UNIT– I – ESTIMATION, COSTING AND VALUATION - SCIA1702

I. ESTIMATE

INTRODUCTION:

- Estimation or estimating is the process of calculating the quantities of various items of works involved in the project.
- Estimate is a document which furnishes the quantities of different works involved, their rates and the expenditure anticipate in a project.

NECESSITY OF ESTIMATES:

- To know about the approximate cost of the building construction.
- To calculate the tax of the building
- To fix the rent of building
- The know about the various items of works involved in the building construction and arrange the available materials of the construction.
- To arrange the labours of the construction works.
- Take the approval for the government projects.
- To having the loan from the bank.

ESTIMATION:

In the civil engineering field, the construction activity contains the following three steps.

- **Plans**: Preparation of drawings plan, section, elevation, with full dimension and detailed, specifications meeting the requirements of the proposed structure.
- **Estimation**: Preparation of an estimate is for arriving the cost of the structure to verify the available funds or to procure the required funds for completion of the proposed structure.
- **Execution (construction):** It is a grounding the proposed structure, for construction as per the provision contained in drawings and estimation.
- In, Estimation and costing there are two basic points involved in construction of structures are:
- **Quantity**: The quantity aspects is with reference to the measurement in the drawings (plan, elevation, section)
- **Quality:** The quality aspects is with reference to the specifications, i.e properties of materials, workmanship etc.
- The estimation and costing of any structure is defined as the process of determination of quantities of items of work, and its cost for completion. Estimate of a project is therefore, a forecast of its probable cost.

- The process of calculating the quantities (The quantity with reference to the measurement in the drawings, i.e., plans, elevation, section) and cost of various construction items i.e., excavation, concreting, masonry, plaster etc. of the project is called an “estimate”.
- Estimating is the technique of calculating or Computing the various quantities and the expected Expenditure to be incurred on a particular work or project.

NEEDS FOR ESTIMATION AND COSTING:

Estimate give an idea of the cost of the work and hence its feasibility can be determined

Estimate gives an idea of time required for the completion of the work.

Estimate is required to invite the tender sand Quotations and to Arrange contract.

Estimate is also required to control the expenditure during the execution of work.

Estimate decides whether the proposed plan matches the funds avail or not.

To know the quantities of various items of work, a material and labour and their source of identification.

To decide whether the proposal can match the available funds to complete the structure.

To obtain the administrative and technical sanction of estimate from the competent authorities to release the funds for construction.

To invite tenders or quotations based on the estimate quantities for entrust of works to the execution.

DATA REQUIRED FOR PREPARING AN ESTIMATE:

Drawings: The detailed drawings of plan, elevation and section, drawn to a scale are necessary to take the details of measurements of various items of work.

Specifications: The specifications give the nature, quality and class of materials, their proportion, method of execution and workmanship and the class of labor required. The cost of the work varies with its specifications. The cement mortar with 1:3 is costlier thancement mortar with 1:6.

Rates: The rates for various items of work, the rates of various materials to be used in construction, the wages of different categories of labour should be available for preparing an estimate. The location of the work and its distance of source of materials and cost of transport should be known. These rates may be obtained from the Standard Schedule of Rates prepared by the engineering departments.

To prepare an accurate estimate, a detailed estimate of quantities of various items of work and an abstract estimate of the quantities and their unit rates are required.

Detailed Estimate

S.no	Description of work	No	Length	Breadth	Height/Depth	Quantity	Remarks

Abstract estimate

S.No.	Description of work	Quantity	Rate	Per	Amount

UNITS OF MEASUREMENT:

- The units of different works depend on their nature, size and shape. In general, the units of different items of works are based on the following principle.
- Massive or volumetric items of work such as earth work, concrete for foundations, R.R Masonry, Brick Masonry etc. The measurements of length, breadth, height or depth shall be taken to compute the volume or cubical contents.
- Shallow, thin and surface work shall be taken in square unit or in area. The measurements of length and breadth or height shall be taken to compute the area,

Ex. Plastering, white washing etc.

- Long and Thin work shall be taken in linear or running units and linear measurement shall, be taken.

Ex: Fencing, Rainwater pipes, ornamental borders

etc.

- Single units of work are expressed in numbers.

Ex. Doors, Windows, Rafters, Trusses etc.

DUTIES OF QUANTITY SURVEYOR:

- The quantity surveyor must be well versed with the drawing of work.
- He should be able to read the drawing correctly and bill the quantities accurately.
- He should have the knowledge of the construction procedure.
- He should be able to write the description of different works.
- He should able to prepare the schedule of the project.
- He should be able to value all variations under the contract.

REQUIREMENTS OF A GOOD ESTIMATOR:

The quantity surveyor must be well versed with the drawings of works.

He should be able to read the drawing correctly and bill the quantities accurately.

IMPORTANT TERMS:

- **Plinth area**

- ✓ It is the covered built-up area measured at the floor level of any storey.
- ✓ Plinth area is also called as built-up area and is the entire area occupied by the building including internal and external walls.
- ✓ **Carpet area**
- ✓ This means area in building which is useful on i.e area of drawing room, dining room, kitchens staircase, stores, verandas, Entrance hall, bathroom.
- ✓ It is generally 50% to 60% of plinth area.
- ✓ Carpet Area is the area that can be covered by a carpet.
- ✓ This area does not include the thickness of pillars and inner walls.
- ✓ The common areas are also not included. Common areas are the lifts, staircase, lobby, play area etc.

DIFFERENT TYPE OF ESTIMATES:

- Preliminary/Approx./Abstract/Rough Cost Estimate
- Plinth Area Estimate
- Cube Rate or Cubical Content Estimate
- Appx. Quantity Method Estimate
- Detailed Estimate or Item Rate Estimate
- Supplementary Estimate
- Revised Estimate
- Sub-Estimate
- Annual Repair or Maintenance Estimate (A.R or A.M Estimate)
- Complete Estimate

Preliminary or Approximate estimate:

- This estimate is prepared to decide financial aspect, policy and to give idea of the cost of the proposal to the competent sanctioning authority.

- It should clearly show the necessity of the proposal and how the cost has been arrived at. The calculations for approximate estimate can be done with the following data.
- The data can be had from a similar construction already complete in the nearby area, executed by the department.
- The following documents should be attached with it.
    - Detailed report
    - Site plan of the proposal
    - It should also clearly mention about the acquisition of land, Provision of electric and water supply etc.

Types of Approximate Estimate:

- Plinth area method
- Cubical content method
- Unit cost (or) service unit method
- Typical bay method
- Carpet area method
- Rough quantity method

Plinth area Estimate:

- P.A. is approximate estimate
- Plinth area should be calculated for covered area by taking external dimensions of the building at the floor level.
- Courtyard and other open area should not be included.
- For multi storied building Plinth Area for each storey is determined separately.
- Plinth area rate is known from cost of similar building in the locality.
- Approx. Cost of the building = Plinth area Rate/ m^2 x Plinth Area

Cubic Contents Estimate:

- Cube rate estimate is again approximate estimate.
- Cubical content of the building is determined by multiplying length, breadth and height of the building.
- External length and breadth at the floor level are calculated for the purpose.
- Height should be taken from the floor level to the top of roof.

- For multi storeyed building height is taken from floor level of one storey to top of next higher floor.
- Cube rate estimate is more accurate as compared to the plinth area estimate.

Unit cost (or) service unit method:

- The unit method of estimating is the simplest and quickest method.
- In this method, the quantity surveyor counts the number of units which are going to be accommodated in a building, for example the number of occupants or main furniture objects used by an individual.
- The number is then multiplied by the cost per unit to get the total estimated cost of the project.

Typical bay method:

- This method is useful and is generally followed in case of building having several bays.
- The cost of the one class room is worked out and then multiplied by the number of bays in that building.
- The extra cost of the end walls and difference in framing. If there is any, should be made, so as to arrive at the correct cost.

Carpet area method:

- Carpet area the covered area of the usable spaces of rooms at any floor.
- It is measured between walls to walls within the building and is the sum of the actual areas of the rooms where you can carpet.
- Floor area = Plinth Area –Area of Walls.
- This includes the floor areas of all rooms, verandahs, passages, staircase rooms, bathroom etc.
- In residential building, the carpet area will be about 55% to 65% of the plinth area.

PROBLEMS:

1. Prepare a preliminary estimate of building of a building with a total plinth area of all building is 1500sq.m. and from following data.

- ✓ Plinth area rate - Rs. 9500/ m^2
- ✓ Special architectural design – 1.5% of building cost.
- ✓ Water supply and Sanitary - 5% of building cost.

- ✓ Electrical Installation - 14% of building cost.
- ✓ Services - 6% of building cost.
- ✓ Contingencies - 3% of building cost.
- ✓ Supervision - 8% of building cost.

Determine the total cost of building project.

Area (given) = 1500 m^2

Rate = Rs. 9500/m^2

Total cost = Rs. 9500 × 1500

= Rs. 1,42,50,000

Cost for,

Architectural design } = 1.5% of building cost } = $\frac{1.5}{100}$ × 14250000

= Rs. 213750

Water supply and sanitary } = 5% of building cost } = $\frac{5}{100}$ × 14250000

= Rs. 712500

Electrical installation } = 14% of building cost } = $\frac{14}{100}$ × 14250000

= Rs. 19,95,000

Services = 6% of building cost = $\frac{6}{100}$ × 14250000

= Rs. 8,55,000

Contingencies = 3% of building cost = $\frac{3}{100}$ × 14250000

= Rs. 427500

Supervision = 8% of building cost = $\frac{8}{100}$ × 14250000

= Rs. 11,40,000

Total = 2,34,41,250

(Two crores thirty four lakhs fourty one thousand two hundred fifty only)

2. Estimate the quantities of brickwork and plastering required in a wall 4 m long, 3 m high and 30 cm thick. Calculate also the cost if the rate of brickwork is Rs.320.00 per cu.m and of plastering is Rs.8.50 per sq.m.

Solution:

Quantity of brickwork = L x B x H = 4 x 3 x .30 = 3.6 cu.m

Quantity of plastering = 2 x L x B = 2 x 4 x 3 = 24 sq.m

(Two faces)

Cost of brickwork = 3.6 x 320.00 = Rs.1152.00

Cost of plastering = 24 x 8.50 = Rs.204.00

Total Cost = Rs.1152.00 + Rs.204.00

= Rs.1356.00.

Annual repair estimate:

- In order to keep building and roads in perfect condition, annual repairs should be carried out as follow: -
- ✓ In case of a building-white washing, painting of doors and windows, cement plaster repairs (inside & outside), repairs of floors etc.
- ✓ In no case this annual repair amount should increase more that 1.5 % to 2 % of the capital cost of the building.
- ✓ In case of a road-filling patches, maintenance of berms etc.

Special repair estimate:

- If the work cannot be carried out of the annual repair funds due to certain reasons resulting in the genuine increase in cost, then special repairs estimate is to be prepared. The reason of increase may be: -
- ✓ In case of a building-opening of new doors, change of floors, re-plastering walls etc.
- ✓ In case of roads-if the whole surface is full of corrugation & patches, then the total surface is to be scarified.
- ✓ The old metal is taken out, consolidation by adding more metal is done and top surface is repainted.

Revised estimate:

- When the sanctioned estimate exceeds by 5% either due to the rate being found insufficient or due to some other reasons, a fresh estimate is prepared which is called a Revised Estimate.
- A comparative statement on the last page of the estimate is attached giving there in the reasons of the increase of cost in case of each item.

Supplementary Estimate:

- This is fresh detailed estimate in addition to the original sanctioned estimate prepared when additional works are deemed necessary during the progress of a work to supplement the original works.
- The abstract of cost should show the amount of the original sanctioned estimate as well as the supplementary amount of the original sanctioned estimate as well as the supplementary amount for which sanction is required.

METHODS OF CALCULATIONS OF QUANTITIES OF MATERIALS:

The calculations of quantities of materials can be done using various methods of estimates. The application of an individual method depends upon the design and shape of the building. The different methods are as under:

- ✓ Centre line method
- ✓ Crossing method
- ✓ Out to out and in to in method
- ✓ Bay method
- ✓ Service unit method

Centre line method:

- This method is suitable only if the offsets are symmetrical and the building is more or less rectangular in shape.
- The centre line of the building is determined carefully after doing deductions for repeated measurements.
- This centre line acts as length for the complete calculations of the estimate.
- If the deduction is not cared for the results of estimates may be wrong.
- All the walls should have the same section.

Crossing Method:

- In this method, lengths and breadths of the masonry walls at plinth level are taken (internal dimension of the room + thickness of the walls) for calculating quantities.
- The symmetrical offsets are a must as in the case of centerline method.

Out to out & in to in Method:

- This method is most practicable under all circumstances and is generally followed in the P.W.D. for computing the quantities of various items.
- The estimation in this book has been done using this method.

Bay Method:

- This method is useful and is generally followed in case of building having several bays.
- The cost of the one class room is worked out and then multiplied by the number of bays in that building.
- The extra cost of the end walls and difference in framing.
- If there is any, should be made, so as to arrive at the correct cost.

Service Unit Method:

- This method is followed in cases such as school building where there are so many class rooms.
- The cost of one class room us worked out and then multiplied by the number of class rooms to be constructed.
- In case of Hospitals, the service unit is a bed, in case of Water Tank, it is a litre and in case of Cinema Hall, the service unit is a seat.

Lumpsum:

- While preparing an estimate, it is not possible to work out in detail in case of petty items. Items other than civil engineering such items are called Lumpsum items or simply L.S. items.
- The following are some of L.S. items in the estimate:

✓ Water supply and sanitary arrangements.

✓ Electrical installations like meter, motor, etc.,

✓ Architectural features.

✓ Contingencies and unforeseen items.

- In general, certain percentage on the cost of estimation is allotted for the above L.S. items.

Work Charged Establishment:

- During the construction of a project considerable number of skilled supervisors, work assistance, watch men etc., are employed on temporary basis.
- The salaries of these persons are drawn from the L.S. amount allotted towards the work charged establishment.
- That is, establishment which is charged directly to work. An L.S. amount of 1½ to 2% of the estimated cost is provided towards the work charged establishment.

ESTIMATION METHODS OF BUILDING WORKS:

- The estimation of building quantities like earth work, foundation concrete, brickwork in plinth and super structure etc., can be workout by any of following two methods:

1. Long wall – short wall method
2. Centre line method.
3. Partly centre line and short wall method.

Long wall – short wall method:

- In this method, the wall along the length of room is considered to be long wall while the wall perpendicular to long wall is said to be short wall.
- To get the length of long wall or short wall, calculate first the centre line lengths of individual walls. Then the length of long wall, (out to out) may be calculated after adding half breadth at each end to its centre line length.
- Thus, the length of short wall measured into in and may be found by deducting half breadth from its centre line length at each end.
- The length of long wall usually decreases from earth work to brick work in super structure while the short wall increases. These lengths are multiplied by breadth and depth to get quantities.

Centre line method:

- This method is suitable for walls of similar cross sections.
- Here the total centre line length is multiplied by breadth and depth of respective item to get the total quantity at a time.
- When cross walls or partitions or verandah walls join with main wall, the centre line length gets reduced by half of breadth for each junction.
- Such junction or joints are studied carefully while calculating total centre line length.
- The estimates prepared by this method are most accurate and quick.

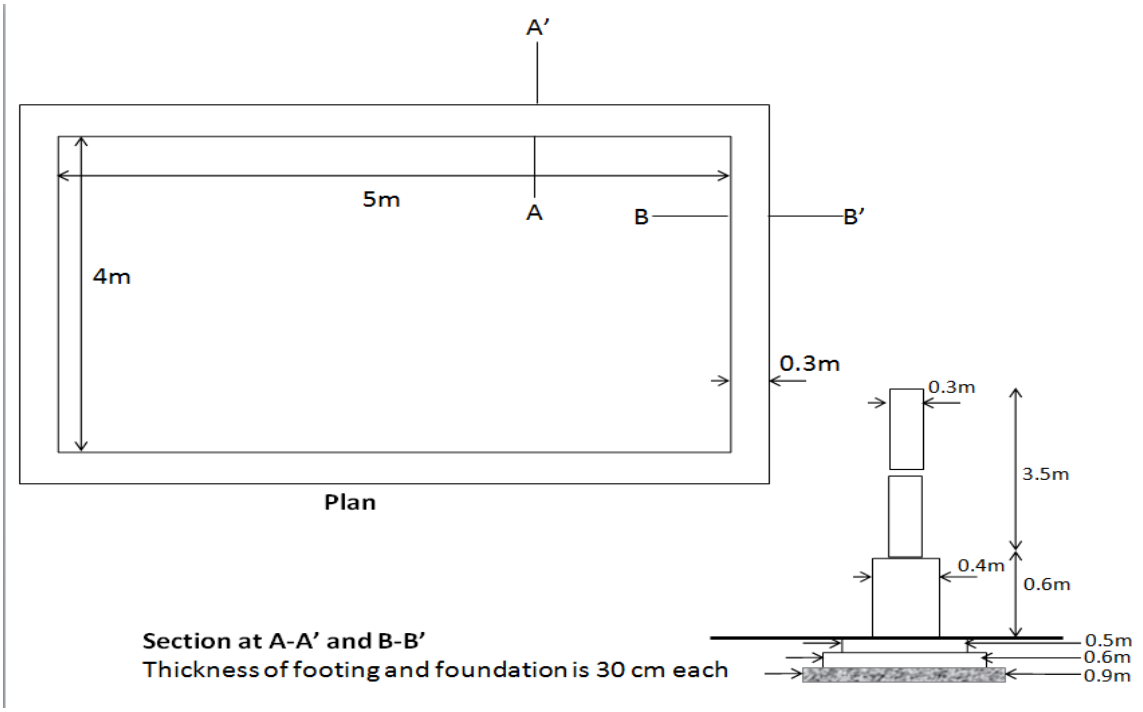
Partly centre line and partly cross wall method:

- This method is adopted when external (i.e., around the building) wall is of one thickness and the internal walls having different thicknesses.
- In such cases, centre line method is applied to external walls and long wall-short wall method is used to internal walls.
- This method suits for different thicknesses walls and different level of foundations.
- Because of this reason, all Engineering departments are practising this method.

PROBLEMS:

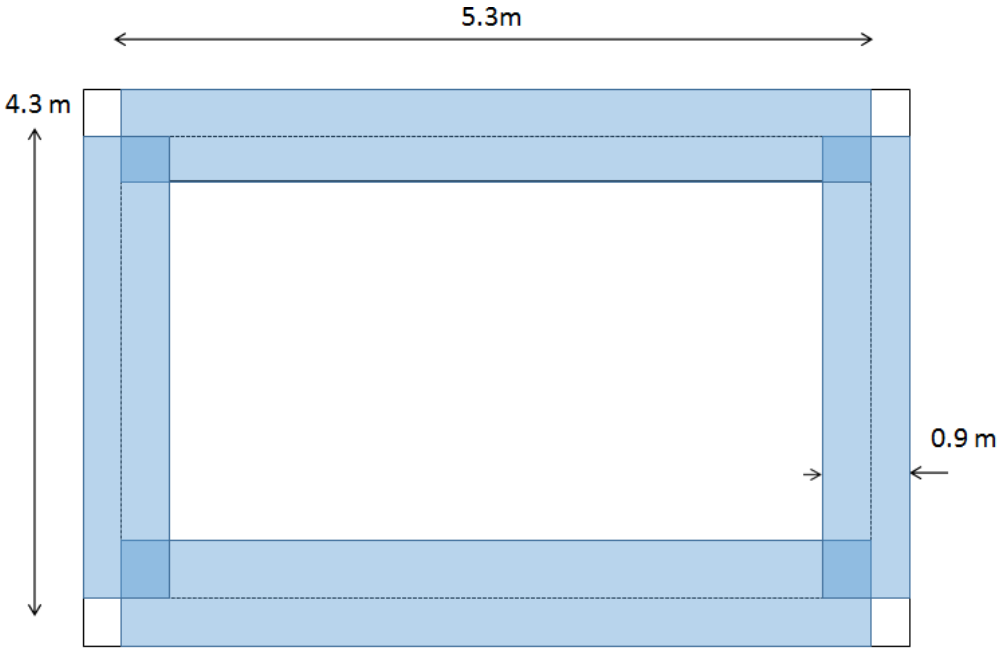
1. Prepare a detailed estimate of a part of a wall of a building from the given plan and section. Calculate,

- ✓ Earthwork excavation in foundation
- ✓ Lime concrete in foundation
- ✓ First class brickwork in foundation and plinth
- ✓ Brickwork in superstructure.



Centre length of walls = 5.3 + 4.3 + 5.3 + 4.3

= 19.20 m.



Center Line Method

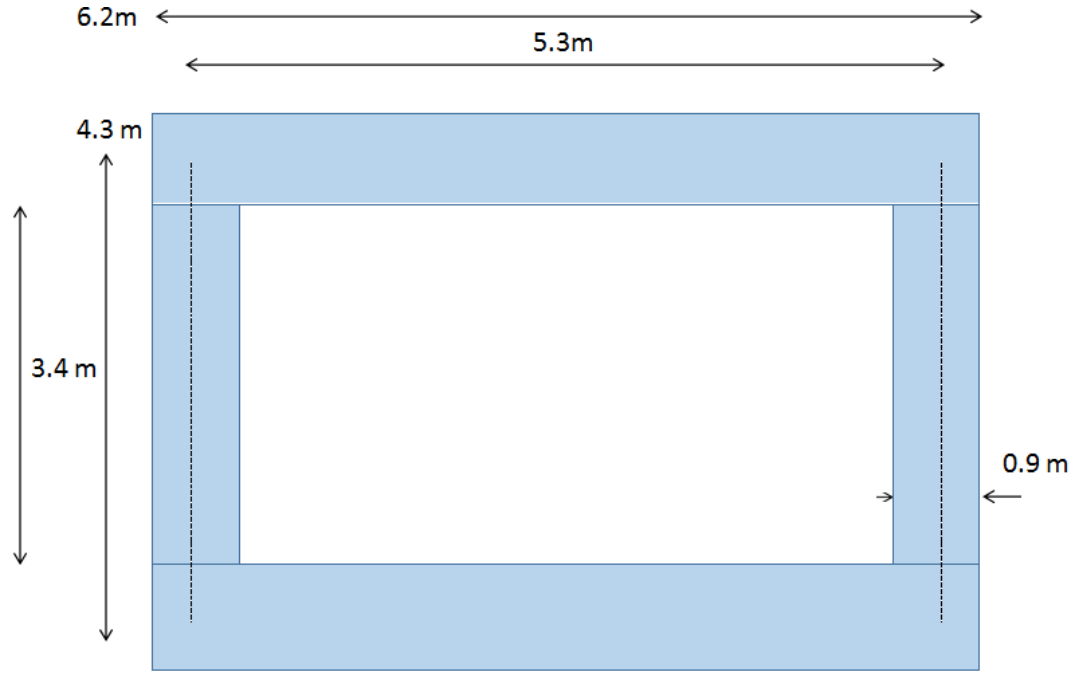
Total Center line = 5.3+5.3+4.3+4.3=19.2 m

Width = 0.9 m

Total Qty of concrete in foundation= (19.2×0.9×0.3) cum

Contents	No.	L	B	H	Quantity
1. Earthwork excavation on foundation	1	19.2	0.9	0.9 (0.3+0.3+0.3)	15.55 m^3
2. Concrete in foundation	1	19.2	0.9	0.3	5.18 m^3

3. Brickwork in foundation and Plinth 1st Footing 2nd Footing 3rd Footing	1 1 1	19.2 19.2 19.2	0.6 0.5 0.4	0.3 0.3 0.6	3.46 m^3 2.88 m^3 4.61 m^3 10.95 m^3
4. Brickwork in Super structure	1	19.2	0.3	3.5	20.16 m^3



Separate Wall Method

Long Wall = 5.3+0.9=6.2 m Short Wall = 4.3-0.9=3.4 m

Width = 0.9 m Total Qty of concrete in fdn= (2×6.2×0.9×0.3) + (2×3.4×0.9×0.3)cum

Long wall = c/c length + one breadth

= 5.3 + 0.9 = 6.2 m

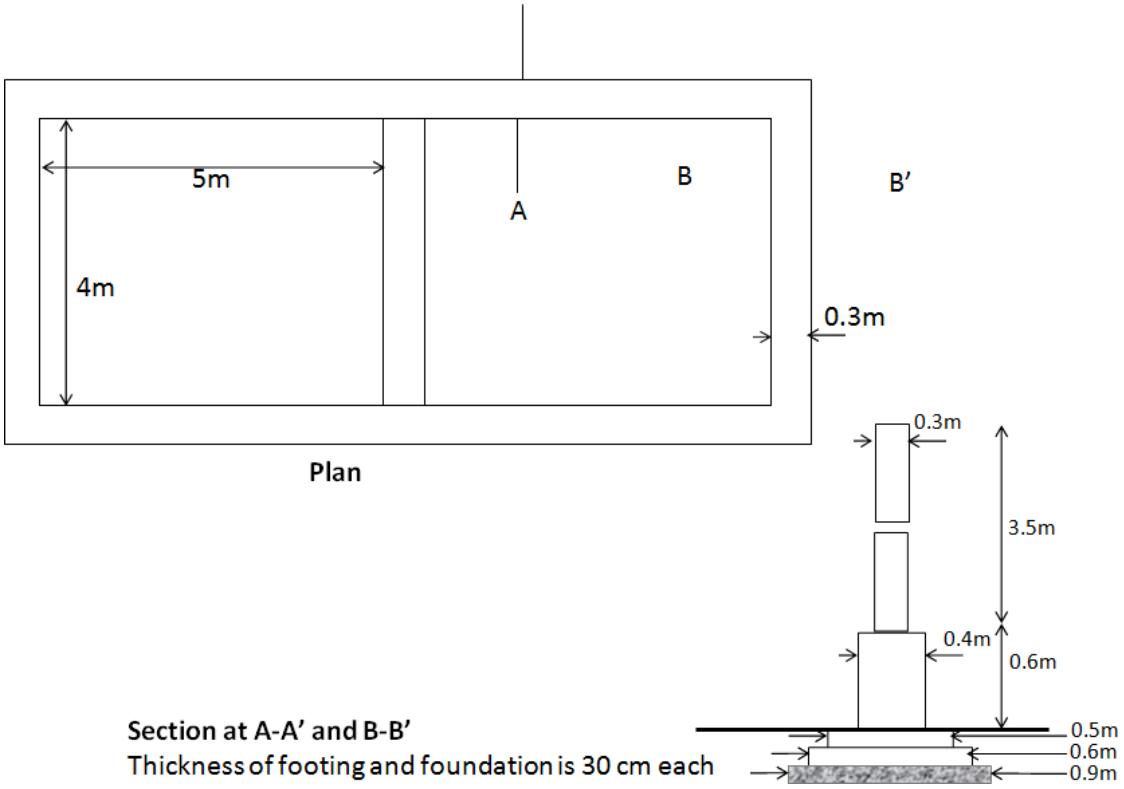
Short wall = c/c length – one breadth

= 4.3 – 0.9 = 3.4 m

Contents	No.	L	B	H	Quantity	Remarks OR Explanatory notes.
1.Earthwork excavation on foundation Long wall Short wall	2 2	6.2 3.4	0.9 0.9	0.9 (0.3+0.3+0.3) 0.9	10.04 m^3 5.51 m^3 15.55 m^3	
2. Concrete in foundation Long wall Short wall	2 2	6.2 3.4	0.9 0.9	0.3 0.3	3.35 m^3 1.83 m^3 5.18 m^3	
3. Brickwork in foundation and Plinth Long wall 1st Footing 2nd Footing Rd 3 Footing Short wall 1st Footing Nd 2 Footing Rd 3 Footing	2 2 2 2 2 2 2	5.9(5.3+0.6) 5.8(5.3+0.5) 5.7(5.3+0.4) 3.7(4.3-0.6) 3.8(4.3-0.5) 3.9(4.3-0.4)	0.6 0.5 0.4 0.6 0.5 0.4	0.3 0.3 0.6 0.3 0.3 0.6	2.13 m^3 1.74 m^3 2.74 m^3 1.33 m^3 1.14 m^3 1.87 m^3 10.95 m^3	
4. Brickwork in Super structure Long wall Short wall	2 2	5.6(5.3+0.3) 4.0(4.3-0.3)	0.3 0.3	3.5 3.5	11.76 m^3 8.4 m^3 20.16 m^3	

2. Prepare a detailed estimate of a part of a wall of a building from the given plan and section. Calculate,

- ✓ Earthwork excavation in foundation
- ✓ Lime concrete in foundation
- ✓ First class brickwork in foundation and plinth
- ✓ Brickwork in superstructure.



Centre line method

Horizontal = 0.15 + 5 + 0.3 + 5 + 0.15 = 10.6 m

Vertical = 0.15 + 4 + 0.15 = 4.3 m

Middle wall = 0.15 + 4 + 0.15 = 4.3 m

c/c length = 10.6 + 10.6 + 4.3 + 4.3 + 4.3 = 34.1 m [OR]

Centre length of walls = 5.3 + 5.3 + 5.3 + 5.3 + 4.3 + 4.3 + 4.3

= 34.1 m.

NOTE: > for 2 rooms Formula to find out the length.

L = c/c length – [No.of.units/2 x 1 breadth]

To find actual length :

L = c/c length – [No.of.units/2 x 1 breadth]

= c/c length –[2/2 x 1 B]

= 34.1 – 1B

= 34.1 – 0.9 = 33.2 m.

Contents	No.	L	B	H	Quantity
1. Earthwork excavation on foundation	1	33.2	0.9	0.9 (0.3+0.3+0.3)	26.89 m^3
2. Concrete in foundation	1	33.2	0.9	0.3	8.96 m^3
3. Brickwork in foundation and Plinth 1st Footing 2nd Footing 3rd Footing	1 1 1	33.2 33.2 33.2	0.6 0.5 0.4	0.3 0.3 0.6	5.976 m^3 4.98 m^3 7.968 m^3 18.924 m^3
4. Brickwork in Super structure	1	33.2	0.3	3.5	34.86 m^3

UNIT – II – ESTIMATION, COSTING AND VALUATION

II. RATE ANALYSIS

INTRODUCTION:

- The process of determining rate of any work in Civil Engineering project like earthwork, concrete work, brickwork, plastering, painting etc. is known as Analysis of Rates or simply Rate Analysis.
- The rates of these works further help in determining cost of particular work and in turn cost of the project.
- Rate Analysis = material cost + labour cost + 1.5 % of water from total cost of project + 10 % profit for Contractorfrom total cost + 5 % contingencies from total cost.
- The following are the steps involved in the preparation of datas,
- Calculate the cost of materials at site.
- Calculate sub data.
- Prepare the data.

PURPOSE OR NEED OF ANALYSIS OF RATES:

- To work out the actual cost of per unit of the items.
- To work out the economical use of materials and processes in completing the particulars item.
- To work out the cost of extra items which are not provided in the contract bond, but are to be done as per the directions of the department.
- To revise the schedule of rates due to increase in thecost of material and labour or due to change intechnique.
- Cost of labour -types of labour, standard schedule of rates
- The labour can be classified into,

Skilled 1st class

Skilled IInd Class

Unskilled

RATES:

- For preparing the estimate the unit rates of each item of work are required.

- For arriving at the unit rates of each item.
- The rates of various materials to be used in the construction.
- The cost of transport materials.
- The wages of labour, skilled or unskilled of masons,carpenters, Mazdoor, etc.,
- The rates of particular item of work depends on thefollowing:
- Specifications of works and material about their quality, proportion and constructional operation method.
- Quantity of materials and their costs.
- Cost of labours and their wages.
- Location of site of work and the distances from source and conveyance charges.
- Overhead and establishment charges.
- Profit
- Cost of materials at source and at site of construction.
- The costs of materials are taken as delivered at site inclusive of the transport local taxes and other charges.

Data:

- The art of finding rate per unit of individual item in a particular work is known as a Data.

Sub Data:

- The data which assists the main data is known as Sub data.
- After finding the sub data then only the main data can be worked out.

For Example: Brickwork in CM 1:5 in this CM 1:5 is a sub data.

Main Data:

- These are the main items of works. In which a particular item of work, rate is worked out.

For Example: Brickwork in Cement Mortar 1:5

Cost of Materials at Site:

- Cost of materials at site is the cost of material at source pluslead charges and handling charges.

Example: Cost of Materials and lead particulars.

Lead:

- The distance between the source of availability of material and construction site is known as lead and is calculated in Km.
- The conveyance cost of material depends on lead.

No.	Materials	unit	Cost	Lead in Km	Rate for lead/Km	Handling Charges
1.	Sand	1 m^3	115.00	6	4.00	14
2.	Bricks	1000 Nos	1785.00	11	6.00	20
3.	Rough stone	m^3	160.00	12	8.00	10

Materials	Unit	Cost	Lead in Km	Rate/km	Cost of conveyance	Handling charges	Cost at site
Sand	1 m^3	115.00	6	4.00	24.00	14	153.00 (115+24+14)
Bricks	1000 Nos	1785.00	11	6.00	66.00	20	1871.00 (1785+66+20)
Rough stone	m^3	160.00	12	8.00	96.00	10	266.00 (160+96+10)

MATERIALS REQUIREMENT FOR IMPORTANT DATAS:

- Unit Weight of Cement 1440 Kg/m^3

Cement Mortar Quantities for various ratios

- For Cement Mortar 1:1 – 1 m^3
  - ✓ Cement – 1440/1 = 1440 Kg (unit Weight of cement is1440 Kg/m^3)
  - ✓ Sand = 1 m^3
  - ✓ Mixing Charges extra.
- For Cement Mortar 1:1.5 – 1 m^3
  - ✓ Cement – 1440/1.5 = 960 Kg (unit Weight of cement is1440 Kg/m^3)
  - ✓ Sand = 1 m^3
  - ✓ Mixing Charges extra.
- For Cement Mortar 1:2 – 1 m^3
  - ✓ Cement – 1440/2 = 720 Kg (unit Weight of cement is 1440Kg/m^3)
  - ✓ Sand = 1 m^3
  - ✓ Mixing Charges extra.
- For Cement Mortar 1:3 – 1 m^3
  - ✓ Cement – 1440/3 = 480 Kg (unit Weight of cement is 1440Kg/m^3)
  - ✓ Sand = 1 m^3
  - ✓ Mixing Charges extra.
- For Cement Mortar 1:4 – 1 m^3
  - ✓ Cement – 1440/4 = 360 Kg (unit Weight of cement is 1440Kg/m^3)
  - ✓ Sand = 1 m^3
  - ✓ Mixing Charges extra.
- For Cement Mortar 1:5 – 1 m^3
  - ✓ Cement – 1440/5 = 288 Kg (unit Weight of cement is 1440Kg/m^3)
  - ✓ Sand = 1 m^3

- ✓ Mixing Charges extra.
- ➢ For Cement Mortar 1:6 – 1 m^3
- ✓ Cement – 1440/6 = 240 Kg (unit Weight of cement is 1440Kg/m^3)
- ✓ Sand = 1 m^3
- ✓ Mixing Charges extra.

Cost of materials and Lead particulars

No.	Materials	Unit	Cost in Rs.	Lead in Km	Rate for lead/Km	Handling Charges
1.	Cement	1 tonne	7000.00	5	22	116.00
2.	Sand	1 m^3	110.00	3	15	40.00

Cost of materials at site

Materials	Unit	Cost in Rs.	Lead in Km	Rate/Km	Cost of conveyance	Handling charges	Cost at site
Cement	1 tonne	7000.00	5	22	110.00	116.00	7226.00 (7000+110+116)
Sand	1 m^3	110.00	3	15	45.00	40.00	195.00 (110+45+40)

Cement Mortar 1:3 – 1 m^3

Qty.	Description	Rate	Per	Amount
480 kg	Cement	7226.00	Tonne	3468.48 (7226.00 X 0.480)
1 m^3	Sand	195.00	m^3	195.00 (1 X 195)
1 m^3	Mixing Charges	37.00	m^3	37.00 (1 X 37)
		Rate for 1 m^3		= Rs. 3700.48

Cement Mortar 1:5 – 1 m^3

Qty.	Description	Rate	Per	Amount
288 kg	Cement	7226.00	Tonne	2081.08 (7226 X 0.288)
1 m^3	Sand	195.00	m^3	195.00 (1 X 195)
1 m^3	Mixing Charges	37.00	m^3	37.00 (1 X 37)
	Rate for 1 m^3	= Rs. 2313.08		

Cement Mortar 1:6 – 1 m^3

Qty.	Description	Rate	Per	Amount
240 kg	Cement	7226.00	Tonne	1734.24 (7226 X 0.240)
1 m^3	Sand	195.00	m^3	195.00 (1 X 195)
1 m^3	Mixing Charges	37.00	m^3	37.00 (1 X 37)
Rate for 1 m^3 = Rs. 1966.24				

- Lime Mortar – 1 m^3
- Grinding Charges extra.

Mix Ratio	Lime	Sand
1:11/2	0.67 m^3	1 m^3
1:2	0.50 m^3	1 m^3

- Lime Surkhi Mortar – 1 m^3
- Grinding Charges extra.

Mix Ratio	Lime	Surkhi	Sand
1:1/2:1	0.67 m^3	0.33 m^3	0.67 m^3
1:1/2:11/2	0.5 m^3	0.25 m^3	0.75 m^3

Prepare Lime Mortar and Surki Mortar for the following Ratios:

- ✓ Lime mortar 1:2 – 1 m^3
- ✓ Lime – 0.5 m^3
- ✓ Sand – 1 m^3
- ✓ Grinding Charges extra.
- ➢ Lime Surki Mortar 1:1/2:11/2 – 1 m^3
- ✓ Lime – 0.5 m^3
- ✓ Surki – 0.25 m^3
- ✓ Sand – 0.75 m^3
- ✓ Grinding Charges extra.

Cost of materials and Lead particulars:

No.	Materials	Unit	Cost in Rs.	Lead in Km	Rate for lead/Km	Handling Charges
1.	Lime	m^3	1075.00	4	10.00	54.00
2.	Sand	m^3	110.00	6	14.00	38.00
3.	Surkhi	m^3	400.00	4	10.00	54.00

Grinding Charges for lime and surkhi mortar – Rs.120/m^3

Materials	Unit	Cost in Rs.	Lead in Km	Rate/Km	Cost of conveyance	Handling charges	Cost at site
Lime	m^3	1075.00	4	10.00	40.00	54.00	1169.00 (1075+40+54)
Sand	m^3	110.00	6	14.00	84.00	38.00	232.00 (110+84+38)
Surkhi	m^3	400.00	4	10.00	40.00	54.00	494.00 (400+40+54)

- Lime mortar 1:2 – 1 m^3

Qty	Description	Rate	Per	Amount
0.5 m^3	Lime	1169.00	m^3	584.50
1 m^3	Sand	232.00	m^3	232.00
1 m^3	Grinding Charges	120.00	m^3	120.00
Rate for 1 m^3 = Rs.936.50				

- Lime mortar 1:1.5 – 1 m^3

Qty	Description	Rate	Per	Amount
0.67 m^3	Lime	1175.00	m^3	787.25
1 m^3	Sand	203.00	m^3	203.00
1 m^3	Grinding Charges	125.00	m^3	125.00
Rate for 1 m^3 = Rs.1115.25				

- Lime Surki Mortar 1:1/2:11/2 – 1 m^3

Qty	Description	Rate	Per	Amount
0.5 m^3	Lime	1169.00	m^3	584.50
0.25 m^3	Surki	494.00	m^3	123.50
1 m^3	Sand	232.00	m^3	232.00
1 m^3	Grinding Charges	120.00	m^3	120.00
Rate for 1 m^3 = Rs.1060.00				

COSTING:

- Cost estimation in project management is the process of forecasting the cost and other resourcesneeded to complete a project within a defined scope.
- Cost estimation accounts for each element required for the project and calculates a total amountthat determines a project's budget.

Principles of Cost Estimation:

- Cost estimation is used to predict the quantity, cost and price of the resources required by the scope of a project.
- A project might be any process that is started to perform work activities and/or create assets.
- The accuracy of the estimate depends heavily on the level of project scope definition: as the design and conditions of the project become better defined, so do the estimated values.
- Cost estimation is needed to provide decision-makers with the means to make investment decisions, choose between alternatives and to set up the budget during the front end of projects.
- For this, estimates made by vendors and contractors need to be validated by clients as well.
- In later phases of the project, the budget estimate is used as a baseline to assess the

performance of a project.

- Estimating is done by breaking down the total scope of a project in manageable parts, to which resources can be assigned and cost.
- There are standardized ways of breaking down a project, like the Work Breakdown Structure (WBS) and the Cost Breakdown Structure (CBS), but depending on the needs of the project team and external parties multiple structures are often implemented to align reporting and sharing of cost data.
- A cost estimate is more than a list of costs. It also includes a detailed Basis of Estimate (BOE) report that describes the assumptions, inclusions, exclusions, accuracy and other aspects that are needed to interpret the total project cost.
- The BOE is required to communicate the estimate to the various parties involved in the decision making but is also handy during closeout when the performance of the project is compared with other projects.
- It is the vital part often overlooked, that allows you to learn from your experience and mistakes.

Meaning of Standard Data:

- Generally large number of man hours is spent in setting the time standards by using stopwatch time study.
- Further management is anxious to have the time standards before the jobs are actually manufactured for cost estimating, scheduling, planning and other decision-making purposes.
- In this case, advantage of previous time standards already on hand can be taken.
- Every operation consists of number of small work elements which are repeated in various combinations.
- The time values for these small work elements are established accurately, and these values are used without further time study, whenever the element occurs.
- These standardized timings for such elements are known as Standard Data.

Cost Control:

1. Cost control is the practice of identifying and reducing business expenses to increase profits, and it starts with the budgeting process.
2. Cost control is an important factor in maintaining and growing profitability.
3. Cost Control is a technique which makes available the necessary information to the management that actual costs are aligned with the budgeted costs or not.

NOTE:

MIX PROPORTION OVERALL QUANTITY

- ✓ For 100 m^3 of finished concrete = 152 m^3 of dry ingredient material.
- ✓ For 10 m^3 of finished concrete = 15.2 m^3 of dry ingredient material.
- ✓ For 1 m^3 of finished concrete = 1.52 m^3 of dry ingredient material.

PROBLEMS:

1. To find mix proportion for 10 m^3 concrete with cement concrete 1:2:4

For 10 m^3 , dry ingredient quantity = 15.2 m^3

15.2/(1+2+4) = 15.2/7 = 2.17 m^3

Cement Quantity = 2.17 X 1 = 2.17 m^3

Sand Quantity = 2.17 X 2 = 4.34 m^3

Aggregate Quantity = 2.17 X 4 = 8.68 m^3

(*a*) Cement concrete (1:4:8) – 1 m^3 quantity

Mix ratio = 1:4:8

= 13 parts

Total volume of ingredients = 1.52 m^3 (40 mm stone)

Volume of stone required = $\frac{1.52}{13} \times 8$

= 0.9354 m^3

= 0.94 m^3

Volume of sand required = $\frac{1.52}{13} \times 4$

= 0.4677 m^3 = 0.47 m^3

Volume of cement required = $\frac{1.52}{13} \times 1$

= 0.117 m^3

Weight of cement required = 0.117 m^3 × 1440 kg/m^3

= 168.48 kg = 168.5 kg (say)

(*b*) Cement concrete of 1:2:4 – 1 m³ quantity

Mix ratio = 1:2:4

= (7 parts)

Total volume of ingredients = 1.57 m³ (20 mm stone)

Volume of stone required = $\frac{1.57}{7} \times 4$

= 0.897 m³

= 0.9 m³

Volume of sand required = $\frac{1.57 \times 2}{7}$

= 0.449 m³

= 0.45 m³

Volume of cement required = $\frac{1.57 \times 1}{7}$

= 0.2248 m³

= 0.225 m³

Weight of cement required = 0.225 m³ × 1440 kg/m³

= 324 kg

(*a*) First Class Brickwork in CM 1:5 – 1 m³

Size of the first class brick = 0.19 × 0.09 × 0.09 m³

Take 10 mm as mortar thickness

Size of the brick with mortar = 0.2 × 0.1 × 0.1 m³

= 0.002 m³

No. of bricks required = $\frac{1}{0.002}$

= 500

Actual volume of bricks in 1 m³ of brickwork = 500 × 0.19 × 0.09 × 0.09

= 0.7695 m³

Volume of cement mortar for 1 m³ of BW = 1 – 0.7695

= 0.2305 m³

Volume of sand required for 0.2305 m³ of mortar = 0.2305 m³

Cement required for 1:5 for 0.2305 m³ = $0.2305 \times \frac{1440}{5}$

= 66.384

= 66.5 kg (say)

(*a*) Plastering with CM 1:6, 12 mm thick – 10 m²

Thickness of the mortar layer = 12 mm

= 0.012 m

Plastering area = 10 m²

Volume of the mortar required = 10 × 0.012

= 0.12 m³

Add 15% allowance = 0.12 × 0.15

= 0.018 m³

Total volume of mortar required = 0.12 + 0.018

= 0.138 m³

Sand required for 1 m³ CM 1:6 = 1 m³

Sand required for 0.138 m³ CM 1:6 = 0.138 m³

Cement required for 0.138 m³ CM 1:6 = $\frac{0.138 \times 1440}{6}$

= 33.12 kg

III. SPECIFICATIONS AND TENDERS

SPECIFICATION:

- Describes the nature and class of the work, materials to be used in work, workmanship etc. and is very important for the execution of the work.
- The cost of a work depends much on the specifications.
- Specifications should be clear.
- Specifications depend on the nature of the work, the purpose for which the work is required, strength of the materials, availability of materials, quality of materials etc.
- Drawings do not furnish the details of different items of work, the quantity of materials, proportion of mortar and workmanship which are described in specifications.
- Thus, the combinations of drawings and specifications define completely the structure.
- Drawings and specifications form important parts of contract document.

Purpose of Specifications:

- Specifications should describe the type and quality of every product required for the project.
- The specifications should describe the requirements for fabrication, erection, application, installation and finishing.
- Specifications should describe the quality of workmanship necessary for the project. This includes

All phases of creation and installation starting with

- ✓ manufacturing
- ✓ fabrication
- ✓ application
- ✓ installation
- ✓ finishing and adjustment.

Factors

The factors on which specifications depend upon:

- ✓ Nature of the work
- ✓ Strength of materials
- ✓ Availability of materials
- ✓ Quality of Materials.

Need

- Work is carried out according to the specification.
- Rate of work is based on specification.
- It is essential for contract document.

Specification Language:

- The following section covers how to be precise and clear when writing specifications and it includes a few things to avoid and how to be concise and save space.
- Four important sections for specification writing

- ✓ Be Clear
- ✓ Be Correct
- ✓ Be Complete
- ✓ Be Concise

Classification of Specifications:

Specifications are of two types:

- General or Brief Specifications
- Detailed Specifications.

General or Brief Specifications:

General specifications give the nature and class of the work and materials in general terms, to be used in the various parts of the work, from the foundation to the superstructure.

- It is a short description of different parts of the work specifying materials, proportions, qualities etc.
- General specifications give general idea of the whole work or structure and are useful for preparing the estimate.

For general idea, the general specifications of different class of buildings are given below.

General specifications of a First-Class Building:

Foundation and plinth:

Foundation and plinth shall be of 1-class brick work in lime mortar or 1:6 cement mortar over lime concrete or 1:4:8 cement concrete.

Damp proof course:

D.P.C. shall be 2.5 cm thick cement concrete 1:11/2:3, mixed with one kg of imperious per bag of cement or other standard water proofing materials as specified and painted with two coats of bitumen.

Superstructure:

Superstructure shall be of 1-class brickwork with lime mortar or 1:6 cement mortar. lintels over doors and window shall be of R.C.C.

Roofing:

Roof shall be of R.C.C slab with an insulation layer and lime concrete terracing above, supported over R.S joist or R.C.C beam as required. Height of rooms shall not be less than 3.7 m (12 feet)

Flooring:

Drawing room and dining room floors shall be of mosaic. Bathroom and W.C floors and dado shall be mosaic.

Floors of bedrooms shall be colored and polished of 2.5 cm cement concrete over7.5 cm lime concrete.

Floors of other shall be of2.5 cm cement concrete over 7.5 cm lime concrete polished.

Finishing:

Inside and outside walls be of 12mm cement lime plastered 1:1:6. Drawing, dining and bedrooms–inside shall be distempered, and other –inside white washed 3 coats.

Outside shall be colored snowcem washed two coats over one coat of white wash.

Doors and windows:

Chaukhats shall be seasoned teak wood.

Shutters shall be teak wood 4.3 cm thick paneled glazed or partly glazed as required, with additional wire gauge shutters. All fittings shall be of brass.

Doors and windows shall be varnished or painted two coats with high class enamel paint over one coat of priming. Window shall be provided with iron gratings or grills.

Miscellaneous:

Rain water pipes of cast iron or of asbestos cement shall be provided and finished painted.

Building shall be provided with 1st class sanitary and water fittings and electrical installations.

1 meter wide 7.5 cm thick C.C 1:3:6 apron shall be provided all-round the building.

General specifications of a Second-Class Building:

Foundation and plinth:

Foundation and plinth shall be of 1st class brickwork with lime mortar over lime concrete.

Damp proof course:

D.P.C. shall be of 2 c.m (3\4") thick cement concrete 1:2 mixed with 1 kg of imperious per bag of cement or other standard water proofing materials

Superstructures:

Superstructures shall be of 2nd class brickwork in lime mortar. Lintels over doors and windows shall be of R.B.

Roofing:

Roof shall be R.B. slab with 7.5 cm lime concrete terracing above (or flat terraced roof supported over wooden battens and beams, or Jack arch roof).

Verandah roof may be of A.C. sheet or Allahabad tiles.

Flooring:

Floors shall be 2.5 cm (1") cement concrete over 7.5 cm (3") L.C. Verandah floor shall be of brick tile or flag stone over lime concrete, finished cement painted.

Finishing:

Inside and outside walls shall be of 12 mm cement mortar plastered 1:6 ceiling shall be cement plastered 1:3 inside shall be white washed 3 coats, colour washed two coats over one coat of white wash.

Doors and windows:

Chaukhat shall be of R.C.C. or well-seasoned sal wood shutters of shisham wood or deodar wood 4 cm(1 ½") thick, panelled, glazed or partly panelled and partly glazed as required, fitted with iron fittings with iron fittings.

Doors and windows shall be painted two coats over one coat of priming.

Miscellaneous:

Rain water pipes shall be of cast iron finished painted. Electrification, and sanitary and water fittings' may be provided if required.

General specifications of a Third-Class Building:

Foundation and plinth:

Foundation and plinth shall be of 2nd class brick work in lime mortar in a lime concrete.

Damp proof course shall be 2cm thick cement mortar1:2 mixed with standard water proofing compound.

Super structure:

Superstructure shall be second class brick work in mud mortar.

Door and window opening shall be provided with arches of 2nd class brick work inlime mortar.

Roofing:

Roof shall be of mud over tiles or brick or G.I sheet or A.C. sheets sloping roof.

Flooring:

Floor shall be of brick-on-edge floor over well rammed earth. Finishing

Inside and outside wall shall be plastered with lime mortar and white washed three coat.

Doors and windows:

Chaukhat shall be salwood, and shuttered of chir mango or other country wood.

Doors and windows shall be painted two coats with ordinary paint over one coat of priming.

General specifications of a Fourth-Class Building:

Foundation and super structure:

Foundation and superstructure shall be of sun-dried in mud mortar.

Door and window opening shall be provided with arches of 2nd class brick work in lime mortar or with wooden plank.

Inside and outside shall be water proof mud plastered.

Roofing:

Roofing shall be of tile roof over bamboo and wooden supports.

Flooring:

Floor shall be kutcha or earthen floor finished with"gobri" washing.

Door and window:

Door and window shall be chir or mango wood or country wood.

GENERAL SPECIFICATION OF ROADS:

Subgrade: Well consolidated and compacted with camber 1 in 60.

Soiling: Minimum 1' wider than metaled width of road with –

- Over burnt bricks filled up with sand and 1" thick earth lightly compacted.
- Stone boulders 6" thick well packed and compacted earth over it.

Inter Coat and Top Coat:

Stone ballast or over burnt brick ballast of 4.5" and consolidated as well as compacted to 3".

Bitumen first coat:

Stone grit of 20mm gauge at 220 kg asphalt or Tar no.3 and 1.35 cum stone grit per 100 sqm.

Bitumen second coat:

Stone grit of 12mm gauge at 120 kg asphalt and 0.75 cum stone grit per 100 sqm.

Brick Edging:

Over burnt bricks on both sides

Misc:

For heavy traffic wearing surface may be provided with cement concrete, if subgrade is soft or weak well compacted thick sub base of inferior materials to be used.

DETAILED SPECIFICATION:

The detailed specification is a detailed description and expresses the requirements in detail.

The detailed specification of an item of work specifies the qualities and Under Review quantities of materials, the proportion of mortar, workmanship, the method of preparation and execution and methods of measurement.

The detailed specification of different items of work is prepared separately, and describes what the works should be and how they shall be executed & constructed.

Detailed specifications are written to express the requirements clearly in concise form avoiding repetition & ambiguity.

The detailed specification is arranged as far as possible in the same sequence of order as the work is carried out.

The detailed specifications if prepared properly are very helpful for the execution of work. The detailed specifications form an important part of contract document.

Every engineering departments prepares the detailed specifications of the various items of works, & get them printed in book form under the name' Detailed specifications.'

When the work, or a structure or project is taken up, instead of writing detailed specification every time, the printed Detailed Specifications are referred.

- The following provisions are made in the detailed specifications.

General provisions

Technical provisions.

❖ **General provisions:**

✓ These are also known as conditions of contract and they apply to the work as a whole.

✓ In this document, the conditions governing the contract are written.

✓ The following groups of conditions of contract are generally accommodated under the general provisions.

➢ Conditions a relating to documents

These pertain to

- ✓ Bill of quantities and schedule of prices
- ✓ Drawings
- ✓ Standard specifications.

➢ Conditions relating to the general obligations of the contractor

These pertain to

- ✓ Acts, bye-laws and regulations
- ✓ Fencing, watching and lighting of the work spot
- ✓ Insurance.

Conditions a relating to labour and personnel

These pertain to

- ✓ Accidents to workmen
- ✓ Contractors representative
- ✓ Rates of wages paid to the employees
- ✓ Removal of the employees of the contractor

➢ Conditions a relating to the execution of the work

These provisions are related to

- ✓ Alterations, additions and omissions during the progress of work
- ✓ Amount of extra items
- ✓ Damages
- ✓ Defective work
- ✓ Work at night and on holidays

- ✓ Workmanship etc.

➢ Conditions a relating to measurements and payments

These pertain to

- ✓ Method of measurement of completed works
- ✓ Method of payments etc.
- ✓ Conditions a relating to default and non-completion

These pertain to

- ✓ Failure to complete the work in time
- ✓ Right to suspend the work
- ✓ Time of completion etc.

➢ Conditions a relating to settlement of dispute

These pertain to

- ✓ Arbitration
- ✓ Jurisdiction of court etc.

Technical Provisions:

- These specifications describe the technical requirements of each type of constructions.
- The technical provisions contain detailed instructions regarding the desired quality of the final product.
- The technical provisions are of three types.

1. Specifications for materials and workmanship

For materials the following properties should be included in the specifications.

- ✓ Physical properties such as size, shape, grade, strength, hardness etc.,
- ✓ Chemical composition of the material
- ✓ Electrical, thermal and acoustical properties
- ✓ Appearance of the material
- ✓ A clear statement regarding the inspection and procedure of test of the material.

For workmanship, the following important features should be included in the specifications.

- ✓ The results desired
- ✓ The tools and plants to be engaged

- ✓ Detailed description of the construction method for each item
- ✓ Instructions regarding the protection of the finished work as well as of the adjacent property.

2. Specifications for performance

- ✓ These specifications are written for the overall performance of the finished product and hence they are written if the contract is for the supply of equipment and machinery such as pumps, motors etc.
- ✓ In these specifications, general description, design and installation and guarantee etc., of the equipment are specified.

3. Specifications for proprietary commodities

- ✓ Commercial products which are standardized or patented are called proprietory commodities.
- ✓ The specifications written for such materials should include the name of a particular brand or firm. (eg. Sun brand, Everest brand etc.)
- ✓ However, it is not desirable in case of public works to specify certain trade names or brands.
- ✓ To avoid monopoly and favouritism, it is general practice to specify the selected brand and then it is followed by the phrase "or equal".

Examples of Detailed Specifications of Materials

Detailed Specification for sand mortar:

- ✓ The Sand used for mortar shall be clean, sharp, heavy and gritty.
- ✓ It should be free from clay, salt, mica and organic impurities.
- ✓ It shall not contain harmful chemicals in any form.
- ✓ Medium and fine sand are to be used in mortars.
- ✓ Coarse sand shall be sifted through 600-micron sieve and used in mortars for plastering works.

Detailed Specification for first class bricks:

- ✓ The earth used for molding the bricks shall be free from organic matters salts and chemicals.
- ✓ The size, weight and colour of the burnt bricks should be uniform.
- ✓ The adjacent faces of the bricks are to be right angles to each other. The bricks shall be free from cracks, flaws and lumps.
- ✓ They should not break where dropped, from 1 metre height, on the ground.

- ✓ They should not absorb water by more 15 % of their self-weight when immersed in water for one hour.
- ✓ The average compressive strength of the bricks shall be not less than 7.5 N/mm2.
- ✓ The dry weight of one brick shall not be less than 3 kg.

Detailed Specification for cement:

- ✓ Ordinary Portland cement or rapid hardening Portland cement confirming to IS: 269 – 1989 and IS:8041 – 1990 shall be used.
- ✓ The fineness of the cement shall not be less than 30 minutes and the final setting time shall not be greater than 10 hours.
- ✓ The average compressive strength, after 7 days curing, of 1:3 cement mortar cubes shall be not less than 33 N/mm2 (33 grade).

Detailed Specification for wood for doors and windows:

- ✓ The wood shall be teak, well-seasoned and dry. It should be free from cracks, knots, defects and disease.
- ✓ It should be sawn in the direction of grains so that the edges are perfectly straight and square.
- ✓ The dimensions of the frames/scantlings/planks shall be as prescribed in the drawings.
- ✓ Patching or plugging of any kind is not permitted.

Detailed Specification for water for concrete:

- ✓ Water used for mixing and curing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel.
- ✓ Potable water may be used for mixing concrete.
- ✓ The suspended organic solid matter in the water shall not exceed 200 mg/l and inorganic solid matter shall not exceed 3000 kg/l, the pH value of water shall be not less than 6.
- ✓ Water sued for curing should not produce any objectionable stain or unsightly deposit on the concrete surface.
- ✓ The presence of tannic acid or iron compounds in the water is objectionable.

Detailed Specification for coarse aggregate:

- ✓ The aggregate to be used in reinforced cement concrete shall be of blue granite stone, machine crushed and well graded with a nominal size of 20 mm.
- ✓ It shall be hard, dense, durable strong and free from flakes.
- ✓ The aggregate shall not contain harmful materials such as coal, mica clay, shells, organic impurities etc.

- ✓ The compressive strength, crushing value of the aggregate shall be in accordance with the requirements of IS:383 – 1970.

Detailed Specification for reinforcement:

- ✓ The reinforcement shall be of high strength deformed steel bars confirming to IS:1786 – 1985.
- ✓ It should be bendable, weldable and have the modulus of elasticity not less than 200 kN/mm^2.
- ✓ The yield strength of the steel used shall not be less than 415 N/mm^2.
- ✓ All reinforcement bars shall be free from loose mill scales, loose rust and coats of paints, oil, mud or other coatings which may destroy or reduce bond.

Examples of Detailed Specifications of Works

1. Detailed Specification for earth work excavation for foundation:

Leveling the surface

- ✓ The whole area of construction is to be cleared of tees, grass, roots of trees etc., complete and leveled horizontally to enable easy marking of centre line of the building.

Dimensions

- ✓ The excavation shall be done in accordance with dimensions of trenches shown in the working drawings.

Shoring

- ✓ The sides of the trenches should be vertical and the bottom of the trenches should be flat.
- ✓ In the case of loose soils, the sides of the trenches should be shored with steel sheets.

Fencing

- ✓ Suitable temporary fencing is to be provided around the site of excavation to avoid any accidental fall into the trenches.

Dumping the soil

- ✓ The excavated soil is to be dumped and heaped at a minimum distance of 1.5 metre away from the trenches so that it does not slide again into the trenches.

Treatment of the bottom

- ✓ The bottom of the trench shall be watered and compacted by ramming before the foundation concrete is laid.
- ✓ Excessive excavations should not be adjusted by filling with loose excavated soils.

- ✓ Sand or plain concrete may be used for the adjustment of levels, that too with proper compaction.

2. Detailed Specification for lime concrete in foundation

Lime

- ✓ The lime used for the concrete shall be freshly burnt and slaked.
- ✓ It should be free from clayey particles and ashes.
- ✓ Unslaked stone particles should be removed by shifting.

Broken Bricks

- ✓ The overburnt bricks and the pieces of well burnt bricks are to be broken to sizes ranging from 20 mm to 40 mm and stacked for easy measurement.
- ✓ The brick bats shall be free from dirt, dust, rubbish, leaf etc.

Fine aggregate

- ✓ Surki made from well burnt brick bats is to be used as fine aggregate.
- ✓ It should pass through I.S. sieve no.48 and free from dust and dirt.

Proportioning

- ✓ Lime, surki and broken bricks are to be mixed in the proportion of 1:2:5 by volume.
- ✓ The materials are to be measured loose without shaking or ramming.

Mixing

- ✓ The mixing shall be done only by mechanical mixer.
- ✓ The broken bats are to be soaked in clean water for atleast 2 hours before mixing.
- ✓ The materials are first mixed to get uniform distribution and then water is gradually added.
- ✓ The mixing process is to be continued till all the brick bats are coated with mortar uniformly and a workable concrete is obtained.

Laying compacting

- ✓ The concrete shall be laid to the required thickness, not more than 200 mm and a time, and compacted by ramming with rammers weighing 4.5 to 55 kg.

Curing

- ✓ The lime concrete, so laid, is to be kept wet for atleast 7 days.

3. Detailed specification of random rubble masonry in foundation and basement

Stone

- ✓ The stone shall be obtained from the approved queries.

- ✓ It shall be sound, free from cracks and decay and shall have a specific gravity of not less than 2.5.

Mortar

- ✓ Cement mortar 1:6 to be used.

Method of Laying

- ✓ The stones are to be laid on broadest face which gives better opportunity to fill the spaces between stones by the mortar.
- ✓ The stones are laid layer by layer with sufficient mortar in between them for better binding.
- ✓ The outer face of the basement should be vertical and the joints are to be staggered.
- ✓ There shall be no gap, between the stones, unfilled by mortar.

Curing

- ✓ The masonry should be kept in we condition by sprinkling water thrice daily for atleast 7 days after construction.

4. Detailed specification of for brickwork in cement mortar 1: using first class bricks in super structure

- ✓ Bricks shall be table molded, well burnt in approved kiln, copper coloured, free from cracks and with sharp and square edges.
- ✓ Bricks shall be uniform in shape and shall be of standard size and shall give clear ringing sound when struck with each other.
- ✓ Bricks shall e well soaked in water for atleast 12 hours before their use, preferably in a tank provided at site of work.
- ✓ The proportion of mortar shall be one part of cement to five parts of sand by volume and shall be prepared as per standard specification for cement mortar.
- ✓ The cement and sand shall confirm to the standard specification.
- ✓ Broken bricks shall not be used except as closers.
- ✓ All corners shall be truly to plumb.
- ✓ Mortar joints shall break for bonding and shall not exceed 10 mm in thickness.
- ✓ Only skilled masons shall be employed on the work and the work shall be kept well-watered for atleast 15 days.
- ✓ All brickwork shall be carried out in such a way that no portion is raised unduly above another.
- ✓ The length and height shall be measured as on site.

- ✓ The thickness of walls shall be paid for as one brick, one and a half bricks, two bricks and so on.
- ✓ The rate for brickwork includes necessary scaffolding also.

Detailed specification of mosaic flooring

Base Course

- ✓ The basic course shall be of 25 mm thick cement concrete of a 1:2:4 mix using 12 mm size granite stone chips as coarse aggregate and sand as fine aggregate.
- ✓ The top of flooring concrete or R.C.C. slab shall be cleaned well and applied with cement slurry of 2 kg/m2 before placing the chips concrete.
- ✓ The base course is to be compacted, leveled and smoothed by wooden floats.

Mosaic Tiles

- ✓ Precast tiles of 200 mm x 200 mm x 20 mm size are to be used.
- ✓ They shall be manufactured under hydraulic pressure of not less than 14 N/mm2 and given the first grinding with machine before laying.
- ✓ The proportion of cement to sand in the backing of the tiles shall not be leaner than 1:3 by weight.
- ✓ Similarly, the proportion of cement to marble power to marble chips in the wearing layer of the tiles shall be not leaner than 3:1:7.
- ✓ The marble chips shall be hard, dense sound and homogeneous in texture.

Laying of Tiles

- ✓ The bedding for the tiles shall be with cement mortar 1:3.
- ✓ The average thickness of the bedding mortar shall be 20 mm and the thickness at any place shall be not less than 10 mm.
- ✓ Cement bedding shall be spread, tamped and corrected to proper levels and allowed to harden before the tiles are set.
- ✓ Neat cement slurry of honey like consistency shall be spread over the bedding at the rate of 4.4 kg/m^2.
- ✓ Tiles shall be washed clean and shall be fixed in this grout one after another, each tile being gently tapped with a wooden mallet till is properly bedded and in level with the adjoining tiles.
- ✓ The joints shall be kept as thin as possible not exceeding 1.5 mm and in straight lines.

Curing, Polishing and Finishing

- ✓ The day after the tiles is laid, all joints shall be cleared of the grey cement grout with a wire brush to a depth of 5 mm and all dust and loose mortar removed and cleaned.

- ✓ Joints shall then be grounded with white cement mixed with pigment to match the shade of tiles.
- ✓ The same cement slurry shall be applied to the entire surface of the tiles in a thin coat.
- ✓ The floor shall then be kept wet for a minimum period of 7 days.
- ✓ The surface shall thereafter be grounded evenly with the polishing machine fitted with coarse grade grit blocks, adding required water during the process.
- ✓ After grinding, the surface shall be washed clean and covered with thin coat of cement slurry with pigment.
- ✓ The surface shall be again cured and polished with machine fitted with medium grade grit blocks.
- ✓ Similarly, a third grinding shall be done by fine grade grit blocks.
- ✓ After the final polish, the surface shall be cleaned using diluted oxalic acid and wiped with a soft cloth.

EARTHWORK IN EXCAVATION IN FOUNDATION:

- ❖ **Excavation:**

- ✓ Foundation trenches shall be dug out to the exact width of foundation concrete & the sides shall be vertical.
- ✓ If the soil is not good & does not permit vertical sides, the sides should be sloped back or protected with timber shoring.
- ✓ Excavated earth shall not be placed within 1m (3') of the edge of the trench.

- ❖ **Finish of trench:**

- ✓ The bottom of foundation trenches shall be perfectly levelled both longitudinally & transversely & the sides of the trench shall be dressed perfectly vertical from bottom up to the least thickness of loose concrete so that concrete may be laid to the exact width as per design.

- ❖ **Water in foundation:**

- ✓ Water, if any accumulates in the trench, should be bailed or pumped out without any extra payment & necessary precautions shall be taken to prevent surface water to enter into the trench.

- ❖ **Trench filling:**

- ✓ After the concrete has been laid masonry has been constructed the remaining portion of the trenches shall be filled up with earth in layers of 15cm (6'') watered & well rammed.
- ✓ The earth filling shall be free from rubbish & refuse matters & clods shall be broken before filling.

- ✓ Surplus earth not required, shall be removed & disposed, & site shall be levelled & dressed.

DETAILED SPECIFICATION OF LIME CONCRETE IN FOUNDATION:

- ✓ A concrete made from a mixture of lime, sand, and gravel is said to be as lime concrete.
- ✓ It was widely used before the lime was replaced by Portland cement.

Lime as the first cement

- ✓ Since long, Lime has been used to make things like plaster and mortar.
- ✓ Lime is usually made by burning of limestone. Chemically; lime itself is calcium oxide (CaO) and is made by roasting calcite (CaCO3) to remove carbon dioxide (CO2).
- ✓ Lime is also called calx or quicklime.
- ✓ Quick Lime is very caustic and can even dissolve human bodies.
- ✓ When lime is mixed with water, lime slowly turns into the mineral portlandite (dense) in the reaction CaO + H2O = Ca (OH)2.
- ✓ Lime is mixed with an excess of water so it stays fluid, this is called slaking and the lime resulting is called slaked lime.
- ✓ Slaked lime continues to harden over a period of weeks.
- ✓ Lime has to be mixed with sand and other ingredients to take form of slaked lime cement, that can be used as mortar between stones or bricks in a wall or spread over the surface of a wall There, over the next several weeks or longer, it reacts with CO2 in the air to form calcite again (artificial limestone) Concrete made with lime cementis well known from more than 5000 years old.
- ✓ It was widely used in all over the world. Sign of its usage can be found easily after surveying different archaeological sites.
- ✓ In dry conditions, it works extremely well.

Drawbacks of Lime concrete

- ✓ Hydraulic lime usually gains strength in time greater than the time in which cement concrete gains same value of strength.
- ✓ Lime cement takes a long time to cure, and while the ancient world had lots of time, today time is money.
- ✓ Lime cement does not harden in water but stays soft.
- ✓ So, there are situations where it cannot be used.

Uses and precautions:

- ✓ used for foundation bases of load bearing walls, columns, and under layers of floors.

- ✓ Due to its flexibility, it adjusts very well with the underneath base ground and upper construction of cement base.
- ✓ For better quality of lime concrete, it is important to compact & cure concrete properly.
- ✓ Lime causes rashes on human skin so the persons which are dealing lime concrete should be provided with suitable rubber gloves.
- ✓ Persons should use oil on their skin to avoid rashes and cracking of their skin due to reaction of lime.
- ✓ To achieve good quality lime concrete, certain admixtures, fibres etc. can be used.

TENDER:

- ➢ Tendering is the process of making an offer, bid or proposal, or expressing interest in response to an invitation or request for tender
- ➢ Tendering usually refers to the process where by governments and financial institutions invite bids for large projects that must be submitted within a finite deadline.

Tender Form:

- ✓ It is a printed standard form of contract giving standard condition of the contract, general rules and directions for guidance of contractors.

Tender Calling:

- ✓ Call for Tender" is the process by which a company (Private or government) invites potential suppliers to submit offers for the execution of a contract.
- ✓ In simple words, Tendering calling procedure (or call for tenders) means that a public-sector organization announces publicly that it wishes to have a contract executed.

Procedure for Inviting Tenders:

- ✓ Preparation of tender documents
- ✓ Issue of tender notice
- ✓ Submission and opening of tenders
- ✓ Acceptance of tender and award of contract.

TENDERING:

- ➢ **Invitation to Pre-qualification:**
- ✓ In this stage the client publishes the requirement using the bidding method (competitive or negotiate) with the intention to select a suitable contractor.
- ✓ The invitation normally calls through the newspaper advertisement.

- **Tender selection stage:**

In this stage the process will take to select the correct tender specially consider the,

- ✓ Way of the application fills
- ✓ Completeness of applications
- ✓ Legal consideration –Whether the organization have any legal problems or acceptance
- ✓ Whether have the eligible to apply.

- **Evaluate the criteria:**

  After select the qualified tender documents from the applications the suitable contractor will select for the project according to the requirement criteria such as

- ✓ General experience
- ✓ Personnel capabilities
- ✓ Equipment capabilities
- ✓ Financial position
- ✓ Litigation history

  Normally this will consider according to the requirement criteria which mention in the paper advertisement.

- **Select the suitable applicant:**

- ✓ After analyze the applicants who pass in the preliminary examination the evaluate criteria will check and the applicant who satisfy the client requirement will select and inform through the "letter of acceptance" to the selected particular and also the submission of evaluation reports to Procuring Entity also will happen in the stage.

- **Contract Form:**

- ✓ This stage identifies as the last stage in the pre- qualification activities after the response from the selected applicant the agreement will sign between the two parties and the construction process will start.

TYPES OF TENDERS:

- **Open tenders:**

- ✓ This type of tender invites the contractors to bid by open advertisement in ITJ or newspaper.

- **Limited tenders:**

- ✓ Only selected number of contractors are invited to quote their rates.

- **Single or negotiated tender:**

- ✓ Only one firm to render a service by quoting their rates.

Advantage of Calling Tender:

- Lowest bid can be obtained due to competition
- Contractor selection can be made upon previous experience
- Quality of work can be assured
- Personal interest, partiality can be eliminated.

Details to be mentioned in notice inviting tenders:

The name and address of the procuring entity.

The designation and address of the Tender Inviting Authority.

Name of the scheme, project or program for which the procurement is to be affected.

The date upto which and places from where the tender documents can be obtained.

The amount of earnest money deposit payable.

The date, time and place for opening of tenders received.

Any other information the Tender Inviting Authority considers relevant.

TENDER DOCUMENTS:

The tender documents contain:

- ✓ Notice inviting tenders
- ✓ Tender form
- ✓ Schedule of quantity of works
- ✓ Special terms and conditions
- ✓ Complete specification
- ✓ Approved drawing.

EARNEST MONEY DEPOSIT:

- Earnest money is a deposit made to a seller showing the buyer's good faith in a transaction.
- Often used in real estate transactions, earnest money allows the buyer additional time when seeking financing.
- This money is a guarantee against the refusal of any contractor to take up the work after the acceptance of his tender.
- In case of refusal, this amount is forfeited.
- Usually 1-2% of the estimated cost is deposited.

SECURITY MONEY DEPOSIT:

- ✓ At the time of execution of the contract agreement, the successful tender has to deposit a further sum of 10% of the contract amount to the department.
- ✓ This amount is known as security deposit.
- ✓ This amount is kept check so that contractor fulfills all terms and condition of the contract.

Receiving of Tenders:

- ➢ After issue of tender document to bidders, the tender opening authority permits an officer to receive the tenders.
- ➢ Tender box marked with the date and time of opening the tender is placed in a suitable place.
- ➢ Contractors places the tenders in the tender box which will be locked and kept.

Opening of Tenders:

- ➢ The sealed tenders received are to be opened in the presence of contractors or their representatives tendering for the work at the time and place already notified.
- ➢ The divisional accountant is requested to presence on such occasion whenever possible.
- ➢ The officer opening the tenders has to read out the rates offered in case of item rate and percentage rate tenders and amount in case of lump sum tenders for information of all those present.

Selection and Acceptance of Tenders:

- ➢ After investigation the comparative statement, the lowest tender shall be accepted as a rule by the competent authority.
- ➢ If for any reason the lowest tender is not accepted, reasons should be recorded confidentially.

Power of Accepting Tender:

- ➢ Chief Engineer – Full Power
- ➢ Superintending Engineer - Full Power
- ➢ Executive Engineer – Upto Rs.5,00,000
- ➢ District Engineer or S.D.O - Upto Rs.50,000
- ➢ Assistant Engineer - Upto Rs.20,000

E-TENDER:

It is a process of carrying out entire tendering cycle online including submission of price bid such that efficiency, economy, speed of the internet can be harnessed.

Advantage of E-Tendering:

- ✓ Completely automated process
- ✓ Shortens time
- ✓ Great transparency
- ✓ Minimize human errors
- ✓ Anytime and anywhere the contractors can bid
- ✓ No dependence of newspaper, courier and bank
- ✓ Saves travelling cost
- ✓ No tender can be missed because of distance
- ✓ Can submit bid on last minute.

IV. CONTRACTS

INTRODUCTION:

- A contract is a legally binding document that recognizes and governs the rights and duties of the parties to the agreement.
- A contract is legally enforceable because it meets the requirements and approval of the law.
- A contract typically involves the exchange of goods, service, money, or promise of any of those.
- An agreement between two private parties that creates mutual legal obligations.
- A contract can be either oral or written.
- Contract, in the simplest definition, a promise enforceable by law.
- A voluntary, deliberate, and legally binding agreement between two or more competent parties.

CONTRACTOR:

- A person or a firm who undertakes any type of contract.
- Contractor means private individuals partnership firm, public or private limited concerns who have made such an undertaking for concerned therewith with the respective govt. the execution of works or supply of materials or for services.
- A general contractor is responsible for providing all of the material, labor, equipment (such as engineering vehicles and tools) and services necessary for the construction of the project.
- A general contractor often hires specialized subcontractors to perform all or portions of the construction work.

ARRANGING CONTRACTOR:

- ✓ Contract for a work is arranged by inviting sealed tenders, by issuing tender notices.
- An agreement
- Between two or more parties
- Recognized by law
- Enforceable through the courts.

TYPES OF CONTRACTS:

- Lump sum contract
- Lump sum and schedule contract
- Schedule contracts or Item Rate contract

- Labour contract
- Target contract
- Materials supply contract
- Piece-Work agreement
- Cost Reimbursement Contracts
    - Cost plus fixed fee contract
    - Cost plus percentage contract
    - Cost plus fluctuating fee contract
    - Percentage rate contract

LUMP SUM CONTRACT:

- ✓ A lump-sum contract is normally used in the construction industry to reduce design and contract administration costs.
- ✓ It is called a lump-sum because the contractor is required to submit a total and global price instead of bidding on individual items.
- ✓ A lump-sum contract is the most recognized agreement form on simple and small projects and projects with a well-defined scope or construction projects where the risk of different site conditions is minimal.
- ✓ Also known as a fixed-price contract.
- ✓ This type of contract is often used in the construction field to decrease the costs of contract administration.
- ✓ It's the most common agreement form for both small and simple projects.
- ✓ It tends to be used where a project is already well-defined in responsibilities and scopes for the parties.
- ✓ There also is little chance for a change, so the owner needs to have specifications and drawings that are complete.

Advantages:

- ✓ Low risk to the owner.
- ✓ 'Fixed' construction cost.
- ✓ Minimize change orders.
- ✓ Owner supervision is reduced when compared to Time and Material Contract.
- ✓ The contractor will try to complete the project faster.
- ✓ Accepted widely as a contracting method.

- ✓ Bidding analysis and selection process is relatively easy.
- ✓ The contractor will maximize its production and performance.

Disadvantages:

- ✓ It presents the highest risk to the contractor.
- ✓ Changes are difficult to quantify.
- ✓ The Owner might reject change order requests.
- ✓ The project needs to be designed completely before the commencement of activities.
- ✓ The construction progress could take longer than other contracting alternatives.
- ✓ The contractor will select its own means and methods.
- ✓ Higher contract prices that could cover unforeseen conditions.

LUMPSUM AND SCHEDULE CONTRACT:

- ✓ In this type of contract, the schedule of rates is also provided in the contract agreement.
- ✓ Measurement of extra items only shall have to be taken.
- ✓ The original work is however be checked and compared.
- ✓ The contract however includes a fixed sum within a fixed time along with the detailed specifications and conditions, and the scheduled rates.
- ✓ This contract is suitable when the number of items are limited or when it is possible to work out exact quantities of work to be executed.
- ✓ Under a lump sum contract, a “fixed price” for the work to be done is agreed upon by the client and contractor before the work begins.

Advantages:

- ✓ Low risk to the owner.
- ✓ 'Fixed' construction cost.
- ✓ Minimize change orders.
- ✓ Owner supervision is reduced when compared to Time and Material Contract.
- ✓ The contractor will try to complete the project faster.
- ✓ Accepted widely as a contracting method.

Disadvantages:

- ✓ It presents higher risk to contractor.
- ✓ The project needs to be designed completely before the commencement of activities.

- ✓ Changes are difficult to quantify.
- ✓ The Owner might reject change order requests.
- ✓ The construction progress could take longer than other contracting alternatives.

SCHEDULE CONTRACTS OR ITEM RATE CONTRACT:

- ✓ An item-rate contract is one in which the contractor agrees to carry out the work as per the drawings, bills of quantities, and specifications in consideration of a payment to be made entirely on measurements taken as the work proceeds, and at the unit- prices tendered by the contractor in the bill.
- ✓ An item rate contract, or unit price or schedule contract is a type of contract which is undertaken on per piece or item basis.

Advantages:

- ✓ There are no rates for individual items the benefit due to increase in quantities will not be availed by the contractor.
- ✓ Comparative statement can be prepared quickly.
- ✓ Overwriting & erasing of rates etc. can be avoided.
- ✓ profit of contractor is linked with actual cost so economic completion of work.
- ✓ Early completion.

Disadvantages:

- ✓ No extra work is allowed.
- ✓ The quantities of works are not guaranteed therefore there is risk to the contractor.
- ✓ The contractor may submit high tender.
- ✓ profit is not assured & depends on economy achieved in construction.

LABOUR CONTRACT:

- ✓ Contract labour refers to an employed person, hired to work in a company through a contractor for a specific work and a finite period.
- ✓ Contract labour, the labour of workers whose freedom is restricted by the terms of a contractual relation and by laws that make such arrangements permissible and enforceable.
- ✓ Other stipulations cover such matters as repayment of the costs of transportation, housing, training, and other expenses.
- ✓ The essence of the contract labourer's obligation is his surrender for a specified period of the freedom to quit his work and his employer.

Advantages:

- ✓ There is a wide disparity of views among the employers whether contract labour is engaged for flexibility or as cost saving mechanism.
- ✓ One of the main benefits, next to cost savings, for hiring contract labor involves the ease of separation.

Disadvantages:

- ✓ Job security: Even though there is no dearth of opportunities available for contract employment.
- ✓ Tax information: This is the part of legal obligation fulfilling which sometimesbecomes difficult for employees.
- ✓ Creating a brand
- ✓ Burden
- ✓ Time management issue

TARGET CONTRACT:

- ✓ Target cost contracts base their pricing on a figure that's aptly known as the target cost.
- ✓ This number is negotiated by both the contractor and the client before signing the contract, and represents the expected cost to the contractor of providing the agreed goods or services.
- ✓ If the final cost of the project is below the target cost, both the contractor and the client split the savings (the "gainshare").
- ✓ Similarly, if the final cost exceeds the target cost, both parties are responsible for paying this extra money.

TIME & MATERIALS SUPPLY CONTRACT:

- ✓ A Raw Material Supply Agreement is essentially an agreement to Sell as defined under the Sale of Goods Act, 1930.
- ✓ In other words, it is a sale agreement where one party agrees to sell and the other agrees to buy definite goods of economic value.
- ✓ The vesting of rights may be immediate or in future.

Advantages:

- ✓ Risk is less – the contractor will receive a fixed amount of overhead and profit, usually based on the total costs in a billing period.
- ✓ If additional costs are spent in a period, the contractor shall receive a larger payment for overhead and profit on top of those costs.
- ✓ Transparency for the client.

Disadvantages:

- ✓ Contractors may not understand the details of accounting in a construction context.
- ✓ They may bill haphazardly and infrequently.
- ✓ They may not have a good grasp of important concepts such as markup and margin.
- ✓ Contractors who agree to T&M contracts may be under cash flow stress and need to get the job started quickly.
- ✓ Contractors who use T&M contracts are often newer or inexperienced businesspeople who may not have substantial amounts of time in the industry.
- ✓ Contractors may find themselves with huge expenses at the end of a project that cannot be collected because of the terms of a T&M contract.

PIECE-WORK AGREEMENT:

- ✓ The piecework agreement between the employer and the individual employee must be in writing and signed by the employer and the employee.
- ✓ The employer must give the individual employee a copy of the piecework agreement and keep it as a time and wages record.

Advantages:

- ✓ When paid per piece, workers tend to develop and adhere to the most efficient means of production.
- ✓ Workers have a vested interest in achieving the company's goals in the most efficient way possible, because they're achieving more both for the company and for themselves.
- ✓ Increases the efficiency of all the employees.
- ✓ It is very easy to calculate the dues of the worker.
- ✓ Workers do not end up wasting any time.
- ✓ They are encouraged to think of better working methods.
- ✓ The number of products produced is much higher.
- ✓ The workers set deadlines for themselves.

Disadvantages:

- ✓ Workers pay much more attention to quantity and not quality.
- ✓ Planning for the future becomes rather tough.
- ✓ Finding and fixing on a reasonable piece cost is a rather tough task.
- ✓ It puts immense pressure on all the employees.
- ✓ Sometimes even more supervision is required.

COST REIMBURSEMENT CONTRACTS:

- ✓ Cost reimbursement items are not fixed prices. Those items are paid for based on what the Contractor spends in executing the work.
- ✓ Therefore, the payment of the Contractor is based on his actual expenditure.
- ✓ It includes labour, material, plants, sub-contracting cost, and other direct costs.
- ✓ Then the Contractor has to submit a load of invoices to demonstrate his actual cost.
- ✓ And also, he will be paid an agreed fee for his overhead and profit.
- ✓ The Contractor's cost accounts are open to audit by the Client (Open-Book Accounting).
- ✓ It is a little contractual incentive for the Contractor to perform, and the final price will depend both on the extent to which risks materialize and on the efficiency of the Contractor.

Advantages:

- ✓ Provide extreme flexibility.
- ✓ Allow and require a high level of client involvement.
- ✓ They facilitate joint planning.

Disadvantages:

- ✓ There is little incentive for the Contractor to perform efficiently.
- ✓ There is no estimate of the final price at the tender.
- ✓ Administrative procedures may be unfamiliar to all parties.
- ✓ In particular, the Client must provide cost accountants or cost engineers, who must understand the nature of a contractor's business.

FORMATION OF CONTRACT

Goals:

The goals of this section will be for you:

- ✓ To understand how a contract is formed.
- ✓ To understand each core concept of a contract.
- ✓ To understand the relationship between each core concept of a contract.

Objectives:

- ✓ To be able to understand the key terminology that relates to the formation of the contract.
- ✓ To be able to identify when a contract has been formed.

- ✓ To be able to identify whether the issue with a contract's formation is with the offer, acceptance, certainty/intention or consideration.

An agreement must have four essential elements to give rise to a contract and its respective obligations:

- ✓ Offer
- ✓ Acceptance
- ✓ consideration
- ✓ intention to create legal relations.

Offer:

- ✓ It is a promise to enter into a contract on certain terms.
- ✓ It must be specific, complete, capable of acceptance, and intended to be bound by acceptance.
- ✓ It can be express or implied by conduct.
- ✓ It can be made to an individual or a group or persons.

Acceptance:

- ✓ An offer must be accepted to create a contract.
- ✓ It must be final and unqualified with no variation to the proposed terms.
- ✓ It must be communicated by the accepting party to the offeror or, in some cases, conduct will constitute acceptance.

Consideration:

- ✓ Consideration essentially means that a person cannot enforce a promise unless he has given or promised something in return.
- ✓ A contract without consideration will only be enforceable if made by deed.

Intention to Create Legal Relations:

- ✓ The parties must intend to create a legally binding agreement, else there is no contract.

CONDITIONS OF CONTRACTS

- ➢ Rates inclusive of materials, labour,etc.
- ➢ Amount of security money
- ➢ Time for completion of work
- ➢ Progress to be maintained
- ➢ Penalty for bad work

- Mode of payment
- Extension of time limit for delay
- Termination of contract
- Compensation to labour, minimum wages, etc.

ELEMENTS OF A CONTRACT

- The contract itself must include the following:

- ✓ Offer.
- ✓ Acceptance.
- ✓ Consideration.
- ✓ Parties who have legal capacity.
- ✓ Lawful subject matter.
- ✓ Mutual agreement among both parties.
- ✓ Mutual understanding of the obligation.

CONTRACTS DOCUMENTS

- ✓ Contract Document is the written documents.
- ✓ It describes clearly about the work and defines the right and obligations of parties. (i.e., Owner and contractor).
- ✓ Its define the basis of the contract including both parties' roles, responsibilities, and detailed description of the work or service such as drawings, specifications, procedures, any other conditions, etc.
- ✓ It should include sufficient information to be able to complete the work or service.
- ✓ Construction contract documents include the Agreement, the Conditions of Contract, the Drawings, and the Specifications.
- ✓ Because of the legal implications, owners produce the Agreement and the Conditions.
- ✓ Architects are responsible for producing the Drawings and the Specifications.

CONTRACT AGREEMENTS AND CONTRACTS:

- ✓ This is an agreement used by the prospective building's owner and the contractor.
- ✓ It is the main contractual document, and other contractual documents attach a reference to it.

Statement of Work (Som):

- ✓ A solid scope of work is crucial in the bidding process and the constructions sequence.

- ✓ This document defines the scope of work to be applied in determining the work amount required for project completion.

General Conditions:

- ✓ This is a contract document defining obligations in regards to project execution and the rights of each party.
- ✓ It includes all overhead costs, what someone can claim, and entitlements.

Special Conditions:

- ✓ This is an amend and an extension of the general conditions.
- ✓ It needs to specify general conditions and clauses pertaining to every project or job.
- ✓ It has special instructions and requirements on how each job should be performed.

Bill of Quantities:

- ✓ This is a document made up by the list of different materials and trades that the construction project will require.
- ✓ This document might not be required by the contracting officer at all times.

Drawings:

- ✓ Each contract can have a set of drawings forming part of the job that ought to be performed.
- ✓ The drawings need to be issued to a contractor before commencing the building.
- ✓ This should include all drawings from consultants and experts constituting the entire project.

Master Format Outline:

- ✓ This is a technical requirement to complete, execute and perform tasks or get matters incorporated in a building project.
- ✓ It adds intelligence to the drawings of a construction.
- ✓ The role of this document is specifying common standards explaining accepted deviations, and providing information on accepted material details.
- ✓ It also cites all required materials for testing.
- ✓ Specifications could be made through referencing construction codes and standards.

Creating Construction Schedule:

- ✓ A construction schedule is a crucial component of this document.
- ✓ A contracting officer knows how and when a project will be completed through the review of this part.

- ✓ At times, a construction contract might need an updated schedule throughout the construction progress.
- ✓ The schedule can be monthly or agreed on payment application terms.

Costs in The Construction Industry:

- ✓ This breaks down all the construction project's incorporated items.
- ✓ It is normally the base for payment application.
- ✓ It could be detailed per item or in the form of lump sum without specifying individual items.

List of Common Types of Construction Insurance:

- ✓ This forms an important part of the contract by providing the owner a guarantee that the contractor has economic backup and means to perform under the construction contract's terms.
- ✓ It includes specific coverage types, insurance protections available to the prospective property owner, and required bonding.

EARNEST MONEY DEPOSIT:

- ➢ Earnest money refers to the deposit paid by a buyer to a seller, reflecting the good faith of a buyer in purchasing a home.
- ➢ The money buys more time to the buyer before closing the deal to arrange for funding and perform the hunt for names, property valuation, and inspections.
- ➢ Earnest money can be called, in many respects, a deposit on a property, an escrow deposit, or money of goodwill.
- ➢ Make sure the contract provides contingencies for funding and inspections.
- ➢ Without these, the deposit will be forfeited if, during the inspection, the buyer can't get funding or a significant defect is found.
- ➢ Read, comprehend, and comply with the terms and conditions of the contract.
- ➢ For instance, if the contract specifies that home inspection needs to be done by a certain date, the buyer must meet the deadline, or they risk losing the deposit and the property.
- ➢ Ensure that the deposit is handled properly.
- ➢ The deposit needs to be payable to a reputed third party, such as a well-known real estate brokerage, title company, escrow, or a law firm (never send the deposit directly to the seller).
- ➢ Buyers can keep the funds in an escrow account and also get a receipt.

SECURITY DEPOSIT:

- A security deposit is money that is given to a landlord, lender, or seller of a home or apartment as proof of intent to move-in and care for the domicile.
- Security deposits can be either be refundable or nonrefundable, depending on the terms of the transaction.
- A security deposit is intended as a measure of security for the recipient, and can also be used to pay for damages or lost property.
- Security deposits serve as an intangible measure of security, or as a means of tangible security in the event of damages or lost property.
- A security deposit might be used toward any repairs or replacement of appliances in a rental unit if the damages resulted from the actions of the renter.

MEASUREMENT BOOK:

- It is a complete measurement of some physical intervention, which can be recorded in the time of completion of any physical intervention.
- The most important objective of maintaining the final measurement would be to keep all the measurements in one place.

- Measurement Book" is an important document in which measurements are recorded for the work done by the contractor, or for the materials received at the site or services rendered.
- MB belongs to the Division and is serially numbered recording to whom issued, date of issue, etc
- Contractor payments are made based on the measurements recorded in the MB.
- It is considered very important accounts record and maintained very carefully and accurately and form substantial evidence in the court of law - should need arises
- Measurements are written legibly so that transactions are readily traceable.

- **Recording of measurements**

  Each set of measurements should commence with entries

  - ✓ Work Name as given in the estimate / agreement
  - ✓ Work location
  - ✓ Contractors Name
  - ✓ Agreement Number and date
  - ✓ Work commencement date
  - ✓ Work completion date
  - ✓ Measurement recording date

NOMINAL MUSTER ROLL:

- ✓ Nominal Muster Roll where daily attendance are recorded.
- ✓ In this part there are column and spaces for the names of the labourer, designation, father's name, dates of attendees, rates, total amount due for each, total amount for whole, signature of the person taking attendance, signature of the officer making payment etc.
- ✓ Nominal Muster Roll never be made in duplicate and entries should be made in such manner that it may not be possible to interpolate or to alter them.
- ✓ The names of the labourer are grouped according to classes as masons, mazdoors, carpenters etc.

ARBITRATION AND LEGISLATION:

Definition:

- ✓ It is a process by which parties by way of an agreement in writing submit their disputes or differences to a neutral person or group of persons for binding adjudication.

Arbitrator:

- ✓ An arbitrator is more or less like a private judge chosen by parties and endowed by them with power and privilege to decide the matter of dispute between them.

Advantages of Arbitration:

- ✓ It is possible to avoid legal formalities, delays and expenses.
- ✓ Simple process to solve the dispute
- ✓ It is conducted in private and not in open as in court.

V. VALUATION

VALUATION:

- Valuation is the analytical process of determining the current worth of an asset or a company.
- Valuation is the technique of estimation or determining the fair price or value of property such as building, a factory, other engineering structures of various types, land etc.
- By valuation the present value of a property is determined.
- The present value of property may be decided by its selling price, or income or rent it may fetch.
- The value of a property depends on its structure, life, maintenance, location, bank interest, legal control etc.
- The value also depends on supply on demand and the purpose for which valuation is required.

PURPOSE OF VALUATION:

- **Buying or Selling Property:**

✓ When it is required to buy or sell a property, its valuation is required.

- **Taxation:**

✓ To assess the tax of a property, its valuation is required.

✓ Taxes may be municipal tax, wealth tax, Property tax etc, and all the taxes are fixed on the valuation of the property.

- **Rent Fixation:**

✓ In order to determine the rent of a property, valuation is required. Rent is usually fixed on the certain percentage of the amount of valuation which is 6% to 10% of valuation.

- **Security of Loans or Mortgage:**

✓ When loans are taken against the security of the property, its valuation is required.

- **Compulsory Acquisition:**

✓ Whenever a property is acquired by law; compensation is paid to the owner. To determine the amount of compensation, valuation of the property is required.

- Valuation of a property is also required for Insurance, Betterment charges, speculations etc.

- **Role of An Engineer:**

✓ The roll of an Engineer in valuation is felt when an Engineering structure is to be valued, if and when it is: -

To be acquired

To be divide

To be allotted to a claim holder.

FACTORS CONSIDERATION FOR VALUATION:

- **Locality: -**

✓ In case a building is located in such an area, where there is easy access to market, schools and is located on road side.

✓ The Orientation of the building is according to Engineering rules.

✓ It will fetch more cost than a building which is in a neglected condition and is locate at unhealthy site.

- **Structure:**

✓ The structure of a building is also an important consideration while evaluating a building.

✓ Workmanship I attractive and the building is properly maintained, it will fetch more cost than the building in a neglected form with poor quality of material used.

- According to specifications a building is divided in four classes:-
  - ✓ First Class
  - ✓ Second Class
  - ✓ Third Class
  - ✓ Fourth Class

- **Value:**

✓ Present day cost of a Engineering structure (Saleable value)

- **Cost:**

✓ Original cost of construction.

✓ It is used to find out the loss of value of property due to various reasons.

IMPORTANT TERMS

- **Municipal Taxes:**

✓ Municipality needs money in order to undertake and maintain public utility services and the same is collected by imposing taxes on the property.

- ✓ The main utility works are roads, drainages, water supply tec. and the construction and maintenance.
- ✓ The taxes are assessed on some percentage basis on the net income from the property and varies from 10 % to 25 % of the net income.
- ✓ Usually for small houses the taxes are less and for big houses the taxes are high.

➢ **Capital Cost:**

- ✓ Capital cost is the total cost of a construction including land or the original amount required to possess a property.
- ✓ It is the original cost and does not change, while value of a property is the present cost which may be calculated by methods of valuation.

➢ **Capitalized Value:**

- ✓ The capitalized value of a property is the amount of a money whose annual interest at the highest prevailing rate of interest will be equal to the net income from the property.
- ✓ To determine the capitalized value of a property it is required to know the net income from the property and the highest prevailing rate of interest.

➢ **Year's Purchase (Y.P):**

- ✓ Year's purchase is defined as the capital sum required to be invested in order to receive an annuity of Rs. 1 at certain rate of interest.
- ✓ For 4 % interest per annum to get Rs.4 it requires Rs.100 to be deposited in a bank.
- ✓ To get Rs.1 per year it will be required to deposit ¼ of Rs.100 i.e 100/4 = Rs.25.
- ✓ Year's Purchase = 100/Rate of interest

➢ **Gross Income:**

- ✓ Gross income is the total income and includes all receipts from various sources of outgoings and the operational and collection charges are not deducted.

➢ **Net Income or Net Return:**

- ✓ This is the saving or the amounts left after deducting all outgoings, operational and collection expenses from the gross income or total receipt.

➢ **Outgoings:**

- ✓ Outgoings or expenses which are required to be incurred to maintain the revenue of the building.
- ✓ The various types of outgoings are as follows:

- Taxes
- Repairs

- Management and Collection charges
- Sinking Fund
- Loss of Rent
- Miscellaneous

Taxes:

These are annual taxes paid by the owner, such as wealth tax, property tax and municipal taxes (varies from 10% to 25% of net income).

Repairs:

For this 1 ½ % of the total construction is set aside for annual repairs of the building.

These repairs are must to maintain the building. It is also calculated as 10% of the gross income.

Management:

Upto 10% of the gross revenue is kept aside for this expense.

This includes, chowkidar sweeper etc. this is applicable only for big buildings or apartments

Miscellaneous:

This is again suitable for big buildings.

Lighting of common place, expenditure of liftman etc. are to be paid by the owner.

Loss of Rent:

This is also an outgoing in case a building in not fully occupied by the tenants.

This has to be deducted from gross income.

Insurance:

Premium given against fire or for theft policy.

Obsolescence:

The value of property decreases if its style and design are outdated i.e. rooms not properly set, thick walls, poor ventilation etc.

The reasons of this is fast changing techniques of construction, design, ideas leading to more comfort etc.

Free Hold Property:

- ✓ Any property which is in complete possession f the owner is known as free hold property.
- ✓ The owner can use the property in an way he likes.

- ✓ But he will have to follow constraints fixed by town planners or Municipality before doing any construction.

Lease Hold:

- ✓ If a property is given to some person on yearly payment basis by the free holder, then the property is called „lease hold property‟ and the person who take s the property is called Lease-holder.
- ✓ In case of building, the lease is for 99 years to 9 years.
- ✓ Types of Lease
    - Building Lease
    - Occupation Lease

Easement:

- ✓ An owner getting over the property of another person, the following faculties is known as easements.
- ✓ Facility of running water and sewer pipes through other's land.
- ✓ Facility of air and light.
- ✓ Facility of drainage of rain water.
- ✓ Facility of access.

Scrap Value:

- ✓ If a building is to be dismantled after the period of its utility is over, some amount can be fetched from the sale of old materials.
- ✓ The amount is known as Scrap Value of a building.
- ✓ If varies from 8% to 10% of the cost of construction according to the availability of the material.
- ✓ In case where Wood & Steel are available, the scrap value is more than as R.C.C structure, as in the latter case, the material has less reuse value.

Salvage Value:

- ✓ If property after being discarded at the end of the utility period is sold without being broken into pieces, the amount thus realized by sale is known as its Salvage Value.
- ✓ For example, railway sleepers can be re-used as posts and even old iron rails taken out can be used as beams in a roof or sheds of a building.

Annuity:

- ✓ The return of capital investment in the shape of annual instalments (monthly, quarterly, half yearly & yearly) for a fixed number of years is known as annuity.

Market Value:

- ✓ It is defined as the value which a property can fetch when sold out in open market.
- ✓ This value is variable, depending upon the will to buy or sell.

Book Value:

- ✓ It is the amount of a property shown in the books, after allowing necessary depreciations year-wise.
- ✓ The book value is independent of market-value.

Sinking Fund:

The fund which is gradually accumulated by way of periodic on annual deposit for the replacement of the building or structure at the end of its useful life is termed as sinking fund.

The calculation of sinking fund depends on the life of the building and scrap value of the building for the cost of old materials.

The cost of land is not taken into account in calculating sinking fund as land remains intact.

This is also taken as outgoings.

A fund which is gradually accumulated and aside to reconstruct the property after the expiry of the period of utility is known as sinking Fund.

The sinking funds may be found out by taking a sinking fund policy with any insurance company or depositing some amount in the bank.

Generally, while calculating the sinking fund, life of the building is considered.

90% of cost of construction is used for calculations & 10% is left out as scrap value.

$$I = \frac{Si}{(1+i)^n - 1}$$

Where, S = total amount of Sinking fund to be accumulated

n = number of years required to be accumulated the Sinking fund

i = rate of interest in decimal

I = annual instalment required.

PROBLEMS ON DETERMINATION OF SINKING FUND:

1. A pumping set with a mortar has been installed in a building at a cost of Rs.2,500.00. Assuming the life of the pump as 15 years, work out the amount of annual instalment of Sinking fund required to be deposited to accumulate the whole amount of 4 % compound interest.

Solution:

$$I = \frac{Si}{(1+i)^n - 1}$$

$$= \frac{2500 \text{ X } 0.04}{(1 + 0.04)^{15} - 1}$$

= Rs.125

2. The cost of newly constructed building is Rs.1,00,000. Assuming the future life of the building is 20 years. Calculate the amount of annual sinking fund @5 % compound interest.

Solution:

$$I = \frac{Si}{(1+i)^n - 1}$$

$$= \frac{100000 \text{ X } 0.05}{(1 + 0.05)^{20} - 1}$$

= Rs.3024

3. An old building has been purchased by a person at a cost of Rs.30,000/- excluding the cost of the land. Calculate the amount of annual sinking fund at 4 % interest assuming the future life of the building as 20 years and the scrap value of the building as 10 % of the cost of purchase.

Solution:

The total amount of Sinking fund to be accumulated at the end of 20 years,

S = 30000 X 90/100 = Rs. 27,000.00

$$I = \frac{Si}{(1+i)^n - 1}$$

$$= \frac{27000 \text{ X } 0.04}{(1 + 0.04)^{20} - 1}$$

= Rs.907.20

4. An old building was purchased by a person for Rs.2,00,000. Calculate the co-efficient of sinking fund, amount of sinking fund and yearly instalment of sinking fund, if the future life of the building is 15 years, rate of interest is 5 % and scrap value is taken as 10 % of the cost of the purchase.

Solution:

Cost of purchase = Rs.2,00,000

Scrap value = 200000 X 10/100 = Rs.20,000

1. Co-efficient of sinking fund:

$$I_C = \frac{I}{(1+i)^n - 1} = \frac{0.05}{(1+0.05)^{15} - 1} = 0.0463$$

2. Annual Instalment of sinking fund:

$$I = \frac{Si}{(1+i)^n - 1} = S \times I_C = 180000 \times 0.0463 = Rs.8334$$

3. Total amount of sinking fund:

Total amount of sinking fund, S = 200000 – 20000 = 1,80,000

5. A person has purchased an old building at a cost Rs.100000 on the basis that cost of land is Rs.40000 and cost of building is Rs.60000. Considering the future life of the building structure be 20 years. Work out the amount of annual sinking fund at 4 % interest when scrapvalue is 10 % of the cost of building structure.

Solution:

Scrap Value = 10 % cost of building structure

= 10/100 X 60000 = Rs.6000

Total amount of sinking fund = 60000 – 6000 = Rs. 54000

1. Annual sinking fund:

$$I = \frac{Si}{(1+i)^n - 1} = \frac{54000 \times 0.04}{(1+0.04)^{20} - 1} = Rs.1813$$

6. A property fetches a net annual income of Rs.900.00 deducting all outgoings. Workout the capitalized value of the property if the rate of interest is 6 % per annum.

Solution:

Year's purchase (Y.P) = 100 / 6 = 16.67

Capitalized value of the property = Net income X Y.P = 900 X 16.67

= Rs.15003.00

VALUATION OF BUILDING:

- **Cost Determination Methods:**
  - ✓ Cost from record
  - ✓ Cost from detailed measurement

- ✓ Cost by plinth area basis

Cost by plinth area basis: the above methods are lengthy, a simple method is to calculate the cost on plinth area basis. The plinth area of the building as measured and the present day plinth area rate of similar building in the locality is obtained by enquiries and then the cost is calculated.

- Method of valuation: the following are the different methods of valuations:

1) Rental method
2) Profit based method
3) Depreciation method

Depreciation Method of Valuation:

- According to this method the depreciated value of the property on the present day rates is calculated by the formula:

$$D = P[(100 - rd)/100]^n$$

Where,

D – depreciated value

P – cost at present market rate

rd – fixed percentage of depreciation (r stands for rate and d for depreciation)

n – The number of years the building had been constructed.

To find the total valuation of the property, the present value of land, water supply, electric and sanitary fitting etc; should be added to the above value.

Depreciation: is the loss in the value of the property due to is use, life, wear, tear, decay and obsolescence.
The general annual decrease in the value of a property is known as annual depreciation.
Usually, the percentage rate of depreciation is less at the beginning and generally increase during later years.
Methods of calculating depreciation: 1) Straight line method 2) constant percentage method 3) Sinking fund method.

METHODS OF VALUATION:

- The following are the various methods of valuation:
  - ✓ Depreciation method of valuation
  - ✓ Valuation based on cost
  - ✓ Valuation based on profit
  - ✓ Valuation by Development method
  - ✓ Rental method of valuation

Depreciation Method of Valuation:

In this method, the structure is divided into four parts for calculating depreciation:

Walls

Roofs

Floors

Doors and Windows

The measurement is done accurately and the cost is found out using current rates.

Depreciated value, $D = P \left(100 - rd \right)^n$

100

Where, D – Depreciated Value

P – Cost at present market rate

rd – Fixed percentage of depreciation

r – Rate

d – Depreciation

n – Number of years the building had been constructed.

- ✓ Structures with 100 years life, rd = 1.0
- ✓ Structures with 75 years life, rd = 1.3
- ✓ Structures with 50 years life, rd = 2.0
- ✓ Structures with 25 years life, rd = 4.0
- ✓ Structures with 20 years life, rd = 5.0

METHODS TO CALCULATING DEPRECIATION:

- Straight line method
- Constant percentage method or Declining balance method
- Sinking fund method

Straight Line Method:

$$\text{Annual Depreciation, } D = \frac{C - S}{n}$$

Where, C – Original capital cost

n – Age of the property in years.

S – Scrap Value or Salvage value.

Constant Percentage Method:

$$\text{Annual Depreciation, } D_m = C\,[\,(1-r)^{m-1} - (1-r)^m\,], \qquad r = 1 - (S/C)^{1/n}$$

Sinking Fund Method:

$$I = \frac{Si}{(1+i)^n - 1}$$

VALUATION BASED ON COST:

- ✓ In this method, the actual cost of the construction is found out and valuation is done after considering depreciations and the points of obsolescence should also be considered.

VALUATION BASED ON PROFIT:

- ✓ This method of valuation is suitable for buildings like cinema theatres, hotels, banks, big shop etc. for which the capitalized value depends on the profit.
- ✓ The capitalized value is calculated by multiplying year's purchase with net profit.

- ✓ In such cases, valuation may work out to be too high in comparison with the cost of construction.
- ✓ The net profit is worked out after deducting all possible outgoings and expenditures from the gross income.
- ✓ In such cases the cost will be too high as compared with the cost of construction actually incurred.

VALUATION BY DEVELOPMENT METHOD:

- ✓ This method of valuation is used for the properties which are in the undeveloped stage or partly developed and partly undeveloped stage.
- ✓ If a large place of land is required to be divided into plots after providing for roads, parks etc., this method of valuation is to be adopted.
- ✓ This method is also used for working out the value of a building.
- ✓ If a building is required to be renovated by making additions, alterations or improvements, development method of valuation may be used.
- ✓ In cases, when the building is still under development.
- ✓ In this case the future development of the building and profits from it should be anticipated while evaluating.

RENTAL METHOD OF VALUATION:

- ✓ Rent of a building is used as a base for calculating value of a building.
- ✓ In this method the net income by way of rent is found out after deducting all out goings from the gross rent.
- ✓ A suitable rate of interest prevailing in the market is assumed and year's purchase (Y.P) is calculated.
- ✓ Based on the above rate of interest, the net income multiplied by Y.P gives the capitalized value or valuation of the property.
- ✓ This method is applicable only when the rent is known or probable rent is determined by enquiries.

FIXATION OF RENT:

- ✓ The rent of building is fixed on the basis of certain percentage of annual interest on the capital cost and all possible annual expenditures on outgoings.
- ✓ The capital cost includes the cost of construction of the building, the cost of sanitary and water supply work, cost of electric installations and cost of subsequent additions and alterations if any.
- ✓ The cost of construction also includes the expenditures on the following:

- Raising, levelling and dressing sites

- Construction of compound walls, fences and gates
- Storm water drains
- Approach road and other roads within the compound.
- Gross rent = Net rent + outgoings
- Gross rent per month = Gross rent/12
- The rent worked out by this procedure is known as standard rent, while the actual rent of the property, may be higher or lower than this rent depending upon the situation of the property, type of construction, demand and supply etc.

PROBLEMS IN CALCULATING DEPRECIATION VALUE:

7. A building has been constructed for Rs.1200000. Assuming its salvage value at the end of 6 years as Rs.300000, determine the amount of depreciation and book value for the 6 years by Straight line method, Constant percentage method and Sinking fund method 4 % rate of interest.

Solution:

1. Amount of depreciation by Straight line method,

$$D = \frac{C - S}{n} = \frac{1200000 - 300000}{6} = \text{Rs.1,50,000}$$

Total Depreciation at 5^{th} year, DT = 150000 X 5 = Rs.7,50,000

Book value at the end of 5^{th} year (B) = C – DT = 1200000 – 750000 = Rs.4,50,000

2. Amount of depreciation by Constant percentage method,

Rate of depreciation, $r = [\ 1 - (S/C)^{1/n}] = [\ 1 - 300000/1200000)^{1/6}\ ]$

$= 1 - 0.7936 = 0.2064$

Annual Depreciation for the 5^{th} year,

$D = C\ [\ (1 - r)^{m-1} - (1 - r)^{m}\ ]$

$= 1200000\ [\ (1 - 0.2064)^{5-1} - (1 - 0.2604)^{5}\ ]$

$= 1200000\ [\ 0.39666 - 0.3147]$

$= 98352$

Total Depreciation at the end of 5 year,

$D_T = C\ [1 - (1 - r)^{5}\ ] = 1200000\ [\ 1 - 0.3147] = 822360$

Book Value at the end of 5-year, B = C – DT = 1200000 – 822360

$= 377640$

2. Amount of depreciation by Sinking fund method,

S = C – Salvage value

= 1200000 – 300000 = 900000

$$I = \frac{Si}{(1+i)^n - 1} = \frac{900000 \times 0.04}{(1 + 0.04)^6 - 1} = 135685.71$$

Annual Depreciation for the 6 year, $D = I (1 + i)^{6-1} = 135695.43 (1 + 0.04)^{6-1}$

$= 165082.41$

Total Depreciation at the end of 6 year,

$$D_T = \frac{I [(1 + i)^6 – 1]}{i}$$

$$= \frac{135685.71 [(1 + 0.04)^6 – 1]}{0.04}$$

= 899999.985

Book Value at the end of 6 year,

$B = C - D_T = 1200000 - 899999.985$

= 300000.015

8. The estimated cost of a building is Rs. 20,000. It is 20 years old & well maintained. The life of the structure is assumed to be 80 years. Work out the cost of building for acquisition solution.

Solution:

Life of the building is given as 80 years, rd = 1.

Depreciated value, $D = \frac{P (100 – rd)^n}{100}$

$$= \frac{20000 (100 – 1)^{20}}{100}$$

D = Rs.16,400.

9. A plot measures 500 sq.m. The built-up area is 300 sq.m. The plinth area rate of this 1st class building is Rs.600/- per sq/metre. This rate includes cost of water supply, sanitary and electric installation. The age of the building is 40 years. The cost of the land is Rs.80/- per sq.m.

Solution:

Cost of land = 500 x 80 = Rs.40,000/-

Cost of building = 300 x 600 = Rs. 1,80,000/-

Life of a building is given 40 years. So rd = 2.

The depreciated value, $D = \frac{P (100 - rd)^n}{100}$

$= \frac{180000 (100 - 2)^{40}}{100}$

$= 180000 \times 0.466$

D = Rs. 80280/-

Total value of property = 80280 + 40000 = Rs. 120,280/-

10. A building is situated on Ambala-Kalka road and costs Rs.38,000/-, considering its scrap value as 10% of the cost and life as 80 years. Find out depreciated value if the life of the building is 20 years.

Solution:

$D = \frac{C - S}{n}$

C =Rs.38,000, S =10% or Rs.3,800, n = 80 years.

$D = \frac{38000 - 3800}{80}$ = Rs.428 per year

In 20 years = 428 x 20 = Rs. 8560

Value of property = 38000 – 8560

Value of property = Rs.29,440

11. A building is situated by the side of a main road of Lucknow city on a land of 500 sq.m. The built-up portion is 20 m X 15 m. The building is first class type and provided with water supply, sanitary and electric fittings and the age of the building is 30 years. Workout the valuation of the property.

Solution:

Plinth area of the building = 20 m X 15 m = 300 sq.m

Assuming the plinth area rate as Rs.200 per sq.m including water supply, sanitary and electric fittings, the cost of the building = 300 X 200 = Rs.60,000

Considering the life of the building as 100 years, the depreciated value of the building:

$D = \frac{P (100 - rd)^n}{100}$

$$= \frac{60000\ (100 - 1)^{30}}{100}$$

D = Rs. 44,280/-

The cost of land assuming Rs.60 sq.m = 500 X 60 = Rs.30,000

Total valuation of property = 44280 + 30000

Total valuation of property= Rs.74,280

12. A Building costing Rs.7,00,000 has been constructed on a freehold land measuring 1000 sq.m recently in a big city. Prevailing rate of land in the neighbourhood is Rs.150 per sq.m. Determine the net rent of the property, if the expenditure on an outgoing including sinking fund is Rs.24,000 per annum. Work out also the gross rent of the property per month.

Solution:

Cost of construction = Rs.7,00,000

Cost of land @ Rs.150 per sq.m = 1000 X 150 = Rs.1,50,000

Net Return:

On building@ 6 % on the cost of construction = 7,00,000 X 6/100

= Rs.42,000

On the land @ 4 % on the cost of land = 1,50,000 X 4/100

= Rs.6,000

Total net rent per year = 42,000 + 6,000

= Rs.48,000

Gross rent = Net rent + outgoings = 48,000 + 24,000 = Rs.72,000 per annum.

Gross rent per month = 72000 / 12 = RS.6,000

13. In a plot of land costing Rs.20,000 a building has been newly constructed at a total cost of Rs.80,000 including sanitary and water supply works, electrical installation, etc. The building consists of four flats for four tenants. The owner expects 8 percent return on the cost of construction and 5 percent return on the cost of land. Calculate the standard rent for each flat of the building consisting:

i) The life of the building as 60 years, and sinking fund will be created on 4 % interest basis.

ii) Annual repairs cost at 1 % of the cost of construction.

iii) Other outgoings including taxes at 30 % of the net return of the building.

Solution:

Net return required on land per annum = 20,000 X 5/100 = Rs.1,000

Net return required on building per annum = 80,000 X 8/100 = Rs.6,400

Total net return per annum = Rs.7400

Expenditure on outgoings per annum:

1) Annual repair @ 1 % on cost of building = 80,000 x 1/100 = Rs.800
2) Sinking fund @ 4 % for 60 years on 90 % of building cost,

= 80,000 X 90/100 X 0.42/100

= Rs.302.40

0.42 % being the amount of sinking fund per annum of Rs.100

3) Other outgoings at 30 % of net return on building = 6,400 X 30/100 = Rs.1920

Total expenditure on outgoing per annum = Rs.3022.40

Gross rent = Net return + outgoings = 7400 + 3022.40 = Rs.10,422.40

per annum

Standard rent per month = 10,422.40 / 12 = Rs.868.53

Standard rent per flat per month = 868.53/4 = Rs.217.13

14. A three-storied building is standing on a plot of land measuring 800 sq.m. The plinth area of each storey is 400 sq.m. The building is of R.C.C framed structure and the future life may be taken as 70 years. The building fetches a gross rent of Rs.1500 per month. Work out the capitalized value of the property on the basis of 6 % net yield. For sinking fund 3 % compound interest may be assumed. Cost of land may be taken as Rs.40 per sq.m. Other data required may be assumed suitably.

Solution:

Gross income per year = 1500 X 12 = Rs.18,000

Outgoings per annum by assuming suitable data:

1) Repairs @ 1/12 gross income

=

Rs.1500

2) Municipal tax 20 % of gross rent = 18000 X 20/100 =
Rs.3600

3) Property tax 5 % of gross rent = 18000 X 5/100 = Rs.900

4) Insurance premium @ ½ % of gross rent = 18000 X 0.5/100 = Rs.90

5) Management charges @ 6 % of gross rent = 18000 X 6/100 = Rs.1080

6) Other miscellaneous charges @ 2 % of gross rent = 18000 X 2/100 = Rs.360

7) Sinking fund required to accumulate the cost of the building (which is at the rate of rs150 per sq.m of plinth area = 400 X 3 X 150 = Rs.180000) in 72 years @ 3 % interest.
= 180000 X 0.0043 = Rs.774

Total outgoings per annum = Rs.8304

Net annual return = 18000 – 8304 = Rs.9696

Capitalized value of the property = Net income X Y.P = 9696 X 100/6

= Rs.161600

Cost of land @ Rs.40 per sq.m = 800 X 40 = Rs.32000

Total = Rs.193600

Total value of the whole property is Rs. 193600

15. A coloniser intends to purchase a land of 100000 sq.m area located in the suburb of a big city to develop it into plots of 700 sq.m each after providing necessary roads and parks and other amenities. The current sale price of small plots in the neighbourhood is Rs.30 per sq.m. The coloniser wants a net profit of 20 %. Workout the maximum price of the land at which the coloniser may purchase the land.

Solution:

Total area of land = 100000 sq.m

Deduct 30 % for roads, parks etc. = 30000 sq.m

Net area of plots = 70000 sq.m

Number of plots @ 700 sq.m per plot = 70000 / 700 = 100

Selling price per plot @ Rs.30 per sq.m = 700 X 30 = Rs.21000

Total price from sale of all plots = 21000 X 100 = Rs.2100000

Deduct expenses:

1) Cost of improving of land levelling and dressing @ Rs.0.25 per sq.m

= 100000 X 0.25 = Rs.25000

2) Cost of providing metallic roads drainage, water supply and electrification @ Rs.3 per sq.m of whole land = 100000 X 3 = 300000

3) Engineer's and Architect's fees for surveying, planning, sub-dividing and supervising @ 3 % on the sale price = 2100000 X 3/100 = Rs.63000

4) Other miscellaneous expenses @ 1 % on the price = 2100000 X 1/100 = Rs.21000

5) Coloniser's profit @ 20 % on the sale price = 2100000 X 20/100 = Rs.420000

Total expenditure = Rs.8,29,000

Maximum price of land in the undeveloped stage = 2100000 – 829000

= Rs.12,71,000

Maximum rate of purchase = 1271000 / 100000 = Rs.12.71 per sq.m

The coloniser may purchase the whole land @ Rs.12.71 per sq.m for a total amount of Rs.12.71 Lakhs.

PROBLEMS BASED ON RENT FIXATION:

16. Find the plinth area required for the residential accommodation for an Assistant Engineer in the pay scale of Rs.400 to Rs.1000 per month.

Solution:

Average Pay = 400 + 1000 /2 = Rs.700 per month.

Average Monthly Rent @ 10 % of salary = 700 X 10/100 = Rs.70

Average Annual Rent 70 X 12 = Rs. 840

Capital cost of the building @ 6 % interest = 840 X 100/6 = Rs.14000

Plinth area required @ Rs.150 per sq.m of plinth area = 14000 / 150

= 93.33 sq.m

Normally the quarters for the Assistant Engineer should be constructed at the cost of Rs.14000 having plinth area of 93.33 sq.m.

MORTGAGE:

- ✓ An owner can borrow money against the security of his property, and for that purpose he is required to grant an interest to the party advancing the loan.
- ✓ The loan is required to be returned in specified.
- ✓ The person who takes the loans is known as Mortgagor, and the person who advances the loan is known as Mortgagee, and the relevant document for the mortgage transaction is known as mortgage deed.

- **Valuation of leasehold interest:** there are two types of properties namely
- Free hold property b) lease hold property
- **A free hold property:**
- The free hold is inherent the absolute owner of the property , he holds it without any pavement in the nature of the rent. He may sell the property, dived it or donate or grant it on lease at his sweet will.
- The freehold or owner who grants the lease known as 'lessor' and leaseholder is known as 'lessee'.
- In common practice it give as for 15, 21, 25 or 50 common in practice. When a lease is granted for a period of 99 it is known as long term lease and when it is for 999 years it is said to be perpetuity or for endless duration.

- **A leasehold property:** The leaseholder is known as lessee and holds the physical possession(under) of the property for the definite period under terms and condition specified in the lease document.
- **The different types of leases:**
- Building lease
- Occupation lease
- Sub-lease
- Life lease
- Perpetual lease