



GOVT CO-ED POLYTECHNIC

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LABMANUAL

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Quantity Surveying And Costing-I(Lab)

METHOD OF BUILDING ESTIMATE

Example 1. — Estimate the quantities of brickwork and plastering required in a wall 4 m long, 3 m high and 30 cm thick. Calculate also the cost if the rate of brickwork is Rs. 320.00 per cu m and of plastering is Rs. 8.50 per sq m.

Quantity of brickwork = $L \times B \times H = 4 \text{ m} \times 3 \text{ m} \times .30 = 3.6 \text{ cu m}$.

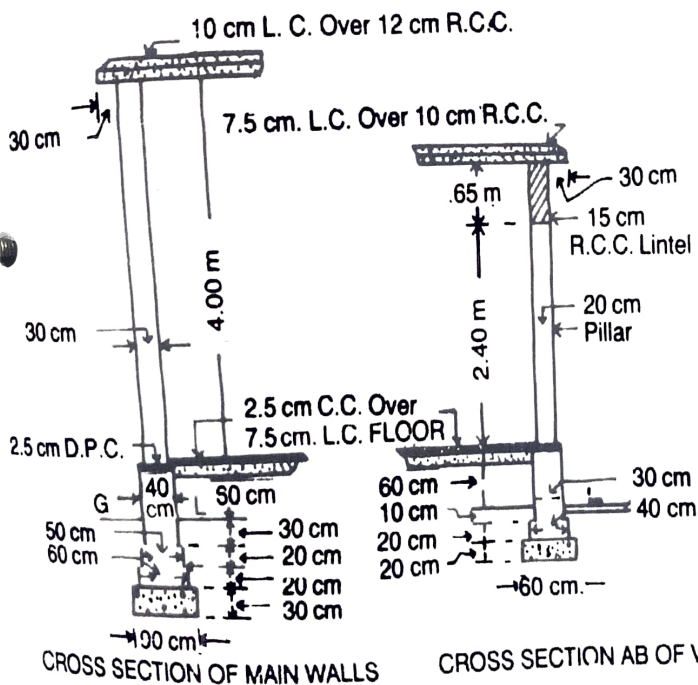
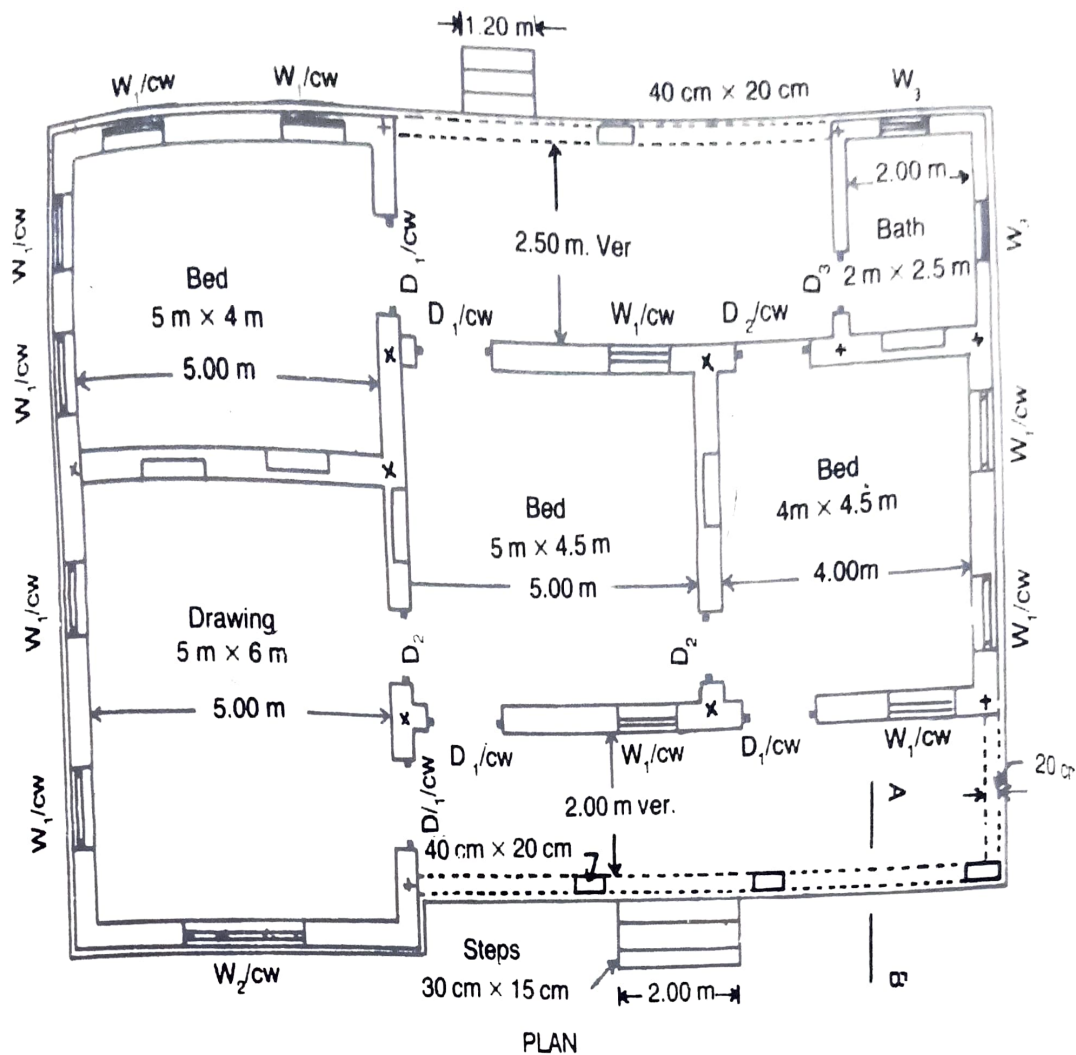
Quantity of plastering (two faces) = $2 \times L \times H = 2 \times 4 \text{ m} \times 3 \text{ m} = 24 \text{ sq m}$.

Cost of brickwork = $3.6 \times 320.00 = \text{Rs. } 1152.00$.

Cost of plastering = $24 \times 8.50 = \text{Rs. } 204.00$.

Total cost = $1152.00 + \text{Rs. } 204.00 = \text{Rs. } 1356.00$.

Example 2. — Prepare a detailed estimate of part of a wall of a building from the following data.



Doors:-
 D_1 - 120 cm $\times$ 210 cm (1.20 m $\times$ 2.10 m)
 D_2 - 100 cm $\times$ 200 cm (1.00 m $\times$ 2.00 m)
 D_3 - 75 cm $\times$ 180 cm (.75 m $\times$ 1.80 m)

Windows:-
 W_1 - 100 cm $\times$ 150 cm (1.00 m $\times$ 1.50 m)
 W_2 - 200 cm $\times$ 150 cm (2.00 m $\times$ 1.50 m)
 W_3 - 75 cm $\times$ 120 cm (.75 m $\times$ 1.20 m)
C.W. - 75 cm $\times$ 60 cm (.75 m $\times$.60 m)

Shelves:-
S - 100 cm $\times$ 150 cm (1.00 m $\times$ 1.50 m)
Lintel Over Doors, Windows Etc.
15 cm R.B.

All walls of Drawing Rooms and
Bed Rooms have same section

Bath Room walls have similar
section.

Note—No beam has been shown in the plan.

Fig. 2-7

Example 5(a). — Estimate the quantities of the following items of a residential building from the given drawings (Fig. 2-7) :—
 (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) 2.5 cm Damp proof course and (5) First class brickwork in lime mortar in superstructure.

Centre to centre lengths of wall —

For estimating it is convenient to find the centre to centre lengths of different walls first. The centre to centre lengths of different walls have been worked out below :—

Drawing and left hand side bed room combined —

$$\text{c. to c. long walls} = 6.00 + 4.00 + .30 + 2 \times .15 = 10.60 \text{ m.}$$

$$\text{c. to c. short walls} = 5.00 + 2 \times .15 = 5.30 \text{ m.}$$

Bed rooms right side (both combined)

$$\text{c. to c. long walls} = 5.00 + 4.00 + .30 + 2 \times .15 = 9.60 \text{ m.}$$

$$\text{c. to c. short walls} = 4.50 + 2 \times .15 = 4.80 \text{ m.}$$

Front verandah —

$$\text{Front wall c. to c. length} = 5.00 + 4.00 + 2 \times .30 + \frac{.30}{2} - \frac{.20}{2} = 9.65 \text{ m.}$$

$$\text{Side wall c. to c. length} = 2.00 + \frac{.30}{2} + \frac{.20}{2} = 2.25 \text{ m.}$$

Back verandah including bath room —

c. to c. long wall (rear wall including bath room) 9.65 m same as front ver. wall.

$$\text{c. to c. length of side wall of bath room} = 2.50 + \frac{.30}{2} + \frac{.20}{2} = 2.75 \text{ m.}$$

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

Item No.	Particulars of Items	No.	Length	Breadth	Height or Depth	Quantity	Explanatory note
3.	Back verandah, including bath room						
	Long wall including bath	1	9.70 m	.60 m	.20 m	1.16	$L = 9.65 - \frac{.50}{2} + \frac{.60}{2} = 9.70m$
	Short wall (remaining walls of bath)	2	2.20 m	.60 m	.20 m	0.53	$L = 2.75 - \frac{.50}{2} - \frac{.60}{2} = 2.20m$
					Total	20.11	cu m
	1st class brickwork in foundation and plinth in 1 : 6 cement mortar						
	Drawing and left bed room Long walls —						
	1st footing	2	11.20 m	.60 m	.20 m	2.69	$L = 10.60 + .60 = 11.20 m$
	2nd footing	2	11.10 m	.50 m	.20 m	2.22	$L = 11.20 - 2 \times .05 = 11.10m$
	Plinth wall above footing	2	11.00 m	.40 m	.90 m	7.92	$L = 11.10 - .10 = 11.00 m$
	Short walls —						
	1st footing	3	4.70 m	.60 m	.20 m	1.69	$L = 5.30 - .60 = 4.70 m$
	2nd footing	3	4.80 m	.50 m	.20 m	1.44	$L = 4.70 + 2 \times .05 = 4.80 m$
	Plinth wall above footing	3	4.90 m	.40 m	.90 m	5.29	$L = 4.80 + .10 = 4.90 m$
	Bed rooms right side (both) —						
	Long walls —						
	1st footing	2	9.60 m	.60 m	.20 m	2.31	$L = 9.60 - \frac{.60}{2} + \frac{.60}{2} = 9.60m$
	2nd footing	2	9.60 m	.50 m	.20 m	1.92	$L = 9.60 - \frac{.50}{2} + \frac{.50}{2} = 9.60m$
	Plinth wall above footing	2	9.60 m	.40 m	.90 m	6.91	$L = 9.60 - \frac{.40}{2} + \frac{.40}{2} = 9.60m$

Item No.	Particulars of Items	No.	Length	Breadth	Height or Depth	Quantity	Explanatory note
	Short walls —						
	1st footing ...	2	4.20 m	.60 m	.20 m	1.01	$L = 4.80 - .60 = 4.20 \text{ m}$
	2nd footing ...	2	4.30 m	.50 m	.20 m	0.86	$L = 4.20 + 2 \times .05 = 4.30 \text{ m}$
	Plinth wall above footing ...	2	4.40 m	.40 m	.90 m	3.17	$L = 4.30 + 10 = 4.40 \text{ m}$
	Front verandah						
	Front wall —						
	Footing ...	1	9.65 m	.40	.20 m	0.77	$L = 9.65 - \frac{.40}{2} + \frac{.40}{2} = 9.65 \text{ m}$
	Plinth wall above footing ...	1	9.60 m	.30 m	.70 m	2.02	$L = 9.65 - \frac{.40}{2} + \frac{.30}{2} = 9.60 \text{ m}$
	Side short wall						
	Footing ...	1	1.85 m	.40 m	.20 m	0.15	$L = 2.25 - \frac{.40}{2} - \frac{.40}{2} = 1.85 \text{ m}$
	Plinth wall above footing ...	1	1.90 m	.30 m	.70 m	0.40	$L = 2.25 - \frac{.40}{2} - \frac{.30}{2} = 1.90 \text{ m}$
	Back verandah including bath room —						
	Long wall —						
	Footing ...	1	9.65 m	.40 m	.20 m	0.77	} Length same as for front verandah long wall
	Plinth wall above footing ...	1	9.60 m	.30 m	.70 m	2.02	
	Short walls (remaining walls of bath)						
	Footing ...	2	2.35 m	.40 m	.20 m	0.38	$L = 2.75 - \frac{.40}{2} - \frac{.40}{2} = 2.35 \text{ m}$
	Plinth wall above footing ...	2	2.40 m	.30 m	.70 m	1.01	$L = 2.75 - \frac{.40}{2} - \frac{.30}{2} = 2.40 \text{ m}$
						Total	44.95 cu m

Example 2. — Prepare a detailed estimate of a roof work only of a building from the given drawings (Fig. 4-2) at the following rates : —

- (1) 7.5 cm lime concrete over 2 layers of tiles — Rs. 30.00 per sq m.
- (2) Cement pointing 1 : 2 in ceiling tiles — Rs. 4.75 per sq m.
- (3) White washing 3 coats in ceiling — Rs. 0.75 per sq m.
- (4) Sal wood work in beams battens — Rs. 4700.00 per cu m.
- (5) Painting wood work two coats over a coat of priming — Rs. 10.40 per sq m.

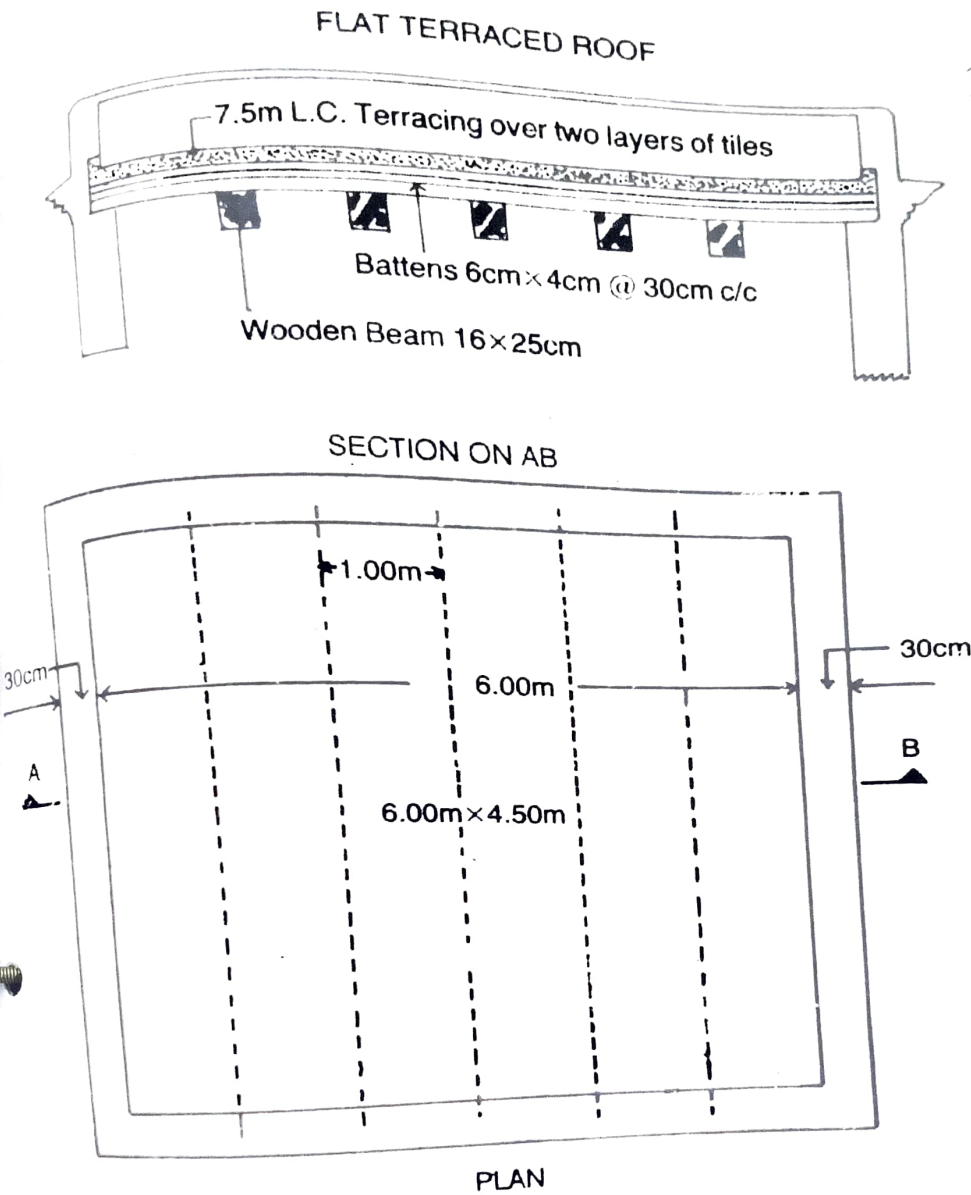


Fig. 4-3

Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
1.	7.5 cm lime concrete over two layers tiles in roof including surface finishing ...	1	6.30	4.80	—	30.24 sq m	Bearing 15 cm.
2.	Cement pointing 1 : 2 in ceiling tiles	1	6.00	4.50	—	27.00 sq m	
3.	White washing 3 coats in ceiling ...	1	6.00	4.50	—	27.00 sq m	
Sal wood work—							
	Beams ...	5	5.00	.16	.25	1.00	Bearing 25 cm No battens adjacent to walls.
	Batten 30 cm ...	14	6.30	.05	.04	0.176	
	c. to c. No. $= (\frac{4.5}{.3} - 1) = 14$					1.176 cu m	
5.	Painting wood work two coats over a coat of priming—						
	Beams ...	5	5.00	.82	—	20.50	Perimeter 82 cm
	Batten ...	14	6.30	.18	—	15.88	Perimeter 18 cm
					Total	36.38 sq m	

ABSTRACT OF ESTIMATED COST (Ex. 1)

Item No.	Name of items and details of work	Quantity	Unit	Rate		Per	Amount	
				Rs.	P.		Rs.	P.
1.	7.5 cm L.C. over two layers of tiles in roof including surface finishing ...	30.24	sq m	30.00	/	sq m	907.20	
	Cement pointing 1 : 2 in ceiling tiles ...	27.00	sq m	4.75	/	sq m	128.25	
	White washing 3 coats in ceiling tiles ...	27.00	sq m	0.75	/	sq m	20.25	
	Sal wood work in beams and battens ...	1.176	cu m	4700.00	/	cu m	5527.20	
	Painting wood work two coats over a coat of priming ...	36.38	sq m	10.40	/	sq m	378.35	
Total ...							6961.25	
Add 5% for Contingencies and Workcharged Establishment							348.06	
Grand Total ...							7309.31	

Note. — Roof battens —

15.2 as in item 2.

CEMENT CONCRETE

Sum total quantity of determining the quantity of materials for 10 cu m concrete is to divide 15.2 by the sum of the numerals of the proportion of the materials which gives the quantity of cement in cu m.

Illustration. — To find the materials for 10 cu m of cement of 1 : 4 : 8 proportion.

$$\text{Cement} = \frac{15.2}{1 + 4 + 8} = \frac{15.2}{13} = 1.17 \text{ cu m} = \text{Say } 1.15 \text{ cu m.}$$

Therefore, sand = $1.15 \times 4 = 4.60$ cu m and ballast = $1.15 \times 8 = 9.20$ cu m.

Materials required for different Proportion of Cement Concrete — 10 cu m.

Quantity of materials may be calculated by 15.2 as sum total and dividing by sum of the proportions.

Proportion	Ballast	Sand	Cement
1 : 1½ : 3	8.40 cu m	4.20 cu m	2.80 cu m (84 bags)
1 : 2 : 4	8.80 cu m	4.40 cu m	2.20 cu m (66 bags)
1 : 3 : 6	9.00 cu m	4.50 cu m	1.50 cu m (45 bags)
1 : 4 : 8	9.20 cu m	4.60 cu m	1.15 cu m (34½ bags)
1 : 5 : 10	9.50 cu m	4.75 cu m	0.95 cu m (28½ bags)
1 : 6 : 12	9.60 cu m	4.80 cu m	0.80 cu m (24 bags)

5. Cement concrete 1 : 5 : 10 in foundation or Floor with Brick Ballast 40 mm (1½") Thick
gauge — unit 1 cu m. Take — 10 cu m.

Particulars	Qntty or Nos.	Rate		Cost	
		Rs.	P.	Rs.	P.
Materials—					
Brick ballast 1st class 40 mm gauge...	9.50 cu m	650.00	per cu m	6175.00	
Sand (local) ...	4.75 cu m	700.00	per cu m	3325.00	
Cement (28½ bags) ...	0.95 cu m	7650.00	per cu m	7267.50	
		Total		16767.50	
Labour—					
Mistri (Head mason) ...	½ no.	350.00	per day	175.00	
Mason ...	1½ no.	300.00	per day	450.00	
Mazdoor (Beldar) ...	12 nos.	220.00	per day	2640.00	
Boy or woman coolie ...	18 nos.	200.00	per day	3600.00	
Bhishti (including curing) ...	4 nos.	200.00	per day	800.00	
Sundries T. and P. etc. ...	Lump sum	120.00	L.S.	120.00	
		Total		7785.00	
Total of materials and labour				24552.50	
Add 1½% Water charges ...	...	...	...	368.00	
Add 10% Contractor's profit ...	...	...	...	2455.25	
		Grand Total ...		27375.75	
Rate per cu m — $\text{Rs.}27375.75 / 10 = \text{Rs.}2737.50$				for 10 cu m	

Brickwork with standard bricks — Calculation of materials required for brick work —
Take a wall $1\frac{1}{2}$ brick thick 30 cm nominal thickness of 20 m length and 5 m height. Nominal volume = $20 \times .3 \times 5 = 30$ cu m.

Normally mortar joint will be less than 1 cm, taking 1 cm mortar joint, the actual thickness of wall will be 29 cm.

Therefore, actual volume = $20 \times .29 \times 5 = 29$ cu m. Number of standard bricks of 20 cm x 10 cm x 10 cm nominal size = $\frac{29}{.20 \times .10 \times .10} = 14500$ nos.

Therefore, number of bricks per cu m (nominal) = $\frac{14500}{30} = 484$ nos. Considering 5% breakages, wastages, etc., this may be taken 500 nos. per cu m.

For 10 cu m of brickwork 5000 bricks are required.

Mortar. — Mortar requirement = total volume of brickwork minus net volume of bricks = $29 - (.19 \times .09 \times .09 \times 14500) = 29 - 22.315 = 6.685$ cu m. For frog filling, for use of cut bricks, for bonding, for uniform joints, wastages, etc. 15% extra mortar may be required. Therefore, the volume of mortar = $6.685 + 6.685 \times .15 = 7.688$ cu m. For dry volume increase by $\frac{1}{4}$ dry volume of mortar = $7.688 + 1.922 = 9.61$ cu m. For 30 cu m of brickwork, dry volume of mortar = 9.61 cu m.

For 10 cu m of brickwork, dry volume of mortar = $9.61 \times \frac{10}{30} = 3.2$ cu m.

In practice, for cement mortar 3 cu m dry mortar and for lime mortar 3.5 cu m of dry mortar are taken for 10 cu m brickwork. As an approximate 30% dry mortar may be taken.

Calculation of Materials of Mortar —

Approximate method to determine the quantity of materials of mortar for 10 cu m brickwork — Divide 3 by the sum of the numerals of the proportion of materials which gives the quantity of cement in cu m. As for example for brickwork in 1 : 6 cement mortar cement = $\frac{3}{1 + 6} = 0.43$ cu m. Therefore, sand = $.43 \times 6 = 2.58$ cu m. But as the cement will go to fill up the voids in sand, .45 cu m of cement and 2.7 cu m of sand may be taken.

14. 1-class Brickwork in Foundation and Plinth with 20 x 10 x 10 cm (nominal size) Bricks with Cement Sand Mortar 1 : 6 — unit 1 cu m. Take — 10 cu m.

Particulars	Qntty or Nos.	Rate		Cost	
		Rs.	P.	Rs.	P.
Materials —					
Brick I-class (500 bricks per cu m)...	5000 nos.	4500.00	per 1000 nos.	22500.00	
Cement (13.5 bags) ...	0.45 cu m	7650.00	per cu m	3442.50	
Sand (local) ...	2.7 cu m	700.00	per cu m	1890.00	
		Total		27832.50	
Labour —					
Mistri (Head mason) ...	½ no.	350.00	per day	175.00	
Mason ...	7 nos.	300.00	per day	2100.00	
Mazdoor (Beldar) ...	7 nos.	220.00	per day	1540.00	
Boy or woman coolie ...	7 nos.	200.00	per day	1400.00	
Bhishti (water man) ...	2 nos.	200.00	per day	400.00	
Sundries, T. and P., etc. (Misc. Petty things)	Lump sum	90.00	L.S.	90.00	
		Total		5705.00	
Total of materials and labour				...	33537.50
Add 1½% Water charges	...	...	...	503.00	
Add 10% Contractor's profit	...	...	...	3353.75	
Grand Total					37394.25
Rate per cu m —				Rs.37394.25 / 10 = Rs.3739.00	

CEMENT CONCRETE FLOOR

Quantity of cement concrete may be calculated by multiplying the area of floor by the thickness of each material may be found on the same principle as for cement concrete. (See page 497).

2.5 cm c.c. floor for 100 sq m. of area the quantity of cement concrete $100 \times .025 = 2.5$ cu m. Adding 10% extra for unevenness of base concrete, the quantity comes to $2.5 \times 1.10 = 2.75$ cu m. For 100 cu m cement concrete the total dry volume of materials is 125, i.e., approximately

For 2.5 cm thick c.c. floor of 1 : 2 : 4 proportion, for 100 sq m total dry volume of materials $2.75 + 50\% = 2.75 + 1.375 = 4.125$ cu m. Therefore, Cement = $\frac{4.125}{1 + 2 + 4} = \frac{4.125}{7} = .59$ cu m (18 bags), Sand = $.6 \times 2 = 1.20$ cu m, and stone aggregate = $.6 \times 4 = 2.40$ cu m. For neat surface finishing additional 0.2 cu m (6 bags) of cement will be required. (See page 498).

For 2 cm thick c.c. floor of 1 : 1½ : 3 proportion for 100 sq m., the dry volume of materials is equal to 4.125 cu m. Therefore, Cement = $\frac{4.125}{1 + 1\frac{1}{2} + 3} = \frac{4.125}{5\frac{1}{2}} = .75$ cu m = 22.5 bag. Quantity of sand = $.75 \times 1\frac{1}{2} = 1.125$ cu m, and the quantity of stone aggregate = $0.75 \times 3 = 2.25$ cu m. For neat surface finishing add extra cement of 0.2 cu m (6 bags).

For 2 cm thick c.c. 1 : 2 : 4 floor 100 sq m., total dry volume of concrete = $100 \times .04 + 10\%$ (for unevenness) + 50% increase for dry volume = $4.4 + 2.2 = 6.6$ cu m. Therefore, Cement = $\frac{6.6}{1 + 2 + 4} = .94$ cu m (28.2 bags), Sand = $.94 \times 2 = 1.88$ cu m and stone aggregate = $.94 \times 4 = 3.76$ cu m. For neat surface finishing add extra cement of 0.2 cu m (6 bags).

For coloured cement floor, mix pigment colour with neat surface cement in the proportion of 1 : 3 to 1 : 6 (colour : cement) to have the desired colour. White cement mixed with colour pigment of the desired proportion may also be used, but for strength it is better if ordinary portland cement is mixed with white cement in the proportion of 1 : 1 to 1 : 3 (grey portland cement : white cement) and then to add colour pigment to have the desired colour.

When colour pigment is mixed with white cement, the requirement of colour pigment is much less, may be 1 : 5 to 1 : 10 (pigment : white cement).

33. 2.5 cm Cement Concrete Floor 1 : 2 : 4 unit 1 sq m. Take — 100 sq m

Particulars		Qntty or Nos.	Rate		Cost	
			Rs.	P.	Rs.	P.
Materials —						
Stone ballast 20 mm gauge (Stone grit)...		2.40 cu m	1800.00	per cu m	4320.00	
Sand (coarse) ...		1.20 cu m	1500.00	per cu m	1800.00	
Cement (18 bags) ...		0.60 cu m	7650.00	per cu m	4590.00	
Cement for surface finishing (6 bags)...		0.20 cu m	7650.00	per cu m	1530.00	
			Total		12240.00	
Labour, etc. —						
Mistri (Head mason) ...		$\frac{3}{4}$ no.	350.00	per day	262.50	
Mason ...		10 nos.	300.00	per day	3000.00	
Mazdoor (Beldar) ...		5 nos.	220.00	per day	1100.00	
Boy or woman coolie ...		5 nos.	200.00	per day	1000.00	
Bhishti (including curing) ...		2 nos.	200.00	per day	400.00	
Side forms ...		Lump sum	200.00	L.S.	200.00	
Sundries, T. and P., etc. ...		Lump sum	90.00	L.S.	90.00	
			Total		6052.50	
Total of materials and labour ...					18292.50	
Add 1½% Water charges ...		...	...	...	274.00	
Add 10% Contractor's profit ...		...	...	...	1829.25	
Grand Total					20395.75	
Rate per sq m — Rs.20395.75 / 100 = Rs.204.00					for 100 sq m	

Appreciation of Materials.

Example 1.—Calculate the materials for 100 metres length of a jail wall whose cross-section is as shown in Fig. 12.1.

The wall is of I-class brickwork in cement sand mortar 1 : 6 finished with 12 mm thick plastering on both sides above G.L. with cement sand mortar 1 : 6. Foundation concrete is of cement, sand I-class in the ratio of 1 : 4 : 8 proportion.

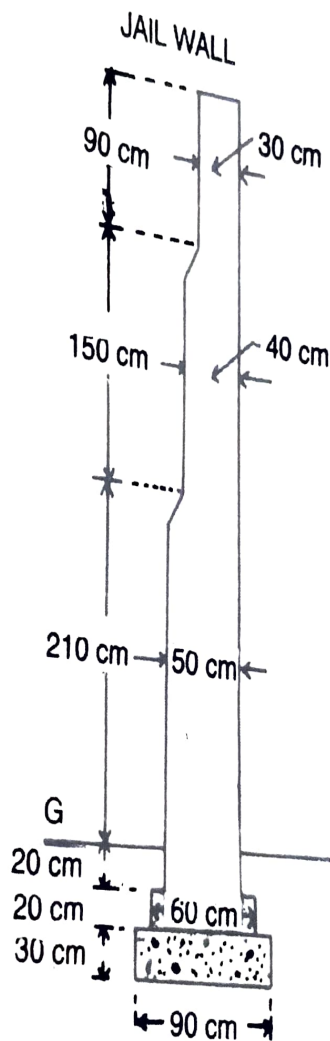


Fig. 12-1

By detailed estimate method the quantities of different items of work have been taken out. When with the help of analysis, the materials worked out.

Details of Measurement and Calculation of Quantities (Ex. 1)

Item No	Particulars of Items of work	No.	Length m	Breadth m	Height or Depth m	Total Quantity	Remark Quantity
1	Cement concrete 1:4:8 in foundation	1	100.00	0.90	0.30	27.00	27.00 cu m
2	1st class Brickwork in cement sand mortar 1 : 6—						
	Footing	1	100.00	0.60	0.20	12.00	
	50 cm wall above footing	1	100.00	0.50	2.30	115.00	
	40 cm wall	1	100.00	0.40	1.50	60.00	
	30 cm wall	1	100.00	0.30	0.90	27.00	
						Total	214.00 cu m
3	12 mm Cement sand plaster 1 : 6						
	Inner side	1	100.00	—	4.50	450.00	
	Outer side	1	100.00	—	4.70	470.00	
	Top	1	100.00	0.30	—	30.00	
						Total	950.00 sq m

Outer sloping considered as solid rectangles.

Ht.=4.5+1+
.1=4.70 m

Quantities of different items of work :—

1. Cement concrete 1 : 4 : 8
2. 1st class Brickwork in cement sand mortar 1 : 6
3. 12 mm Cement sand plaster 1 : 6

Note : End faces of the wall have not been taken into account as the same has been considered as part of a wall.

27 cu m
214 cu m
950 sq m

Calculation of Materials (Ex. 1)

Particulars of items of work and basis of materials per unit	Requirement of Material			
	Brick I-class	Brick ballast I-class	Sand	Cement
Cement concrete 1:4:8—27 cu m 0.92 cu m ballast 4.6 cu m sand, 1.15 cu m cement (4.5 bags)	—	24.84 cu m	12.42 cu m	3.105 cu m
Brickwork in cement sand mortar 1:6—214 cu m 500 nos. bricks, 27 cu m sand, 0.45 cu m cement, (3.35 bags)	107000 nos.	—	57.78 cu m	9.63 cu m
2 mm Cement sand plaster 1:6 50 sq m @ 0.30 cu m (9 bags) cement 1.80 cu m sand	—	—	17.10 cu m	2.85 cu m
Total	107000 nos.	24.84 cu m	87.30 cu m	$15.585 \times \text{cu m}$ $= 15.585 \times 30$ bags $= 467.55 \text{ bags}$

Requirement of materials are as given below :—

Bricks I-class	10,7000 nos.
Brick Ballast I-class 40 mm gauge	24.84 cu m
Sand (Local)	87.30 cu m
Cement	467.55 bags (233.78 quintals)