stored properly.
- Precast beams, pieces of timber and slabs which are likely to be affected by the soil or support should be stored with properly adopted measures.
- Materials like cement bags which are easily affected by the contact of moisture are to be stored with special precautions.
- The materials regularly used is to be placed relatively nearer to the place of use.

g) There should be a proper arrangement of fire-extinguisher & fire buckets wherever necessary for the safety measure.



