

IntroductionEstimate -

An estimate is the probable cost of a work and is usually prepared before the construction is taken up.

→ Before undertaking any work or project it is necessary to know its probable cost which is obtained or derived by estimating.

→ The estimate is prepared by computing or calculating the quantities required and then calculating the cost at suitable rates, to get the expenditure for the construction of the work or structure.

Data for estimate -

To make out an estimate for a work the following data are necessary -

- (i) Drawing (Plan, section)
- (ii) Specification
- (iii) Rate

(i) Drawing -

Plan, sectional elevation and detailed drawing to scale, fully dimensioned are required.

The plan, elevation and sectional elevation are usually drawn to a scale of $1\text{ cm} = 1\text{ m}$ ($1\text{ inch} = 8\text{ feet}$) ($1'' = 8'$).

① Specification -

(a) General specification or brief specification
These gives the nature, quality and class of work and material.

In general terms to be used in the various parts of the wall.

General specification help to form a general idea of the whole building or structure and are useful in preparing the detailed estimate.

(b) Detailed specification -

These give the detailed description of the various items of work laying down the quantities and qualities of materials. their proportion the methods of preparation, workmanship and execution of work.

③ Rate -

The rate per unit of various item of work the rate of various material to be used in the construction and the uses of different categories of labour, skilled or unskilled as mason, carpenter etc. available for preparing estimate.

Types of estimate -

- (i) Preliminary estimate or approximate or abstract estimate or rough cost estimate
- (ii) Plinth area estimate
- (iii) Cube rate estimate or cubical content estimate
- (iv) Approximate quantity method estimate
- (v) Detailed estimate or item rate estimate
- (vi) Revised estimate
- (vii) Supplementary estimate
- (viii) Supplementary and revised estimate
- (ix) Annual repair or maintenance estimate

Plinth area estimate -

Plinth area is the built up covered area of a building measured at floor level of a ~~area~~ any storey.

Plinth area is calculated by taking the external dimension of the building at the floor level excluding plinth offset if any.

- (iii) Balcony, courtyard, ~~or~~ open area, cantilever projection are not included in the plinth area.

Supported porches are included in the plinth area.

Floor area -

Floor area of a building is the total area of floor in between walls and consist of floor of all rooms, verandah, passages, corridors, staircase room, entrance hall, kitchen, store, bathroom etc. ~~Seats~~ ^{Sills} of doors and opening are not included in the floor area.

(ii) ~~Floor area~~ is equal to ~~plinth area~~.

Floor area = plinth area - area occupied by walls.

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

Carpet area -

Carpet area of building is the useful area or ~~use~~ lettable area.

This is the total floor area - The circulation area. _(minus)

Circulation area, verandah, corridors, passages, staircase, lift, entrance hall etc. and - other non useable area as sanitary accommodations, air conditioning room etc.

(ii) For office building carpet area is the useful area and for residential building carpet area is the liveable area and should ~~exp~~ exclude kitchen, storage and similar other room which are not useful for living purposes.

Degree of accuracy in estimating

The accuracy, to be observed in preparing an estimate depends on the rate of the item and the unit of payment. The higher the rates the greater should be the accuracy with which the quantities are calculated. Where rates are high and paid per unit, dimensions should be absolutely correct, though taking dimensions to the nearest 1 cm to 5 cm may be allowed for practical purposes. The quantities in such cases should be worked out to at least two places of decimal. But where rates are low and paid for % to % unit such extreme accuracy is not required.

In general, dimensions should be measured to the nearest 1 cm (0.01 m), areas should be worked out to the nearest 0.01 sq m and cubic contents should be worked out to the nearest 0.01 cum. Thickness of slabs, partitions, etc. and sectional dimensions of columns, pillars, beams, etc. - should be taken to the nearest half centimetre (0.005 m)

Units of measurements in metric system

The principle for dimensions and measurements is to use millimetre (mm) for minute dimensions, centimetre (cm) for small dimensions and metre (m) for big dimensions. Distances are measured in kilometre (km).

Units

<u>S.No.</u>	<u>Item</u>	<u>Units of measurement in MKS</u>	<u>Units of payment in MKS</u>	<u>Units of payment in FPS</u>
1.	Lime concrete in foundation (L.C)	cum	per cum	% cu ft
2.	Lime concrete in roof terracing, thickness specified (L.C)	sq m	per sq m	% sq ft
3.	Cement concrete (C.C)	cum	per cum	per cu ft
4.	Reinforced cement concrete	Cum	per cum	per cu ft
5.	C.C. or R.C.C. Chujja, Sun shade	cum	per cum	per cu ft
6.	Precast C.C. or R.C.C.	cum	per cum	per cu ft
7.	Jaliwork or jaffaiwork or C.C. tracery panels	sq m	per sq m	per sq ft
8.	Cement concrete bed	cum	per cum	per cu ft
9.	D.P.C Damp proof course - cement concrete, Rich concrete mortar, Asphalt, etc.	sq m	per sq. m	% sq. ft

Brickwork

- Brickwork in foundation and plinth, in super structure, in arches, etc, in cement, lime or mud mortar

- | | | | | |
|----|---|-------|----------|---------|
| 2 | Sun dried brickwork | cum | per cum | % cu ft |
| 3 | Honey-comb brickwork, thickness specified | sq m | per sq m | % sq ft |
| 4 | Brickwork in jack arches, if measured separately | cum | per cum | % cu ft |
| 5 | Jack arch roofing including top finishing | sq m | per sq m | % sq ft |
| 6 | Brickwork in well steining | cum | per cum | % cu ft |
| 7 | Half-brickwork with or without reinforcement | sq m | per sq m | % sq ft |
| 8 | Thin partition wall | sq m | per sq m | % sq ft |
| 9 | Reinforced brickwork | cum | per cum | % cu ft |
| 10 | String course, drip course, weather course, coping etc. | metre | per m | per ft |
| 11 | Cornice | metre | per m | per ft |
| 12 | Brickwork in fireplace, chulla, chimney | cum | per cum | % cu ft |
| 13 | Pargetting chimney, fireplace flue | metre | per m | per ft |
| 14 | Brick edging | metre | per m | per ft |

Stonework -

- | | | | | |
|---|--|------|----------|-----------|
| 1 | Stone masonry, Random Rubble masonry, coursed Rubble masonry, Ashlar masonry in walls, in arches, etc. | cum | per cum | % cu ft |
| 2 | Cut stone work in lintel, beam, etc. | cum | per cum | per cu ft |
| 3 | Stone slab in roof, shelves, etc, stone chujjas, stone sun shed, etc. | sq m | per sq m | % sq ft |
| 4 | Stone work in wall facing or lining | sq m | per sq m | per sq ft |

Wood work -

① Wood work, door & window frame, or chowkhat, rafters beams, roof truss etc.	cu m	per cum	per cu ft
② Door and window shutters or leaves, panelled, battened, glazed, part panelled and part glazed, wire gauged, etc.	sq m	per sq m	per sq ft
③ Door & window fittings as hinges tower bolts, sliding bolts, handles, etc.	no.	per no.	per no.
④ Timbering, boarding	sq m	per sq m	per sq ft
⑤ Timbering of trenches	sq m	per sq m	per sq ft
⑥ Sawing of timber	sq m	per sq m	per sq ft
⑦ Woodwork in partition, ply wood, etc.	sq m	per sq m	per sq ft
⑧ Ballies	metre	per m	per ft

Steel work -

① Rolled steel joints, channels, Angles, T-irons, Flats, Squares, Rounds, etc.	quintal	per q	per cwt
② Steel reinforcement bars, etc. in R.C.C, R.B work.	quintal	per q	per cwt
③ Bending, binding of steel reinforcement	quintal	per q	per cwt
④ Fabrication and hoisting of steel work	quintal	per q	per cwt
⑤ Expanded Metal, (X.P.M) size specified	sq m	per sq m	per sq ft
⑥ Fabric reinforcement, wire netting	sq m	per sq m	per sq ft
⑦ Iron work in stress	quintal	per q	per sq ft
⑧ Gussat plate (min ^m rectangular size from which cut	quintal	per q	per cwt

- (9) cutting of Iron joists, ~~quintal~~ per cm per m
- (10) cutting, Angles, Tees, sq m per sq cm per sq inch
plate
- (11) Threading in iron ~~sq cm~~ per cm per inch
- (12) Welding, solder of sheets, cm per cm per inch
plates
- (13) Boring holes in iron ~~cm no.~~ per no. per no.
- (14) Cast Iron pipe, Dia. specified metre per m per ft
- (15) Rivets, Bolts and nuts, Anchor ~~metre~~ per q per cwt
bolts, Lewis bolts, Holding
down bolts, etc. quintal
- (16) Barbed wire fencing ~~metre~~ per m % a ft
sq. m per sq m. per sq ft
~~metre~~
- (17) Iron gate quintal per q per cwt
~~metre~~
- (18) Iron hold fast metre per m per a ft
- (19) Iron railing
- (20) Iron grill, collapsible sq m per sq m per sq ft
gate
- (21) Rolling shutter sq m per sq m per sq ft
- (22) Steel doors & windows sq m per sq m per sq ft

Roofing -

- (1) Tiled roof - Allahabad tile, sq m per sq m % sq ft
Faizabad tile, Mangalore
tile, etc. including battens
- (2) Country tile roof including sq m per sq m % sq ft
bamboo jaffri
- (3) Corrugated iron roof, sq m per sq m % sq ft
Asbestos cement sheet roof
- (4) Slate roofing, timber roofing sq m per sq m % sq ft
- (5) Thatch roofing including sq m per sq m % sq ft
bamboo jaffri
- (6) Bare board sq m per sq m per sq ft
- (7) R.C.C, R.B slab roof cum per cum per cwt

- | | | | |
|---|-------|----------|---------|
| ⑧ Lime concrete roof over and inclusive of tiles or brick, or stone slab, etc. | sq m | per sq m | % sq |
| ⑨ Mud roof over and inclusive of tiles, or bricks, or stone slab, etc. | sq m | per sq m | % sq |
| ⑩ Ridges, valleys, gutters, | metre | per m | per m |
| ⑪ Tar felting, Bituminous painting | sq m | per sq m | % sq |
| ⑫ Insulating layer in roof of sand and clay, asphalt, etc. | sq m | per sq m | % sq |
| ⑬ Expansion, contraction or construction joint | metre | per m | per m |
| ⑭ Ceiling - Timber, A.C. sheet plain, cloth, cement plaster or XPM, Paste board, etc. | sq m | per sq m | per sq |
| ⑮ Centering and shuttering, form work - surface area of R.C.C. or R.B. work supported | sq m | per sq m | % sq ft |

Plastering, Pointing and Finishing -

- | | | | |
|---|-------|----------|---------|
| ① Plastering - Cement mortar, Lime mortar, mud etc. | sq m | per sq m | % sq ft |
| ② Pointing - struck, flush, Weather, etc. | sq m | per sq m | % sq ft |
| ③ Dado - | sq m | per sq m | % sq ft |
| ④ Skirting | metre | per m | per m |
| ⑤ Cement mortar or Lime mortar rubbing | sq m | per sq m | % sq ft |
| ⑥ White washing, Colour washing, cement washing | sq m | per sq m | % sq ft |
| ⑦ Distemping | sq m | per sq m | % sq ft |
| ⑧ Snow cement washing or finishing | sq m | per sq m | % sq ft |

(9) Painting, Varnishing	sq m	per sq m	% sq ft
(10) Polishing of woodwork	sq m	per sq m	% sq ft
(11) Painting letters and figures	no.	per no.	per no.
(12) Oiling and clearing of doors & windows	sq. m	per sq m.	% sq ft
(13) Coal tarring	sq m	per sq m	% sq ft
(14) Removing of paint or varnish	sq m	per sq m	% sq ft
(15) Gobri Lepping	sq m	per sq m	% sq ft

Flooring -

(1) 2.5 cm (1") C.C. over 7.5 cm (3") L.C. Floor (including L.C.)	sq m	per sq m	% sq ft
(2) Conglomerate floor, artificial patent stone floor 2.5 cm (1") C.C. over 7.5 cm (3") L.C.	sq m	per sq m	% sq ft
(3) 4 cm (1 1/2") thick stone floor flag stone floor over 7.5 cm (3") L.C.	sq m	per sq m	% sq ft
(4) 2.5 cm (1") marble flooring over 7.5 cm (3") L.C.	sq m	per sq m	per sq ft
(5) Mosaic or terrazo on granolithic floor over 7.5 cm (3") L.C.	sq m	per sq m	per sq ft
(6) Brick flat floor over 7.5 cm (3") L.C.	sq m	per sq m	% sq ft
(7) Brick on edge floor over 7.5 cm (3") L.C.	sq m	per sq m	% sq ft
(8) 2.5 cm (1") or 4 cm (1 1/2") C.C., floor	sq m	per sq m	% sq ft
(9) Mud flooring finished gobri lepping	sq m	per sq m	% sq ft
(10) Apron or Plinth protection	sq m	per sq m	% sq ft

(11) Door and window sill.	sq m	per sq m.	% sq ft
<u>Miscellaneous Items -</u>			
(1) Ornamental cornice (projection, type specified)	metre	per m	per m
(2) Moulding string course, Deep course, Beading, Throating, etc.	metre	per m	per m
(3) Ornamental pillar caps, pillar base, Flowers, Brackets, etc.	no.	per no.	per no.
(4) Railing (Height & type specified)	metre	per m	per m
(5) surface drain small	metre	per m	per m
(6) surface drain large - (item wise)	cu m	per cum	% cu ft
(7) Masonry	sq m	per sq m	% sq ft
(8) Plastering	sq m	per sq m	% sq ft
(9) Pipe - rainwater, Sanitary, water pipe, etc.	metre	per m	per m
(10) Laying pipe line - sanitary, water pipe, etc.	metre	per m	per m
(11) Jungle clearance (May also be per km for road and irrigation channel)	sq m or hectare	per sq m	% sq ft or per acre
(12) Silt clearance in irrigation channels (similar to earthwork) (For thin layer upto 5cm may be on area basis)	cu m	per cum	% cu ft
(13) Trestle, Crates &	no.	per no.	per no.
(14) cleaning flues	no.	per no.	per no.
(15) Cotton cords in sky light	no.	per no.	per no.
(16) Easing doors & windows	no.	per no.	per no.
(17) Fixing doors & windows	no.	per no.	per no.
(18) Supply and fixing of Hinges, Tower bolts, Hasp and staples, Handles, Hardwares, etc	no.	per no.	per no.

17) Glazing	sq m	per sq m.	per sq. ft
18) Glass panes	sq m	per sq m.	per sq ft
19) Fixing of glass panes or cleaning	no.	per no.	per no.
20) Renewing of glass panes	no.	per no.	per no.
21) Well sinking (masonry or tubewell)	metre	per m.	per r ft
22) Pile driving or sinking	metre	per m	per r ft
23) Furnitures - chairs, tables, etc.	no.	per no.	per no.
24) Painting furnitures	no	per no	per no.
25) Carving chairs	no	per no	per no
26) Pitching of brick, stone, kankar, etc.	cu m	per cum	% cu ft
27) Lining of Irrigation channel, Tunnel, etc. Materials, thickness specified	sq m	per sq m	% sq ft
28) kankar quarrying, kankar supply	cu m	per cum.	% cu ft
29) kankar consolidation, road metal consolidation	cu m	per cum	% cu ft
30) Dag-belling	metre	per m	% r ft
31) Bituminous road surfacing	sq m	per sq m	% sq ft
32) Dismantling	Same as for Different items	Same as for different items	Same as for diff items
33) Dismantling of brick masonry	cu m	per cum	% cu ft
34) Grouting (Bituminous grouting of road metal, Cement grouting of concrete)	sq m	per sq m	% sq ft
35) Grouting of cracks, joints, etc.	metre	per m	per r ft
36) Electric Wiring or Electrification. Light, fan, plug points	point	per point	per point
37) Water closet (W.C.), wash hand basin, Manhole, etc.	no.	per no.	per no

Materials -

① Supply of bricks	% nos.	per % nos.	% nos.
② Supply of sand, surkhi, Cinder, etc.	cu m	per cu m	% nos. % cost
③ Supply of cement	bag of 50 kg	per bag or per quintal or per tonne	per cu on per ton
④ supply of lime unslaked	quintal	per q	per mass
⑤ supply of lime slaked	quintal	per q	per mass
⑥ Supply of Brick ballast, Stone ballast, Aggregate, etc.	cu m	per cu m	% cost
⑦ Broken bricks, kankar, etc.	cu m	per cu m	% cost
⑧ Supply of Timber	cu m	per cu m	% cost
⑨ Supply of steel	quintal	per q	per cu
⑩ Supply of Bitumen, Tan.	tonne	per ton	per ton
⑪ Supply of coal	tonne	per ton	per ton
⑫ Supply of A.C sheets	sq m	per sq m	sq ft
⑬ Supply of G.I sheet	quintal	per q	per cu
⑭ supply of switches, plugs, ceiling roses, bulbs, brackets, etc.	no.	per no.	per no.
⑮ supply of insulated electric wire	quintal	per q	per cu
⑯ supply of bare electric wire	quintal	per q	per cu
⑰ Tents, sholdarries	no.	per no.	per no.
⑱ supply of water closet, W.C.	no.	per no.	per no.
⑲ Supply of Wash hand basin	no.	per no.	per no.
⑳ Supply of cowl, Mica valve, Intercepting trap, etc.	no.	per no.	per no.

- (21) supply of Bib cock, stop cock, Ball cock, etc. no. per no. per no.
- (22) supply of ferrule, C.I. Tank, Water meter, etc. no. per no. per no.
- (23) supply of pipe, C.I. pipe, S.W. pipe, Hume pipe, A.C. pipe, G.I. pipe etc. metre per m. per ft
- (24) supply of lead, lead wool kg or quintal per kg or per q per cwt
- (25) spun yarn kg per kg per lb
- (26) supply of varnish, oil etc. litre per litre per gal
- (27) supply of paint ready mix litre per litre per gal
- (28) supply of stiff paint kg per kg per lb
- (29) Explosive for blasting kg per kg per lb

Method of estimating -

① Estimate

② Actual cost

③ Detailed estimate

(a) Details of measurement & calculation of quantities

Details of measurement form:-

Item No.	Particulars	No.	Length	B	H/D	Quantity LXBXH

(b) Abstract of estimate cost

Item No.	Particulars	Qty	Unit	Rate	Amount

Main item of work -

1. Earth-work
2. Concrete in foundation
3. Soling
4. D.P.C (Damp proof course)
5. Masonry (Deduction for opening, bearing etc)
6. Arch masonry work
7. Lintel over opening
8. RCC work
9. Flooring & Roofing
10. Plastering & pointing
11. Cornice
12. Pillars
13. Door, window (Door frame, Door shutter)
14. Wood work
15. Iron work
16. White washing or colour washing or distemping
17. Painting

Q) Estimate the quantities of brick work and plastering required in a wall 4m long 3m height and thickness 30cm. Calculate the cost if the rate of brick, ~~also~~ ~~calculate~~ work is Rs 320/- per ~~sq~~ m³, and plastering is 8.50 per sq. m.

$$L = 4 \text{ m}$$

$$H = 3 \text{ m}$$

$$B = 30 \text{ cm} = 0.3 \text{ m}$$

$$\text{Quantity} = 4 \times 3 \times 0.3 = 3.6 \text{ m}^3$$

$$\text{Total Rs} = 3.6 \times 320 = 1152/-$$

Cost of brickwork.

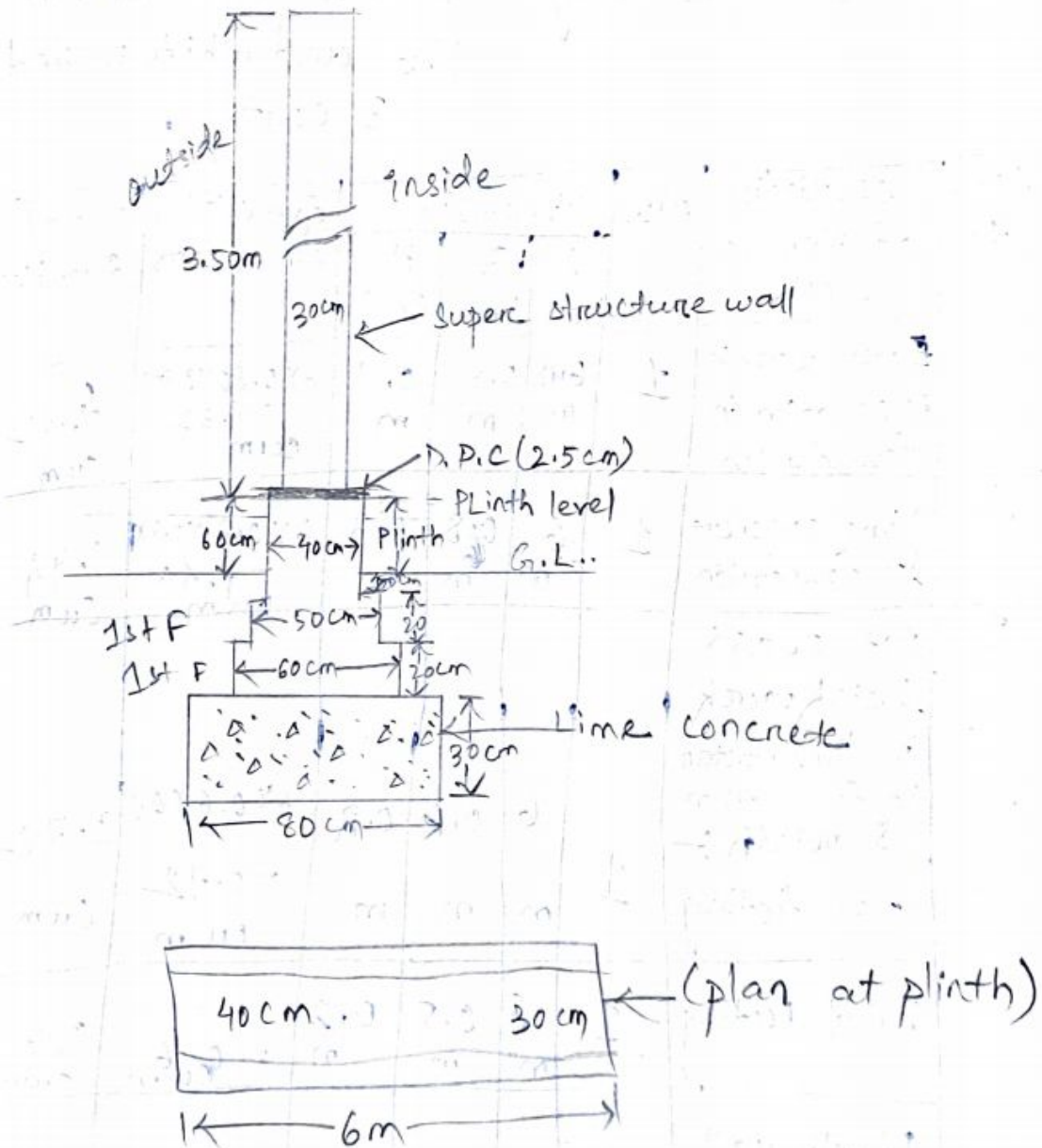
For plastering

$$2 \times L \times H = 2 \times 4 \times 3 = 24 \text{ sq m}$$

$$\text{Cost of plastering} = 24 \times 8.50 = 204 \text{ /-}$$

$$\text{Total Cost} = 1152 + 204 = 1356 \text{ /-}$$

Q2. Prepare a detailed estimate of part of a wall of a building from the given plan & section & general specification.



Specification —

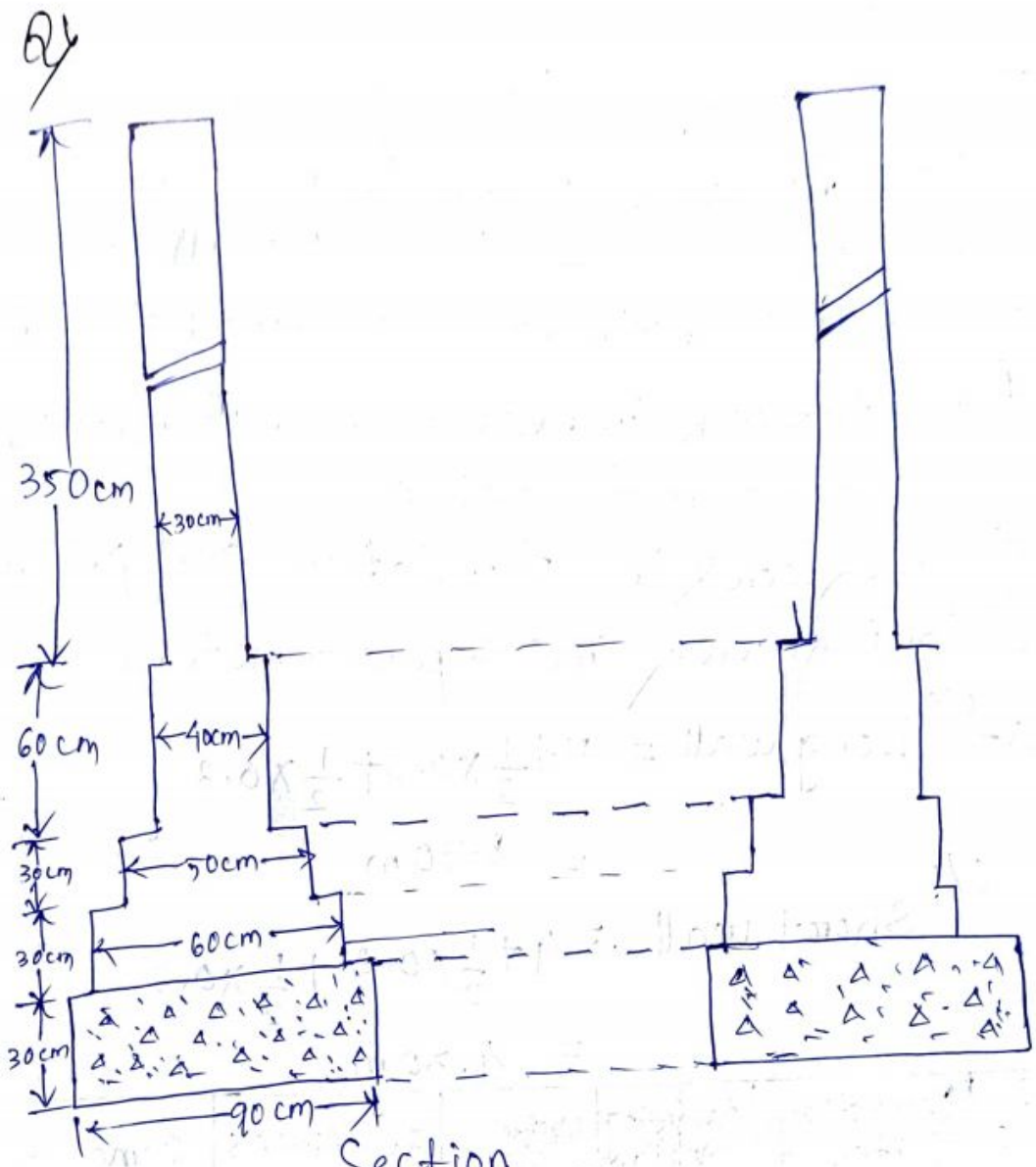
- ① Foundation concrete shall be of lime concrete
- ② foundation and plinth shall be of 1st class brick work in lime mortar.
- ③ D.P.C — 2.5 cm (C.C)
1:1½:3
- ④ Super structure — 1st class brickwork in lime mortar
- ⑤ Wall finishing — inside wall 12 mm 1:6 and white washed 3 coats.

Item No.	Description of item of work	No.	Dimensions			Quantities or contents	Total Quantity
			L (m)	B (m)	H (m)		
1	Earth work in excavation in foundation	1	6 m	0.8 m	0.9 m	$6 \times 0.8 \times 0.9 = 4.32$ cum	4.32 Cum
2	Lime concrete in foundation	1	6 m	0.8 m	0.3 m	$6 \times 0.8 \times 0.3 = 1.44$ cum	1.44 Cum
3	1st class brickwork in lime mortar in foundation & plinth :- 1st footing	1	6 m	0.6 m	0.2 m	$6 \times 0.6 \times 0.2 = 0.72$ cum	0.72 Cum
	2nd footing	1	6 m	0.5 m	0.2 m	$= 0.6$ cum	0.6 cum
	Plinth wall upto ground level	1	6 m	0.4 m	0.2 m	$= 0.48$ cum	0.48 cum

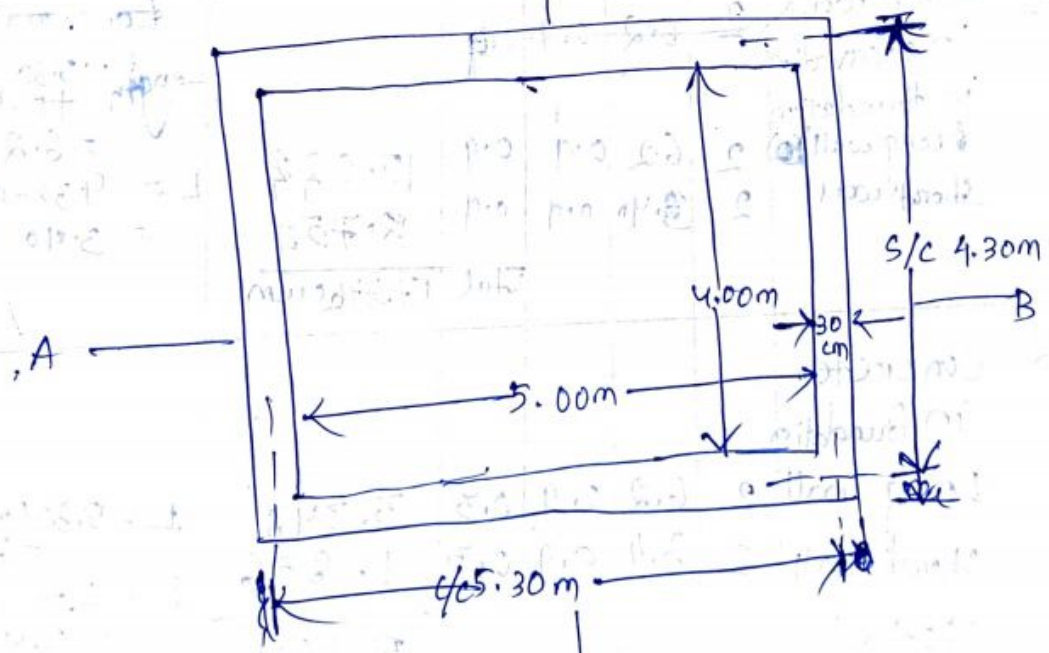
	1.44 m wall above ground level	1	6 m	0.4 m	0.6 m	1.44 cu m	0.72 1.44 #1.44 = 3.24 cu m
4	D.P.C. (2.5cm)	1	6 m	0.4 m		6 x 0.4 = 2.4 sq m	2.4 sq m
5	For Super structure 1st class brick work in lime mortar.	1	6 m	0.3 m	3.5 m	6 x 0.3 x 3.5 = 6.3 cu m	6.3 cu m
6	12 mm 12 mm plaster of cement sand 1:6						
	→ Inside	1	6 m	-	3.5 m	6 x 3.5 = 21 sq m	21 + 25.2 = 46.2
	→ Out side including 10 cm below G.L	1	6 m	-	4.2 m	6 x 4.2 = 25.2 sq m	sq m
7	white washing 3 coats (inside)	1	6 m	-	4.2 m	6 x 4.2 = 25.2 sq m	25.2
8	colour washing 2 coats over one coat of white washing outside whole G.L	1	6 m	-	4.1 m (3.5 + 0.6)	6 x 4.1 = 24.6 sq m/m ²	24.6

Abstract of Estimated Cost

Item No.	Description of item of work	Quantity	Unit	Rate Rs	Per	Amount Rs
1	Earthwork in excavation in foundation	4.32	Cum	350.00	% cum	15.12
2	Lime concrete in foundation	1.44	Cum	220.00	per cum	3, 16.8
3	1st class brick work in lime mortar in foundations & Plinth	3.24	Cum	300.00	per cum	9, 72
4	D.P.C. (2.5cm)	2.4	Sq m	20.00	per sq m	48
5	1st class brickwork in lime mortar (for superstructure)	6.3	Cum	320.00	per cum	20, 16
6	12mm plaster of cement sand 1:6	46.2	Sq m	8.50	per sq m	3, 92.7
7	whitewashing 3 coats	25.2	Sq m	0.75	per sq m	18.9
8	Colour washing 2 coats over one coat	24.6	Sq m	0.82	Per sq m	20.172
				Total =		3799.692
				Add for contingencies 3% =		113.99
				Add for work charged at 2% =		75.99
				Establishment		3989.672



Section ON AB



Plan of super structure wall

The plan of super structure wall of single room building of room size 5m x 4m and section represent the cross section of the wall with foundation. Estimate the quantities of

- (i) Earthwork in excavation in foundation
- (ii) Concrete in foundation
- (iii) Brickwork in foundation and plinth
- (iv) Brickwork in super structure

Ans - c/c Long wall = $5 + \frac{1}{2} \times 0.3 + \frac{1}{2} \times 0.3$
 $= 5.30 \text{ m}$

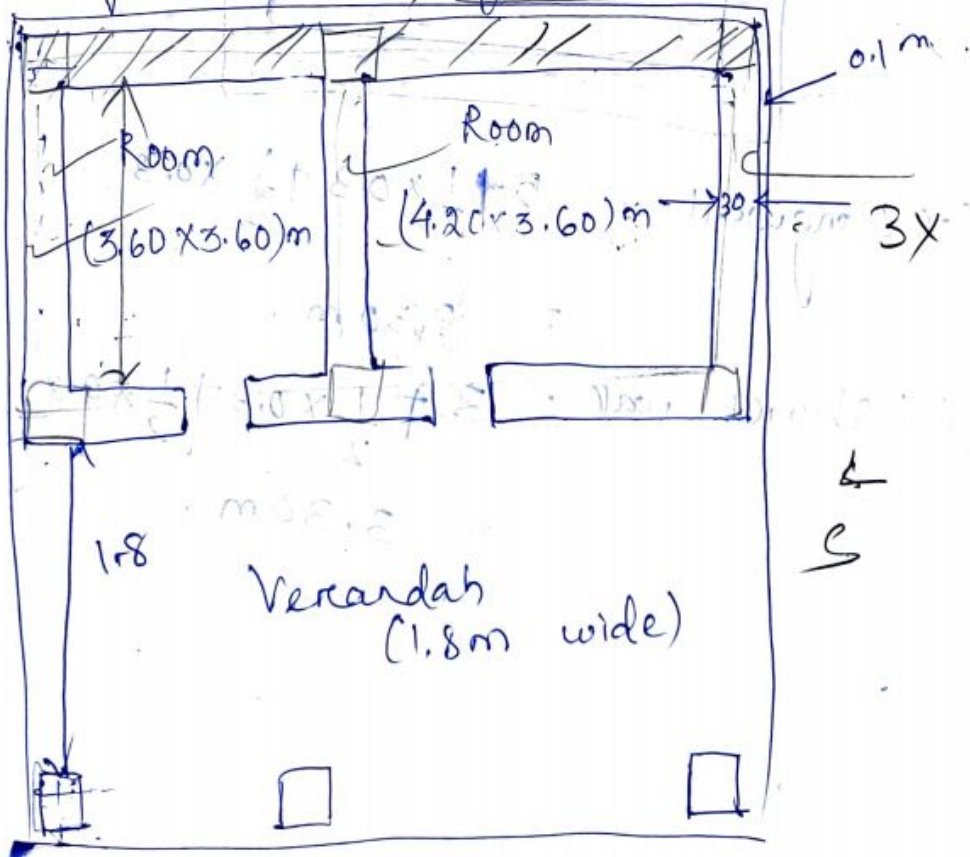
c/c Short wall = $4 + \frac{1}{2} \times 0.3 + \frac{1}{2} \times 0.3$
 $= 4.30 \text{ m}$

Item No.	Description of item of work	Quantity No	Dimensions L B H			Quantities	Remark
1	Earthwork in excavation in foundation	2	6.2	0.9	0.9		
	Long wall	2	6.2	0.9	0.9	10.044	Long wall Length = 5.30 + 0.9 = 6.2 L = 4.30 - 0.9 = 3.40
	Short wall	2	3.4	0.9	0.9	5.508	
	Total					15.552 cum	
	Concrete in foundation						
	Long wall	2	6.2	0.9	0.3	3.348	L = 5.30 + 0.9 = 6.2
	Short wall	2	3.4	0.9	0.3	1.836	L = 4.30 - 0.9 = 3.4
	Total					5.184 cum	

3	Brick work in foundation & Plinth - Long wall	1st footing	2	5.9	0.6	0.3	2.124	$L = 5.3 + 0.6 = 5.9$
			2	5.8	0.5	0.3	1.74	$L = 5.3 + 0.5 = 5.8$
			2	5.7	0.4	0.6	2.736	$L = 5.3 + 0.4 = 5.7$
	Short wall		2	3.7	0.6	0.3	1.332	$L = 4.3 - 0.6 = 3.7$
			2	3.8	0.5	0.3	1.14	$L = 4.3 - 0.5 = 3.8$
			2	3.9	0.4	0.6	1.872	$L = 4.3 - 0.4 = 3.9$
			Total				10.944	cu m
	4	Brickwork in superstructure	Long walls	2	5.6	0.3	3.5	11.76
Short walls			2	4.0	0.3	3.5	8.4	$L = 4.3 + 0.3 = 4.0$
			Total				20.16	cu m

Pb-1

Calculate the plinth area of the building in the diagram $3.6 \times 4.20 + 3 \times 0.60$



$$\text{Long wall} = 3.60 + 4.20 + 3(0.3)$$

$$= 8.7 \text{ m}$$

$$\text{short wall} = 3.60 + 1.80 + 2(0.3)$$

$$= \cancel{6.0 \text{ m}} \cdot 4.2 \text{ m}$$

~~$$\text{Plinth area} = 8.7 \times 6.0$$

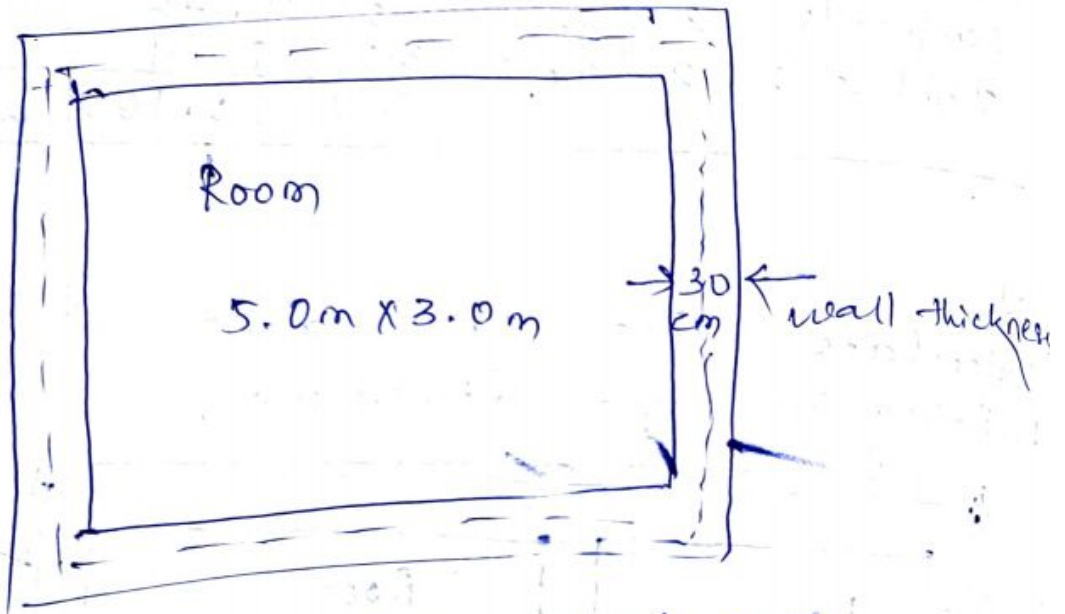
$$= 52.2 \text{ m}^2$$~~

Plinth area

Pr. 2

$$\text{Total A (LXB)} = \cancel{57.8559} \text{ m} \cdot B = 0.1 + 0.3 + 3.60 + 1.80 + 0.3 + 0.1 = 6.1$$

In a room of size $6.0 \times 3.0 \text{ m}$ with wall thickness 30 cm , calculate the length of long wall & short wall for construction of masonry.



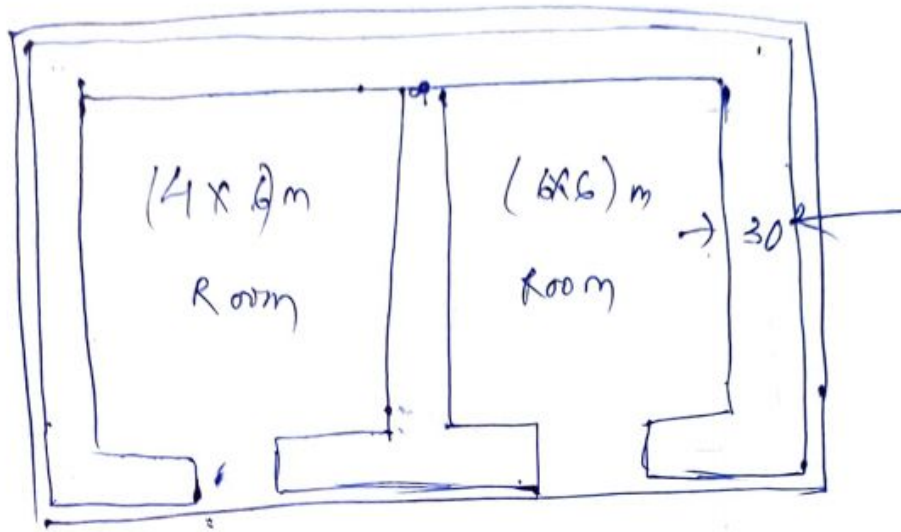
$$\text{C-C Long wall} = 5 + \frac{1}{2} \times 0.3 + \frac{1}{2} \times 0.3$$

$$= 5.30 \text{ m}$$

$$\text{C-C short wall} = 3 + \frac{1}{2} \times 0.3 + \frac{1}{2} \times 0.3$$

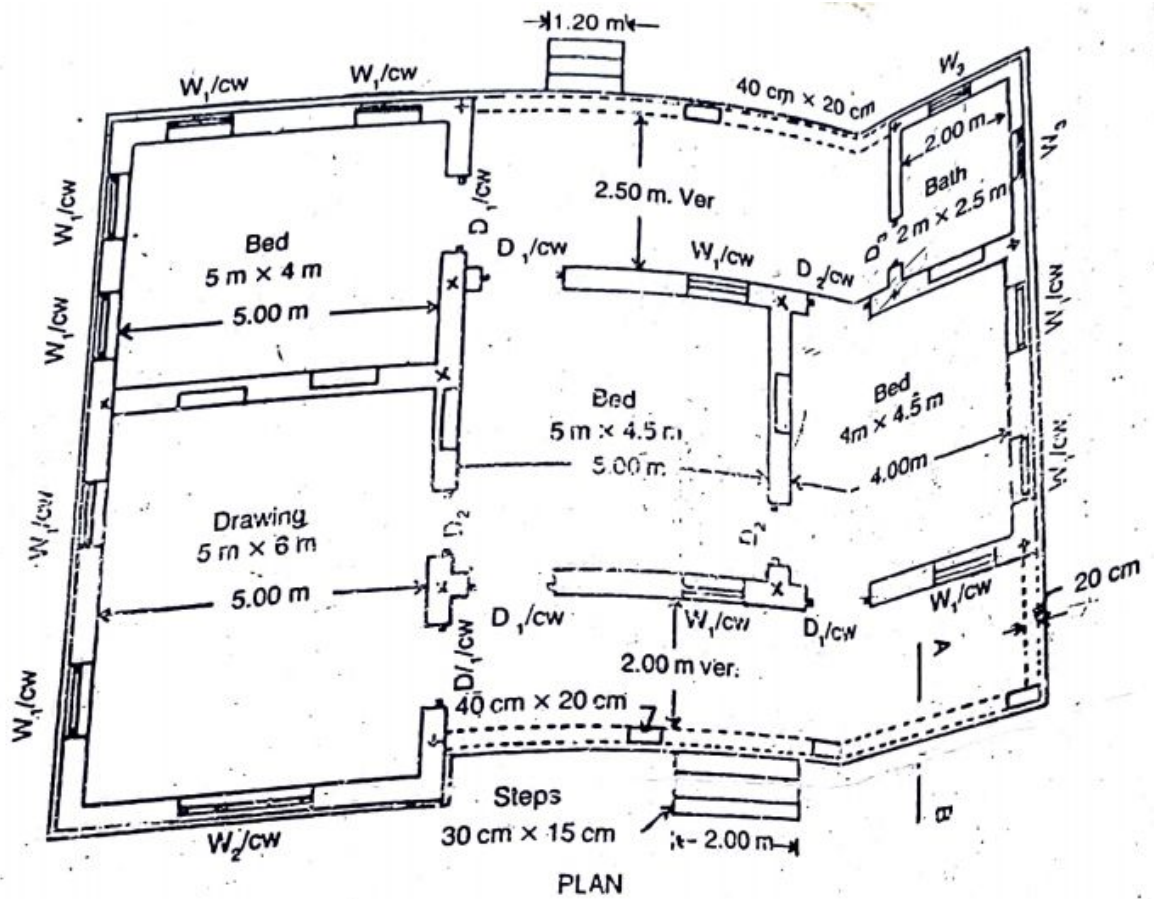
$$= 3.30 \text{ m}$$

M. 3

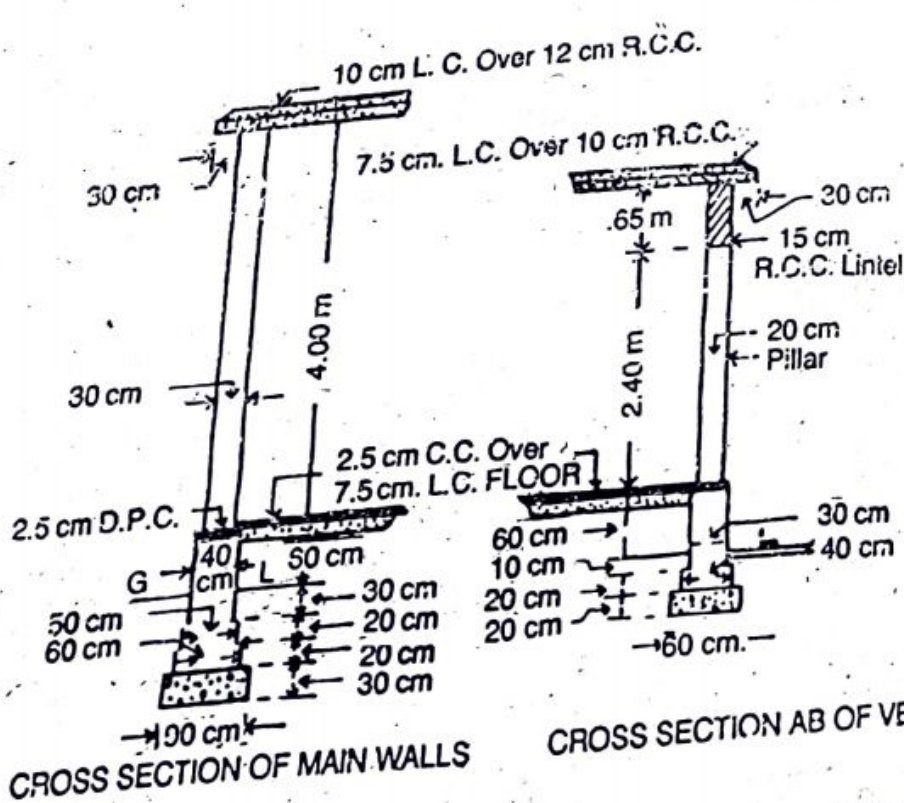


$$\begin{aligned} \text{C/c Long wall} &= 4 + 6 + 2\left(\frac{0.3}{2}\right) + 0.3 \\ &= 10.6\text{m} \end{aligned}$$

$$\begin{aligned} \text{C/c Short wall} &= 6 + 2\left(\frac{0.3}{2}\right) \\ &= 6.30\text{m} . \end{aligned}$$



PLAN



- Doors:-
 $D_1 - 120 \text{ cm} \times 210 \text{ cm} (1.20 \text{ m} \times 2.10 \text{ m})$
 $D_2 - 100 \text{ cm} \times 200 \text{ cm} (1.00 \text{ m} \times 2.00 \text{ m})$
 $D_3 - 75 \text{ cm} \times 180 \text{ cm} (.75 \text{ m} \times 1.80 \text{ m})$
- Windows:-
 $W_1 - 100 \text{ cm} \times 150 \text{ cm} (1.00 \text{ m} \times 1.50 \text{ m})$
 $W_2 - 200 \text{ cm} \times 150 \text{ cm} (2.00 \text{ m} \times 1.50 \text{ m})$
 $W_3 - 75 \text{ cm} \times 120 \text{ cm} (.75 \text{ m} \times 1.20 \text{ m})$
 $C.W. - 75 \text{ cm} \times 60 \text{ cm} (.75 \text{ m} \times .60 \text{ m})$
- Shelves:-
 $S - 100 \text{ cm} \times 150 \text{ cm} (1.00 \text{ m} \times 1.50 \text{ m})$
 Lintel Over Doors, Windows Etc.
 15 cm R.B.

All walls of Drawing Rooms and Bed Rooms have same section
 Note—No beam has been shown in the plan.

Bath Room walls have similar section.

Fig. 2-7

Estimate the quantities of the following items of a residential building from the given drawings

- ① Earthwork in excavation in foundation
- ② Lime concrete in foundation.
- ③ First class brickwork in 1:6 Cement sand mortar in foundation and plinth
- ④ 2.5cm Damp proof course, and
- ⑤ First class brickwork in lime mortar in superstructure.

3- Drawing and left hand side bed room combined:-

$$\begin{aligned} \text{C.to.C. Long walls} &= 6 + 4 + 0.3 + 2 \times \frac{0.3}{2} \\ &= 10.60 \text{ m} \end{aligned}$$

$$\text{C.to.C. Short walls} = 5 + 2 \times \frac{0.3}{2} = 5.30$$

Bed room right side (both combined)

$$\begin{aligned} \text{C.to.C. Long wall} &= 5 + 4 + 0.3 + 2 \times \frac{0.3}{2} \\ &= 9.60 \text{ m.} \end{aligned}$$

$$\text{C.to.C. short wall} = 4.5 + 2 \times \frac{0.3}{2} = 4.80$$

Front verandah:-

$$\begin{aligned} \text{Front wall c.to.c. length} &= 5 + 4 + 2 \times 0.3 + \frac{0.3}{2} - \frac{0.2}{2} \\ &= 9.65 \text{ m.} \end{aligned}$$

$$\begin{aligned} \text{Side wall c.to.c. length} &= 2 + \frac{0.3}{2} + \frac{0.2}{2} \\ &= 2.25 \text{ m.} \end{aligned}$$

Back verandah including bath room -

$$\begin{aligned} \text{c. to c. long wall} &= 5 + 4 + 2 \times 0.3 + \frac{0.3}{2} - \frac{0.2}{2} \\ 5 + 4 + 0.3 + \frac{0.3}{2} + 0.1 + \frac{0.2}{2} &= 9.65 \text{ m.} \end{aligned}$$

$$\begin{aligned} \text{c. to c. length of side wall of bath} \\ \text{room.} &= 2.5 + \frac{0.3}{2} + \frac{0.2}{2} = 2.75 \text{ m.} \end{aligned}$$

Item No.	Particulars of Items	No.	L	B	H	Quantity	Remarks
1	Formwork in excavation in foundation	1					
	Drawing room & left bed room						
	Long walls	2	11.5	0.9	1.0	20.70 cu m	$L = 10.6 + 0.9 = 11.5$
	Short walls	3	4.4	0.9	1.0	11.88 cu m	$L = 5.3 - 0.9 = 4.4$
	Bed rooms right side (both)						
	Long walls	2	9.6	0.9	1.0	17.28 cu m	$L = 9.6 - \frac{0.9}{2} + \frac{0.9}{2}$
	Short walls	3	3.9	0.9	1.0	7.02	$= 9.6$ $L = 4.8 - 0.9 = 3.9$
	Front verandah						
	Front long wall	1	9.65	0.6	0.5	2.85	$L = 9.65 - \frac{0.9}{2} + \frac{0.9}{2} = 9.6$
	side short wall	1	2.25	0.6	0.5	0.45	$L = 2.25 - \frac{0.9}{2} + \frac{0.9}{2} = 2.25$
	Back verandah including bath room						
	Long wall (rear wall including bath)	1	9.50	0.6	0.5	2.85	$L = 9.65 - \frac{0.9}{2} + \frac{0.6}{2} = 9.5$
	short walls (rearranging walls of bath)	2	2.00	0.6	0.5	1.20	$L = 2.75 - \frac{0.9}{2} - \frac{0.6}{2} = 2.1$
						Total = 64.23 cu m	

2.

Lime concrete in foundation - Drawing and left bed room

Long walls
Short walls

Bedroom right side (both) -

Long walls
Short walls

Front verandah

Front long wall

Side short wall

Back verandah, including bath room

Long wall including bath

Short wall (remaining walls of bath)

2	11.50	0.9	0.3	6.24	$L = 10.60 + 0.9 = 11.50 \text{ m}$
3	4.40	0.9	0.3	3.56	$L = 5.30 - 0.9 = 4.40 \text{ m}$
2	9.60m	0.9 m	0.3	5.18	$L = 9.6 - 0.9 + \frac{0.9}{2} = 9.6 \text{ m}$
2	3.90m	0.9 m	0.3	2.11	$L = 4.8 - 0.9 = 3.9 \text{ m}$
1	9.7m	0.6m	0.2	1.16	$L = 9.65 - \frac{0.5}{2} + \frac{0.6}{2} = 9.7$
1	1.8 m	0.6m	0.2	0.20	$L = 2.25 - \frac{0.5}{2} - \frac{0.6}{2} = 1.7 \text{ m}$
1	9.7	0.6	0.2	1.16	$L = 9.65 - \frac{0.5}{2} + \frac{0.6}{2} = 9.7 \text{ m}$
2	2.2	0.6	0.2	0.53	$L = 2.75 - \frac{0.5}{2} - \frac{0.6}{2} = 2.2 \text{ m}$
Total				20.11	

3	1st class brick work in foundation and plinth in 1:6 cement mortar	2	11.20	0.6	0.2	2.69	$L = 10.6 + 0.6 = 11.20\text{ m}$
	Drawing and left bed room Long walls -	2	11.10	0.5	0.2	2.22	$L = 10.60 + 2 \times 0.5 = 11.10\text{ m}$
	1st footing	2	11.00	0.4	0.9	7.92	$L = 10.6 + 0.4 = 11.00\text{ m}$
	2nd footing						
	Plinth wall above footing						
	Short walls -						
	1st footing	3	4.7	0.6	0.2	1.69	$L = 5.30 - 0.6 = 4.70$
	2nd footing	3	4.8	0.5	0.2	1.44	$L = 5.30 - 0.5 = 4.80$
	Plinth wall above footing	3	4.9	0.4	0.9	5.29	$L = 5.30 - 0.4 = 4.90\text{ m}$
	Bed rooms right side (both)						
	Long walls -						
	1st footing	2	9.6	0.6	0.2	2.51	$L = 9.60 - \frac{0.6}{2} + \frac{0.6}{2} = 9.6\text{ m}$
	2nd footing	2	9.6	0.5	0.2	1.92	$L = 9.6 - \frac{0.5}{2} + \frac{0.5}{2} = 9.6\text{ m}$
	Plinth wall above footing	2	9.6	0.4	0.9	6.91	$L = 9.6 - 0.4 + \frac{0.4}{2} = 9.6\text{ m}$

Short walls -
 1st footing
 2nd footing
 Plinth wall above footing
 Front verandah
 Front wall -
 Footing
 Plinth wall above footing
 Side short wall footing
 Plinth wall above footing

2
2
2

1
1
1
1

4.2
4.3
4.4

9.65
9.60
1.85
1.9

0.6
0.5
0.4

0.4
0.3
0.4
0.3

0.2
0.2
0.9

0.2
0.7
0.2
0.7

1.01
0.86
3.17

0.77
2.02
0.15
0.40

$$L = 4.8 - 0.6 = 4.2$$

$$L = 4.8 - 0.5 = 4.3$$

$$L = 4.8 - 0.4 = 4.4$$

$$L = 9.65 - \frac{0.4}{2} + \frac{0.4}{2} = 9.6$$

$$L = 9.65 - \frac{0.4}{2} + \frac{0.3}{2} = 9.60$$

$$L = 2.25 - \frac{0.4}{2} - \frac{0.4}{2} = 1.85$$

$$L = 2.25 - \frac{0.4}{2} - \frac{0.3}{2} = 1.90$$

Back verandah including bath room - Long wall - Footing	1	9.65	0.4	0.2	0.77	$L = 9.65 - \frac{0.4}{2} + \frac{0.4}{2} = 9.65$ $L = 9.65 - \frac{0.4}{2} + \frac{0.3}{2} = 9.60$
Plinth wall above footing	1	9.60	0.3	0.7	2.02	
Short walls (remaining walls of bath)	2	2.35	0.4	0.2	0.38	$L = 2.75 - \frac{0.4}{2} - \frac{0.4}{2} = 2.35$ $L = 2.75 - \frac{0.4}{2} - \frac{0.3}{2} = 2.40$
Footing	2	2.40	0.3	0.7	1.01	
Plinth wall above footing				total =	44.95 cum	
4 2.5 cm Damp proof Course	2	11.00	0.4	-	8.80	$L = 10.6 + 0.4 = 11.00$
Drawing and left bed rooms - Long walls	3	4.90	0.4	-	5.88	$L = 5.3 - 0.4 = 4.9$
Short walls						

Bed rooms innerside.

Long walls

Short walls

Verandah Pillars

Bathroom

Rear wall

side and inter walls

Deduct :-

Door sills D₁

Door sills D₂

Door sills D₃

2	9.6	0.4	—	7.68	$L = 9.6 - \frac{0.4}{2} + \frac{0.4}{2} = 9.6$ $L = 4.2 + 2 \times 0.5 = 4.3$ 5 cm extra on all sides
2	4.4	0.4	—	3.52	
4	0.5	0.3	—	0.60	
1	2.5	0.3	—	0.75	
2	2.4	0.3	—	1.44	
			Total	28.67	sqm
6	1.20	0.4	—	2.88	
2	1.00	0.4	—	0.80	
1	0.25	0.3	—	0.23	
			Total deduction	3.91	sqm
			Net Total	24.76	

5 1st class brick work in superstructure in brick mortar - Drawing's & left bed room -

Long walls
Short walls

Bed room right side

Long walls
Short walls

Front verandah
Front wall as solid
side wall as solid

Back verandah
including bath room!

2	10.90	0.3	4.00	26.16	$L = 10.6 + 0.3 = 10.90 \text{ m}$
3	5.00	0.3	4.00	18.00	$L = 5.30 - 0.3 = 5.00 \text{ m}$
2	9.6	0.3	4.00	23.04	$L = 9.6 - \frac{0.3}{2} + \frac{0.3}{2} = 9.6$
2	4.5	0.3	4.00	10.80	$L = 4.8 - 0.3 = 4.5$
1	9.6	0.2	3.05	5.86	$L = 9.65 - \frac{0.3}{2} + \frac{0.2}{2} = 9.1$
1	2.0	0.2	3.05	1.22	

Back long wall as
as solid.
side and inter
walls of bath

Deduct -

Door openings

D. openings D₁

D. openings D₂

D. openings D₃

Window openings

W. opening W₁

W. opening W₂

W. opening W₃

Cherestory window

(C.W.) opening

Shelves opening

1	9.6	0.2	3.05	5.86
2	2.5	0.2	3.05	3.05
Total				93.99 cum
6	1.2	0.3	2.1	4.54
2	1.00	0.3	2.00	1.20
1	0.75	0.2	1.80	0.27
11	1.00	0.3	1.50	4.95
1	2.00	0.3	1.50	0.90
2	0.75	0.2	1.20	0.36
18	0.75	0.3	0.60	2.43
5	1.00	0.2	1.50	1.50

$$L = 9.65 - \frac{0.3}{2} + \frac{0.2}{2} = 9.6m$$

area of shelves

Front verandah opening between pillars	1	8.40	0.2	2.40	4.03	$L = 9.6 - 3 \times 0.4 = 8.4m$
Front verandah opening side	1	2.00	0.2	2.40	0.96	
Back verandah opening side	1	6.80	0.2	2.40	3.26	$L = 9.6 - 2.40 - 0.4 = 6.80$
Lintels - over doors						
D. doors D ₁	6	1.50	0.2	0.15	0.405	Bearing 15cm
D. doors D ₂	2	1.30	0.3	0.15	0.117	Bearing 15cm
D. doors D ₃	1	0.95	0.2	0.15	0.029	Bearing 15cm
Over windows						
W. windows W ₁	11	1.30	0.3	0.15	0.644	Bearing 15cm
W. windows W ₂	1	2.30	0.3	0.15	0.103	Bearing 15cm
D. windows W ₃ over C.W.	2	0.95	0.2	0.15	0.057	Bearing 10cm
Over shelves	18	0.95	0.3	0.15	0.770	Bearing 10cm
Verandah lintels	5	1.30	0.3	0.15	0.293	Bearing 15cm
Front side	1	9.75	0.2	0.15	0.293	$L = 9.6 + 0.15 = 9.75$
Back	1	2.15	0.2	0.15	0.065	$L = 2.00 + 0.15 = 2.15$
	1	7.50	0.2	0.15	0.225	$L = 9.6 - 2.40 + 2 \times 0.15 = 7.5$
Total				de deduction	27.401 cm	
				net total	66.59 cm	

Schedule of rate or Analytical rate

It is a booklet which contains the following

- (i) Rate of material
- (ii) Royalty
- (iii) Transportation or conveyance
- (iv) Wages of labourers
- (v) Rate of different items
- (vi) ~~Rate~~ Inflation

Analysis of rate

It is a booklet which contains the following

- (i) The quantity of different items
- (ii) Quantity of different materials
- (iii) Different category of labour involve in the work
- (iv) Water charges (1 1/2 %)
- (v) Tools and plans work charge establishment
- (vi) Contractors profit (10 - 15%)

What do you mean by task or outturn

The capacity of doing work by a skilled labourer in the form of work per day is known as task or outturn of that labour.

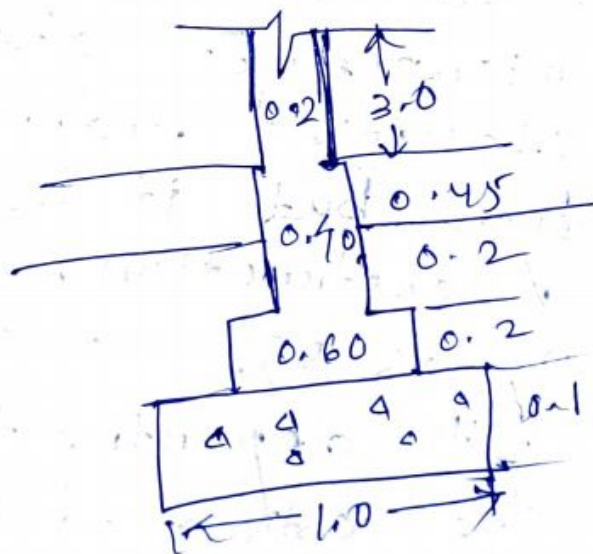
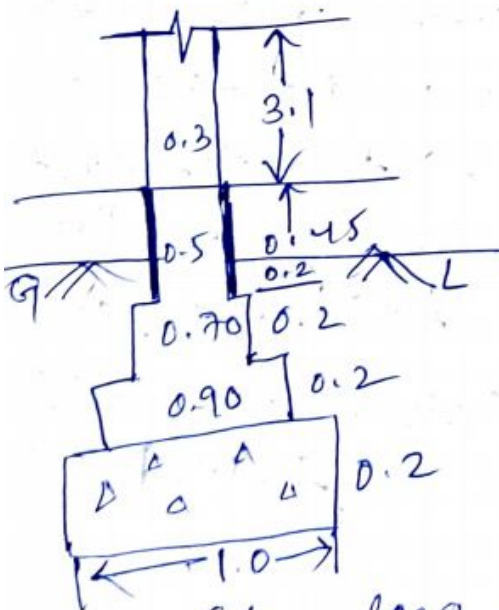
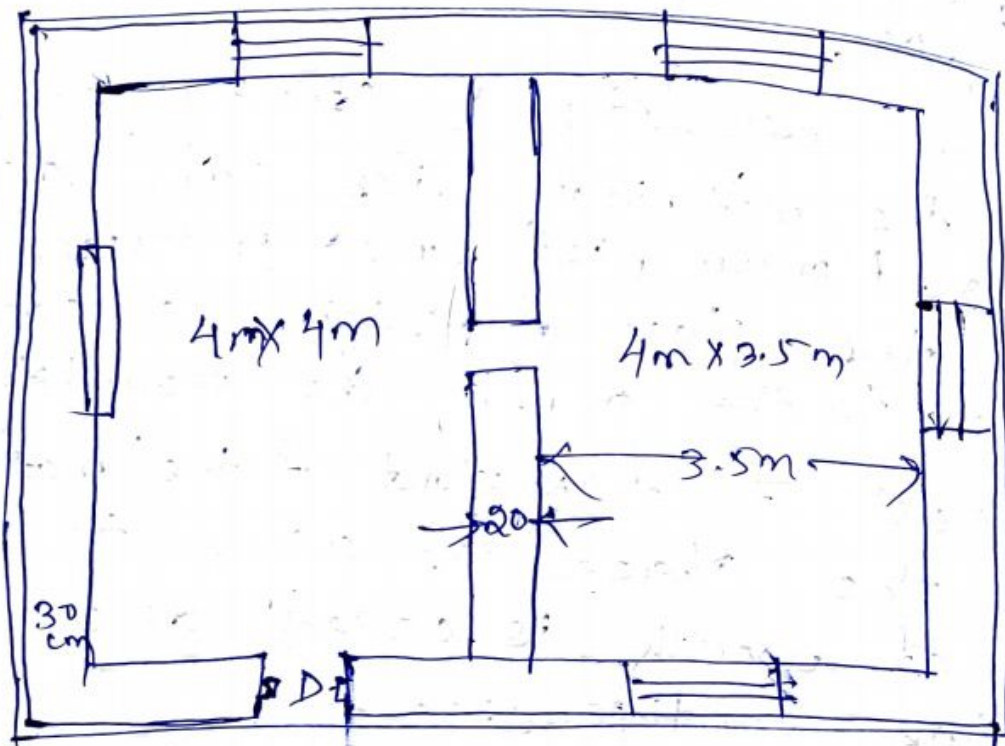
The outturn may varies up to extent according to the nature, size of work situation, location etc.

→ What is the minimum lead and lift?
For the calculation of earthwork in a road or building or balast work in railway, the quantity is estimated in the form of lead & lift.
A length of 30m. is called as lead. A depth of 1.5m is called as lift.

→ Define Royalty & conveyance.
When the materials, like sand, aggregate stones, Morcum, soil are procured from the place of origin, a cost is given to the owner as royalty.
The cost of transport of the material from the place of origin to the site of work is called as conveyance.

→ Define contingencies + ? =
It is defined as incidental expenses of miscellaneous character which can't be classified under any particular surveyor but it added to the cost of construction. It is generally taken as 5% of the estimated cost in P.W.D department, Odisha and 3% of the estimated cost C.P.W.D, Odisha.

- ① Earthwork in excavation
- ② Lime concrete in foundation
- ③ 2nd class brick masonry (1:6) in foundation
- ④ 2.5 cm thick DPC (cement concrete (1:2))
- ⑤ 1st class brick masonry (1:3) cement mortar in superstructure.



C/c long wall = $0.15 + 4 + 0.2 + 3.5 + 0.15 = 8$

C/c short wall = $4 + 2 \times \frac{0.3}{2} = 4.3$

Sl. No.	Description or Item Name	No	L	B	H	Quantity	Remark
1	Earthwork in excavation in foundation 30 cm wall Long wall Short wall	2	9	1.0	0.8		$L = 8 + \frac{2 \times 1.0}{2} = 9$
		2	3.3	1.0	0.8		$L = 4.3 - \frac{2 \times 1.0}{2} = 3.3$
		1	3.3	1.0	0.5		$L = 4.3 - \frac{2 \times 1.0}{2} = 3.3$
2	Lime concrete in foundation 30 cm wall Long wall Short wall 20 cm wall Short wall	2	9	1.0	0.2		
		2	3.3	1.0	0.2		
		1	3.3	1.0	0.1		

3

2nd class brickwork
masonry 1:6 in foundation
Long wall

1st footing
2nd footing
3rd footing with plinth
Short wall

1st footing
2nd footing
3rd footing with plinth
20 cm wall

Short wall
1st footing
2nd footing
3rd footing with plinth

$$L = 8 + 0.9 = 8.9$$

$$L = 8 + 0.7 = 8.7$$

$$L = 8 + 0.5 = 8.5$$

$$L = 4.3 - 0.9 = 3.4$$

$$L = 4.3 - 0.7 = 3.6$$

$$L = 4.3 - 0.5 = 3.8$$

$$L = 4.3 - 0.9 = 3.4$$

$$L = 4.3 - 0.7 = 3.6$$

2 8.9 0.9 0.2
2 8.7 0.7 0.2
2 8.5 0.5 0.65

2 3.4 0.9 0.2
2 3.6 0.7 0.2
2 3.8 0.5 0.65

1 3.4 0.6 0.2
1 3.6 0.4 0.2

4	DPC	<u>30cm</u>															
		Long wall	2	8.5	0.5	-	-	-	8.5								$L = 8 + 0.5 = 8.5$
		short wall	2	3.8	0.5	-	-	-	3.8								$L = 4.3 - 0.5 = 3.8$
		<u>20cm</u>															
		short wall	1	3.9	0.4	-	-	-	1.56								$L = 4.3 - 0.4 = 3.9$
		<u>Deduct</u>															
		Door	2	1.2	0.3	-	-	-	0.92								
										Total	3.1						
										Total	3.1						$L = 8 + 0.3 = 8.3$
											3.0						$L = 4.3 - 0.3 = 4.0$
																	$L = 4.3 - 0.2 = 4.1$

5 1st class brickwork in super structure 20cm wall

Long wall

short wall

20cm wall

short wall

Deduct

Door

30cm wall

20cm wall

Window

Cobbort

Lintel

Door (1)

Door (2)

Window

Cobbort

4

1

1

1

4

1.1

1.5

1.5

1.5

1.4

0.3

0.2

0.3

0.2

0.3

1.3

1.2

0.1

0.1

0.1

$$L = 1.2 + 0.15 + 0.15 \\ = 1.5$$

* What is work charge ?

During the construction of a ^{big} ~~work~~ work or big project of a building or a road, no of skilled supervisor, maulsi, Choukidar etc are employed to help the existing staff & they are called as work charge establishment. For their salary & amount of 2% is provided based on estimated cost.

* What is the meaning of ~~tools~~ tools plants & sundries (T, P & sundries)

T & P are known as tools & plants.

For the smooth execution of the work there is provision for the head of the masonries from the out side. The masonaries are concrete mixture,

Vibrator, roller, transporting pan etc.

It is taken as 2% estimated cost are provided.

Sundries is defined as the provision which is made to meet the cost of tools & plants.

Analysis of rates

The determination of rate per unit of a particular item, of work, is the cost of quantity of material, cost of labour and other miscellaneous ~~expansion~~ ^{work} required for its completion is known as analysis of rates.

A reasonable profit usually 10% for the contractor is also included in the analysis of rates.

Rate of Labour

- ① Head mason
- ② Mason
- ③ Mazdoor
- ④ Coolie
- ⑤ Bhisti (watermen)

- ① Unskilled
- ② skilled
- ③ semiskilled
- ④ High skilled

Administrative approval ~~are~~ ~~are~~ ~~are~~

For any work or project required by a department an approval or sanction of the competent authority of the department. The approval authority is the engineering department to take off the work. Arithmetic approvals denote the formal acceptance by the department concerned of the proposal and after the administrative approval is given the engineering department to take off the work and execute the work.

Estimate the quantity of the following item

- ① Earthwork in excavation in foundation
- ② Lime concrete in foundation
- ③ 1st class brickwork in foundation in plinth.
- ④ Damp proof course
- ⑤ 1st class brick work in superstructure including parapet.
- ⑥ RCC work in roofwork sunset, lintel.
- ⑦ Steel Reinforcement bar in RCC work.

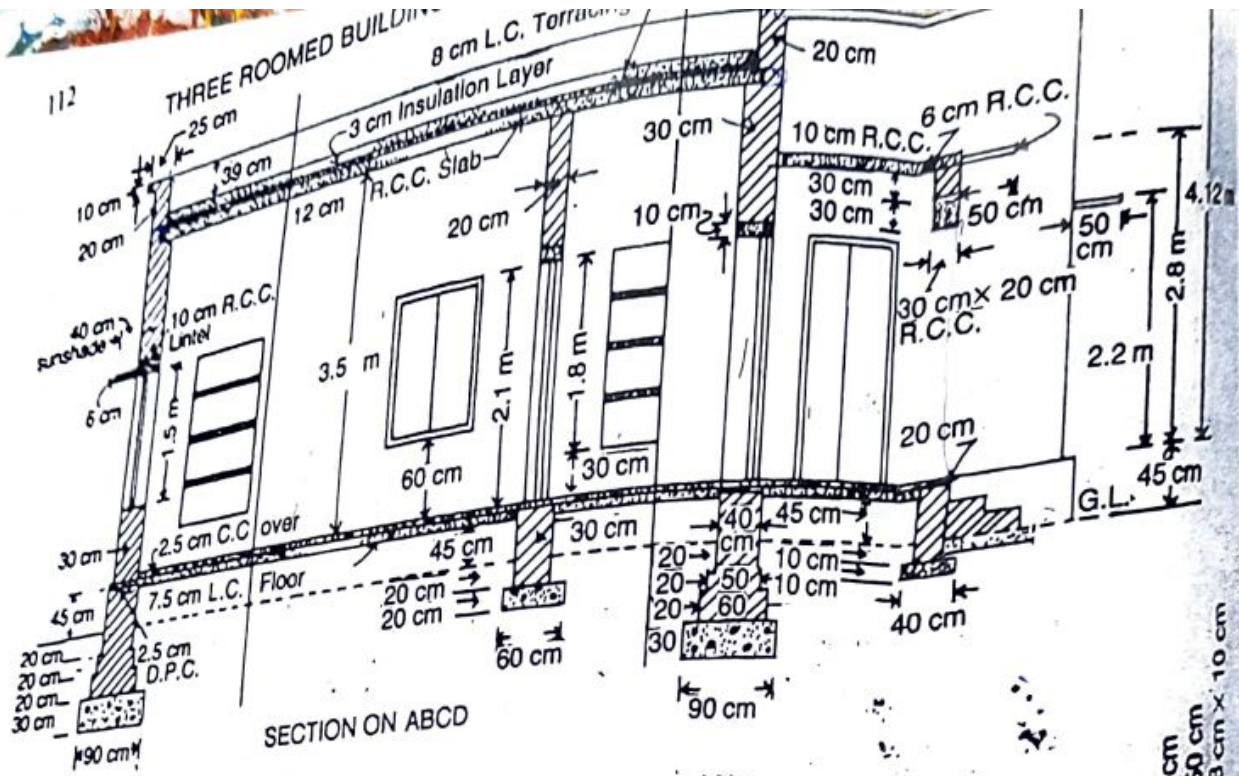
c/c long wall for top two rooms

$$= 4.5 + 4.2 + 0.2 + 2 \times \frac{(0.3)}{2}$$
$$= 9.2$$

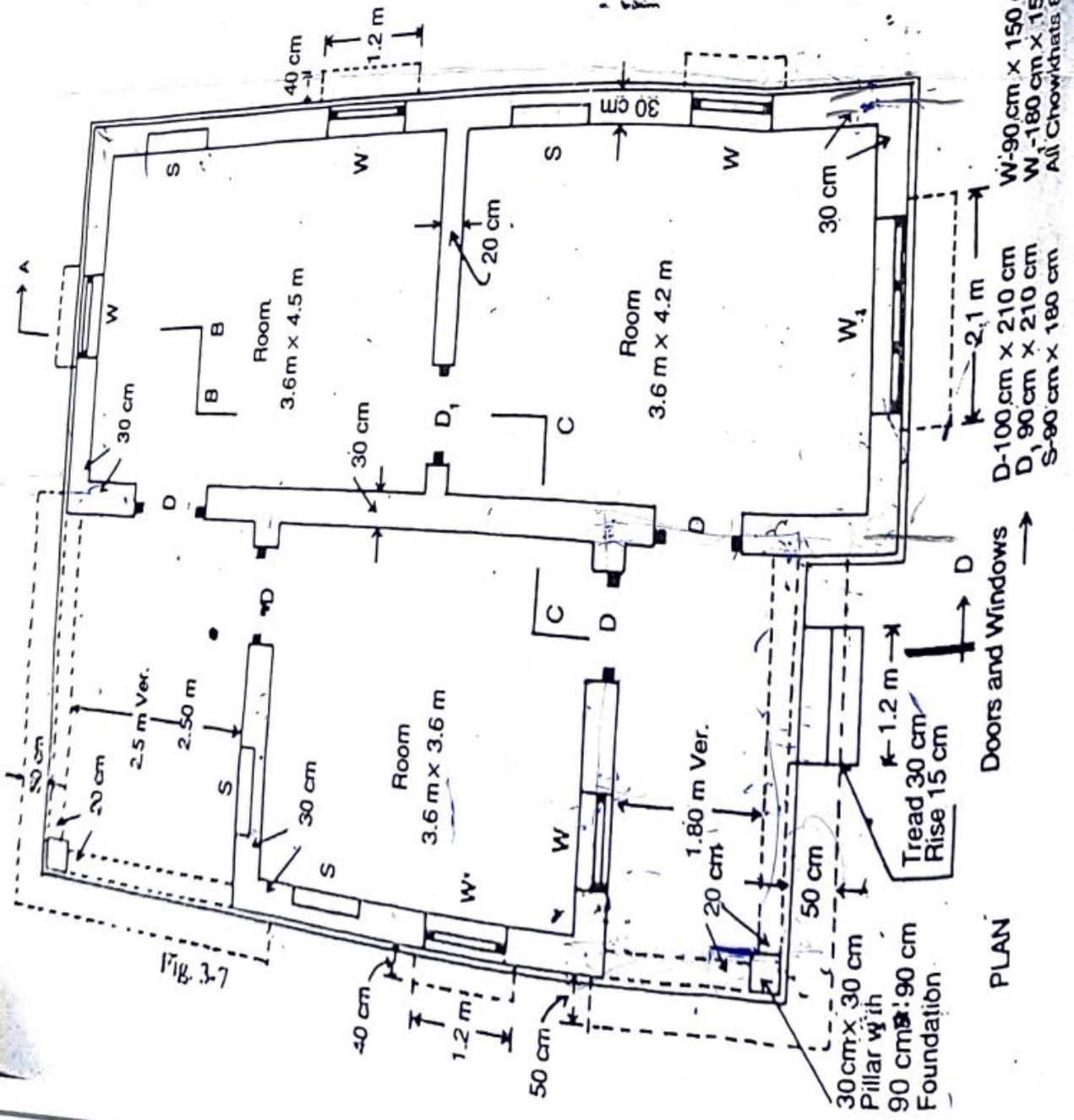
Short wall = $3.6 + 2 \left(\frac{0.3}{2} \right)$

$$= 3.9$$

THREE ROOMED BUILDING



SECTION ON ABCD



Doors and Windows

PLAN

- W-90 cm x 150 cm
- W₁-180 cm x 150 cm
- All Chowkhats, 8 cm x 10 cm
- D-100 cm x 210 cm
- D₁-90 cm x 210 cm
- S-90 cm x 180 cm

Fig. 3-7

Square room -

$$C/c \text{ Long wall} = 3.6 + 2\left(\frac{0.3}{2}\right) = 3.9$$

$$C/c \text{ Short wall} = 3.6 + 2\left(\frac{0.3}{2}\right) = 3.9$$

Front verandah -

$$\text{Long wall} = \overset{3.6}{\cancel{3.6}} + \frac{0.2}{2} + \frac{0.3}{2} + \frac{(0.3 - 0.2)}{2} = 3.95$$

$$\text{Short wall} = 1.8 + \frac{0.3}{2} + \frac{0.2}{2} = 2.05$$

Back verandah -

$$\text{Long wall} = 3.6 + \frac{(0.3 - 0.2)}{2} + \frac{0.3}{2} + \frac{0.2}{2}$$

$$= 3.95$$

$$\text{Short wall} = 2.5 + \frac{0.3}{2} + \frac{0.2}{2}$$

$$= 2.5 + 0.15 + 0.1$$

$$= 2.75$$

Item No.	Description on Item Name	No	L	B	H	Quantity	Remarks
1	Earthwork in excavation in foundation						
	two rooms combined						
	Long walls	2	10.1	0.9	0.9	16.362	$L = 9.2 + 0.9 = 10.1$
	Short walls	2	3.0	0.9	0.9	4.86	$L = 3.9 - 0.9 = 3.0$
	Inter 20cm wall square rooms	1	3.0	0.9	0.4	0.72	$L = 3.9 - 0.9 = 3.0$
	Long walls	1	4.8	0.9	0.9	3.888	$L = 3.9 + 0.9 = 4.8$
	Short walls	2	3.0	0.9	0.9	4.86	$L = 3.9 - 0.9 = 3.0$
	Verandah pillars	2	0.9	0.9	0.9	1.458	
	Front Long wall	2	3.05	0.4	0.2	0.488	
	Short wall	1	1.15	0.4	0.2	0.092	$L = 3.95 - \frac{0.9 + 0.9}{2} = 3.05$
	front verandah	1	1.85	0.4	0.2	0.148	$L = \frac{2.05 - 0.9}{2} = 0.05$
	back verandah	1	1.2	0.7	0.15	0.126	$L = 2.05 - 0.9 = 1.15$
	Step						$L = 2.75 - 0.9 = 1.85$
					Total	633.002	

2 Lime concrete in foundation
 two combined rooms
 Long wall
 Short wall
 Inter room wall
 Square room
 Long wall
 Short wall
 verandah pillars
 front long wall
 short wall
 front verandah
 back verandah
 step.

2	10.1	0.9	0.3	5.454	$L = 9.2 + 0.9 = 10.1$
2	3.0	0.9	0.3	1.62	$L = 3.9 - 0.9 = 3.0$
1	3.4	0.6	0.2	0.408	$L = 3.9 - 0.5 = 3.4$
1	4.8	0.9	0.3	1.296	$L = 3.9 + 0.9 = 4.8$
2	3.0	0.9	0.3	1.62	$L = 3.9 - 0.9 = 3.0$
2	0.9	0.9	0.3	0.486	$L = 3.9 - 0.9 = 3.0$
2	3.55	0.4	0.1	0.284	$L = 3.95 - 0.4 = 3.55$
1	1.65	0.4	0.1	0.066	$L = 2.05 - 0.4 = 1.65$
1	2.35	0.4	0.1	0.094	$L = 2.75 - 0.4 = 2.35$
1	1.2	0.7	0.1	0.084	
total =				11.412	

3

1st class brickwork in lime mortar in foundation & plinth combined rooms Long walls :-
 1st footing
 2nd footing
 3rd footing with plinth
 short walls :-
 1st footing
 2nd footing
 3rd footing with plinth
 Outer 20cm wall
 plinth wall

$$L = 9.2 + 0.6 = 9.8$$

$$L = 9.2 + 0.5 = 9.7$$

$$L = 9.2 + 0.4 = 9.6$$

$$L = 3.9 - 0.6 = 3.3$$

$$L = 3.9 - 0.5 = 3.4$$

$$L = 3.9 - 0.4 = 3.5$$

2	9.8	0.6	0.2	2.352	$L = 9.2 + 0.6 = 9.8$
2	9.7	0.5	0.2	1.94	$L = 9.2 + 0.5 = 9.7$
2	9.6	0.4	0.65	4.992	$L = 9.2 + 0.4 = 9.6$
2	3.3	0.6	0.2	0.792	$L = 3.9 - 0.6 = 3.3$
2	3.4	0.5	0.2	0.68	$L = 3.9 - 0.5 = 3.4$
2	3.5	0.4	0.65	1.82	$L = 3.9 - 0.4 = 3.5$
1	9.5	0.3	0.65	0.68	

Square room in bet ⁿ verandah	1	4.5	0.6	0.2	0.54	$L = 3.9 + 0.6 = 4.5$
Long wall	1	4.4	0.5	0.2	0.44	$L = 3.9 + 0.5 = 4.4$
1st footing	1	4.3	0.4	0.65	1.12	$L = 3.9 + 0.4 = 4.3$
2nd footing with plinth						
3rd footing with plinth						
Short wall	2	3.3	0.6	0.2	0.792	$L = 3.9 - 0.6 = 3.3$
1st footing	2	3.4	0.5	0.2	0.68	$L = 3.9 - 0.5 = 3.4$
2nd footing	2	3.5	0.4	0.65	1.82	$L = 3.9 - 0.4 = 3.5$
3rd footing with plinth						
Verandah pillars	1					
1st footing	2	0.6	0.6	0.2	0.144	
2nd footing	2	0.5	0.5	0.2	0.1	
3rd footing with plinth	2	0.4	0.4	0.65	0.208	
Verandah dwarf walls -						
Long walls front & back	2	3.55	0.2	0.55	0.781	$L = 3.9 - 0.4 = 3.5$
Short side wall (front)	1	1.65	0.2	0.55	0.181	$L = 3.9 - 0.5 = 3.4$
Short side wall (back)	1	2.35	0.2	0.55	0.5	$L = 3.9 - 0.4 = 3.5$

Step	1st step	2nd step										
4	2.5cm damp proof course - combined rooms											
	Long walls	1.2	0.6	0.15	0.108							
	Short walls	1.2	0.3	0.15	0.054							
	Inter 20cm wall			Total	20.482							
	Square room											
	Long wall	2	9.6	-	7.68							$L = 9.2 + 0.4 = 9.6$
	Short wall	2	3.5	-	2.8							$L = 3.9 - 0.4 = 3.5$
	Verandah pillars	1	3.5	-	1.05							$L = 3.9 - 0.4 = 3.5$
		1	4.3	-	1.92							$L = 3.9 + 0.4 = 4.3$
		2	3.5	-	2.8							$L = 3.9 - 0.4 = 3.5$
		2	0.4	-	0.32							
	Deduct Door sills			Total	16.37							
	D	4	1.00	-	1.6							
	D	1	0.9	-	0.27							

1st class brickwork in 1:1:6 cement mortar in super structure

Combined room -

long wall
short wall

Inter 20 cm wall

Square room
long wall
short wall

verandah
pillars

Verandah
long wall (front & back)

short wall (front)

short wall (Back)

Parapet combined rooms

long wall

short wall

2	9.5	0.3	3.5	19.95	$L = 9.2 + 0.3 = 9.5$
2	3.6	0.3	3.5	7.56	$L = 3.9 - 0.3 = 3.6$
1	3.6	0.2	3.5	2.52	$L = 3.9 - 0.3 = 3.6$
1	4.2	0.3	3.5	4.41	$L = 3.9 + 0.3 = 4.2$
2	3.6	0.3	3.5	7.56	$L = 3.9 - 0.3 = 3.6$
2	0.3	0.3	2.8	0.504	
2	3.65	0.2	0.3	0.438	$L = 3.95 - 0.3 = 3.65$
1	1.75	0.2	0.3	0.105	$L = 2.05 - 0.3 = 1.75$
1	2.45	0.2	0.3	0.147	$L = 2.75 - 0.3 = 2.45$
1	9.5	0.2	0.5	0.95	ht of parapet
2	4.0	0.2	0.5	0.8	$0.39 + 0.08 + 0.03 = 0.50$

front verandah side
 back verandah side
 square room outer wall

walls in betⁿ verandah & room

Deduction -

Door openings D

D₁

windows openings W

W₁

1	2.5	0.2	0.5	0.24	$L = 9.5(4.2 + 2.7) = 2.4$
1	2.5	0.2	0.3	0.25	$L = 3.9 + 0.3 = 4.2$
1	4.2	0.2	0.5	0.42	$L = 3.9 + 0.3 = 4.2$
2	3.9	0.2	0.5	0.78	$L = 3.9 + 0.3 = 4.2$
4	1.00	0.30	2.10	2.52	$L = 3.6 + 0.3 = 3.9$
1	0.90	0.20	2.10	0.378	
5	0.90	0.30	1.5	2.025	
1	1.8	0.3	1.5	0.8	
				46.634	

Shelves
 Lintels over doors $D \times D_1$
 Lintels over windows w_1
 Lintels over shelves S

4	0.90	0.2	1.8	1.296	0.15 bearing either side. $L = 1 + 0.15 + 0.15$ $= 1.3$ $L = 0.9 + 0.3 = 1.2$ $L = 1.8 + 0.3 = 2.1$ $L = 0.9 + 0.3 = 1.2$
4	1:3	0.3	0.10	0.156	
1	1.2	0.2	0.10	0.024	
5	1.2	0.3	0.10	0.18	
1	2.1	0.3	0.10	0.063	
4	1.2	0.2	0.10	0.096	
Total deduction =				7.548	
				46.634	
				7.548	
Total =				39.086	
4.2	3.9	0.12		41.006	

6: RCC work in roof work
 excluding lintel (1:2:4)
 including steel and its
 bending including centring
 and shuttering and binding steel.
 Roof slab - Combined roof -

Square room

Verandah front

Verandah back

Verandah chajja front & back

Long

Side (front)

Side (back)

Sunshades over

window W

w₁

Lintel over doors D

D₁

Lintels over window w

w₁

Shelves S

1	3.9	0.12	1.8
1	2.15	0.10	0.84
1	2.85	0.10	1.154
2	0.5	0.06	0.273
1	0.5	0.06	0.085
1	0.5	0.06	0.085
4	0.4	0.06	0.115
1	0.4	0.06	0.085
4	0.3	0.1	0.156
1	0.2	0.1	0.024
5	0.3	0.1	0.18
1	0.3	0.1	0.036
4	0.2	0.1	0.096
4	0.2	0.1	0.044

$$3.6 + 0.1 + 0.18 + 0.1 = 3.95$$

$$3.6 + 0.15 + 0.1 + 0.2 + 0.5 = 4.55$$

$$L = 1 + 0.15 + 0.15 = 1.3$$

$$L = 0.9 + 0.3 = 1.2$$

verandah lintels
 front and back
 long
 side (front)
 side (back)

steel reinforcement
 bars including
 bending at 5%

	2	1	1				bearing bars
	4.1	2.0	2.7	0.2	0.3	0.492	L = 3.6 + 0.2
				0.2	0.3	0.12	+ 0.22
				0.2	0.3	0.162	= 4.1
						10.02	L = 1.8 + 0.2
						10.02	+ 0.15
						10.02	= 2.15
						Cum.	

10.021 \times $\frac{1}{100}$ = 0.10021

@ 78.5 g/cum

= 0.10021 \times 78.5

= 7.87

7.87 \times 100 = 787

Dry material calculations for different items -

① Cement concrete -

It has been observed that 10 cum of wet concrete = 15.2 cum dry concrete
 For example,

M₁₅ concrete amount of cement (1:2:4)

$$= \frac{15.2}{1+2+4} = 2.17 \text{ cum.}$$

$$0.035 \text{ cum} = 1 \text{ bag of cement/50kg}$$

$$2.17 \text{ cum} = \frac{2.17}{0.035} = 62 \text{ bags cement.}$$

ii) Amount of sand = 2×2.17

$$= 4.34 \text{ cum}$$

iii) Amount of coarse agg = 4×2.17
 $= 8.68$

Q) Find out the quantity of dry material for 46.8 cum of concrete in foundation (1:3:6)₁₀

$$\frac{15.2}{1+3+6} = 1.52$$

$$1.52 \times 46.8 = 71.14$$

$$0.035 \text{ cum}$$

$$1.52 \text{ cum} =$$

~~$$\frac{46.8}{1+3+6} = 5.1$$~~

~~$$5.1 \times 46.8 = 239.28 \text{ cum}$$~~

$$\frac{71.14}{0.035} = 2032.57$$

$$10 \text{ cum wet} = 15.2 \text{ dry}$$

$$10 \text{ cum wet} \frac{15.2}{1+3+6} = 1.52 \text{ cum}$$

(157)

$$16.8 \text{ cum} = 1.52 \times 4.6 \times 8 = 71.14 \text{ cum}$$

Amount of cement

$$\text{No. of bags} = \frac{71.14}{1+3+6} = 7.114 \text{ cum}$$

$$0.035 \text{ cum} = 1 \text{ bag of cement}$$

$$7.114 \text{ cum} = \frac{7.114}{0.035} = 203.25$$

(i) Amount of sand = 2×7.114
 $= 14.228$

(ii) Amount of Agg = 4×7.114
 $= 28.456$

(3) Brick masonry (1:4)
10 cum brick masonry of (1:4) mortar
 1 cum of brick masonry contains 500 nos. of bricks.
 10 cum of brick masonry contains 5000 nos. of bricks.

Normal size of brick = $(19 \times 9 \times 9) \text{ cm}$
 volume of 5000 bricks will be $= 5000 \times 0.19 \times 0.09 \times 0.09$
 $= 7.695 \text{ cum}$
 $= 7.70 \text{ cum}$

\therefore so volume of wet mortar = $10 - 7.70 \text{ cum}$
 $= 2.30 \text{ cum}$

Adding 15% extra for filling of the frog & wastage. so that

So that volume of ^{wet} ~~wet~~ mortar
 $= 2.3 * 15\% = 2.3$

$$= 2.645 \text{ cum} = 2.65 \text{ cum}$$

To get the total volume of dry mortar and we will add 25% extra of the volume of dry mortar

$$= 2.65 + 25\% \text{ of } 2.65$$

$$= 3.31 \text{ cum} = 3.32 \text{ cum}$$

$$\text{Amount of cement} = \frac{3.32}{1+4} = 0.66 \text{ cum}$$

$$0.66 \text{ cum} = \frac{0.66}{0.035} = 18.8 = 19 \text{ bags}$$

$$\text{Amount of sand} = 4 \times 0.66 = 2.64 \text{ cum}$$

Q) Find out the quantity of dry material for 33.8 cum of brick masonry in foundation using (1:5) cement concrete.

$$1 \text{ cum} = 500 \text{ No. of bricks}$$

$$33.8 \text{ cum} = 500 \times 33.8 = 16900$$

Volume of ~~33.8 cum~~ ¹⁶⁹⁰⁰ bricks

$$= 16900 \times 0.19 \times 0.09 \times 0.09$$

$$= 26 \text{ cum}$$

$$\text{volume of wet mortar} = 33.8 - 26 = 7.8 \text{ cum}$$

So Adding 15% extra for filling the frog & wastage.

So that volume of weight mortar

$$= 7.8 + 15\% \cdot 7.8$$

$$= 8.97 \text{ cum.}$$

To get the total volume of dry mortar and we will add 25% extra of the volume of dry mortar

$$= 8.97 + 25\% \cdot 8.97$$

$$= 11.21 \text{ cum.}$$

$$\text{Amount of cement} = \frac{11.21}{1+5} = 1.87 \text{ cum.}$$

$$1.87 \text{ cum} = \frac{1.87}{0.035} = 53.43$$

$$= 54 \text{ bags.}$$

$$\text{Amount of sand} = 5 \times 1.87 = 9.35 \text{ cum.}$$

③ PCC in flooring - (1:2:4) :-

2.5 cm of PCC of 100 sqm

$$\text{volume of cement concrete} = \frac{2.5}{100} \times 100$$

$$= 2.5 \text{ cum.}$$

10% extra will be added for filling the unevenness of base concrete.

So total volume of wet concrete

$$= 2.5 + 10\% \cdot 2.5 = 2.75 \text{ cum.}$$

To get the volume of dry concrete
we 50% extra.

$$\begin{aligned} \therefore \text{total volume of dry concrete} \\ &= 2.75 + 50\% 2.75 \\ &= 4.125 \text{ cu m.} \end{aligned}$$

$$\begin{aligned} \text{① Amount of cement} &= \frac{4.125}{1+2+4} \\ &= 0.589 \text{ cum} \end{aligned}$$

$$\begin{aligned} 0.589 \text{ cum} &= \frac{0.589}{0.035} = 16.82 \\ &= 17 \text{ bags.} \end{aligned}$$

$$\begin{aligned} \text{② Amount of sand} &= 0.589 \times 2 \\ &= 1.18 \text{ cu m.} \end{aligned}$$

$$\text{③ Amount of Agg.} = 0.589 \times 4 = 2.36 \text{ cum.}$$

Q) Find out the amount of dry material
having flooring ~~203~~ ⁸ cm thickness
153.30 sq m. area the concrete used
in (1:1½:3).

$$\begin{aligned} \text{Ans - volume of cement concrete} \\ &= \frac{3}{100} \times 153.30 \\ &= 4.6 \text{ cum.} \end{aligned}$$

10% extra will be added for filling

so total

$$= 4.6 + 10\% \cdot 4.6 = 5.06 \text{ cum.}$$

To get the volume of dry concrete
are 50% extra,

$$\text{so total volume of dry concrete} \\ = 5.06 + 50\% \cdot 5.06$$

$$= 7.6 \text{ cum.}$$

$$\text{① Amount of cement} = \frac{7.6}{1+1.5+3}$$

$$= 1.38 \text{ cum.}$$

$$1.38 \text{ cum} = \frac{1.38}{0.035} = 39.43 \\ = 40 \text{ bags.}$$

$$\text{② Amount of sand} = 1.38 \times 1.5 \\ = 2.07 \text{ cum.}$$

$$\text{③ Amount of Agg} = 1.38 \times 3 = 4.14 \text{ cum.}$$

④ Dry material calculation for
plastering.

12 mm thick cement plastering of
1:4 ratio,

$$\text{Amount of } \begin{matrix} 100 \text{ sqm} \\ \text{wet mortar} \end{matrix} \\ = \frac{12}{1000} \times 100 = 1.2 \text{ cum}$$

30% ^{or 20%} extra will be added to fill the joints in bricks and wastage

$$\begin{aligned} \text{So the volume of wet mortar} \\ &= 1.2 + 30\% \text{ of } 1.2 \\ &= 1.56 \text{ cum.} \end{aligned}$$

To get the total volume of dry mortar 25% extra will be added

$$\begin{aligned} \text{So total volume of dry mortar} \\ &= 1.56 + 25\% \text{ of } 1.56 \\ &= 1.95 \text{ cum.} \end{aligned}$$

$$\begin{aligned} \text{① Amount of cement} &= \frac{1.95}{1+4} \\ &= 0.39 \text{ cum.} \end{aligned}$$

$$\begin{aligned} 0.39 \text{ cum} &= \frac{0.39}{0.035} = 11.14 \\ &= 12 \text{ bags.} \end{aligned}$$

$$\begin{aligned} \text{Amount of sand} &= 0.39 \times 4 \\ &= 1.56 \text{ cum.} \end{aligned}$$

→ Find out the quantity of dry material for 140.5 sqm of plastering of 12 mm thickness in a building (1:5) preparation.

Dry material calculation for masonry.

A random rubble masonry (10 cum)

(a) The volume of R.R masonry = 12.5 cum

(b) Volume of dry mortar = 5 cum.

(B) Coarsed rubble masonry (10 cum)

(a) Volume of coarsed rubble masonry = 12.5

(b) Volume of dry mortar = 4.20 cum.

(C) For Ashlar masonry (10 cum)

(a) Volume of Ashlar masonry = 12.5 cum.

(b) Volume of dry mortar = 2.5 cum.

Q) Find out the quantity of dry materials for a random rubble stone masonry work having volume 37 cum. in mortar 1:6 proportion.

Ans- For 10 cum random rubble masonry

The volume of R.R = 12.5 cum.

So for 1 cum = $\frac{12.5}{10} = 1.25$ cum.

for 37 cum = $37 \times 1.25 = 46.25$ cum.

Volume of R.R.

For 10 cum R.R masonry the volume of dry mortar = 5 cum.

$$\text{for } 1 \text{ cum} = \frac{5}{10} = 0.5 \text{ cum.}$$

$$\text{for } 37 \text{ cum} = 37 \times 0.5 = 18.5 \text{ cum.}$$

$$\text{Amount of cement} = \frac{18.5}{1+6} = 2.64 \text{ cum.}$$

$$2.64 \text{ cum} = \frac{2.64}{0.035} = 75.43 \\ = 76 \text{ bags.}$$

$$\text{Amount of sand} = 2.64 \times 6 = 15.84 \text{ cum.}$$

Lead & Lift

A 300 m length is called as 10 unit of lead.
A depth of 3m is called as 2 unit of lift.

But for large works a different lead & lift are taken.

① If the lift is 3.6 m, then lead is lift ~~at~~ $\times 10$.

② If the lift is 3.6-6 m then lead = $\frac{(\text{lift})^2}{3.6} \times 3.25$

③ If the lift is greater than 60m. then lead = lift $\times 20$.

Q) For a given road work in cutting and filling as shown in figure find out the corresponding lead.



$$\text{lift depth} = \frac{1.5 + 1.2}{2} = \frac{2.7}{2} = 1.35 \text{ m}$$

$$\text{lead} = 1.35 \times 10 = 13.5 \text{ m}$$

Duty of overseers -

The overseers are directly in charge of works.

They are to look after the execution and management of all works in their section and they are required to do all works connecting with stores, accounts and the execution of work. In general the duty of overseers may be classified under 3 heads:

- (i) Works
- (ii) Store
- (iii) Accounts

Duty of overseers on works —

The overseers is in immediate and direct charge of all ~~work~~^{work} in each section.

He has to supervise and to execute all works according to the specification, departmental procedure & the rules instructions etc.

The overseers has to prepare estimate for maintenance & repair work.

Overseer has to take proper step for the preservation of all government building. The overseers has to make 'immediate report to the nearest police station as well as to the assistant engineer & Executive Engineer giving the particular of ~~the~~ incident.

Duty of overseers regarding stores

The overseer is entirely responsible for all stock and tools and plans in his charge. He has to maintain the accounts of stock and tools and plans correctly upto ~~date~~ date. The overseer has to see the materials and

articles are properly stacked and store in such a way that there is no possibility of any damage or loss.

Duty of overseen regarding accounts.

Accounts & documents which the overseen has to maintain should be kept correctly. The overseen has to keep day to day accounts of receipts and issue of stock materials and tools & plans in prescribed form. And he has to prepare monthly, half-yearly & yearly registers and return to submit them in due time.

Though overseen has to maintain accounts of expenditure of all work in his charge and has to keep check on the expenditure, so that the section land allotment succeed.

→ Analyse ^{with} ~~different materials~~ the rate of Material & Labour.

- Material
- (i) 1000 bricks = 2900/- 1 brick = 2.90/-
 - (ii) 1 cum of sand = 60/- or 3000/-
 - (iii) 1 cum of coarse aggregate/chips = 1130/-
 - (iv) 1 bag of cement = 250/-
 - (v) 1 quintal of steel rod = 5400/-

Labour

- (i) Head Mason - 430/day
 - (ii) Mason - 370/day
 - (iii) Mazdoor - 320/day
 - Unskilled - 280/-
 - Semi skilled - 320/-
 - Skilled - 370/-
 - Highly skilled - 430/-
 - (iv) Coolie - 280/-
 - (v) Bhisti - 280/-
- } As per PWD Department Code 2019.

- Analyse the rate of following items with suitable rate of materials in labour as per Odisha PWD rule.

- 1) 1st class brickwork in Cement mortar (1:6) in foundation & ~~beam~~ ^{Plinth} with standard bricks.
- 2) 12 mm thick plastering in 1:4 in cement mortar. Assume standard volume 100 cum
- 3) RCC work for 30cm with 1:2:4 in roof slab.

Ans-
10 cum brick masonry contains 5000
of bricks.

10 cum of brick masonry contains
of bricks.
 $= 500 \times 10 = 5000$

Normal size of brick = $(19 \times 9 \times 9)$ cm

Volume of 5000 brick will be
 $= 5000 \times 19 \times 0.09 \times 0.09$
 $= 7.695 \text{ cum}$
 $= 7.7 \text{ cum}$

\therefore So volume of wet mortar
 $= 10 - 7.70 = 2.30 \text{ cum}$

Adding 15% extra for filling of the frog
& wastage.

So the volume of wet mortar

$$= 2.3 + 15\% \text{ of } 2.3$$

$$= 2.645 \text{ cum}$$

$$= 2.65 \text{ cum.}$$

To get the total volume of dry
mortar, and we will add 25% extra
of the volume of dry mortar.

$$= 2.65 + 25\% \text{ of } 2.65$$

$$= 3.31 \text{ cum} = 3.32 \text{ cum.}$$

Amount of cement = $\frac{3.32}{1+6} = 0.47 \text{ cum.}$

$$0.47 \text{ cum} = \frac{0.47}{0.035} = 13.43 \text{ bag} = 14 \text{ bags}$$

Amount of sand = $0.47 \times 6 = 2.82 \text{ cum}$
 nos Bricks = 5000

<u>Material</u>	<u>Quantity</u>	<u>Cost</u>	<u>Rate</u>
Bricks	5000 nos.	3000/-	$3000 \times 5 = 15000$
cement	14 bags	250/-	3500/-
sand	2.82 cum	60/-	169.2/-

<u>Labour</u>	<u>Quantity</u>	<u>Cost</u>	<u>Rate</u>
Head mason	$\frac{1}{2}$	430/-	215/-
Mason	7	370/-	2590/-
Mazdoor	7	320/-	2240/-
Cookie	7	280/-	1960/-
Bhisti	2	280/-	560/-
Total of material & labour			= 26234.2/-

Add 1.5% or 1 1/2% water charges
 $26234.2 + 1.5\% \text{ of } 26234.2$
 $= 26627.7$

~~1% Tools & plants~~
 ~~$26234.2 + 1\% \text{ of } 26234.2$~~
~~=~~

~~4% of establishment of~~

10% Contractors profit
 $= 26234.2 + 10\% \text{ of } 26234.2$

Grand Total = ~~30169.33~~ 28857.6

Total Cost = $26234.2 + 26627.7 + 28857.6 = 81719.5$

<u>Labour</u>	<u>Quantity</u>	<u>Cost</u>	<u>Rate</u>
Head mason	$\frac{1}{2}$	430/-	215/-
mason	10	370/-	3700/-
mazdoor	15	320/-	4800/-
coolBhisti	1	280/-	280

Total of materials & Labour = 12088.6

Add 1.5% water charges

$$= 12088.6 + 1.5\% \text{ of } 12088.6$$

$$= 12269.93/-$$

10% contractors profit

$$= 12088.6 + 10\% \text{ of } 12088.6$$

$$= 13297.46/-$$

Grand total cost

$$= 12088.6 + 12269.93 + 13297.46$$

$$= 37655.99/-$$

$$= 37656/-$$

③ RCC work for 30 cum with 1:2:4 roof slab.

2.5 cm RCC of 30 cum volume
cement concrete = $\frac{2.5}{100} \times 30 = 0.75$

10% extra will be added for fill the unevenness of base concrete
So, volume of wet concrete = $0.75 + 10\%$

To get the volume of dry concrete = 0.825
are 15% extra

So, total volume of dry concrete
= $0.825 + 15\% \text{ of } 0.825$
= 0.95

1) Amount of cement = $\frac{0.95}{1+2+4} = \frac{0.95}{7}$

$0.135 \text{ cum} = \frac{0.135}{0.035} = 3.8 = 4 \text{ bags}$
= 0.135 cum

2) Amount of sand = $0.135 \times 2 = 0.27 \text{ cum}$

3) Amount of Aggregate = $0.135 \times 4 = 0.54 \text{ cum}$

<u>Material</u>	<u>Quantity</u>	<u>cost</u>	<u>rate</u>
cement	4 bags	250/-	1000
Sand	0.27 cum	250 60/-	16.2
Aggregate	0.54 cum	1130/-	610.2

<u>Labour</u>	<u>Quantity</u>	<u>Cost</u>	<u>Rate</u>
Head mason	$\frac{1}{2}$	430/-	215/-
Mason	2	370/-	740/-
Mazdoor	12	320/-	3840/-
Bhisti	6	280/-	1680/-
coolie	20	280/-	5600/-

Total of materials & Labour = 12075/-

Add 1.5% water charges

$$= 12075 + 1.5\% \text{ of } 12075$$

$$= 12256.125/-$$

10% contractors profit

$$= 12256.125 + 10\% \text{ of } 12256.125$$

$$= 13282.5/-$$

Grand total cost

$$= 12075 + 12256.125 + 13282.5$$

$$= 37613.625/-$$

$$= 37614/-$$

Duty & responsibility of officers of PWD department -

① Chief engineer -

- The chief engineer is the administrative and professional head of a department.
- There may be one & more chief engineers in one department and in that case ~~the~~ ^{per} chief engineer submits annually ~~the~~ ^{per} person of the budget estimate relating to the works, under each government.
- The chief engineer will ~~be~~ accord administrative approval for works for the government. ~~A~~
- He will give technical sanction for works value beyond the power ~~the~~ of superintendent engineer.
- He will sanction the purchase of materials, tool & plants and live stock articles beyond the power of a superintendent engineer in connection with works according to the

rules and already administering the sanction by the government and also ~~formed~~ fund is placed for ~~research~~ the same.

② Superintending engineer -

It is the duty of the superintending engineer to check up items and rates of the estimate of works submitted by his executive engineer before forwarding the same to his chief engineer.

→ He should give technical sanction to estimates within his powers.

→ He should invite tender for works sanction administratively as well as technically and fund is placed against the work.

→ He should inspect the divisional office at least once a year and record the results of such inspection in the prescribed form.

→ The superintending engineer is required to make ~~visit~~ in his duty ~~visit~~ during which tour and the measurements are properly recorded and the

per check the measurements
in percentage as per rule.

③ Divisional Officer of Execution

→ The executive unit of the department in the division and engineer in charge is the executive engineer who is responsible through the superintending engineer for efficient execution & management of all works within his division. → It is the duty

of the executive engineer to prepare estimate of proposed works through its subordinates and submit the same to his superintending engineer.

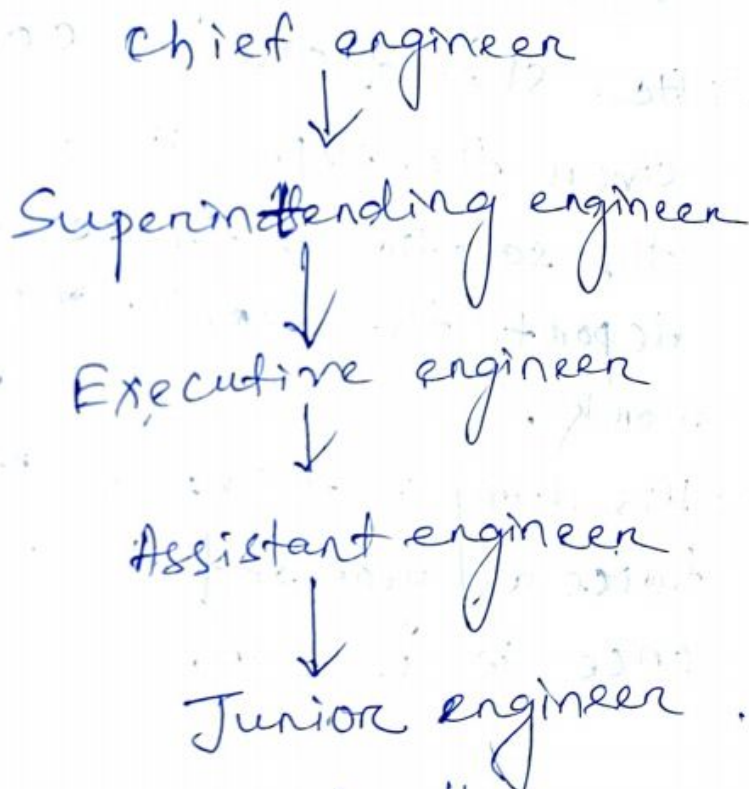
→ It is his duty to invite tender for works value within his power after it has administratively approved and technically sanctioned and fund is placed for its execution.

→ His duty is to prevent encroachment on the government land under his division.

→ He should submit monthly accounts after examining the books, ^{written} ~~written~~ and papers from which the same are compiled.

→ It is his duty to see ~~that~~ that the accounts are posted from day to day that the accountant carries out his duty regularly & punctually.

④ Assistant engineer, & SDO -



→ He is responsible for the management and efficient execution of works with jurisdiction.

→ His duty is to maintain the initial account records of cash and tools under incharge.

- > He should see that initial records of the measurement books, the muster roll are written up neatly in order to avoid all doubts about its authenticity.
- > His duty is to check a certain percentage of measurement recorded in measurement book by his junior engineer.
- > He should give a controlled over the expenditure against the sanction estimate and to report the monthly progress of work.
- > His duty is to check stores at least twice a year and tools & plants once in a year.

Regular establishment

Both permanent & temporary employees of the department are included in the regular establishment. Their salary and allowances are drawn monthly or regularly in bills from the ~~treasury~~ treasury in a prescribed form: that is the detailed pay bill.

The payment to each is made after taking receipt on the pay bill.

Acquittance roll -

The payment of salary to person of regular establishment for working out station is drawn on the regular pay bill for the payment is made on a separately sheet, or is known as acquittance roll.

→ The acquittance roll is a receipt in evidence of payment in a prescribed form having ~~two~~ ^{five} columns as:-

Sl No.	Name, Designation, Next amount pay	and Date	Signature
--------	------------------------------------	----------	-----------

The acquittance roll is prepared for the total amount as per establishment bill and passed by the drawing officer.

Work charge establishment

The work charge establishments are the employees who are employed directly on the work for the actual execution of a specific work.

Usually they are work as supervisor, chowkidar, maters are employees of a work charge establishment.

They are paid in charge direct to the work for which provision is made in the estimate of the work adding 2 to 3% of the estimated amount of the work.

Contract

Contract is an undertaking by a person or firm to do any work under certain terms and conditions.

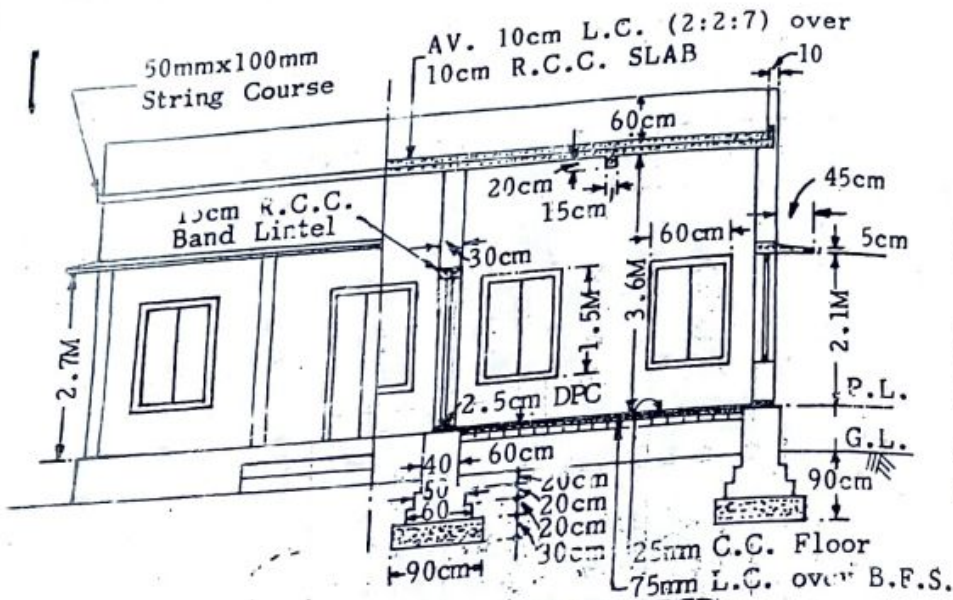
The work may be for the construction for maintenance or repair etc.

Contractor -

The term contractor means a person or a firm to ~~do any work~~ under takes any type of contract. usually this term is confined to the contractors ~~are~~ engaged for the construction or execution of work or ~~preparations~~.

Tender -

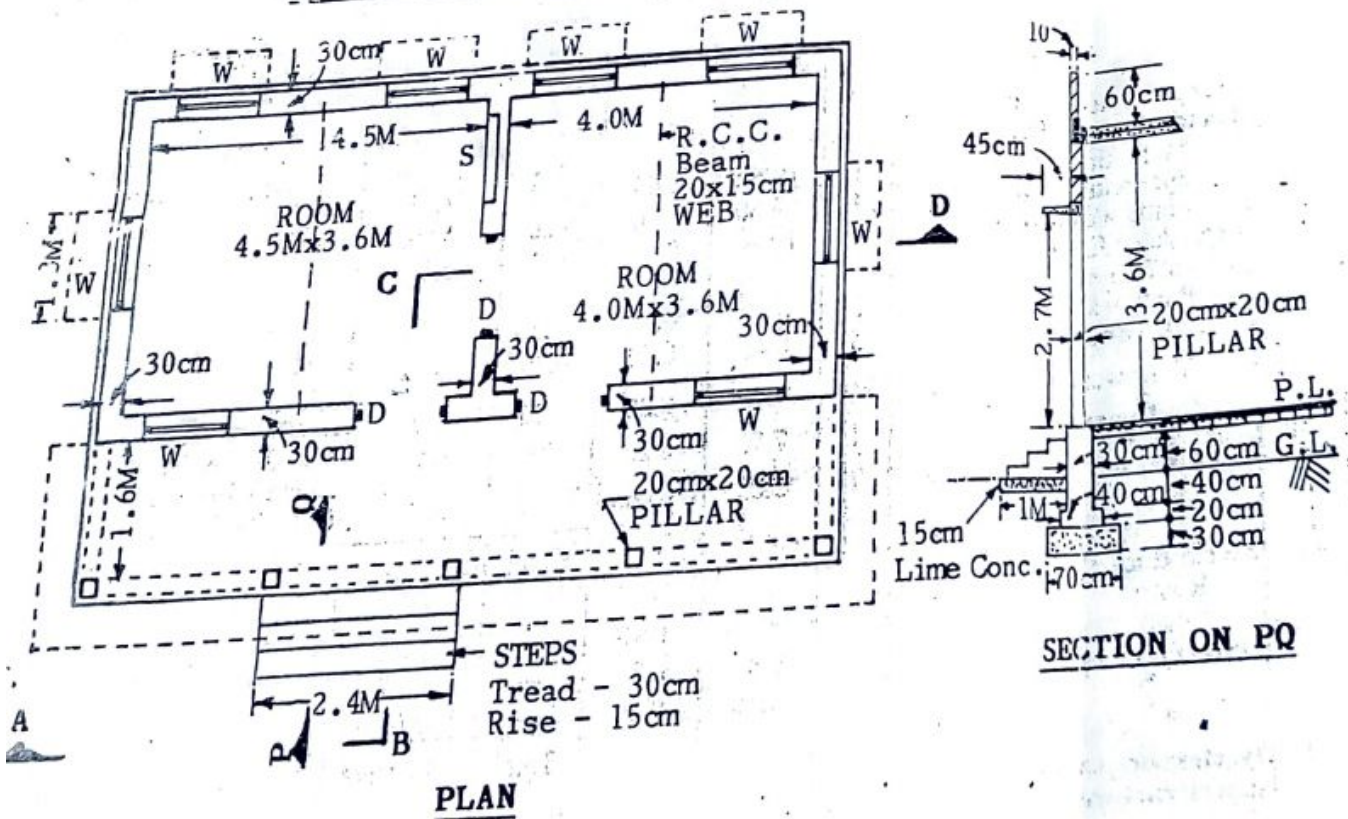
Tender is an offer in ^{the} writing to execute some specified work or to supply some specified articles at a certain rate ~~or~~ within a fixed time under certain condition of contract or agreement between the contractor ~~team~~ or department of owner.



Schedule

- DOOR :
D = 1.2M x 2.1M
FRAME = 10cm x 8.0cm
- WINDOW :
W = 1.1M x 1.5M
FRAME = 10cm x 8.0cm
- SHELF
S = 1.1M x 1.5M
20cm Deep

SECTIONAL ELEVATION ON ABCD



PLAN

SECTION ON PQ

FIG. 5-2

ESTIMATE

c/c longwall of two rooms

$$= 4.5 + 4.0 + 0.3 + 2 \times \left(\frac{0.3}{2}\right)$$

$$= 9.1 \text{ m.}$$

c/c short wall of two rooms

$$= 3.6 + 2 \times \left(\frac{0.3}{2}\right)$$

$$= 3.9 \text{ m.}$$

front verandah c/c long wall

$$= 4.5 + 4.0 + 0.3 + 2 \times (0.3 - 0.2) + 2 \times \frac{0.2}{2}$$

$$= 9.2 \text{ m.}$$

c/c short wall -

$$= 1.6 + \frac{0.3}{2} + \frac{0.2}{2}$$

$$= 1.85 \text{ m.}$$

Item | Descriptions & Item Name | No. | L | B | H | Quantity | Remark

Item No.	Descriptions & Item Name	No.	L	B	H	Quantity	Remark
1.	Earthwork in excavation in foundation two rooms - Long walls Short wall front verandah Long wall Short wall	2	10	0.9	0.9	16.2	$L = 9.1 + 0.9 = 10$
		3	3	0.9	0.9	7.29	$L = 3.9 - 0.9 = 3.0$
		1	10.9	0.9	0.9	8.18	$L = 9.2 + 0.7 = 9.9$
		2	1.05	0.9	0.9	1.54	$L = \frac{1.85 - 0.9 - 0.7}{2} = 1.05$
2	Lime concrete in foundation two rooms - Long walls - Short wall Front verandah - Long wall Short wall	2	10	0.9	0.3		$L = 10$
		3	3.0	0.9	0.3		$L = 3.0$
		1	9.9	0.7	0.3		$L = 9.9$
		2	1.05	0.7	0.3		$L = 1.05$

3 1st class brick work in line
mortar in foundation & plinth

two rooms

Long wall

1st footing
2nd footing

3rd footing with plinth

Short wall

1st footing
2nd footing

3rd footing with plinth

Electric front verandah

long wall

1st footing

2nd footing with plinth

Short wall - 1st footing

Plinth

Grid footing with Plinth
Plinth wall (Copper part)
D.P.C (1:2:4)

4 2.5 cm thick
Long wall

$L = 9.1 + 0.6 = 9.7$
 $L = 9.1 + 0.5 = 9.6$
 $L = 9.1 + 0.4 = 9.5$

$L = 3.9 - 0.6 = 3.3$
 $L = 3.9 - 0.5 = 3.4$
 $L = 3.9 - 0.4 = 3.5$

$L = 9.2 + 0.4 = 9.6$
 $L = 9.2 + 0.3 = 9.5$

$\frac{0.6 - 0.4}{2}$
 $L = 1.85 - 0.4 = 1.45$
 $L = 1.85 - 0.3 = 1.55$
 $L = 1.85 - 0.5 = 1.35$

$\frac{0.6 - 0.4}{2} = 0.1$
 $L = 9.1 + 0.3 = 9.4$
 $L = 3.9 - 0.3 = 3.6$

0.2

0.2

0.8

0.2

0.2

0.8

0.2

1.0

0.2

0.2

0.8

0.6

0.5

0.4

0.6

0.5

0.4

0.4

0.3

0.4

0.3

0.3

9.7

9.6

9.5

3.3

3.4

3.5

9.6

9.5

1.35

1.45

1.50

2

2

2

3

3

3

1

1

2

2

2

2

3

9.7

9.6

9.5

3.3

3.4

3.5

9.6

9.5

1.35

1.45

1.50

0.2

0.2

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0.3

9.7

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9.5

3.3

3.4

3.5

9.6

9.5

1.35

1.45

1.50

2

2

2

3

3

3

1

1

2

2

2

2

3

9.7

9.6

9.5

3.3

3.4

3.5

9.6

9.5

1.35

1.45

1.50

0.2

0.2

0.8

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0.4

0.3

0.3

9.7

9.6

9.5

3.3

3.4

3.5

9.6

9.5

1.35

1.45

1.50

4	<p>Plinth wall with Plinth. Plinth wall (upper part) 2.5 cm thick D.P.C (1:2:4)</p> <p>Long wall short wall</p> <p>Deduct door sills -</p> <p>1st class brick work (1:6) in superstructure walls</p> <p>Rooms, Long wall short wall</p> <p>verandah over lintels - Front, Long walls sides, short walls.</p> <p>Pillars</p> <p>Deduct - Door openings, D window opening W</p> <p>R.C band lintel for - main walls verandah serves opening</p>	<p>1.30 1.85 1.50</p> <p>0.7 4.3 0.3</p> <p>0.2 0.8 - - -</p> <p>9.4 3.6 1.2</p> <p>0.3 0.3 0.3 0.3</p> <p>2 2 3 3 1</p> <p>9.4 3.6 1.6 0.2</p> <p>0.2 0.2 0.2</p> <p>3.6 3.6 (3.6-2.7) 0.9 0.9 2.7</p> <p>0.3 0.3 0.2 0.2 0.2</p> <p>2 3 1 2 5 3 8 1 1 1</p> <p>2.1 1.5 0.15 0.15 0.15</p> <p>29.60 12.60 1.10</p>	<p>$L = 1.85 - \frac{0.2}{2} = 1.9$ $L = 1.85 - \frac{0.3}{2} = 1.95$ $L = 1.85 - \frac{0.5}{2} = 1.95$ $L = 9.1 + 0.3 = 9.4$ $L = 3.9 - 0.3 = 3.6$</p> <p>$L = 9.1 + 0.3 = 9.4$ $L = 3.9 - 0.3 = 3.6$</p> <p>$L = 9.2 + 0.2 = 9.4$ $L = \frac{1.85 - 0.3 - 0.2}{2} = 1.0$</p>
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6

12mm thick cement plastering on wall	Inside - Room 1	2	4.5	3.6	32.4			
	Longside	2	13.6	3.6	25.92			
	Shortside	2						
	Room 2 -							
	Longside	2	4.0	3.6	28.8			
	Short side	2	3.6	3.6	25.92			
	Self	1	5.2	3.6				
	Room 1							
	out side - Room 1	2	9.4	3.6	69.56			$5.2 = 2(1.1 + 1.5)$
	entire back - Long side	2	4.2	3.6	31.08			$L = 4.5 + 4 + 0.3$
	Short side	2	9.28	3.6	11.04			$+ 0.3 + 0.3$
	outside	2	9.4	3.6	6.96			$= 9.4$
	back	2	6	0.6	13.66			$L = 3.6 + 0.3 + 0.3$
	plastering	2	6	0.6	7.2			$= 4.2$
	parapet	1	9.0	0.9	8.1			$L = 3.6 + 0.2 + 0.2$
	Room side above opening -	1	9.4	0.9	8.46			$+ 1.6 + 0.2$
	verandah above opening -	2	1.6	0.9	2.88			$= 6.0$
	verandah side opening -	2	1.8	0.9	3.24			
	inter-							
	outer -							

2	1.8	-	0.9	3.24
5x4 = 20	0.2	-	2.7	10.8
			Total =	285.82
3	1.2	-	2.1	7.56
8	1.1	-	1.5	13.2
			Total Deductions	20.76
				285.82
				20.76
			Net total =	265.06

sqm

Pillars

Deduction of openings

Doors

Windows

Types of estimate -

The estimate can be classified into different category -

- (1) Preliminary estimate or rough estimate.
- (2) Plinth area estimate
- (3) Detailed estimate or item wise estimate.
- (4) Revised estimate
- (5) Supplementary estimate.

(1) Preliminary estimate -

It is an approximate estimate which is required for the preliminary study of various aspect of work and also to decide the financial position of the person.

In the preliminary estimate the residential building of similar type may be taken into account and in this type of estimate the practical knowledge may be taken into account.

The preliminary estimate can be prepared on the following basis -

- (i) No. of inhabitants, No. of rooms of similar residential building.
- (ii) No. of students for the school, college and hostel.
- (iii) No. of beds for a construction of a hospital.
- (iv) No. of sheets for the construction of cinema hall.

Plinth area estimate -

① This is prepared on the basis of a plinth area of a building. The plinth area estimate is calculated by finding out the plinth area of the building and multiplying by a standarded plinth area rate.

The plinth area rate is available from the local experienced contractors and this estimate is also an experimental estimate.

② Detailed estimate -

The detailed estimate is an accurate method of estimate which consists of finding out the quantity of each item of the work and its cost. The various dimensions Length, Breadth, thickness or height or depth of each item are taken out correctly from the given drawing & specification, the detailed estimate is prepared in two stage -

- ① Details of measurement
- ② Calculation of quantities.

Revised estimate -

Revised estimate is also a detailed estimate and which can be prepared under anyone of the following circumstances.

- ① When the original sanction estimate is exceeded by more than 5%.
- ② When the expenditure of the work is exceeded by 10% from the administrative sanction estimate.

(c) When there will be diversion of material cost from the original proposal estimate.

(d) The revised estimate should be accompanied by a comparative statement showing the variation of each item or work, its quantity, rate and cost under original and revised and the cause of variation.

⑤ Supplementary estimate -

The supplementary estimate which are prepared when the additional are required to be added during the progress of the work. And this is a fresh estimate of the additional work.

* DPC (Damp proof course)

The DPC is usually of plain cement concrete of 1:2:4 (m₁₅) or 1:1½:3 (m₂₀) the thickness of the DPC is generally 2 to 4 cm it is provided at the plinth level to the full width of the plinth wall. It is calculated in sqm.

The quantity of DPC = Length of the wall × square width of the plinth wall.

- The DPC is not provided at the bottom sill of the door and verandah opening for which deduction is made.

* RCC work in lintel, chajja & Roof slab

The RCC work is the combination of plain cement concrete and steel rod as reinforcement. The plain cement concrete is calculated in cum by multiplying its area and thickness (A_m). The volume of steel work is taken as 1 to 2% of the volume of concrete work.

The volume of steel should be converted into its corresponding weight that is

volume of steel in cum \times density of steel. The density of steel is 78.50 g/cum or 7850 kg/cum .
 * Find out the quantity of a concrete and steel for a roof slab $3\text{m} \times 4\text{m}$ by using 1% of steel. the thickness of the slab is 15cm .
 Area of roof slab = $3 \times 4 = 12 \text{ sqm}$.
 volume of roof slab = $12 \text{ sqm} \times 0.15 \text{ cm} = 1.8 \text{ cum}$.
 volume of steel = 1% of volume of concrete.
 $= 1.8 \times \frac{1}{100} = 0.018 \text{ cum}$.
 weight of steel = $0.018 \times 78.50 = 1.413 \text{ g}$.

* Plastering -

The plastering of generally 12mm thickness or 20mm thickness are provided on the exposed masonry work. It is calculated in sqm . The plastering are taken for the whole face of the wall and the direction are made for opening as the following manner.

- ① White washing
- ② Colour washing
- ③ Distemporing

The above quantity are calculated as sqm and are usually same as that of plastering. The inside surface of the building is usually white washed or distempored and the outside surface of the building is generally colour washed.

Painting in doors & window -

They are also calculated in sqm and the dimension should be taken for the outer dimension of the chokhat. The area is same as the area of the wall opening for both faces of door and window the similar area is measured above. is multiplying by a appropriate no. is known as multiplying factor.

Sl. No.	Types of doors & windows	Multiplying factor (MF)
1	Panelled, framed, batten, braced, Ledged	2 1/4 times for both faces
2	fully glazed	1 time for both faces
3	Partly panelled & partly glazed	2 times for both faces
4	flush door	2 times for both sides
5	Iron grill	1 time clear span in between the chowkhat

* Actual size of the brick = 19cm x 9cm x 9cm
 Nominal size of the brick = 20cm x 10cm x 9cm
 Standard modular brick tile -
 Actual size = 19cm x 9cm x 4cm
 Nominal size = 20cm x 10cm x 5cm

Different methods of estimate building work

- ① Long wall & short wall method.
- ② Centre line method.
- ③ Crossing method.
- ④ Long wall & short wall method on individual wall method -

In this method, the total building is split up into different parts which contains one room or a no. of room. Then in each part we select the longest wall as long wall and shortest wall as short wall.

The centreline length of the long wall & short wall is find out.

The outer to outer length of the long wall is taken which is equal to centre to centre length of the long wall + 2 x (1/2 width at that level)

inner to inner length of the short wall is taken which will equal to centreline length of the short wall - $2 \times \frac{1}{2}$ width at that level.

In this type of method we can find out the cost of the individual walls to this type of method is generally used in the Govt. department. In this type of estimate there will be less no. of mistake but it will take more time.

② Centre line method -

In this method calculate the total centre line length of the wall in a building and multiply the same by the breadth and depth of the respective item to get the total quantity at that time.

For different section of walls in a building the centreline length per each tile shall be worked out separately. This method estimates may be prepared more quickly and this method is accurate than other methods.

③ Crossing method -

In this method calculate the overall perimeter of the building and subtract from this, 4 times the thickness, of the wall to obtain centreline length.

Principally this method is same as the centreline method but differs in the process of calculation to find the centreline length.

Labour estimate for different items of work -

~~Different category~~

Labour estimate for cement concrete in foundation (1:5:10) or 1:4:8

- (a) Head mason - $\frac{1}{2}$ no.
- (b) Mason - 2 no.
- (c) Mazdoor or belter - 12 No.
- (d) (Boy or women) (coolie) - 18 No.
- (e) Bhisti (water man) - 4 No.

Labour estimate for PCC (1:1½:3) locum in super structure -

- (a) Head mason - $\frac{1}{2}$ no.
- (b) Mason - 2 no.
- (c) Mazdoor etc - 12 no.
- (d) Coolie - 20 no.
- (e) Bhisti - 6 no.

Labour estimate for cement concrete flooring (2.5 cm depth) 100 sq m (1:2:4) or (1:1½:3) -

- (a) Head mason - $\frac{3}{4}$ no.
- (b) Mason - 1 no.
- (c) Mazdoor - 15 no.
- (d) Coolie - 5 no.
- (e) Bhisti - 2 no.

estimate
labour work for Brick masonry

Brick masonry in foundation For 10 cum	Brick masonry in superstructure For 10 cum.
Head mason - 1/2 no.	1/2 no.
Mason - 7 no.	10 no.
Mazdoor - 7 no.	7 no.
Coolie - 7 no.	10 no.
Bhisti - 2 no.	2 no.

labour estimate for stone masonry

stone masonry work in foundation	stone masonry in superstructure
Head mason - 1/2 no.	1/2 no.
Mason - 14 no.	16 no.
Mazdoor - 14 no.	16 no.
Coolie - 6 no.	8 no.
Bhisti - 2 no.	2 no.

labour estimate for the RCC work

RCC work for Beam, Slab, Lintel etc (1:2:4) or (1:1 1/2:3) for 10 cum.	RCC work for column (1:2:4) or (1:1 1/2:3) for 10 cum.
Head mason - 1/2	1/2
mason - 3	3
Mazdoor - 12	12
Coolie - 18	18
Bhisti - 4	4

B) Centring & Shuttering -

(a) Carpenter - 10 | 10

(b) Mazdoor - 10 | 10

C) Bending or Binding -

(a) Blacksmith - 8 | 12

(b) Mazdoor - 8 | 12

Q) What is the standard weight of 12mm diameter HYSD bar of one meter.

$$\frac{\text{Dia}^2}{162} = \frac{(12)^2}{162} = \frac{144}{162} = 0.88 \text{ kg/m}$$

Classification of works according to their cost -

With respect to the cost the original work is classified as ~~major work~~

(1) Major work

(2) Minor work

(3) Petty work

Major work -

The work cost is more than 2 lakh is known as major work. And the estimate for such work is known as major estimate.

Minor work -

The work cost is more than 50,000 but not exceed 2 lakh is known as minor work.

③ Petty work -
The work cost 50,000 is known as petty work. which is ~~not~~ ^{not} ~~classification~~ ^{classification}.

Classification of works according to the nature -

① Original work

② Repair work

① Original work

The original work may be different types, entirely new construction as road, dam, project etc. or new building, bridge, etc.

② Repair work

The repair work may be required to maintain the work in proper condition and annual repair of new building, road etc.

Annual repair is the whitewashing colour washing etc.

Earnest money deposit - (E.M.D)

While submitting a tender the contractor is to deposit a certain amount about 1-2% of the estimated cost with the department, As earnest money as guarantee of the tender this amount is for a check or draft. So that the contractor may not refuse to accept the work when this tender is accepted.

