CHAPTER 3

CONSTRUCTION CONTRACTS AND CONTRACT DOCUMENTS

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CONSTRUCTION CONTRACT

Contract is a signed document between two parties (client & contractor) that binds the contractor to do the job with the specified requirements and the client to pay for it. Contract in Construction industry may be grouped in two categories:

A. competitive bid contracts
B. Negotiated contracts
COMPETITIVE BID CONTRACTS

Competitive Contracts are:
- Unit Price Contracts
- Lump sum contracts

Unit price Contracts
Total cost = estimated quantity X unit price in bid
(Bid is based on the price per unit of work)

Advantages
- Payment can be calculated easily
- Freedom to alter the work of construction
- Tenderers prices are on exactly the same basis
- Plans & specifications do not need to be completed in detail
Lump Sum Contract

- Bidding is done on a total amount of the works specified.
- Drawings and specifications need to be completed in every detail.
- Bill of quantities is provided not for pricing but to list the activities to be done.

Advantages

- Avoid a lot of detailed accounting & measurement
- Owner does know the exact cost of the work
- The work is straightforward for the contractor and he will try to complete it as early as possible to increase his profit.
Disadvantages of Lump sum contracts

• alteration of project during construction causes troubles.
• plans & specifications must be comprehensive and include every detail.
• contractor tends to use cheaper labour and materials.

Lump Sum Contracts are good when:
• the work is not very large
• the work precisely described in all detail
• no risk attached to its construction (unforeseen troubles)
• not many alterations are necessary in construction stage.

However, combination of Lump-sum and unit price contracts may be used in one work,
NEGOTIATED CONTRACT

• It is also known as Cost + Contracts.
• Price = Cost + Profit
• profit is professional fee, subject to bidding and negotiations.
• These contracts are useful when:
  – complete plans & specifications are not available
  – there is uncertainty to exact cost of the construction
  – possible wishes to change the work during construction.
  – in the case of emergency or war
TYPES OF NEGOTIATED CONTRACTS

a) Cost + Percentage of Cost Contracts
   (outlawed in some countries)

b) Cost + Fixed Fee Contracts

c) Cost + Fixed Fee + Profit Sharing Contracts

d) Cost + Sliding Scale of Fees Contracts

e) Cost + Guaranteed Ceiling Price Contracts
a) **Cost + percentage of Cost**
(outlawed in some countries)

Includes great disadvantages:
• Contractor will tend to pull up the cost of the work to increase his fee - owner has a great risk.

b) **Cost + Fixed Fee Contracts**

**Disadvantages:**
• Owner has risk of increasing construction cost.
• Contract is not incentive for the contractor to reduce the cost.
c) Cost + Fixed Fee + Contract with a Profit Sharing

- An increase in the profit of contractor if he decreases the estimated cost.
- Contractor may get 25% to 50% of the saving he makes.
- One of the best negotiated contract
d) Cost + Sliding Scale of Fees

• Construction Cost Contractor's fee changes proportionally to the actual cost of the work with a sliding scale of fixed fee.
• However, a minimum fee is guaranteed to contractor.
• There is an incentive to the contractor to reduce the cost of construction.
• It is good and preferable by the clients.

For example,

<table>
<thead>
<tr>
<th>Construction Cost</th>
<th>Contractor Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0x10^6</td>
<td>200,000 TL</td>
</tr>
<tr>
<td>5.5x10^6</td>
<td>220,000 TL</td>
</tr>
<tr>
<td>5.0x10^6</td>
<td>240,000 TL</td>
</tr>
</tbody>
</table>
e) Cost + Guaranteed Ceiling Price

- Contractor guarantees that the cost of construction will not exceed a maximum.
- The contractor can not get any compensation for the exceeding amount.
- The contracts require exact plans and specifications to fix the ceiling price.
Sources of controversy in (Cost + Contracts)

The source of controversies in negotiated contracts are:

- contractor overhead (expenses)
- depreciation cost of equipment

- Contractors always try to get them counted as parts of the costs.
- In reality they are to be paid by the contractor as cost of doing his business and should be included in contract document.

New equipment purchasing is under negotiation.
A construction contract comprises:

a) **Contract drawings:** Pictorially shows the works, dimensions & levels.

b) **Specifications:** work is described in **Words**. The quality of materials, workmanship, and testing methods.

c) **Bill of quantities:** gives the expected measure of each operation from the drawings. Operations are classified according to trade or location within the work.

d) **General Conditions of Contract:** defines the liabilities, responsibilities, and power of employer, engineer & contractor. Methods of payment, insurance also mentioned.

e) **Tender:** Signed financial offer of the contractor to construct the work.

f) **Letters of Explanation:** Covers agreed matters between the parties to elucidate their intentions.

g) **Legal Agreements:** Signed by both parties, owner & contractor, confirming their intentions.
FORMS OF CONSTRUCTION CONTRACTS

1. Competitive Bid Contracts
   – No standard type of contract for all phases of engineering work.
   – However, all contracts include:

a) **Introduction:** date of agreement & parties take place

b) **Articles:** (could be standardized and printed)
   – work to be done and price
   – timing (beginning & ending)
   – liquidated damages
   – required security
   – payment to the contractor
   – definition of terms
FORMS OF CONSTRUCTION CONTRACTS (continued)

– responsibility & right of owner
– responsibility & right of contractor
– duties & authority of the Engineer
– progress and control of work
– insurance, safety and security requirements
– provisions relating to subcontractor
– changes in the work
– termination of contract

c) Final concluding paragraph - signature and witnesses of parties.
2. **Negotiated Contract** (selection of contractor)

Selection of contractor is especially important. He acts as an agent of the client.

Consider those factors in selecting contractor:

- Previous experience in that area
- Reputation for fairness and excellence in performance
- Quality and experience of personnel
- Record in management & co-ordination of subcontractors.
- Available working capital
- Available plant & equipments
- Normal volume of work per year
- Incomplete works in progress
- Available work capacity
FORMS OF CONSTRUCTION CONTRACTS (continued)

Terms of Contract

- definition of work, estimated cost, & the fee of contractor
- time for completion
- responsibilities of owner, engineer & contractor
- definition of reimbursable direct cost & overhead costs
- labour & material
- provisions for plant rental or purchase
- subcontractors
- method of compensation
- Changes
- Termination
- Accounting method and control
SPECIFICATIONS

• While the drawings shows the extend of the quantity of works, specifications define the quality and standard of it.

• Specifications are prepared by engineers, and contracts are prepared by lawyers.

• Specifications are supposed to be specific - not general.

• In specification, the following characteristics should be covered.
SPECIFICATIONS (continued)

a) **Balanced composition:** all requirements to be consistent with the results desired.

b) **Definite requirements**
   - There must be directions, not suggestions
   - no indefinite expressions like "reasonable" or "best quality"
   - define the days as working days or calendar days

c) **Accuracy**
   - non-accurate and misleading information will be avoided.
   - repetition of text are sources or error.
SPECIFICATIONS (continued)

d) **Practicability**
   - Use standard sizes and patterns as much as possible.
   - Un-practicable requirements let the contractor to add an extra safety factor to protect himself.

e) **Prevention of conflicting requirements**
   - they are sources of error.

f) **Fairness**
   - don't impose the contractor harsh & unfair conditions
   - don't cancel difficulties from him.
   - risk increases the cost of construction.
TYPES OF SPECIFICATIONS

2. Technical provisions

1. General provisions
   ➢ related to the whole work, to the standardized materials.
   ➢ relate to control of the work & drawing reference.

a) Drawings (If the contractor will prepare)
   ➢ they must be exact
   ➢ suitable to drawings techniques
   ➢ details must be prepared.

b) The sequence of the work:
   ➢ determined by the contractor
   ➢ when necessary sequence of operations can be changed.
c) The progress schedule
   - Periodical progress reports to the engineer
   - new schedule when construction time is extended

d) Control of Materials
   Contractor is required to provide all sample and bear all expenses for their sampling, transportation and testing.

e) Space
   The space for construction operations and storage for materials should be written explicitly.

f) Information
   Information on water, light sources and costs should be given and expenses for their use.
g) **Facilities to the Engineer**

Contractor will be required to furnish at his own expenses site office for the engineers. How many weeks after commencing of the work these facilities will be ready should be mentioned.

h) **Warranties**

The finished work must be free from defects for a special period (usually one year from the acceptance date of work),

i) **The owner's right to use**

- Owner's right to use completed portions of work should be stated.
- Such portions acceptance by owner will be relieved from contractor's responsibilities.

This part includes quality requirements of the work and technical requirements for inspection and test during construction.

Technical provisions divided into three:

- Specification for materials
- specification for workmanship
- specification for performance.

a) **Specification for Materials**

- materials should be specified by their properties
- type of the tests on the material must be defined.
b) **Specifications for workmanship**

- specify the result, not the method
- specify tolerances on the results
- Define construction methods or procedures when necessary for particular purposes
- limitations or restrictions on the contractor's method for coordination the work.
- precautions to protect the work or adjacent property.
- methods of inspection and test

c) **Specification for Performance**

- provisions made for tests
- provisions made for inspections
- warranties to guarantee durability
• Bill of Quantities (BOQ) is a contract document to define the quantity of work to be done in each type of activity of the contract.

• Quantities are **Exact** measured from drawings.

• Drawings can be architectural; civil engineering; structural engineering; geotechnical engineering; electrical; mechanical, chemical; etc.

• When the work is constructed, the quantities are replaced by the measurement of the actual quantity of the work.
BILL OF QUANTITIES (cont’d)

- Drawings must be detailed enough to be able to produce accurate and thorough Bills of Quantities;
- Well prepared and accurate bills of quantities lead to
  - well prepared tenders – do not leave the contractor guessing;
  - Easy evaluation of tenders;
  - Smooth administration of the contract.
Nature of BOQ

• Bills of Quantities comprise a list of items of work which are briefly described.
• The BOQ also provides a measure of the extent of work and this allows the work to be priced.
• The work included in the item is defined in detail by the rules in the Method of Measurement.
• The item descriptions are therefore a shorthand to allow the relevant rules of the Method to be identified.
• The measure may be a single item or number, dimension (linear metre, square metre, cubic metre), time (hrs, weeks) or weight.
Definition - Bills of Quantities

Definition:

- Bill of Quantities is a compiled list of items of work to be performed by the contractor;
- They describe the works giving quantities and extent of work involved;
- These are referred to as item of work;
- Item of work are generally arranged in the BOQ in the order of their execution;
- BOQ items are separated to reflect the different trades that may be involved in the project;
Function of BOQ

• The Bills of Quantities may serve a number of functions as:
  – A breakdown of the tendered price, with no contractual status, but providing information for the selection from tenderers;
  – An estimate measure of the work for the tendered price, to be used to arrive at a revised contract price once the actual quantities of work carried out are measured.
  – A schedule of rates as the contract basis for valuing variations in the work.
  – A basis for measure of the value of work completed for interim payments.
  – Contractors are asked to insert their prices against the work items;
Functions of BOQ (cont’d)

• When summed up, together with other direct cost of supply of materials and machinery (Primary Cost Sums) and contingencies, they form the tender sum;

• The preparation of BOQ for building works is normally prepared by Quantity surveyors while that of civil engineering works is normally prepared by civil engineers;

• In a lot of cases, they work together.

• In some special cases, other branches of engineering are incorporated such as mechanical engineers, electrical engineers, service engineers etc.

Prime cost item is an allowance in the contract for the supply of necessary items (taps, roof tiles, sanitary appliances, doors and windows handles etc.) to be provided by the contractor that will be selected by the client later. The allowance is exclusive of any labour cost, profit mark up or attendance(such as material handling, scaffolding and rubbish clearance etc) by the contractor.

Contingency costs are allowances for the unknown and unexpected risks associated with a project. Contingency cost is often expressed in terms of percentage of all calculated project cost.
Measuring Quantities – Taking-off

- All items are measured as accurately as possible to enable a fair price to be obtained;
- Various standard methods of measuring work items eg. SMM or CESMM;
- These standards contain classifications of work items as Class A - Y
- Classifications include general items as well as specific work items.
Measuring Quantities – Taking-off (cont’d)

• The BoQ should in principle contain all items described by drawings (or implied) and all other possible items that a contractor may have to perform to complete the works.

• If at the construction stage a contractor is necessitated to perform work that was not originally in the BOQ, a variation is normally issued.

• Frequent or excessive variations raise concerns from the client – either concerns for incompetence of the engineer or corruption!!
CESMM Classifications (2nd Ed)

- Class A: General Items
- Class B: Ground Investigations
- Class C: Geotechnical and other Work Classifications
- Class D: Demolition and site Clearance
- Class E: Earthworks
- Class F: In situ Concrete
- Class G: Concrete Ancillaries
- Class H: Precast Concrete
- Class I: Pipe work - pipes
- Class J: Pipe work – fittings and and valves
- Class K: Pipe work – manholes and pipe wok ancillaries
- Class L: Pipe work – Support and protections etc
- Class M: Structural Metal work
- Class N: Miscellaneous metalwork
- Class O: Timber
- Class P: Piles
- Class Q: Piling Ancillaries
- Class R: Roads and and pavings
- Class S: Rails Track
- Class T: Tunnels
- Class U: Brickwork, blockwork & masonry
- Class V: Painting
- Class W: Water proofing
- Class X: Miscellaneous works
- Class Y: Sewer renovation and ancillary works

You are free to select your own classification system.
### Sample Items

Items in this class in a BOQ format could be for example:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Price</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>F156</td>
<td>Provision of ordinary prescribed concrete mix grade C25, sulphate resistant maximum aggregate size 14mm</td>
<td>$m^3$</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F413</td>
<td>Placing of mass concrete for blinding of thickness not exceeding 150mm</td>
<td>$m^3$</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F524</td>
<td>Reinforced concrete for footings thickness exceeding 500mm</td>
<td>$m^3$</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F663</td>
<td>Pre-stressed concrete for beams cross-sectional area between 0.1 –0.25$m^2$</td>
<td>$m^3$</td>
<td>29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To be inserted by contractors
Recommended Method of Preparing BOQ

• Computer aided systems can be based on simple database software or spreadsheets to sophisticated softwares.

• **Microsoft Excel Templates**, Standard software such as those listed on [http://www.bidshop.org/](http://www.bidshop.org/)

• Some demo versions of these are freely available from the web.

• More sophisticated software are available.
Reasons for Bills of Quantities

• All tendering contractors base their prices on the same information & therefore tenders are strictly comparable (even if an error exists in the Bill)
• Contractors are saved the costly exercise of each having to take off quantities for themselves.
• Bills provide a fair basis for valuing variations and adjustments for the final account.
• Bills may provide a convenient basis for valuation of certificated stage payments during the contract, before the accurate re-measurement figures are available.
• Bills provide an approximate checklist for the contractor to order materials and other resources.
• Bills can provide data for cost analysis for use in cost planning of future projects.
RECOMMENDED ITEMISING METHOD

- For large works divide it into separate groups
- Each group is subdivided into various trades such as

Demolition work
Excavation & filling
Pipe laying
Roads
Concrete - insitu
reinforcement
shuttering
precast
Brick work
Masonry
Water proofing works
Steelwork and ironwork
Roofing
Carpentry
Joinery
Flooring
plastering

Electrical work
Plumbing
Painting & fencing
Glazing
Divide each of them into subdivisions.

For example, a bridge construction may be divided as:

- Piers
- Abutments
- Superstructure
- approach roads and surfacings
- miscellaneous

- In each item, another grouping is possible for trades such as:
  - Excavating
  - compacting bottom soil
  - Reinforcement
  - Shuttering
  - concreting etc
• A sense of proportion must be retained when billing. (for a large work do not divide the activities in very much details).

• **Ex** On a very large road construction project there are some ancillary road side **manholes**.

• If they are almost similar, do not divide them into many items to increase the number of items. Such as

  - excavations for manholes
  - concreting manhole base
  - brickwork to manhole walls
  - providing and setting covers

• But you can just express them as a single item: "construct manholes as specified on the drawings."
RECOMMENDED NUMBERING OF ITEMS

- Some items could be missing or amendments are made.
- If items are numbered right through it is difficult to add.
- All numbers will change.
- Late items could be added at the end, but not suitable.
- However the best method is to use different letter prefix for each section of bill. For example,
  - Excavations: A1, A2 etc.
  - Concreting: B1, B2 etc.
    So if an item is added to any section, it can be added to the end of correct section.
- General summary at the end to summaries the section of the bill is necessary.
COSTING

• Precise costing is almost impossible.
• Cost is just predicted.
• Costing is defined as, finding the cost of separate classes of work, such as bricklaying, shuttering etc.
• Costing involves finding charges for
  - Labour
  - Material
  - Plant and
  - Overhead
LABOR COSTING:

• Responsible foremen fills the time sheet showing hours spent each day by each man on the various types of work.
• Hours entered for a particular work is priced.
• So the labour cost for a particular work trade is calculated.

• **Difficulties:**
  • Overhead calculations
  • Considering other wage payment, such as time checker, night watch men, chainman, storekeeper
MATERIAL COSTING

- Difficulties arise from calculating the cost of materials for a particular work.
- Invoice comes for the bulk of materials.
- Bill of quantities help in costing separate parts of work.
- Difficulties for timber for shuttering, scaffolding tools etc.
PLANT COSTING

- Allocation of plant charges is relatively easy, cost for owning & operating for a plant can be calculated or rent rates are used.
OVERHEADS

Site on costs

- Wages for general foremen, engineers, site clerk, agent etc. telephone, water, gas expenditure.
- Site on costs may change from week to week depending on the rate of activities.
- The costs obtained are entered into bill of quantities to calculate the total cost. HOW?
- The costs should be replaced by the actual cost after completion of the work for new costing operations.
THANKS FOR YOUR ATTENTION