LECTURE NOTE ON

ESTIMATION & COST EVALUATION-I

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COURSE CONTENT:

[1] Introduction

1.1 Types of estimates – Plinth area, floor area / carpet area

1.2 Units and modes of measurements as per IS 1200

1.3 Accuracy of measurement for different item of work

[2] Quantity Estimate of Building

2.1 Short wall long wall method and centre line method, deductions in masonry, plastering, white washing, painting etc., multiplying factor (paint coefficients) for painting of doors and windows (panelled/glazed), grills etc.

2.2 Detailed estimate of single storied flat roof building with shallow foundation and RCC roof slab with leak proof treatment over it including staircase and mumty room.

[3] Analysis of Rates and Valuation

3.1 Analysis of rates for cement concrete, brick masonry in Cement Mortar, laterite stone masonry in Cement Mortar, cement plaster, white washing, Artificial Stone flooring, Tile flooring, concrete flooring, R.C.C. with centring and shuttering, reinforcing steel, Painting of doors and windows etc. as per OPWD.

3.2 Calculation of lead, lift, conveyance charges, royalty of materials, etc. as per Orissa P.W.D. system (Concept of C.P.W.D./Railways provisions)

3.3 Abstract of cost of estimate.

3.4 Valuation- Value and cost, scrap value, salvage value, assessed value, sinking fund, depreciation and obsolesce, methods of valuation.

[4] Administrative Set-Up of Engineering Organisations:

4.1 Administrative set-up and hierarchy of Engineering department in State Govt./Central Govt./PSUs/Private Sectors etc. Duties and responsibilities of Engineers at different positions /levels.

ESTIMATION & COST EVALUATION-I

INTRODUCTION:

Estimating

- It is the process of calculating the quantities and costs of the various items required in connection with the work for its satisfactory completion.
- An estimate is the anticipated or probable cost of work is usually prepared before the construction is taken up. Before undertaking any project it is necessary to know its probable cost shall be occurred.

Requirements of Building estimation

- Plan of building (To get Area)
- Cross -section & evaluation of the structure (To get volume)
- Specification (Different types of materials used like doors, windows, steel rod etc...)

Purpose of Estimation

- To know the approximate cost of proposed work.
- to obtain administrative approval & technical sanction.
- to know the requirements of tools, plants, & equipment's.
- To fix up the completion period.
- To invite tenders.
- Valuation to know value of property
- To decide the quantities of materials to be required so that it can proceed for work.
- To calculate no. of people & categories of people from the volume of work required to complete the project.

Types of estimation

- Approximate Estimate or Preliminary estimate
- Plinth area estimate
- Cube rate estimate
- Labour estimate
- Detail estimate
- Abstract estimate
- Revised estimate
- Supplementary estimate
- Annual repair & maintenance estimate

Approximate Estimate or Preliminary estimate:

It is rough estimate prepared to know the approximate cost of work in short time. In this type of estimate, estimate is prepared on the basis of actual cost of similar existing structure. The various factors of comparisons may be cubic content, per capita, per km, service unit, etc. These are useful to know the cost at initial stages to decide the feasibility of work. To prepare approximate estimate less skill and time is required.

Purpose Of Approximate Estimate

1. To know the feasibility of project.
2. To know project duration.
3. foe insurance and tax schedule.
4. For planning the project.
5. To know benefit cost ratio.

Plinth area estimate:

These estimate is prepared on the basis of plinth area of building. The rates obtained from a similar building having similar specification, heights & constructions in the locality.

∴ Approximate cost = Plinth area X plinth area rate Plinth area should be calculated for the covered area by taking external dimensions of the building at the floor level. Courtyard & other open area should not be included in the plinth area.

Cube rate estimate:

In this method the volume of the proposed building is worked out & multiplied by the rate per cubic volume of similar building the locality.

∴ Approximate cost = volume of building X rate per volume

The volume of building can be obtained by multiplying the plinth area with the height of building.

The volume of building=Length X Breadth X Height The Cubic Content Method is more accurate than plinth area method and is used for residential as well as public building.

Labour estimate:

Here the quantity of material to be used in a building is calculated separately and labour item require for per square meter of the plinth area of that work is taken out for calculation of cost of labour and making arrangement for the labour.

Detail estimate:

- It is prepared by finding out actual quantities of different items of work and then it is multiplied by in corresponding rates.
- Quantities of all items of work shall be calculated from the drawing on a measurement sheet. multiplying these quantities by their respective *rates in a separate sheet, the cost of all item are worked out individually & then abstracted.*

DETAIL ESTIMATE TABLE :

SL.NO.	Description or particulars	No. of items	Length (L)	Breath (B)	Height or depth(H)	Quantities (Q)	Explanatory Note

Abstract estimate:

It is second part of detail estimate.

TABLE FOR ABSTARCT ESTIMATION:

SL.NO	QUANTITIES	UNIT Sqm./cum.	RATE	AMOUNT	Explanatory Note

Supplementary estimate:

Supplementary estimate is prepared when additional works or changes are required to supplement the original works during the execution of work. Then a fresh detailed estimate of additional works is prepared in addition to the original estimate.

Revised estimate:

- During execution of a project if it is found that there is increase in volume of original proposed work, estimate is necessary to revise and at the same time sanctioned of supplementary works.
- For such a case a revised estimate is prepared for increased volume of the original work & a detailed estimate for the supplementary works are prepared separately.

- The amount of supplementary estimate is added to the revised estimate showing the amount separately. Thus total amount of the revised estimate include the amount of supplementary works also. Revised estimate is prepared under any one of the following circumstances.
- When the original sanctioned estimate is likely to exceed by more than 5%.
- When the expenditure on a work exceeds the amount of administrative sanctioned by more than 10%.

Annual repair & maintainace estimate:

- After completion of work it is necessary to maintain the same for its proper function & for that an estimate is prepared for the items like renewal, replacement, repairs, etc. in the form of detailed estimate is called maintenance and repair estimate.
- For petty works such as replacement of glass pans, repairs of floors, patch repairs to cement plaster to walls etc. whose repairs can not be estimated in the beginning , only lump sum provision is made for different items in the estimate.

Difference between Revised & supplementary estimate

SL.NO	REVISED ESTIMATE	SUPPEMENTARY ESTIMATE
1.	This is needed is the sanction amount is exceeded because of additional work or change of rates fairly dependent on work of first sanction. So, a revised estimate is used because of material deviation from the original proposal.	This is needed because of supplementary work which are fairly independent of the work at the first sanctioned. So supplementary estimate is because of material deviation of a structural nature from the design originally approved.
2.	It is accompanied with a comparative statement abstract form showing probable variations for quantity, rate, amount against each item of work involved in the project.	No comparative abstract form is required. This is an estimate for additional work only. The abstract shows the original estimate and the total amount of sanction required including supplementary amount.
3.	Revised estimate is required due to change of rate or quantity of materials, so no addition or revisions of drawing is necessary.	Supplementary is required due to some new works or due to change of design, so addition or revisions of drawings may be necessary.

UNITS & MEASUREMENTS:

MATERIALS	UNITS
➢ EARTH WORK EXCAVATION	Cubic meter
➢ ROCK WORK EXCAVATION	Cubic meter
➢ EARTH FILLING	Cubic meter
➢ LIME CONCRETE	Cubic meter
➢ R.C.C	Cubic meter
➢ CHAJJA	Cubic meter
➢ MASONARY	Square meter
➢ SURFACE DRESSING	Square meter
➢ ROOFING	Square meter
➢ HONEY COMB	Square meter
➢ CEILLING	Square meter
➢ DAMP PROOF COURSE	Square meter
➢ WINDOW	Number
➢ BRICK	Quintal
➢ STEEL	Square meter
	Number
	Quintal

UNITS OF MEASUREMENTS:

Sr. No.	Details of Material/ item	Unit of Measurement
1	Cement	Bag
2	Sand, Aggregate, Brick bats	Cu. m.
3	Bricks	Nos.
4	WhiteCement	Kg
5	Slacked Lime	Quintal
6	Wood	Cu. m.
7	Reinforcement steel	Kg
8	G. I. Sheet	Kg
9	A.C. Sheet	Sq. m.

10	Steel Sections (angles, channel, I- sections)	Kg
11	Adhesives	Kg
12	Turpentine, Primer, Varnish	Litre
13	Oil Paint	Litre
14	Water proof Ower, Distemper	Kg
15	Kotah Stone	Sq. m.
16	Mozai Tiles	Sq. m.
17	W. C. Tub	No.
18	Nanhi Trap, Gully Trap	No.
19	GI Pipe, CI pipe, PVC Pipe	m
20	Rolling shutter	Sq. m.

21	Wire Grill	Sq. m.
22	Plywood Sheet	Sq. m.
23	Wash Basin	No.

Size of Brick:

Standard size brick = 19 X 9 X 9 cm.

Nominal / modular size of brick = 20 x 10 x 10 cm.

Traditional brick = 24.8 x 12.1 x 7 cm.

Traditional brick with mortar = 25.4 x 12.7 x 7.6 cm.

Nominal brick: - **Nominal brick** dimensions are used in modular construction and are the specified size plus the width of the mortar joint.

Traditional brick: - In a **traditional** brickworks, clay is taken from the quarry, and then carried by workers to the yard After the forming or cutting, the **bricks** must be dried, in the open air, in drying sheds, When the **bricks** have been dried, they must then be fired or 'burnt' in a kiln, to give them their final hardness and appearance. **Traditional Bricks** are those which have not been standardized in size. ... The commonly adopted nominal size of **traditional brick** is 23 cm x 11.4 cm x 7.6 cm (9”x4 ½ “x3”) approximately.

Density of materials:

- Concrete: 2370 kg/m^3
- Cement: 1440 kg/m^3
- Cement Mortar: 2080 kg/m^3
- Brick: 1600-1920 kg/m^3
- Brick Masonry: 1920 kg/m^3
- Dry Sand: 1600 kg/m^3
- River Sand: 1840 kg/m^3
- PCC: 2240 kg/m^3
- Steel: 7849 kg/m^3
- Cast Iron: 7208 kg/m^3
- RCC 2% Steel: 2420 kg/m^3
- Aluminium: 2739 kg/m^3
- Gravel with sand: 1920 kg/m^3
- Crushed Stone: 1600 kg/m^3
- Marble: 2560 kg/m^3
- Limestone: 2739 kg/m^3
- Granite Stone: 2460–2800 kg/m^3

PLINTH AREA:

Plinth area shall mean the built-up covered measured at the floor level of the basement or of any storey.

It is calculated by taking external dimension.

Plinth area included:-

1.Area of floor

2.Area of wall

3.lift

4.Area of porch, etc....

Plinth area excluded:-

1.balcony

2.Courtyard

3.open area

4.Cantilever porch, etc....

FLOOR AREA:

Floor area of building is the total area of floor in between wall and consist of floor at all rooms, verrendah, passages, corridors, staircase room, entrance hall , kitchen , stores ,bathroom & latrine etc. sills and openings are not includes in floor area.

Floor area = plinth area – area occupied by walls.

CARPET AREA:

The carpet area at a building for any storage shall be the floor area excluding the following: - ➢ Sanitary accommodation ➢ Veranda ➢ Corridor or passage ➢ Stores in domestic buildings ➢ Entrance Hall ➢ Staircase ➢ Lift

➢ Garages,etc..

Concrete properties:

Concrete Grade	Mix Ratio (cement : sand : aggregates)	Compressive Strength MPa
Grades of Concrete		
M5	1 : 5 : 10	5 MPa
M7.5	1 : 4 : 8	7.5 MPa
M10	1 : 3 : 6	10 MPa
M15	1 : 2 : 4	15 MPa
M20	1 : 1.5 : 3	20 MPa
Standard Grade of Concrete		
M25	1 : 1 : 2	25 MPa

M30	Design Mix	30 MPa
M35	Design Mix	35 MPa
M40	Design Mix	40 MPa
M45	Design Mix	45 MPa

High Strength Concrete Grades

M50	Design Mix	50 MPa
M55	Design Mix	55 MPa
M60	Design Mix	60 MPa
M65	Design Mix	65 MPa
M70	Design Mix	70 MPa

M =mix proportion

No.s =characteristic comp. strength of concrete

PROBLEM NO – 1

For 1 cubic meter of CC (cement concrete) the dry material volume is 1.52cum. If the proportion is 1:2:4 then calculate the required cement and no. of cement bag required. Given density of cement = 1440kg/m^3.

Ans: - dry volume =1.52m^3

Sum of total proportion= 1+2+4=7

Cement content = (proportion of cement /sum of total proportion) x dry vol material

= (1/7) x 1.52

=0.217m^3

1 bag cement volume

1 bag = 50kg = 50kg/1440kg/m^3

No of cement bag = 0.217/0.347

= 6.25 i.e 7bags

SUB-HEAD OF ESTIMATE:-

In working estimate this term is used to describe the sub division into which the total cost of work is divided each sub-head of estimate is grouped from similar items of work.

EARTHWORK :- It includes earthwork excavation, plinth filling, filling, surface dressing & dressing.

CONCRETE WORK :- This includes ~~earthwork~~ lime or cement or reinforced concrete work.

BRICK WORK :- This includes brickwork in foundation, plinth & brickwork in super-structure.

STONE WORK :- To placing small aggregate or small stone chips in the surface of flooring before placing concrete work.

ROOFING :- To provide the concrete slab over the ceiling level.

WOODWORK :- To provide lintel, doors & windows & other interior furnishing accessories.

STEEL WORK :- To provide door fittings, steel railing or iron gates, grills etc.

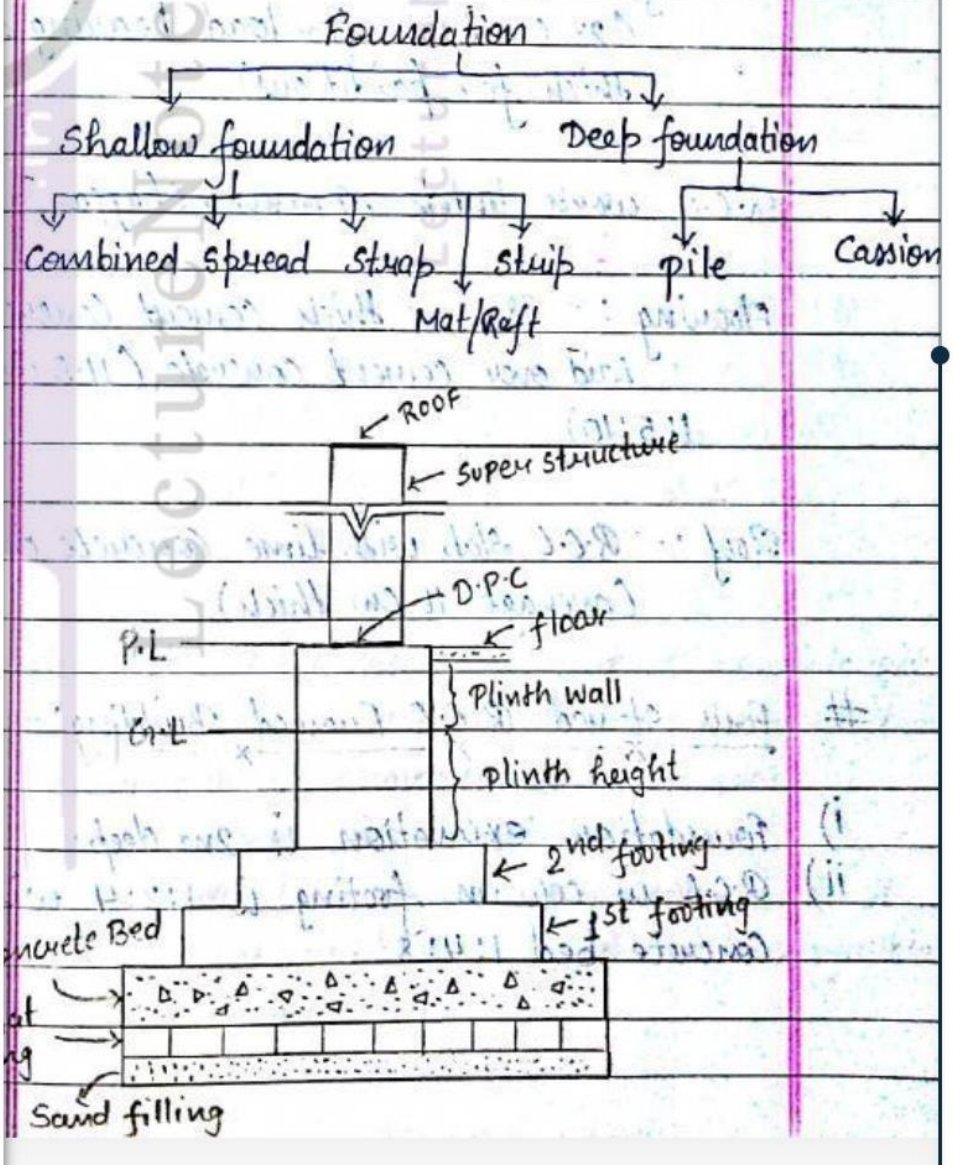
WATER SUPPLY & SANITATION :- To provide sanitary pipeline for drainage or kitchen sewage. (4 to 5% of estimated cost of the building work).

PLASTERING & PAINTAINING :- To provide similar surface or finishing of work like finishing of white wash, colour wash and paint & primar.

ELECTRICAL WORK :- To provide wiring or electrical wiring for the required place in the construction. (9% of estimated

cost of the building would for electric fair, light = 3% from the estimated cost of building work.

MISCELLANEOUS WORK :- Additional work like your design of adding of some extra rooms.



Q. Estimate the quantities of brick work and plastering required in a wall 4m long, 3m height and 30 cm thick. Calculate the cost if the cost of brick work Rs 320/m^3 & for plastering Rs 8.5/m^2 (plastering of two faces wall).

→ Quantity or vol. of brick work = $4 \times 3 \times \frac{30}{100}$

$= 3.6\ m^3$

cost of brick work = 320×3.6 = Rs 1152

Quantity/ Area of plastering = 4×3 = $12 m^2$

Total area of plastering = $2 \times 12 = 24 m^2$

cost of plastering = $2 \times 12 \times 8.5$

= Rs 204

A person construct a building of plinth area 100 m^2 on a plot of land in a certain locality at a cost of Rs 95000. The height of the building from ground level to the top of the roof is 3.5 m and a parapet wall of height = 80cm is constructed on the terrace. Determine the cost of a similar building of plinth area 135 m^2 to be constructed in the same locality by plinth area rate, also by cube rate method.

Plinth Area Method:-

100 Sqm = 95000/-

for plinth rate = $\frac{95000}{100}$ = Rs 950/m^2

For 135 Sqm = 135 X 950

= Rs 128250

Cube Rate or Volume Method:-

Volume = Existing Building Area (height of Building + half height of parapet wall)

Volume of 100 Sqm = 100 (3.5 + 0.8/2)

= 390 m^3

For 100 Sqm = 95,000

For 390 m^3 = 95,000

For 1 " = $\frac{95,000}{390}$ = Rs 243.58/m^3

Volume of 135 Sqm = 135 (3.5 + 0.8/2)

= 526.5 m^3

Cost of 526.5 m^3 = 526.5 X 243.58

= Rs 128244.87

A person construct a building of plinth area 180 Sqm and on a plot of land in a certain locality at a cost of rupees 132270, the height of the building from ground to the top of the roof is 4.5m and a parapet wall of height is 100cm is constructed on the terrus. Determine the cost of a similar building of plinth area 200 Sqm to be constructed in the same locality by plinth area rate method and also by cube rate or volume method.

Plinth Area Method :-

For plinth rate = $\frac{132270}{180}$ = Rs 734.83/m^2

For 200 sq.m = 200 X 734.83

= Rs 146966.67

Cube rate or volume method:-

Vol. of 180 sq.m = 180 (4.5 + 1/2)

= 180 X 5

= 900 m^3

For 900 m^3 = Rs 132270

For 1 m^3 = $\frac{132270}{900}$ = Rs 146.96/m^3

Vol. of 200 sq.m = 200 (4.5 + 1/2)

= 1000 m^3

For 1000 m^3 = Rs 146.96 X 1000

= Rs 146960

METHODS OF CALCULATING QUANTITIES FOR BUILDING WORK

The quantities of various item can be estimated by any one of the following methods.

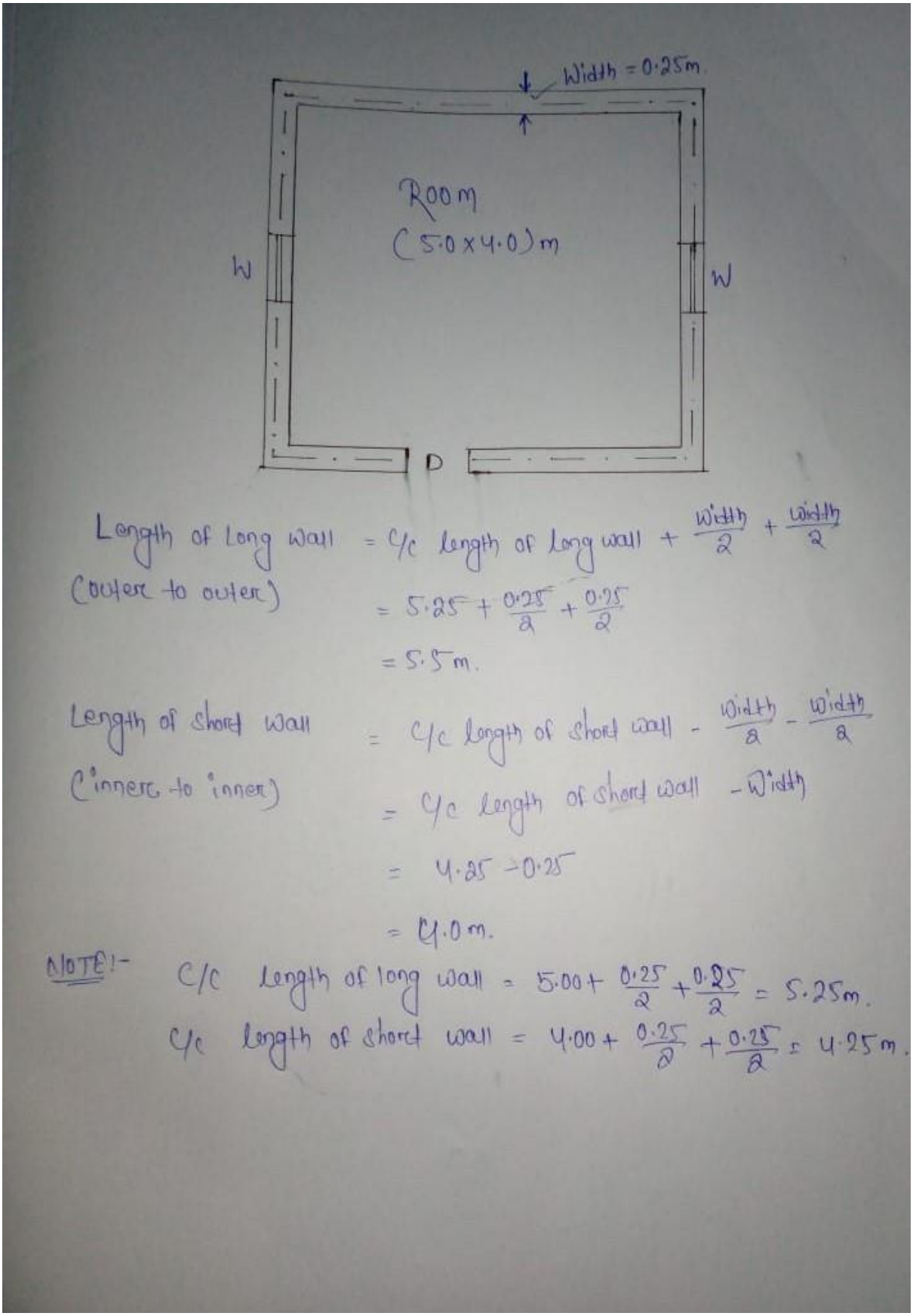
1. Long wall & short wall method
2. Centre line method
3. Partly centre line and partly cross wall method

LONG WALL & SHORT WALL METHOD:

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

EXAMPLE: -

Calculating long wall & short wall in following diagram.



Length of Long wall (outer to outer) = C/c length of long wall + $\frac{\text{width}}{2}$ + $\frac{\text{width}}{2}$

$= 5.25 + \frac{0.25}{2} + \frac{0.25}{2}$

$= 5.5$ m.

Length of short wall (inner to inner) = C/c length of short wall - $\frac{\text{width}}{2}$ - $\frac{\text{width}}{2}$

= C/c length of short wall - width

$= 4.25 - 0.25$

$= 4.0$ m.

NOTE:- C/c Length of long wall $= 5.00 + \frac{0.25}{2} + \frac{0.25}{2} = 5.25$m.

C/c length of short wall $= 4.00 + \frac{0.25}{2} + \frac{0.25}{2} = 4.25$ m.

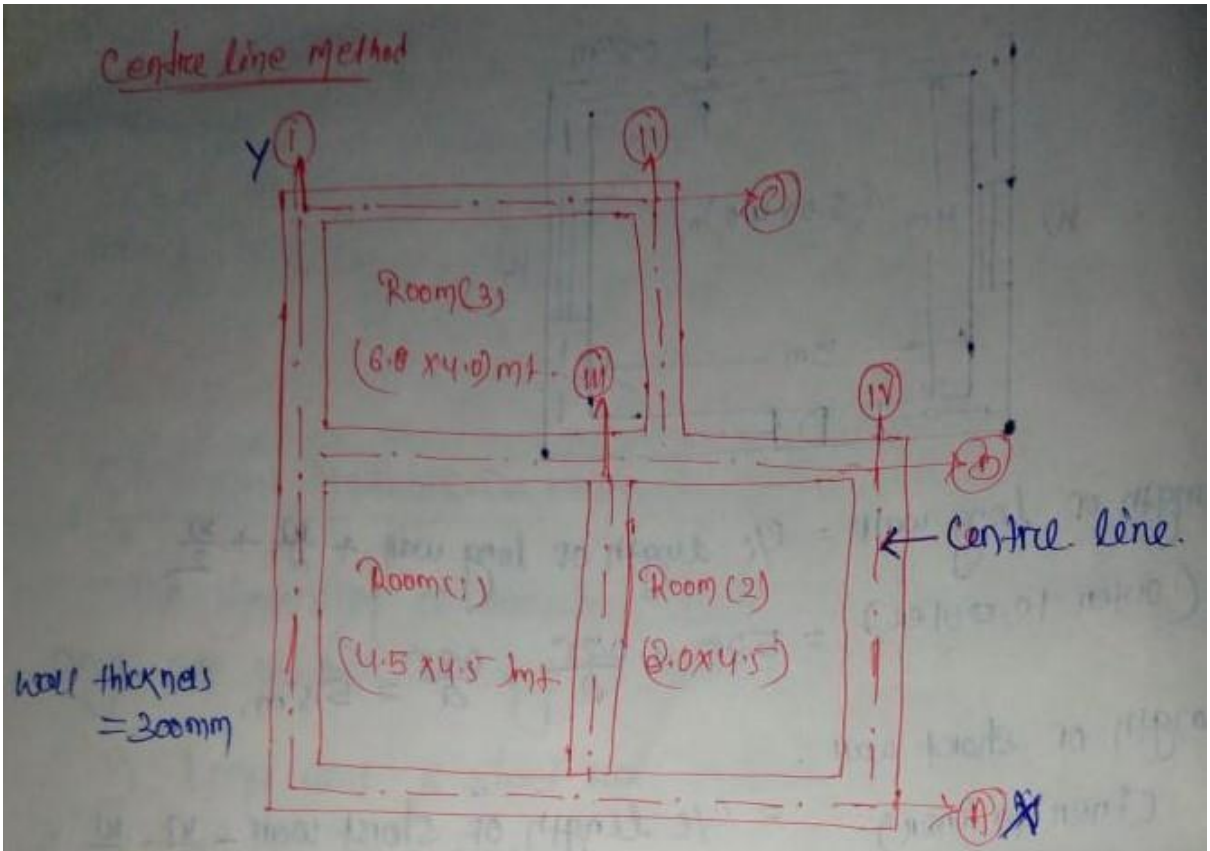
CENTER LINE METHOD:

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

Partly centre line and partly cross wall method:

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

Centre line method



Totatal Centre line

(A) $= \frac{0.3}{2} + 4.5 + 0.3 + 3.0 + \frac{0.3}{2} = 8.1$ m

(B) $= \frac{0.3}{2} + 4.5 + 0.3 + 3.0 + \frac{0.3}{2} = 8.1$ m.

(C) $= \frac{0.3}{2} + 6.0 + \frac{0.3}{2} = 6.3$

(I) $= \frac{0.3}{2} + 4.5 + 0.3 + 4.0 + \frac{0.3}{2} = 9.1$ m.

(II) $= \frac{0.3}{2} + 4.5 + \frac{0.3}{2} = 4.8$ m.

(III) $= \frac{0.3}{2} + 4.0 + \frac{0.3}{2} = 4.8$ m.

(IV) $= \frac{0.3}{2} + 4.5 + \frac{0.3}{2} = 4.8$ m

Total $= 45.5$ m.

Rules for Deduction of plastering:

1. No deduction shall be made for openings less than 0.5 sq m in area, and no addition shall be made reveals, jambs, soffits, sills, etc. of these openings.
2. No deduction shall be made for ends of joists, steps, etc. not exceeding 0.5 sq m in area.
3. For openings exceeding 0.5 sq m but not exceeding 3 sq m and when both faces are plastered with same type of plaster each deduction shall be made for one face only, and the other face shall be allowed for jambs, soffits and sills which shall not be measured.
4. For openings exceeding 0.5 sq m but not exceeding 3 sq m and when two faces are plastered with different type of plaster or with one side plaster and other side pointed, deduction shall be made on one side of chaukhat (frame)of door an window on which the width of jambs and reveals is less than the other side, and no deduction shall be made for other side.
5. In case of openings of area above 3 sq m, each deduction shall be made for both faces of openings, and the jambs and sills shall be measured and added. In taking measurement of jamb, soffits, and sills, chaukhat (if any) shall not be deducted.

Rules for deductions to be made for openings in brick wall are as follows:

- No deductions are to be made for openings up to 0.1 square metre areas, ends of beams, rafter, purlins, etc., up to 0.05 square metre in areas and wall plate, bed plates, etc., up to 100 mm depth.
- Full deductions are to be made for the rectangular openings by multiplying the length of the opening by its width and the thickness of the wall.
- The brick work in arches is to be measured separately.
- For lintels over openings, the length of the lintel is found out by adding twice the thickness for bearing to the clear span.

Thus, the quantity of deduction to be made shall be equal to:

$(l + 2t) \times$ (Thickness of lintel) x (Wall thickness) where t =

Thickness of lintel and l = Length of the opening.

It may be noted that lintels also from separate item to be measured in cubic metres. the quantity being equal to = $(l + 2t) \times t \times$ Wall thickness

Brick work in columns and pillars shall be described fully and shall be measured separately in cubic metres.

Circular brick work above 6 m radius shall be measured in the general item of brick work in cubic metres.

Brick work in staircase, arches, etc. shall be measured separately in cubic metres.

Opening Deductions in Plastering as per IS 1200:

1) There is no deduction shall be made for opening area is less than 0.5 Sqm.
2) For opening sizes in between 0.5 Sqm to 3.0 Sqm, deduction shall be made on one side of the plastered wall.
3) For above 3.0 Sqm opening sizes, deductions shall be made on both side of the wall but the areas of sill, jambs, and soffits to be taken into count.

Practical cases
1) One of the wall surfaces is plastered and other one with pointing or different mix, deduction shall be made on which side revel is lesser but no deduction shall be made on other side. If reveal is equal, 50% deduction shall be made on each side of the wall.
2) Plastering is done in one face of the wall and other is not, if width of reveals is less in plastered side, then full deduction shall be made. If it is equal or more, there is no deduction shall be made

Deductions in Masonry Construction Estimate:

Masonry Estimate deduction is compulsory in many cases while the estimate is carried out. There are openings in masonry walls, bearing, doors, windows, segmental arch openings, and semi-circular arch openings. The deduction can be conduct properly in a suitable mathematical rule that needs to be applied.

Rectangular Opening

The quantity of deduction is equal to the opening height and its width, the thickness of the masonry wall.

Doors and Windows with Small Segmental Arch

The subtraction is made of the door and the window up to the horizontal line. The less amount of counting is similar to the rectangular opening.

Semi-Circular Arch Opening

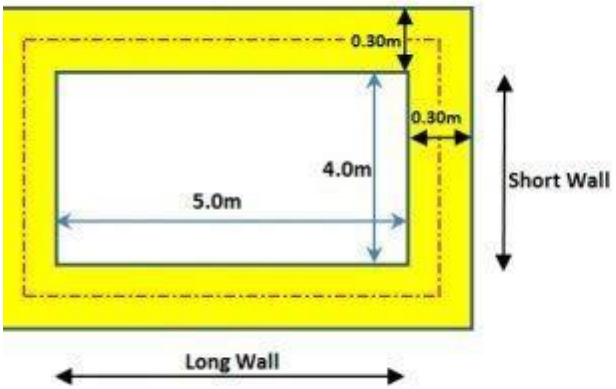
This is also known as Roman Arch the semi-circular arch forms a hand circle and it is a major feature of Roman architecture. The semi-circular arch is mainly seen in the bridges and aqueducts. In this arch, the centre lies exactly on the springing use

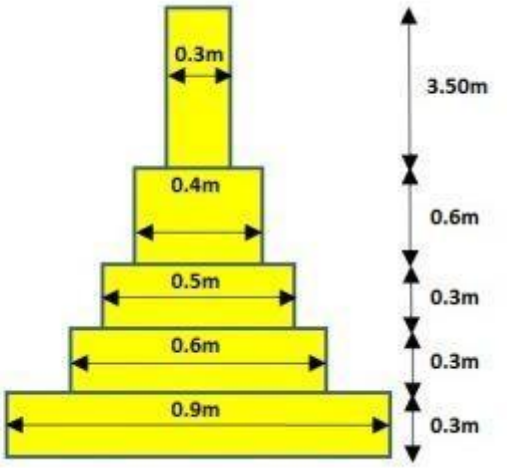
Lintels Over Openings

Lintels Over Opening is the item that needs to be deduced from the masonry construction estimate. The minimum bearing length should be 12 cm **Flat Arch**

The Flat arch acts as a base of the equilateral triangle which is form by the horizontal angle of 60 degrees by the springer

Long wall short wall method: -





Find the following items of work

1. Excavation in foundation
2. Concrete in foundation
3. Brick work in foundation & plinth
4. Brick work in super structure

Solution:

First find the length of long wall and short wall.

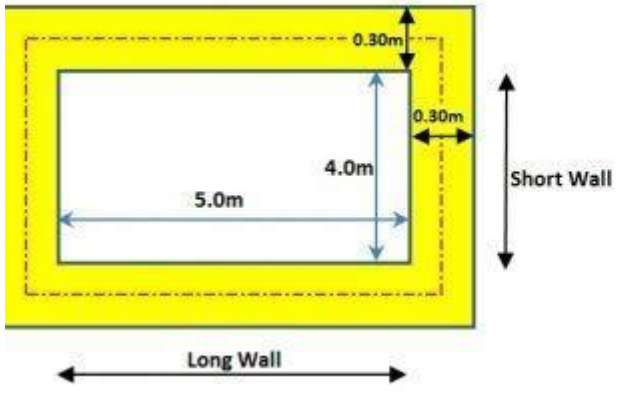
Centre to Centre length of long wall = 5+ (1/2×0.30) + (1/2 x 0.30) = **5.30 m**

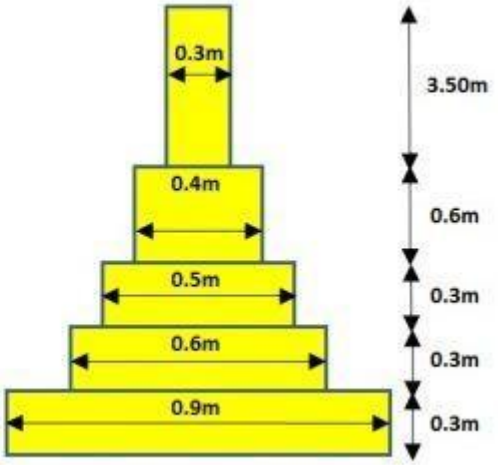
Centre to Centre length of short wall = 4+ (1/2 x 0.30) + (1/2×0.30) = **4.30 m**

After finding out the length of the long wall and short wall, now find the quantity of the various items which are used in construction

Details of Measurement and Calculation of Quantities							
Sr no.	Item Description	No	Length	Breadth	Height/Depth	Quantity	Note
01	**Excavation** in Foundation						
	Long walls	2	6.20 m	0.90 m	0.90 m	10.04	Length = 5.30 + 0.90 = 6.20 m
	Short walls	2	3.40 m	0.90 m	0.90 m	5.51	Breadth = 4.30 - 0.90 = 3.40 m
					Total	15.55 Cumt	
02	**Concrete** in Foundation						
	Long walls	2	6.20 m	0.90 m	0.30 m	3.35	Length = 5.30 + 0.90 = 6.20 m
	Short walls	2	3.40 m	0.90 m	0.30 m	1.84	Breadth = 4.30 - 0.90 = 3.40 m
					Total	5.18 Cumt	

Long wall short wall method:-

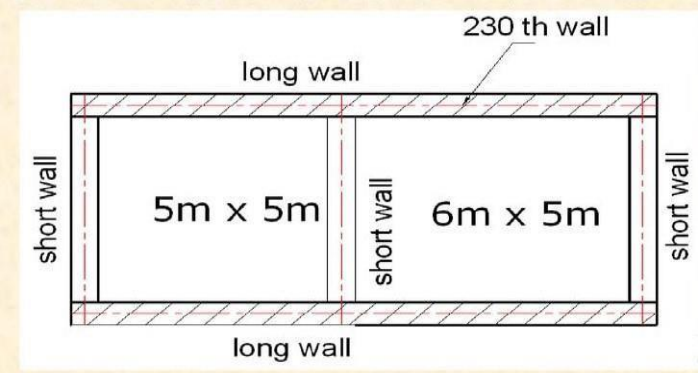




03	**Brickwork** in Foundation and Plinth						
	Long walls						
	1 st footing	2	5.90 m	0.60 m	0.30 m	2.12	Length = 5.30 + 0.60 = 5.90 m
	2 nd footing	2	5.80 m	0.50 m	0.30 m	1.74	Length = 5.30 + 0.50 = 5.80 m
	Plinth walls	2	5.70 m	0.40 m	0.60 m	2.74	Length = 5.30 + 0.40 = 5.70 m
	Short walls						
	1 st footing	2	3.70 m	0.60 m	0.30 m	1.33	Length = 4.30 - 0.60 = 3.70 m
	2 nd footing	2	3.80 m	0.50 m	0.30 m	1.14	Length = 4.30 - 0.50 = 3.80 m
	Plinth walls	2	3.90 m	0.40 m	0.60 m	1.87	Length = 4.30 - 0.40 = 3.90 m
					Total	10.94 Cumt	
04	**Brickwork** in Superstructure						
	Long walls	2	5.60 m	0.30 m	3.50 m	11.76	Length = 5.30 + 0.30 = 5.60 m
	Short walls	2	4.00 m	0.30 m	3.50 m	8.40	Length = 4.30 - 0.30 = 4.00 m
					Total	20.16 Cumt	

PROBABLE QUESTION:

1. Find ,
   - ❖ Length of long wall & short wall.
   - ❖ Length of center line



2. Differentiate between detailed estimate & abstract estimate.
3. What are the methods of estimate.
4. What is steel work?

TWO BED ROOM BUILDING

Generally Two Bed Room Building Consists of

- Two Bed Rooms (Masters bed and Children's bed)
- Kitchen
- Dining/Living halls
- Verandah
- Toilets

EXAMPLE

- Consider a Two Bed Room Building Shown in the Fig.

Workout Detailed Estimate

Steps to Calculate Quantities of various Items

- Understands the specifications
- Calculate quantities

GF PLAN

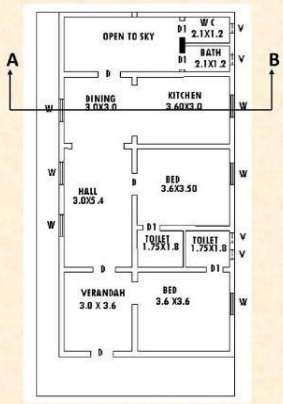
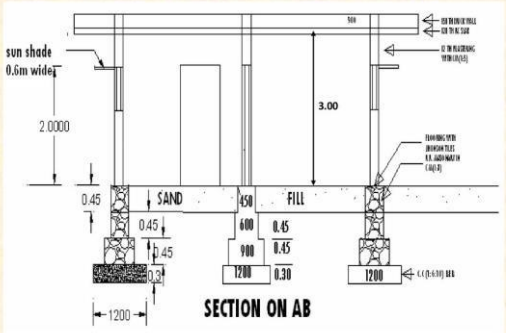


Fig 3

*All dimensions are in meters

13

CROSS SECTION OF BUILDING



SECTION ON AB

*All dimensions are in meters

Fig.4

C 605.1

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SPECIFICATION OF TWO ROOM BUILDING:

FOUNDATION DETAILS

- Depth of foundation below ground level = 1.20 m
- Width of foundation = 1.20 m
- Bed concrete CC (1:4:8) 300 mm thick
- Two stepped footings are provided with R.R Masonry cm (1:5)

  first footing width 0.90m depth 0.45m

  Second footing width 0.60m depth 0.45m

Note: No foundation is constructed below partition walls

BASEMENT DETAILS

- Basement is constructed with R R masonry in CM(1:5)
- Depth of basement = 0.45m
- Width of basement = 0.45 m

SUPERSTRUCTURE DETAILS

- Superstructure is constructed with Brick masonry in CM(1:5)
- Height of superstructure = 3.0 m
- Width of main wall = 230 mm

  width of partition walls = 100mm

  Width of Parapet wall = 150mm

LINTELS AND SUNSHADES

- LINTELS

  Discontinuous Lintels over openings

  150mm bearing on either side

  150 mm thick
- SUNSHADES

  600 mm width

  75 mm average thickness

ROOFING DETAILS

- R.C.C. M20 Grade (1:1 ½ :3)
- Slab thickness 120 mm
- Projection on left side = 1.0 m

  Projection on front side = 1.8 m

DOORS AND WINDOWS

- Fully Paneled teak wood doors windows, and ventilators

DISCRIPTION	SIZE IN (M)
DOOR (D)	1.00 X 2.00
DOOR (D1)	0.75 X 1.80
WINDOW (W)	1.00 X 1.20
VENTILATORS (V)	0.60 X 0.45

FLOORING DETAILS

- Flooring with Johnson's ceramic tiles laid over CM(1:3) and pointed with CM (1:3) over a bed of 100 mm thick cement concrete (1: 5: 10)

PLASTERING DETAILS

- Plastering with CM (1:5) of 12mm thick to all surfaces

WHITE WASHING AND COLOUR WASHING

- White washing with shell lime three coats for all exposed plastered surfaces and roof ceiling
- White washing with Birla white cement inside rooms
- Colour washing with good quality emulsion paint

PAINTING DETAILS

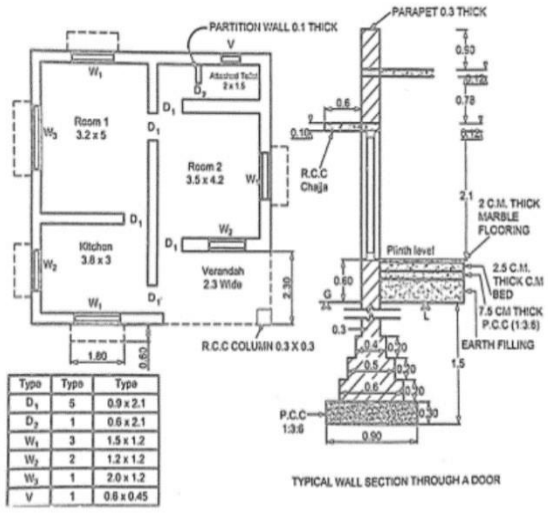
- Painting with ready mixed synthetic enamel paint first quality two coats over a primary coat on all wood work

Long wall short wall method: -

PROBLEM NO: 2

The plan and section of a residential building is shown in figure. Calculate the quantities and costs of the following items using Long wall short wall method;

1. Excavation in foundation
2. P.C.C. (1:3:6) in foundation
3. Brickwork in foundation
4. Brickwork in super-stricture
5. R.C.C. work in Slab, Weather shed and lintel beam (bearing 15cm)
6. 2 cm thick marble flooring
7. Earth filling in plinth



Type	Type	Type
D_1	5	0.9 x 2.1
D_2	1	0.6 x 2.1
W_1	3	1.5 x 1.2
W_2	2	1.2 x 1.2
W_3	1	2.0 x 1.2
V	1	0.6 x 0.45

SOLUTION:

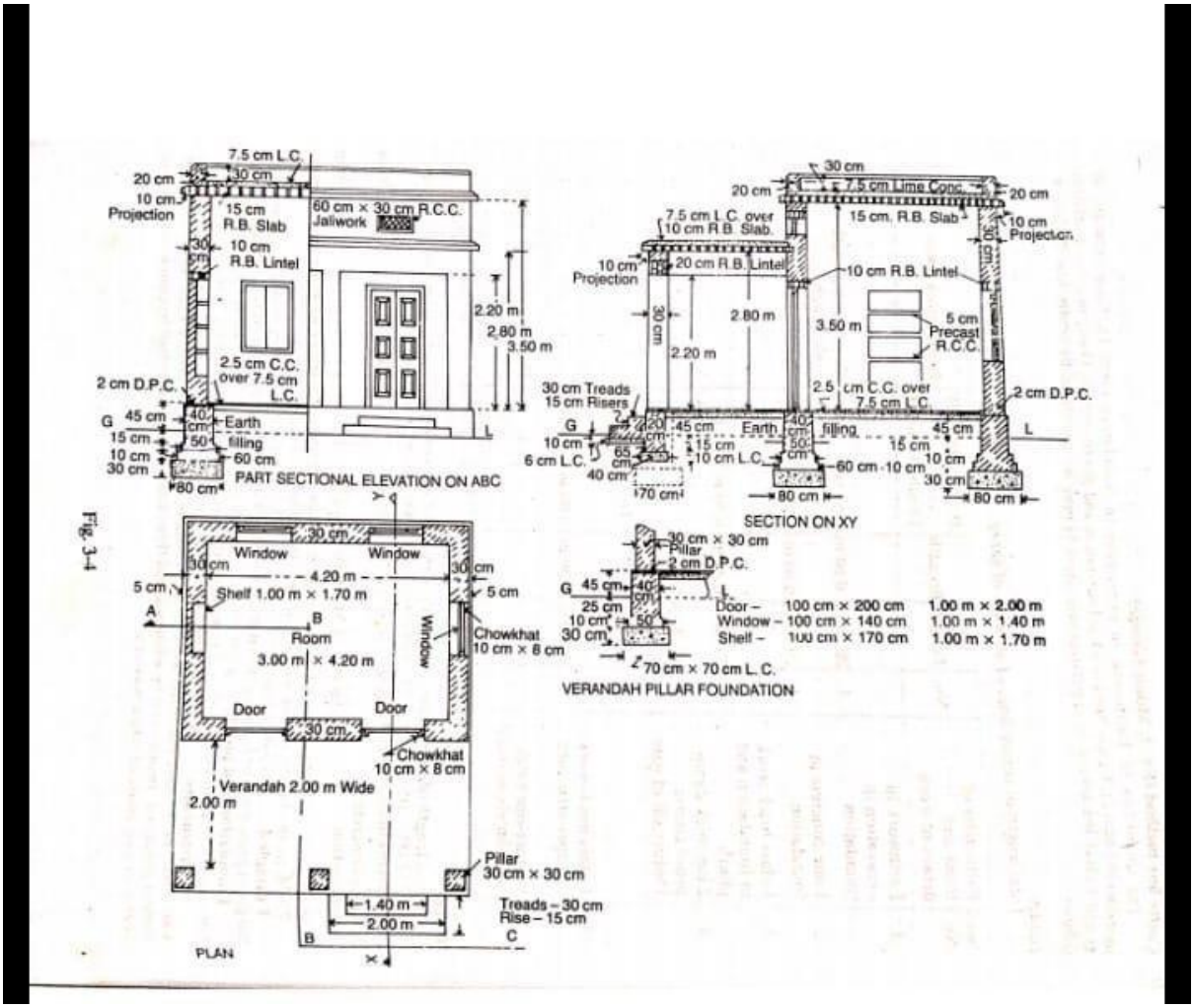
Measurement sheet						
Item No.	Description	No.	Length (m)	Width (m)	Height (m)	Quantity
01	**Excavation in Foundation**					
	Long wall :					
	L = [5 + 3 + 0.3 + 2 x 0.15]+ (2x0.45) = 9.5 m	3	9.5	0.9	1.5	38.48
	Short wall-1:					
	L = 3.8 + 2 x 0.15 – 2 x 0.45 = 3.2 m	3	3.2	0.9	1.5	12.96
	Short wall-2:					
	L = 3.5 + 2 x 0.15 – 2 x 0.45 = 2.9 m	4	2.9	0.9	1.5	15.66
						67.10 m^3
02	**P.C.C. (1:3:6) in foundation (M10)**					
	Long wall	3	9.5	0.9	0.30	7.70
	Short wall-1	3	3.2	0.9	0.30	2.60
	Short wall-2	4	2.9	0.9	0.30	3.13
						13.43 M^3
03	**Brick work in foundation up-to plinth level**					
	Long wall:					
	1st step: L = 9.5 – 2 x 0.15 = 9.2 m	3	9.2	0.6	0.2	3.31
	2nd step : L = 9.2 – 2 x 0.05 = 9.1 m	3	9.1	0.5	0.2	2.73
	3rd step : L = 9.1 – 2 x 0.05 = 9.0 m	3	9.0	0.4	0.2	2.16
	4th step : L = 9.0 – 2 x 0.05 = 8.9 m H = (1.5 – 0.3 – 3 x 0.2) + 0.6 = 1.2	3	8.9	0.3	1.2	9.61
	Short wall-1:					
	1st step: L = 3.2 + 2 x 0.15 = 3.5 m	3	3.5	0.6	0.2	1.26
	2nd step : L = 3.5 + 2 x 0.05 = 3.6 m	3	9.1	0.5	0.2	1.08
	3rd step : L = 3.6 + 2 x 0.05 = 3.7 m	3	9.0	0.4	0.2	0.89
	4th step : L = 3.7 + 2 x 0.05 = 3.8 m	3	8.9	0.3	1.2	4.10
	Short wall-2:					
	1st step: L = 2.9 + 2 x 0.15 = 3.2 m	4	3.2	0.6	0.2	1.54
	2nd step : L = 3.2 + 2 x 0.05 = 3.3 m	4	3.3	0.5	0.2	1.32
	3rd step : L = 3.3 + 2 x 0.05 = 3.4 m	4	3.4	0.4	0.2	1.09
	4th step : L = 3.4 + 2 x 0.05 = 3.5 m	4	3.5	0.3	1.2	5.04
	Total Quantity of brick work up-to plinth level =					**34.13 m^3**
04	**Brick work in super structure**					
	Up-to slab:					
	Long wall-1: L = 8.9 m	2	8.9	0.3	3	16.02
	Long wall-2: L = 8.9 – 2.30 = 6.6 m	1	6.6	0.3	3	5.94
	Short wall-1: L = 3.8 m	3	3.8	0.3	3	10.26
	Short wall-2: L = 3.5 m	3	3.5	0.3	3	9.45
	For Parapet wall:					
	Long wall	2	8.9	0.3	0.9	4.81
	Short wall	2	8.2	0.3	0.9	4.10
	Total quantity if brick work for super structure =					**50.58 m^3**

Measurement sheet

Item No.	Description	No.	Length (m)	Width (m)	Height (m)	Quantity
❖	**Deductions:**					
	For doors and windows					
	D_1	5	0.9	0.3	2.1	2.84
	W_1	3	1.5	0.3	1.2	1.62
	W_2	2	1.2	0.3	1.2	0.86
	W_3	1	2.0	0.3	1.2	0.72
	V	1	0.6	0.3	0.45	0.08
						- 6.12 m^3
	For Lintels					
	D_1	5	1.2	0.3	0.12	0.22
	W_1	3	1.8	0.3	0.12	0.19
	W_2	2	1.5	0.3	0.12	0.11
	W_3	1	2.3	0.3	0.12	0.08
	V	1	0.9	0.3	0.12	0.03
						- 0.63 m^3
						50.58
						- 6.12
						- 0.63
	Net Quantity of brickwork inn super-structure =					**43.83 m^3**
05	**RCC work in slab, weather shed and lintel**					
	R.C.C Slab :					
	L = 5 + 3 + 3 x 0.3 = 8.9 m	1	8.9	8.2	0.12	**8.76 m^3**
	B = 3.8 + 3.5 + 3 x 0.3 = 8.2 m					
	R.C.C. Weather shed					
	W1	3	1.8	0.6	0.10	0.324
	W2	1	1.5	0.6	0.10	0.09
	W3	1	2.3	0.6	0.10	0.14
						0.554 m^3
	R.C.C lintels (From quantity of deduction for lintels)					**0.630 m^3**
	Total quantity of R.C.C. work =					**9.944 m^3**
06	**2 cm thick marble flooring**					
	Room-1	1	3.8	5.0	-	19.0
	Room-2	1	3.5	4.2	-	14.70
	Kitchen	1	3.8	3.0	-	11.40
	Verandah	1	3.8	2.3	-	8.74
	Door sills (D_1)	5	0.9	0.3	-	1.35
					Total =	**55.19 m^2**
07	**Earth filling in plinth**					
	Room-1	1	3.8	5.0	0.48	9.12
	Room-2	1	3.5	4.2	0.48	7.06
	Kitchen	1	3.8	3.0	0.48	5.47
	Verandah	1	3.5	2.0	0.48	3.36
	Toilet	1	3.5	1.5	0.48	2.52
						27.53 m^3

Long wall short wall method: -

PROBLEM NO: 3



Solution—

Centre to centre length of walls —

Long wall c. to c. length = 4.20 + .30 = 4.50 m

Short wall c. to c. length = 3.00 + .30 = 3.30 m

Verandah front c. to c. length = 4.20 + .30 = 4.50 m

Verandah side c. to c. length = 2.00 + .30 = 2.30 m

DETAILS OF MEASUREMENT AND CALCULATION OF QUANTITIES (SINGLE ROOM BUILDING EX. 4)

Item No.	Particulars and details of work	No.	Dimensions			Quantity or Content	Explanatory notes
			Length m	Breadth m	Height or Depth m		
1.	**Earthwork** in excavation in foundation—Room						
	Long walls ...	2	5.30	.80	.65	5.51	L = 4.50 + .80 = 5.30 m
	Short walls ...	2	2.50	.80	.65	2.60	L = 3.30 – .80 = 2.50 m
	Verandah —						
	Pillars ...	3	.70	.70	.65	0.96	
	Plinth dwarf wall front (sum total length) ...	1	3.10	.40	.25	0.31	L=4.50 – 2 × .70 = 3.10 m
	Plinth dwarf wall sides ...	2	1.55	.40	.25	0.31	L=2.30 – $\frac{.80}{2}$ – $\frac{.70}{2}$=1.55 m
	Step ...	1	2.10	.65	.10	0.14	
					Total	9.83 cu m	
2.	**Earthwork** in filling in Plinth—						
	Room ...	1	4.10	2.90	.375	4.46	
	Verandah ...	1	4.50	2.10	.375	3.54	L = 4.90 – .40 = 4.50 m B=2.35 – .20 – .05=2.10 m
					Total	8.00	
	Deduct —						
	Projection central pillar ...	1	.40	.20	.375	0.03	These deductions may be neglected being small.
	Projection side pillar ...	2	.20	.20	.375	0.03	
					Total	0.06	
				Net	Total	7.94 cu m	

Item No.	Particulars of Items and details of work	No.	Dimensions			Quantity or Content	Explanatory notes
			Length m	Breadth m	Height or Depth m		
3.	**Lime concrete** in foundation—						
	Room —						
	Long walls ...	2	5.30	.80	.30	2.54	
	Short walls ...	2	2.50	.80	.30	1.20	
	Verandah Pillars ...	3	.70	.70	.30	0.44	
	Dwarf wall front (sum total length) ...	1	3.70	.40	.10	0.15	L=4.50 – 2 × .40 = 3.70 m
	Dwarf wall sides ...	2	1.85	.40	.10	0.15	L=2.30 – $\frac{.50}{2}$ – $\frac{.40}{2}$ = 1.85
	Step ...	1	2.10	.65	.06	0.08	
					Total	4.56 cu m	
4.	**First class Brickwork in Foundation and Plinth in** lime mortar—						
	Room—						
	Long walls —						
	1st footing ...	2	5.10	.60	.10	0.61	L = 4.50 + .60 = 5.10 m
	2nd footing ...	2	5.00	.50	.10	0.50	L = 4.50 + .50 = 5.00 m
	Plinth wall above footing ...	2	4.90	.40	.60	2.35	L = 4.50 + .40 = 4.90 m
	Short walls —						
	1st footing ...	2	2.70	.60	.10	0.32	L = 3.30 – .60 = 2.70 m
	2nd footing ...	2	2.80	.50	.10	0.28	L = 3.30 – .50 = 2.80 m
	Plinth wall ...	2	2.90	.40	.60	1.39	L = 3.30 – .40 = 2.90 m
	Verandah —						
	Pillars footing ...	3	.50	.50	.10	0.075	
	Pillars Plinth	3	.40	.40	.70	0.336	
	Dwarf wall front (sum total length) ...	1	3.70	.20	.60	0.44	L=4.50 – 2 × .40 = 3.70 m
	Dwarf wall sides ...	2	1.90	.20	.60	0.46	L = 2.30 – .40 = 1.90 m
					C.O.	6.76	

Item No.	Particulars of Items and details of work	No.	Dimensions			Quantity or Content	Explanatory notes
			Length m	Breadth m	Height or Depth m		
					B.F.	6.76	
	Step —						
	1st step ...	1	2.00	.60	.19	0.23	
	2nd step ...	1	1.40	.30	.15	0.06	
					Total	7.05 cu m	
5	**2 cm D. P. C.** of 1:2 cement mortar with water-proofing materials—						
	Long walls ...	2	4.90	.40	—	3.92	Length, breadth same as plinth wall.
	Short walls ...	2	2.90	.40	—	2.32	
	Verandah —						
	Pillars ...	3	.40	.40	—	0.48	
						6.72	
	Deduct door sills ...	2	1.00	.40	—	0.80	
					Total	5.92 sq m	
6.	**I-class Brickwork in superstructure** in lime mortar—						
	Room—						
	Long walls ...	2	4.80	.30	3.50	10.08	L = 4.50 + .30 = 4.80 m
	Short walls ...	2	3.00	.30	3.50	6.30	L = 3.30 – .30 = 3.00 m
	Verandah —						
	Pillars ...	3	.30	.30	2.20	0.59	
	Front above lintel ...	1	4.80	.30	.40	0.57	
	Sides above lintel ...	2	2.00	.30	.40	0.48	
	Parapet long walls ...	2	4.80	.20	.375	0.72	
	Parapet short walls ...	2	3.20	.20	.375	0.48	
					Total	19.22	
	Deduct —						
	Door openings ...	2	1.00	.30	2.00	1.20	
	Window openings ...	3	1.00	.30	1.40	1.26	
	Shelf ...	1	1.00	.20	1.70	0.34	
	Ventilators ...	2	.60	.30	.30	0.11	

Item No.	Particulars of Items and details of work	No.	Dimensions			Quantity or Content	Explanatory notes
			Length m	Breadth m	Height or Depth m		
	Lintel over doors ...	2	1.20	.30	.10	0.07 (a)	10 cm bearing.
	Lintel over windows ...	3	1.20	.30	.10	0.11 (a)	
	Lintel over shelves ..	1	1.20	.30	.10	0.04 (a)	Total of (a) s = 0.24 cu m
	Lintel over ventilator ...	1	.80	.30	.10	0.02 (a)	

Total of deduction 3.15

Net total = 16.07cum

Long wall short wall method:-

PROBLEM NO:4

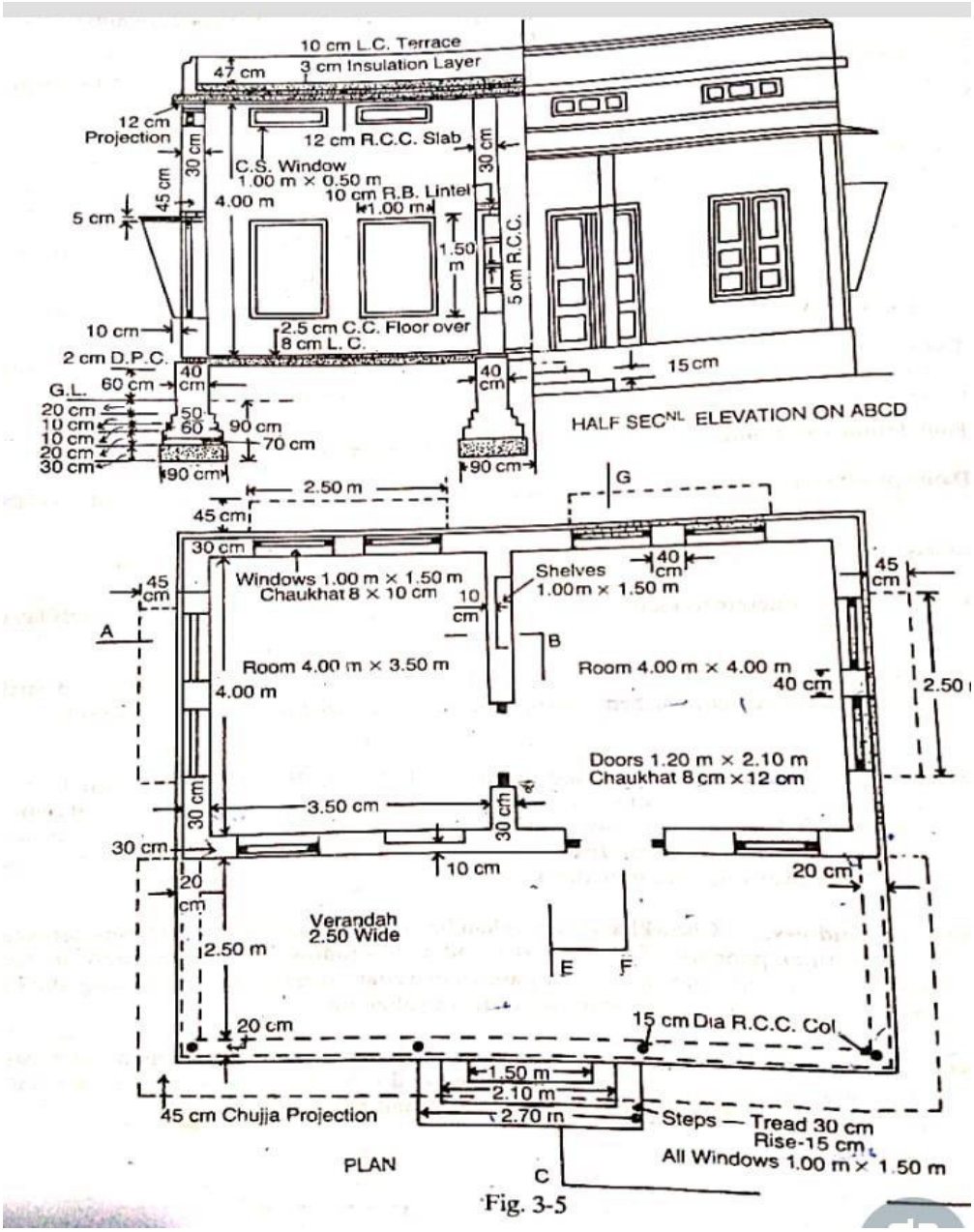
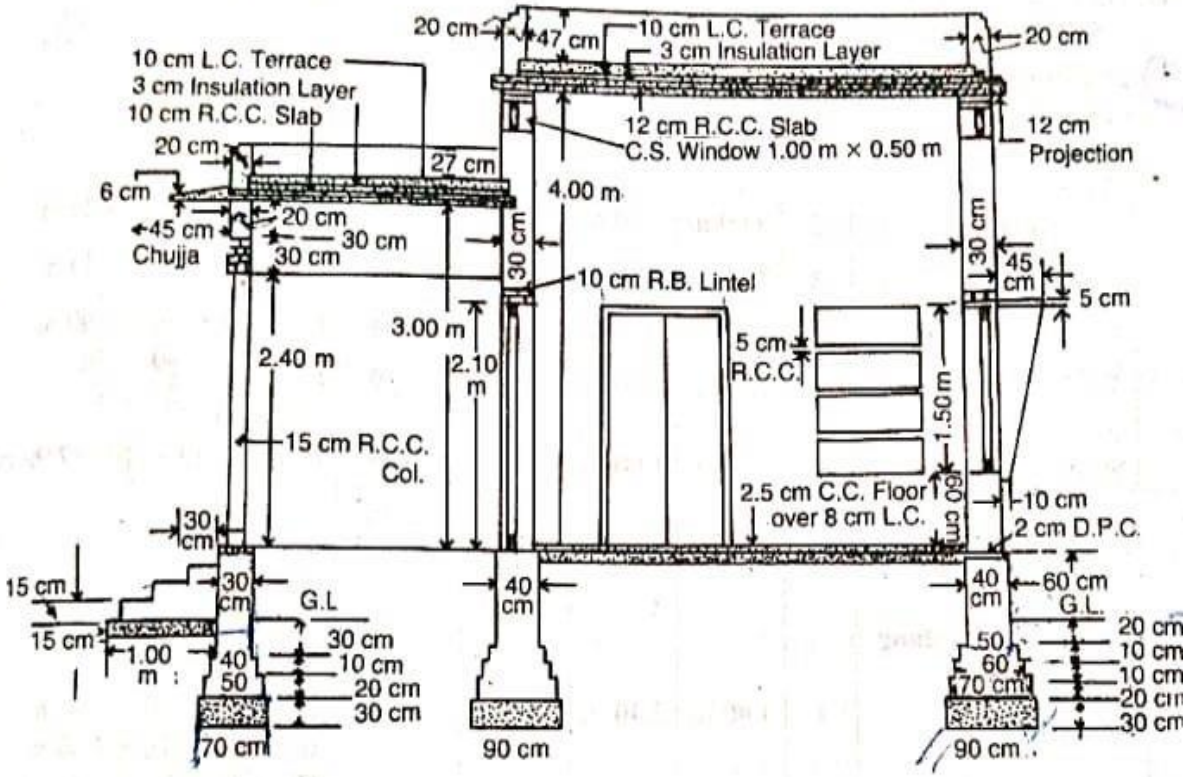


Fig. 3-5

CROSS-SECTION OF TWO-ROOMED BUILDING



SECNL ELEVATION ON CEFG

Fig. 3-6

Note — *Foundation of verandah is continuous of same section.*

Centre to centre lengths —

Room Long walls -- $3.50 + 4.00 + .30 + (2 \times \frac{.30}{2}) = \mathbf{8.10\ m}$ *combined total length.*

Room Short walls— $4.00 + (2 \times \frac{.30}{2}) = \mathbf{4.30\ m}$

Verandah Front—Extreme outer length at plinth—$(2 \times \frac{.30}{2})$

$= \{ 3.50 + 4.00 + (3 \times .30) + (2 \times .05) \} - .30 = \mathbf{8.20\ m}$

Verandah Sides— $2.50 + \frac{.30}{2} + \frac{.20}{2} = \mathbf{2.75\ m}$

DETAILS OF MEASUREMENT AND CALCULATION OF QUANTITIES (Ex. 5)

Item No.	Particulars of items and details of works	No.	Length	Breadth	Height or Depth	Quantity	Explanatory note
1.	**Earthwork in excavation** in foundation—						
	Rooms						
	Long walls ...	2	9.00 m	.90 m	.90 m	14.58	L = 8.10 + .90 = 9.00 m
	Short walls ...	3	3.40 m	.90 m	.90 m	8.26	L = 4.30 – .90 = 3.40 m
	Verandah front ...	1	8.90 m	.70 m	.90 m	5.61	L = 8.20 + .70 = 8.90 m
	Verandah sides ...	2	1.95 m	.70 m	.90 m	2.46	$L = 2.75 - \frac{.90}{2} - \frac{.70}{2}$ = 1.95 m
	Step ...	1	2.90 m	1.00 m	.15 m	0.44	L=2.70 + (2 × .10) =2.90 m
					Total	31.35 cu m	
2.	**Earthwork in filling** in plinth—						
	Room (i) ...	1	3.90 m	3.40 m	.54 m	7.16	L = 4.00 – .10 = 3.90 m B = 3.50 – .10 = 3.40 m Ht. = 60 + 2 – 8 = 54 cm = .54 m
	Room (ii) ...	1	3.90 m	3.90 m	.54 m	8.22	L = 8.20 – .30 = 7.90 m
	Verandah ...	1	7.90 m	2.40 m	.54 m	10.23	$B = 2.75 - \frac{.40}{2} - \frac{.30}{2}$ = 2.40m
					Total	25.61 cu m	
3.	**Lime concrete in** foundation						
	Rooms —						
	Long walls ...	2	9.00 m	.90 m	.30 m	4.86	May be taken 1/3 of excavation.
	Short walls ...	3	3.40 m	.90 m	.30 m	2.75	
	Verandah front ...	1	8.90 m	.70 m	.30 m	1.87	
	Verandah sides ...	2	1.95 m	.70 m	.30 m	0.82	
	Step ...	1	2.90 m	1.00 m	.15 m	0.44	
					Total	10.74 cu m	

Item No.	Particulars of items and details of works	No.	Length	Breadth	Height or Depth	Quantity	Explanatory note
4.	**I-class Brick-work in Foundation and Plinth** in 1 : 6 cement mortar—						
	ROOMS —						
	Long walls —						
	1st footing ...	2	8.80 m	.70 m	.20 m	2.46	L = 8.10 + .70 = 8.80 m
	2nd footing ...	2	8.70 m	.60 m	.10 m	1.04	L = 8.80 – .10 = 8.70 m
	3rd footing ...	2	8.60 m	.50 m	.10 m	0.86	L = 8.70 – .10 = 8.60 m
	Plinth wall ...	2	8.50 m	.40 m	.80 m	5.44	L = 8.60 – .10 = 8.50 m
	Short walls —						
	1st footing ...	3	3.60 m	.70 m	.20 m	1.51	L = 4.30 – .70 = 3.60 m
	2nd footing ...	3	3.70 m	.60 m	.10 m	0.67	L = 3.60 + .10 = 3.70 m
	3rd footing ...	3	3.80 m	.50 m	.10 m	0.57	L = 3.70 + .10 = 3.80 m
	Plinth wall ...	3	3.90 m	.40 m	.80 m	3.74	L = 3.80 + .10 = 3.90 m
	VERANDAH—						
	Front wall (long)—						
	1st footing ...	1	8.70 m	.50 m	.20 m	0.87	L = 8.20 + .50 = 8.70 m
	2nd footing ...	1	8.60 m	.40 m	.10 m	0.34	L = 8.70 – .10 = 8.60 m
	Plinth wall ...	1	8.50 m	.30 m	.90 m	2.30	L = 8.60 – .10 = 8.50 m
	Side wall (short) —						
	1st footing ...	2	2.15 m	.50 m	.20 m	0.43	$L=2.75-\frac{.50}{2}-\frac{.70}{2}=2.15m$
	2nd footing ...	2	2.25 m	.40 m	.10 m	0.18	$L=2.75-\frac{.40}{2}-\frac{.60}{2}=2.25m$
					C.O.	20.41	

Item No.	Particulars of items and details of works	No.	Length	Breadth	Height or Depth	Quantity	Explanatory note
					B.F.	20.41	
	Plinth wall 10 cm above footing ...	2	2.35 m	.30 m	0.10 m	0.14	L=2.75 − $\frac{.50}{2}$ − $\frac{.30}{2}$ =2.35m
	Plinth wall remaining portion ...	2	2.40 m	.30 m	.80 m	1.15	L=2.75 $\frac{.40}{2}$ − $\frac{.30}{2}$ =2.40 m
	Steps —						
	1st step ...	1	2.70 m	.90 m	.15 m	0.36	
	2nd step ...	1	2.10 m	.60 m	.15 m	0.19	
	3rd step ...	1	1.50 m	.30 m	.15 m	0.07	
					Total	22.32 cu m	
5	**2 cm Damp proof course**						
	Rooms —						
	Long walls ...	2	8.50 m	.40 m	—	6.80	Length, breadth same as for plinth wall.
	Short walls ...	3	3.90 m	.40 m	—	4.68	
					Total	11.48	
	Deduct door sills ...	2	1.20 m	.40 m	—	0.96	
					Net Total	10.52 sq m	
6	**I-class Brick-work in superstructure** in lime mortar—						
	Rooms —						
	Long walls ...	2	8.40 m	.30 m	4.00 m	20.16	Length — Out to out.
	Short walls ...	3	4.00 m	.30 m	4.00 m	14.40	Length — In to in.
	Ver. above lintels (over pillars)—						
	Front (long) ...	1	8.40 m	.20 m	.30 m	0.50	
	Sides (short) ...	2	2.50 m	.20 m	.30 m	0.30	
	Parapet —						
	Over Rooms —						
	Long walls ...	2	8.40 m	.20 m	.60 m	2.02	Ht. = 47 + 10 + 3 = 60 cm = .60 m
	Short walls ...	2	4.20 m	.20 m	.60 m	1.01	L=4.00 + (2 × .30) − (2 × .20) = 4.20 m
					C.O.	38.39	

Item No.	Particulars of items and details of works	No.	Length	Breadth	Height or Depth	Quantity	Explanatory notes
					B.F.	38.39	
	Verandah —						
	Front (long) ...	1	8.40 m	.20 m	.40 m	0.67	Ht. = 27 + 10 + 3 = 40 cm = 40 cm
	Side (short) ...	2	2.50 m	.20 m	.40 m	0.40	
					Total	39.46 cu m	
	Deduct—						
	Door openings ...	2	1.20 m	.30 m	2.10 m	1.51	
	Window openings	10	1.00 m	.30 m	1.50 m	4.50	
	C.S. Window ,, ...	12	1.00 m	.30 m	0.50 m	1.80	
	Shelves ,, ...	2	1.00 m	.20 m	1.50 m	0.60	Back of shelf 10 cm
	R.B. lintels over—						
	Doors ...	2	1.40 m	.30 m	.10 m	0.084 (a)	10 cm bearing.
	Windows ...	10	1.20 m	.30 m	.10 m	0.360 (a)	
	C.S.Windows ...	12	1.20 m	.30 m	.10 m	0.432 (a)	Total of (a) s = 0.948 cu m
	Shelves ...	2	1.20 m	.30 m	.10 m	0.072 (a)	
					Total	9.36	
				Net	Total	30.10 cu m	

VALUATION

11.1. Definition

Valuation is the technique of determination of fair price of a property such as land, building, factory or other structures. Valuation determines present value of the property for sale or renting purpose.

11.1.1 Difference between Cost, Price and Value

- Cost means the original cost of construction minus the loss due to its age and change in taste or fashion.
- Price is the amount calculated adding the cost of the production, interest on investment and profit to the producer or the owner.
- Value is the worth or utility of a property. Value of a property depends largely on the demand and supply.

For example the cost to draw a painting may be 1,000/- rupees, but by adding profit for the painter the price may be fixed at 1,500/- rupees. Let us consider the painting is a very famous painting whose demand is more (like Monalisa by Leonardo da Vinci) then the value of the painting may be significantly high.

11.2. Purpose of the Valuation

The main purposes of valuation are as follows:

- Sale or Purchase of a property
- To fix up the municipal taxes, wealth tax and estate duty on a property
- To fix up the gift tax payable to the govt when the property is gifted to somebody else.
- To probate, i.e. to prove before a court that the written paper purporting to be the will of a person who has died is indeed his lawful act the official copy of a will is to be presented along with court stamp fees. The stamp fee depends on the value of a property and for this valuation is necessary.
- To divide the property among the shareholders in case of the partition.
- Assessment of income or stamp duty.

- To pay the capital gains tax when a capital asset is disposed of and the proceeds exceed the costs incurred in acquiring the asset.
- Rent Fixation
- To work out the insurance value of a property
- To determine the quantum of loan that can be sanctioned against a property as mortgage or security
- For compulsory acquisition of the property by govt. for public purpose.
- To determine the speculative value of a property, *i.e.* the purchase of a property with intention to sale at a later date and to make some profit.
- To fix up the betterment charges, *i.e.* construction of new road, providing market complex, community hall etc. so that the value of the property will increase.

11.3. Terminology

11.3.1. Incomes:

a) **Gross income**: Total income from all sources.

b) **Outgoings**: these are the expenses which are required to be incurred to maintain the property. These includes: Taxes, periodic repairs, management and collection charges, sinking fund, and loss of rent (for the period when the property is not occupied).

c) **Net income**: The amount left after deducting all outgoings from the gross income.

d) Net income = gross income- outgoings.

e) **Perpetual income**: It is the income receivable for indefinite period of time.

f) **Deferred Income**: it is the income receivable after a lapse of certain period.

11.3.2. Scrap value

If a building is to be dismantled after the period its utility is over, some amount can be fetched from the sale of old materials. The amount is known as scrap value of a building. Scrap value varies from 7% to 10% of the cost of construction according to the availability of the material.

11.3.3. Salvage value

If a property after being discarded at the end of the utility period is sold without being into pieces, the amount thus realized by sale is known as its salvage

Scrap value	Salvage value
This is the dismantled sale value of the materials of an asset at the end of its useful life.	This is the estimated value of an asset as a whole without dismantling at the end of its useful life.
Scrap value is counted in the calculation of depreciation of a property at the end of the useful life and usually this is considered 10% of the cost of the structure or on lump sum basis.	Ordinarily the salvage value factor in the calculation is omitted by accounting scrap value
Scrap value of an asset is merely sale of scarp and has a limitation.	Salvage value deposition may take the form of a sale of the asset to a purchaser who will continue to use it for the function for which it was originally designed. In this case salvage value dominate scrap value in the calculation of depreciation
Scarp value is not counted as a minus quantity.	There are time when it may be a minus quantity

11.3.4. Year's purchase

It may be as the figure which when multiplied by the net income from a property gives capitalized value of the property. It can also be defined as "a certain amount of capital whose annuity of Rs.1/- at a certain rate of interest can be received"

Year's purchase = 100/rate of interest = 1/i

11.3.5. Capitalized value

It is defined as that amount of money whose annual interest at the highest prevailing rate will be equal to the net income received from the property. To calculate the capitalized value, it is necessary to know highest prevailing on such properties and income from the property.

11.3.6. Obsolescence

The value of property decreases if its style and design are outdated *i.e* rooms not properly set, thick walls, poor ventilation etc. The reason of this is fast changing techniques of construction, design, ideas leading to more comfort etc.

11.3.7. 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.

11.3.8. Book value

Book value is the amount shown in the account book after allowing necessary depreciations. The book value of a property at a particularly year is the original cost minus the amount of depreciation up to the previous year.

Market Value	Book Value
Value is fixed by the purchaser	Value is fixed by the depreciation
Value is higher during the subsequent years due to increase in price index	Book value cannot be higher during subsequent years even due to the increase of price index.
Value may be constant for a period	Value cannot be constant, rather there is a gradual fall
Applicable to any type of property	This cannot be applicable in case of land or metal articles like steel copper or gold etc.
Market value is considered for the valuation	Book value is considered for the accounts book of a company
Depends on the forces of demand and supply	Book value does not vary due to demand and supply

Assignment:

1. **Differentiate between book value & market value.**
2. **What is obsolescence?**
3. **Differentiate between scrap value & salvage value.**
4. **What is valuation and write the purpose of valuation.**

11.3.10. Sinking fund

It is an amount which has to set aside at fixed intervals of time (say annually) out of the gross income so that at the end of the useful life of the building or the property, the fund accumulated should be equal to the initial cost of the property. The sinking fund may also be required for payment of the loans.

Sinking fund, $I = \frac{Si}{(1+i)^n - 1}$, Where, S = Total amount of sinking fund to be accumulated, n = useful life of the property or nos. of years required to accumulate the sinking fund, i= rate of interest in decimals and I = is the annual instalments paid.

Example:

A pumping set with motor has been installed in a building at a cost of 2500.00. Assuming the life of the pump as 15 years, find the annual installment of sinking fund required to be deposited to accumulate the whole amount of 4% compound interest.

Ans:

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

$$= I = 2500 x \frac{0.04}{(1+0.04)^{15} - 1}$$

$$= 2500 * 0.05 = \text{Rs. } 125.00 \qquad \text{(Ans.)}$$

11.4. Factors Affecting Value of a Building

- Type of the building
- Location
- Building structure and durability
- The quality of materials used in the construction
- Size of the building

11.5. Depreciation

It is the loss in value of a building or property due to structural deterioration, wear and tear, decay and obsolescence. It depends on use, age, nature of maintenance etc. A certain percentage (per annum) of the total cost may be allowed as depreciation to determine its present value.

The percentage rate of depreciation is less at the beginning and increases with age. Annual depreciation is the annual decrease in the value of the property.

11.6. Comparison Between Depreciation and Obsolescence

Depreciation	Obsolescence
This is the physical loss I the value of the property due to wear & tear, decay etc.	This is the loss in the value of the property due to the change in design, fashion, in structure of the other, change of utility and demand.
Depreciation depends on its original condition, quality of maintenance and mode of use.	Obsolesce depends on normal progress in the arts, inadequacy to present or growing needs etc.
This is variable according to age of the property. More is the age, more will be the amount for depreciation	This is not dependent on age of the building. A new building may suffer in its usual rent due to obsolescence.
There are different methods by which the amount of depreciation can be calculated	At present there is no method of calculation of obsolescence

11.7. Calculation of Depreciation

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

- Straight line method
- Constant percentage method
- Sinking fund method
- Quantity survey method

11.8.1. Straight line method

It is assumed that the property loses its value by the same amount every year. A fixed amount is deducted every year, so that at the end of the utility period, only the scrap value remains. Therefore, the annual depreciation "D" is estimated as:

$$D = \frac{Original\ value - Scrap\ value}{Life\ in\ years} = \frac{C - S}{N}$$

And the book value after 'n' years = Original cost – n x D

11.8.2. Constant percentage method (declining balance method)

It is assumed that the property will lose its value by a constant percentage of its value at the beginning of every year.

Annual Depreciation, $D = 1 - \left(\frac{Scrap\ value}{\text{Original cost}}\right)^{1/n}$

Or, $D = 1 - \left(\frac{S}{C}\right)^{1/n}$

Value of property of depreciated cost = C – DC

11.8.3. Sinking fund method

It is assumed that the depreciation is equal to the annual sinking fund plus the interest on the fund for the 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, then the depreciation at the end of various years can be calculated as:

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)
			And so on……

11.8.4. Quantity survey method

The property is studied in detail and loss in value worked out. Each step is based on some logical reasoning without any fixed percentage of the cost of the property.

Only an experienced valuator can work out the amount of depreciation and the present value of the property using this method.

11.8. Determination of Depreciation of a building

After deciding the cost using the previous measures, it is necessary to allow a suitable depreciation on the cost. The following table provides a reasonable depreciation of a building whose life if 80 years and well maintained.

Age of the building	Depreciation per year	Total depreciation
0-5 years	Nil	Nil
5-10 years	@ 0.50%	2.5%
10-20 years	@ 0.75%	7.5%
20-40 years	@ 1.00%	20%
40-80 years	@ 1.50%	60%
Total depreciation after 80 years		**90%**

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

11.9. Methods of Valuation of Building.

The valuation of a building is determined by working out its cost of construction at the present day rate and allowing a suitable depreciation.

Following data are required for valuation of a building

- Cost of incurred if the building to be constructed in present day
- Age of the building should be determined
- Visual inspection of its present condition
- Future life span should be determined

Assignment:

1.what is sinking fund?

2.what is depreciation?

3.differentiate between depreciation & obsolesces.

6.1. Rate Analysis

The process of determining rate per unit of any work in Civil Engineering project like earthwork, concrete work, brickwork, plastering, painting etc. is known as Analysis of Rates or simply Rate Analysis. The rates of materials and labour vary from place to place and hence the rates of different items of works also vary from place to place. The rates of these works further help in determining cost of particular work and in turn cost of the project.

6.2. Necessity of Rate Analysis

- To determine the actual cost per unit of the items.
- To work out the economical use of materials and processes in completing the particulars item.
- To calculate the cost of extra items which are not provided in the contract bond, but are to be executed as per the directions of the department.
- To revise the schedule of rates due to increase in the cost of material and labour or due to change in technique.

6.3. Factors Deciding Rate of Items

The various factors that are involved in determining rate of any item, process or work are mentioned below:

- Specifications of works and material about their quality, proportion and constructional operation method.
- Quantity of materials and their costs.
- Cost of labour and their wages.
- Location of site of work and the distances from source and conveyance charges.
- Overhead and establishment charges
- Profit and miscellaneous expenses of the contractor

6.4. Procedure of Rate Analysis

The analysis of rates is worked out for the unit payment of the particular item of work under two heads: Materials and Labour.

- The cost of items of work = Material cost + Labour cost
- Other costs included to the above cost of items of work are:
  - Tools and Plants (T & P) = 2.5 to 3 % of the labour cost
  - Transportation cost (if conveyance more than 8 km is considered.)
  - Water charges = 1.5 to 2 % 0f total cost
  - Contractor's profit = 10 %

6.4.1 Material cost

The rate of various materials as per specifications for the items under consideration can be chalked out from market survey. The costs of materials are taken as delivered at site of work. This is inclusive of:

- The first cost (cost at origin),
- Cost of transport, railway freight (if any), etc.
- Local taxes and other charges.

a) Lead statement

The distance between the source of availability of material and construction site is known as "Lead" and is expressed in Km. The cost of conveyance of material depends on lead. This statement is required when a material is transported from a distant place, more than 8kms (5 miles). The lead statement will give the total cost of materials per unit item including first cost, conveyance loading-unloading, stacking charges etc.

A typical lead statement is provided as follows:

Sl. No.	Materials	Unit	Cost at Source (per unit)	Lead (in Km)	Conveyance charges (Per Km/ Per Unit)	Total Conveyance charges (/Per Unit)	Total Cost (In Rs. /Per unit)
1	Rough Stone	Cum	250.00	25	5.00	125.00	375.00
2	Sand	Cum	12.00	20	4.00	80.00	92.00
3	Cement	Bag	370.00	Local	-	-	-

6.4.2. Labour cost

To obtain labour cost the number and wages of different categories of labourers, skilled (Skilled 1st Class), semi-skilled (Skilled 2nd Class) and unskilled, required for each unit of work should be known and this number is multiplied by the respective wage per day. The labour charges can be obtained from the standard schedule of rates. 30% of the skilled labour provided in the data may be taken as 1st class, remaining 70% as 2nd class.

The length of time required to do a certain piece of the work may vary according to the skill and mental development of the workmen and working conditions to the particular job.

a) Task or out-turn work

This is the quantity of work which can be done by an artisan or skilled labour (with the help of semiskilled and unskilled labours) of the trade working for 8 hours a day. The out-turn of work per artisan varies according to the nature, size, height, situation, location etc. Out-turn is more in larger cities, as the more specialized and experienced labours are available, than the small cities and country sides.

Assignment

1. **What is estimation?**
2. **What is the size of modular brick & standard brick?**
3. **What is the unit of DPC, BRICK WORK, EARTH WORK ,STEEL, & LIME CONCRETE?**
4. **What are the requirements of building estimation?**
5. **What is the density of cement, steel and water?**
6. **What is rate analysis?**

Analysis of rate

OUT-TURN OR TASK

	Particulars of items	Quantity of work per day (8 hrs a day)
1.	Earthwork in excavation in foundation in ordinary soil, lead up to 50m and lift up to 1.5 m	3.00 cum per mazdoor/Beldar
2.	Earthwork in excavation in hard soil for 100m lead and 1.5 m lift.	2.00 cum per mazdoor/Beldar
3.	Excavation in rock	1.00 cum per mazdoor
4.	Sand filling in plinth	4.00 cum per mazdoor
5.	Breaking of brick ballast 40mm gauge	0.75 cum per labour/breaker
6.	Breaking of stone ballast 40mm gauge	0.40 cum per labour
7.	Breaking of stone ballast 20mm gauge	0.25 cum per labour
8.	Brickwork in cement mortar in foundation and plinth	1.25 cum per mason
9.	Brickwork in cement mortar in superstructure	1.00 cum per mason.
10.	Half brick wall in partition	5.00 square meter per mason
11.	Brick work in cement mortar in arches	0.55 cum per mason
12.	Lime concrete in foundation/ flour	8.50 cum per mason
13.	Lime concreting in roof terracing	6.00 cum per mason
14.	Cement concrete (1:2:4)	5.00 cum per mason
15.	R.C.C. work	3.00 cum per mason

16.	12 mm plastering with cement morter	8.00 square meter per mason
17.	Pointing with cement/line mortar	10.00 sq.m. per mason
18.	25 mm I.P.S. (cement concrete) floor	7.50 sqm per mason
19.	Terrazo floor 6 mm thick mosaic work over 20 mm cement concrete (1:2:4)	5.00 sq.m. per mason
20.	Brick flat floor in cement or lime mortar	8.00 sq. m per mason
21.	Timber framing sal or Teak wood	0.07 cum per carpenter
22.	Timber framing in country wood	0.15 cum per carpenter
23.	Door and window shutters panelled or glazed	0.15 sq.m. per carpenter
24.	White washing or colour washing one coat	200 sq.m. per white washer
25.	White washing or colour washing 3 coats	70 sq.m. per white washer
26.	Painting or varnishing doors or windows one coat	25 sq.m. per painter
27.	Distempering one coat	35 sq.m. per painter
28.	Amount of work done by a mazdoor (helper) per day.	
	i) Mix	3 cum per mazdoor
	ii) Delivery bricks	4000 to a distance of 15 m per mazdoor
	iii) Delivery mortar	5.5 cum of brick work

The recommendation of All India Standard Schedule of Rates and various other govt. reports are used to work out approximate quantity of labour required to prepare the analysis of rates. IS: 7272 (part 1)-1974, provides recommendations for labour output constants for building work which can be used to fix up the labour cost.

A typical labour output constant issued by **National Building Organization** is provided bellow:

LABOUR REQUIREMENTS

	Description of work	Quantity	Labour
1.	Earthwork in excavation in foundation, trenches etc. in ordinary soil including disposal up to 30 m and lift of 1.5 m	28.30 m^3 (1000 cft)	Beldar - 5 nos. Mazdoor-4 nos.
2.	Refilling of excavated earth in foundation, plinth etc. including consolidation in 150 mm layer.	28.30 m^3 (1000 cft)	Beldar-3 nos. Mazdoor-2 nos. Bhisti-0.5 nos.
3.	Laying cement concrete	2.83 m^3 (100 cft)	Beldar-2 nos. Mazdoor-3 nos. Bhisti-3/4 nos. Mason-1/4 nos.
4.	Laying of R.C.C. work	2.83 m^3 (100 cft)	Beldar-3 nos. Mazdoor-3 nos. Bhisti-1.5 nos. Mason-0.5 no.
5.	Reinforcement work for R.C.C.	1 quintal	Blacksmith-1 no. Beldar-1 no.
6.	First class Brickwork in 1:4 cement morter in superstructure	2.83 m^3 (100 cft)	Mason-2.25 nos. Mazdoor-4.5 nos. Bhisti-0.5 no.
7.	Wood work in door/window fromes	0.18 m^3	Carpenter-2 nos. Beldar-1 nos.
8.	Wood work in panelled, glazed shutters etc.	0.30 m^3	Carpenter-15 nos. Beldar-4 nos.
9.	40 mm cement concrete flooring	40 m^2	Mason-5 nos. Beldar-4 nos. Mazdoor-3 nos. Bhisti-1 no.
10.	12 mm cement mortar plastering	40 m^2	Mason-3 nos. Mazdoor-3 nos. Bhisti-1 no.
11.	Three coats white washing/colour washing	60 m^2	White washer-1 no. Mazdoor-1 nos.
12.	Two coats painting on wood or steel	10 m^2	Painter-3 nos. Mazdoor-2 nos.

6.4.3. Miscellaneous cost

a) Cost of equipment, Tools and Plants (T & P)

The cost of equipment and ordinary tools and plats and miscellaneous petty items (sundries) are added to the specific item rate as lump-sum. A provision of 2.5 to 3 % of the labour cost is made for such items. In certain tools and plants if it is difficult to allocate their use for a particular item of rate; then the cost of such tools or plants may be allocated to the over-head expenditure.

For big works and projects where it becomes necessary to use special types of equipment like batching plants or WMM plant or dumpers or cranes for transportation of concrete mix, provisions of an amount 1% to 1.5% of the estimated cost is provided in the estimate under the head "special tools and plants".

b) Water charges

For drinking purpose of the workers and for the work, arrangement of water is made sinking tube well; bore well or from temporary connection from municipality. For this purpose a provision of 1.5 to 2 % of total cost (Material + Labour+ Sundries) is made in the estimate.

c) Over head charges

Overhead charges include general office expanses, rents, taxes, supervision and other cost which are indirect expanses on the job. Expanses for small tools such as planks, ladders, ropes and other hand tools are also included in the over-head charges. A provision of 2.5% to 5% is made in the rate analysis as overhead charge. Overhead charges can be divided under two categories: General Overhead and job overhead.

General overhead:

These are the expanses made throughout the year irrespective to running works in hand. These include:

- Establishment charge including rent of office space and taxes
- Salaries to office staff
- Purchase of stationary, Printing, postage etc.
- Electricity, telephone and water bills
- Travelling expanses

Job overhead:

These are the expanses indirectly incurred for the job or the project. These include:

- Salaries of personnel engaged for the work (Site engineers, Surveyors or site office staff)
- Rent of temporary site office space, electricity, telephone and water bills
- Handling of materials
- Repairs, carriage and depreciation of T & P.
- Labour welfare, safety measures and insurance etc.
- Interest on investment
- Thept and other losses.

c) Contractor's profit

Generally a provision of 10% is made in the rate analysis as contractor's profit for ordinary contracts. For small jobs 15% profit and for large jobs 8% profit may be considered as reasonable. Contractors profit is not included in rate analysis if material is supplied by the department.

Assignment

1. **What is water charged & overhead charged?**
2. **What is general overhead & job overhead?**
3. **What is contractor profit?**

6.5. Rate Analysis of Important Items

6.5.1. Earthwork in excavation in foundation including filling in trenches up to 30m lead and 1.5 m lift

Assume volume of excavation = 100 cu m

Particulars	Qnty/Nos.	Rate (Rs.)	Cost (Rs.)
Material Charges	-	-	-
Labour Charges			
1. Head Mason	$^1/_2$ Nos.	450.00 per day	225.00
2. Beldar	18 Nos.	250.00 per day	4500.00
3. Mazdoor	14 Nos.	220.0 per day	3080.00
T&P, Sundries, etc.	LS	240.00 LS	240.00
		Total Materials and Labour	**8045.00**
		Add 1.5% water charges	120.67

Add 10% Contractors profit	804.50
Grand Total	**8970.17**
Rate per cu m	**Rs. 89.70**

6.5.2. First class brickwork in super structure with cement mortar (1:6)

a) Estimation of Materials

Assume volume of brickwork = 10 cu m

Nominal size of modular brick = 10 cm×10 cm× 20 cm

Hence, the number of bricks required = $\frac{10}{0.1\times0.1\times0.2} = 5000\ nos.$

Actual size of modular brick = 9 cm× 9 cm× 19 cm

The remaining space is filled by mortar, hence the volume of mortar required for 10 cum

= 10 – (5000 × 0.09 ×0.09 × 0.19) = 2.3 cu m.

Additional mortar required for frog filling, brick bonding and wastages @ 15%.

Thus volume of set mortar = 2.3 + 2.3 × 15\100 = 2.64 cum.

But, 1.25 cu m of dry volume of mortar materials produces 1.0 cu m set mortar.

Hence, volume of dry materials required for 2.64 cu m of set mortar

= 1.25 × 2.64 cu m = 3.30 cu m.

[Note: As a thumb rule, dry volume of mortar materials is 30% of brick work]

Sum of proportion of cement and sand = 1+6 = 7

Hence, volume of cement = 3.3/7 = 0.47 cu m.

However, cement is available in 50 kg bag whose volume is 0.0347 cu m.

[*Mass = 50 kg; Density =1440 kg/m3; Thus, Volume = 50/1440 = 0.0347 cu m*]

[*Thumb rule: 1 cu m of cement = 30 bags of cement.*]

Therefore, number of bags required = 0.47 / 0.0347 ≈ 13.5 bags.

Volume of sand required = 0.47 × 6 = 2.82 cu m.

b) Rate Analysis

Assume, the volume of brickwork = 10 cu m.

Particulars	Qnty/Nos.	Rate (Rs.)	Cost (Rs.)
Material Charges			
1. Brick	5000 Nos.	250.00 (/100 nos.)	12500.00
2. Cement	13.5 bags	320.00 per bag	4320.00
3. Sand	2.82 cu m	350 per cu m	987.00
Labour Charges			
1. Head Mason	2 Nos.	450.00 per day	900.00
2. Mason	6 Nos.	350.00 per day	2100.00
3. Mazdoor	16 Nos.	220.00 per day	3520.00
4. Bhisti	08 Nos.	220.0 per day	1760.00
T&P, Sundries, etc.	LS	200.00 LS	200.00
		Total Materials and Labour	**26287.00**
		Add 1.5% water charges	394.30
		Add 10% Contractors profit	2628.70
		Grand Total	**29310**
		Rate per cu m	**Rs. 2931.00**

Terminology (cntd.)

- **Lead** : During the earthwork, the average horizontal distance between center of excavation to the center of deposition is known as Lead.
  - Lead is normally calculated in multiple of 50m
- **Lift** : Similarly during the earthwork, the average height through which soil has to be lifted from source to the place of spreading(also known as heaping) is known as Lift.
  - The first Lift is taken upto 2m.
  - The extra lift is counted for upto 1m after the first lift and so on.

6.5.3. 12 mm thick plaster with cement mortar (1:6)

a) Estimation of Materials

Assume plastering area = 100 sq m

Hence volume of mortar for 12 mm plaster = 100 m × 0.012 m = 1.2 cum

Add 30 % more to the above volume for filling of joints, for making un uniform surface well and for wastages

Thus total set volume of mortar including wastages and joint filling etc.

$= 1.2 + 1.2 \times 30\backslash 100 = 1.56$ cu m.

As, 1.25 cu m of dry volume of mortar materials produces 1.0 cu m set mortar;

Volume of dry materials required for 1.56 cu m of set mortar is

$= 1.25 \times 1.56$ cu m $= 1.95$ cu m,

Hence, volume of cement = 1.95/7 = 0.28 cu m.

Number of bags required = 0.28 / 0.0347 ≈ 8 bags.

Volume of sand required = 0.28 × 6 = 1.68 cu m.

b) Rate Analysis

Assume, the area of plastering = 100 sq. m.

Particulars	Qnty/Nos.	Rate (Rs.)	Cost (Rs.)
Material Charges			
1. Cement	8 bags	320.00 per bag	2560.00
2. Sand	1.68 cu m	350 per cu m	588.00
Labour Charges			
1. Head Mason	2 Nos.	450.00 per day	900.00
2. Mason	6 Nos.	350.00 per day	2100.00
3. Mazdoor	08 Nos.	220.00 per day	1760.00
4. Bhisti	02 Nos.	220.0 per day	440.00
T&P, Sundries, etc.	LS	200.00 LS	130.00
		Total Materials and Labour	**8478.00**
		Add 1.5% water charges	127.17
		Add 10% Contractors profit	847.80
		Grand Total	**9452.97**
		Rate per sq m	**Rs. 94.53**

6.5.4. Cement Concrete (1:2:4) for RC work excluding reinforcement and form work

a) Estimation of Materials

Assume volume of R.C.C. = 10 cu m (Set volume)

1.54 cu m dry volume of concrete making materials produces 1.0 cu m set concrete

Therefore volume of dry materials required for 10 cu m of set concrete is 15.4 cu m.

Sum of proportion of cement, sand and course aggregate = 1+2+4 = 7

Hence, volume of cement = 15.4/7 = 2.2 cu m.

Number of bags required = 2.2 / 0.0347 ≈ 64 bags.

Volume of sand required = 2.2 × 2 = 4.4 cu m.

Volume of course aggregate required = 2.2 × 4 = 8.8 cu m.

b) Rate Analysis

Assume, volume of R.C.C. = 10 cu m.

Particulars	Qnty/Nos.	Rate (Rs.)	Cost (Rs.)
Material Charges			
1. Cement	64 bags	320.00 per bag	20480.00
2. Sand	4.4 cu m	350 per cu m	1540.00
3. C. aggregate	8.8 cu m	800 per cu m	7040.00
Labour Charges			
1. Head Mason	$^1/_2$ Nos.	450.00 per day	225.00
2. Mason	2 Nos.	350.00 per day	700.00
3. Beldar	10 Nos.	220.00 per day	2200.00
4. Mazdoor	10 Nos.	220.00 per day	2200.00
5. Bhisti	05 Nos.	220.0 per day	1100.00
T&P, Sundries, etc.	LS	200.00 LS	200.00
Scaffolding	LS	400.00 LS	400.00
		Total Materials and Labour	**36085.00**
		Add 1.5% water charges	541.28
		Add 10% Contractors profit	3608.50
		Grand Total	**40234.78**
		Rate per sq m	**Rs. 4023.50**

Note: If concrete mixture is employed for mixing of concrete, hiring and running charges may add @ Rs. 100.00 per cu m of concrete; but the labour may be reduced by 2 beldars per 10 cu m of concrete.

6.5.5 Lime Concrete in foundation with 25 mm down brick chips (or jhama chips) with lime surki mortar (1:2:5½)

a) Estimation of Materials

Assume volume of lime concrete = 10 cu m (Set volume)

1.54 cu m dry volume produces 1.0 cu m set concrete

Therefore volume of dry materials required for 10 cu m of set lime concrete is 15.4 cu m.

Sum of proportion of cement, sand and course aggregate = 1+2+5½ = 8½

Hence, volume of slaked lime = 15.4/8½ = 1.8 cu m.

Volume of surki required = 1.8 × 2 = 3.6 cu m.

Volume of jhama brick chips required = 1.8 × 5½ = 10 cu m.

b) Rate Analysis

Assume, volume of R.C.C. = 10 cu m.

Particulars	Qnty/Nos.	Rate (Rs.)	Cost (Rs.)
Material Charges			
1. Slaked lime	1.8 cum	600.00 per cum	1080.00
2. Surki	3.6 cu m	250.00 per cu m	900.00
3. Brick chips	10.0 cu m	350.00 per cu m	3500.00
Labour Charges			
1. Head Mason	$^1/_2$ Nos.	450.00 per day	225.00
2. Mason	1 Nos.	350.00 per day	350.00
3. Mazdoor	18 Nos.	220.00 per day	3960.00
4. Bhisti	02 Nos.	220.0 per day	440.00
T&P, Sundries, etc.	LS	300.00 LS	150.00
		Total Materials and Labour	**10605.00**
		Add 1.5% water charges	159.08
		Add 10% Contractors profit	1060.50
		Grand Total	**11824.58**
		Rate per sq m	**Rs. 1182.50**

B. Cost of materials

Sr. No.	Material	Unit	Quantity	Rate	Amount	
					₹	P.
1.	Cement	Bags	44	350/-	15400	00
2.	Sand	m^3	4.56	1000/-	4560	00
3.	Aggregate	m^3	9.12	1200/-	10944	00
					Total Amount = ₹ 30904.00/-	

(1+3+6)

C. Cost of labours

Sr. No.	Labour	Men (nos.)	Rate	Per(Day)	Amount	
					₹	P.
1.	Head Mason	½	400/-	Day	200	00
2.	Mason	1½	350/-	Day	525	00
3.	Male Mazdoor	12	200/-	Day	2400	00
4.	Coolie	18	150/-	Day	2700	00
5.	Bhisti	3	250/-	Day	750	00
6.	T&P	Lump sum	100/-	_	100	00

Total amount =6675/-

Total cost = Cost of materials+ Cost of labours

= 30904.00+6675.00

Total cost = **₹ 37579.00/-**

Add 1.5% Water Charges of total cost

$$= \left(\frac{1.5}{100}\right) \times 37579$$

Water charges = **₹ 563.69/- (say = ₹ 564.00/-)**

Add 10% Contractor's Charges = $\left(\frac{10}{100}\right)$ ×37579

Contractor's Charges = ₹ 3758.90/- (say = ₹ 3759.00/-)

Grand total = 37579.00+564.00+3759.00

= ₹ 41901.00/-

Rate of work per m^3 = $\frac{41901}{10}$ ⇒ ₹ 4190.10/-

Hence Rate of PCC work per m^3 is ₹ 4190.00/-

RATE ANALYSIS OF BRICK WORK

Q. Prepare Rate analysis for a Brick work in cement-mortar (1:4).

Soln.:-

Given: - Take volume = $10m^3$

W.K.T. No. of Bricks @ 500 per m^3

No. of Bricks = 500×10

= 5000 nos.

Volume of dry mortar = 30% of Volm.

$$= \frac{30}{100} \times 10$$

$$= 3\ m^3$$

Quantity of cement = $\left(\frac{3}{1+4}\right) \times 1$

$$= 0.60\ m^3$$

No. of bags $= 0.60 \times 28.5$

$= 17.10$ bags $\cong 18$ bags (say)

Quantity of sand = $\left(\frac{3}{1+4}\right) \times 4$

$$= 2.40\ m^3$$

B. Cost of materials

Sr. No.	Material	Unit	Quantity	Rate	Amount	
					₹	P.
1.	Cement	Bags	18	350/-	6300	00
2.	Sand	m^3	2.40	1000/-	2400	00
3.	Bricks	Nos.	5000	4/-	20000	00
					Total Amount = ₹ 28700.00/-	

C. Cost of labours

Sr. No.	Labour	Men (nos.)	Rate	Per(Day)	Amount	
					₹	P.
1.	Head Mason	1	400/-	Day	400	00
2.	Mason	8	350/-	Day	2800	00
3.	Male Mazdoor	6	200/-	Day	1200	00
4.	Coolie	6	150/-	Day	900	00
5.	Bhisti	1	250/-	Day	250	00
6.	T&P	Lump sum	100/-	_	100	00
7.	Scaffolding	Lump sum	250/-	_	250	00
					Total Amount = ₹ 5900.00/-	

Total cost = Cost of materials+ Cost of labours

= 28700.00+5900.00

Total cost = **₹ 34600.00/-**

Add 1.5% Water Charges of total cost

$$= \left(\frac{1.5}{100}\right) \times 34600$$

Water charges = **₹ 519.00/-**

Add 10% Contractor's Charges $= \left(\frac{10}{100}\right) \times 34600$

Contractor's Charges = ₹ 3460.00/-

Grand total = 34600.00+519.00+3460.00

= ₹ 38579.00/-

Rate of work per m³ $= \frac{38579}{10} \Rightarrow$ **₹ 3857.90/-**

Hence Rate of Brick work per m³ is ₹ 3858.00/-

6.5.7 25 mm thick cement concrete (1:2:4) damp proof course.

a) Estimation of Materials

Assume area of DPC is = 100 sq m

The volume of concrete will be = 0.025*100= 2.5 cum.

Following example 21.5.4, the quantity of cement, sand and course aggregates required for 2.5 cu m concrete are estimated as:

Number of cement bags required = 16½ bags.

Volume of sand required = 1.10 cu m.

Volume of course aggregate required = 2.20 cu m.

Quantity of water proofing compound required = 3% by weight of cement =

= 3% of 16½×50 kg = 25 kg.

b) Rate Analysis

Assume, area of DPC = 100 sq m.

Particulars	Qnty/Nos.	Rate (Rs.)	Cost (Rs.)
Material Charges			
1. Cement	16½ bags	320.00 per bag	5280.00
2. Sand	1.1 cu m	350.00 per cu m	385.00
3. C. aggregate	2.2 cu m	800.00 per cu m	1760.00
4. Water proof compound	25 kg	25.00 per kg	625.00
Labour Charges			
1. Head Mason	$^1/_2$ Nos.	450.00 per day	225.00
2. Mason	08 Nos.	350.00 per day	2800.00
3. Mazdoor	08 Nos.	220.00 per day	1760.00
4. Bhisti	01 Nos.	220.0 per day	220.00
T&P, Sundries, etc.	LS	500.00 LS	100.00
		Total Materials and Labour	**13155.00**
		Add 1.5% water charges	197.33
		Add 10% Contractors profit	1315.50
		Grand Total	**14667.83**
		Rate per sq m	**Rs. 146.70**