CIVIL ENGINEERING

Construction Practice, Planning and Management

Comprehensive Theory
with Solved Examples *and* Practice Questions

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Construction Practice, Planning & Management

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CHAPTER

1

Basics of Construction Management

1.1 INTRODUCTION

1.1.1 Project

A project is a temporary effort undertaken to achieve a clear goal or objective within specific constraints of time and resources.

1.1.2 Project Management

It is an art of attaining the project objective by utilising human, material and financial resources within a specified time period.

1.1.3 Objectives of Project Management

1. A project should be completed in minimum time.
2. A project should be completed in minimum cost.
3. A project should utilise the available resources as sparingly as possible.

1.2 KEY PHASES OF PROJECT MANAGEMENT

1.2.1 Planning Phase

It involves

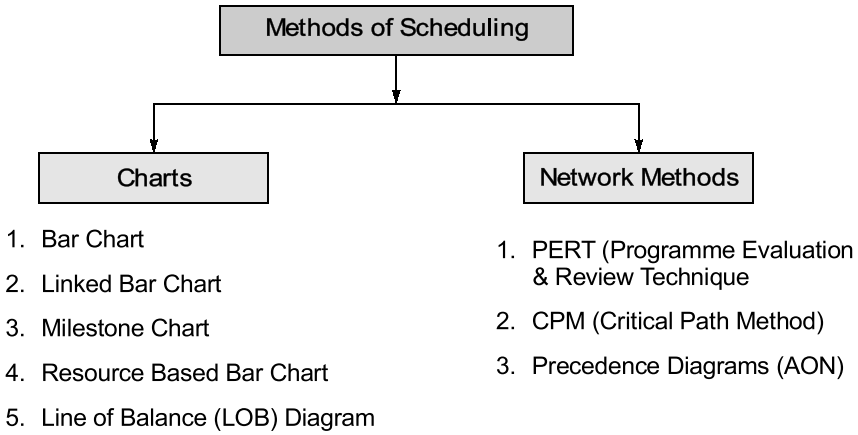
- Defining of objectives,
- Listing of jobs to be performed,
- Determining gross resource requirement.

1.2.2 Scheduling Phase

It involves

- Allocation of resources to various tasks/activities,
- Placing the tasks logically and sequentially,
- Identifying the scheduled completion time of the project.

Note: Planning and scheduling phases of project management are done even before the actual start of the project.



1.2.3 Monitoring and Controlling Phases

It is the execution of planning & scheduling. If the project deviates from its proposed plan & schedule, it helps with replanning & rescheduling, also called as Updating.

Note: A project is said to be complete only when all the activities are 100% complete.

1.3 BASICS OF CONSTRUCTION MANAGEMENT

- A construction project is an endeavor or a venture taken up by a project team on behalf of an owner or client to build a facility as per the owner or client's requirements.
- From inception to completion, the project goes through various stages.
- Each stage involves definite inputs, processes and deliverable.
- Typically, the life cycle of a project from inception to completion has the following stages:
  - **Project appraisal:** Inception, feasibility and strategic planning.
  - **Project development:** Project planning and design finalization of proposals, procurement method, construction documents along with tender drawings, fabrication drawing, cost estimate, bill of quantities etc.
  - **Construction planning:** Sequencing of project components, resource planning, time-cost-trade off etc.
  - **Tendering:** Competitive bidding, pre-qualification of agencies, issue of tender documents, bids evaluation, negotiation and award of work.
  - **Construction:** Execution, monitoring, control and acceptance of work.
  - **Commissioning and handing over:** Contract closure, financial closure, defect liability commencement, handing over etc.
- It is always required to get the project done within the specified time limit.

- Project management is essential to provide the necessary directions, coordinating the various activities involved and coordinating the responsibilities of the various stake holders of the project.
- IS 15883 (Part 2) : 2013 lays down the various construction project guidelines.

1.3.1 Types of Construction Projects

Construction projects are classified into various categories which are as given below:

1. On the basis of type of work, construction projects are classified as:
   (a) Building project
   (b) Infrastructure projects
   (c) Industrial project
   (d) Other projects
2. On the basis of project completion time, construction projects are classified as:
   (a) Long duration projects (with project duration exceeding 5 years)
   (b) Medium duration projects (with project duration 3 to 5 years)
   (c) Short duration projects (with project duration 1 to 3 years)
   (d) Special short term projects (with project duration less than 1 year)
3. On the basis of project value, construction projects are classified as:
   (a) Mega value projects
   (b) Large value projects
   (c) Medium value projects
   (d) Small value projects
4. On the basis of pace of execution, construction projects are classified as:
   (a) Fast track projects
   (b) Normal pace projects

1.3.2 Tenders and Contracts

Tender: Tender is an offer in writing to execute some specified work at certain rates, within a fixed time under some agreement. Whenever work has to be executed, tenders (i.e., offers) are invited through NIT (Notice Inviting Tender).

Contract: A contract is an agreement between the two parties to undertake a work. This agreement is enforceable by law. Thus any agreement between the two parties that is enforceable by law is called a contract.

NOTE: All contracts are agreements but all agreements are not contracts.

Offer: A proposal to perform an act or to pay an amount for that is called as **offer**.

Acceptance: It is the assent to the person to whom offer is made. A proposal when accepted becomes a promise. The party who makes the offer is called as **promisor** and the party who accepts the offer is called as **promisee**.

Essential conditions of contracts: The essential conditions that a contract must fulfill are as follows:

(a) **Competent parties:** The parties entering into the contract must be competent i.e., they must not be minor, they must not be of unsound mind and they must not be disqualified by law.

(b) **Free consent:** The parties entering into the agreement must give free consent i.e., consent is not due to coercion, fraud, mistake, misrepresentation or under influence.

(c) **Lawful subject matter:** The agreement is for a lawful consideration i.e., consideration must not be forbidden by law, must not be fraudulent and must not oppose the public policy.

(d) **Not declared void:** The agreement may satisfy all the conditions of a valid contract and must not have been expressly declared void by the law in force.

(e) **Proper and valid consideration:** It is defined as the promise to do something by a party in return of some money or other interest.

1.3.3 Types of Tender

In general, there are three types of tender viz.:

(a) **Open tender** wherein the tender is open for everyone and any one can take part in the tendering process.

(b) **Limited tender** where the offer of tender is sent to limited parties and is not open for all.

(c) **Single tender** where the tender enquiry is sent only to one party. This type of tender is generally used for certain specialized items of work for which there are very limited firms available.

1.3.4 Types of Contracts

The various types of contracts for execution of Civil Engineering works are as follows:

(a) Item rate contract

- Item rate contract is also known as unit price contract or schedule contract.
- A contractor agrees to complete the work at a predetermined rate per item or unit. In other words, the contractor agrees to complete a certain amount of work for a specified per unit of measurement.
- It is suitable for works which can be distinctly split into various items and quantities under each item can be estimated accurately.

Merits:

- This method ensures a very detailed analysis of cost and payment to the contractor and also is based upon detailed measurements of each item actually done.
- This type of contract provides greater flexibility to the project owner, as they can add or subtract items as needed, and the cost can be easily adjusted based on the actual quantities of items used.

Demerits:

- The total cost of work can only be known after completion. As such the owner may face financial difficulty if the final cost is substantially high.
- Additional staff is required to take detailed measurements of work.
- Item rate contracts require detailed tracking of quantities used and can be difficult to manage, especially for larger projects with many different items and materials.

(b) Percentage Rate Contract

- It is a type of contract where the contractor's compensation is calculated as a percentage of the total cost of the project. In other words, the contractor is paid based on a percentage of the cost of the materials, labour, and any other expenses incurred during the project.

Merits:

- Percentage rate contracts offer flexibility to the contractor as they are not bound by a fixed price. The contractor can adjust the fees based on the project's complexity and the scope of work required.
- Percentage rate contracts provide transparency in pricing as the client knows the exact percentage that the contractor will be paid. This reduces the likelihood of disputes arising from pricing issues.
- They provide an incentive for the contractor to complete the project efficiently, as they will earn more money for completing the project sooner.
- Percentage rate contract can result in cost savings for the client, as the contractor is motivated to complete the work using the most efficient and cost-effective methods possible.

Demerits:

- This type of contract can be risky for the contractor as they are responsible for all cost overruns.
- Clients have limited control over the costs of the project as they are dependent on the contractor's decisions.

(c) Lump-Sum Contract

- A Lump sum contract is a type of contract where a fixed price is agreed upon by the contractor and the client for a specific scope of work.
- Under this contract, the client pays the contractor a predetermined amount, often in installments, in exchange for the completion of the project.
- It is commonly used in construction projects where the scope of work is well defined, and client wants to avoid any cost overruns.

Merits:

- Lump-sum contract provides certainty to the owner regarding the cost of the project, which is particularly beneficial for budgeting and financing purposes.
- Detailed measurements of the work done are not required except in respect of additions and alterations.
- The contractor's profit mainly lies in the completion time. Hence for getting more profit the contractor tries to complete the work as early as possible.

Demerits:

- Lump-sum contracts can be less flexible than other types of construction contracts. Once the contract is signed, changes to the scope of work may be difficult to accommodate without additional cost.
- For any intermediate payment, the value of work done should not be less than payment being made.

(d) Labour Contract

- The contractor undertakes contract for the labour portion only excluding the materials which are arranged and supplied at the work site by the department/owner.
- The contractor engages the requisite labour and gets the workdone as per drawings and specifications.

Merits:

- The workdone through labour contract is of superior quality as better quality materials are arranged by the owner.
- The overall cost of construction may be less, as no profit is paid on the cost of materials.

Demerits:

- The owner and the department will have to remain vigilant and watch full over the materials used, the contractor may overlook the material wastage involved.
- A large storage area is required to store the various kinds of materials to be used in the construction under a constant guarding.

(e) Material Supply Contract

- In this type of contract, a contractor has to offer his rates for supply of the required quantities of materials, inclusive of all local taxes, carriage and delivery charges to the specified stores within the time limit prescribed in the tender.
- All such materials received should be examined and counted when delivery is taken.

Merits:

- Payment is very prompt, so the contractors try to take supply order at less profit, resulting in low cost of material.

Demerits:

- Constant control over quality of materials received in several batches and at different times required.

(f) Cost plus percentage rate Contract

- A cost plus percentage rate contract is a type of agreement between a client and a contractor in which the contractor is paid for their services based on a percentage of the actual cost of the project, in addition to a pre-agreed profit margin.
- Under this contract, the client agrees to pay for all of the costs of the project, such as labour, materials, and equipment, plus an additional percentage of the costs as a fee to the contractor.
- The percentage fee is typically negotiated and agreed upon by both parties prior to the start of the project.

Merits:

- The contract can be quickly drawn up and agreed and work can be completed in the shortest possible time. It is well suited during war period or calamity period when the shortest possible project time is the main criteria in place of the cost involved.
- It is particularly suitable when work can not be executed by other type of contracts due to uncertainty and fluctuations in the market rates of labour and materials.

Demerits:

- A proper control over purchase of materials and of labour shall have to be exercised by the department or the owner.

(g) Cost Plus Fixed Fee Contract

- In this type of contract, the contractor is paid by the owner an agreed fixed lump-sum and above actual cost of the work.
- This fixed fee will include overhead and profit to the contractor. The fee does not vary with actual cost of the work as in the case of cost plus percentage rate contract.

Merits:

- Since the fixed fee covers the contractor's overhead charges and profit, the contractor will try to finish the work as early as possible, so the owner gets the advantage of early completion.

Demerits:

- Close supervision and checking of delivery notes and invoices which it involves, makes it unsuitable for works where the necessary staff is not available.

(h) Cost Plus Sliding or Fluctuating fee scale contract

- A cost plus sliding or fluctuating fee scale contract is a type of contract in which a contractor is paid for the actual cost of the project, plus a sliding or fluctuating fee that is based on the final cost of the project.
- In addition to the actual costs, the contractor is paid a fee that is based on percentage of the final cost of the project. The amount of fee is inversely variable according to the increase or decrease of the estimated cost agreed first by both the parties.
- Higher the actual cost, lower will be the percentage rate of fee and vice-versa.

Merits:

- The owner and the contractor both will be benefited in the lowest possible cost of construction and this is treated the best system of contract.

Demerits:

- The estimated cost must be accurately determined. In case the estimated cost is much higher than the required one due to inefficiency of the estimate, a contractor will get more amount on the basis of savings.

(i) Target Contract

In this system, the contractor is paid on a cost plus percentage basis of work and in addition he receives a percentage plus or minus on savings or excesses effected against a prior agreed estimate by measuring the work on completion and valuing at prior agreed rates.

Merits:

- The contractor is encouraged to use his skill and expertise in order to keep the cost of construction as low as possible.

Demerits:

- The contractor may try to increase the cost of construction high because he gains more amount on the basis of fixed percentage of cost of construction without caring about the penalty on account of excess expenditure.

(j) Negotiated contract

- When the contract is awarded without calling tenders on the basis of negotiations only, it is called negotiated contract. It may be any form discussed above.

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