

ESTIMATION AND VALUATION

Class Notes

BY

Er. Nirajan Silwal

Class notes on Estimation and Costing

Er. Nirajan Silwal

Contingencies:-Incidental expenses of miscellaneous characteristics which cannot be classified under any distinct item sub-head. Physical contingencies=10% and price adjustment contingencies= 10%	3-5% of the estimated cost of project																
Work Charged Establishments: - Additional supervising staff engaged at work site.	1.5 to 2% of estimated cost.																
Overhead: - indirect cost of unproductive nature.	2-5%																
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%;">General Overhead</th> <th style="width: 75%;">Job Overhead</th> </tr> <tr> <td>Establishments (Office staff)</td> <td>Salary of engineer, supervisors Handling of materials</td> </tr> <tr> <td>Stationary, Printing</td> <td>Repair and depreciation of Tools and plants</td> </tr> <tr> <td>Travelling expenses</td> <td>Workman's compensation, insurances.</td> </tr> <tr> <td>Telephone</td> <td>Interest on investments</td> </tr> <tr> <td>Taxes</td> <td>Lighting at sites</td> </tr> <tr> <td>Postage</td> <td>Losses on advance</td> </tr> <tr> <td>Electric bills etc.</td> <td>Amenities to labor</td> </tr> </table>	General Overhead	Job Overhead	Establishments (Office staff)	Salary of engineer, supervisors Handling of materials	Stationary, Printing	Repair and depreciation of Tools and plants	Travelling expenses	Workman's compensation, insurances.	Telephone	Interest on investments	Taxes	Lighting at sites	Postage	Losses on advance	Electric bills etc.	Amenities to labor	
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Water Charges: - For drinking purpose of the workers and for the work, arrangement of water either by sinking tube-well or by taking temporary water connection from the corporation or municipality becomes necessary.	1.5% of total cost of material and labor.																
Value Added Tax (VAT)	13% of total cost of project																
Contractor Tax	1.5% of paid bill																
Centage charge:-charged levied to department for planning, designing and monitoring and supervision of work.	10-15% of estimated cost																
Scrap value and salvage value Note: Scrap value < Salvage value	8-10% of cost of construction Generally 10%																
Approximate cost of electrification	8% of estimated cost																
Cost of sanitary and water supply	8% of estimated cost																
For electric fan	4% of estimated cost																
Un-sewered area, additional cost for septic tank	3-4% of bldg. cost																
Provision of supervision	5 to 10%																
Profit to contractor (Analysis of rates)	10% of total cost.																
Valuation (70% fair market value + 30% governmental value)																	
Gross income of building	5-10% of building																
Annual repair and maintenance	10% of gross income Or, 1% to 1.5% of total cost of construction Or, 1 to 1.5 months' rent.																
Annual rent	5-10% value of building																
Penalty	0.05% of contract amount per day does not exceed 10%																

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Estimation: - calculation of quantities of various item of work and expenses to be incurred there on a particular work.

- Estimated cost: - probable (theoretical) cost of work before the start of work.
- Actual cost: - Real cost of project after the completion of work. It is taken from the account register.
- % Fluctuation between estimated cost and actual cost should be ($\pm 10\% - 15\%$).
- Generally take **10%**.

Purposes:-

- Estimation of various types and quantities of materials requirement.
- Estimation of various types and member of labor.
- Estimation various types of tools and equipment.
- Preparation of work schedule.
- **Data required for estimating**
 - Drawings: - fully dimensioned drawing.
 - Schedules of rate: - government approved rates is essential.
 - Specifications: - general and detail specification.
 - Method of measurement.
- Principle unit of measurement
 - Mass, voluminous and thick works shall be measured in m^3
 - Thin, shallow and surface work shall be taken in m^2 .
 - Long and thin works shall be taken in running meter (rm).
 - Piece work or job work shall be taken in number.

Sub- head of item of work:-

- It is used to describe the sub-divisions into which the total cost of a work is divided for financial control and statistical convenience.
 1. Earthwork: - it includes the cost of all items of E/W as E/W in excavation, filling, dressing of earthwork etc.
 2. Concrete: - lime concrete, cement concrete, RCC etc.
 3. Brick work
 4. Stone work
 5. Woodwork
 6. Steel work
 7. Roofing
 8. Flooring
 9. Plastering and pointing
 10. Painting and distempering
 11. White washing and color washing
 12. Miscellaneous work.

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Specification:-

- A specification is a specific description of a particular subject.
- An engineering specification contains detailed description of all workmanship and materials which are required to complete an engineering project in accordance with its drawings and details.
- It is very important for the execution of the work.
- The cost of the work depends upon the specifications.
- Specification should be clear and there should not be any ambiguity anywhere about the drawings of a structure arrangement of the room, various parts and the dimensions.
- Drawings do not furnish the details of different items of work, quantity of materials, proportion mortar and workmanship, which are described in specification.
- Specification don't include *dimension*.

Purpose of Specifications:-

- To specify the nature of work
- To estimate the quantity and cost
- To clarify any ambiguity (in-exactness).
- To identify the quality of materials.
- To identify the material proportion.
- To identify the types of workmanship used.

Type of specification: -

1. General Specifications

- ✓ In general specifications, nature and class of works and names of materials that should be used in the various items of works are described.
- ✓ Only a brief description of each and every item is given.
- ✓ *It is useful for estimating the project.*
- ✓ Without going through the lengthy detailed specifications, general information for the quantities of the materials, nature and class of work can be known from the general specifications, but they do not form part of the contract document.

2. Detail Estimate: -

- ✓ *Detail specification form a part of contract document.*
- ✓ It specifies the qualities, quantities and proportion of material and the method of preparation and execution for a particular item of work.
- ✓ Detail specification of different items of work is prepared separately and they describe what the work should be and how they shall be executed and constructed.
- ✓ While writing the detailed specifications the same order of sequence as the work is to be carried out is maintained.

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➤ Rule for deductions:-

1. Plastering: - no deduction is made for opening less than $0.5\ m^2$ areas.
For area $0.5-3m^2$, deduction is made for only one face.
For area $> 3m^2$, deduction shall be made for openings, jambs, soffits and sill are measured.
End of beam and rafters.
2. Masonry work: - Opening of less than $0.1\ m^2$ areas.
Bearing of floor and roof slab.
Horn of door or window frame.
3. No deduction is made for volume occupied by reinforcement in concrete.
4. In case of expanded metal, wire netting etc. opening less than $0.2\ m^2$ are not deducted.
5. Ceiling: - opening less than $0.4\ m^2$ are not deducted.
6. Hollow concrete block: - No deduction is made on hole of concrete block.
7. Volume occupied by water pipe, conduit not exceeding 25 cm².
8. No deduction is made for volumes occupied by pipes, not exceeding 100 sq. cm in cross-section.
9. Formwork: - opening less than $0.4\ m^2$ are not deducted.

Type of estimate:-

1. Approximate or rough or preliminary estimate
 - Prepared for administrative sanction.
 - Rough estimate.
 - Done in preliminary state of work.
 - Carried out for feasibility study, tax, valuation, insurance etc.
 - This estimate is accompanied by a report duly explaining necessity and utility of project with a site or layout plan.

Types

- a) **Unit rate estimate**: - Per bed of hospital, per km of road, per span of bridge.
- b) **Plinth area estimate**:-
 - o Called square rate method.
 - o **Mostly** adopted in building.
 - o Calculate by multiplying plinth area rate of similar building to plinth area of building.

Plinth area:-

- Plinth area= Floor area+ area of walls
- Floor area= Circulation area+ carpet area
- So, PL= Carpet area+ circulation area+ area of walls.
-

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Points to remember:-

- **Plinth Area**: - built up covered area of a building measured at floor level of any stored is called plinth area.
- **Include**
 1. All floors excluding offsets.
 2. Area of barsati/ mumpti at terrace level.
 3. Internal shaft for sanitary less than $2m^2$.
 4. Area of porches but not cantilever.
 5. Machine room, lift, duct etc.
- **Exclude:-**
 1. Area of cantilever porch.
 2. Area of cantilever projections.
 3. Courtyard area.
 4. Loft
 5. Internal shaft for sanitary more than $2m^2$.
 6. Unclosed balcony
 7. Tower, sunshade, external staircase etc.
- **Floor Area**:- Total area of floor in between walls, i:e area of floor of all rooms, verandahs, corridors, passages, entrance halls, staircase room, kitchen, bath and latrines etc. is called floor area.
- **50% of area of balcony** is included in floor area.
- **Circulation area**: - The area of verandahs, corridors, passages, entrance halls, staircase, balconies, and shafts of lifts is called circulations area. These areas are used for movements in building.
 - a) **Vertical circulation area**:- area occupied by staircase, lifts and entrance hall
 - 4% to 5% of the plinth area.
 - b) **Horizontal circulation area**: - verandah, passage, corridor, balconies, porches etc.
 - 10% to 15% of the plinth area.
- **Carpet area**: - Livable area of building is called carpet area. It is the total floor area minus the circulation area and minus the other un- useable areas such as of bathroom, water closets, air conditioning rooms etc. It should also exclude the kitchen areas, stores and similar other rooms which are not use for living purposes
- Carpet area of the building for any storey shall be the floor area excluding the following
 - a) Sanitary accommodation b) Verandah c) Corridor and passage d) Kitchen and pantries e) Entrance hall and porches f) staircase and mumties g) Barsaties h) Garages i) Shaft for lifts j) Canteen
- **For Residential Building**:-
 - Carpet area: - 50% to 65% of the plinth area.

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- *For Office Building:-*
 - Carpet Area: - 60% to 75% of the plinth area.
- c) **Cubic rate estimate:-**
- Most accurate than plinth area estimate.
 - Cubic rate of similar building is obtained and multiplied by cubic area to get cubic cost of building.
 - Parapet wall is not included while calculating height.
 - The height should be measured from the top of the flat roof (or half way of the sloped roof) to half the depth of the foundation below the plinth.
2. **Detailed or item rate estimate:-**
- Most accurate and reliable estimate.
 - Done after administrative sanction.
 - First rate per unit work are considered and total cost for the item is found by multiplying the cost per unit rate of the rate by the number of item.
 - Then, 3% to 5% is added as contingencies and amount of about 2% is provided for work charged establishments.
 - It is done in two stage
 1. Details of measurements and calculation of quantity.
 2. Abstraction of estimated cost.
 - It is accomplished with
 - i) Report
 - ii) General specification.
 - iii) Drawing
 - iv) Calculation
 - v) Design
 - vi) Analysis of rate.
3. **Revised Estimate:-**
- Prepared when original sanctioned detail estimate exceed by 5% or
 - Expenditure exceed by 10% due to rate being found insufficient or other reason.
4. **Supplementary Estimate:-**
- While a work in progress, some additional works may be thought necessary for development of a project which was not foreseen when the original estimate was framed and the expenditure for such supplementary work cannot be meet up, an estimate is prepared to cover up all such work are called supplementary estimate.

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- Same as detailed estimate but it should be accompanied by a full report of the circumstances which render it necessary.
- The abstract must show the amount of original estimate and the total of the sanction required including supplementary amount.

5. Annual repair and maintenance estimate-

- After completion of a work, it is necessary to maintain the same for proper function and for the same, estimate is prepared for the items which require renewal, replacement, repair etc. in the form of a detailed estimate.
- The estimated amount should not more than 1.5% of the capital cost of the work.

6. Extension and Improvement of Estimate:-

- When some changes and extensions are required to be made in old works, the cost of which cannot meet out annual maintenance estimate, a detail estimate of the additional works prepared, called extension and improvement of estimate. This estimate includes
 - a. Report explaining the necessity of the additional work.
 - b. Existing drawings.
 - c. Drawing of changed work.
 - d. Calculation sheet as per design.
 - e. Rates followed for preparing the abstract of cost.

7. Conceptual Estimate: - An estimate of construction costs made from designer's preliminary sketches and outline specification.

8. Supplementary and revised estimate: - This estimate is prepared when a particular work is abandoned and the cost of the work remaining is less than 95% of the original sanctioned amount of work
or

Where there are material deviations from the original proposed work which may result in substantial saving in the estimate.

Method of calculating Quantities

1. Center Line method:- In this method, calculate the total center line length of walls in a building and multiply the same by the breadth and depth of the respective item to get the total quantity.
 - Quick method as compared to other method.
 - Suitable to calculate quantity of circular, hexagonal, octagonal shaped building.
 - Only in the case of an unsymmetrical wall which is generally rare, no advantages may be claimed by this method.
 - More chance of mistake.

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2. Out to out and in to in method or long wall or short wall method:- In this method, the longer walls in a building are considered as long walls and measured from out to out: and shorter or partition walls , in a perpendicular direction of the long walls, are considered as short walls and measured from in to in for a particular layer of work. These length of long and short walls are multiplies separately by the breadth and height of the corresponding layer and are added to get quantity.

- Length of long wall= center to center length+ half breadth at each end.
- Length of short wall= center to center length- half breadth at each end.
- Suitable to unsymmetrical building.
- Less chance of mistake and suitable for complicated building.
- **More accurate** method than other methods.

3. Crossing Method: - In this method calculate the overall perimeter of the building and subtract from this **four times** the thickness of wall to obtain the center line length.

- This method is now rarely use.

Bill of Quantity (BOQ):-

- Statement showing item number, description of work, quantity but not units of rate.
- Prepared by **quantity surveyors**.
- Prepared in tabular form where rate and amount column are left blank, which is filled by contractor.
- Unit rate of item is written in figure (number) and words (alphabets).

Item no.	Description of Item	Quantity	Unit	Rate (NRs.)		Amount(NRs.)
				In Figure	In Words	
1.00 SITE CLEARANCE						
1.01	Clearing & grubbing of site for construction as per drawings, specifications and instruction of site engineer.	285.00	Sq.m.			
1.02	Building lay out for construction as per drawings, specifications and instruction of site engineer.	145.00	Sq.m.			
2.00 EARTHWORKS						
2.01	Earthwork in excavation in trenches, foundation etc. in all kinds of soil including timbering and pumping out water from the basement (if necessary) dressing of sides, ramming of bottom, lift upto 8m and stacking of excavated materials at least 30m lead	100.00	Cu.m.			

- The written in words is generally preferred if differ between them.

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Schedule of Rate:-

- Documents containing detailed description of all item of work together with their estimated rate but not mentioning their quantity.

Line No.	Description	Unit	Unit Rate
17	PCC 1:2:4 FOR COPING: Providing and laying 60 mm average thickness coping in CC 1:2:4 mix using 6 to 12 mm stone aggregate with 40 mm projection on either side of wall with drip mould. Rate to include 20 mm thick plaster in CM 1:4 for fixing of glass pieces including mixing, providing necessary shuttering, compaction and curing. Thickness of coping at the ends shall be 40 mm and 80 mm at centre.	CUM	3100
18	PCC 1:2:4 FOR GROUTING ANGLE: Providing and laying PCC 1:2:4 mix using 20 mm to 12 mm stone aggregate including mixing, providing necessary shuttering, compaction and curing.	CUM	3500

Schedule of quantity:-

- List of quantity of various item of work required for construction.
- Also called quantity survey.

Sl No.	Description of Item	Qty.	Unit	Rate	Amount
1.	Providing & laying cement concrete of specified grade excluding cost of centering and shuttering – all work upto plinth level in 1:4:8 (1 cement : 4 coarse sand : 8 graded stone agg. 40 mm nominal size)	74.00	Cum.		
2.	Providing & laying cement concrete of specified grade excluding cost of centering and shuttering – all work upto plinth level in 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone agg. 20 mm nominal size)	110.00	Cum.		
3.	Centering and shuttering including strutting, propping etc. and removal of form for Foundations, footings, bases of columns etc. for mass concrete.	96.00	Sq. m.		

Rate analysis: - labor, material and equipment.

- Art of determining the rate of item of work considering the
 1. Total cost of material.
 2. Total cost of labor.
 3. Hire tools and equipment's (Generally, 3% of unskilled labor).
 4. Contractor's profit (10%) and overheads (5%) = total 15%.
- Purpose
 1. To revise the schedule of rate.
 2. To work out economical use of material.
- Requirements:-
 1. Correct information of market rate of materials.
 2. Correct information of various categories of labors.
 3. Out turn of labors.

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4. Knowledge, rate and outturn of various tools and plants.
5. Up to date knowledge of construction.
- Factors affecting
 1. Quality of material.
 2. Proportion of material.
 3. Transportation charge.
 4. Location of work site.
 5. Overhead cost
 6. Profit desired.
- Method of rate analysis
 - A. Total Cost of a material = Rs. X
 - B. Total cost of laborers:- Rs. Y
 - C. Hire of tools and equipment (3% of unskilled labors cost) = Rs. Z
so, Sub-total (A) = Rs. (X+Y+Z)
- D. Contractor overhead (5%) and profit(10%) = 15% of A = Rs. 0.15*A
so, Total (B) = Rs. (A+0.15*A) = Rs. 1.15*A (unit rate of item).

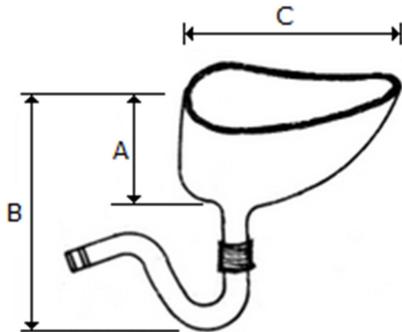
Notes:-

1. In concrete mix: - To get dry mix, increase 50% to 55% of wet mix.
2. In mortar mix: - To get dry mix, increase 30% to 35% of wet mix.
3. In plastering works: -First increase 25% for filling in between joints and irregular surface.
 - In case of ceiling of concrete surface only 10% to 15% increase in wet mix.
 - Then to get dry mix, increase 30% to 35% of wet mix.
4. In case of stone works
 - Increase 15% to 20% of total work due to wastage and dressing to get the required stone.
 - Volume of dry mix = 30% to 40% of stone masonry.
5. In R.C.C works
 - To get reinforcement= (0.6 to 1%) volume of R.C.C
 - Binding wires = 1kg per quintal.
 - For column = 1 to 5%
 - Chajja= 0.5%
6. Capacity of Truck= 4000 bricks and 4 cu.m sand

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- 3 tonner truck= 1000 bricks
- 5 tonner truck= 1500 bricks
- 8 tonner truck = 2000 bricks



A= 30 cm, B= 45cm and C= 50cm

Material detail:-

1. Brick:-

- Modular brick (19*9*9) cm. 500 nos. per cubic meter wall.
- Local Brick (55*110*230) mm. 560 nos. per cubic meter wall.
- Machine made brick. 530 nos. per cubic meter wall.

2. Reinforcement:-

- Density= 7850kg/m³.

- Wt. per meter= $\frac{d^2}{162.2}$

Bar diameter= 10mm	Wt. per meter= $\frac{10*10}{162.2}$	0.62 kg per meter.
Bar diameter= 12mm	Wt. per meter= $\frac{12*12}{162.2}$	0.88 kg per meter.
Bar diameter= 16mm	Wt. per meter= $\frac{16*16}{162.2}$	1.57 kg per meter and so on...

- Rebar Size= 8mm, 10mm, 12mm, 16mm, 20mm, 25mm, 28mm, 32mm, 36mm, 40mm.
- Rebar length= 12m.
- When not specified, volume of steel in RCC work= 0.6 to 1.0% of R.C.C work.

3. Cement:-

- Density of cement= 1440 kg/m³.
- Volume of cement= 0.0347 m³.
- 1 bag cement= 50 kg.
- 1 m³ cement= 28.8 bags.

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Method of measurement

- Dimensions shall be measured to the nearest 0.01 meter.
- Area shall be measured to the nearest 0.01 sq. meter.
- Volume shall be measured to the nearest 0.01 cu. meter.
- Wt. shall be measured to the nearest about 1kg.
- Each pane of glass is measure nearest to 0.5 cm.
- Length of wooden frame for window and door is measure nearest to 2 cm and width and thickness to the nearest 2 mm.
- Sectional dimension of different R.C.C member shall be taken nearest to 0.5 cm.

Sanction for construction:-

1. Administrative sanctions.
 - (It is done 1st among other two).
 - Preliminary estimate is done during administrative sanctions.
 - Detail estimate is done after administrative sanctions.
2. Expenditure sanctions.
3. Technical sanctions.

Provisional sum: -

- Amount provided in the estimate and bill of quantity *for some specialized work to be carried out by a specialist form*, whose details are not known at the time of preparing estimate.
- The payment of provisional sum is done on actual basis.

Provisional quantity: -

- When the quantity of a particular item is not known, certain provisional quantities are provided separately for such item. For this purpose the quantities are calculated from measurement of the drawing with certain assumption of the probable increase.
- Kept separately in BOQ and marked as provisional.

$$- \text{Sinking Fund} = \frac{R}{(1+R)^n - 1}$$

Task work or out turn of worker

- The expected out- turn of 2.5 cm cement concrete floor per mason per day= 7.5 sq.m
- The expected out turn for earth work in excavation in ordinary soil per mazdoor per day is = 3.00 cu.m

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For hard soil = 2 cu.m and for rock= 1 cu.m

- The expected out turn of 12 mm plastering with cement mortar is = 8 sq.m
- The expected out turn of cement concrete 1: 2: 4 per mason per day = 5.0 cu.m.
- The number of masons required for cu.m cement concrete 1:2:4 (as per HMG norms) = 0.8.
- The expected out turn of half brick partition wall per mason per day = 5.0 sq.m.
- The expected out turn of brick work in cement mortar in foundation and plinth per mason per day = 1.25 cu.m.
- The expected out turn of brick work in cement mortar (1:6) in foundation and plinth per mason per day (as per HMG norms) = 0.67 cu.m. (D Parsad)
- The quantity of stone required for 10 cu.m of rubble stone masonry = 12.5 cu.m (Increase by 15 to 20%).
- The number of mason required for cu.m of stone masonry (as per HMG norms), =1.5. (D Parsad)
- How many mazdoors will be required for the disposal of 30 cu.m of surplus earth within a lead on 30m in one day?

(Note:-1 mazdoor = 2.83 cu.m per day for 30m lead)= 10

- In RCC work, one mason in one day can perform = 1.25 cu.m (D Parsad).
 - The quantity of lime required for 100sq.m white washing (single coat)(as per HMG norms)= 10 kg. (D Parsad).
 - For 12mm thick cement plaster 1:6 on 100 sq.m new brick work, the quantity of cement required is 0.274 m³.
- (Hint:- add 1st 25% to fill joint and then 30-35% to get dry volume)
- The volume of cement required for 10 cu.m of brick work in 1:6 cement mortar is approximately equal to $\frac{3}{7}$ cu.m.
 - For 100 sq.m cement concrete (1:2:4) 4cm thick floor, the quantity of cement required = $0.94 m^3$.

Hint: - increase by 10% to fill undulation and then increase by 50% to get dry volume.

Nepal Standard norms

Item no.	Description of work	Skilled	Unskilled	Transportation upto	Unit
1	B/W (Machine made brick)				
	B/W (1:3-1:6)	1.5	2.2	30m	m^3
2	Local Brick				
	B/W (1:3-1:4)	1.5	2.2	30m	
	B/W (soil)	1.0	1.7	30m	
3	Stone				
	Rubble (1:3-1:6)	1.5	5.0	10m	
	Rubble (dry)	1.0	2.0	30m	
4	PCC				

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	1:5:10-1:2:4	1	4	30m	
5	RCC				
	1:2:4-1:1:2	0.8	7	30m	
6	Steel (1.05) & Binding wire 10kg	12	12	30m	MT
7	Wood				
	Chaukhat (HF=92 & Nail=184)	34	3.4	1m3	
8	Plaster				
	12.5mm (1:3 and 1:4)	15	20	100m2	Ceiling
	12.5 mm	12	16	100m2	walls
	20mm	14	19	100m2	All

Unit of measurement of payment for various items of works.

Item no	Description of work	Unit of measurement	Unit of payment
1	Earthwork a. E/W in excavation. b. E/W in filling and cutting. c. Surface excavation (30cm) and surface dressing (15cm), leveling, cleaning etc. d. Hire and labor charge for shoring. e. Puddling. f. Rock excavation.	m^3 m^3 m^2 m^2 m^3 m^3	
2	Brickwork a. Brickwork (with lime and mortar) of one or more than one brick wall b. Brickwork in arches.(work turn is least) c. Reinforced B/W. d. Honey comb B/W e. 10cm or half brick walls with lime or cement mortar f. Flat brick soling (one or two layer) g. B/W in foundation h. B/W in superstructure. i. Brick arch work j. Fair faced B/W. k. First class B/W in mud mortar in foundation and plinth. l. Moulding,Cornices, string courses, drip course (pani patti). m. B/W in coping. n. Broken Glass Coping o. Beading in door and window frame. p. Brick edging. q. Brick on edging	m^3 m^3 m^3 m^2 m^2 m^2 m^3 m^3 m^3 m^3 rm rm rm m^2 rm rm rm m^2	

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	r. Cutting holes through existing B/W. s. Jack arch roofing including top finish. t. Sundried B/W.	Per cm m^2 m^3	
3.	Concrete works a. Lime or cement concrete in foundation. b. RCC work (beam, slab, lintel etc.) c. DPC (thickness is 2 to 4cm) d. R.C chajja. e. Precast C.C or R.C.C blocks - Block construction exceeding 10cm on bed - Not exceeding 10cm f. Hollow concrete block wall g. Expansion and contraction joint. h. Concrete jaffries and sunshade. i. Concrete fencing posts j. PCC in foundation. k. 50mm thick PCC. l. Cement concrete bed.	m^3 m^3 m^2 m^3 m^3 m^2 m^3 rm m^2 m^3 m^3 m^2 m^3	
4.	Steel and iron works. a. Steel reinforcement on RCC works b. Steel truss and purlins c. Welding and soldering of plates. d. Steeling reinforcement including binding wire. e. M.S grill f. Rolling, collapsible & main gate shutter g. Wire fencing h. Expanded metal, wire netting etc. i. Lightening conductors. j. Bending, Binding of steel reinforcement k. Hoop iron	MT Quintal Quintal Quintal Kg m^2 rm m^2 Rm Quintal Rm	
5.	Wood works a. Door and window shutter b. Door and window frame c. Form work d. Scantlings, batterns, trusses etc. e. Handrail f. Wooden false ceiling g. Lintel over opening h. Striking i. Ballies (Stick) j. Wooden pile k. Wooden partition l. Fillets, beadings	m^2 m^3 m^2 m^3 rm m^2 m^3 m^2 rm rm m^2 rm	

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6.	Finishing <ul style="list-style-type: none"> a. Plastering b. Pointing c. Painting works in door, grill, roof, grating etc. d. Painting on eaves, gutters, rainwater and ventilation pipe e. Painting letter and figures f. Lime concrete roof terracing g. Plastering band up to 30cm 	m^2 m^2 m^2 rm No. m^2 Rm	
7.	Flooring works <ul style="list-style-type: none"> a. Brick on edge or brick flat flooring b. Lime or cement concrete floors or paving. (note: - if thickness exceed 20cm, it shall be measured as work on foundation) c. Terrazzo or mosaic flooring d. Tile flooring e. Skirting <ul style="list-style-type: none"> o Less than 30 cm o Greater than 30cm f. Interlocking block flooring g. Artificial stone to floor, dado, staircase etc h. Stone slab flooring i. Tile flooring 	m^2 m^2 m^2 m^2 m^2 m^2 m^2 m^2 m^2 m^2	
8.	Miscellaneous works <ul style="list-style-type: none"> a. Rain water pipe gutter, vent waste pipe etc b. Iron bracket for gutter c. Surface drain d. Sanitary fittings e. Glass panes (supply) f. Fixing glass panel or cleaning g. Door handle h. Bolts i. Cutting of tree j. Ornamental pillar cap k. Sawing of timber, timbering of trenches l. Plantation of trees m. Jungle clearing including uprooting, vegetation, grass etc. n. Scaffolding o. Blasting p. Silt clearance in irrigation canal (for thin layer up to 5cm, may be on area basis) q. Grouting (Bituminous grouting of road metal, cement grouting of concrete) r. Grouting of crack, joints etc. s. Bituminous road surfacing. 	Rm quintal rm No. m^2 No. No. No. No. No. No. No. No. Per Km. m^2 m^2 Kg m^3 m^2 Rm m^2	

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	t. Dismantling of B/W. u. Pargetting chimney. v. Holdfast. w. Barbed wire fencing. x. Glazing. y. Insulated cable z. Bare cable aa. Holdfast bb. Sheet piles	m^3 Rm Quintal Rm m^2 Rm Kg or Quintal Quintal m^2	
9.	Supply of works a. Supply of brick b. Supply of sanitary fittings c. Supply of ordinary cement d. Supply of sand, aggregate e. Supply of paints f. Supply of electric wire g. Supply of glass panel h. Supply of GI sheet i. Supply of AC sheet j. Supply of bitumen, coal and Tar k. Supply of Timber l. Supply of stiff paint. m. Supply of slaked and un-slaked lime.	No. No. bags. m^3 Ltr. Per m m^2 Quintal m^2 Ton m^3 Kg Quintal.	
10.	Stone masonry works a. Stone work in Wall facing, wall lining etc. b. Dressed stone in chujja, shelves, stone sunshade and stone slab. c. Stone masonry. d. Cut stone work in jail e. Dressed stone work in sills, steps, column, coping lintel f. Cut stone in lintel, beam. g. Blasting of rock (<i>Blasted stone stacked and then measured</i>) h. Boulder work	m^2 m^2 m^3 m^2 m^3 m^3 m^2 m^3	

Note: - When plan area of E/W is more than $10\ m^2$ and width is more than 1.5m but depth less than 30cm is called E/W excavation.

Valuation:-

- Technique of determining the fair price.
- Present price of property is known.

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- Value of property depends upon structure, life, maintenance, location, bank interest etc.

Purpose of valuation:-

- Buying and selling of property.
- Taxation.
- Rent fixation (6-10% of valuation amount)
- Security of loan.
- Compulsory acquisition.

Depreciation:-

- Loss of value of property due to structural deterioration, use, wear and tear, decay and obsolescence.

Type of depreciation:-

- Physical depreciation: - due to structural deterioration, wear and tear etc.
- Functional depreciation: - due to technological advancement, lack of demand etc.
- Locational Depreciation: - Caused by factors other than the property itself. For example, areas with a high crime rate are less attractive to investors or the establishment of an industrial plant in the neighborhood can result in noise pollution, waste dumping, and untreated fumes, which can adversely affect the residents living in the neighborhood.

Method of calculating Depreciation: -

1. Straight line method: - lost its value at same amount every year and only scrap value remains at last.
- Annual Depreciation= $\frac{\text{Original cost} - \text{Scrap value}}{\text{life in years}}$
2. Constant percentage method.
 - Also called declining percentage method.
 - Property will lose its value by a constant value.
 - $D = 1 - \left(\frac{V}{C}\right)^{\frac{1}{n}}$ Where,
 - D= percentage rate of annual depreciation.
 - V= scrap value
 - C= original cost.

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3. Sinking fund method.
 - Depreciation is assumed to be equal to the annual sinking fund plus the interest on the sinking fund for that year.
 - Sinking fund coefficient (S_C) = $\frac{R}{(1+R)^n - 1}$ (i)
 - S_n for n years = $\frac{(1+R)^n - 1}{R} * 1 \dots \dots \dots \dots \dots \dots \dots$..(ii)
 - Product of equation (i) & (ii) give rate of depreciation.

Method of valuation:-

1. Depreciation method.
 - Value of property= value of land+ depreciated value of building.
 - Depreciated value of building (D) = $P * \left(1 - \frac{r}{100}\right)^n$
 - P= cost of building at present market rate= plinth area* rate
 - r= fixed rate of depreciation.
 - n= age of building.

Life of building (yrs)	Value of r
100	1
75	1.3
50	2
25	4
20	5

2. Plinth area method.
 - Value of property= value of land+ plinth area*plinth area rate – depreciation ($\frac{C-S}{n}$).
 3. Cost based method.
 - Value of property= value of land+ value of building as per detail estimate- depreciation ($\frac{C-S}{n}$).
 4. Profit based method.
 - Used in cinema hall, commercial complex, hotel etc.
 - Value of building= value of land + capitalized value.
 - Capitalized value= Net income* year's purchase.
 5. Capital value comparison method:-
 - Rental value is not available but sale value of similar property is known.
 6. Rental method: -
 - Rental income is calculated by deducting all gross income to outgoings.
 - Value of property= value of land + capitalized value.
 - Capitalized value= net income * year's purchase.
 - Year's purchase = $\frac{1}{I_p + I_c}$
 - $I_p = \text{rate of interest}$ & $I_c = \text{rate of interest on sinking fund}$

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7. Development method:-

- Valuation done on partially developed or undeveloped phase. Like in plotting.

1. Value and Cost

Value indicates the present market value of any property which may be higher or lower than the cost of construction, whereas the cost means actual cost of construction.

The value is fluctuating in nature whereas cost is a constant which required for the construction, and the value depend upon the;

- Supply and demand of the property
- Location of the property.
- Purpose of valuation etc.

2. **Book Value:** - It is the original investment shown in the account books of a company on its assets including properties and machinates. Thus, the book value will be reduced year to year depending upon depreciation and will be only the scrap value at the end of the utility period. Book value is applicable on building and movable properties but not on land. Book value = Original cost - Total depreciation up to previous

3. **Assessed Value:** -It is the value of any property recorded in the record of local authority which is used for the purpose of determining the various taxes to be collected from the owner of the property. Generally, the assessed value is determined from the gross annual rent at which the land or building might to be let after allowing a factor of 10% for repair.

4. **Distress Value or Forced Sale Value:** -

When a property is sold at a lower price than the market value of that time, it is said to have a distress value. Such distress value may be due to any of the following reason;

- a) Financial difficulties of the seller.
- b) Insufficient knowledge about the market value.
- c) Quarrel among partners.
- d) Panic due to war or riots or civil commotion.

5. **Replacement Value:** - It is that value of a property or its services calculated on the prevailing market rate to replace the same.

6. **Ratable Value:** - It 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 on the ratable value of the property.

7. **Potential Value:** - Some property like land has an inherent value which may go on increasing due to the passage of time or can fetch more return if used for some alternative purposes. This inherent value is known as potential value. It includes the following; a) Beneficial present use of land. b) Better layout than the existing one. c) Better suitability for a different purpose. d) Future usefulness.

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8. **Annuity:** - It is defined as the annual periodic payments for repayment of the capital amount invested in a property or in some other form of investment by a party. These annual payments are either paid at the beginning of the year or at the end of the year for a specified number of years.
9. **Perpetual Annuity:** - If the payments of annuity continue for indefinite period, it is known as perpetual annuity.
10. **Differed Annuity:** - If the payment of annuity begins at some future date after years, this is known as differed annuity.
11. **Scrap Value:** - Scrap value is the dismantled materials value of a property at the end of its utility period and absolutely useless except for sale as scrap. The value of dismantled material after deducting the cost of demolition gives scrap value.
The scrap value of a building is usually considered 10% of the cost of construction. In the case of machineries, scrap value is the value of metal only or the value of the dismantled parts.
12. **Salvage Value:** - It is the value of any property at the end of its utility period without being dismantled.
For example, a machine after the completion of its usual life span or when it becomes uneconomic may be sold and one may purchase the same for use for some other purpose, the sale value of the machine is salvage value. It doesn't include the cost of removal sale, etc.
13. **Gross Income:** - It is the total revenue relished from a property either as rent or lease money during a year. Gross income is the total income or receipt from all sources without deducting the outgoing necessary for taxes, maintenance, operation replacement etc.
14. **Outgoing:** - These are the expenses incurred to maintain the property by undertaking periodic repairs. It also include the taxes levied by the government or local authority on that property sinking fund, management or collection charges and other miscellaneous charges which are borne by the owner.
15. **Net Income:** - This is the saving or the amounts left after deducting all outgoings, operational and collection expenses from the gross income or receipt.
Net income= Gross income - Outgoings
16. **Capitalized Value:** - It is defined as that amount of money whose interest at the highest prevailing rate of interest will be equal to the net income from the property in perpetuity (for an indefinite period or for a specified period).
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.
Capitalized value = Net income x Year purchase (Y.P.)
17. **Year's Purchase (Y.P.):** - It is defined as the capital sum (i.e. capitalized value) required to be invested in order to receive an annuity of Rs. 1.00 at the prevailing rate of interest.
$$\text{Year's Purchase (Y.P.)} = \frac{100}{\text{Rate of interest}}$$

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18. **Prime cost:** - Net cost or purchased cost of articles and refer to supply of articles only and not to carrying out of work.
19. **Liquidated damage:** - Fixed stipulated sum of penalty by contractor.
- Have no relation with real damage.
- Depend up-on term of condition.
20. **Un-liquidated damage:** - Ordinary damages are having relations with real damage.
21. **Provisional sum:** - amount provided in the estimate and BOQ for specialized firm, where detail - are not known at the time of preparing estimate.
- Payment of provisional sum is done on actual basis.
22. **Provisional quantity:** - When the quantities of a particular item are not known.

Points to remember:-

- Septic tank
 - 1. Minimum width and detention time = 75 cm and 30 minutes.
 - 2. Minimum size of pipe connecting septic tank = 100mm
 - 3. Capacity of septic tank for 100 users = $7-8 m^3$
 - 4. Sludge is removed = 1- 2 years.
- Domestic sewer pipe laid in 1:100 = 150 mm.
- CGI sheet
 - 1. Pitch = 3"
 - 2. Thickness= 0.13-4 mm.
 - 3. Standard width= 32"
 - 4. No. of corrugation = 10.
 - 5. Thickness of CGI sheet is specified in AWG (American Wire Gauge).
As AWG increase, diameter and x-section decrease.
- Asbestos sheet
 - 1. Standard sheet = 1.05m.
 - 2. No. of corrugation= 7.
 - 3. End lap= 15cm
 - 4. Side lap= 4cm.
- Defect liability period = 1 years.
- Trafford sheet width=1.10m
- CGI pipes
 - 1. Width = 60-150cm
 - 2. Density of zinc coating in CGI sheet= 60-600 gm/m².
- The portion which is wrongly excavated by contractor is filled by concrete as specified.
- If bearing is not specified, thickness of lintel
 - 1. *thickness of lintel with a minimum of 12cm*
- Work turn in cu. m. per mason per day is least
 - 1. Stone arch work.
- Information not conveyed to estimator by drawing, is conveyed by
 - 1. Specification.
- Layer of dry bricks put below the foundation concrete, in the case of soft soil = soling.
- Steel form work can be used up to = 50 times.

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- Quantity of masonry arch work = Mean arch length* breadth* thickness.
- Area of segmental portion of arch having span length L and rise h= $\frac{2}{3} * L * h$.
- Minimum number of hold fasts
 1. Door= 6.
 2. Window =4.
- Minimum number of hinges in window and door shutter= 2 & 3.
- In case of grills, for the estimation of painted area is equal flat area.
- For white washing or distempering on A.C. corrugated sheet, plan area of sheet is increased by 10%.
- For color washing on A.C. corrugated sheet, plan area of sheet is increased by 20%.
- For white washing or distempering in iron sheet, 14%.
- Annual financial statement of anticipated expenditures and receipts= Budget.
- The unit rate is only for finding cost.
- In case of roof truss of steel, the rivets, bolts and nuts account for = 5%.
- For residential building, minimum width of stairs= 90 cm.
- Roll commonly used for keeping record to pay the labor engaged on daily wages is Muster roll.
- The book showing the original record of work done or supply of materials received duly weighted measured = measurement book.
- The scrap value of RCC work is always negative.
- Total length of cranked bar = $L + 2 * 0.42 * d$.
- Outgoings means
 1. Repair cost.
 2. Municipal, land tax, insurance etc.
 3. Re-instatement cost.
- Bern are provided = partly in embankment and partly in excavation.
- If tensile stress of steel of rod of diameter D is 400 kg/cm² and bond stress is 6kg/cm², then required bond length of rod = $59 * D$.
- Running bill: -
 1. Also called interim bill.
 2. Monthly statement of work done prepared by contractor and submitted to client for payment after joint measurement.
- Voucher: - written record document kept as proof of payment.
- Bill: - Account of work done or supply of materials that includes particulars, quantity, rates and due amount.
- Life of structures

S.N.	Work type	Life in years
1	Brick work	100
2	Road (Asphalt)	10-15
3	Road (Concrete)	20-40
4	Paint	5

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5	Teak work	4
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- Penalty: - 0.05% of contract amount per day but should not more than 10%.
- Debit= Expenditure and Credit= receipts.
- Excavation of E/W = manpower *rate + plant.
- The actual cost of supplementary and revised estimate= less than estimated cost.
- 1 British gallon = 4.546 liters.
- 1 US gallon = 3.785 liters.
- Contractor's
 - 1. Main aim is to earn more profit.
 - 2. Assured the client that he can do work better.
- The overheads and profit claimed by contractor to client is included in rate analysis.
- The rate analysis induces
 - 1. Material, labor, contractor's overhead and profit.
- Administrative sanction is done first.
- Center line method is easiest for the estimation of the quantity than long wall and short wall method.
- 1 kilo-liter = 1 cubic meter.
- Contractor profit is added to
 - 1. Rate analysis.
- Rate analysis prepared by ministry of transport and work includes
 - 1. Labor, material & equipment.
- The thickness of 25 gauge sheet is less than 1 mm.
- Dis-mental: - breaking up the structure with care.
- Demolition: - breaking up the structure.
- Rate able value: - Gross income- yearly repairs.
- Book value- original cost – depreciation.
- Book value is shown in account book.
- Find the value of years-'s purchase to get Rs. 1 per year at the interest rate of 5%

$$\text{Year's purchase} = \frac{100}{\text{Rate of interest}} = \frac{100}{5} = \text{Rs.20.}$$

- Linear method of depreciation imposed on cost related to service.
- The main purpose of rate analysis is
 - 1. To find actual cost per units item.
- The two type of specification commonly are
 - 1. Material and item specification.
- Prismoidal formula method = $\frac{L}{6} (A_1 + A_2 + 4 * A_m)$.
- Volume by prismoidal formula = $\frac{D}{3} (\text{First area} + \text{Last area} + 4 * \sum \text{even area} + 2 * \sum \text{odd areas})$.
- In case of Prismoidal formula, it should have odd number of sections.
- E/W calculated by prismoidal Formula is more accurate.

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Case I: Wholly in banking or wholly in cutting

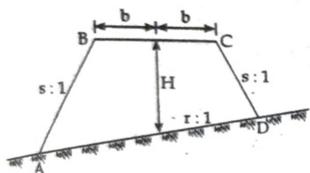


Figure: Fully banking

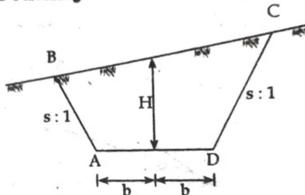


Figure: Fully cutting

Thus, from geometry; we have,

$$\text{Area of ABCD} (\text{Area of fully cutting or banking}) = \frac{sb^2 + r^2(2bH + sH^2)}{r^2 - s^2}$$

where, $s : 1$ is the side slope.

$r : 1$ is the transverse slope.

H is the height of banking or depth of cutting.

b is the half of formation width.

Case II

a) When centre line (FG) is in cutting portion (figure a)

Partly in banking and partly in cutting;

Area of ABE = Area of banking

$$= \frac{1}{2} \frac{(b - rH)^2}{r - s}$$

Area of EDC = Area of cutting

$$= \frac{1}{2} \frac{(b + rH)^2}{r - p}$$

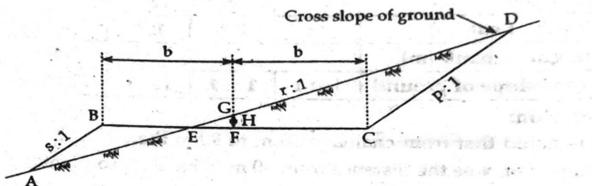


Figure: (a)

b) When centre line (FG) is in banking portion (figure b)

$$\text{Area of ABE} = \text{Area of banking} = \frac{1}{2} \frac{(b + rH)^2}{r - s}$$

$$\text{Area of EDC} = \text{Area of cutting} = \frac{1}{2} \frac{(b - rH)^2}{r - p}$$

where, H is the centre depth of cutting or banking.

$s : 1$ is the side slope of banking.

$P : 1$ is the side slope of cutting.

- Mean harmonic slope at Zero point (r) = $\frac{2 * r_1 * r_2}{r_1 + r_2}$

- Crest width at Zero point (Balance point) (b) = $\frac{1}{2} \left(\frac{B_1}{r_1} + \frac{B_2}{r_2} \right)$.

- When the contractor fails to complete the work, an agency is employed to execute a part or whole of work at the cost of contractor. Such agency called **debitable** agency.

- Quantity assurance technique means

- Inspection
- Testing
- Sampling

- Scrap value is also called junk value or demolition value.

- Quantity Survey: - calculation of quantities of material required completing a work.

- The **general specification** is given to the detail estimate.

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- The capital cost of building does not include scrap value.

OLD QUESTION

1. Basic record of payments made to daily labor is kept in a
 - Muster roll.
2. The annual periodic payment made for repayment of capital investment is called
 - Sinking Fund.
3. Subgrade preparation in Road Work is generally measured in
 - Cubic meter.
4. Specification of works required only when the work is carried out by
 - Contractor's
 - Muster roll
 - User committee.
5. Site order book is used for recording
 - Instruction by executive engineers.
6. Detail specifications of a particular projects give
 - Qualities of material.
 - Execution and workmanship of work.
7. As provisioned in the estimated norms for rate analysis, a timber frame work can be reused for
 - 6 times.
 - Steel = 50 times
8. The girth of trees are to be measured at a height above the ground level
 - 1m
9. Net rent+ outgoings = Net rent
10. Minimum floor area required for water closet
 - $1.1m^2$.
 - For kitchen = $4.5m^2$.
 - For bath and WC= $5.5m^2$.
 - Drawing room= $16m^2$.
11. First class over burnt brick is preferred for road construction.
12. For E/W excavation under water, the rate is increased by 20%.
13. In the center line method of working out volumes, for cross walls, what deductions must be made from center line length at each junctions.
 - Half the breadth.
14. In rate analysis, 5% waste for scantling is considered.
15. The size of door handle is specified by
 - The grip length.
16. Note:-
 - Scrap value of property may be positive or negative.
 - Scrap value of RCC is always negative.
17. Total length of bar having hook at both ends is

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L+18D

18. For E/W excavation under water, the rate is increased by 20%.

Life of different material

S. No.	Life	Items
1.	100 years or more	Masonry in lime or cement. Stone work in lime or cement
2.	100 years	Arches of brick work in lime or cement. Brickwork in C.M.
3.	80 years	Iron works in roof
4.	75 years	Sun-dried brickwork in clay. R.C.C. and R.B. roofing, R.S. Joints.
5.	60 years	Salwood work in roofing
6.	50 years	Cement concrete flooring. Stone flooring. G.I. sheet roofing.
7.	40 years	Brick flooring over lime concrete. Teakwood. Salwood.
8.	30 years	Deodar wood joinery.
9.	20 years	Lime concrete terraced floor. Sal ballies roofing.
10.	15 years	Country wood work in roof.

19. **Multiplying factors for different surfaces to get equivalent plan area**

S.N	Name of surface Painted	Multiplying factor for each sides
1	Panelled, framed and braced, ledged and battened or ledged battened and braced.	$\frac{9}{8}$ times
2	Fully glazed or gauzed	$\frac{1}{2}$ times
3	Part panelled and part glazed or gauzed	1 times
4	Fully venetioned or louvered	$\frac{3}{2}$ times
5	Flush door	1 times
6	Corrugated iron sheeting in roof	1.14
7	A.C corrugated sheeting in roof	1.2
8	A.C. Semi corrugated sheeting in roof	1.1
9	Steel rolling shutter	$\frac{5}{4}$ times
10	Guard bars, balustrades, grating, railing, grills, expanded metal	1

20. For framed multistoried building, area occupied by wall is 5% to 10% of PA (3% for external wall and 2% internal wall)

For ordinary building without frame, 10% to 15% of PA.

For A.C sheet

- Standard length = 1.50m, 1.75m, 2.00m, 2.25m, 2.75m and 3.00m
- Standard width = 1.05m
- No. of corrugation= 7
- Pitch of corrugation= 14.6cm
- Depth of corrugation= 4.8cm
- End lap= 15cm

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- Side lap= 4cm

22. Semi-corrugated or Trafford sheets

- Same standard length as for corrugated sheet.
- Standard width= 1.10m
- End lap = 15cm
- Side lap= 1 corrugation of about 8.5cm

23. G.I. Sheet

- Standard length = 1.10m, 2.20m, 2.50m, 2.80m and 3.20m.
- Standard width = 80cm (32")
- No. of corrugation = 10
- Pitch (Center to center distance) of corrugation= 7.5cm
- Depth of corrugation= 18mm
- End lap= 15cm
- Side lap = two corrugation (7.5cm)
- Each bundle= 72 fts.

24. Classification of work according to their cost.

- Major work: - work costing more than Rs. 2 lakh.
- Minor work: - work costing more than 50,000 but not exceeding Rs. 2 lakh.
- Petty work: - work whose cost does not exceed Rs. 50, 000/-

ALL THE BEST