

2 credits

ESTIMATION AND QUANTITY SURVEYING.

Introduction

UNIT - I

— DUTTA B.N

Estimating and Costing :-

Estimating is the technique of calculating or computing the various quantities and the expected expenditure to be incurred on a particular work or project.

For all engineering works it is required to know beforehand the probable cost of construction known as the estimated cost.

If the estimated cost is greater than the money available, then attempts are made to reduce the cost by reducing the work or by changing the specifications.

From this the importance of estimate for engineers may be understood.

Accuracy in estimate is very important, if estimate is exceeded it becomes a very difficult problem for engineers to explain, to account for and arrange for the additional money.

The rate of each item should also be reasonable and workable. The rates in the estimate provide for the complete work, which consist of the cost of materials, cost of transport, cost of labour, cost of scaffolding, cost of tools and plants, cost of water, taxes, establishment and supervision cost, reasonable profit of Contractor etc.

## UNIT - 1

### ESTIMATE OF BUILDINGS

#### Need for Estimation and Costing :-

1. Estimate give an idea of the cost of the work and hence its feasibility can be determined.
2. Estimate gives an idea of time required for the completion of work.
3. Estimate is required to invite the tenders and quotations and to arrange contract.
4. Estimate is also required to control the expenditure during the execution of work.
5. Estimate decides whether the proposed plan matches the funds available or not.

#### Procedure of Estimating :-

Estimating involves the following operations.

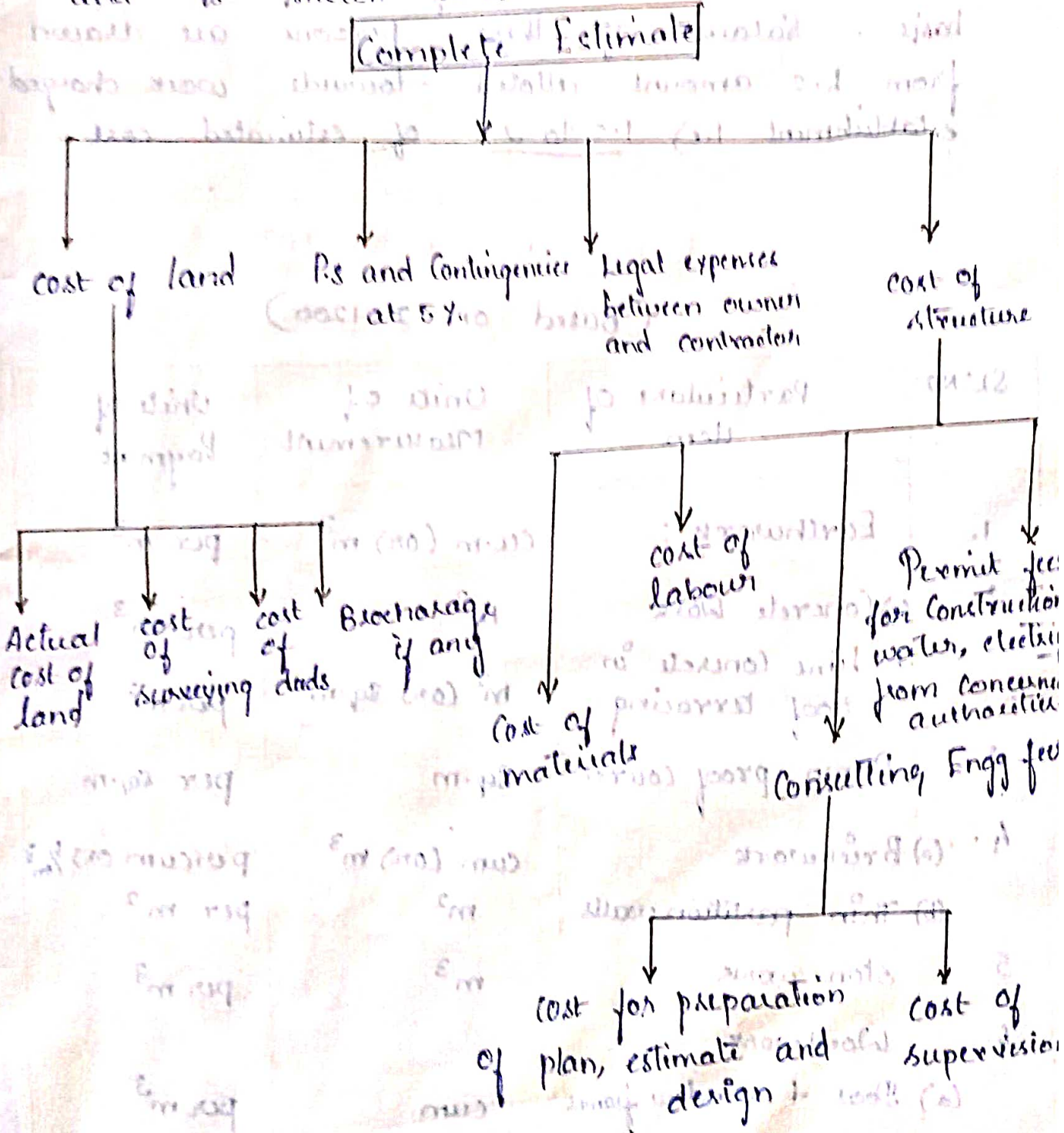
1. Preparing detailed estimate
2. Calculating the rate of each unit of work.
3. Preparing abstract of estimate.



# Data Required to prepare an Estimate :-

- (1) Drawings
- (2) Specifications
- (3) Rates

Complete Estimate not only includes the estimate of structure, but also includes cost of land, materials and labour. It also includes many other direct and indirect costs and is shown below.



## Lumpsum :-

L.S. Items are as follows :-

1. Water supply and sanitary arrangements
  2. Electrical Installations like meter, meter etc
  3. Architectural features
  4. Contingencies and unforeseen items
- Work charged Establishment:

Skilled, Supervisors, work assistance, watch men etc are employed on temporary basis. Salary of these persons are drawn from L.S. amount allotted towards work charged establishment i.e) 1.5 to 2% of estimated cost.

## UNITS OF MEASUREMENTS

(Based on IS 1200)

Sl. No.	Particulars of item	Units of Measurement	Units of Payment
1.	Earthwork :	cu.m (or) $m^3$	per $m^3$
2.	(a) Concrete Work	$m^3$	per $m^3$
	(b) Lime concrete in roof terracing	$m^2$ (or) sq.m	per $m^2$
3.	Damp proof course	Sq.m	per sq.m
4.	(a) Brickwork	cu.m (or) $m^3$	per cu.m (or) $\frac{1}{m^3}$
	(b) Thin partition walls	$m^2$	per $m^2$
5.	stonework	$m^3$	per $m^3$
6.	Woodwork		
	(a) Door & window frames	cu.m	per $m^3$



(b) Shutters of doors & windows	$m^2$	per $m^2$
(c) Doors & Windows fittings	Number	per number
7. Steel Work - Iron grills	Quintal $m^2$	per quintal per $m^2$
8. Roofing		
(a) R.C.C and R.B slate roof	$m^3$	per $m^3$
(b) L.C. roof	$m^2$	per $m^2$
(c) centering & shuttering formwork	$m^2$	per $m^2$
(d) AC sheet roofing	$m^2$	per $m^2$
9. Plastering, points & finishing	$m^2$	per $m^2$
10. Flooring	$m^2$	per $m^2$
11. Rainwater pipe / plane pipe	1 RM	per RM
12. Steel Wooden Trusses	1 NO.	per 1 NO.
13. Glass Pannels (supply)	sq-m	per $m^2$
14. Fixing of Glass pannels on cleaning	No.	per no.

## Rules for Measurement :-

The rules for measurement of each item are described in IS1200.

However some of the general rules are listed below.

1. Measurement shall be made for finished item of work and description of each item shall include materials, transport, labour, fabrication tools and plant and all types of overheads for finishing the work in required shape, size and specification.

2. In booking, the order shall be in sequence of length, breadth and height or thickness.

3. All works shall be measured subject to the following tolerances.

(i) Linear measurement  $\rightarrow$  nearest  $0.01\text{m}$

(ii) Area measurement  $\rightarrow$  nearest  $0.01\text{m}^2$

(iii) Cubic measurement  $\rightarrow$  nearest  $0.01\text{m}^3$ .

4. Same type of work under different conditions & nature shall be measured separately under separate items.

5. The bill of quantities shall fully describe the materials, proportions, workmanships and accurately represent the work to be executed.

6. In case of masonry or structural concrete, the categories shall be measured separately and the heights shall be described.



- (a) from foundation to plinth level
- (b) from plinth level to first floor level
- (c) from first floor level to second floor level.

### Deduction For Openings :-

#### Masonry work

1. No deduction of beams, wall plates, lintel, purlins slips etc upto  $0.1m^2$  in section.
2. No deduction is made for openings upto  $0.1m^2$  in area.
3. No deduction is made for formwork openings upto  $0.4m^2$ .

#### Plastering and White Washing area :

1. No deduction is made for openings of area less than  $0.5m^2$ .
2. Deductions are made if the area between  $0.5m^2$  to  $3m^2$  only one side.
3. Deduction area made both sides of opening if the area greater than  $3m^2$ .

#### Painting Coefficient

When calculate the area of doors and windows for painting, the area of opening on side is measured and multiplied by a constant is known as painting coefficient.

Painting Measurement for both the faces.

$$\text{Area of painting} = \text{Coefficient} \times \text{Area of opening (overall)}$$

Degree of accuracy in measurement:

While preparing the estimate, the smaller dimensions shall not be neglected, it all affect the total quantity of work. The quantities of costly items are to be measured to the accuracy of 2 decimals.

### TYPES OF ESTIMATION

- (1) Approximate (or) Rough  
(or) Preliminary
- (2) Detailed Estimate
- (3) Revised Estimate
- (4) Supplementary Estimate
- (5) Sub Estimate
- (6) Annual maintenance estimate
- (7) Repair Estimate
- (8) Complete Estimate.



## Types of Approximate Estimate :-

1. Plinth Area method
2. Cubical content
3. Service Unit (or) Unit Cost method
4. Typical bay method
5. Carpet area method.

→ It is the effective area available for use within a building excluding the area occupied by the walls.

### Plinth Area Method :-

The built up covered area measured at the floor level of the basement is called plinth area.

It can be calculated including the following such as area of the floor level, porch, stair cover, internal shaft, machine room.

Pbm Q :-

calculate the approximate cost of the building of plinth area  $85\text{m}^2$  and the rate may be assumed as Rs. 800/- for civil works only?

Solution :-

$$\text{Area of the building} = 85\text{m}^2$$

$$\text{Plinth area rate} = \text{Rs. } 800$$

$$\text{The approximate cost} = \text{Plinth area of the building} \times \text{Plinth area rate}$$

$$= 85 \times 800$$

$$= \text{Rs. } 68000$$

Pbm 2

The actual expenditure incurred in the construction of a single storey residential building of plinth area  $80\text{m}^2$  is found to be Rs 3,00,000/- in which 60% is towards the cost of materials and the remaining is towards the cost of labour. It is now proposed to construct a similar building of same height and specifications with a plinth area of  $110\text{m}^2$  at place where the cost of materials is 10% more and the cost of labour is 15% less. Estimate approximately the cost of the proposed building?

Solution :-

$$\text{Plinth area} = 80\text{m}^2$$

$$\text{Cost of building} = 3,00,000 \text{ Rs.}$$

$$\text{Plinth area rate} = \frac{\text{cost of building}}{\text{Plinth area}}$$

$$= \frac{3,00,000}{80}$$

$$= 3750 \text{ Rs./m}^2$$

$$\text{Cost of material} = \frac{60}{100} \times 3750$$

$$= 2250$$

$$\text{Cost of labour} = \frac{40}{100} \times 3750$$

$$= 1500$$



## Service Unit Method.

Pbm (A)

The cost of construction of a polytechnic building of yearly intake 120 students is found to be Rs 20.8 lakhs. Allowing 10% increase in the cost of material and labour, determine the probable expenditure towards the construction of a new building for a polytechnic of yearly intake 180 students.

Service unit method :-

$$\text{Approximate cost} = (\text{No. of units}) \times (\text{cost per unit})$$

Solution :-

$$\text{cost of existing polytechnic} = 20.8 \text{ lakhs.}$$

$$\left. \begin{array}{l} \text{No. of students} \\ \text{intake} \end{array} \right\} = 120$$

$$\text{Cost per unit} = \frac{20,80,000}{120}$$

$$= 17,333 \text{ Rs.}$$

$$\left. \begin{array}{l} \text{Increase in cost of material} \\ \text{+ labours} \end{array} \right\} = \frac{10}{100} \times 17,333,3$$
$$= 1733$$

$$\text{Approximate - unit rate of proposed building} = 17333$$
$$+ 1733$$
$$= 19,066 \text{ Rs.}$$

$$\left. \begin{array}{l} \text{No. of students} \\ \text{intake} \end{array} \right\} = 180.$$

$$\begin{aligned}
 \text{Approximate cost} &= \text{No. of units} \times \text{cost per unit} \\
 &= 180 \times 19,066 \\
 &= 34,31,880 \\
 &= \text{Rs } 34.32 \text{ lakhs.}
 \end{aligned}$$

### Typical Bay Method.

$$\text{Estimated cost} = \text{No. of bays} \times \text{cost of 1 bay.}$$

Plm. (5)

The cost of construction of an auditorium which has 8 bays of 3 metre span each and 10 metre width is Rs 10,00,000. Determine the approximate cost of construction of a similar building with 10 bays.

Solution :-

$$\text{Cost of existing building} = 10,00,000$$

$$\text{Number of bays} = 8$$

$$\text{cost of building per bay} = \frac{10,00,000}{8}$$

$$= 1,25,000 \text{ Rs.}$$

$$\text{No. of bays of proposed building} = 10$$

$$\therefore \text{approximate cost} = 10 \times 1,25,000$$

$$= 12,50,000 \text{ Rs.}$$



## Proposed building:-

$$\text{Increased rate of materials} = \frac{10}{100} \times 2250 \\ = 225$$

$$\therefore 225 + 2250 \\ = 2475$$

$$\text{Less rate of labour} = \frac{15}{100} \times 1500$$

$$= 225$$

$$\therefore 1500 - 225 = 1275$$

$$\therefore \text{Plinth area rate} = 2475 + 1275 \\ = 3750$$

$$\text{Plinth area of proposed building} \\ = 110 \text{m}^2$$

$$\text{Approximate cost of proposed building} = 3750 \times 110 \\ = \underline{\underline{4,12,500}}$$

## Cubical Content Method.

$$\text{Cubic content} = \text{Plinth area} \times \text{Height of building}$$

Pbm. ③

The total cost of a building constructed at Rs 4,50,000/- . The plinth area of building is  $60 \text{m}^2$  and height of building upto top of roof from floor is  $3.2 \text{m}$ . Work out the plinth area rate and cubic unit rate? If a similar building of plinth area  $135 \text{m}^2$  is to be constructed, find the approximate cost of construction.

Solution :-

$$\text{Plinth area rate} = \frac{\text{Total cost}}{\text{Plinth area}}$$

$$= \frac{4,50,000}{60}$$

$$= 7500 \text{ /m}^2$$

$$\text{Cubic content} = \text{Plinth area} \times \text{Height of building}$$

$$= 60 \times 3.2$$

$$\text{Cubic content} = 192 \text{ m}^3$$

$$\text{Cubic content rate} = \frac{\text{Total cost}}{\text{Cubic content}}$$

$$= \frac{4,50,000}{192}$$

$$= 2343.75$$

$$\text{Cubic content rate} = 2344 \text{ Rs. /m}^3$$

Approximate cost of construction

$$= \text{Plinth area} \times \text{Plinth area rate}$$

$$= 135 \text{ m}^2 \times 7500$$

$$= \underline{\underline{\text{Rs } 10,12,500}}$$



Item No.	Description of items of work	No.	Dimensions			Quantity or Contents	Total Qty.
			length (m)	Breadth (m)	Ht. (m)		
1.	Earthwork in excavation in foundation	1	6	0.8	0.9	4.32	4.32 m <sup>3</sup>
2.	lime concrete in foundation	1	6	0.8	0.3	1.44	1.44 m <sup>3</sup>
3.	1 <sup>st</sup> class brickwork :- (in foundation & plinth)						
	1 <sup>st</sup> footing	1	6	0.6	0.2	0.72	} 3.24 m <sup>3</sup>
	2 <sup>nd</sup> footing	1	6	0.5	0.2	0.6	
	Plinth wall upto G.L.	1	6	0.4	0.2	0.48	
	Plinth wall above G.L.	1	6	0.4	0.6	1.44	
4.	2.5cm Damp proof course	1	6	0.4	-	2.4	2.4 m <sup>2</sup>
5.	1 <sup>st</sup> class Brickwork in lime mortar for superstructure	1	6	0.3	3.5	6.3	6.3 m <sup>3</sup>
6.	12 mm plaster of cement Sand 1:6 -						
	Inside (only wall)	1	6	-	3.5	21.0	} 46.2 m <sup>2</sup>
	outside including (wall + plinth) 10cm below G.L.	1	6	-	3.5 + 0.6 + 0.1 = 4.2	25.2	
7.	White washing 3 coats Inside wall	1	6	-	3.5	21.0	21 m <sup>2</sup>
8.	colour washing 2 coats outside wall (wall + plinth)	1	6	-	4.1	24.6	24.6 m <sup>2</sup>



## Abstract of Estimated cost

Item no.	Description of items of work	Qty	Unit	Rate Rs.	Per	Amount Rs.
1.	Earthwork in Excavation	4.32	m <sup>3</sup>	350	per m <sup>3</sup>	1512
2.	Lime concrete in foundation	1.44	m <sup>3</sup>	220	per m <sup>3</sup>	316.8
3.	1st class brickwork in foundation & plinth	3.24	m <sup>3</sup>	300	per m <sup>3</sup>	972
4.	2.5cm thick DPC	2.4	m <sup>2</sup>	20	per m <sup>2</sup>	48
5.	1st class brickwork in superstructure	6.3	m <sup>3</sup>	320	per m <sup>3</sup>	2016
6.	12mm plaster (1:6)	46.2	m <sup>2</sup>	8.50	per m <sup>2</sup>	392.7
7.	white washing 3 coats	21	m <sup>2</sup>	0.75	per m <sup>2</sup>	15.75
8.	colour washing 2 coats	21.6	m <sup>2</sup>	0.82	per m <sup>2</sup>	20.17

Total = 3796.54

Contingencies 5% 189.82

Uncharged Establishment 2% 75.92

Grand total = Rs 4062.3

Note :- Earthwork in trench filling  
 = Quantity in excavation - Quantity of concrete  
 Quantity of brickwork upto 62.

$$4.32 - (1.44 + 1.80)$$

$$= 1.08 \text{ m}^3$$



Details of Measurement & calculation of Quantities (Fig 2.2)  
[Traditional Bricks]

Item no	Description of Items of work	No.	Dimensions			Qty	Total Qty
			L	B	H		
1.	Earthwork in excavation in foundation	1	6	0.8	0.75	3.6m <sup>3</sup>	3.6m <sup>3</sup>
2.	lime concrete in foundation	1	6	0.8	0.3	1.44m <sup>3</sup>	1.44m <sup>3</sup>
3.	1st class brickwork in foundation + plinth						
	1st footing	1	6	0.686	0.15	0.62m <sup>3</sup>	3.19m <sup>3</sup>
	2nd footing	1	6	0.571	0.15	0.52	
	plinth wall upto C.L	1	6	0.454	0.15	0.41	
	plinth wall above C.L	1	6	0.454	0.6	1.64	
4.	2.5cm DPC	1	6	0.454	-	2.74	2.74m <sup>2</sup>
5.	1st class brickwork in Superstructure	1	6	0.343	3.5	7.20	7.20m <sup>3</sup>
6.	12mm plaster						
	Inside	1	6	-	3.5	21	46.2m <sup>2</sup>
	Outside	1	6	-	4.2	25.2	
7.	White washing (Inside wall)	1	6	-	3.5	21.0	21m <sup>2</sup>
8.	Colour washing (Outside wall)	1	6	-	4.1	24.6	24.6m <sup>2</sup>



## LONG WALL - SHORT WALL METHOD

Long wall length out to out

$$= \text{Centre to centre length} + \text{half breadth one side} + \text{half breadth other side}$$

$$= \text{Centre to Centre length} + \text{one breadth}$$

Short wall length in to in

$$= \text{Centre to Centre length} - \text{one breadth}$$

Pbm :- ①

Fig 2-3, the plan represents the plan of superstructure wall of a single room building of  $5\text{m} \times 4\text{m}$ , and sections represent the cross sections of the walls with foundation.

Estimate the quantities of -

- (1) Earthwork in excavation in foundation
- (2) Concrete in foundation
- (3) Brickwork in foundation and plinth area
- (4) Brickwork in superstructure



## Method of Building Estimate

- (1) long wall - short wall method
- (2) Centre line Method
- (3) Partly centre line and short wall method

Pbm. ①

Estimate the quantities of brickwork and plastering required in a wall 4m long, 3m high and 30cm 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.

Solution:-

$$\begin{aligned}\text{Quantity of brickwork} &= L \times B \times H \\ &= 4 \times 0.3 \times 3 \\ &= \underline{3.6 \text{ m}^3}.\end{aligned}$$

$$\begin{aligned}\text{Quantity of plastering} \\ \text{(2 faces)} &= 2 \times L \times H \\ &= 2 \times 4 \times 3 \\ &= \underline{24 \text{ m}^2}\end{aligned}$$

$$\begin{aligned}\text{Cost of brickwork} &= \text{Rs. } 320 / \text{m}^3 \\ &= 3.6 \times 320 \\ &= 1152 \text{ Rs.}\end{aligned}$$

$$\begin{aligned}\text{Cost of plastering} &= 24 \times 8.50 \\ &= \text{Rs. } 204\end{aligned}$$

$$\begin{aligned}\text{Total Cost} &= 1152 + 204 \\ &= \underline{\underline{\text{Rs. } 1356}}\end{aligned}$$



Pbm. 2

Prepare a detailed estimate of part of a wall of a building from the given plan and section and general specifications.

General specification :-

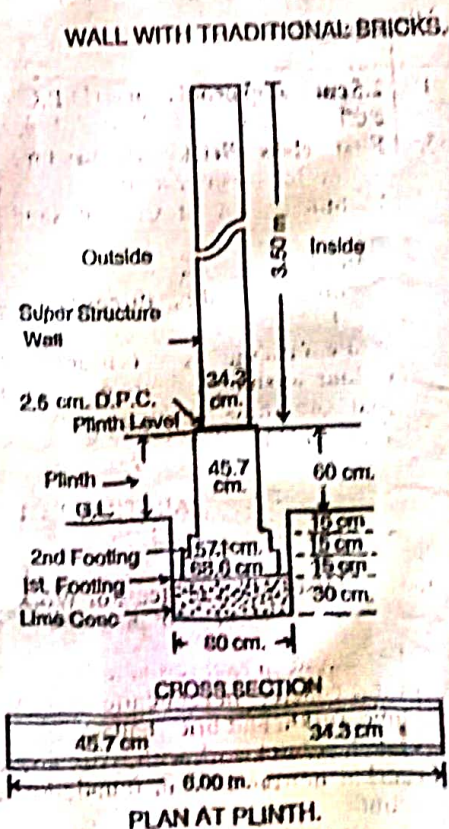
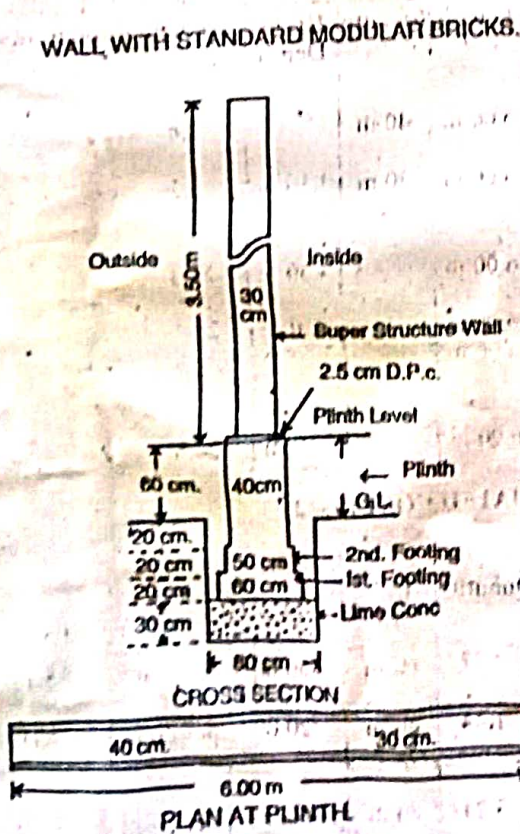
- (1) Foundation concrete shall be of lime concrete
- (2) Foundation and plinth shall be of 1<sup>st</sup> class brickwork in lime mortar.
- (3) Damp proof course - 2.5mm c.c. 1:1.5:3 with water proofing compound.
- (4) Superstructure - 1<sup>st</sup> class brickwork in lime mortar.
- (5) Wall finishing - Inside wall 12mm Cement plastered 1:6 and white washed 3 coats.

Outside wall 12mm Cement plastered 1:6 including 10cm below ground level and finished with two coats of colour wash over one coat of white wash.

RATE

Plan and Section Fig. 2-1

Fig. 2-2





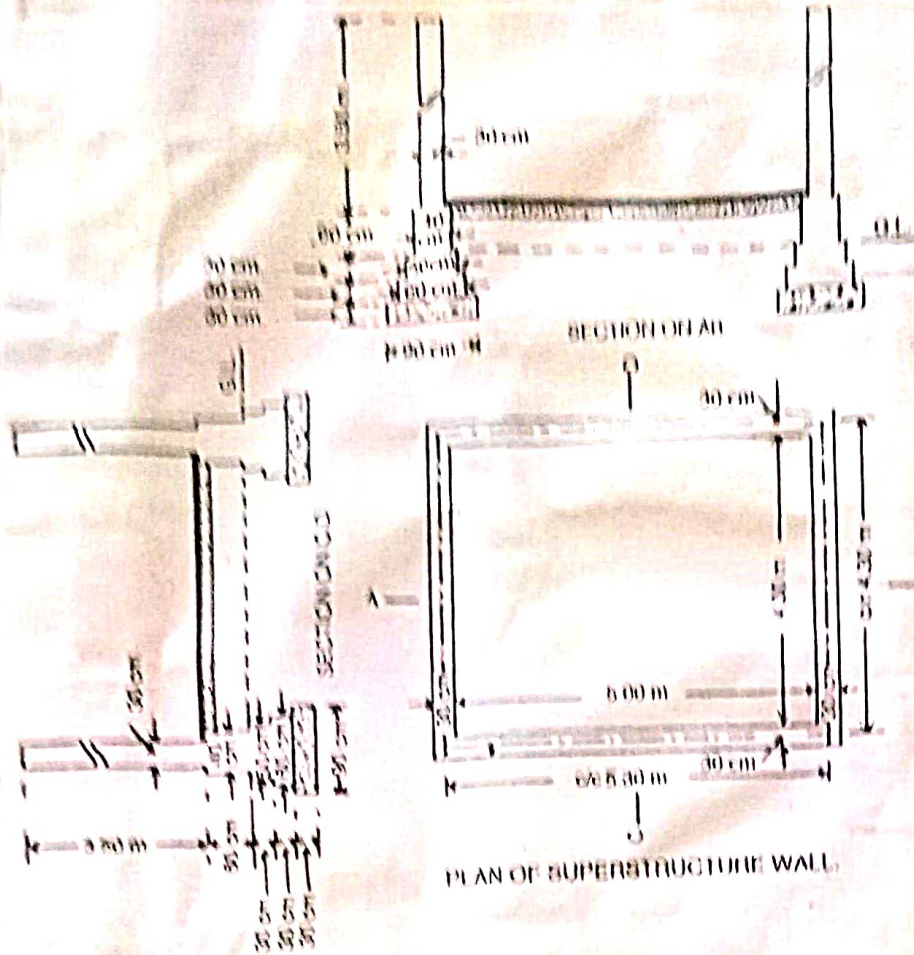


Fig. 2.3

Item no.	Particulars of Item	No.	Length	Breadth	Height or Depth	Quantity	Explanatory note.
1.	Earthwork in excavation in foundation - Long walls Short walls	2	6.2 m	0.9 m	0.9 m	10.04	$5.30 \times 0.9 = 4.77$
2		2	3.4 m	0.9 m	0.9 m	5.51	$4.30 \times 0.9 = 3.87$
Total =						16.55 m <sup>3</sup>	
2.	Concrete in foundation - Long walls Short walls	2	6.2 m	0.9 m	0.3 m	3.35	
2		2	3.4 m	0.9 m	0.8 m	1.83	
Total =						5.18 m <sup>3</sup>	
3.	Brickwork in foundation and plinth						



Item no	Description	No.	Length	B. width	Height	Quantity
	Long walls					
	1st footing	2	5.9m	0.6m	0.3m	2.13
	2nd footing	2	5.8m	0.5m	0.3m	1.74
	Plinth walls	2	5.7m	0.4m	0.8m	2.74
	Short walls					
	1st footing	2	3.7m	0.6m	0.3m	1.33
	2nd footing	2	3.8m	0.5m	0.3m	1.14
	Plinth walls	2	3.9m	0.4m	0.8m	1.87
					Total	10.95m <sup>3</sup>
4.	Brickwork in Superstructure					
	Long walls	2	5.6m	0.8	3.5m	11.76
	Short walls	2	4.0m	0.8m	3.5m	8.40
					Total	20.16m <sup>3</sup>

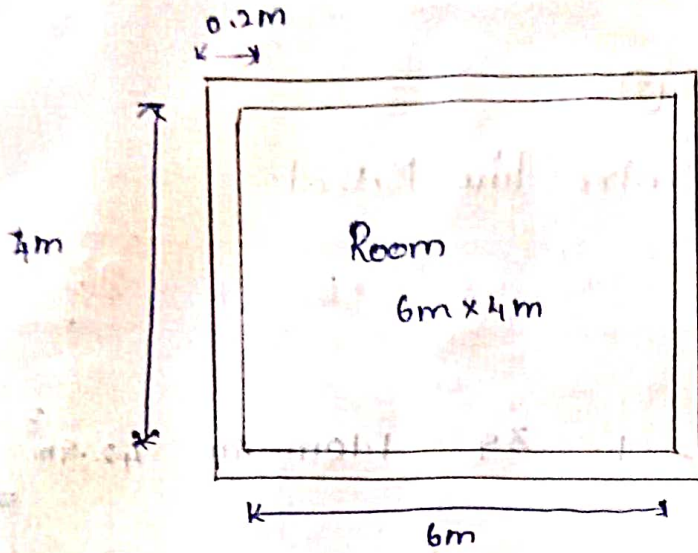
Pbm. ②

Estimate the quantities of the following items of a two roomed building from the given plan & section:

- (1) Earthwork in excavation in foundation
- (2) Lime concrete in foundation
- (3) 1st class brickwork in cement mortar 1:6 in foundation & plinth
- (4) 2.5cm damp proof course
- (5) 1st class brickwork in lime mortar in Superstructure



## CENTRE LINE METHOD.



$$\begin{aligned} \text{Total Centre length of walls} &= 6.2 + 6.2 + 4.2 + 4.2 \\ &= 20.8 \text{ m} \end{aligned}$$

Pbm. ③

Refer Pbm. ①

Solve using centre line Method.

Item no.	Description	No.	Length	Breadth	Height	Quantity	Explanatory notes
1.	Earthwork in excavation	1	19.2	0.9	0.9	15.55 m <sup>3</sup>	Total Centre length = (5.3 x 2) + (4.3 x 2) = 19.2 m.
2.	Concrete in foundatn.	1	19.2	0.9	0.3	5.18 m <sup>3</sup>	
3.	Brickwork in foundatn + plinth	1 <sup>st</sup> flng	19.2	0.6	0.3	8.46	
		2 <sup>nd</sup> flng	19.2	0.5	0.3	2.88	
		Plinth wall	19.2	0.4	0.6	4.61	
Total =						10.95 m <sup>3</sup>	
4.	Brickwork in superstruct.	1	19.2m	0.3	2.50	20.16 m <sup>3</sup>	



Pbm ①

Refer Pbm ②

Solve by Centre line Method.

Sl. No.	Description	No.	L	B	H	Qty	Explanation
1.	Earthwork in Excavation	1	39	1.10m	1m	42.9m <sup>3</sup>	$\frac{1}{2} \text{ length} = 20.10m$ $40.10 - 2 \times 1.0$ $= 39m$
2.	Lime concrete in foundation	1	39	1.10	0.3m	12.87	1. Same as above
3.	1 <sup>st</sup> class brickwork in foundation & plinth						
	1 <sup>st</sup> footing	1	39.3m	0.8m	0.2m	6.29	$L = 40.1 - 2 \times 0.5 = 39$
	2 <sup>nd</sup> footing	1	39.4m	0.7m	0.1m	2.76	$L = 40.10 - 2 \times 0.5 = 39$
	3 <sup>rd</sup> footing	1	39.5m	0.6m	0.1m	2.37	
	4 <sup>th</sup> footing	1	39.6m	0.5m	0.1m	1.98	
	Plinth wall above fltg	1	39.7m	0.4m	0.8m	12.7	
4.	Damp Proof course	1	39.7m	0.4m	-	15.88	$L = 40.10 - 2 \times 0.4$
	Deduct door sill	2	1.20m	0.4m	-	0.96	
					Net	14.92m <sup>3</sup>	
5.	1 <sup>st</sup> class brickwork in superstructure	1	39.8m	0.8m	1.2m	50.15m <sup>3</sup>	$L = 40.1 - 2 \times 0.5$
	<u>Deduct -</u>						
	Same						
	Refer Pbm ②						



Prob 6

Detailed Estimate of a small residential building by long wall & short wall method. (2 rooms)

- No. of long wall = 3 (L)
- No. of short wall = 2 (S<sub>1</sub>)
- No. of short wall = 2 (S<sub>2</sub>)
- No. of short wall = 1 (S<sub>3</sub>)
- One partition wall = 1

c/c distance between the long wall =  $8.7 - 0.2 = 8.5m$

c/c distance between the short wall (1) =  $6.9 - 0.2 = 6.7m$

c/c distance between the short wall (2) =  $3.2 + 0.2 = 3.4m$

c/c distance between the short wall (3) =  $3.1 + 0.2 = 3.3m$

Area of T. Total

8.0	2.1	16.8
8.0	7.0	56.0
8.0	3.0	24.0
8.0	1.0	8.0
8.0	2.0	16.0

8.0	3.0	24.0
8.0	7.0	56.0
8.0	1.0	8.0
8.0	2.0	16.0
8.0	3.0	24.0

(1) 1000 bricks  
 (2) 1000 bricks  
 (2) 1000 bricks  
 (2) 1000 bricks

partition

net area 20.0

(1) 1000 bricks  
 (2) 1000 bricks  
 (2) 1000 bricks  
 (2) 1000 bricks

partition if the wall is constructed in

Item no.	Description of work	No.	Length	Breadth	Height	Quantity	Remarks / Explanatory notes
1.	Earthwork in excavation in foundation long walls (L) Short wall 1 (S <sub>1</sub> ) Short wall 2 (S <sub>2</sub> ) Short wall 3 (S <sub>3</sub> ) Steps	3	9.3	0.8	0.8	17.856	L = c/c distance + width of foundation = 8.5 + 0.8 = 9.3m
		2	5.1	0.8	0.8	6.528	S <sub>1</sub> = c/c distance - width of foundation - width = 6.7 - 0.8 - 0.8 = 5.1m
		2	2.6	0.8	0.8	3.328	S <sub>2</sub> = c/c distance - width = 3.4 - 0.8 = 2.6m
		1	2.5	0.8	0.8	1.600	S <sub>3</sub> = c/c distance - width = 3.3 - 0.8 = 2.5m
		2	1.2	0.7	0.10	0.168	H = 0.6 + 0.2 = 0.8m (width of foundation)
							Steps = (1 + 0.1 + 0.2) × 1.2m
							B = 0.3 + 0.3 + 0.1 = 0.7m
					Total = 29.48m <sup>3</sup>		
2.	P.C.C 1:5:10 below the footing long Wall (L) Short wall 1 (S <sub>1</sub> ) Short wall (S <sub>2</sub> ) Short wall (S <sub>3</sub> ) Steps	3	9.3	0.8	0.2	4.464	
		2	5.1	0.8	0.2	1.632	
		2	2.6	0.8	0.2	0.832	
		1	2.5	0.8	0.2	0.4	
		2	1.2	0.7	0.1	0.168	
							Total = 7.496m <sup>3</sup>



3. RR Masonry with  
CM 1:6 for footing  
and base ment.

For footing :-

long wall (L)

Short wall (S<sub>1</sub>)

S<sub>2</sub>

S<sub>3</sub>

For base ment

long wall (L)

Short wall (S<sub>1</sub>)

(S<sub>2</sub>)

(S<sub>3</sub>)

4. Earth filling in base ment

Hall  
Kitchen

Bed

Bed

W.C

$$L = 8.5 + 0.6 = 9.1m$$

$$S_1 = 6.7 - 0.6 - 0.6 = 5.5m$$

$$S_2 = 3.4 - 0.6 = 2.8m$$

$$S_3 = 3.3 - 0.6 = 2.7m$$

$$L = 8.5 + 0.4 = 8.9m$$

$$S_1 = 6.7 - 0.4 - 0.4 = 5.9m$$

$$S_2 = 3.4 - 0.4 = 3m$$

$$S_3 = 3.3 - 0.4 = 2.9m$$

$$8.1 - 0.2 = 7.9$$

$$3.1 - 0.2 = 2.9$$

$$3.2 - 0.2 = 3$$

$$3.2 - 0.2 = 3$$

$$3.2 - 0.2 = 3m$$

4.828  
 3.96  
 2.016  
 0.972

5.34  
 2.36  
 1.2  
 0.58

4.872  
 2.94  
 3.15  
 3.465  
 1.05

0.6  
 0.6  
 0.6  
 0.6

0.5  
 0.5  
 0.5  
 0.5

0.35  
 0.35  
 0.35  
 0.35  
 0.35

9.1  
 5.5  
 2.8  
 2.7

8.9  
 5.9  
 3  
 2.9

7.9  
 2.9  
 3  
 3  
 3

3  
2  
2  
2

3  
2  
2  
1

1  
1  
1  
1  
1

Total = 15.477m<sup>3</sup>

Sl. No.	Description	no.	length	Breadth	Height	Quantity	Explanatory notes
5	EW long with CM 1:5 for superstructure						
	Long wall (L)	5	8.7	0.2	3	15.66	$L = 8.5 + 0.2 = 8.7m$
	Short wall (S)	2	6.3	0.2	3	7.56	$S_1 = 6.7 - 0.2 - 0.2 = 6.3m$
	(S <sub>2</sub> )	2	2.2	0.2	3	3.84	$S_2 = 3.4 - 0.2 = 3.2m$
	(S <sub>3</sub> )	1	3.1	0.2	3	1.86	$S_3 = 3.3 - 0.2 = 3.1m$
	Partition wall	1	1.2	0.1	3	0.36	
	Pampet wall	2	8.7	0.1	0.6	1.044	$L = 8.5 + 0.2 = 8.7m$
	long wall	2	6.7	0.1	0.6	0.804	$S = 6.7$
	Short wall	2	1	0.6	0.15	0.18	
	Steps ①	2	1	0.3	0.15	0.09	
	Steps ②	2	1	0.3	0.15	0.09	
	Deduction				Total	51.398	
	Door	5	1.0	0.2	2.0	2	
	D <sub>1</sub>	1	0.9	0.1	1.8	0.162	
	Arch opening	1	1.3	0.2	2.1	0.546	
	Window (W)	8	1.4	0.2	1.4	3.136	



Ventilators	1	0.9	0.2	0.6	0.198
Lintels					
long wall	3	8.7	0.2	0.15	0.783
Short wall S1	2	6.3	0.2	0.15	0.378
S2	2	3.2	0.2	0.15	0.192
S3	1	3.1	0.2	0.15	0.093
Parapet wall	1	1.2	0.1	0.15	0.018
			Total		7.416
			Net Quantity		31.398
					6) 7.416
					<u>23.982 m<sup>3</sup></u>
6. Rec 1:2:4 for lintels, roof slab, sunshade & loft.					
Roof slab	1	6.9	8.7	0.1	6.003
Rec lintel (same in items total)					1.464
Rec sunshade along length	1	33.6	0.6	0.15	3.024
Breadth "	1	3.1	0.6	0.15	0.279
loft				Total	10.77m <sup>3</sup>

Lintel portion only

$$\text{Sunshade} = (6.9 + 1.2) \times 2 + (8.7) \times 2 = 33.6$$

Sl. No.	Description	no. lengths	Excess	Height	Area	Explanatory notes
7.	Damp proof course					
	long wall (1)	3	0.2	8.7	5.22	
	Short wall (2)	2	0.2	6.3	2.52	
	(S <sub>2</sub> )	2	0.2	3.2	1.28	
	(S <sub>3</sub> )	1	0.2	3.1	0.62	
				Total	9.64 m <sup>2</sup>	
8.	Ceiling Plastering with C.M.F. 10mm Tex.					
	Hall	1	5	3.1	15.5	
	Bed 1	1	3.2	3.2	10.24	
	Bed 2	1	3.5	3.2	11.2	
	W.C & passage	1	1.2	3.2	3.84	
	Kitchen	1	3.1	3.1	9.61	
				Total	50.39 m <sup>2</sup>	
	loft	1	1.35	3.10	14.185	0.6 + 0.15 + 0.6 = 1.35
	Sunshade					
	Top & Bottom	2x2	0.6	9.9	23.76	8.7 + 0.6 + 0.6 = 9.9m
	length side	2x2	0.6	6.9	16.56	6.9 (width of building)
	Width side	1	-	3.6	5.76	[8.7 + 6.9 + 2(0.6) + 2(0.6)] = 36m
	side portion					



Total =  $96.4 \text{ m}^2 + 4.185 = 100.295 \text{ m}^2$

9. Wall plastering with C.M:4  
12mm thick

Inside wall

- Hall 1
- Bed 1 1
- Bed 2 1
- Kitchen 1
- W.C 1
- Passage 1
- Outside (from basement to top of parapet) 1

Steps :-

- Tread 2x2
- Rise 3x2
- Side ① 2x2
- ② 2x2

Top of the parapet (length) 2  
(width portion) 2

Inside of Parapet (length portion) 2  
(width portion) 2

16.2	-	3	$48.6 \text{ m}^2$	$l = 2 \times (3.1) + 2(5) = 16.2 \text{ m}$
12.8	-	3	$38.4 \text{ m}^2$	$l = 2(3.2) + 2(3.2) = 12.8 \text{ m}$
13.4	-	3	$40.2 \text{ m}^2$	$l = 2(3.2) + 2(3.8) = 13.4 \text{ m}$
12.4	-	3	$37.2 \text{ m}^2$	$l = 2(3.1) + 2(3.1) = 12.4 \text{ m}$
6.4	-	3	$19.2 \text{ m}^2$	$l = 2(2) + 2(1.2) = 6.4 \text{ m}$
5.4	-	3	$16.2 \text{ m}^2$	$l = 2(1.1) + 2(1.6) = 5.4 \text{ m}$
31.2	-	3.55	$110.76 \text{ m}^2$	$l = (3 + 1 + 0.6) - (0.15) = 3.55 \text{ m}$
0.3	0.3	-	$1.2 \text{ m}^2$	
0.6	-	0.15	$0.9 \text{ m}^2$	
0.3	0.6	0.15	$0.36 \text{ m}^2$	
0.1	0.3	0.15	$0.18 \text{ m}^2$	
0.1	0.1	-	$1.74 \text{ m}^2$	$l = (8.7) = 8.7$
0.1	0.1	-	$1.54 \text{ m}^2$	$6.9 - 0.2 = 6.7$
0.6	-	0.6	$10.00 \text{ m}^2$	
0.6	-	0.6	$8.04 \text{ m}^2$	$8.7 - 0.1 - 0.1$
TOTAL = 21.4				

Sl. No.	Description	No.	Length	Breadth	Height	Quantity	Explanatory Notes
	Deductions :-						
	Door - D	5	1	-	2.0	10	L.H = 2 x 23 m <sup>2</sup> (deduct 18m <sup>2</sup> )
	Door - D1	1	0.9	-	1.8	1.62	
	Window	8	1.4	-	1.4	15.68	
	Ventilation	1	0.9	-	0.6	0.54	
	Ac	1	1.3	-	2.1	2.73	
					Total =	30.57 m <sup>2</sup>	
						334.5 m <sup>2</sup>	
						- 30.57	
					Net Quantity	503.93 m <sup>2</sup>	
10.	Flooring finish mosaic tiles						
	Hall	1	3.1	5.0	-	15.5	as same as ceiling
	Bed ①	1	3.2	3.2	-	10.24	
	②	1	3.2	3.5	-	11.2	
	Kitchen	1	3.1	3.1	-	9.61	
	W.C	1	2.0	1.2	-	2.4	
	passage	1	1.1	1.6	-	1.76	1.2 x 0.2 + 0.2 x 1.6 = 1.6

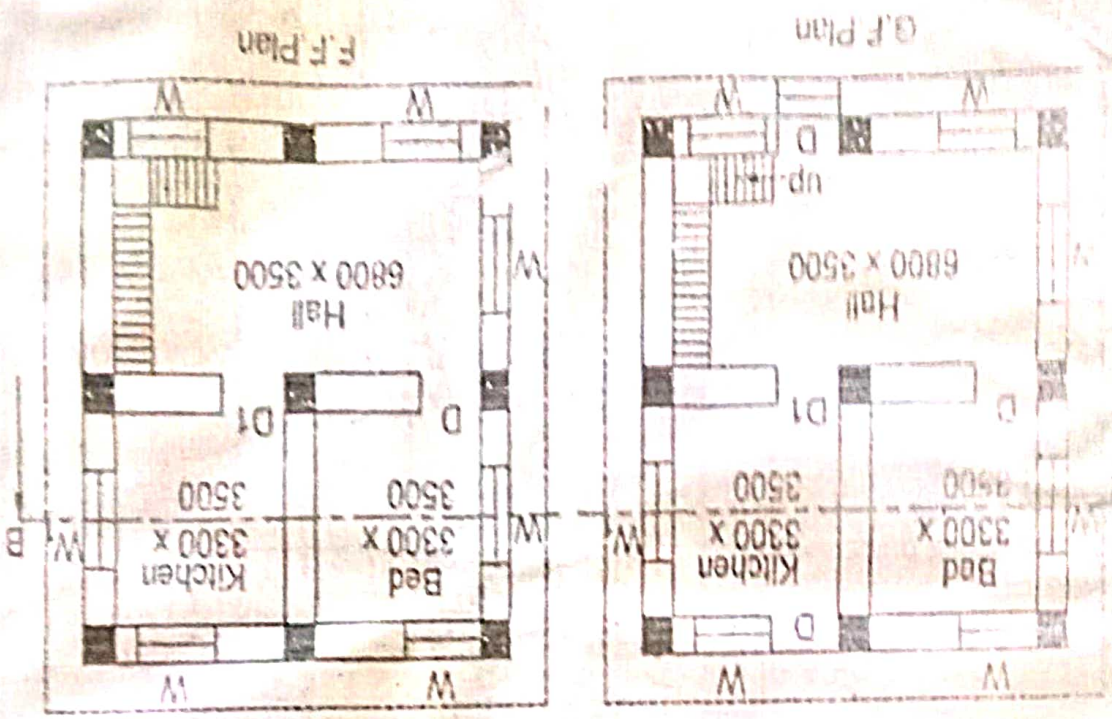
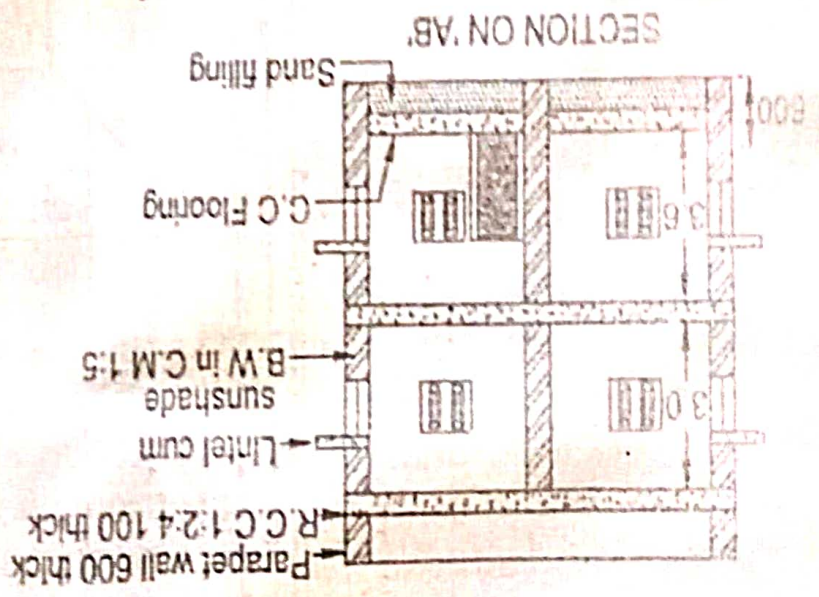


Door slit - D	1.0	0.2	-	0.2
Door slit - D <sub>1</sub>	0.9	0.1	-	0.09
Do	1.3	0.2	-	0.26
Total				51.26
11. Flooring with cc 115:10				
Hall	3.7	5.0	0.13	2.015
Bed C	3.2	3.2	0.13	1.3312
Bed D	3.2	3.5	0.13	1.456
Kitchen	3.1	3.1	0.13	1.2493
Wc	2.0	1.2	0.13	0.312
Passage	1.1	1.6	0.13	0.2388
Door slit D	1.0	0.2	0.13	0.13
Door slit D <sub>1</sub>	0.9	0.1	0.13	0.0117
Do	1.9	0.0	0.13	2.0338
Total				6.7916
12. Supplying & fixing of doors, windows & Ventilators				
Door D	34	5.2	2	10
Door D <sub>1</sub>	0.9		1.8	1.62
Windows W	1.4		1.4	15.68
Ventilator V	0.9		0.6	0.54
Total				27.84

Item no	Description	No	Length	Breadth	Height	Quantity	Explanatory notes
13.	Pointing with C.M 1:6 in RR masonry	1	32	-	0.5	16m <sup>2</sup>	
14.	Weathering course	1	6.7	8.5	-	56.95 m <sup>2</sup>	6.9 - 0.1 - 0.1 = 6.7 = L
15.	White washing (2 coats) Quantity as per item 8					100.295 m <sup>2</sup>	8.7 - 0.1 - 0.1 = 8.5 = B
16.	Colour Washing (2 coats) Quantity as per item 9					303.95	
17.	Paint with good emulsion paint of 2 coats over primary coat : Door D D, Window W Ventilator	2 x 5 2 x 1 2 x 8 2 x 1	1.0 0.9 1.4 0.9		2 1.8 1.4 0.6	20 3.24 31.36 1.08	
18.	Electrification Work					Lump sum	



Detailed Estimate of Two storied Building (Frame structure) with RCC roof (By CENTRE LINE METHOD)











Item no.	Description	No.	L	B	H	Qty	Remarks
1	Earthwork Excavation column steps Plinth Beam walls around Cross wall Bed + Hall Cross wall Bed + kitchen	9	1.20	1.20	1.80	23.33	28.8 - 8(1.2) = 19.20  7 - 1.2 = 5.8
		2	1.40	0.95	0.10	0.27	
		1	19.2	0.20	0.30	1.25	
		1	5.80	0.20	0.30	0.35	
		1	2.50	0.20	0.30	0.15	
		Total = 25.25 m <sup>3</sup>					
2.	P.C.C 1:4:8 for foundation Column Steps	9	1.20	1.20	0.15	1.94	0.75 + 0.2 = 0.95
		2	1.40	0.95	0.10	0.27	
		Total = 2.21 m <sup>3</sup>					
3.	R.C.C 1:2:4 for columns, footings, plinth, beams, roof beams, lintels etc Column: - Level base	9	1.20	1.20	0.15	1.94	$A_1 = 1.2 \times 1.2$ $A_2 = 0.2 \times 0.2$ , $A_m = \frac{0.2 + 1.2}{2} = 0.7$



slipping portion	9	0.172	1.55				
Column below							
Plinth beam:	9	0.2	0.2	1.15	0.41		
" " up to parapet	9	0.2	0.2	6.60	2.38		
Plinth beam:							
Walls around	1	28.8	0.2	0.3	1.73		
c/w between Bed + Hall	1	6.8	0.2	0.3	0.41		
c/w between Bed + Kitchen	1	3.5	0.2	0.3	0.21		
Lintel (G.F + F.F)							
Door D	6	1.30	0.2	0.15	0.31		
Windows W <sub>1</sub>	2x5	1.70	0.2	0.15	0.51		
W <sub>2</sub>	2x2	1.50	0.2	0.15	0.18		
Ventilator V	2x1	1.30	0.2	0.15	0.08		
Roof beam (G.F + F.F)							
Walls around	1x2	28.80	0.2	0.45	5.18		
c/w Bed, Kitchen + Hall	1x2	6.80	0.2	0.45	1.22		
c/w Bed + Kitchen	1x2	3.50	0.2	0.45	0.63		
Roof slab (G.F + F.F)	1x2	7.20	7.60	0.10	10.094		

$$= \frac{1}{6} (A_1 + A_2 + 4A_m)$$

$$A_m = 0.7$$

$$7.4 - 2(0.3) - 2(0.1) = 6.6$$

$$= 6.6m$$

Item no.	Description	NO.	L	B	H	Qty	Remarks
5	Earth filling inside the basement	1	6.80	3.50	0.45	10.71	
			3.30	3.50	0.45	5.20	
			3.30	3.50	0.45	5.20	
			Total =			21.11m <sup>3</sup>	
6.	Ceiling plastering 1:3 (G.F + P.P)	2	6.80	3.50	-	47.60	$7.2 + 2(0.6) = 8.4$ $7.6 + 2(0.6) = 8.8$ $(8.8 + 8.4)^2 = 34.40$
			3.30	3.50	-	23.10	
			3.30	3.50	-	23.10	
			3.2.0	0.60	0.05	76.8	
			34.4	-	-	6.68	
			Total =			177.48m <sup>2</sup>	
7.	Wall plastering 1:5 (G.F + P.P)	1	29.6	-	-	219.04	
			Total =			219.04	



$$= \frac{1}{6}(A_1 + A_2 + 4A_m)$$

$$A_m = 0.7$$

$$7.4 - 2(0.3) - 2(0.1) = 6.6$$

$$= 6.6m$$

slipping portion	9	0.172	1.55				
column below							
plinth beam:	9	0.2	0.2	1.15	0.41		
" " up to parapet	9	0.2	0.2	6.60	2.38		
Plinth beam:							
Walls around	1	28.8	0.2	0.3	1.43		
c/w between Bed + Hall	1	6.8	0.2	0.3	0.41		
c/w between Bed + kitchen	1	3.5	0.2	0.3	0.21		
Lintel (G.F + P.F)							
Door D	6	1.30	0.2	0.15	0.31		
Windows W	2x5	1.70	0.2	0.15	0.51		
" " W	2x2	1.50	0.2	0.15	0.18		
Ventilator V	2x1	1.30	0.2	0.15	0.08		
Roof beam (G.F + P.F)							
Walls around	1x2	28.80	0.2	0.45	5.18		
c/w Bed, kitchen + Hall	1x2	6.80	0.2	0.45	1.22		
c/w Bed + kitchen	1x2	3.50	0.2	0.45	0.63		
Roof slabs (G.F + P.F)	1x2	7.20	7.60	0.10	10.094		

Inside the hall  
 Inside the bed  
 Inside the kitchen  
 Step rise portion  
     2nd step  
     3rd step  
 Tread portion  
 staircase steps  
 Waist slabs  
 Waist slabs  
 landing  
 Parapet wall top  
 Inside

Deduct for

Doors D  
 Windows W  
 W,  
 Ventilator V

2	20.6	-	3.00	123.60
2	13.6	-	3.00	81.60
2	13.6	-	3.00	81.60
2x1	2.5	-	0.15	0.75
2x1	2.0	-	0.15	0.60
2x1	1.50	-	0.15	0.45
2x3	1.00	0.25	-	1.50
18	0.75	0.4	-	5.40
1	2.05	0.75	-	1.54
1	3.18	0.75	-	2.40
1	0.75	0.75	0	0.56
1	28.8	0.20	-	5.76
1	28.0	-	0.60	16.80
			Total	541.6m <sup>3</sup>
6	1	-	2.10	12.60
2x5	1.4	-	1.50	21.0
2x2	1.2	-	1.50	3.20
2	1	-	1.60	3.20
				44.00
			Net Quantity =	497.6m <sup>3</sup>



Item no.	Description	No.	L	B	H	Qty	Remarks
8.	Floors finishing (G.F & P.F)						
	Inside the Hall	2	6.80	2.50	-	41.60	
	Inside the bed	2	3.30	3.50	-	23.10	
	Inside the kitchen	2	3.30	3.50	-	23.10	
	Sills of Doors - D	6	1.00	0.20	-	1.20	
						Total = 95.00m <sup>2</sup>	
9.	Supplying & fixing of doors & windows						
	Doors - D	6				6 NO.S	
	Window - W	2x5				10 NO.S	
	" W,	2x2				4 NO.S	
	Ventilator V	2x2				2 NO.S	
10.	Weathering course first floor slab	1	6.80	4.20	-	48.96m <sup>2</sup>	

2-17-75 AT 1000 300 300

<p>11. White washing 2 coats Qty as per item no-6</p>			
<p>12. Colour washing two coats Qty as per item no-7</p>			
<p>13. Painting 2 coats (C.F.F.F)</p>			
<p>Doors 3</p>	6x2	1	25.1
<p>Windows 2</p>	2x5x2	1.4	47.0
<p>W</p>	2x1x5	1.2	16.00
<p>V</p>	2x1x5	1.1	27.10
			Total = \$3,500.00
<p>14. Providing Electrification</p>			1.5
<p>15. Providing Plumbing work</p>			1.5
<p>16. Providing Drainage work</p>			1.5
<p>17. Rain Water Harvesting system</p>			1.5
<p>18. Petty works &amp; Supervision</p>			1.5



Item (4)

# Estimate of a Three Roomed Building

with Front and Back Verandahs.

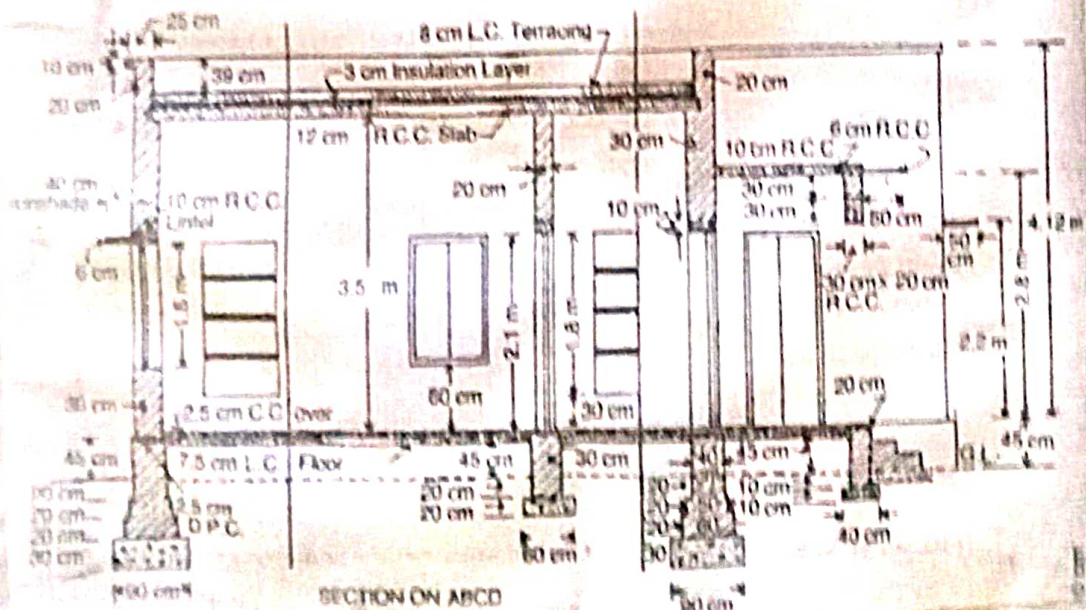
Estimate the quantities of the following items of work of the building.

- (1) Earthwork in excavation in foundation
- (2) Lime concrete in foundation
- (3) First class brickwork in 1:6 cement mortar in superstructure including parapet.
- (4) 1st class brickwork in lime mortar in foundation & plinth
- (5) Damp proof & c.
- (6) R.C.C. work in roof slabs, lintels, sunshades etc.
- (7) Steel reinforcement bars in R.C.C. work at 1%.

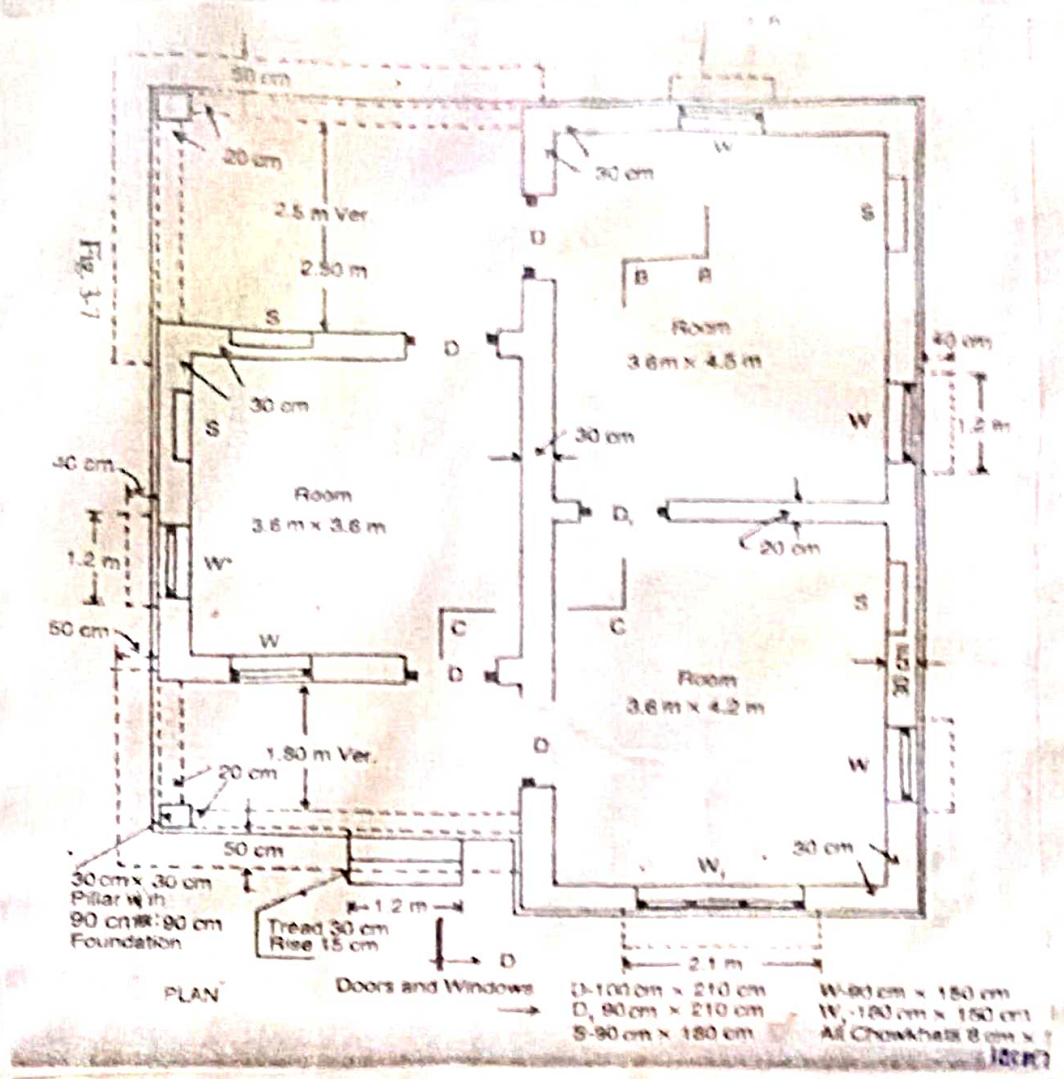
(12)

## ESTIMATING AND COSTING

### THREE ROOMED BUILDING WITH FRONT AND BACK VERANDAH







Solution:-

Centre to centre lengths of two adjoining rooms (3.6 x 4.5m room and 3.6 x 4.2m room)

Combined -

Long walls - 9.00m, Short walls - 3.90m

Square room - (3.60 x 3.60m room)

Long walls - 3.90m, short walls - 3.90m

Verandah:-

centre to centre of 30 cm wall and 30cm sq. pillar.

Front Verandah (1.80m Ver.) -

Long wall (Front) - 3.90m, short wall (side) - 2.10m

Back Verandah (2.50m Ver.)

Long wall (Back) - 3.90m, short wall (side) - 2.10m



Sl. No.	Particulars of items and details of work	Quantity	Length (m)	Breadth (m)	Height (m) Depth (m)	Quantity	Expanding rates
1.	Reinforcement in foundation						
	Adjoining room (concrete)						
	Long walls	2	10.10	0.90	0.90	16.36	$L = 9.20 + 0.90 = 10.10$
	Short walls	2	3.00	0.90	0.90	4.86	$L = 3.00 + 0.90 = 3.90$
	Inter room wall	1	3.00	0.60	0.40	0.72	$L = 3.00 - 0.90 = 2.10$
	Square room						
	Long walls (center)	1	4.80	0.90	0.90	3.88	$L = 3.90 + 0.90 = 4.80$
	Short walls	2	3.00	0.90	0.90	4.86	$L = 3.90 + 0.90 = 4.80$
	Murabah pillars	2	0.90	0.90	0.90	1.46	
	Verandah district wall - long walls (front + back)	2	2.00	0.40	0.20	0.48	$L = 3.90 - 0.90 = 3.00$
	Short wall front (side)	1	1.10	0.40	0.20	0.09	$L = 2.00 - 0.90 = 1.10$
	Short wall back side	1	1.80	0.40	0.20	0.15	$L = 2.70 - 0.90 = 1.80$
	step	1	1.20	0.70	0.15	0.08	







Item no.	Particulars of items & details of works	No.	Length m	Breadth m	Depth m	Quantity	Explanatory Notes
3.	I-class brick work in lime mortar in foundation & plinth - Adjoining rooms combi.						
	long walls						
	1st footing	2	9.80	0.60	0.20	2.35	$L = 9.20 + 0.60 = 9.80m$
	2nd footing	2	9.70	0.50	0.20	1.94	$L = 9.80 - 0.10 = 9.70m$
	Plinth Wall	2	9.60	0.40	0.65	4.99	$L = 9.70 - 0.10 = 9.60m$
	Short Walls						
	1st footing	2	3.30	0.60	0.20	0.79	$L = 3.90 - 0.60 = 3.30m$
	2nd footing	2	3.40	0.50	0.20	0.68	$L = 3.30 + 0.10 = 3.40m$
	Plinth Wall	2	3.50	0.40	0.65	1.82	$L = 3.40 + 0.10 = 3.50m$
	Inter room wall						
	Plinth Wall	1	3.50	0.30	0.65	0.68	$L = 3.90 - 0.40 = 3.50m$
					0.0	13.25	



Quantity	Description	Length (m)	Height (m)	Thickness (m)	Volume (cu.m)	Remarks
1	1st footing	4.50	0.60	0.20	0.54	
1	2nd footing	4.40	0.50	0.20	0.44	
1	Plinth Wall	4.30	0.40	0.65	1.12	
2	1st footing	3.30	0.60	0.20	0.79	
2	2nd footing	3.34	0.50	0.20	0.68	
2	Plinth Wall	3.50	0.40	0.65	1.82	
2	Plinth Pillars	0.60	0.60	0.20	0.15	
2	1st footing	0.50	0.50	0.20	0.10	
2	2nd footing	0.40	0.40	0.65	0.21	
2	Plinth Wall	3.50	0.20	0.55	0.77	
1	Long walls front & back	1.60	0.20	0.55	0.18	
1	Short side wall (front)	2.30	0.20	0.55	0.25	
1	Short side wall (back)	1.20	0.60	0.15	0.11	
1	1st step	1.20	0.30	0.15	0.05	
1	2nd step					
	Total				20.46	cu.m

$$L = 3.90 + 0.60 = 4.50m$$

$$L = 4.50 - 0.10 = 4.40m$$

$$L = 4.40 - 0.10 = 4.30m$$

$$L = 3.90 - 0.60 = 3.30m$$

$$L = 3.30 + 0.10 = 3.40m$$

$$L = 3.40 + 0.10 = 3.50m$$

$$L = 3.90 - 0.40 = 3.50m$$

$$L = 2.00 - 0.40 = 1.60m$$

$$L = 2.70 - 0.40 = 2.30m$$



Sl. No.	Particulars	No.	Length	Breadth	Depth	Quantity	Explanatory Notes
14.	2.5cm damp proof course						
	Adjoining room						
	Combined						
	Long walls	2	9.60	0.40	—	7.68	Same as plinth wall
	Short walls	2	3.50	0.40	—	2.80	
	Inter room wall	1	3.50	0.30	—	1.05	
	Square room						
	Long wall (outer)	1	4.30	0.40	—	1.72	
	Short walls	2	3.50	0.40	—	2.80	
	Verandah Pillars	2	0.40	0.40	—	0.32	
	Deduct Door sills				Total	16.97	
	— D	4	1.00	0.40	—	1.60	
	— D <sub>1</sub>	1	0.70	0.30	—	0.27	
	Total deduction				Total deduction	1.87	
	Net total				Net total	14.50 sq.m	



5

1st class brickwork in  
1:6 cement mortar in  
superstructure -

Adjoining rooms  
combined -

long walls

short walls

Inter room wall

Square room in between

Verandah -

long wall (only)

short walls

Verandah pillars

Verandah room wall above  
lintel -

long wall (front &  
back)

short wall front  
side

short wall back  
side

20.63

7.82

1.52

3.62

3.62

3.50

0.30

0.30

0.20

9.50

3.60

3.60

2

2

1

4.20

3.60

0.30

1

2

2

3.60

1.70

2.40

2

1

1

ME upto top of slab

ME upto top of slab

ME upto bottom of slab

$$L = 3.90 + 0.30 = 4.20$$

$$L = 3.90 - 0.30 = 3.60$$

4.56

7.82

0.50

3.62

3.62

2.80

0.30

0.30

0.30

4.20

3.60

0.30

0.43

0.10

0.14

0.30

0.30

0.30

0.20

0.20

0.20

3.60

1.70

2.40



Item no.	Particulars	No.	Length	Breadth	Height	Quantity	Explanatory Notes
	Parapet -						Ht. of Parapet = 0.30 + 0.08 + 0.03 = 0.41m
	Adjoining rooms -						
	Outer long wall (with out)	1	9.50	0.20	0.50	0.95	L = 9.20 + 0.30 = 9.50m
	Short walls	2	4.00	0.20	0.50	0.80	L = 3.60 + 0.30 + 0.10 = 4.00m
	Front Verandah side	1	2.40	0.20	0.50	0.24	L = 1.80 + 0.60 = 2.40m
	Back Verandah side	1	2.50	0.20	0.50	0.25	L = 2.50 + 0.20 + 0.20 = 2.90m = 2.50m
	Square room - outer wall	1	4.20	0.20	0.50	0.42	L = 3.60 + 0.60 = 4.20m
	Walls in between Ver. and room	2	3.90	0.20	0.50	0.78	L = 3.60 + 0.20 + 0.10 = 3.90m
	Deduct -						
	Door openings -	4	1.00	0.30	2.10	2.52	
		1	0.90	0.20	2.10	0.38	
					Total	47.96 cu.m	



# Window Openings

5	0.90	0.30	1.50	2.02
1	1.80	0.30	1.50	0.81
4	0.90	0.20	1.80	1.30
	Same as for	item 6		0.567
	Total	deduction	7.60	
		Net total	40.36	

Bearing of roof slab not deducted may be deducted if specified.

Bearing 15 cm  
Bearing 15 cm  
Bearing 15 cm

- 6. R.C.C. work 1:2:4, excluding steel and its bending, but including centering & shuttering & lining steel.
- Roof slab -
- Adjoining rooms combined
- Square room
- Verandah front
- Verandah back

1	9.20	3.90	0.12	4.306
1	3.90	3.90	0.12	1.825
1	4.05	2.15	0.10	0.871
1	4.05	2.85	0.10	1.154



Item no.	Description	No.	Length	Breadth	Height	Quantity	Explanatory notes
	Verandah chujja -						
	Front & back long	2	4.55	0.50	0.06	0.273	
	side (front)	1	2.15	0.50	0.06	0.063	
	Side (back)	1	2.85	0.50	0.06	0.085	
	Sunshades over windows W <sub>1</sub>	4	1.20	0.40	0.06	0.115	
	W <sub>2</sub>	1	2.10	0.40	0.06	0.050	
	Lintels over doors, windows, shelves -					8.744	
	Doors D	4	1.30	0.30	0.10	0.156 (a)	Bearing 15cm
	Doors D <sub>1</sub>	1	1.20	0.20	0.10	0.024 (a)	Total of (a) = 0.56744 m
	Windows W	5	1.20	0.30	0.10	0.180 (a)	
	Windows W <sub>1</sub>	1	2.10	0.30	0.10	0.063 (a)	
	Shelves S	4	1.20	0.30	0.10	0.144 (a)	
	Verandah lintels						
	Front and back	2	4.10	0.20	0.30	0.492	Bearing over



# Various Types of Arches

1. Flat Arch
2. Segmental Arch
3. Semi-Circular Arch
4. Horse shoe Arch
5. Pointed Arch
6. Venetian Arch
7. Florentine Arch
8. Relieving Arch
9. Slitted Arch
10. Semi-Elliptical Arch

CALCULATION OF BRICKWORK AND RCC WORK.

Pbm. ①.

Calculate the quantity of brickwork in an arch over a 1.80 metre span opening. The arch is 40cm, thick and the breadth of wall is 40cm.

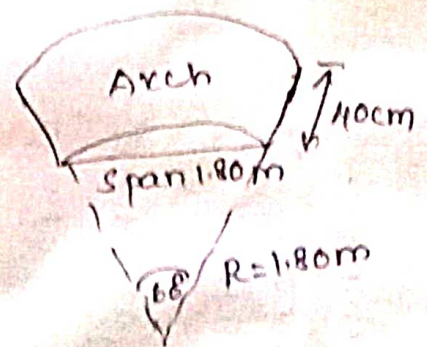
Soln:-

Radius of arch = 1.80m

Thickness of arch = 40cm

Breadth of wall = 40cm

Mean dia =  $3.60 + 0.40$   
= 4.00m



Mean length of arch given

$$= \frac{1}{6} \times \frac{22}{7} \times 4$$

$$= 2.1m \quad \left( \frac{\pi \times d}{6} \right)$$

$$\therefore \text{Qty of brick} = 2.1 \times 0.40 \times 0.4 = 0.34m^3$$

$$\text{No of bricks required} = 0.34 \text{ cu.m} @ 550 \text{ bricks/cu.m}$$



15.	Colour washing 2 coats over one coat of white washing outside walls upper surface & edges of chujja	Same as o/s plaster	224.77 6.12	
16.	Painting 2 coats over a coat of priming Rolling shutters	1 12.00 0.51 —	230.89 Sq.m	3x2 = 6 faces, 1 1/4 for 1 face.
		Total	60.75 Sq.m	

15.	Colour washing 2 coats over one coat of white washing outside walls upper surfall & edges of chujja	Same as o/s plaster	224.77	6.12	Total 230.89 Sq.m	3 x 2 = 6 faces, 1/4 for 1 face.
16.	Painting 2 coats over a coat of priming Rolling shutters	-	6 x	2.70	60.75 sq.m	3 x 2 = 6 faces, 1/4 for 1 face.
		-	1.25	3.00		



## Various Types of Arches

1. Flat Arch
2. Segmental Arch
3. Semi-Circular Arch
4. Horse shoe Arch
5. Pointed Arch
6. Venetian Arch
7. Florentine Arch
8. Relieving Arch
9. Stilted Arch
10. Semi-Elliptical Arch

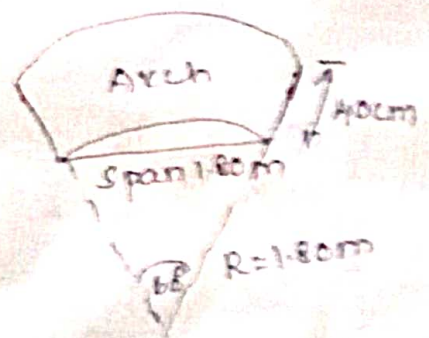
### CALCULATION OF BRICKWORK AND R.C. WORK.

Pbm. ①.

Calculate the quantity of brickwork in an arch over a 1.80 metre span opening. The arch is 40cm, thick and the breadth of wall is 40cm.

Soln:-

Radius of arch = 1.80m  
Thickness of arch = 40cm  
Breadth of wall = 40cm  
Mean dia =  $3.60 + 0.40$   
= 4.00m



$$\begin{aligned} \text{Mean length of arch given} &= \frac{1}{6} \times \frac{22}{7} \times 4 \\ &= 2.1\text{m} \quad \left( \frac{\pi \times d}{6} \right) \end{aligned}$$

$$\therefore \text{Qty of brick} = 2.1 \times 0.40 \times 0.4 = 0.34 \text{ m}^3$$

$$\begin{aligned} \text{No. of bricks required} &= 0.34 \text{ cu.m @} \\ &= 550 \text{ bricks/cu.m} \\ &= \underline{187} \text{ Ans} \end{aligned}$$

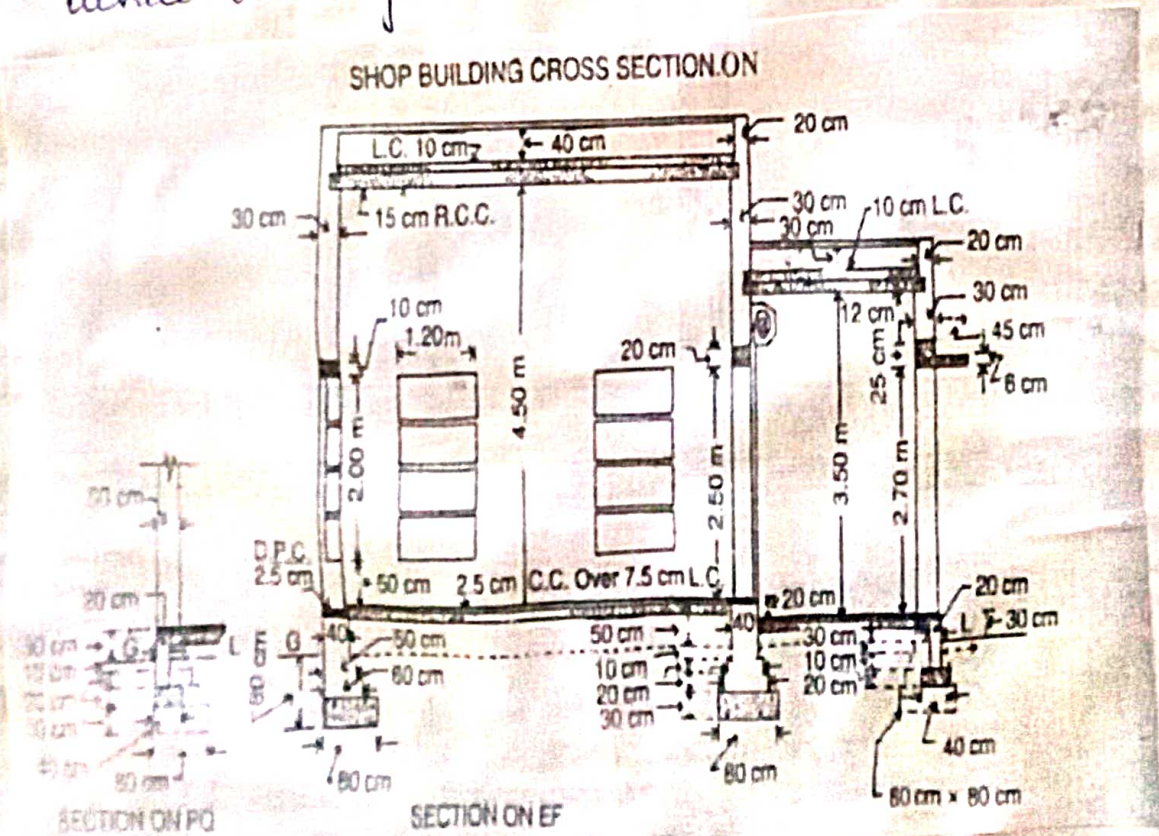






Estimate of a shop building consisting of three shops with front Verandah from the given drawing.

Foundation concrete shall be of lime concrete. Foundation & plinth masonry shall be of first class brickwork in 1:6 cement sand mortar. 2-5cc Damp proof course shall be provided at the plinth level. Superstructure shall be of first class brickwork in lime mortar. Roof slab, lintels etc shall be of R.C.C. lime concrete terracing shall be provided over the roof. Floor shall be of 2.5cm c.c. over 7.5cm lime concrete. Sills of openings shall be of only 2.5cm c.c. I/s & o/s shall be plastered with 12mm thick 1:6 cement mortar. I/s shall be finished with three coats of white washing & o/s finished with the two coats of colour washing over 1 coat of white washing.





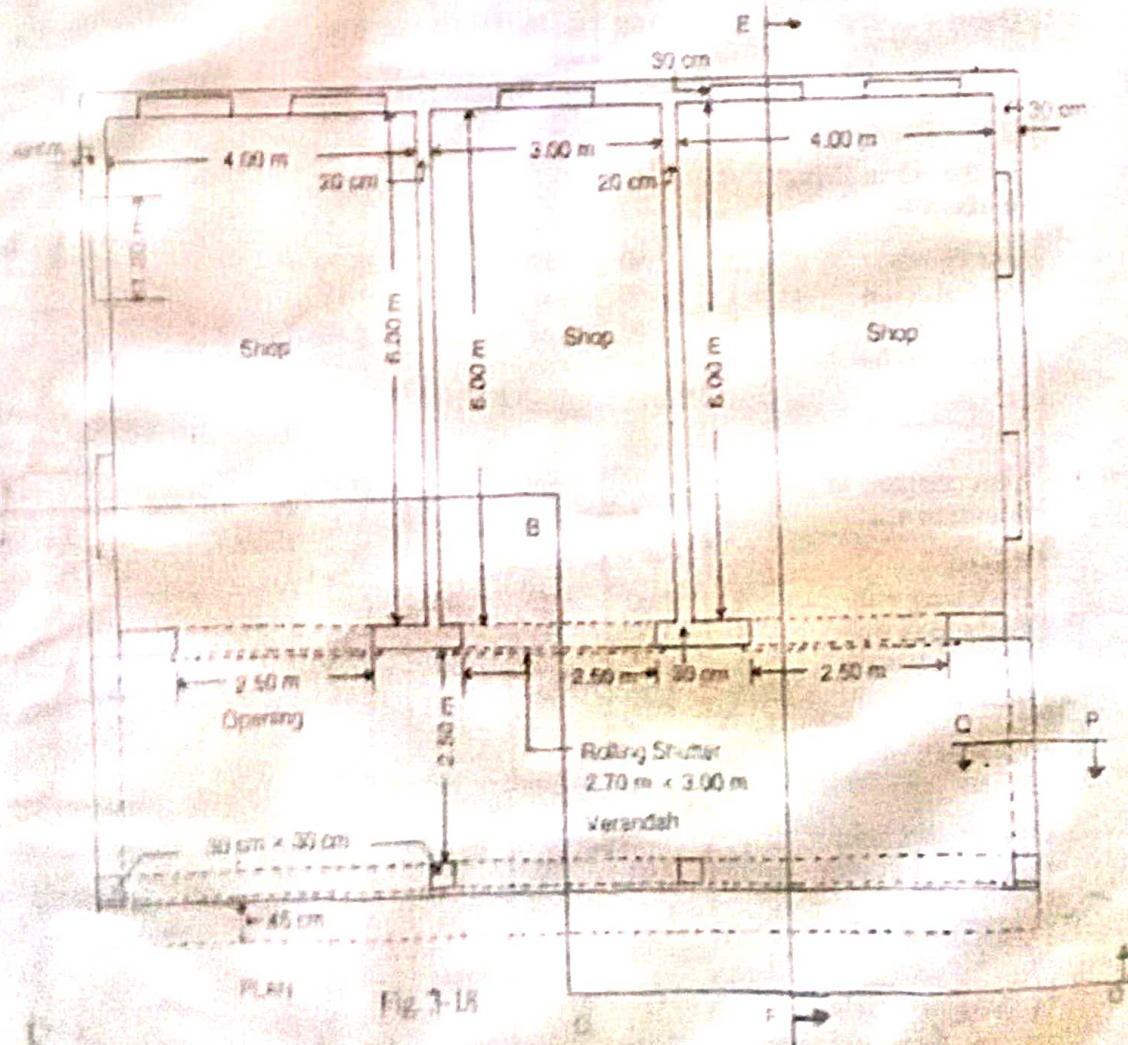
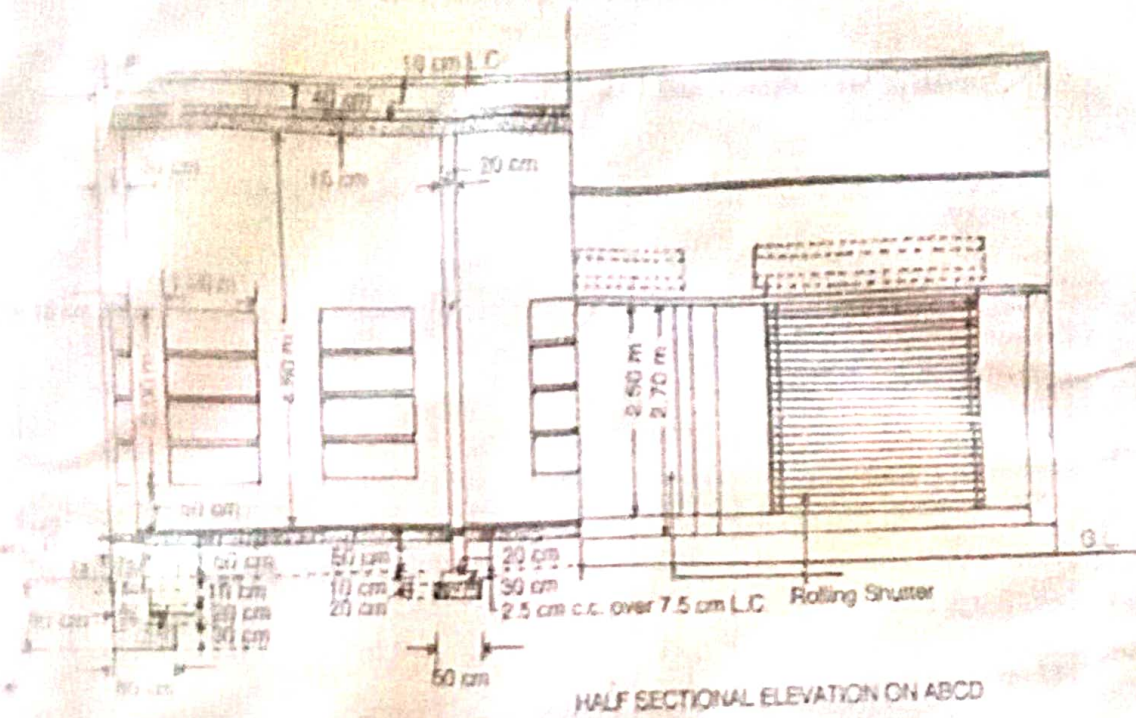


Fig. 3-18



Thm no.	Description	No.	Length	Breadth	Height	Quantity	Explanatory Notes
1.	Earthwork in foundation						
	Rooms						
	Back long Walls	1	12.00	0.80	0.80	7.68	
	Front long Walls	1	12.00	0.80	0.80	7.68	
	Outer side wall	2	5.25	0.80	0.80	6.72	$L = (6.00 + 0.30 + \frac{0.30}{2})$
	Inner walls	2	5.25	0.50	0.30	1.57	$= \frac{0.80 - 0.30}{2} = 0.25$
2.	Verandah — Pillars	4	0.80	0.80	0.80	2.05	
	Dwarf wall front	1	8.80	0.40	0.50	1.76	$L = 12.00 - 4 \times 0.80 = 8.80$
	Dwarf wall sides	2	2.00	0.40	0.50	0.80	$L = 2.80 - 0.80 = 2.00$
	Earthwork in filling in plinth —	2	3.90	5.85	0.425	19.39	
	Side rooms	1	3.00	5.85	0.425	7.46	
	Central room						
					Total	28.26 cum	



$$B = 2.50 + 0.30 + 0.05 \\ - 0.20 \\ = 2.65 \text{ m}$$

$$L = 12.00 - 4 \times 0.60 \\ = 9.60 \text{ m}$$

$$L = 2.80 - 0.60 \\ = 2.20 \text{ m}$$

	1	11.60	2.65	0.225	6.92
Verandah Deduction for Ver. pillars		Neglect			
3. Lime Concrete in foundation					
<u>Rooms</u>					
Back long Wall	1	12.00	0.80	0.30	2.88
Front long Wall	1	12.00	0.80	0.30	2.88
Outer side walls	2	5.25	0.80	0.30	2.52
Inter Walls	2	5.70	0.50	0.20	1.14
<u>Verandah - Pillars</u>					
	4	0.80	0.80	0.30	0.77
Dwarf wall front	1	9.60	0.40	0.20	0.77
Dwarf wall sides	2	2.20	0.40	0.20	0.35
Total 33.77 cu.m					
Total 11.91 cu.m					

4. 1st class brickwork in 1:6 cement mortar in foundation + plinth - Rooms



Item no.	Description	No.	Length	Breadth	Height	Quantity	Explanatory Notes
4.	1 <sup>st</sup> class brick-work in 1:6 cement mortar in foundation & plinth — <u>Rooms —</u> front and back walls —	2	12.00	0.60	0.20	2.88	
	1 <sup>st</sup> footing	2	12.00	0.50	0.20	2.40	
	2 <sup>nd</sup> footing	2	12.00	0.40	0.60	5.76	
	Plinth Wall						
	<u>Outer Side Walls —</u>						
	1 <sup>st</sup> footing	2	5.55	0.60	0.20	1.33	
	2 <sup>nd</sup> footing	2	5.70	0.50	0.20	1.14	
	Plinth Wall	2	5.85	0.40	0.60	2.81	
	<u>Inner Walls</u>						
	Footings	2	5.85	0.30	0.10	0.35	
	Plinth Walls	2	5.85	0.20	0.50	0.17	

Verandah

Pillars -

1st footing

2nd footing

Plinth wall

Dwary Wall front

Dwary Wall Sides

5. 2.5cm c.c. Damp proof

course -

Rooms -

Back and front Walls

Outer side Walls

Inter Walls

Verandah pillars

4	0.60	0.60	0.20	0.20	0.29
4	0.50	0.50	0.20	0.20	0.20
4	0.40	0.40	0.40	0.40	0.26
1	10.00	0.20	0.20	0.20	0.40
1	10.40	0.20	0.40	0.40	0.83
1	2.30	0.20	0.20	0.20	0.09
1	2.40	0.20	0.40	0.40	0.19

$L = 12.00 - 4 \times 0.50 = 10.00m$   
 $L = 12.00 - 4 \times 0.40 = 10.40m$   
 $L = 2.80 - 0.50 = 2.30m$   
 $L = 2.80 - 0.40 = 2.40m$

Total =	20.10 cu.m
9.60	
4.68	
2.34	
0.64	
Total	17.26



Item no	Description	No.	L	B	H	Quantity	Explanatory Notes
	Deduct sill of gate.	3	2.50	0.40	—	3.00	
					Total	14.26 sq.m	
6.	I-class brick work in superstructure in lime mortar —						
	Rooms front, back & outer side walls	1	36.00	0.30	4.50	48.60	Total length of outer walls = $2 \times 12 + 2 \times 6 = 36.00m$
	Inter Walls	2	6.00	0.20	4.50	10.80	
	Verandah —						
	Pillars	4	0.30	0.30	2.70	0.97	
	Walls above lintels over pillar, front & sides	1	17.00	0.30	0.55	2.81	Total length = $12 + 2 \times 2.50 = 17m$
	Parapet, rooms total length	1	36.40	0.20	0.65	4.73	$L = 2 \times 12 + 2 \times 6.20 = 36.40m$

Parapet, Yerandah

$$L = 12 + 2 \times 2.60 = 17.20m$$

Deduct —

Grate Openings

Shelf Openings

Lintels over gates

Lintels over shelf

Bearing 15cm  
Bearing 10cm

R.C.C. Work including  
Steel & its lunding

Room roof slab

Yerandah roof slab

Lintel over gates

Lintel over shelf

Yerandah lintel (f. & sides)

Front chivin

1	17.20	0.20	0.52	1.79
3	2.50	0.30	2.50	5.63
9	1.20	0.20	0.20	0.43
3	2.80	0.30	0.20	0.50
9	1.40	0.30	0.10	0.38
			<b>Total</b>	<b>6.94</b>
			<b>Net Total</b>	<b>62.76 cu.m</b>
1	11.60	6.20	0.15	10.78 } Bearing 10cm
1	11.60	2.70	0.12	3.75 }
3	2.80	0.30	0.20	0.50
9	1.40	0.30	0.10	0.37
1	17.40	0.30	0.25	1.30
1	12.00	0.45	0.06	0.30



Item no.	Description	No.	L	B	H	Qty	Exp. Notes
8.	Mild steel work @ 9%.						
					B.F		
					Total	17.02 cum	
							Density of mild steel = 78.59/cum
9.	10cm lime concrete terracing - Room Verandah	1 1	11.60 11.60	6.20 2.70	- -	71.92 31.32	
					Total	103.24 Sq.m	
10.	12mm thick cement plastering 1:6 in walls - <u>Inside</u> Side room 4 walls	2	20.00	-	4.50	180.00	

$$\frac{0.9 \times 17.02 \times 78.5}{100} = 12.02 \text{ q}$$

Central room 4 walls Verandah	1	16.00	—	4.50	81.00	Its perimeter
Room wall	1	11.40	—	3.50	39.90	
Front & side wall above pillar	1	16.40	—	0.30	13.12	$L = 11.40 + 2 \times 2.50 = 16.40m$
Pillars Inner face	12	—	0.30	2.70	9.72	
Jambes of shelf	9	6.40	0.20	—	11.52	
Jambes & Soffits of gates	3	7.50	0.30	—	6.75	2 jambes + 1 soffit
soffit of Ver. lintel, front & sides	1	15.80	0.30	—	4.74	$L = 11.40 + 2 \times 2.50 = 16.40m$ $2 \times 0.30 = 0.60m$
Deduct gate openings	3 x 2	2.50	—	2.50	346.75	
				Total	37.50	
				Total of I/s	309.25	Sq.m
11. 2.5cm c.c over & including 7.5cm l.c./floor—						
Side rooms	2	4.00	6.00	—	48.00	
Central rooms	1	3.00	6.00	—	18.00	
Ver.	1	11.60	2.60	—	30.16	
					94.16	Sq.m



12.	2.5cm c.c. floor — sill of gate Sills of Verandah opening over 20cm dway wall	3 1	2.50 15.80	0.30 0.20	— —	2.25 3.16	$K = (12.00 - 4.10 \times 30) + 2 \times 2.50 = 15.80m$
			Total			5.41 sq.m	
13.	Steel rolling shutters	3	2.70	—	3	24.30 sq.m	
14.	White Washing 3 coats Inside — Inside Walls Ceiling Ceiling Verandah Soffits of chujja	same 2 1 1 1	as ° inside plastering 4.00 3.00 11.40 12.00	6.00 6.00 2.50 0.45	— — — —	309.25 48.00 18.00 28.50 5.40	
			Total			409.15 sq.m	

Item No.	Description	No.	Length	Breadth	Depth	Quantity
	Short walls					
	1st footing	2	5.5	0.8	0.2	2.64
	2nd	2	5.6	0.7	0.1	1.18
	3rd	2	6.7	0.6	0.1	1.03
	4th	2	5.8	0.5	0.1	0.87
	Plinth wall above footing	2	5.9	0.4	0.8	5.66
						<u>Total = 26.10 m<sup>3</sup></u>

(4) Damp Proof Course  
(Plinth wall length is same for DPC)

Long walls	2	11	0.4	-	8.80
Short walls	2	5.9	0.4	-	4.08
					<u>Total = 15.88</u>
Deduct door sills	2	1.2m	0.4m	-	0.96
					<u>Total = 14.92 m<sup>3</sup></u>

(5) 1st class brickwork in superstructure

Long walls	2	10.9 m	0.3 m	4.2	27.47
Short walls	2	6 m	0.3 m	4.2	22.68
					<u>Total = 50.15 m<sup>3</sup></u>

Deduct -

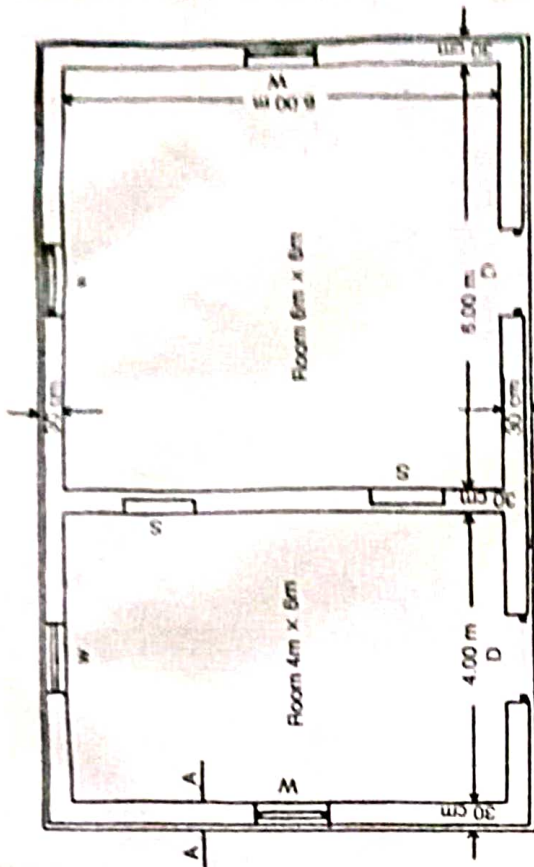
Door openings	2	1.2 m	0.8 m	2.1 m	1.51
Window openings	4	1 m	0.3 m	1.5 m	1.8
Shelves	2	1 m	0.2 m	1.5 m	0.6
Lintels over doors	2	1.5 m	0.3	0.15	0.14
Lintels over windows	4	1.3 m	0.3	0.15	0.23
Lintels over shelves	2	1.3 m	0.3	0.15	0.12

Total deduct = 4.4 m<sup>3</sup>

Net Total = 45.75 m<sup>3</sup>



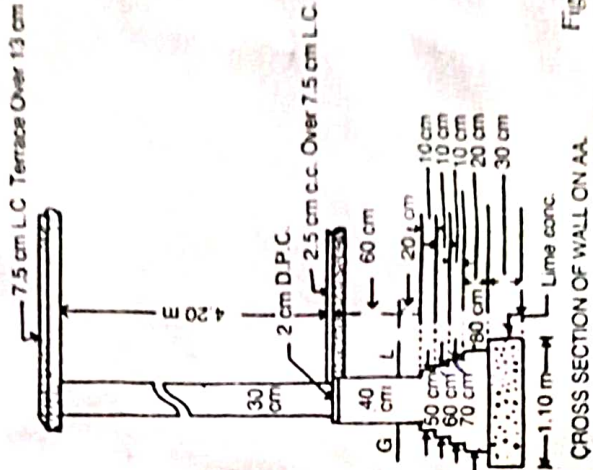
TWO ROOMED BUILDING



PLAN  
7.5 cm L.C Terrace Over 13 cm R.C.C

All Walls are of same section  
Lintels over Doors, Windows and  
Shelves are 15 cm thick R.C.

Doors D-1.20 m x 2.10 m  
Windows W-1.00 x 1.50 m  
Shelves S-1.00 m x 1.50 m



CROSS SECTION OF WALL ON AA

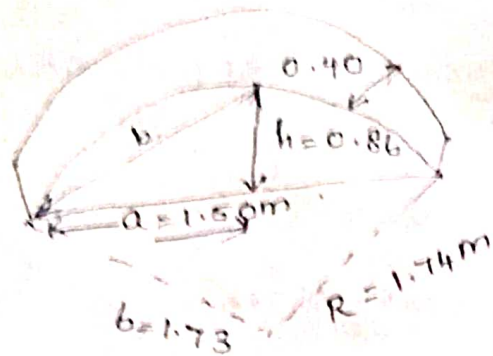
Fig. 2-6

Item no	Particulars of Items	No.	Length	Breadth	Depth	Quantity	Explanatory note
1.	Earthwork in excavation in foundation long walls short walls	2 2	11.7m 5.2m	1.1m 1.1m	1m 1m	25.74 17.16	$10 + 0.15 + 0.15$ $+ 0.3 = 10.6$ $\pm 10.6 + 1.10$ $= 11.7m$ $6 + 0.15 + 0.15$ $= 6.3$ $= 6.3 - 1.10$ $= 5.2m$
2.	Lime concrete in foundation long walls short walls	2 2	11.7 5.2	1.1m 1.1m	0.3m 0.3m	7.72 5.15	$\frac{3}{10}$ of excav.
3.	1 <sup>st</sup> class brickwork in foundation + plinth long walls 1 <sup>st</sup> footing 2 <sup>nd</sup> " 3 <sup>rd</sup> " 4 <sup>th</sup> " Plinth wall above ftng	2 2 2 2 2	11.4 11.3 11.2 11.1 11.0	0.8 0.7 0.6 0.5 0.4	0.2 0.1 0.1 0.1 0.8	3.65 1.58 1.34 1.11 7.04	$10.6 + 0.8 = 11.4$
						Total =	42.9m <sup>3</sup>



Prob 2

Work out the Brickwork and Cement plaster to soffit of an arch as per data given below in fig.



clear span = 3m.

Soln:-

$$R = \text{Radius} = \frac{h}{2} + \frac{s^2}{8h}$$

where,  $h = \text{Rise}$

$s = \text{Span}$

$$= \frac{0.86}{2} + \frac{3.0 \times 3.0}{8 \times 0.86} = 1.74 \text{ m}$$

$$R_m = \text{Radius of mean arc} = \frac{R + t}{2}$$

$$= 1.74 + \frac{0.40}{2}$$

$$= 1.94 \text{ m}$$

$$b = \sqrt{a^2 + h^2}$$

where,  $a = \text{half span} = 1.50 \text{ m}$

$$h = 0.86 \text{ m}$$

$$\therefore b = \sqrt{1.50^2 + 0.86^2}$$

$$\boxed{b = 1.73 \text{ m}}$$

$$l = \text{length of arch}^{\circ} \text{ intrados} = \frac{8b - 2a}{3}$$

$$= \frac{8 \times 1.73 - 2 \times 1.50}{3}$$

$$= 3.61 \text{ m}$$

$$l_m = \text{mean length of arc} = l \times \frac{R_m}{R}$$

$$= \frac{3.61 \times 1.94}{1.74} = 4.0 \text{ m}$$



Brickwork  $= 11.0 \times 4.0 \times 0.40$

$= 17.60 \text{ cu. m}$

Cement plaster to soff of arch

$= 1 \times 11.0 \times 3.61 = 39.71 \text{ sq. m}$

No. of bricks  $= 17.60 \times 550$

$= 9680 \text{ Nos.}$

Estimate of Joineries for Doors, Windows,  
Ventilators, Hand Rails, etc.

#### 5.1 PANNELED DOOR

Supply and fixing teak wood fully paneled with  $10 \times 4$  cm styles, and  $10 \times 4$  cm rails and 3.5 CM III panels with teak wood frame of  $6.25 \times 10$  cm size including cost of hold fasts, but hinges and labour charges for fixing door in position and fixing furniture etc., complete for one door of size  $1.00 \times 2.00$  of area 2.2 sqm. (Figure 5.5).

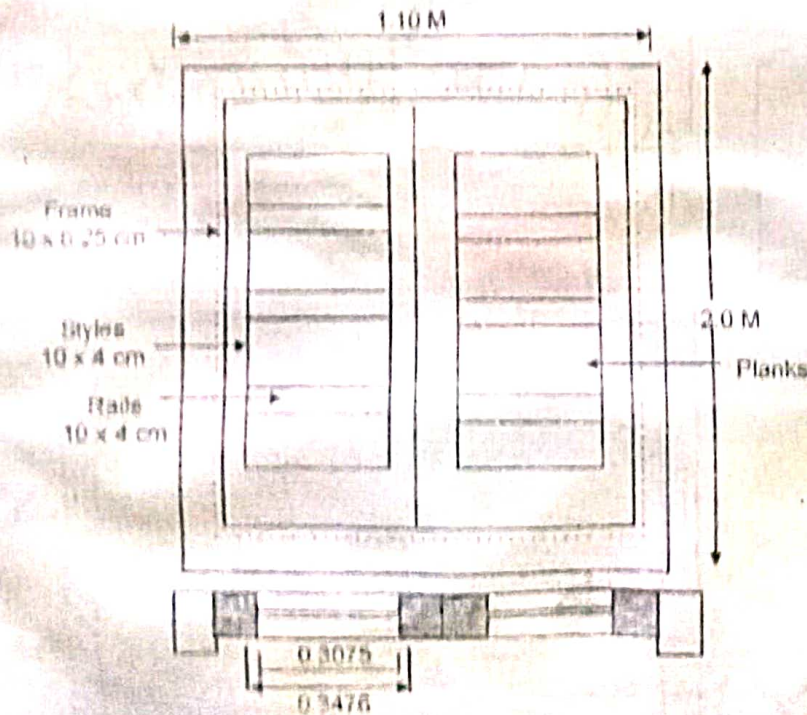


Figure 5.5

Item no	Description of item	No.s	Length	Breadth	D (ON H)	Qty	Explanatory Notes
1	Earthwork Excavation in foundation						
	Central pillar straight portion	1	2.1	0.5	0.5	0.525	$L = 1.5 + 0.15 + 0.15$ $+ 0.15 + 0.15$ $= 2.1$
	Central pillar Triangular ends	2	$\frac{1}{2}(0.5 \times 0.43)$		0.5	0.108	
	End pillars of bed @ 2 nos	2	2.1	0.5	0.5	1.05	$L = 1.5 + 0.15 + 2.1$ $+ 0.15 = 6.3$
	End pillars @ bank	2	6.3	0.5	0.3	1.89	$D = 0.1 + 0.2 = 0.3$
	Slopes of stream for pitching	2	$\frac{6+8.8}{2} = 7.4$	1.84	0.2	5.446	$B = \sqrt{1.4^2 + 1.2^2} = 1.84$
	Slope of minor for pitching	2x2	3	1.8	0.1	2.16	$B = \sqrt{1.2^2 + 1.2^2} = 1.8$
	Bed of minor for pitching	2	3	1.8	0.1	1.08	$B = \sqrt{1.2^2 + 1.2^2} = 1.8$
	Toe wall	2	8.8	0.1	0.3	1.056	
	Cement Concrete 1:4:8 in foundation				Total =	13.315 m <sup>3</sup>	
2.	Central pillar straight portion	1	2.1	0.5	0.2	0.21	
	Central pillar triangular ends	2	$\frac{1}{2}(0.5 \times 0.43)$		0.2	0.043	
	end pillars of bed @ 2 nos	2	2.1	0.5	0.2	0.42	
	end pillars including minor	2	6.3	0.5	0.2	1.26	



Item No	Description of items	No	L	B	H or D	Qty	Notes
3.	I class brickwork Central pillar - 5t. portion Triangular portion End pillars @ bed @ bank wing walls	1	1.8	0.3		1.134	
		2	$\frac{1}{2} \times 0.3 \times 0.26$	-		0.164	
		2	1.8	0.3	2.1	2.268	
		2	1.8	0.3	0.7	0.756	
		4	2.1	0.3	2.15	5.418	
			Total				9.74 m <sup>3</sup>
4.	Rcc work in Trough excluding steel and its bending bottom slab side slab	1	8.3	1.8	0.15	2.241	
		2	8.3	0.15	1.8	3.227	
			Total				5.478 m <sup>3</sup>
5.	Mild steel reinforcement bars @ 1% of steel					4.309 m <sup>3</sup>	
						$\times 100$ = 430 kg	
							$2.200 + 100 + 200 + 200$ $1.5 + 15 = 8.300 \text{ m}$ 175 78.57/m

Estimate of other structures

Pbm ①

Estimation of Septic tank with Soak Pit.

Prepare a detailed estimate of a septic tank with Soak-pit for 50 users together with sanitary fittings of one seat of latrine from the given drawings

Assume :-

Capacity of tank @ 0.08 cu.m per user =  $50 \times 0.08$   
 $= 4.00 \text{ cu.m}$

Taking depth of water as 1.20m }  
 the floor area of tank }  $= \frac{4.00}{1.20} = 3.34 \text{ Sq.m}$

Taking length as 4 times the breadth

$$L \times B = 3.34$$

$$4B \times B = 3.34$$

$$B^2 = 3.34/4$$

$$B = \sqrt{0.83}$$

$$B = 0.91 \text{ m}$$

$\therefore$  Length of tank =  $4B = 4 \times 0.91$

$$L = 3.64 \text{ m}$$

Taking a free board of 30cm total depth of tank =  $1.20 + 0.30 = 1.50 \text{ m}$

A tank of 3.70m long  $\times$  0.90m wide and 1.50m depth will serve the purpose.



### Requirements :-

- (i) Verticals =  $2 \times 2.0 \times 0.10 \times 0.0625 = 0.0250$   
 (ii) Horizontals =  $1 \times 1.0 \times 0.10 \times 0.0625 = 0.00625$   
 (iii) Stiles =  $4 \times 1.437 \times 0.10 \times 0.04 = 0.0230$   
 (iv) Rails =  $2 \times 5 \times 0.5075 \times 0.10 \times 0.04 = 0.0203$   
 (v) Planks =  $2 \times 4 \times 0.364 \times 0.3075 \times 0.25 = 0.354$
- 0.0094 m<sup>3</sup>

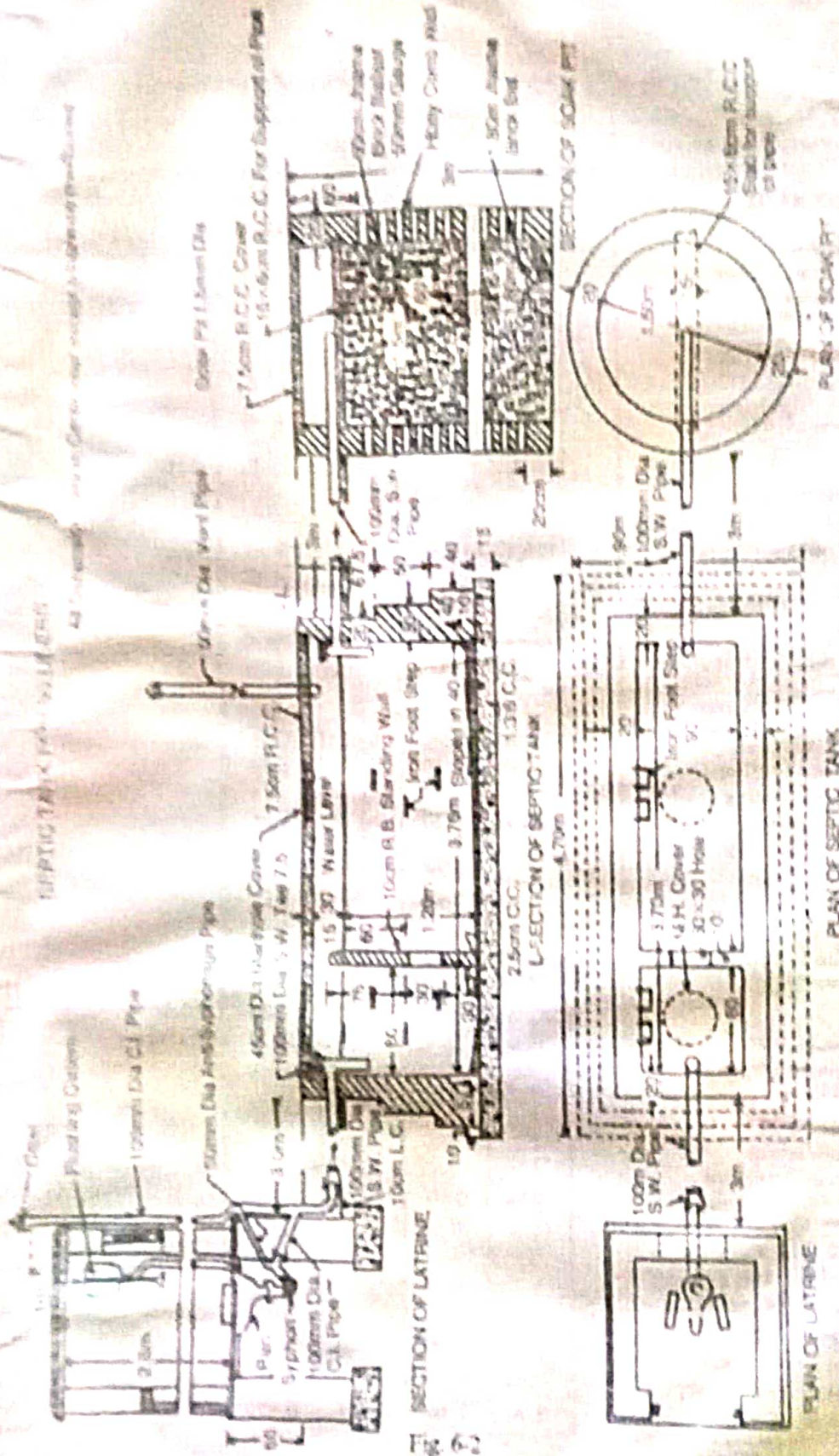
S-NO	Description of Items	Quantity	Unit	Rate	Per	Amount
1.	Wood Cost	0.009	Cum	30,000	Cum	270
2.	Butt Hinges	6	No-S	40	each	240
3.	2-Hold fast	6	No-S	20	each	120
4.	Cost of labour	2.2	Sq-m	2,000	Sq-m	4,400
Total =						5030

$$\text{cost of door per } 1\text{m}^2 = \frac{5030}{2.2}$$

$$= \text{Rs. } 2286 \underline{\underline{2290 \text{ Rs}}}$$



# SEPTIC TANK FOR 30 USERS



SEPTIC TANK FOR 30 USERS

As per the drawing, the system is designed to serve 30 users.



Item no	Particulars of items	No.	Length m	Breadth m	Depth m	Quantity	FF Notes
1.	Septic tank + Soak Pit						
	Earthwork in excavation						
	Septic tank	1	4.70	1.90	1.725	15.41	
	Soak Pit	1	$\frac{\pi \times (1.9)^2}{4}$	3	-	8.50	
					Total	23.91 cu.m	
2.	Cement Concrete 1:3:6 in foundation of septic tank	1	4.70	1.90	0.15	1.34 cu.m	floor taken Separately
3.	1 <sup>st</sup> class brickwork in septic tank						
	Long Walls						
	1 <sup>st</sup> footing	2	4.50	0.40	0.40	1.44	
	2 <sup>nd</sup> footing	2	4.30	0.30	0.50	1.29	
	3 <sup>rd</sup> footing upto top	2	4.10	0.20	0.675	1.11	
	Short Walls						
	1 <sup>st</sup> footing	2	0.90	0.40	0.40	0.36	
	2 <sup>nd</sup> footing	2	0.90	0.30	0.50	0.27	
	3 <sup>rd</sup> footing upto top	2	0.90	0.20	0.675	0.24	
					Total	4.64 cu.m	No deduct for casing
4	R.B work in partition wall with 1:3 cement mortar in septic tank including v/fmt	1	0.90	0.10	1.35	0.122 cu.m	
5	P.C.C. work						
	slab cover of septic tank	1	3.90	1.10	0.075	0.322	
	slab cover of Soak Pit	1	$\frac{4 \times 1.4^2}{4}$	-	0.075	0.170	
	Rcc support (soak pit)	1	1.70	0.45	0.06	0.015	



Item no.	Particulars of items	No	length	Breadth	D	Qty	Exp. Notes
					B.F		
					Total	0.507	cu.m.
6.	12mm plastering 1:2 cement mortar						
	Long Walls	2	3.70	-	1.50	11.10	
	Short Walls	2	0.90	-	1.50	2.70	
	Partition Walls both sides	2	0.90	-	1.35	2.43	
	Partition Walls top	1	0.90	-	0.10	0.09	
					Total	16.32	Sq.m.
7.	C.C. floor 1:2:4, 5cm avg. thickness	1	3.70	0.90	-	3.33	Sq.m
8.	II class brickwork in 1:6 cement mortar in soak pit	1	$\pi \times 0.70$	0.20	3	3.20	cu.m
9.	Shamma brick 10mm size i/s soakpit	1	$\frac{\pi \times 1.5^2}{4}$	0.60		1.06	cu.m
10.	Shama brick i/s soakpit	1	$\frac{\pi \times 1.5^2}{4}$	1.80	-	3.18	cu.m
11.	C.I Manhole Cover 45cm dia over Septic tank	2	-	-	-	-	2 NO.S
12.	Iron foot steps Septic tank	8	-	-	-	-	8 NO.S
13.	Sanitary works W.C Indian pattern 50cm white glazed pan with syphon d with 135 dia C.I						



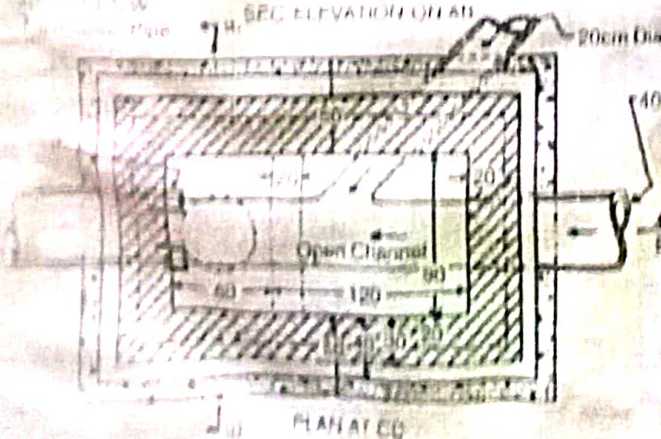
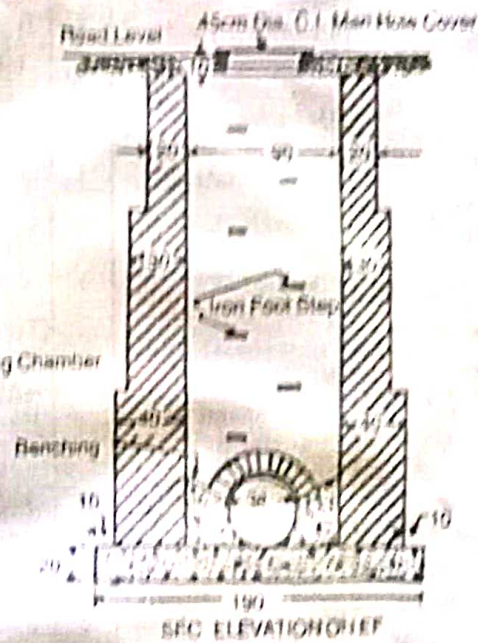
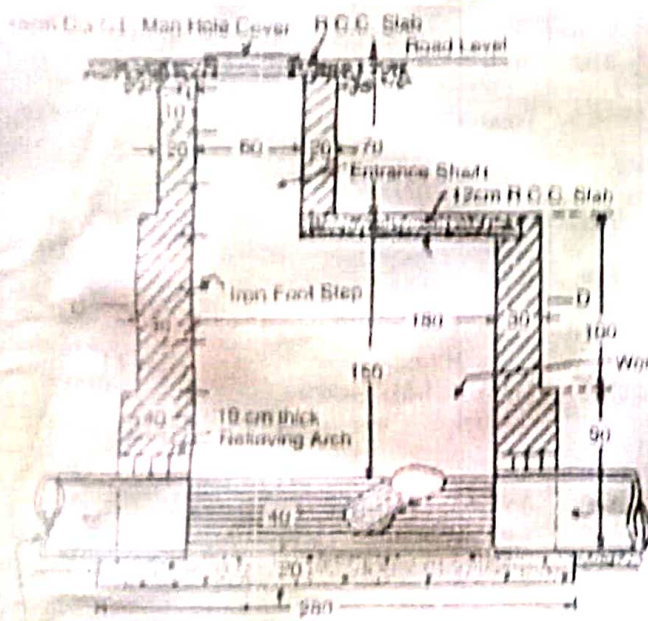
# Estimate of a manhole & water supply main of a building

Plan ②

Prepare a detailed estimate of a Manhole from the given drawings:

General specifications:-

Foundation & floor concrete shall be of 1:3:6 Cement concrete with wire mesh & brickwork shall be of first class in 1:1 cement mortar & inner face of wall shall be pointed with 1:2 cement mortar. Inside channel & benching floor shall be finished with 20mm thick plastering with 1:3 cement mortar.



All Dimensions in Centimetre



Item no.	Particulars of items & details	No.	Length	Breadth	Height	Qty	Explanatory Notes
1.	Earthwork in Excavation		2.80	1.90	2.90	15.43 cum	
2.	Cement Concrete 1:3:6 with brick ballast						
	Foundation & bed	1	2.80	1.90	0.20	1.06	
	Benching	1	1.80	0.90	0.40	0.65	
	<u>Deduct</u>				Total	1.71	
	Upper portion of main channel	1	1.80	$\frac{0.90 + 0.38}{2}$	0.15	0.17	
	Upper portion of branch channel	1	0.30	0.20	0.15	0.01	
				Total deduction		0.18	
				Net total		1.53 cum	
3.	I-class brickwork in 1:4 cement mortar long walls						No deduction for pipes
	1st step	2	2.60	0.40	0.90	1.88	
	2nd step	2	2.40	0.30	1.00	1.44	



Item no.	Description	No.	L	B	H	Qty	Explanatory Notes
1.	3rd step	2	1.00	0.20	0.70	0.28	L = 60 + 20 + 20 = 100 cm
	Short walls						
	1st step	2	0.90	0.40	0.90	0.65	
	2nd step	2	0.90	0.30	1.00	0.54	
	3rd step	2	0.90	0.20	0.70	0.25	
					Total	5.04 w.m	
4.	Cement pointing 1:2						
	long walls upto slab	2	1.80	—	1.50	5.40	
	Short walls upto slab	2	0.90	—	1.50	2.70	
	short left face	1	0.90	—	0.82	0.74	
	short right face	1	0.90	—	0.70	0.63	
	above slab						
	Remaining face	2	0.60	—	0.82	0.98	
					Total	10.45 sq.m	
5.	20 mm thick cement plaster 1:3 in floor and						

B = 90 + 30 = 120cm  
 Additional 30cm  
 for channel  
 curvature

channels	1	1.80	1.20	—	2.16 sq.m
6. R.C.C Slab including steel complete work					
Roof slab of working chamber	1	1.35	1.20	0.12	0.194
Roof slab of shaft	1	0.80	1.10	0.10	0.088
Deduct Manhole	1	$\frac{\pi \times 45^2}{4}$	—	Total	0.282
				0.10	0.016
				Net total	0.266 cu.m
7. C-I Manhole cover 42cm dia including frame	1	—	—	—	1 No.
8. Iron foot steps of 16mm dia bar	7	—	—	—	7 No.s



## Water supply line and Sewer line

Water supply works mainly consists of pipe lines.

Water main pipes may be Galvanised Iron (G.I), cast Iron (C.I), steel, Home steel (cement lined steel), R.C.C (Home pipe), etc.

The service connections & internal connections are usually made with G.I pipe.

Sanitary fittings:—

(1) As per shape

- (i) P-Trap
- (ii) Q-Trap
- (iii) S-Trap

(2) As per their use

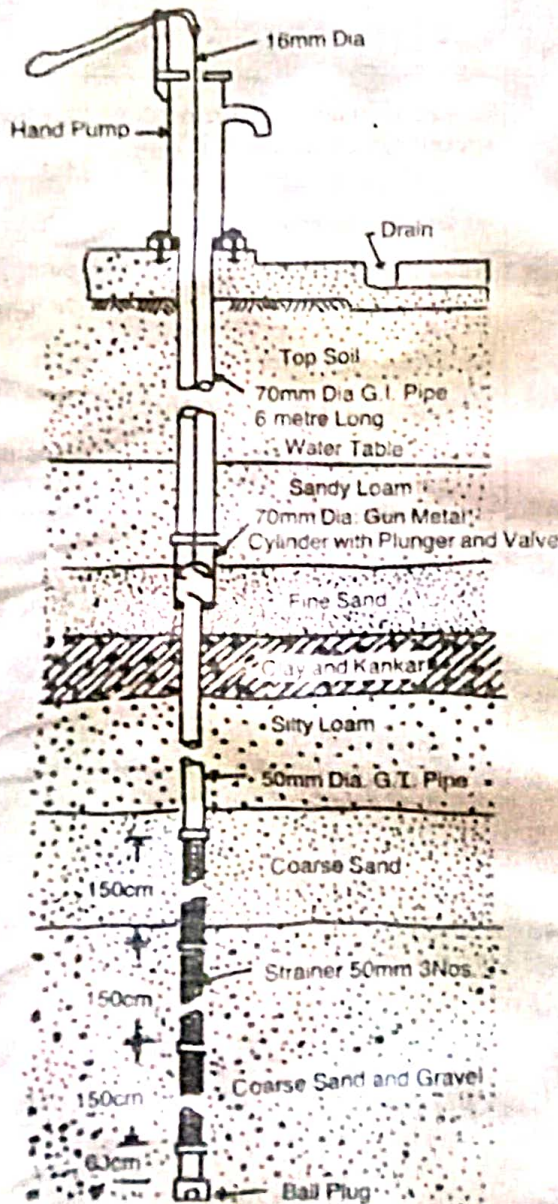
- (i) Floor traps
- (ii) Gully traps
- (iii) Intercepting traps
- (iv) Kitchen sink
- (v) Wash Basins
- (vi) Flushing cisterns
- (vii) Water closets



# Tube Well

Pbm.

Prepare an estimate of 50mm dia tube well 100 metre deep well pump from the go. drawing. The strainer will consist of 3 pieces of 1.50 m each. The housing pipe consist of 70mm dia. G.I pipe 6m in length. Assume suitable rates.





Item no	Description of items	Qty	Rate	Amount
1	50mm dia, galvanized iron (G.I) pipe	94.65m	11.50 per 7 m	1087.50
2	70mm dia G.I housing pipe	6.65m	22.00 per 7 m	145.50
3	50mm dia. Strainer 3 nos & 1.50m each	3 nos &	55.00 each	165.00
4	70mm dia. gun metal cylinder with valve and plunger	1 no.	100.00 each	100.00
5	Hand pump with extra length of 10mm dia. connecting rod	1 no.	45.00 each	45.00
6	Bail Plug	1 no.	4.50 each	4.50
7	Socket 4 nos extra	4 no.	2.50 each	10.00
8	Transport of materials to site of work	1 Job	20.00	20.00
9	<u>Sinking:-</u>			
	(i) 0 to 20m	20m	7.50 per 7m	150.00
	(ii) Below 20m to 35m	15m	11.00 per 7m	165.00
	(iii) Below 35m to 50m	15m	15.50 per 7m	232.50
	(iv) Below 50m to 65m	15m	20.00 per 7m	300.00
	(v) Below 65m to 80m	15m	24.00 per 7m	360.00
	(vi) Below 80m to 95m	15m	28.50 per 7m	427.50
	(vii) Below 95m to 100m	5m	33.00 per 7m	165.00
10.	Inserting coarse sand surrounding the strainers including supply of sand	1 Job	20.00	20.00
11.	fixing & erecting hand pump in position including holding down bolts	1 Job	10.00	10.00



Item no.	Particulars of Items	Qty	Rate	Amount
12.	Cement concrete platform and foundation, surface finished smooth.	1 Job	30.00 Rs	30.00
13.	Cement concrete drain 3m long finished smooth	3.00m	9.00 per r.m	27.00
14.	Pumping out water till clear water is obtained	1 Job	15.00 Rs	15.00
			Total	3468.50
	Add 5% for contingencies		+ workcharged & Establishment	173.42
			Grand total	3641.92

### Open Well.

Masonry wells are constructed for drinking water purposes, for irrigation water supply and for the foundation of bridges. Usually excavation is done upto the sub-soil water level or spring level, a curb is then laid and masonry constructed upto a height of about 3m (10 ft) above ground level and the sinking operation is done.







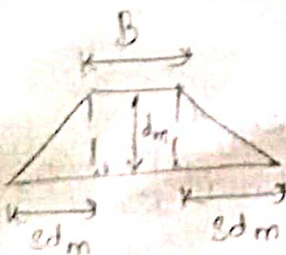
# Estimate of bituminous and Cement Concrete Roads.

The Quantity of earthwork may be calculated by the various methods of mensuration out of which three methods are given below

Method 1:-

Mid Sectional Area Method

Area of mid section = Area of rectangular portion + area of two  $\Delta$ las portion



$$\boxed{\phi = (Bd + sd^2) \times L}$$

where,  $d$  = mean ht. or depth

Method 2:-

Mean Sectional Area Method

$$\text{mean sectional Area } A = \frac{A_1 + A_2}{2}$$

$$\text{Qty, } \phi = \frac{A_1 + A_2}{2} \times \text{Length}$$

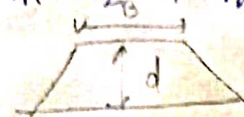
Method 3:-

Prismoidal formula Method

$$\text{Qty or Volume} = \frac{L}{6} (A_1 + A_2 + 4A_m)$$

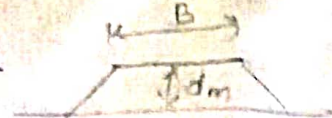


$$A_1 = Bd_1 + sd_1^2$$



$$A_2 = Bd_2 + sd_2^2$$

$$A_m = Bd_m + sd_m^2$$



$$A_m = B \left( \frac{d_1 + d_2}{2} \right) + s \left( \frac{d_1 + d_2}{2} \right)^2$$



Prob. Q

Estimate the quantity of earthwork for a portion of a road from the following data:  
Road width at the formation surface is 8m. Side slopes 2:1 in banking and  $1\frac{1}{2}$ :1 in cutting. Length of chain is 20m.

Chainage	10	21	29	33	34	35	36	37	38
Ground level	71.50	71.35	70.9	71.25	70.85	70.45	70.20	70.35	69.10
Formation level							69.65	69.70	

29      30  
69.65    69.70  
Formation level 70.00 ← upward gradient of 1:200 →

Solution -

calculation of quantities of earthwork

B = 8m,  $s = 2$  in banking,  $s = 1\frac{1}{2}$  in cutting

# Estimate of a Retaining Wall

Prob:-

Calculate the quantities of all elements of work for the construction of a retaining wall for a length of 20m.

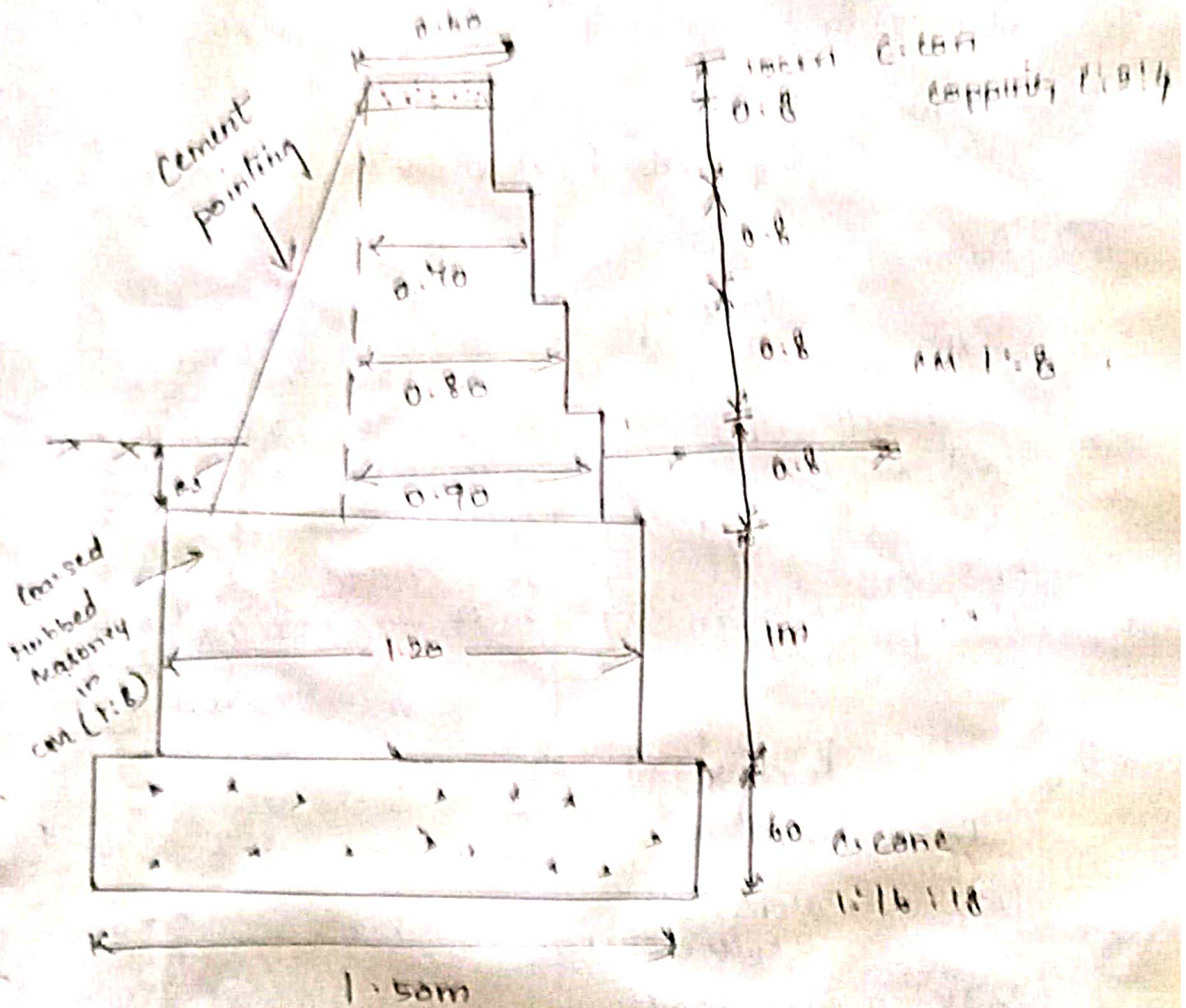


Fig 1.



S.No	Particulars of Items of Work	No.	L	B	H	Qty
1.	Excavation for foundations in soil	1	20.30	1.50	2.1	63.94
2.	Cement Concrete (1:6:18) in foundations	1	20.30	1.50	0.60	18.27
3.	Cement Concrete (1:2:4) Capping Wall	1	20.00	0.60	0.1	1.2
4.	Coursed Rubble Masonry					
	1 <sup>st</sup> step	1	20.00	1.20	1	24
	2 <sup>nd</sup> step	1	20.00	0.90	0.8	14.4
	3 <sup>rd</sup> step	1	20.00	0.80	0.8	12.8
	4 <sup>th</sup> step	1	20.00	0.70	0.8	11.2
	5 <sup>th</sup> step	1	20.00	0.60	0.8	9.6
	Triangular Portion	1	20.00	$\frac{1}{2} \times 3.2$	0.20	6.4
					Total	<u>78.4 m<sup>3</sup></u>
5.	Cement Pointing (1:2)					
	Front side	1	20.0	—	3.2	64
	Back side along road surface	1	20.0	0.9	—	18
	Ends above road surface	2	0.7	—	0.8	1.12
					Total	<u>83.12 m<sup>2</sup></u>



# Detailed Estimate of a slab culvert.

Pbm

Prepare a detailed estimate of a slab culvert of 1.50m span & 4m roadway from the given drawing.

Example 1. — Prepare a detailed estimate of a slab culvert of 1.50 metre span and 4.00 metre roadway from the given drawing (Fig. 8.5). The general specifications are as follows:

Foundation concrete shall be of cement concrete 1 : 3 : 6 with stone ballast and coarse sand. Masonry shall be of first class brick work in 1 : 4 cement coarse sand mortar. Slab shall be of R.C.C. 1 : 2 : 4 with reinforcement as per drawing. Exposed surface of brick masonry shall be cement coated 1 : 2. Road shall be provided with 10cm thick wearing coat of 1 : 2 : 4 cement concrete having suitable base.

R.C.C. SLAB CULVERT 1.50 m SPAN with standard masonry & coat

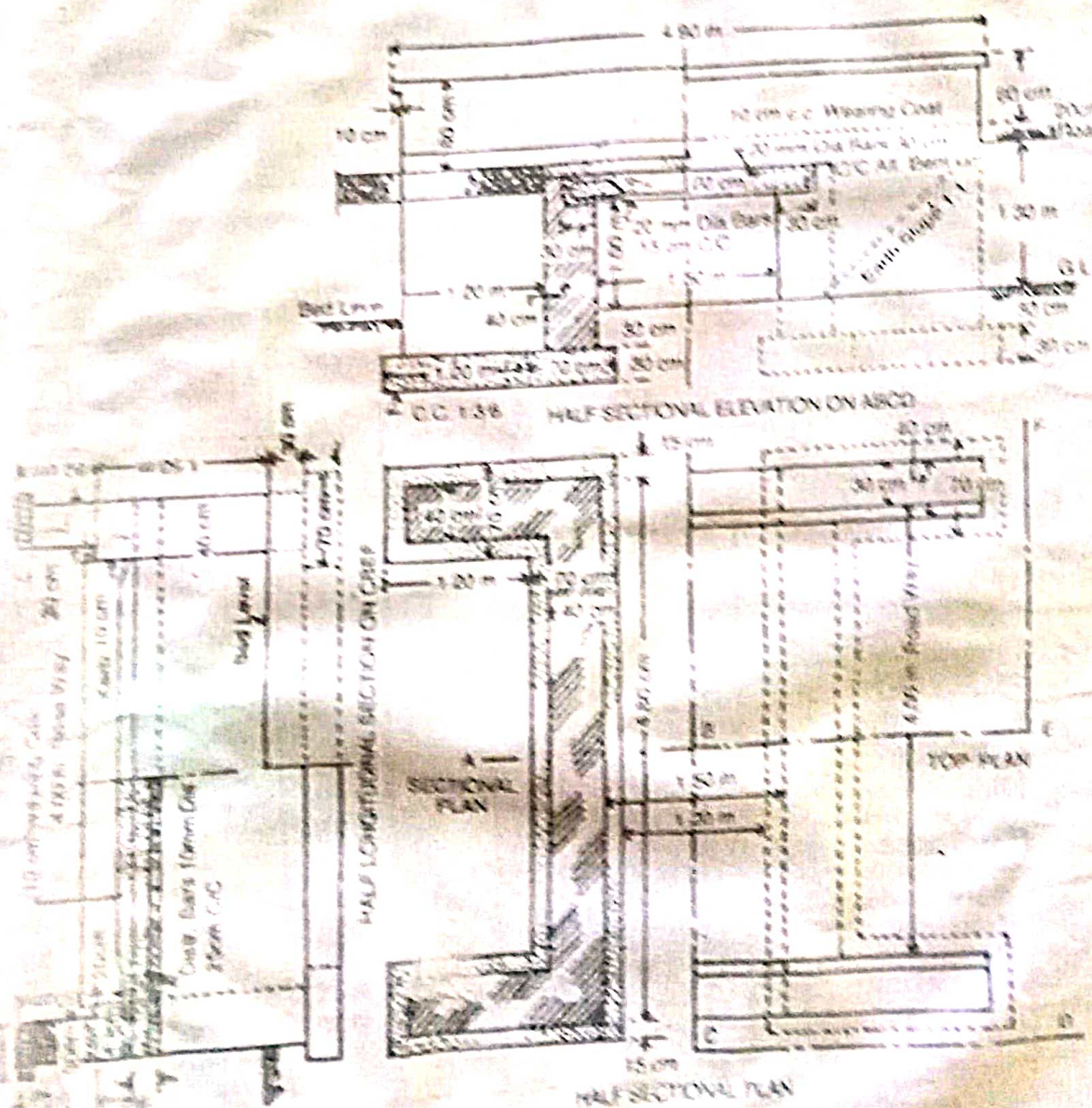


FIG. 8.5



Item no.	Description of Items	No.s	Length	Breadth	Height	Quantity	Explanatory Notes								
1.	Earthwork Excavation in foundation Abutments Wing Wall	2 4	5.1 1.2	0.7 0.7	0.6 0.6 Total	4.284 2.016 6.30 m <sup>3</sup>	$L = 0.15 + 4.8 + 0.15 = 5.1m$ $D = 0.3 + 0.3 = 0.6$								
								2.	C.C. 1:3:6 in Foundation with stone ballast & coarse sand	2 4	5.1 1.2	0.7 0.7	0.3 0.3 Total	2.142 1.008 3.15 m <sup>3</sup>	
Abutments	Wing wall upto Kerb	Parapet above Kerb	Coping												



Deductions						
Bearing for Rec Slab in Reinforcement in Abutment	2	1.8	0.3	0.2	-0.576	
4. Rec work 1:2:4 in Slab excluding Steel of slab, bending but including centering & shuttering & lighting steel	1	1.8	2.1	0.2	2.016 m <sup>3</sup>	L = 4.8 m B = 0.3 + 1.5 + 0.3 = 2.1 m
5. Steel bars including bending in Rec 20mm dia bars					10.46 m	$\frac{4.8 - 16 \times 3}{0.3} = 1776.5$ Length = 2.1 = 2 (slab over + 18 (φ bar) bar = 2.1 - 0.16 = 1.94 m } = add one depth = 2.08 x 1016 = 2134
(i) Main straight bars 20mm dia	17	2.38	-		10.64 m	
(ii) Main Lendup bars @ 20mm dia	16	2.54			811 m	
20mm dia bars @ 2.4 x 4 x 1 m						
Total					8110.924 m <sup>3</sup>	8110.924 m <sup>3</sup> = 208.817 kg

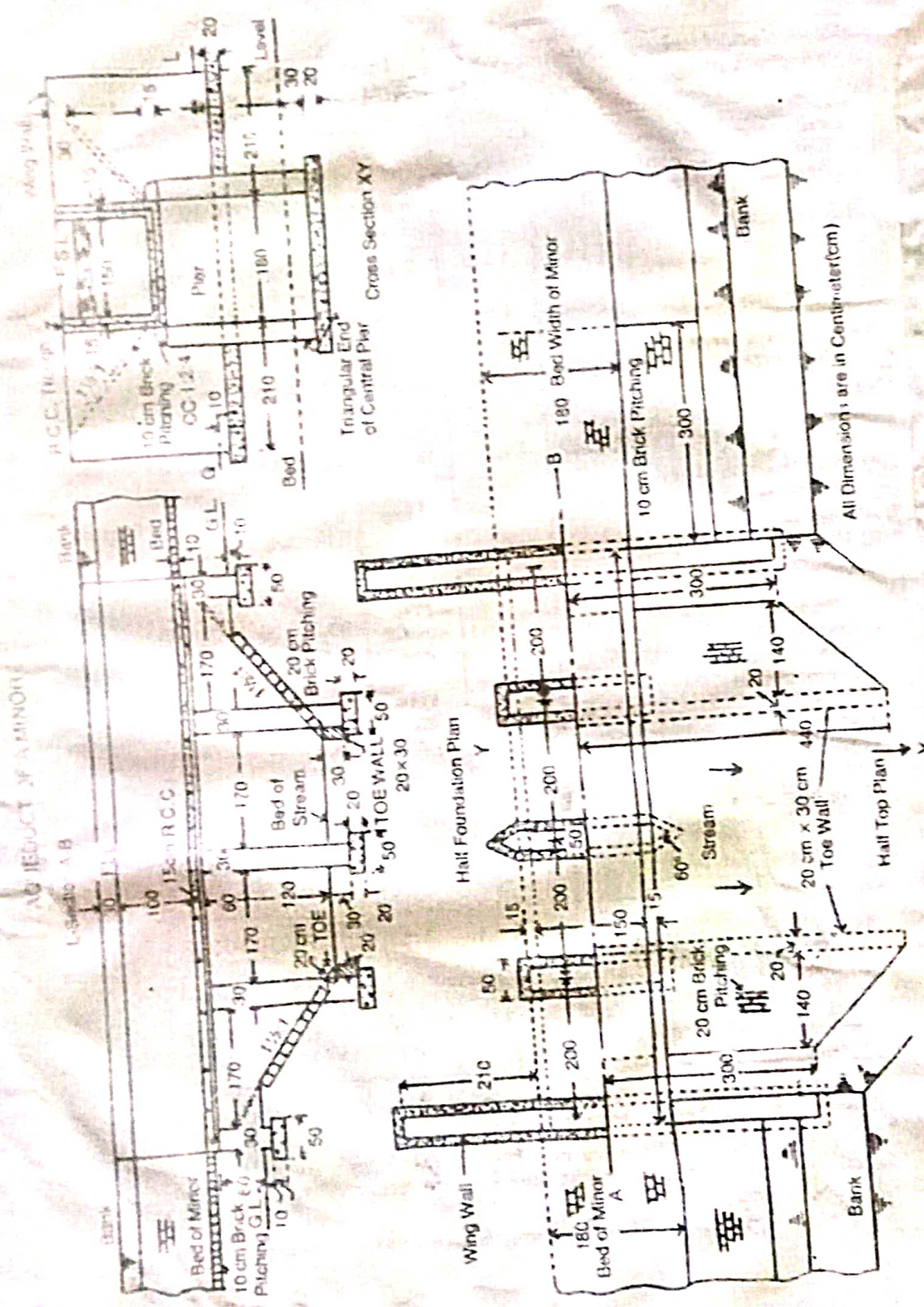


Item no.	Description of item of work	No.s	Length	Breadth	D (or) H	Quantity	Explanatory Note
	10mm dia bars distributing bottom side of 25cm c/c distribution of bottom	9	4.9			44.1m	No. of bars $\frac{2.1}{0.25} = 8.4$ say 9 Nos
		4	4.9			19.6m	length = $4.8 - 2(0.04)$ + 18 (9 bars) = 4.9m
				Total		63.7m	
	10mm dia rod @		0.62kg/m	$\Rightarrow$	63.7 x 0.62	= 39.49kg	1 ton = 1000kg = 0.237 ton
6.	c-c 1:2:4 wearing coat	1	4	2.3	0.1	0.92m <sup>3</sup>	1 ton = 100 quintal = 2.37 under
7.	cement pointing 1:2 in walls Face wall from 10cm below	2	4.7	-	2.1	19.74m <sup>2</sup>	k = $4.9 - 0.1 - 0.1$ = 4.7m
		2	4.7	-	0.8	7.52	
	Parapet wall	2	4.7	-			



Prepare a detailed Estimate of a aqueduct

ESTIMATING AND COSTING





Coping	2	-	0.4	0.2	0.32
Ends of parapet	4	-	0.3	0.5	0.6
③ Ends of parapet	4	-	0.4	0.1	0.16
Ends of coping	4	-			
$H = 0.6 - 0.1 = 0.5$					
Total					<u>35.20 m<sup>2</sup></u>

### Deductions

Rectangular opening  
below the slab

Rec slab portion

Triangular portion }  
below earth slope }

1.1	0.2	3.3 m <sup>2</sup>	0.84 m <sup>2</sup>	1.67 m <sup>2</sup>
Total		<u>- 5.83</u>		
Net total =		29.37 m <sup>2</sup>		



SPECIFICATIONS AND TENDERSData :-

The quantities of materials and labour required per unit of various finished item of work have been standardized and given in the "Data Book".

Schedule of Rates :-

The rates of materials at source + wage of labour of various categories and conveyance charges of materials including loading, unloading and special allowances such as area allowances, Abat road allowances, etc., needed to the construction of works in various departments.

Analysis of Rates :-

The determination of rate per unit of a particular item of work, from the cost of quantities of materials, the cost of labours and other miscellaneous petty expenses required for its completion is known as the analysis of rates.

The rates of particular item of work depends on the following :-

(i) Specifications of works and materials, quality of materials, proportion of mortar method of constructional operation, etc.



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Analysis of Rates :-

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The rates of particular item of work depends on the following :-

(i) Specifications of works and materials, quality of materials, proportion of mortar method of constructional operation, etc.



6	Cement Concrete 1:2:4 in top ends of Central pillars	2	( $\frac{1}{2} \times 0.3 \times 0.86$ )	$\frac{1}{3} \times 0.15$	$0.0027m^2$
7	Cement pointing 1:2 Central pillar	1	4.8	1.8	8.64
	End pillars @ bed @ bank	2	4.2	1.8	15.12
	Wing Wall	2	1.8	0.6	2.16
		2x2	2.1	2.05	17.22
				<u>Total</u>	<u>43.14m<sup>2</sup></u>
8	Dry brick pitching Slope of stream for pitching	2	$\frac{6+8.8}{2} = 7.4$	0.2	5.464
	Slope of minor for pitching	2x2	3	0.1	2.16
	Bed of minor for pitching	2	3	0.1	1.08
				<u>Total</u>	<u>8.69m<sup>2</sup></u>



(2) Quantities of materials & their rates, number of different types of labourer & their rates.

(3) Location of the site of work & its distances from the source of materials and the rate of transport, availability of water.

(4) Profits and miscellaneous & overhead expenses of contractor.

**Task or out-turn work: -**

Task:

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

**Sundaries: -**

The lumpsum amount is generally provided at the analysis of rates toward the petty items which can't be accounted in detail an amount of 2.5% to 3% of labour cost is provided for this purpose.

**Overhead charges: -**

It is the expenditure incurred other than cost of construction materials labour and other related works.

Overhead charges may considered in the following two heads

- (i) General over head
- (ii) Job over head.

# Specifications

Specifications specify or describe the nature and class of the work, materials to be used in the work, workmanship etc and is very important for the execution of the work.

The cost of a work depends much on the specifications.

Specifications depend on the nature of the work, the purpose for which the work is required, strength of materials, availability of materials, quality of materials, etc.

## Types of specifications :-

Specifications are of two types :-

(1) General specifications

(2) Detailed specifications

## General or Brief Specifications :-

It gives the nature and class of the work and materials in general terms, to be used in the various parts of the work, from the foundation to the superstructure.

1. General specification of a first class Building

Foundation and plinth :-

It shall be of 1<sup>st</sup> class brickwork in lime mortar (or) 1:6 cement mortar over lime concrete.



## Damp Proof Course :-

It shall be 2.5cm (1") thick  
Cement concrete 1:1½:3, mixed with one kg of  
per bag of cement.

## Superstructure :-

It shall be of I class brickwork  
with lime mortar or 1:6 cement mortar.  
Lintels over doors and windows shall be of  
RCC.

## Roofing :-

Roof shall be of RCC slab with an  
insulation layer and lime concrete terracing above,  
supported over R.S. joints or RCC beams as reqd.

## Flooring :-

It shall be of mosaic (terrazzo).

## Finishing

Pls and o/s walls shall be of 12mm (½")  
Cement lime plastered 1:1:6.

## Doors and Windows :-

Chaukhats shall be seasoned teak wood.  
Shutters shall be teak wood 4.3cm (1¾") thick  
panelled glazed or partly panelled and partly  
glazed as required.

## Miscellaneous :-

Rain water pipes of cast Iron or of  
asbestos cement shall be provided and finished  
painted.

## Detailed Specifications

→ It is a detailed description and expresses the requirements in detail.

→ Detailed specification of an item of work specifies the qualities and quantities of materials, the proportion of mortar, workmanship, and of preparation and execution and the aids of measurement.

→ Every Engineering department prepares the detailed specification of the various items of works, and get them printed in book form under the name "Detailed Specification".

→ When the work, or a structure or project is taken up, instead of writing detailed specification every time, the printed Detailed Specifications are referred.

### Detailed Specifications of Various Items of Works: -

#### 1. Earthwork in Excavation in foundation: -

Excavation

Finish of trench

finds

water in foundation

Trench filling

Measurement

#### 2. Lime Concrete in foundation: -

Materials

Pine Aggregate

Lime

Proportions

Mixing

Laying and Compacting



Joint and Consecutive layers

Curing

Measurement

3. Lime Concrete in Roof Terracing :-

Materials

Fine aggregate

lime

Proportion

Mixing

Laying & compaction

Finishing

Curing

Measurement

4. Cement Concrete 1:2:4 :-

Materials

Coarse Aggregate

Fine Aggregate

Cement

Water

Proportion

Mixing

Slump

Formwork

Laying

Curing

5. Reinforced Cement Concrete (RCC) :-

Steel

Centering & Shuttering

Proportion

Materials

Mixing

Laying

Curing

Finishing

Measurement

6. Damp Proof Course 2.5cm (1") cc : 1:1½:3

Materials

Mixing

Laying

Curing

Painting with Asphalt

2cm DPC

7. Brickwork 1<sup>st</sup> class :-

Bricks

Mortar

Soaking of bricks

Laying

Curing

Protection

Scaffolding

Measurement

Brickwork in arch.

### Road Specifications

General Specification of Modern Road :-

1. Subgrade :- 1:60 camber
2. Soling :- 30cm wider than metalled width
3. Intercoat :- 12cm thick layers
4. Topcoat :- 12cm thick layer
5. First coat of bituminous painting :-  
shall be of Asphalt or
6. Second coat of bituminous painting Road Tax No. 3
7. Brick Eging



## Preparation of Tender notice :-

→ Tender for work or supply are invited by issuing tender notice in prescribed form.

→ In the tender notice, the following particulars are given.

- (i) Name of the authorities inviting tender
- (ii) Name of work & its location
- (iii) Estimated cost
- (iv) Time of completion
- (v) Cost of complete set of tender forms and conditions
- (vi) Date, time and place of tender
- (vii) Amount of Earnest money & security money
- (viii) Validity of tender, etc.

→ Tender notice is posted in the notice board of the department and for major work, the tender notice in brief is also given in the newspaper.

## Tender Document :-

- (1) General Conditions of Tender
- (2) Schedule of items of works
- (3) Special Conditions

- Location of work
- Quantity of work
- Amount of F.M.D
- Penalty conditions
- Designation of arbitrary authority

## Contracts

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

### Types of Contracts :-

#### (1) Lumpsum Contract :-

In Lumpsum Contract, the contractor undertakes the execution or construction of a specific work with all its contingencies, to complete it in all respects within a specified time for a fixed amount.

#### (2) Lumpsum & Schedule Contract :-

This is similar to lump sum contract but the schedule of rates is also provided in the contract agreement.

#### (3) Schedule Contract (or) Item rate Contract :-

In schedule contract, the contractor undergoes the execution of or construction of a work on the item rate basis.

#### (4) Cost plus percentage Contract :-

In this system, contractor is given certain percentage over the actual cost of the construction as his profit.



## Drafting of Contract Documents

Before the work is given out on contract an agreement or bond is prepared. The following documents shall be attached to the contract document or bond which should be duly endorsed & sealed.

### 1. Title page

- having name of work,  
contract bond no. etc.,

### 2. Index page

### 3. Tender notice

### 4. Tender form

### 5. Bill of quantities

### 6. Schedule of issue of materials

### 7. General Specifications

### 8. Detailed "

### 9. Drawings

### 10. Condition of Contract

### 11. Special condition.

## Legal Requirements:-

### Liquidated damages:-

It is a fixed stipulated sum of penalty by the contractor or having no relationship with real damage.

### Termination of Contract:-

The contract can be terminated by the Executive Engineer or by competent authority in default & penalty may be imposed as per terms of contract agreement.

## Penalty :-

It is a sort of fine for non-fulfilment of terms of contract. Every contract usually contains certain provisions for penalty for breach of terms and conditions of contract or for not maintaining the progress, for delay in completion, for bad work etc.

## Arbitration :-

The alternative dispute resolution is a technique for the resolution of dispute outside the court, where the parties dispute refer it to one (or) more person by whose decision they agree to be a resolution technique in which a third party reviews the evidence in the case and impose that is legally binding for both sides.

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## Tenders.

Tender is an offer in writing to execute some specified work or to supply some specified articles at certain rates within a fixed time under certain conditions of contract and agreement, between the contractor and the department or owner or party.

### E-Tender:-

→ It is an internal based process wherein the complete tendering process from advertising to receiving and submitting tender related information are done online.

→ This enables firms to be

① more efficient

② paper based transactions are reduced or eliminated.

③ facilitating for a more speedy exchange of information.

### TIT Act:-

[ Tamilnadu Transparency in Tender Act ]

It is an act to provide for transparency in the public procurement and to regulate the procedure in inviting & accepting tender.

## Detailed Specification of Roadwork: -

1. Overburnt lime
2. Overburnt lime ballast
3. Stone ballast
4. Kankar
5. Laying & Consolidation of road metal
6. " " of kankar metal
7. First coat of painting
8. Second coat of painting
9. 2cm ( $3/4$ " ) premix chips carpet
10. Preparation of base

## Sources of Specification: -

1. Contract Drawings
2. Previous Specifications
3. Requirement of owner
4. Site Investigation
5. std. Specification
6. Trade catalogues.



CONTRACT REPORT PREPARATIONPrinciples for Report Preparation :-

(\*) Each estimate is accompanied with a report describing the various features of the work.

(\*) The report should be written in such a manner that on the study of the report one can form an idea about the whole work.

(\*) The report of each work differs from the other and shall have to be written according to the nature of the work.

(\*) The report is usually given at the beginning of the estimate followed by calculations, design, general and detailed specifications, analysis of rate, materials statement and then the detailed estimate.

(\*) The plans & drawings are enclosed at the end.

(\*) In the last page of the abstract of estimate there are space for signatures for the Assistant Engineer, the executive Engineer & the Superintending Engineer & for the sanctioning authority.

(\*) In the top of title page, the estimate number, name of work, name of division, head of accounts, total cost of estimate, etc. are written.

(\*) In Index page, the contents & page numbers are given.

Annual repairs:-

$$\text{Building \& roads @ 1\%} = \frac{4,20,000 \times 1}{100} \\ = \text{Rs } 4,200.00$$

$$\text{Sanitary \& water works} = 3,200 \times \frac{1}{100} \\ = \text{Rs } 32.00$$

$$\text{Electric Installation @ 1\%} = \frac{4,00,000 \times 1}{100} \\ = \text{Rs } 4,000.00$$

Special Repairs:-

$$\text{Building \& roads @ 0.5\%} = \frac{4,20,000 \times 0.5}{100} \\ = \text{Rs } 2,100.00$$

$$\text{Sanitary \& works @ 0.5\%} = \frac{3,200 \times 0.5}{100} \\ = \text{Rs } 16.00$$

$$\text{Electric Installations @ 0.5\%} = \frac{4,00,000 \times 0.5}{100} \\ = \text{Rs } 2,000.00$$

$$\text{Municipal House Tax} = \text{Rs } 6,000.00$$

$$\text{Local Property Tax} = \text{Rs } 1,100.00$$

$$\text{Total Standard Rent} = \frac{\text{Rs } 6,718.00}{\text{per annum}}$$



# Report on Estimates for the Construction of Residential Building.

The detailed estimate for construction of a residential bldg for the executive Ee at Udaynagar has been prepared in compliance of S.E.'s letter no. .... dated ..... There is no bldg for the residence of Executive Ee at Udaynagar & he has to live in a rented bldg with meagre accomodation at a very high rent. Head of accounts will be 50 Civil Original works, bldg.

Estimate provides following accomodation:

- One drawing room, one dining room, three bed rooms, one guest room & the necessary store, kitchen, bath, front & back Verandah enclosed.
- land of 60m x 30m (200 x 100')
- lime conc. foundation & 1<sup>st</sup> class masonry & superstructure shall be of 1<sup>st</sup> class masonry.
- Lintel shall be of R.B work & roof-RCC
- drawing & dining room shall be colour washed & inside of remaining rooms shall be white washed & o/s wall shall be colour washed
- Doors & windows ⇒ 4.5cm (1 3/4") thick teak wood with Sal wood & enamel painted.
- Estimate has been prepared at P.W.D. schedule of rates

→ Population ⇒ safe load = 9 ton/ft<sup>2</sup>  
Pie roof ⇒ safe load = 100 kg/ft<sup>2</sup>

with 400 kg/cm<sup>2</sup> as tensile stress &  
50 kg/cm<sup>2</sup> as compressive stress.

→ Plans, drawings, site plans are also enclosed with estimate.

→ Provision made for electrification & sanitary & water supply system.

→ Provision for compound wall.

→ Statement of important materials as cement, steel, coal etc., enclosed with estimate.

→ work carried on contract by tenders.

→ Estimate work out as Rs 5000.00

& is submitted out for sanction & allotment of funds.

## Report on Estimate for Construction of A Culvert

→ Estimate has been prepared for construction of an arch culvert of 3m span in 15km - 300m on Lucknow - Daultpur road.

→ Road at this point is flooded almost every year during the rainy season causing flood & damages in area.

→ During last inspection, E.F. has asked to prepare an estimate in compliance of E.F. letter no. ... dated ... the cost of construction will be met from ... so civil works



- Culvert designed for IRA class a loading
- Catchment area determined from 2.5 cm (1") map of area = 1200 acres.
- water way calculated from Talbot formula,  $a = CA^{3/4}$ .  $a$  = waterway in sqft  
 $A$  = Catchment area  
 $C = 0.2$
- Soil tested & spread foundation will be sufficient.
- foundation of Cement concrete 1:4:8 & abutments, wing walls and parapets shall be of brick masonry in 1:5 Cement mortar.
- Arch work  $\Rightarrow$  1:3 cement mortar.
- Exposed surfaces  $\Rightarrow$  1:2 cement pointed
- All works should be in detailed PWD specifications.
- Estimate amount is to Rs 15,000.00 is submitted for sanction & allotment of fund.

## Report on Estimate for A Road Construction

→ The estimate for the construction of Alindnagar - Kaliganj road of 25km - 500m in length has been prepared for linking Kaliganj with district Headquarter, in compliance with S.F.'s letter no. .... dated .....

- Detailing of construction area should be point out.
- Plane table surveying has been made for whole length of road for both width on each side of central line.
- L-Section has been prepared by taking levels at every 30m & cross levels have been taken every 90m.
- Formation line has been fixed & ruling gradient 1 in 40.
- A number of culverts will be reqd. along length of road & a bridge of about 30m span across stream 12km.
- A list of bridge & culverts has been enclosed & provisions made at rate of Rs 5,000.00 per m span for culverts & Rs 6,000.00 per m span for bridges.
- Designed for IRC class A loading.
- Land of 30m width shall be required.
- Formation width shall be 10m & side slope 2:1 in banking & 1/2:1 cutting.
- Soiling coat of lime on edge with Overburnt lime & 2 coats of metalling, inter coats, top coat, each of 8m compacted layer with stone ballast.
- Second coat ⇒ bituminous paint.
- Survey Plan, L-sections & Cross sections of proposed road are enclosed with estimate.
- The estimate amounting to Rs. 25,00,000.00 has been submitted for sanction & allotment of fund.



- 11. erect concrete shaft on long finished smooth
- 12. Pumping out water till clear water is obtained

The above items of work should be furnished with the details of estimate in the report.

### Report on Estimate of Openwell

Masonry well are constructed for drinking water purposes for irrigation water supply & for foundation and bridges. Excavation is done upto the water level on spring level, a well is the laid of masonry constructed upto a depth of about 3m (10ft) above ground level if the sinking operation is done.

The following items of work should be furnished in the estimate

1. Earthwork in excavation
  - upto 1.50m depth
  - 1.50m to 3.00 depth
  - 3.00m to 4.50m depth

2. RCC work in curb including steel

3. Iron work including 125x125x6mm Angles etc

# Report Preparation on Estimate of Tubewell.

The detailed estimate for the construction of tubewell <sup>(50mm) dia.</sup> for the purpose of arrangement of drinking water supply in village per capita availability with seasonal variations.

Estimate provides following accommodations:-

- (1) 50mm diameter Galvanised Iron (G.I) pipe including sockets
- (2) 50mm diameter strainer 2 nos, 2-0m each.
- (3) Hand pump ordinary (No. 4 Hand pump)
- (4) Bail plug
- (5) Sockets 4 nos each
- (6) Transport of materials to site for work.
- (7) Sinking - Boring with 60mm dia. casing type including water arrangements lowering the 50mm dia. tube well pipe + strainer including joining & with drawing casing pipe -
  - (i) 0 to 20m
  - (ii) Below 20m to 30m
  - (iii) Below 30m to 40m
  - (iv) Below 40m to 50m
- (8) Inserting coarse sand surrounding the strainer including supply of sand.
- (9) Fixing and erecting of hand pump in position of including holding down bolts.
- (10) Cement concrete platform + foundation surface finished smooth.



REPORT TO ACCOMPANY THE ESTIMATE  
FOR PROVIDING WATER SUPPLY TO VILLAGE

→ It provides water supply to Village  
Sirunagallur in Maduranthakam Panchayat  
Union of Kanchipuram district.

→ Provisions made for following items

1. 150mm dia + 60m deep bore well
2. Multistage turbine pump of 7.5 kw  
Capacity
3. An Overhead tank of 1,20,000 litres  
Capacity.
4. Distribution Systems.

→ Cost of multistage pump = Rs 30,000.00

→ Rcu overhead tank will be constructed  
near the borewell for a height of 15M  
from ground level.

→ Distribution system consists of a 75mm dia  
G.I pipe overhead tank and 20mm dia G.I pipe  
will be provided.

→ It is proposed to distribute the water  
at selected points by 20mm tape.

→ Estimate has been prepared adopting the  
Schedule at rates + work out to Rs 3,50,000.

→ The expenditure can be met from the  
fund allotted for self sufficiency scheme.

→ The estimate may be sanctioned + fund  
allotted.

## Report on Estimate for sanitary installation

→ The estimate has been prepared for installing sanitary arrangements at Sivunagallur in Kancheepuram district in the construction of Medical building.

→ Inside toilets & all cross walls are provided with brick partition wall having thickness of 10cm with C.M. 1:3 using II class bricks.

→ Necessary fund provisions are made for the following items of works:

1. Providing internal & external water supply arrangements.
2. Providing internal & external sanitary arrangements.
3. Providing electrification.
4. Levelling the site.
5. Pavement & approach steps.
6. P.S & contingent charges.
7. Unforeseen items of works.

→ The estimate has been prepared adopting schedule of rates for year 1997-1998 & the works are for Rs 2,92,905/-

→ Estimate may be sanctioned & funded.



4. 1:6 class brickwork in well skinning in 1:6 cement mortar.
5. Cement pointing
6. 6cm cc over 7.5cm h.c. apron (floor).

Estimate has to be prepared adopting the schedule of rates & work out to Rs. 295570 approximately for the above mentioned work.

The expenditure can be met from the fund allotted for self sufficiency scheme.  
The estimate may be sanctioned & fund allotted.

————— x —————

VALUATION

Valuation is the art of assessing the present fair value of a property at a specified time. It is the estimate of the value of a particular thing in terms of money. It is based on certain facts and factors.

Necessity :-

- (i) for Purchase :-
- (ii) Sale
- (iii) Tax fixation
- (iv) Rent fixation
- (v) Mortgage Value
- (vi) Compulsory Acquisition
- (vii) Wealth tax
- (viii) Capital Gains Tax
- (ix) Partition
- (x) Assessment of stamp fees
- (xi) Insurance Premium
- (xii) Gift tax.

Basis of Value Engineering :-Market Value :-

It is the value at which it can be sold in the open market at a particular time.



## Book Value :-

It is defined as the value of the property shown in the account book in that particular year. i.e., the original cost less total depreciation till that year.

## Scrap Value :-

This is the value of machinery obtained when it becomes absolutely useless except for sale as junk.

## Salvage Value :-

It is the value of a machinery realised on sale when its useful span of life is over, but it has not become useless.

## Sinking Fund :-

It is an amount which has to be set aside at fixed intervals of time out of the gross income so that at the end of the useful life of the building or property, the fund should accumulate to the initial cost of building.

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

$$I_c = \frac{i}{(1+i)^n - 1}$$

where,  $S$  = total amount of sinking fund

$I$  = annual installment

$i$  = rate of interest in decimal

$n$  = no. of yrs.

$I_c$  = coefficient of annual sinking fund so that,

$$I = I_c \times S$$

## Capitalised Value :-

The Capitalised Value of property is the amount, the interest on which at the highest prevailing rate would be equal to the net income out of the property.

Example :-

Capitalised Value of a property fetching a net annual rent of Rs 1,000 and the highest rate of interest prevalent being 5% is as follows :-

For Rs 5,00 interest, capital = Rs 1000.00

To get Rs 1000.00 interest, capital =  $\frac{100}{5} \times 1000$   
= Rs 20000.00

In short capitalised value is Net income  $\times$  years purchase

$$8\% \text{ interest} = \frac{1000 \times 100}{8}$$

$$= \text{Rs } 12500.00$$

Thus higher the rate of interest, the Capitalised Value of built property goes down, obviously the rent shall have to go up.

Pbm ① :-

An old building has been purchased by a person at a cost of Rs 50,000 excluding the cost of the land. Calculate the amount of annual sinking fund at 4% interest assuming the future life of the building as 20 yrs and the scrap value of building as 10% of the cost of purchase.



Solution :-

The total amount of sinking fund to be accumulated at the end of 20 yrs.

$$S = 30000 \times \frac{90}{100} = \text{Rs. } 27,000.00$$

Annual Instalment of sinking fund,

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

$$= \frac{27000 \times 0.04}{(1+0.04)^{20} - 1}$$

$$= \text{Rs. } 907.20.$$

Annual instalment for sinking fund required for 20 yrs = Rs. 907.20.

**Depreciation :-**

It is the gradual exhaustion of the usefulness of a property.

**Method of Valuation :-**

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

$$\text{Depreciation Value, } D = P \left( \frac{100 - rd}{100} \right)^n$$

Where,  $D = P \left( \frac{100 - rd}{100} \right)$  depreciated Value.

$r = \text{rate}$

$d = \text{depreciation}$

$n = \text{no. of yrs}$

Structure with 100 yrs life,  $rd = 1$

75 yrs life,  $rd = 1.3$

50 yrs life,  $rd = 2.0$

25 yrs life,  $rd = 4.0$

20 yrs life,  $rd = 5.0$

**Prblm ①: -**

A three storied building is standing on a plot of land measuring 800 sq. m. The plinth area of each storey is 400 sq. m. The building is of RCC framed structure & its future life may be taken as 70 yrs. The building fetches a gross rent of Rs 150000 per month. Work out the capitalized value of the property on the basis of 6% net yield. For sinking fund 3% compound interest may be assumed. Cost of land may be taken as Rs 4000 per sq. m. Other data required may be assumed suitably.

**Solution:**

$$\text{Gross income per year} = 1500 \times 12 = \text{Rs. } 18,000.00$$

**Outgoings per annum assuming suitable data:**

$$(i) \text{ Repairs at } \frac{1}{10} \text{ of gross income} = \text{Rs. } 1800.00$$



(ii) Municipal tax 2% of gross rent  
 $= 18000 \times \frac{2}{100} = \text{Rs } 360.00$

(iii) Property tax 5% of gross rent  
 $= 18000 \times \frac{5}{100} = \text{Rs } 900.00$

(iv) Insurance premium @ 1.5% of gross rent  
 $= 18000 \times \frac{1.5}{100} = \text{Rs } 270.00$

(v) Management charges @ 6% of gross rent  
 $= 18000 \times \frac{6}{100} = \text{Rs } 1080.00$

(vi) Other miscellaneous charges @ 3% of all the gross rent  
 $= 18000 \times \frac{3}{100} = \text{Rs } 540.00$

(vii) Sinking fund required to accumulate the cost of the building in 7 years @ 5% interest  
 $= 180000 \times 0.0043 = \text{Rs } 774.00$

Total of outgoings per annum  
 $= \text{Rs } 8204.00$

Net Annual return =  $18000 - 8204.00 = \text{Rs } 9796.00$

Capitalised value of building  
 $= \text{Net income} \times Y.P$   
 $= 9796 \times \frac{100}{5}$   
 $= \text{Rs } 195920.00$

Less: cost of land @ Rs 20000 per acre = 20000.00  
 $(1) = \text{Rs } 175920.00$

The total value of the property =  $\text{Rs } 175920.00$

Q. 10

A building is situated by the side of a main road of Lucknow City on a land of 500 sq. m. The built up portion is 20m x 15m. The building is first class type and provided with water supply, sanitary and electric fittings and the age of building is 30 yrs. Work out the valuation of property.

$$\begin{aligned}\text{Plinth area of building} &= 20 \times 15 \\ &= 300 \text{ sq. m}\end{aligned}$$

Assuming the plinth area rate as Rs 200.00 per sq. m including water supply, sanitary & electric fittings, the cost of building =  $300 \times 200$   
= Rs 60,000.00

$$\text{Life of building} = 100 \text{ yrs}$$

$$D = P \left( \frac{100 - rd}{100} \right)^n$$

$$P = 60000.00, n = 30, rd = 1$$

$$\begin{aligned}\therefore D &= 60000 \left( \frac{100 - 1}{100} \right)^{30} \\ &= 44,280.00\end{aligned}$$

The cost of land assuming Rs 60.00 per sq. m =  $500 \times 60 = \text{Rs } 30,000.00$

$$\begin{aligned}\therefore \text{Total Valuation of property} &= 44,280.00 \\ &+ 30,000.00 \\ &= \text{Rs } 74,280.00\end{aligned}$$



## Mortgage lease: -

An owner can borrow money against the security of his property, & for that purpose he is reqd. to grant an interest to the party advances the loan.

## Lease: -

It indicated the physical possession of the property & the use of it may be allowed by the original owner as per lease document.

The owner of a free hold property may give permission to any other person to use his freehold which is known as giving property on lease.

Main types of lease are

- (i) Building lease
- (ii) Occupation lease

## Easement: -

Easement are the rights and privileges which one owner of a property enjoys through or over the property of another.

## Fixation of Rent: -

The rent of building is fixed on the basis of certain percentage of annual interest on the capital cost & all possible annual expenditures on outgoings.

$$\text{Gross rent} = \text{Net rent} + \text{outgoings}$$

Pbm (4) :-

A building costing Rs 7,00,000.00 has been constructed on a freehold land measuring 100 sq.m. recently in a big city. Prevailing rate of land in the neighbourhood is Rs 150.00 per sq.m. Determine the net rent of the property if the expenditure on an outgoing including sinking fund is Rs. 24,000.00 per annum. Work out also the gross rent of the property per month.

$$\text{Cost of construction} = \text{Rs } 7,00,000.00$$

$$\text{Cost of land @ Rs } 150.00 \text{ per sq.m.} = 100 \times 150 = \text{Rs } 1,50,000.00$$

Net return :-

On building @ 6% on construction cost

$$= 7,00,000.00 \times \frac{6}{100}$$

$$= \text{Rs } 42,000.00$$

On the land @ 4% on cost of land

$$= 1,50,000.00 \times \frac{4}{100}$$

$$= \text{Rs } 6,000.00$$

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$$\text{Total net rent per year} = \text{Rs } 48,000.00$$

$$\text{Gross rent} = \text{Net rent} + \text{Outgoings}$$

$$= 48000 + 24000$$

$$= 72000.00 \text{ per annum}$$

Gross rent per

month

$$= \frac{72000}{12} = 6000.00$$



# Calculation of Standard Rent

Prob (5) - Calculate the standard rent of a Govt residential building newly constructed from the following data:-

- (i) Cost of land = Rs 10,000
- (ii) Cost of construction of building = Rs 40,000
- (iii) Cost of roads within the compound and fencing = Rs 2,000
- (iv) Cost of electric installation = 10% of cost of building
- (v) Cost of Sanitary & water supply = 8% " " "
- (vi) Municipal House Tax = Rs 400.00 per annum
- (vii) Water Tax = Rs 200.00 per annum
- (viii) Property Tax = Rs 140.00 " "

## Total Capital Cost :-

Cost of building	= Rs 40,000.00
Cost of roads & fencing	= Rs 2,000.00
Cost of sanitary & water supply works	$= 40,000 \times \frac{8}{100}$
	= Rs 3,200.00
Cost of electric installation	$= 40,000 \times \frac{10}{100}$
	= Rs 4,000.00
<b>Total</b>	<b>= Rs 49,200.00</b>

Std. rent @ 6% interest on capital cost  
 $= 49,200 \times \frac{6}{100}$   
 $= Rs 2,952.00 \text{ per annum}$

## Method I :-

Interest on total capital cost  
 @ 6% =  $49,200 \times \frac{6}{100}$

1. NOV - DEC - 2018 (14 b) . NOV Dec - 2015 (14 b)

$$\text{Cost of building} = 40,000.$$

$$\text{Cost of roads \& fencing} = 2,000$$

$$\begin{aligned} \text{Cost of electrical installations} &= 10\% \text{ building cost} \\ &= \frac{10}{100} \times 40,000 = 4000. \end{aligned}$$

$$\text{Total} = 46,000.$$

$$\begin{aligned} \text{Standard rent @ 6\% interest} &= 46000 \times \frac{6}{100} = 2760 \text{ per annum} \\ \text{on capital cost} & \end{aligned}$$

Annual Repair -

$$\text{Building \& roads @ 1.5\%} = \frac{42,000 \times 1.5}{100} = 630$$

$$\text{Sanitary \& water supply @ 1\%} = - \quad 60.00.$$

$$\text{Electrical installation @ 1.5\%} = \frac{4000 \times 1.5}{100}$$

Special repairs -

$$\text{Building \& roads @ 0.6\%} = \frac{42,000 \times 0.6}{100} = 252.00$$

$$\text{Sanitary \& water supply @ 3.5\%} = - \quad 140.00.$$

$$\text{Electrical installation @ 3.5\%} = \frac{4000 \times 3.5}{100}$$

$$\text{Municipal House tax} = 400.$$

$$\text{Government property tax} = 140.$$

$$\text{Least of the two} = \frac{2760}{12} = ₹ 230.$$

April / May 2017. (14b)

$$\text{Gross rent per year} = 2500 \times 12 = 30,000 \text{ per annum.}$$

Assuming suitable data for outgoing, per annum,

$$\text{i) Repair @ 10\% gross income} = \frac{30,000 \times 10}{100} = 3000$$

$$\text{ii) Municipal taxes @ 20\%} = \frac{30,000 \times 20}{100} = 6000.$$

$$\text{iii) Property tax @ 5\%} = \frac{3000 \times 5}{100} = 1500.$$



3-1

Insurance premium @ 0.5%  $\cdot 30,000 \times \frac{0.5}{100} = 150$

Miscellaneous @ 2%  $\cdot 30,000 \times \frac{2}{100} = 600$

Sinking fund required to accumulate building cost in 70 years @ 3%  $= 30000 \times 0.043$

$$S_0 = \frac{R}{(1+R)^n - 1} = \frac{0.003}{(1+0.003)^{70} - 1} = 0.0043 = 150.10$$

Assuming plinth area rate as ₹150/m<sup>2</sup>,

Cost of building =  $150 \times 3 \times 500 = 2,25,000$

Total outgoing per annum =  $3000 + 600 + 1500 + 150 + 600 + 130$   
 $= 11,380$

Net annual return =  $30,000 - 11,380 = 18,620$

Capitalised value = Net rent % P.

Cost of land =  $1000 \times 100 = 1,00,000$

Capitalised Value =  $18,620 \times \frac{100}{6} = 3,10,333$