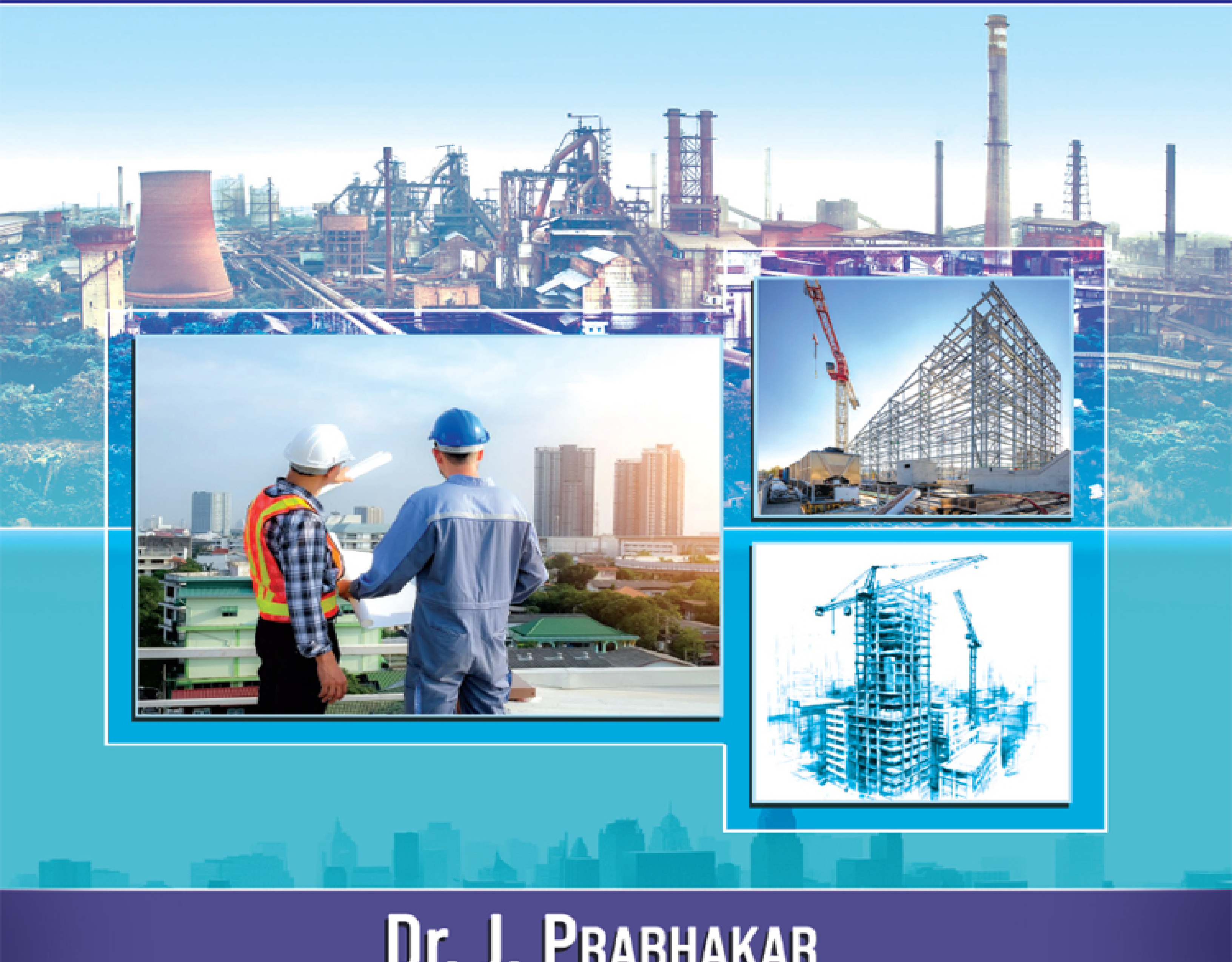
HAND BOOK FOR

CONSTRUCTION ENGINEER



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In Construction Engineering, there are two major phases:

1. **Design phase**
2. **Project phase**

Design phase consists of designing RCC structures and Steel structures.

This phase consists of, **Tendering team**, **Contract teams**, and **Project execution team** which is responsible for project completion in time, within the budget, as per the drawing, bill of quantity, contract Agreement, project monitoring, Bills certification, Project supervision, quality assurance report/site quality records, final bull certification and finally contract closure including delay analysis, additional items which are essential to complete the project.

Project owner is **client**.

Consultant: Is responsible for design of structures, preparation of tender, contract agreement, etc., project monitoring, bills certification including contract closure.

Now we need to know the **types of contracts**. The types of contracts are as follows.

1. Turnkey contract
2. Item rate contract

3. Lump sum contract
4. BOOT Contract

Turnkey contract: Scope of this contract including design, drawings tender, project execution (supervision), monitoring, quality control, bills certificates and commissioning the project and finally hand over key to client.

Item rate contract: There is a bill of quantities (BOQ) along with contract agreement with details of particular description of item and its rate.

We need to go through the items description thoroughly, to carry out as per the quantities and item rate.

Some of the items may have abnormal rate, these items shall be executed limited to BOQ quantity only. If it exceeds, separate rate analysis may be done to arrive in line with the existing market rate.

Lump sum contract: This type of contract is provided for small type works and special works. It is the combination of turnkey and items rate contract.

BOOT: (BUILD, OPERATE, OWN AND TRANSFER) In this type of contract, mobilize fund on their own for construction. Build it, Operate for certain period and transfer to the client.

Pre-construction stage:

1. Tendering
   - Suitable for Open tender system for public contract work.
   - Suitable for Closed tender system for private work for sub vendors.
2. **Award of contract:** Letter of Intent will be issued. He shall be asked to submit **Security deposit** after adjusting Earnest Money Deposit amount, **Bank Guarantee** for performance guarantee.
3. Taking Labor license from enforcing officer.
4. RA Bills as per terms of payment.
5. Indemnity bond will be provided again supply of material, machineries.

6. Termination clause and penalty clause are mandatory is mandatory for the constructions contract.

   Risk and cost of contractor clause is required.

   Construction of QC lab & equipment.

7. Survey regarding soil exploration, availability of construction materials etc.,

   Scope of the contractor shall be thoroughly acquainted.

Construction stage:

1. Mobilization of materials like, cement reinforcement, bricks, for work and construction equipment likes, excavator, dozer, Batching plant, mixer machine, vibrator etc.,

   Mobilization of man power as per requirement of progress. Progress curve are at beginning and at end, will be slow and the remaining period goes faster.

2. Man power:

   Planning Engineer

   Contracts engineer

   QC Engineer

   Billing Engineer

   Safety Engineer

The above no. of engineers will be decided as per the requirement from the project.

Daily/Weekly/monthly meetings shall be conducted to monitor the project.

1. Progress of work
2. Site issue
3. Budgetary control etc.,

Based on the type of contract, priority of following documents may vary.

1. Letter of Acceptance

2. Contract agreement
3. Drawing, and technical specification
4. Special condition of contract
5. General conditions of contract

Keeping records right from, Daily progress register in which all the activities shall be recorded. It will be useful in all phases of construction even after construction is completed or in arbitration stage. It is to note that absence of documents will adversely affect arbitration, extra claim.

A common mail ID for the individual project shall be created and the same shall be used. Everybody shall be able to access this mail Id.

The following files shall be maintained in construction/project office.

1. Contract file
2. Bill of quantities
3. Technical Specification
4. Quality control file
5. Store records
    - Receipt of material at site - A
    - Consumption of material - B
    - Balance material after - (A-B)
6. Correspondence
    - Correspondence with contractor file
    - Correspondence with Client file
    - Correspondence with PMC file
    - Correspondence file with Sub vendors
    - Correspondence with file Stores
7. Minutes of meeting file
8. Follow up of payment file
9. Schedule of rates file

Final bill documents normally attached with final bill:

1. Detailed measurements including Total amount/Quantity, Paid and balance to be paid.
2. Reconciliation of material.
3. Bank Guarantees/Material Guarantees.
4. As built drawings in CD with original hard copies.
5. Penalty levied with approval.
6. Deviation statement if any.

Bank Guarantee:

A Financial promise by bank to fulfill contract.

Security Deposit:

A sum of money held by client to ensure performance it will be returned after DLP.

Defect liability period:

One year period after commissioning the work. Any defect with in this period, contractor with no cost will attend the repair/damage etc.,

EMD:

Earnest money deposit, deposited with the tender. Purpose of the deposit to push the contractor to carry out the work. If the refuses to take up the work, EMD will not be Standard Penetration Test: suitable for cohesion less soil to asses soil properties.

Care shall be taken no to engage child Labor whose age is less than 18.

Soil which is fit for filling, shall be of plasticity index is of maximum of 20 and its liquid limit is max 40. Soil should be free from lumps, Organic matter etc.,

Site engineer shall mark the foundation layout as per the approval drawing. He should use revised and updated drawings only.

SBC of the founding soil should match with the SBC of issued of drawings., If it is green field project, bush clearance, tree cutting., shall be carried out.

Take initial level at a 5 m interval, take actual levels with the surveyor. It will be useful to compute the cutting and filling quantity.

Once cutting is over, final level is taken. Final quantity could be computed with these readings.

Site engineer shall mark the setback distance of building that is frontage distance from road, all 3 sides distance from compound wall etc, as per the approved plan and as per National Building Code.

Stores engineer shall purchase the material as per the priority and sequence of project.

Material should be stacked properly, first come shall go first. Stores engineer shall reconcile material every day and on monthly basis.

Reconciliation is made by taking Purchased quantity issued quantities consumed quantities with allowed wastages if any and balance quantity available at stores in to account.

2. The Role and Duties of Construction Engineer

1. Arrange site office (portable cabin) and then go for construction of site office including Toilet, first aid facility etc.,
2. As a project engineer, one needs to know what is the scope of work.

   At construction sites, one toilet commode and one urinal must be provided per 20 employees. 2 no. of toilet commode and two urinals must be provided for additional 20 employees.

   Toilets should be cleaned regularly and maintained in good order, running water, must be provided along with soap and individual hand towels.
3. Site Engineer shall read carefully specification, contract agreement, drawing, bill of quantities etc., before stepping up in to project site.
4. Geotechnical report will be available with client. Take that report to have knowledge about the topography of the site, reduced level, co-ordinate, sage bearing capacity of soil, soil resistivity report, water table level, availability of nearby of construction materials, etc.,
5. Water shall be tested as per IS 456. It shall be suitable for construction purpose. If not, building structure will get affected.
6. He should check whether necessary plan approval from corporation, municipal authorities is obtained.

   Contract labor license shall be taken if contactor engages more than 20 no. of labors from labor enforcement authorities.

Site manager needs to take care of the following parameters.

1. Program/progress monitoring - by using PERT and CPM chart.
2. Equipment/vehicle productivity - by using productivity chart against actual usage.
3. Co-ordination between owner, designer, site contractors and their sub vendors.
4. Cost control – Budget control
5. Quality control – quality assurance plan shall match with progress.
6. Billing – R.A Bills, Final bills, supply bills, stores bills etc.,
7. Contract claims/disputes: if any additional/extra items to suit site condition, engineer shall be able to claim extra claims after approval.
8. value improvement methods.
9. Stores management - Procurement, maintenance, issue of material etc.,
10. Contract closure - final bill, final payment, after defect liability period with all relevant documents contract shall be closed.