

## **Unit-I**

### **GENERAL ITEMS OF WORK IN BUILDING**

#### **1.1. PRINCIPLE OF WORKING OUT QUANTITIES:**

The units of measurements are mainly categorized for their nature, shape and size and for making payments to the contractor and also. The principle of units of measurements normally consists the following:

- a) Single units work like doors, windows, trusses etc., are expressed in numbers.
- b) Works consists linear measurements involve length like cornice, fencing, hand rail, bands of specified width etc., are expressed in running metres (RM)
- c) Works consists areal surface measurements involve area like plastering, white washing, partitions of specified thickness etc., are expressed in square meters ( $m^2$ )
- d) Works consists cubical contents which involve volume like earth work, cement concrete, Masonry etc are expressed in Cubic meters ( $m^3$ )

#### **1.2. METHODS OF ESTIMATING:**

Estimation is the calculation of quantities required and expenditure likely to be incurred for the project. The accurate estimates can be done by detailed estimate and approximate estimate can be done by many ways as mentioned below.

##### **1.2.1. Detailed Estimate**

The estimate may be approximate or preliminary estimate or accurate estimate. In approximate estimate the approximate cost of the work is estimated. In the accurate estimate the details of various items are taken and calculated.

##### **Definition**

The estimate prepared by dividing the work into different items, taking detailed measurements of each item of work and calculating their quantities is known as detailed estimate.

##### **Stages of preparation**

To prepare the complete estimation of the project, besides the estimated cost of different main items of work, the cost of preliminary works and surveying, cost of land and its acquisition, cost of leveling and preparation of ground and the cost of external services are to be provided. Provision of supervision charges and contractors profit is to be provided in the estimate. Data required for preparing an estimate: To prepare an estimate for a work the following data are necessary.

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 gives the nature, quality and class of materials, their proportion, method of execution and workmanship and the class of labour required. The cost of the work varies with its specifications. The cement mortar with 1:3 is more costly than cement 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 labor 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.

### **Details of measurements and calculation of quantities and abstract of estimated cost**

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.

**Table: Detailed Estimate**

<b>S.No</b>	<b>Description of work</b>	<b>No</b>	<b>Length</b>	<b>Breadth</b>	<b>Height/Depth</b>	<b>Quantity</b>	<b>Remarks</b>

**Table: Abstract Estimate**

<b>S.No</b>	<b>Description of work</b>	<b>Quantity</b>	<b>Unit</b>	<b>Rate</b>	<b>Amount</b>

### **1.2.2. Preliminary or Approximate Estimate**

Preliminary or approximate estimate is required for preliminary studies of various items of work or project, to decide the financial position and policy for administrative sanction by the competent authority. The preliminary estimate is prepared by different methods for different types of works. The various methods of preparing the preliminary estimate are plinth area estimate, cubical rate estimate and estimate per unit base.

### **Plinth area estimate**

The plinth area rate is calculated by finding the plinth area of the building and multiplying by the plinth area rate. The plinth area rate is obtained by comparing the cost of the cost of similar building having similar specifications in the locality.

### **Cubic area estimate**

The cubic rate estimate is prepared on the basis of the cubical contents of the building. The cubic rate is obtained from the cost of the similar building in the locality having similar specifications. The cost of the building is estimated by multiplying the volume of the building with the cubic area rate. Cubic rate estimate is more accurate as compared to the plinth area estimate.

### **Estimate per unit base**

The preliminary estimate may be prepared for different structures and works by various ways. For schools and hostels, per class rooms for schools, per bed for hospitals, per seat for theater halls, etc. For roads and highways and for irrigation works, the preliminary estimate is made per kilometer. For bridges and culverts per running meter. For sewerage and water supply projects on the basis of per head of population served.

### **1.3. MAIN ITEMS OF WORK:**

- 1) Earth work excavation
- 2) P.C.C in Foundation
- 3) Soling
- 4) Damp proof course
- 5) Masonry
- 6) Arch masonry work
- 7) Lintels over openings
- 8) RCC work
- 9) Flooring and roofing
- 10) Plastering
- 11) Pointing
- 12) Pillars
- 13) Doors& windows
- 14) Wood work
- 15) Bar bending
- 16) White washing and color washing

- 17) Painting
- 18) Lump sum items
- 19) Electrification & sanitary

#### 1.4. UNITS OF MEASUREMENTS

S.No.	Particulars of items	Units of measurement	Unit of payment
<b>1</b>	<b>Earth work</b>		
	Earth work in Excavation	cu.m	Per cu.m
	Earthwork in filling in foundation trenches	cu.m	Per cu.m
	Earth work in filling in plinth	cu.m	Per cu.m
<b>2</b>	<b>Concrete</b>		
	Lime concrete in foundation	cu.m	Per cu.m
	Cement concrete in Lintels	cu.m	Per cu.m
	R.C.C.in slab	cu.m	Per cu.m
	C.C. or R.C.C. Chujja, Sunshade	cu.m	Per cu.m
	L.C. in roof terracing	sq.m	Per sq.m
	Cement concrete bed	cu.m	Per cu.m
	R.C. Sunshade (Specified Width & Height)	cu.m	Per cu.m
<b>3</b>	<b>Damp Proof Course (D.P.C)</b>		
	(Thickness should be mentioned)	sq.m	Per sq.m
<b>4</b>	<b>Brick work</b>		
	Brickwork in foundation	cu.m	Per cu.m
	Brick work in plinth	sq.m	Per sq.m
	Brick work in super structure	sq.m	Per sq.m
	Thin partition walls	sq.m	Per sq.m
	Brick work in arches	sq.m	Per sq.m
	Reinforced brick work (R.B.Work)	sq.m	Per sq.m

<b>5</b>	<b>Stone Work</b>		
	Stone masonry	cum	Per cu.m
<b>6</b>	<b>Wood work</b>		
	Doors and windows frames or chowkhats, rafters beams	cum	Per cu.m
	Shutters of doors and windows (thickness specified)	sq.m	Per sq.m
	Doors and windows fittings (like hinges, tower bolts, sliding bolts, handles)	Number	Per Number
<b>7</b>	<b>Steel work</b>		
	Steel reinforcement bars etc in R.C.C. and R.B.work. quintal	Quintal	Per Quintal
	Bending, binding of steel Reinforcement	Quintal	Per Quintal
	Rivets, bolts, & nuts, Anchor bolts, Lewis bolts, Holding down bolts.	Quintal	Per Quintal
	Iron hold fasts	Quintal	Per Quintal
	Iron railing (height and types specified)	Quintal	Per Quintal
	Iron grills	Ton	Ton
<b>8</b>	<b>Roofing</b>		
	R.C.C. and R.B. Slab roof (excluding steel)	cum	Per cu.m
	L.C. roof over and inclusive of tiles or brick or stone slab etc (thickness specified)	sq.m	Per sq.m
	Centering and shuttering form work	sq.m	Per sq.m
	A.C. Sheet roofing	sq.m	Per sq.m
<b>9</b>	<b>Plastering, points&amp; finishing</b>		
	Plastering-Cement or Lime Mortar (thickness and proportion specified)	sq.m	Per sq.m
	Pointing	sq.m/ rmt	Per sq.m/ rmt
	White washing, color washing, cement wash (number of coats specified)	sq.m	Per sq.m
	Distemping	sq.m	Per sq.m

	(number of coats specified)		
	Painting, varnishing (number of coats specified)	sq.m	Per sq.m
<b>10</b>	<b>Flooring</b>		
	25 mm thick cement concrete over 75mm lime concrete floor (including L.C.)	sq.m	Per sq.m
	25mm or 40mm C.C. floor	sq.m	Per sq.m
	Doors and window sills (C.C. or cement mortar plain)	sq.m	Per sq.m
<b>11</b>	<b>Rain water pipe /Plain pipe</b>	1rmt	per rmt
<b>12</b>	<b>Trusses</b>	1No	Per 1No
<b>13</b>	<b>Glass panels (supply)</b>	sq.m	Per sq.m
<b>14</b>	<b>Fixing of glass panels or cleaning</b>	1No	Per 1No

### 1.5. RULES FOR MEASUREMENT

Measurement of works occupies a very important place in the planning and execution of any work or project, from the time of the first estimate are made until the completion and settlement of payments. The methods followed for the measurement are not uniform and the practices or prevalent differ considerably in between the states. Even in the same state different departments follow different methods. For convenience a uniform method should be followed throughout the country. The uniform methods of measurement to be followed, which is applicable to the preparation of the estimates and bill of quantities and to the side measurement of completed works have been described below.

#### General Rules

1. Measurement shall be item wise for the finished items of work and the description of each item shall be held to include materials, transport, labor, fabrication, hoisting, tools and plants, over hands and other incidental charges for finishing the work to the required shape, size, design and specifications.
2. In booking dimensions the order shall be in the sequence of length, breadth and height or depth or thickness.
3. All works shall be measured not subjected to the following tolerances unless otherwise stated.
  - (a) Dimensions shall be measured to the nearest 0.01 meter, i.e. 1 cm.

(b) Areas shall be measured to the nearest 0.01 sq.m (0.1 sqft).

(c) Cubic contents shall be worked up to the nearest 0.01 cu.m (0.1 cuft)

4. Same type of work under different condition and nature shall be measured separately under separate items.

5. The bill of quantities shall fully describe the materials, proportions and the workmanship and accurately represent the work to be executed. A work which by its nature cannot be accurately taken off or which requires site measurements shall be described as provisional.

6. In case of structural concrete, brickwork or stone masonry, the work under the following categories shall be measured separately and the heights shall be described.

(a) From first floor level

(b) From plinth level to first floor level.

(c) From first level to second floor level and so on.

The parapet shall be measured with the corresponding items of the story next below.

**1.6. Long wall and short wall method:** This method is also called as separate or individual wall method. This is simple and it gives accurate values.

The following procedure is adopted.

1. The dimensions of long wall and short wall should be taken separately.

2. Irrespective of its lengths, the wall which is taken first is long wall and the wall which is taken next is the short wall.

3. The centre line of the wall of the building is considered for determining the centre to centre line length of long walls and short walls.

4. The centre to centre length of long walls or short walls is obtained by adding half the width of the wall to the internal length to long wall on both sides and deduction for short walls.

5. Centre to centre length of long wall = internal length of long wall +  $\frac{1}{2}$  width of the wall.

6. Centre to centre length of short wall = internal length of short wall +  $\frac{1}{2}$  width of the wall.

7. To determine the lengths of different quantities such as earthwork, c.c. bed in foundation, R.R. Masonry etc, **length of long wall = centre to centre length of long wall + width, the width is the respective width of the item in consideration.**

8. Similarly **length of the short wall = centre to centre length of the short wall – width, where the width is the respective width of the item such as earthwork, c.c. bed etc.**

**1.7. Centre line method:** In the centre line method, the sum of all the centre line lengths of long walls and short walls are added to get the total centre line length. At the junctions of two walls, the length is present in both of the walls. Hence half of the length of that width is to be subtracted from the total centre line length.

$$\text{Length} = \text{Total centre line length} - \frac{1}{2} \text{ width} \times \text{number of junctions.}$$



## UNIT – II

### Estimation Costing & Valuation Earthwork for Roads and Canals

#### Course objectives:

1. Learn calculating road works quantities and canal work quantities.

#### Syllabus:

Quantity and Cost estimation of road. Quantity and cost estimation of canal

#### Learning Outcomes:

Students will be able to

- Evaluate road work quantities

#### Road work Estimation:

All Civil Engineering projects like roads, railways, earth dams, canal bunds, buildings etc. involves the earth work. This earth work may be either earth excavation or earth filling or Some times both will get according to the desired shape and level. Basically the volume of earthwork is computed from length, breadth, and depth of excavation or filling. In this chapter the various methods of calculating the earth work quantities shall be discussed.

Depending upon the terrain, alignment of the canal or road and the proposed formation / bed level, the nature of earthwork will be either in cutting or in filling or partially in cutting and filling. The filling is called banking or embankment. Principles of conveying earth (lead and lift) and earthwork in different types of soils are the same as for earthwork excavation in foundation as described in Section.

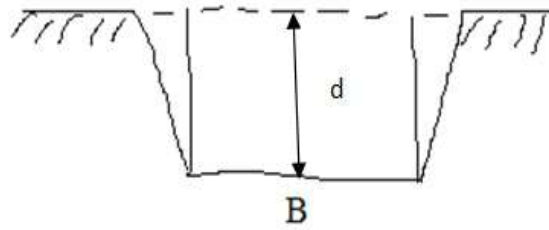
In order that the excavated or the banked sections remain without collapsing, side slopes depending upon the nature of the soil (angle of repose) are provided. Therefore, most cross-sections (except in rocks) are trapezoidal in geometry.

There are 3 cases of canal sections.

- 1) Fully in excavation
- 2) Partly in excavation and partly in embankment

3) Fully in embankment

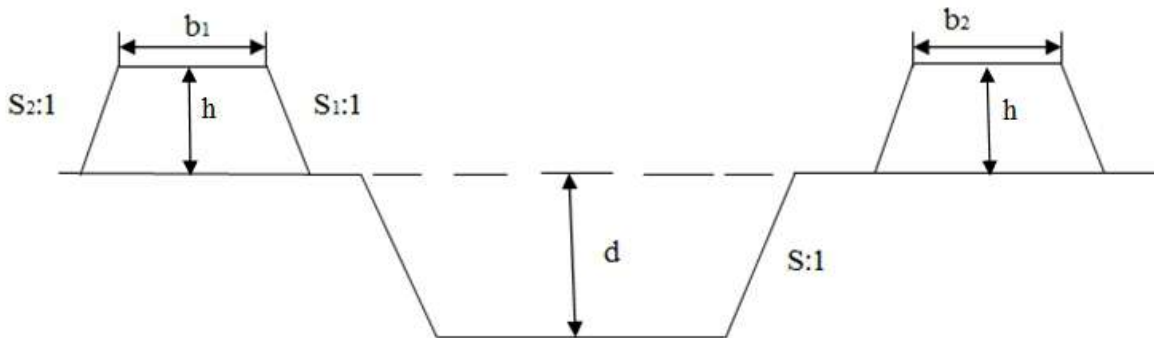
**Case 1: Fully in excavation:**



Quantity=

=

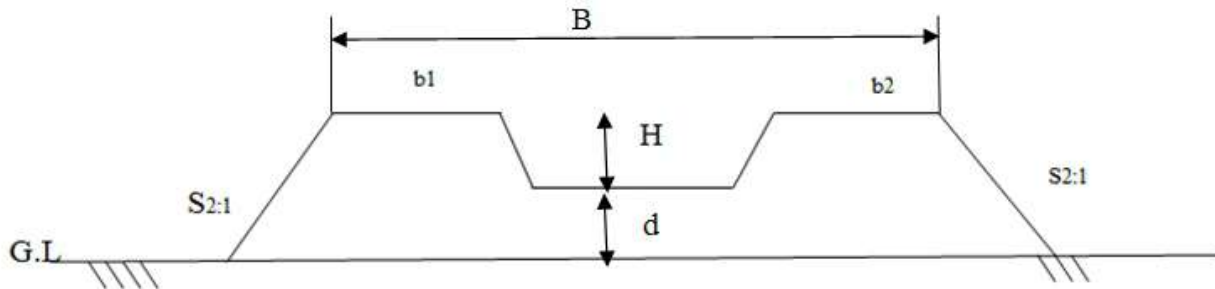
**Case2: Partly in excavation and partly in embankment:**



- Earthwork of excavated canal is calculated by principle  $(Bd+sd^2) \times L$ . earthwork on banks are also calculated by the same principle.
- Excess quantity required for banking is to be taken from borrow pits.
- If excavated quantity is sufficient to banking portion, depth of excavation is known as economical depth of digging or balancing depth.
- If quantity of earthwork in excavation is more than quantity in banking, surplus earth is through away from bank.
- Sectional area of excavation =  $(Bd+sd^2)$ .  
Sectional area of banking =  $(b_1+b_2) \times h + S_1 h^2 + s_2 h^2$
- Side slope of excavation and inner side slope of banks are given in such a manner that in due course of time, both will attain same slope.

- Economical depth can be calculated by equating the quantity of cutting portion with quantity of banking portion.

### Fully Banking:



Bed of the canal is above ground level.

The quantities of earthwork may be calculated considering the whole as solid and deducting the channel portion.

$$\begin{aligned} \text{Quantity} &= [\text{whole sectional area} - \text{sectional area of channel}]L \\ &= BD + S_2D^2 + 2S_1H + 2S_2D + \text{Extra width} \end{aligned}$$

The quantity of excavation or banking can be computed by using various mensuration techniques out of which three are given below:

1. Mid section Area Method,
2. Mean Sectional Area Method or Trapezoidal Method, and
3. Prismoidal Method.

**Note:** Use of tabular statement is advocated for calculation of earth work using any of the three methods.

#### 1. Mid section Area Method

In this method, the mean depth is to be calculated first by averaging the depth of two consecutive sections, From the mean depth, the area of the midsection is to be worked out and the volume of earthwork to be computed by multiplying the area of midsection by the distance between the two original sections.

Volume of earthwork =  $A_m \times L$

Where  $A_m$  = area of midsection and

$L$  = length of distance between two consecutive sections.

We get,

$A_m$  = Area of midsection + area of two sides =  $Bd_m + Sd_m^2$

Therefore,  $V = (Bd_m + Sd_m^2) \times L$

**Table: Mid section Area Method**

Stations or Chainage	Depth or Height	Mean depth or Height (d)	Area of Central Portion $B*d$	Area of sides $S*d^2$	Total sectional area $Bd+Sd^2$	Length B/w stations $L$	Quantity $(Bd+ Sd^2)*L$	
							Embankment	Cutting

## 2. Mean Sectional Area Method

This method is based on the assumption that the mid area of a pyramid is half the average area of the ends and the end sections are in parallel planes. If  $A_1$  and  $A_2$  are the areas of the ends and  $L$  is the length between two sections, the volume of the prismoid is given by

$$V = \frac{L}{3} (A_1 + A_2 + A_m) \text{ or } V = L \times A_m$$

Where,  $A_m$  = mid-sectional area.

**Table: Mean sectional Area Method**

Stations or Chainage	Depth or Height	Area of Central Portion $B*d$	Area of sides $S*d^2$	Total sectional area $Bd+Sd^2$	Mean Sectional Area	Length B/w station $L$	Quantity $(Bd+ Sd^2)*L$	
							Embankment	Cutting

## Trapezoidal Method

Considering a number of consecutive sections, having areas  $A_1, A_2, \dots, A_{n-1}, A_n$ .

Therefore, the total volume of earthwork =  $(L/2) (A_1 + 2A_2 + 2A_3 + \dots + 2A_{n-1} + A_n)$

### **3. Prismoidal Method**

From mensuration, volume of a prism having end faces that are in parallel planes

$$V = (L/6) (A_1 + A_2 + 4A_m)$$

Where  $A_1$  and  $A_2$  are the cross-sectional areas at the ends of a portion of the embankment or cutting of length  $L$  and  $A_m$  is the mid-sectional area.

**UNIT-III**  
**Estimation Costing & Valuation**  
**Rate Analysis**

**Course Objectives:**

- Understand the different specifications for civil works.
- Appreciate rate Analysis, contracts and valuation.

**Syllabus:**

**Rate Analysis**

Specifications, Purpose and method of writing specifications; General specifications. Detailed Specifications for Brick work; R.C.C; Plastering; Mosaic Flooring; R.R.Stone Masonary

**Analysis of Rates:**

Task or out – turn work; Labour and materials required for different works; Rates of materials and labour; Preparing analysis of rates for the following items of work: I) Concrete ii) RCC Works iii) Brick work in foundation and super structure iv) Plastering v) CC flooring vi) White washing.

**Learning Outcomes:**

Students will be able to

- calculate rate analysis and prepare valuation reports for roads and buildings.

**Rate Analysis**

To estimate the cost of the building, the quantities of various items of work are calculated from the drawings. The unit rates of various items of work are calculated from the specifications of the various types of materials. The rates are calculated as per the rates in the standard schedule of rates. The unit rates of various items of work increase considerably with the specifications. The specifications indicate the quality of the work while the drawings are used for the quality of the work.

**3.0 Importance of Specifications**

Specification specifies or describes the nature and the class of work, materials to be used in the work, workmanship etc., and is very important for execution of work. The cost of a work much depends on execution of the work. From the study of specifications one can understand the nature of that work and what the work shall be. 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 combination of drawing and specifications form important parts of contract documents.

### **3.1.Types of Specifications:**

Specifications are of two types.

- 1) General specifications
- 2) Detailed specification

#### **3.1.1. General Specifications:**

It gives the nature and class of the work and materials in general terms, to be used in the various parts of work, from foundation to super structure. It is a short description of different parts of work , specifying materials, proportions, quantities etc. It gives the general idea of whole work or structure and useful for preparing the estimate.

**3.1.2. Detailed specifications :** Detailed specifications are written to express the requirements clearly in a concise form avoiding repetition and ambiguity. The detailed specifications for various items of work are as follows.

##### **3.1.2.1. Earthwork excavation of foundation**

The following specifications shall be followed in the earthwork in excavations in foundations.

1. Foundation trench shall be dug to the exact width and depth of foundation.
2. Excavated earth shall not be placed within 1 m. of the edge of the foundation.
3. The bottom of the trenches shall be perfectly leveled both longitudinally and transversely.
4. If water accumulates in the trench, it should be pumped out. Care should be taken to prevent water from entering the trench.
5. If rocks and boulders are found during excavation, they should be removed and the bed of the trench should be leveled and consolidated.
6. Foundation concrete should be laid only after the inspection and approval by the Engineer in charge.

##### **3.1.2.2 Cement concrete in foundation (1:5:10)**

The following specifications should be followed in cement concrete in foundation.

1. Course aggregate should be of hard broken stone, free from dust, dirt and foreign matter.
2. Fine aggregate shall be of coarse sand, consisting of hard, sharp and angular grains and shall

pass through screen of 5 mm. square mesh.

3. Sand should be free from dust, dirt and organic matters.
4. Water shall be clean and free from alkaline and acid matter.
5. Mixing should be done on a masonry platform or sheet iron tray in hand mixing.
6. Coarse aggregate and sand should be mixed by volume and cement by weight.

### **3.1.2.3 Random rubble masonry**

The following specifications should be followed in random rubble masonry

1. The stones should be sound, hard and durable. Stones with rounded surface shall not be used.
2. No stone shall be less than 15 cm. in size.
3. Bond stones should be provided at every 1 m. length.
4. Cement mortar 1:3 to 1:6 shall be provided.
5. The joints in the stone masonry shall not be thicker than 2 cm.
6. The masonry shall be watered for at least 10 days.

### **3.1.2.4 Brick masonry**

The following specifications should be followed in brick masonry first class

1. Bricks of standard size, copper red color, regular in shape, having sharp square edges should be used.
2. The bricks should not absorb more than 20% of water when immersed in water for 24 hours.
3. The mortar used in brick masonry shall be 1:3 to 1:6.
4. The bricks shall be well bonded and laid in English bond unless otherwise specified.
5. Mortar joints shall not exceed 6 mm. in thickness and the joints shall be fully flushed with mortar.
6. The bricks should be soaked in water before use in masonry.
7. The brick masonry shall be watered for at least 10 days.

### **3.1.2.5. Plastering**

The following specifications should be followed in plastering

1. The materials of mortar, cement and sand used in plastering should be as per specifications.
2. The joints of the brickwork shall be raked for a depth of 18 mm. on the surface.
3. Ceiling plastering should be completed before the start of wall plastering.
4. The thickness of the plastering should not be less than 12 mm. for internal plastering and 20 mm. for external plastering.



5. The plastering work shall be checked for horizontality with a straight edge and for verticality with a plumb bob.
6. Any defective plastering shall be cut in rectangular shape and replaced.
7. The plastering should be watered for at least 10 days.

### 3.2. Task or Out-turn work:

The capacity of doing work by an artisan or skilled labor in the form of quantity of work per day is known as the task-work or out-turn of the labor.

The following may be taken as the approximate quantity of work or out-turn or task for an average artisan per day.

S.No	Particulars of item	Quantity
1	Brickwork in lime or cement mortar in foundation	1.25 cu.m
2	Brickwork in lime or cement mortar in super structure	1.00 cu.m
3	Brickwork in mud mortar in foundation	1.50 cu.m
4	Brickwork in mud mortar in super structure	1.25 cu.m
5	Brick in cement or lime mortar in arches	0.55 cu.m
6	Brick in cement or lime mortar in jack arches	0.55 cu.m
7	Half brick wall in partition	5.00 sq.m
8	Coursed rubble stone masonry in lime or cement mortar including dressing	0.80 cu.m
9	Random rubble stone masonry in lime or cement mortar	1.00 cu.m
10	Ashlar masonry in lime or cement mortar	0.40 cu.m
11	Stone arch work	0.40 cu.m
12	Lime concrete in the foundation or floor	8.50 cu.m
13	Lime concrete in roof terracing	6.00 cu.m
14	Cement Concrete 1:2:4	5.00 cu.m
15	R.B work	1.00 cu.m
16	R.C.C work	3.00 cu.m
17	12mm plastering with cement or lime mortar	8.00 sq.m
18	Pointing with cement or lime mortar	10.00 sq.m
19	White washing or colour washing three coats	70.00 sq.m
20	White washing or colour washing one coat	200.00 sq.m
21	Painting varnishing doors or windows one coat	25.00 sq.m
22	Coal tarring or solignum painting one coat	35.00 sq.m
23	Painting large surface one coat	35.00 sq.m
24	Distempering one coat	35.00 sq.m
25	2.5cm cc floor	7.50 sq.m
26	Flagstone floor laying with lime or cement mortar	10.00 sq.m

	excluding L.C.	
27	Terrazo floor 6mm thick mosaic work 2 cm thick cement concrete(1:2:4)	5.00 sq.m
28	Brick on edge in floor lime or cement mortar excluding L.C	7.00 sq.m
29	Brick flat floor as in above	8.00 sq.m
30	Timber framing sal or teak wood	0.07 cu.m
31	Timber framing country wood	0.15 cu.m
32	Door and window shutters paneled or glazed	0.15 sq.m
33	Door and window shutters battned	0.80 sq.m
34	Sawing hard wood	4.00 sq.m
35	Sawing of soft wood	6.00 sq.m
36	Single Allahabad tiling	6.00 sq.m
37	Double Allahabad tiling	4.00 sq.m
38	Breaking of brick ballast 40mm gauge	0.75 cu.m
39	Breaking of brick ballast 25mm gauge	0.55 cu.m
40	Breaking of stone ballast 40mm gauge	0.40 cu.m
41	Breaking of stone ballast 25mm gauge	0.25 cu.m
42	Ashlar stone dressing	0.70 cu.m
43	Flagstone dressing	1.50 sq.m
44	Earthwork in excavation in ordinary soil	3.00 cu.m
45	Earthwork in excavation in hard soil	2.00 cu.m
46	Excavation in rock	1.00 cu.m
47	Sand filling in plinth	4.00 cu.m
48	Number of bricks laid by a mason in brick work upto a height of 3m	600 bricks

### 3.3. Preparation of unit rates for different works

#### 3.3.1 Cement Concrete:

The sum of total quantities of materials for cement concrete should 15.2 cu.m for every 10cu.m of concrete.

Based on the proportion of the materials given each material quantity is determined.

Cement concrete 1:2:4- unit 1 cu.m. Take 10 cu.m

Particulars	Quantity or No.s	Rate per unit (Rs.)	Cost (Rs)
<b>Materials</b>			
Coarse Aggergate			
Sand			
Cement			
<b>Labour</b>			
Mistri	1/3 no.		
Mason	2 nos		
Mazdoor	12 nos		

Boy or woman coolie	20 nos		
Bhisthi (including curing)	6 nos		
Forms etc (according to requirement)	Lump sum		
Sundries T. and P. etc.	Lump sum		
Total cost of materials and labour			
		Add 1.5% of water charges	
		Add 10% contactor profit	
		<b>Grand Total</b>	

### 3.3.2 RCC work

#### R.C.C work in beams, slabs, etc 1:1:2- unit 1 cu.m- Take 10 cu.m

Particulars	Quantity or No.s	Rate per unit (Rs.)	Cost (Rs)
<b>Materials</b>			
Coarse Aggergate			
Sand			
Cement			
Steel (Mild steel bars@1%)			
<b>Labour</b>			
Mistri	1/2 no.		
Mason	2 nos		
Mazdoor	12 nos		
Boy or woman coolie	20 nos		
Bhisthi (including curing)	6 nos		
Forms etc (according to requirement)	Lump sum		
Sundries T. and P. etc.	Lump sum		
<b>Bending, Cranking and binding steel bars in position</b>			
Black smith (II class)			
Mazdor (Beldar)			
T. And P.	Lump sum		
<b>Centering and shuttering (both erection and dismantling)</b>			
Timber planks and ballies	Lump sum		
Carpeneter (II Class)	10 no.s		
Mazdoor (Beldar)	10 no.s		
Nails	Lump sum		
T and P.	Lump sum		
Total cost of materials and labour			
		Add 1.5% of water charges	

Add 10% contactor profit	
<b>Grand Total</b>	

### 3.3.3. Brick Work

- For 10cu.m of brick work, 5000 standrad or nominal size bricks are required.
- Total mortar requird= total voume of brick work- net volumes of bricks  
Generally for standard bricks, for every 10cu.m of work, 3.2 cu.m is required.

#### I class brick work in super structure with 20x10x10 cm brick 1:6 cement sand mortar- unit 1cu.m- Take 10 cu.m

Particulars	Quantity or No.s	Rate per unit (Rs.)	Cost (Rs)
<b>Materials</b>			
Brick I-class			
Sand			
Cement			
<b>Labour</b>			
Mistri	1/2 no.		
Mason	10 nos		
Mazdoor	7 nos		
Boy or woman coolie	10 nos		
Bhisthi (including curing)	2 nos		
Scaffolding	Lump sum		
Sundries T. and P. etc.	Lump sum		
Total cost of materials and labour			
Add 1.5% of water charges			
Add 10% contactor profit			
<b>Grand Total</b>			

#### I class brick work in Foundation and plinth with 20x10x10 cm brick 1:6 cement sand mortar- unit 1cu.m- Take 10 cu.m

Particulars	Quantity or No.s	Rate per unit (Rs.)	Cost (Rs)
<b>Materials</b>			
Brick I-class			
Sand			
Cement			
<b>Labour</b>			
Mistri	1/2 no.		
Mason	7 nos		
Mazdoor	7 nos		
Boy or woman coolie	7 nos		
Bhisthi (including curing)	2 nos		
Sundries T. and P. etc.	Lump sum		

Total cost of materials and labour	
	Add 1.5% of water charges
	Add 10% contactor profit
	<b>Grand Total</b>

### 3.3.4. Plastering:

To determine the volume of materials required for plastering, the area is multiplied with thickness and it may be increased by 30% for 12mm plastering and 20% for 20 mm plastering for wet mortar. Further to obtain the dry mortar they should be multiplied with 1.25 to get interms of dry mortar.

#### 12mm Plastering 1:6 unit 1 sq.m. Take- 100 sq.m

Particulars	Quantity or No.s	Rate per unit (Rs.)	Cost (Rs)
<b>Materials</b>			
Sand			
Cement			
<b>Labour</b>			
Mistri	no.		
Mason	10 nos		
Mazdoor including raking of joints	15 nos		
Bhisthi (including curing)	3/4 nos		
Scaffolding, Sundries T. and P. etc.	Lump sum		
Total cost of materials and labour			
Add 1.5% of water charges			
Add 10% contactor profit			
<b>Grand Total</b>			

### 3.3.5 White washing

#### White washing one coat- unit 1 sq.m. Take 100sq.m

Particulars	Quantity or No.s	Rate per unit (Rs.)	Cost (Rs)
<b>Materials</b>			
White lime unslaked			
Surkhi (or sand)			
Glue Powder			
<b>Labour</b>			
White washer	no.		
Boy Coolie	2/3 nos		
Sundries T. and P. etc.	Lump sum		
Total cost of materials and labour			
Add 1.5% of water charges			
Add 10% contactor profit			
<b>Grand Total</b>			

**3.3.6 C.C. Flooring****2.5 cm cement concrete floor 1:2:4 unit 1 sq.m. Take- 100 sq.m**

<b>Particulars</b>	<b>Quantity or No.s</b>	<b>Rate per unit (Rs.)</b>	<b>Cost (Rs)</b>
<b>Materials</b>			
Coarse Aggergate of 20mm			
Sand			
Cement			
Cement for surface finishing			
<b>Labour</b>			
Mistri	3/4 no.		
Mason	10 nos		
Mazdoor	5 nos		
Boy or woman coolie	5 nos		
Bhisthi (including curing)	2 nos		
Forms etc (according to requirement)	Lump sum		
Sundries T. and P. etc.	Lump sum		
Total cost of materials and labour			
Add 1.5% of water charges			
Add 10% contactor profit			
<b>Grand Total</b>			

## UNIT-IV

### Estimation Costing & Valuation

#### Reinforcement Bar Bending and Bar Requirement Schedules

Bar bending schedule (or schedule of bars) is a list of reinforcement bars in a given RCC work item, and is presented in a tabular form for easy visual reference. This table summarizes all the needed particulars of bars – diameter, shape of bending, length of each bent and straight portions, angles of bending, total length of each bar, and the number of each type of bar. This information is a great help in preparing an estimate of quantities.

Figure 1 depicts the shape and proportions of **hooks and bends in the reinforcement bars** – these are standard proportions that are adhered to:

(a) Length of one hook =  $(4d) + [(4d + d)]$  – where,  $(4d + d)$  refers to the curved portion =  $9d$ .

(b) The additional length ( $l_a$ ) that is introduced in the simple, straight end-to-end length of a reinforcement bar due to being bent up at say  $30^\circ$  to  $60^\circ$ , but it is generally  $45^\circ$ ) =  $l_1 - l_2 = l_a$

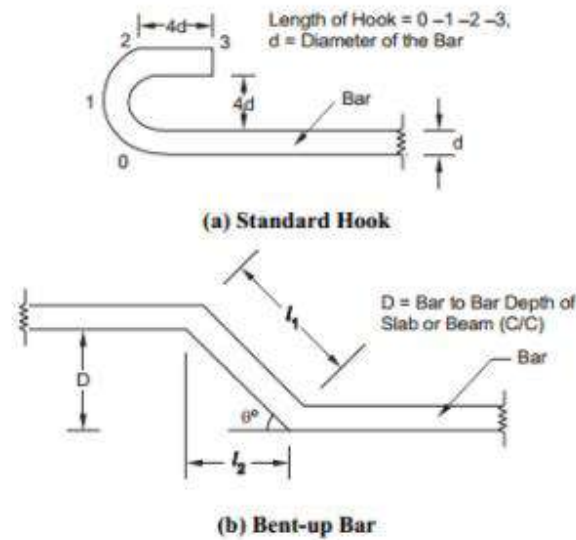
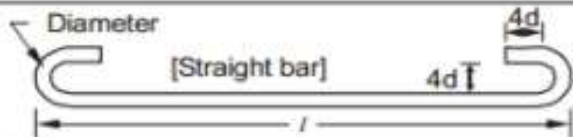
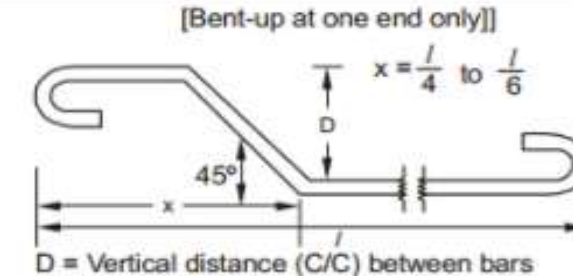
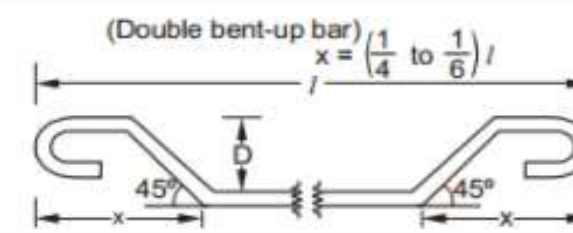
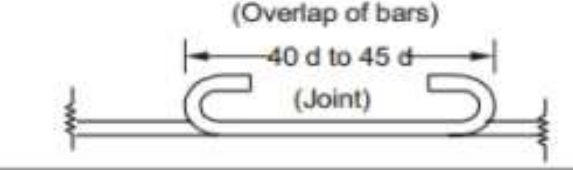
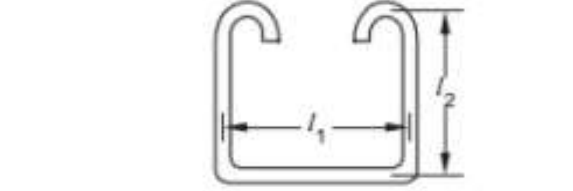



Figure 1: Hooks and bends in the reinforcement bars

Sl.No	$\theta$	$\frac{D}{\sin \theta}$	$\frac{D}{\tan \theta}$	Additional length of bent up bar
1	$30^\circ$	$\frac{D}{0.5}$	$\frac{D}{0.573}$	$0.27D$
2	$45^\circ$	$\frac{D}{0.707}$	$\frac{D}{1.0}$	$0.42D$
3	$60^\circ$	$\frac{D}{0.866}$	$\frac{D}{1.732}$	$0.58D$

Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.	 <p>[Straight bar]</p>	$2[9d] = 18d$ (both hooks together)	$[l + 18d]$
2.	 <p>[Bent-up at one end only]</p> <p><math>x = \frac{l}{4}</math> to <math>\frac{l}{6}</math></p> <p><math>45^\circ</math></p> <p><math>D</math> = Vertical distance (C/C) between bars</p>	$2[9d] = 18d$ (both hooks together)	$[l + 18d + 0.42D]$
3.	 <p>(Double bent-up bar)</p> <p><math>x = \left(\frac{1}{4}</math> to <math>\frac{1}{6}\right)l</math></p> <p><math>45^\circ</math></p> <p><math>D</math></p>	$2[9d] = 18d$ (as for above cases)	$[l + 18d + 2 \times 0.42D]$
4.	 <p>(Overlap of bars)</p> <p>40d to 45d</p> <p>(Joint)</p>	$2[9d] = 18d$	Overlap length at joint = $[(40d \text{ to } 45d) + 18d]$
5.	 <p><math>l_1</math></p> <p><math>l_2</math></p>	[Here, one hooks height = $14d$ ] $2 \times (14d) = 28d$	$[l_1 + 2l_2 + 28d]$
6.	 <p><math>l_1</math></p> <p><math>l_2</math></p>	$2(12d) = 24d$	$[2(l_1 + l_2) + 24d]$

### General guidelines to be followed in preparing BBS:

- The bars should be grouped together for each structural unit, e.g. beam, column, etc.
- In a building structure, the bars should be listed floor by floor
- For cutting and bending purposes schedules should be provided as separate A4 sheets and not as part of the detailed reinforcement drawings.



- The form of bar and fabric schedule and the shapes of bar used should be in accordance with BS 8666.
- It is preferable that bars should be listed in the schedule in numerical order.
- It is essential that the bar mark reference on the label attached to a bundle of bars refers uniquely to a particular group or set of bars of defined length, size, shape and type used on the job.
- This is imperative as a bar mark reference can then point to a class of bar characteristics. Also, this helps steel fixers and laborers keep track of the type and number of bars needed to complete a certain work.

**Bar Bending Schedule Preparation:**

<b>Sl. No</b>	<b>Dia. Of the bar</b>	<b>Shape of the Bar</b>	<b>Length of the Hook</b>	<b>Total length of bar</b>
<b>1</b>				
<b>2</b>				
<b>3</b>				
<b>4</b>				
<b>5</b>				

**Standrad form for detailed estimate**

<b>Item</b>	<b>Particulars of Items</b>	<b>No.</b>	<b>Length</b>	<b>Breadth</b>	<b>Height or depth</b>	<b>Quantity</b>
-------------	-----------------------------	------------	---------------	----------------	------------------------	-----------------

No.			<i>m</i>	<i>m</i>	<i>m</i>	
1						
2						

## Unit-5

### Estimation Costing & Valuation

#### CONTRACTS

**Contract.**—Contract is an undertaking by a person or firm to do any work under certain terms and conditions. The work may be for the construction or maintenance and repairs, for the supply of materials, for the supply of labour, for the transport of materials, etc.

#### **Types of contracts:**

##### **Lump Sum Contract.**

In Lump-Sum Contract the contractor undertakes the execution or construction of a specific work with all its contingencies, to complete it in all respects within specified time for a fixed amount. The detailed specification of all items of works pertaining to the whole work, plans and detailed drawings, and deposit of 10% security money, penalty, progress and other conditions of contract are included in the contract agreement. The general specification and descriptions of different part of the building with dimensions where required are included. The quantities or schedule of different items of work are not provided, the contractor shall have to complete the work as per plan and specification, within the contract fixed sum, within a fixed time irrespective of qualities of different items. On completion of the work no detailed measurement of different items of Work is required but the whole work is compared and checked with plans and drawings.

**Lump Sum and Schedule Contract.** — This is similar to lump sum contract but the schedule of rates is also provided in the contract agreement. In this system the contractor undertakes the execution or construction of a particular work at a fixed sum within a specified time as per plans and the detailed specifications and conditions, and the schedule of rates for various items of work are also provided which regulates the extra amount to be paid or deducted for any additions and alteration. In this case also no measurement of various items of work involved in the original work is required, but measurement of extra items only shall have to be taken. The original work shall however be checked and compared, other conditions of contract are included in the contract agreement.

**Schedule Contract or Item Rate Contract** — In schedule contract, the contractor undertakes the execution or construction of a work on the item rate basis. The amount the contractor is to receive depends upon the quantities of various items of work actually done. The contract agreement includes quantities, rates and amounts for various items of work and the total amount of contract (Bill of quantities with rate, amount and total amount), plans and detailed drawings, detailed specifications and deposit Of 10% security money; penalty, progress, date of completion and other conditions of contract. The payment to the contractor is made by detailed measurement of different items of works actually don by the contractor. The system is used for all works,

Item rate contract may also be a percentage above or below the printed schedule of rates of the department. Documents of contract or agreement are same as given in page 696 under, contract document.

### **Labour Contract.**

In labour contract the contractor undertakes contract for the labour portion. All materials for the construction are arranged and supplied at the site of work by the department or owner, the labour contractor engages labour and gets the work done according to specifications. The contract is on item rate basis for labour portion only and contractor is paid for the quantities of work done on measurement of the different items of work at the stipulated rate in the contract agreement. Materials for scaffolding, centering and shuttering and other similar materials are supplied by the department 'or owner; contractor may also use his own materials for scaffolding, centering and shuttering, etc., if provided in the agreement. Contractor uses his own fools for working, but plants and machineries are arranged by the department Or owner. An agreement with all conditions of contract, rates, bill of quantities, etc., is prepared before the work is given out to the contractor. This system of contract is not generally adopted in the Government department. Private buildings are however constructed by labour contract system-Which is less troublesome.

### **Cost plus percentage contract**

In this system contractor is given certain percentage over the actual cost of the construction as his profit. Contractor arranges materials and labour at his cost and keeps proper account and he is paid by the department or owner the whole cost together with certain percentage, say 10% as his profit as agreed upon beforehand. An agreement is prepared with all conditions of contract in

advance. In this case proper Control in the purchase of the materials and in labour shall have to be exercised by the department or owner.

**Labour engaged through contractors.** — Normally, laborer should not be engaged and paid through contractor. In the case of emergency when labourers are not available directly and the work is required very urgently, labourers may be employed through contractor. In such case if possible, the quantifies of work done should be determined by measurement at the completion of the work and the contractor paid at suitable rates on the measured quantities. But if this method is not practicable, it is permissible to pay the contractor on the basis of number of labourers employed day-to-day at current rates a profit or commission being included in the rate or paid separately on lump sum or percentage basis. When payment on measured work is not possible a record of the number of labourers employed day-to-day should be kept by the overseer incharge and a report submitted to the Assistant Engineer or Executive Engineer to enable him to keep a check on the work and expenditure and to deal with the contractor's claim.

## **CONTRACT DOCUMENT**

Before the work is given out on contract an agreement or bond is prepared. The following Documents shall be attached to the contract agreement or bond which should be duly endorsed and sealed. Each page shall bear the signature of the contractor and the accepting authority and all corrections shall be similarly initialled:—

**Title page** — Having the name of work, contract bond number, etc.

**Index page** — Having the contents of the agreement with page references.

**Tender notice** — giving brief descriptions of the work, estimated cost of work, date and time of the tender, amount of earnest money and security money, time of completion, etc. Earnest money, usually 2% of the estimated cost, is deposited along with tender.

**Tender form-** giving the bill of quantities, contractor's rates, and total cost of works, and time for completion, progress of works, security money, penalty clause, etc.

**Bill of quantities or schedule of quantities** — giving quantities and rates of each item of work and cost of each item of work and the total cost of the whole work.

**Schedule of issue of materials** — giving list of materials to be issued to the contractor with rates and place of issue.

**General specifications** — specifying the class kind type of works in general.

**Detailed specifications** — of each item of work, and of each material to be used in the work.

**Drawings** — complete set of drawings including plans, elevations, sections, detailed drawing, etc. and site plan, all fully dimensioned.

**Condition of contract** — containing the terms and conditions of contract in detail. The conditions specify the following

1. Rates inclusive of materials, transport, labour, T. and P. all other agreements necessary for completion of work, (2) Amount of the security money, (3) Time for completion of the work, (4) Progress to be maintained. (5) Penalty for unsatisfactory and bad work, for failure in maintaining progress for delay in completion .

## **CONDITIONS OF CONTRACT**

(1) The pieceworker would carry on the work with due diligence and in workman like manner.

He would use the best available materials subject to the approval of the Executive Engineer/ Sub-

Divisional Officer whose decision as to the rate of progress and quantity of work or material would be final.

(2) Payments would be made after measurement of work on its completion or termination of the agreement. In works of long duration, payments may be made at convenient intervals, usually once a month.

(3) The Executive Engineer/ Sub-Divisional Officer may put an end to this agreement at his option at any time.

(4) In the case of bad work or materials, the Executive Engineer/ Sub-Divisional Officer may remove the same have them replaced, deducting the value of the work rejected and materials removed, or the cost of replacing the same as he may think proper from any amount due or that may become due.

(5) If the Government have to pay any/ compensation to any of the piecework under the Workmen's Compensation Act, this amount would be recovered from the later.

(6) When the agreement is terminated before the work is completed, the Executive Engineer/ Sub-Divisional Officer would take over the materials required for its completion if the piecework accepts his valuation. If he does not accept the valuation, he must remove the materials from the site

Of work within 14 days otherwise they would be removed at his expense.

## **P.W.D.ACCOUNTS AND PROCEDURE FOR WORKS**

**Organization of Engineering Department**—The engineering departments of the government Deal the construction and maintenance of public works as buildings, roads, bridges and culverts, canals and connecting works, dams, sanitary and water supply works, electrification work, etc. The engineering departments ate therefore known as Public Works Departments (P. W. D.). There are different engineering departments dealing with the different branches of works as:

1. Public Works Department, Building and Road (B. and R.) branch, which deals with the buildings, roads, bridges and culverts, etc., and connecting works.
2. Irrigation Department which deals with the canals and work connecting with canals, irrigation, navigation, etc.
3. Public Health Engineering Department which deals with water supply works, sanitary work, etc.
4. Electricity Department deals with the electrification, installation of power lines and connecting works. Electricity Department now comes under an autonomous Electricity Board. Though all the above departments deal with the public works only the Building and Road Branch is known as P. W. D. (Public Works Department) and other engineering departments are known by their individual names. Besides dealing with the construction and maintenance works, the departments also deal with the collection of certain categories of revenue connected with their respective works. Each state has got the above departments in some form or other. Each of the engineering department has a Chief Engineer(C.E.) who is the administrative head of the department and is directly responsible to the Government. He prepares the budget estimates annually relating to the works under his control and administers the grant and keeps a close watch over the expenditure. He exercises control with the Accountant General, in maintaining accounts, and in enforcing strict observance of rules.

**Work charged Establishment.** — The work charged establishment are the employees who arc. employed direct on the work for the actual execution of a specific work or for the supervision of the departmental labour, stores machineries, etc. Usually, work-supervisors, chaukidars, mates, mistries. etc.; are employed as workcharged establishment. Their pay is charged direct to the

work for which provision is made in the estimate of the work by adding 2% to 3% over the estimated amount of the work. The appointment of work charged employees is done by taking previous sanction of the competent authority, usually of the Executive Engineer, in prescribed form. The sanction specifies the name and designation of the employee, rate of pay, the period of sanction and the name of the work and estimate to which chargeable. The application form for sanction of Work charged establishment is given below

Wages of work charged establishment are prepared, drawn and paid on prescribed account form, Form No. 29, which has seven columns containing—Item No. , Name of incumbent, Designation, Period, Amount due, Amount paid, Dated acknowledgement of payee, and Dated initial of officer making payment. The name of the work and No. and reference of the sanction are written in red ink above the entries of the pay bill. The Sub-Divisional Officer or the Assistant Engineer certifies at the bottom of the pay bill, that the persons were on duty during the period shown against their names and each person was employed on the work and was on duty on the work for which the appointment was sanctioned. The pay bill of the work charged establishment is a combined pay bill and acquittance roll.

The service of the work charged establishment may be terminated at any time without giving any notice, but usually; one month's notice is given. If the services are terminated earlier than the period of sanction, they are not entitled for any leave, travelling and other allowance, but casual leave and other leave may be allowed by the Executive Engineer. Actual expenses may be allowed by the Executive Engineer for the journeys performed in the interest of work.

**Tender.**—Tender is an offer in writing to execute some specified work or to supply some specified articles at certain rates, within a fixed time under certain conditions of contract and agreement, between the contractor and the department or owner or party. The construction of work is usually done by contract. Sealed tenders are invited and the work is usually entrusted to the lowest tender. While inviting tenders the bill of quantities, detailed specifications, conditions of contract and plans and drawings are supplied on payment of the requisite cost to the contractors who tender or quote their rates.





**Tender notice.** — Tender for work or supply are invited by issuing tender notice in prescribed

for in the tender notice the following particulars are given :

- (1) Name of the authorities inviting tender; (2) Name of work, and its location;
- (3) Estimated cost; (iv) Time of completion: (v) Cost of complete set of tender forms and conditions; (VI) Date, time and place of tender; (7) Amount of earnest money and security money; (8) Validity of tender, etc.

Tender notice is posted in the notice board of the department and for major work the tender notice in brief is also given in the newspaper . A typical tender notice inviting tenders is given below. The blank spaces are to be filled up as required

1. Sealed Tenders will be received up to A.M./P.M. on the . of by the Executive Engineer Name of work

Division for the following work Estimated cost Rs. .

2. The work must be completely finished to the satisfaction of the Executive Engineer within months from the date of the order to commence the work.

3. The Tender Form with complete sets of blank forms of contract can be obtained from the office of the Executive Engineer day (except Sunday and holiday) from per set. Divisions at .. A.M. to ..... every P.M. at a charge of as earnest

4. Each tender must be accompanied by a deposit of Rs. . money. Such earnest money may be of the following forms

(1) Cash or Treasury Challan.

(2) Post office savings bank pass-book having the requisite amount in the account, pledged to the Executive Engineer.

(iii) Deposit Receipt of State Bank or other approved Bank pledged to the Executive Engineer.

(iv) National plan loan or National Saving Certificate pledged to the Executive Engineer.

5. The tenders will be opened at... A.M./P.M. on the ..... day by the Executive Engineer or his authorised agent at the office at

6. Power is reserved to reject any tender or all tenders without assigning any reason or given any explanation.

7. Unless the person, whose tender has been accepted, signs the contract and deposits the security specified within days, the earnest money deposited by him will be forfeited and the acceptance of his tender will be withdrawn.

8. The tendered rates shall be for the complete work and shall include all quarrying charges, royalty, testing, screening, tools and plants, carriage of materials to site, removal and changes of rejected materials, all taxes, income-tax, sales-tax, octroi charges, materials, labour, etc.

9. The tender rates will remain valid for a period of three months from the date of opening tenders.

10. The quantities in the bill of quantities are approximate and liable to variation or cancellation for which contractor will not be entitled to any compensation. The quantities of any item or items and the total cost may vary by 20% for which rates shall not be altered.

II. The rate should be quoted in the bill of quantities, legibly both in figures and words. Executive -Division.

**Earnest money.**—While submitting a tender the contractor is to deposit a certain amount, about % of the estimated cost, with the department, as earnest money as guarantee Of the tender. This amount is for a check so that the contractor may not refuse to accept the work or run away when his tender is accepted. In case the contractor refuses to take up the work his earnest money is forfeited. Earnest money of the tenderer whose tender has not been accepted is refundable. The amount of earnest money depends on the estimated cost of works and is as follows :

Rs. 50.00 for works up to Rs. 2,000.00,	Rs. 100.00 for works above Rs. 2,000.00	Rs. 5,000.00,	Rs. 200.00 for works above Rs. 5,000.00 to Rs. 10,000.00 and Rs. 100.00 for every Rs. 5,000.00 or part thereof above	Rs.	10,000.00.
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Earnest money should be in cash or encashable at any time. Earnest money may be in the form of deposit in Treasury or State Bank or other approved Bank or Government security, or Saving Certificate or Post Office, Savings Pass-Book or cash Certificate, pledged to the Executive Engineer

**Security money.** — On acceptance •of the tender, the contractor has to deposit of the tendered amount as security money with the department which is inclusive of the earnest money already deposited. This amount is kept as a check so that the contractor fulfils all the terms and conditions

of the contract and carries out the work satisfactorily according to the specifications and maintain progress and completes the work in time. If the contractor fails to fulfil the terms of contract his whole or part of the security money is forfeited by the department. The security money is refunded to the contractor after the satisfactory completion of the whole work after a specified time, usually after one rainy season or six months of the completion of the work. Instead of collecting the whole of security money in one installment before starting the work, this can be collected gradually by deducting from the running account bill of the contractor. Usually the earnest money is taken as part of the security money and the balance amount of the security money is collected by deduction from the running account bill of the contractor at 10% of every running bill, up to the extent of 10 per cent of the total cost of whole work.

**Measurement Book (M.B.).** — The measurements of all works and supplies are recorded in The measurement Book Form No. 23 and payment of all works and supplies are made on the basis of measurement recorded. The measurement books are very important account records. All measurement book are numbered serially register is maintained in the divisional office showing the serial number of each book, the names of the sub-division or officer to whom issued, the date of issue, the date of return and remark. A similar register is maintained in the sub-division office showing the names of the officers, to whom issued, date of issue, date of return, etc.

<b>Particulars</b>	<b>Detail actual Measurement</b>				<b>Contents of area</b>
	<b>No.</b>	<b>L</b>	<b>B</b>	<b>D</b>	

### **Administrative Approval or Sanction—**

For any work or project required by a department, an approval or sanction of the competent authority of the department, with respect to the cost and work is necessary at the first instance. The Approval authorises the engineering department to take up the work. Administrative approval denotes the formal acceptance by the department concerned of the proposal, and after the administrative approval is given the engineering department (P.W.D.) take up the work and prepares detailed designs, plans and estimates and then executes the work. The engineering department prepares approximate estimate and preliminary plans and submits to the department concerned for administrative approval.

### **Expenditure Sanction—**

Expenditure sanction means the concurrence of the Government of the expenditure proposed and represents allotment of the money to meet the expenditure. No expenditure can be incurred before Expenditure Sanction is given. Expenditure sanction means allotment of fund or money for a specific work and is usually, accorded by the Finance Department.

### **Technical Sanction—**

Technical sanction means the sanction of the detailed estimate, design calculations, quantities of works, rates and cost of the work by the competent authority of the engineering department. After the technical sanction of the estimate is given, then only the work is taken up for construction. In case of original work the counter signature of the local head of the department should be Obtained in the plan and estimate before technical sanction is accorded by the engineering department. The power for Technical Sanction differs from state to state. Power for Technical Sanction in U.P.—Technical Sanction can be given by—

- (1) The Chief Engineer - Full Powers..
- (2) The Superintending Engineer ... . Up to Rs. 15 lakhs
- (iii) The Executive Engineer Up to Rs. 5 lakhs if the estimate is on a standard design.

**Plinth Area.**—Plinth area is the built up covered area of a building measured at floor level of An orey. Plinth area is calculated by taking the external dimensions of the building at the floor level excluding plinth offsets if any. Court-yard, open areas, balconies and cantilever projections are

not included in the Plinth area. Supported porches (other than cantilevered) are included in the Plinth area.

The following shall be included in the Plinth Area—  
All floors, area of walls at the floor level excluding plinth offsets, if any, (h) Internal shafts for sanitary installations provided these do not exceed 2 sq m in area air condition ducts, lifts etc. (iii) The area of barsati and the area of mummy at terrace level. (iv) Area of porches other than cantilevered.

The following shall not be included in the Plinth Area—  
(i) Area of loft, (h) Internal sanitary shafts provided these are more than 2 sq m in area, (ii) Unenclosed balconies (iv) Towers, turrets, domes etc. projecting above the terrace level, not forming a storey at the terrace level, (v) Architectural bands, cornices etc. (VI) Sunshades, Vertical sun breakers or box louvers projecting out.

**Floor Area.**—Floor area of a building is the total area of floor in between walls and consists of II rooms verandahs passages corridors staircase room, entrance halls, kitchen, stores, bath floor and latrine (W. Cs.) etc. Sills of doors and openings are not included in the Floor area. Area occupied by walls, pillars, pilaster, and other intermediate supports are not included in the Floor area. In short, Floor area is equal to Plinth area minus area occupied by walls.

For deduction of wall area from plinth area to obtain Floor area the area shall include—

(1) Door and other openings in the wall. (h) Intermediate pillars and supports, (ii) Pilasters along walls exceeding 300 sq cm in area (iv) Flues which are within walls. But the following shall be excluded from the walls area (1) Pilaster along walls not exceeding 300 sq m in area, (h) Fire place projecting beyond the face of wall in living rooms, (3) Chulla platforms projecting beyond the face of wall in kitchens.

The floor of each storey and different types of floor should be measured and taken separately.

The floor area of basement, mezzanines, barsaties, munties, porches, etc. should be measured separately.

**Carpet Area** — Carpet Area of building is the useful area or liveable area or lettable area. This is the total floor area minus the Circulation area. verandahs, corridors, passages, staircase, lifts. entrance hall. etc. and minus other non-useable areas as sanitary accommodations (Bath and W.Cs.), air conditioning room etc. For office building Carpet area is the lettable area or useable

area and for residential building Carpet area is the liveable area and should exclude the kitchen, pantry, stores and similar other room which are not used for living purposes.

The carpet area of a building for any storey shall be the floor area excluding the following :

(a) Sanitary accommodation, (b) Verandahs, (c) Corridors and passages, (d) Kitchen and pantries, (e) Stores in domestic buildings, (f) Entrance hall and porches, (g) Stair cases and munties, (h) Shafts for lifts, (i) Barsaties, (D) Garages, (k) Canteens, (l) Air conditioning ducts and air conditioning plant room.

The Carpet area of an office building may be 60% to 75% of plinth area of the building with a target of 75%. The planners should aim to achieve a target to 75% of the plinth area. The carpet area of residential building may be 50% to 65% of the plinth area of building with a target of 65%.

For a framed multi- storeyed building the area occupied by wall may be 5% to 10% of the plinth area (a standard 3% for external walls and 200 for internal walls). For ordinary building without frame. the area occupied by walls may be loco to 15% of the plinth area:

### **Preliminary or Approximate Estimate or Abstract Estimate—**

Preliminary or- Approximate or Abstract Estimate is required for preliminary studies of various aspects of a work or project, to decide the financial position and policy for administrative sanction by the competent administrative authority. In case of commercial projects as Irrigation projects, Residential building project and similar projects which earn revenue income, the probable income may be worked out, and from the preliminary estimate the approximate cost may be known and then it may be seen whether the investment, on the project is justified or not. For non\_ commercial projects or for projects giving no direct return, their necessity, utility, availability of money, etc., may be considered before final decision is taken. The approximate estimate is prepared from the practical knowledge and cost of the similar works. This estimate is prepared showing separately the approximate cost of all important items of work as cost of land, cost of each building, cost of roads, water supply sanitary works, electrification, etc. The estimate is accompanied by a brief report explaining the necessity and utility of the project and showing how the cost of separate items have been arrived at. This is also accompanied with a site plan or layout plan. A percentage of about 5% to 10% is added as contingencies.

The preliminary estimate may be prepared by various ways for different structures and works—I

(a) Buildings

(i) Per unit basis.—Per student for schools and hostels, per class room for schools, per bed for hospitals, per seat for cinema and theatre halls, per bay for factories, barracks and dormitories, per tenement for residential buildings. Approximate cost of a hostel building for 100 students @ Rs. 10,000/- per student

works out as Rs. 10 lakhs. Approximate cost of a 100 bed hospital @ Rs. 50,000/- per bed comes to Rs. 50 lakhs. Approximate cost of a barrack of 10 bays [each bay of 3 m (10') and 6 m (20') wide] @ 10,000/- per bay comes to Rs. 1 lakh. Approximate cost of a two roomed quarter may be Rs. 60,000/- a three roomed quarter may cost Rs. 1 lakh.

(1) Plinth area basis

(h) Cubic content basis.

(iii) Approximate quantity method

These are dealt separately in pages 451-452.

(b) Roads and Highways.—Per kilometer (per mile) basis depending on the nature of road, width and thickness of metalling, etc. For 10 kilometers of a state highway approximate cost @ Rs. per 1 km works out as Rs. 50 lakhs.

(c) Irrigation Channels—

(1) Per kilometer (per mile) basis depending on the capacity of the channel.

(il) Area of land commanded i.e., per hectare basis (per acre basis).

The approximate cost of 10 kilometers length of irrigation channel of 3 cu m per sec. capacity @ Rs. 70,000/- per km works out as Rs. 7 lakhs. For an irrigation project having a commanded area 2000 hectares, approximate cost @ Rs. 1000/- per hectare comes to Rs. 20 lakhs.

(d) Bridges and Culverts—Per running meter (running feet) of span depending on the roadway, nature and depth of foundation, type of structure, etc. For small culverts approximate cost may also be per number of culverts of different spans. Approximate cost of a bridge of 3 spans of 50 metre each span @ Rs. 30,090/- per running meter of span comes to 45 lakhs.

Approximate cost of bridges may also be worked out separately for sub-structure and superstructure.

(e) Sewerage Project and water supply project—

On the basis of per head of population served. On the basis of area covered i.e., per hectare basis



(per acre basis). Approximate cost of sewerage project for a population of one lakh @ Rs. 100/- head works

out as Rs. 100 lakhs. Approximate cost of water supply project for a population of 75000 people @ Rs. 90/- per head comes to Rs. 67.5 lakhs.

(f) Over head water tank.—On the basis of capacity, per litre (per gallon) of tank depending on the type of structure height of tank etc. Approximate cost Of an overhead R.C.C. water tank of 50,000 litre capacity Rs. 2.00 per litre works out as I lakh.

### **Plinth Area Estimate for Building-**

This is prepared on the basis of plinth area o building, the rate being deducted from the cost of similar building having similar specification, heights and construction, in the locality. Plinth area estimate is calculated by finding the plinth area of the building and multiplying by the Plinth area Rate. The plinth area should be calculated for the covered area by taking external dimension ofthe building at the floor level. Courtyard and other open area should not be included in the plinth area. Plinth area Estimate is only approximate, and is a preliminary estimate, to know the approximate cost before hand. If the plan of the building is not ready or available, at the beginning just prepare a proposal, floor area of rooms, etc. may be determined front the requirement and 30 to 40 per cent ofme total area thus found may be added for walls, circulation and waste to get the approximate total plinth area which multiplied by the plinth area rate gives the approximate cost of the building. The approximate cost of a building having plinth area of 100 sqm@ Rs. 900/ - per sq m works out as Rs. 90,000/-

For storeyed building, the Plinth Area Estimate is prepared for each storey separately.

### **Revised Estimate—**

Revised Estimate is a detailed estimate and is required to be prepared under any one of the following circumstances :

- (1) When the original sanctioned estimate is exceeded or likely to exceed by more than 5%
- (2) When the expenditure on a work exceeds or likely to exceed the amount of administrative sanction by more than 10%.
- (3) When there are material deviation from the original proposal, even though the cost may be

met from the sanctioned amount.

The revised estimate should be accompanied by a comparative statement showing the variations of each item of works, its quantity, rate and cost under original and revised, side by side, the excess or saving and reason for variation.

### **Supplementary Estimate—**

Supplementary Estimate is a detailed estimate and is prepared when additional works are required to supplement the original works, or when further development is required during the progress of work. This is a fresh detailed estimate of the additional works in addition to the original estimate.

## UNIT-VI

### VALUATION OF BUILDINGS

**Valuation**—Valuation is the technique of estimating or determining the fair price or value of a such as a building, a factory, other engineering structures of various types, land, etc. By prop 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 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. Cost means original cost of construction of purchase, while value means the present value (saleable value) which may be higher or lower than the cost. A building whole cost of construction is Rs• 50,000.00, when put for sale may fetch Rs.60,000.00 this sale prices the value of the building. Similarly, the value may be less than the original cost.

**Purpose of valuation**-The main purpose of valuation are as follows :—

- (1) Buying or Selling Property. — When it is required to buy or to sell a property, its valuation is required. —To assess the tax of a property its valuation is required.
- (2) **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.
- (3) Rent fixation. In order to determine the rent of a property, valuation is required. Rent is usually fixed on certain percentage of the amount of valuation (6% to 10% of the valuation).
- (4) Security of Loans or Mortgage. ----- When 'loans are taken against the security of the property, its valuation is required.
- (5) 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.
- (6) Valuation of a property is also required for Insurance, Betterment Charges, Speculations, etc.

**Gross income:** Gross income is the total income and includes all receipts from various sources the 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 small outgoings, operational and collection expenses from the gross income or total receipt.

Net income = Gross income ----- outgoings.

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

**Taxes,** —These includes Municipal Tax, Property Tax, Wealth Tax, etc., which arc to be Paid by the owner of the property annually. These taxes are fixed on the basis of 'Annual Rental value of the property after deduction for annual repairs, etc.

2. **Repairs:** The repairs to required to be carried out every year to maintain a property in fit condition, the amount go be spent on repairs depends on the age, construction nature of the building, etc., and usually 10 to 15 percent of the gross income or gross rent or 1 to 1 h months is allowed for repairs. For annual repairs to 1 of the total cost of construction may also be taken.

3. **Management and Collection charges:** These include the expenses on Rent Collector

Chaukidar, (watchman) Liftman, Pump attendant, Sweeper, etc. About 5 to 10 per cent of the Gross

rent may be taken on these account For small building none of these may be required and be no outgoings on these account.

4. Sinking Fund. — A certain amount of the gross rent is set aside annually as sinking fund to accumulate the total cost of construction when the life of the building is over. This Annual sinking fund is also taken as outgoings.

5. Loss of rent. — The property may not be kept fully occupied in such a case a suitable amount should be deducted from the gross rent under outgoings.

6. Miscellaneous. — These include electric charges for running lift, pump, for lighting common places, and similar other charges which are to be borne by the owner.

**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, etc., and the construction and maintenance. The taxes are assessed on some percentage basis on the net income from the property and varies from to of the net income. Usually for small houses the taxes are less and for big houses the taxes are high

**Scrap value.** — Scrap value is the value of dismantled materials. For a building when the life is over at the end of its utility period the dismantled materials as steel, bricks, timber, etc., will fetch a certain amount which is the scrap value of the building. In the case of machine the scrap value is the value of the metal only or the value of the dismantled parts. The scrap value of a building may be about 10 per cent of its total cost of construction. The cost of dismantling and removal of the rubbish material is deducted from the total receipt from the sale of the useable materials to get the scrap value

**Salvage value.** — It is the value at the end of the utility period without being dismantled. A machine after the completion of its usual span of life or when it become uneconomic, may be sold and one may purchase the same for use for some other purpose, the sale value of the machine is the salvage value. It does not include the cost of removal, sale, etc. Normally, the scrap value, or the salvage value of a property or an asset has got some positive figure, but it may also be zero or negative. As for example the scrap value or R.C.C- structure will be negative, as dismantling and removal will be costly.

**Market value.** — The Market value of a property is the amount which can be obtained at any particular time from the open market if the property is put for sale. The market value will differ from time to time according to demand and supply. The market value also changes from time to time for various miscellaneous reasons such as changes in industry, changes on fashions, means of transport, cost of materials and labour, etc.

**Book value.** — Book value is the amount shown in the account book after allowing necessary depreciations. The book value of a property at a particular year is the original cost minus the amount of depreciation up to the previous year. The book value depends on the amount of depreciation allowed per year and will be gradually reduced year to year and at the end of the utility period of the property the book value will be only scrap value.

**Rateable value.** — Rateable value is the net annual letting value of a property, which is obtained after deducting the amount of yearly repairs from the gross income. Municipal and other taxes are charged at a certain percentage on the rateable value of the property.

**Obsolescence.** --The value of property or structures become less by its becoming out of date in style,

in structure in design. etc., and this is termed as Obsolescence. An old dated building with massive walls, arrangements of rooms not suited in present days and for similar reasons, becomes obsolete even if it is maintained in a very good condition, and its value becomes less due to obsolescence. The obsolescence may be due to the reasons such as progress in arts, changes in fashions. changes in planning ideas, new inventions, improvements in design technique, etc, A machine of old design may become obsolete, though it may be in good running condition and its value will be less, Thus, though the property is physically sound, it may become functionally inadequate and its economical return becomes less.

**Annuity-** Annuity is the annual periodic payments for repayments of the capital amount invested by a party. These annual payments are either paid at the end of the year or at the beginning of the year, usually for a specified number of years.

If the amount of annuity is paid for a definite number of periods or years, it is known as Annuity certain. In such cases the amount of annuity will be higher, the lesser the number of the years the higher will be the amount and vice versa to clear up to the whole amount of capital. If the amount of annuity is paid at the beginning of each period of year and payments continued for definite number of periods. it is known as Annuity due,

If the payment of annuity begins at some future date after a number of years. this is known as Deferred Annuity,

If the payments of annuity continue for indefinite period, it is known as Perpetual Annuity.

Though annuity means annual payment, the amount of annuity may be paid by twelve monthly instalments or quarterly or half-yearly instalments.

**Capital cost.** — Capital cost is the total cost of construction including land, or the original total 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

Example. —

Capitalised value of a property fetching a net annual rent of Rs. 1,000.00 and the highest rate of interest prevalent being 5% is as follows :

For Rs. 5.00 interest, capital Rs. 1,000.00

To get Rs. 1,000.00 interest, capital =  $100 \times 1000 / 5$

In short capitalized value is— Net annual income x Year's purchase. =Rs. 20,000.00

For the same net income if the rate of interest is 8% the capitalized value,

$$= 1000 \times 100 / 8 = \text{Rs. } 12,500.00$$

**Methods of valuation** — The following are the different methods of valuation :

1. Rental method of valuation. 2. Direct comparisons of the capital value. 3. Valuation based on the profit. 4. Valuation based on the cost. 5. Development method of valuation. 6. Depreciation method of valuation,

**1. Rental method of valuation** — In this method, the net income by way of rent is found out by deducting all outgoings from the gross rent (See pages 621-622). A suitable rate of interest as Prevailing in the market is assumed and year's purchase IS calculated. This net income multiplied by P, gives the capitalized value or valuation of the property. This method is applicable only when rent IS known or probable rent is determined by enquiries.

**2. Direct comparison with the capital value.** — This method may be adopted when the rental IS not available from the property concerned, but there are evidences of sale price of properties as a whole. In such cases the capitalized value of the property is fixed by direct comparison with capitalized)value of similar property in the locality.

**3.Valuation based on profit** — This method of valuation is suitable for buildings like hotels, cinemas, theatres, etc. for which the capitalized value depends on the profit. In such cases the net annual income is worked out after deducting from the gross income all possible working expenses outgoings, interest on the capital Invested. etc, The net profit is multiplied by YAP to get capitalized value. In such cases the valuation may work out to be too high in comparison With the cost of construction

**4. Valuation based on cost.** In this method the actual cost incurred in constructing the building or in possessing the property is taken as basis to determine the value of property, In such cases necessary depreciation should be allowed and the points of obsolescence should also be considered.

**5. Development method of valuation**— 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 evaluation is to be adopted. In such cases, the probable selling price of the divided plots, the area required for roads, parks, etc., and other expenditures for development should be known.

If a building is required to be renovated by making additions, alterations or improvements, the development method of valuation may be used. The valuation of the property may be worked out from the anticipated future net income which it may fetch after its renovation. The net income multiplied by the Y. P. will give the anticipated capitalized value. The total expenditure required to be incurred in renovation should be worked out, and the original cost of the property together with the new expenditure should be compared with anticipated value and decided if the investment in renovation is justified.

**6. Depreciation method of valuation**— According to this method of valuation the building should be divided into four parts viz. — (i) Walls, (ii) Roofs, (iii) Floor and (iv) Doors and windows and the cost of each parts should first be worked out on the present-day rates by detailed measurements. The life of each of the four parts should then be ascertained with the help of table in page (From 1, Annexure (B) to Chapter XIII of the Financial Hand Book Volume V, (Part 1)

and the depreciated value of each part is ascertained by the formula  $D = P ( 100-rd/100)^n$

Where D is the depreciated value, P is the cost at present market rate and rd the fixed percentage of depreciation (rate of depreciation, r stands for rate and d for depreciation) and n the number of years the building had been constructed. The value of rd may be taken as below

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, Structure. with 20 years life, rd= 5.0. The values arrived at will be exclusive of cost of land, water supply, electric and sanitary, fittings, etc., and will apply to those buildings only which have been properly maintained. If the repairs had been neglected in the past and the present condition is bad or dilapidated suitable deduction should be made from the values as deducted above, for neglected repairs. The present value of land and water supply, electric and sanitary fittings, etc. should be added to the valuation of the building to arrive at total valuation of the property.

**Cost of land**— For the valuation of the whole property the cost of land should also be added to the depreciation value of the building. The cost of land should be taken as prevalent in the locality from the recent sale transactions or from the enquiries from the property Brokers or from the Sub-Registrar's. For Mortgage purposes, the mortgage value of a property is taken as 1/2 to 2/3 of valuation or capitalized value.

**Depreciation** — Depreciation is the gradual exhaustion of the usefulness of a property. This may be defined as the decrease or loss in the value of a property due to structural deterioration use, life wear and tear, decay and obsolescence. The value of a building or structure will be gradually reduced due to its use, life, wear and tear, etc., and a certain percentage of the total cost may be allowed as depreciation to determine its present value. Usually a percentage on depreciation per annum is allowed. 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 gradually increases during later years.

The amount of depreciation being known, the present value of a property can be calculated after deducting the total amount of depreciation from the original cost.

**Method of calculating depreciation.** — The various methods of calculating depreciation are as follows :—

(1) Straight line method, (2) Constant percentage method, (3) Sinking fund method and (4) Quantity survey method. In all these methods, it is necessary to decide the economic or effective life of the property.

**(1) Straight line method** — In this method it is assumed that the property loses its value by the same amount every year. A fixed amount of the original cost is deducted every year, so that at the end of the utility period only the scrap value is left.

$$\begin{aligned} \text{Annual depreciation } D &= (\text{Original cost} - \text{Scrap value}) / \text{Life in year} \\ &= (C - S) / n \end{aligned}$$

where C— original Cost, S —scrap value, n—life of the property in years and D—annual depreciation. The book value after the number of years, say N years = original cost —N x D.

**(2) Constant percentage method or Declining balance method** — In this method, it is assumed that the property will lose its value by a constant percentage of its value at the beginning of every year.

$$\text{Annual depreciation, } D = I \left( \frac{S}{C} \right)^n$$

Where C, S, n and D have the same meaning as above. The value of the property of the depreciated cost at the end of the first year, =  $C - DC = C1$

The value of the property at the end of the second year =  $C1 - DC2$  and so on.

The value of the property or the depreciated cost at the end of the m years =  $C (S/C)^{m/n}$

The formula will fail when  $S = 0$ . When the ratio  $(S/C)$  is very small, the depreciation for the first year will be considerable.

**(3) Sinking fund method**— In this method the depreciation of property is assumed to be equal

to the annual sinking fund plus the interest on the fund for that year, which is supposed to be invested on interest bearing investment. If A is the annual sinking fund and b, c, d, etc., represent interest on the Sinking fund for subsequent years, and C = total original cost, then —

At the end of year	Depreciation for the year	Total Depreciation	Book value
1st year	A	A	C-A
2nd year	A+b	2A+b	C-(2A+b)
3rd year	A+c	3A+b+c	C-(3A+b+c)
4th year	A+d	4A+b+c+d	C-(4A+b+c+d)

So on

**(4) Quantity survey method** — In this method the property is studied in detail and loss in due to life, wear and tear, decay, obsolescence, etc., worked out. Each and every step is based on some logical ground without any fixed percentage of the cost of the property. Only experienced value can work out the amount of depreciation and present value of a property by this method.

## VALUATION OF BUILDINGS

Valuation of a building depends on the type of the building, its structure and durability, on the situation, Size, shape, frontage, width of roadways, the quality of materials used in the construction and present-day prices of materials. This also depends on the height of the building, height of plinth, thickness of wall, nature of floor, roof, doors, windows, etc. A building located in market area will have higher value than a similar building in the residential area. Building in the area having sewer, water supply and electricity will have increased value. Building on freehold land, will have higher value than building on leasehold land. The value also depends on the demands purchase which varies from time to time. The valuation of building mainly depends on the will fetch if let out. Usually 6% interest per annum of the capital cost is taken as annual rent, it be more or less according to the prevalent market rate. The valuation of building is determined on working out its cost of construction at present-day rate and allowing a suitable depreciation. Before valuation the age of the building should be obtained from record if available or by enquiries or from visual inspection and its future life



should be ascertained. Present-day cost may be determined by the following method:

**Cost from record** -Cost of construction may be determined from the estimate, from the bill of quantities, from record at present-day rate. If the actual cost of construction is known, this may increase or decrease according to the percentage rise or fall in the rates which may be obtained from the P.W.D schedule of rates.

**Cost by detailed measurement** -If record is not available, the cost of construction may be preparing of quantities of works by detailed measurement at site and taking the rate for each item as prevalent in the locality or as current P.W.D. schedule of rates .All the items of works should be thoroughly scrutinised and their detailed specifications ascertained as actually exists

**Cost by plinth area basis** — Determination of cost by detailed measurements and bill of quantities

is laborious and lengthy, a simple method is to calculate the cost on plinth area basis, The plinth area of the building G measured and the present-day plinth area rate of similar building in the locality is obtained by enquiries and then cost calculated. To fix the plinth area rate it's necessary to examine thoroughly the different parts Of the building, the foundation, structure, floor, roof, doors and windows, finishing. etc. If judiciously worked out the cost determined by plinth area method will be fairly correct and sufficient for practical purpose. Cost may be calculated by cubical content method.

**Determination of depreciation**— After deciding the cost of the building or structure by any one of the above method it is necessary to allow a suitable depreciation on the cost. The depreciation depends on the ultimate use of the building, the present age of the building, nature maintenance, etc. Generally, for the first 5 to 10 years there is little depreciation of the building or structure. The depreciation increases with the life.

For a building whose life is considered as 80 years, if well maintained the following may be reasonable depreciation

	Depreciation per year	Total
depreciation		
0 to 5 years	-----	Nil
5 to 10 years	@ 0.5 per cent	2.5 percent
10 to 20 years	@ 0.75 per cent	7.5 percent
20 to 40 years	@ 1 per cent	20.0 percent
40 to 80 years	@ 1.5 per cent	60.0 percent
		Total= 90.0 percent

The balance 10% represents the net scrap value on dismantling at the end of the utility period.

### **Mortgage Lease**

**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 Marty advancing the loan. The loan is required to be returned in

specified time. 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. When the loan is fully repaid together with interest the mortgagor has got the right to free his property from the mortgagee, and this is known as Equity of redemption. The amount of loan will depend on the valuation of the property, usually 50 to 70 per cent of the valuation is advanced as loan. The interest should be paid by regular instalments, and the loan also may be repaid by regular instalments spread over the specified period of the mortgage. If the mortgagor fails to pay the instalment of loan as per condition of the mortgage deed, the mortgagee can take over possession of the property and sell it to recover the amount of loan, the interest and other expenses. The surplus, if any, is paid to the mortgagor.

### **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 and the cost of electric installations and the cost of subsequent additions and alterations if any. The cost of construction also includes the expenditures on the following:—

(1) Raising, levelling and dressing sites, (2) Construction of compound walls, fences and gates, (3) Storm water drains, and (4) Approach roads and other roads within the compound. Allowing a certain prevalent percentage of interest on the capital, the return may be worked out. The capital cost divided by the Year's purchase will give the return. If the capital cost is not known, this may be worked out by any method of valuation. The owner expects about 2 per cent higher interest than the prevalent interest to cover up the risk of his investment. To this net return, all possible expenditures on outgoings are added to get gross annual rent.

Gross rent = Net rent + outgoings.

Dividing the gross rent by 12, rent per month can be calculated. 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. In present day an interest of 12 per cent may be a reasonable one for investment on building, but government allows only 6 per cent 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 Re. 1.00 at certain rate of interest. For 4% interest per annum, to get Rs. 4.00 it requires Rs. 100.00 to be deposited in a bank.

To get Re. 1.00 per year it will be required to deposit 1/4 of Rs. 100.00, i.e.,  $100/4 = \text{Rs.}25.00$ .

Thus, year's purchase =  $100/(\text{Rate of Interest}) = 1/i$  Where  $i$  = rate of interest in decimal, For 5% interest,

Year's purchase =  $100/5 = 20$ , For 6% interest,

Year's purchase =  $100/6 = 16.67$  and so on..

In the case of a property whose period of utility is limited to a number of years a certain amount is required to be set aside in the form of sinking fund, to accumulate the amount of original capital cost at the end of the utility period of the property, otherwise the owner of the property will lose both capital and income at the end of the utility period. Hence the Year's purchase will be reduced in such a

way that income of the property will provide both for interest on the capital and for accumulation of the sinking fund to replace the capital. In such cases, Year's purchase

$$1/(i+s),$$

where  $s$  = sinking fund to replace Re. 1.00 at the end of the given period.

### **Plinth Area Required For Residential Buildings**

Government residential buildings are planned according to the salary of the official for whom the building is meant. Normally, Government officials pay a rent of  $I / 10$  of their salary, therefore, the capital investment should be on the basis of this rent, considering the rental value as 6% on the capital cost. But due to the tremendous increase in the cost of construction the capital cost may be fixed at 100% to 150% higher.

Example 4—Find the plinth area required for the residential accommodation for an Assistant Engineer in the pay scale of Rs. 400.00 to 1,000.00 per month.

$$\text{Average pay} = (400+1000)/2 = \text{Rs. } 700 \text{ per month}$$

$$\text{Average monthly rent @ } 10\% \text{ of salary} = 700/10 = \text{RS } 70$$

$$\text{Average annual rent } 70.00 \times 12 = \text{RS } 840.00$$

$$\text{Capital cost of the building @ } 6\% \text{ interest} = (840 \times 100)/6 = \text{RS. } 14,000.00$$

$$\text{Plinth area required @ Rs. } 150.00 \text{ per sq m of plinth area} = 14000/150 = 93.33 \text{ sq m}$$

Normally the quarters for the Assistant Engineer should be constructed at the cost of Rs. 14,000.00 having plinth area of 93.33 sq m.

But due to the increase in the cost of construction, this may be increased by 100% and the capital cost of construction may be fixed as Rs. 28,000.00 and the approximate plinth area of 93.33.