LECTURE NOTES

ON

Estimating and Costing

IV B. Tech I semester (JNTUH-R13)

CIVIL ENGINEERING

INDEX

Chapter 1

INTRODUCTION TO THE SUBJECT

DEFINITION OF 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.

In case the funds avilable are less than the estimated cost the work is done in part or by reducing it or specifications are altered, the following require-ment are necessary for preparing an estimate.

a) Drawings like plan, elevation and sections of important points.

b) Detailed specifications about workmenship & properties of materials etc.

c) Standard schedule of rates of the current year.

NEED FOR ESTIMATION AND COSTING

1. Estimate give an idea of the cost of the work and hence its feasibility can be determined i..e whether the project could be taken up with in the funds available or not.
2. Estimate gives an idea of time required for the completion of the work.
3. Estimate is required to invite the tenders and Quotations and to arange 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 OR METHOD 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 i.e.plans, elevations, sections etc.
2. Specifications.
3. Rates.

1.4.1 DRAWINGS

If the drawings are not clear and without complete dimensions the prepa-ration of estimation become very difficult. So, It is very essential before prepar-ing an estimate.

SPECIFICATIONS

a) General Specifications: This gives the nature, quality, class and work and materials in general terms to be used in various parts of wok. It helps no form a general idea of building.

b) Detailed Specifications: These gives the detailed description of the vari-ous items of work laying down the Quantities and qualities of materials, their proportions, the method of preparation workmanship and execution of work.

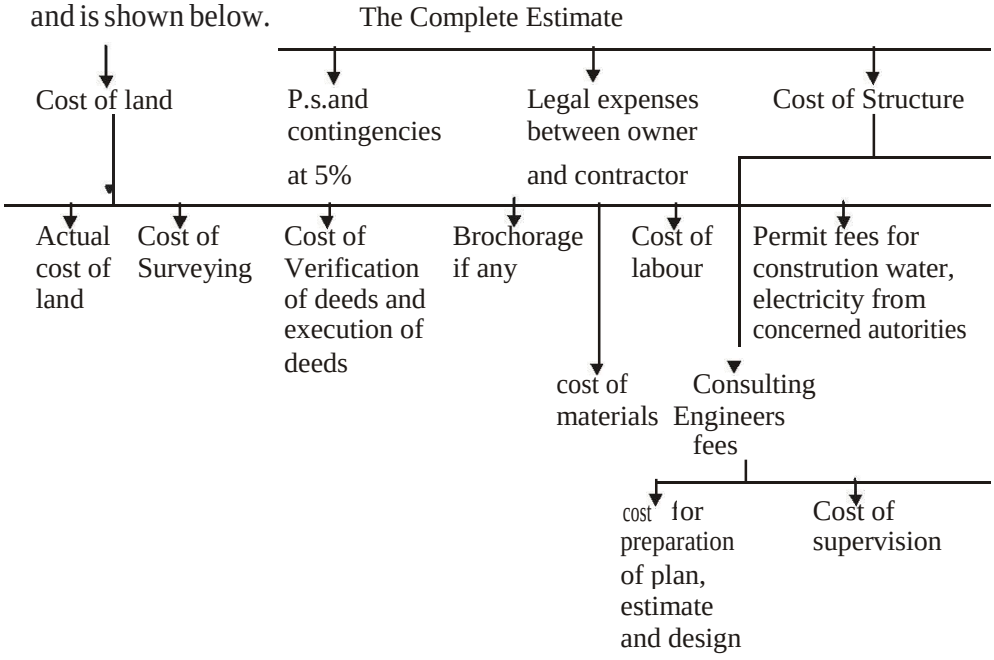
RATES:

For preparing the estimate the unit rates of each item of work are re-quired.

1. For arriving at the unit rates of each item.
2. The rates of various materials to be used in the construction.
3. The cost of transport materials.
4. The wages of labour, skilled or unskilled of masons, carpenters, Mazdoor, etc.,

COMPLETE ESTIMATE:

Most of people think that the estimate of a structure includes cost of land, cost of materials and labour, But many other direct and indirect costs included and is shown below.



LUMPSUM:

While preparing an estimate, it is not possible to workout in detail in case of petty items. Items other than civil engineering such items are called lumpsum items or simply L.S.Items.

The following are some of L.S. Items in the estimate.

1. Water supply and sanitary arrangements.
2. Electrical installations like meter, motor, etc.,
3. Architectural features.
4. Contingencies and unforeseen items.

In general, certain percentage on the cost of estimation is allotted for the above L.S.Items

Even if subestimates prepared or at the end of execution of work, the actual cost should not exceed the L.S.amounts provided in the main estimate.

WORK CHARGED ESTABLISHMENT:

During the construction of a project considerable number of skilled su-pervisors, work assistance, watch men etc., are employed on temporary basis. The salaries of these persons are drawn from the L.S. amount alloted towards the work charged establishment. that is, establishment which is charged directly to work. an L.S.amount of 1½ to 2% of the estimated cost is provided towards the work charged establishment.

EXERCISE

Short Answer Questions

1. State the requirements of an estimate?
2. Briefly Explain need for estimation?
3. What is work charged establishment?

Chapter 2

MEASUREMENT OF MATERIALS AND WORKS

UNITS OF MEASUREMENTS:

The units of measurements are mainly categorised for their nature, shape and size and for making payments to the contractor and also. The principle of units of measurements normally consists the following:

a) Single units work like doors, windows, trusses etc., are expressed in numbers.

b) Works consists linear measurements involve length like cornice, fencing, hand rail, bands of specified width etc., are expressed in running metres (RM)

c) Works consists areal surface measurements involve area like plastering, white washing, partitions of specified thickness etc., are expressed in square meters (m^2)

d) Works consists cubical contents which involve volume like earth work, cement concrete, Masonry etc are expressed in Cubic metres.

[BASED ON IS 1200 REVISED]

Sl. No.	Particulas of item	Units of Measurement	Units of payment
I	**Earth work:**		
	1. Earth work in Excavation	cum	Per%cum
	2. Earthwork in fillingin founda-tion trenches	cum	Per%cum
	3. Earth work in filling in plinth	cum	Per%cum
II	**Concrete:**		
	1. Lime concretre in foundation	cum	percum
	2. Cement concrete in Lintels	cum	percum
	3. R.C.C.in slab	cum	percum
	4. C.C. or R.C.C. Chujja, Sun-shade	cum	percum
	5. L.C. in roof terracing (thickness specified)	sqm	persqm

	6. Cement concrete bed	cum	per cum
	7. R.C. Sunshade (Specified Width & Hight	cum	1rm
III	**Damp ProofCource (D.P.C)**		
	(Thickness should be mentioned)	sqm	persqm
IV	**Brick work:**		
	1. Brickwork in foundation	cum	percum
	2. Brick work in plinth	cum	percum
	3. Brick work in super structure	cum	percum
	4. Thin partition walls	sqm	percum
	5. Brick work in arches	cum	percum
	6. Reinforced brick work (R.B.Work)	cum	percum
V	**Stone Work:**		
	Stone masonry	cum	percum
VI	**Wood work:**		
	1. Door sand windows frames or chowkhats, rafters beams	cum	percum
	2. Shutters of doors and windows (thickness specified)	sqm	persqm
	3. Doors and windows fittings (like hinges, tower bolts, sliding bolts, handles)	Number	per number
VII	**Steel work**		
	1. Steel reinforcement bars etc in R.C.C. and R.B.work. quintal	Quintal	per quintal
	2. Bending, binding of steel Reinforcement	Quintal	per quintal
	3. Rivets, bolts, & nuts, Anchor bolts, Lewis bolts, Holding down bolts.	Quintal	per quintal
	4. Iron hold fasts	Quintal	per quintal
	5. Iron railing (height and types specified)	Quintal	per quintal
	6. Iron grills	sqm	per sqm

VIII	**Roofing**		
	1. R.C.C. and R.B.Slab roof (excluding steel)	cum	per cum
	2. L.C. roof over and inclusive of tiles or brick or stone slab etc (thickness specified)	sqm	per sqm
	3. Centering and shuttering form work	sqm	per sqm
	4. A.C.Sheet roofing	sqm	per sqm
IX	**Plastering, points&finishing**		
	1. Plastering-Cement or Lime Mortar (thickness and pro-portion specified)	sqm	per sqm
	2. Pointing	sqm	per sqm
	3. White washing, colour washing, cement wash (number of coats specified)	sqm	per sqm
	4. Distempering (number of coats specified)	sqm	per sqm
	5. Painting, varnishing (number of coats specified)	sqm	per sqm
X	**Flooring**		
	1. 25mm cement concrete over 75mm lime concrete floor (including L.C.)	sqm	per sqm
	2. 25mm or 40mm C.C. floor	sqm	per sqm
	3. Doors and window sills (C.C. or cement mortar plain)	sqm	per sqm
XI	**Rain water pipe /Plain pipe**	1RM	per RM
XII	**Steel wooden trusses**	1No	per 1No
XIII	**Glass pannels(supply)**	sqm	per sqm
XIV	**Fixing of glass panels or cleaning**	No	per no.

RULES FOR MEASUREMENT :

The rules for measurement of each item are invaribly described in IS-1200. 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 shall be measured to the nearest 0.01m.
   ii) Areas shall be measured to the nearest 0.01 sq.m
   iii) Cubic contents shall be worked-out to the nearest 0.01 cum
4. Same type of work under different conditions and 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 masonary (stone or brick) 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 Fist floor to Second floor level and so on.

METHODS OF TAKING OUT QUANTITIES:

The quantities like earth work, foundation concrete, brickwork in plinth and super structure etc., canbe workout by any of following two methods:

a) Long wall - short wall method

b) Centre line method.

c) Partly centre line and short wall method.

a) Long wall-short wall method:

In this method, the wall along the length of room is considered to be long wall while the wall perpendicular to long wall is said to be short wall. To get the

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

b) Centre line method:

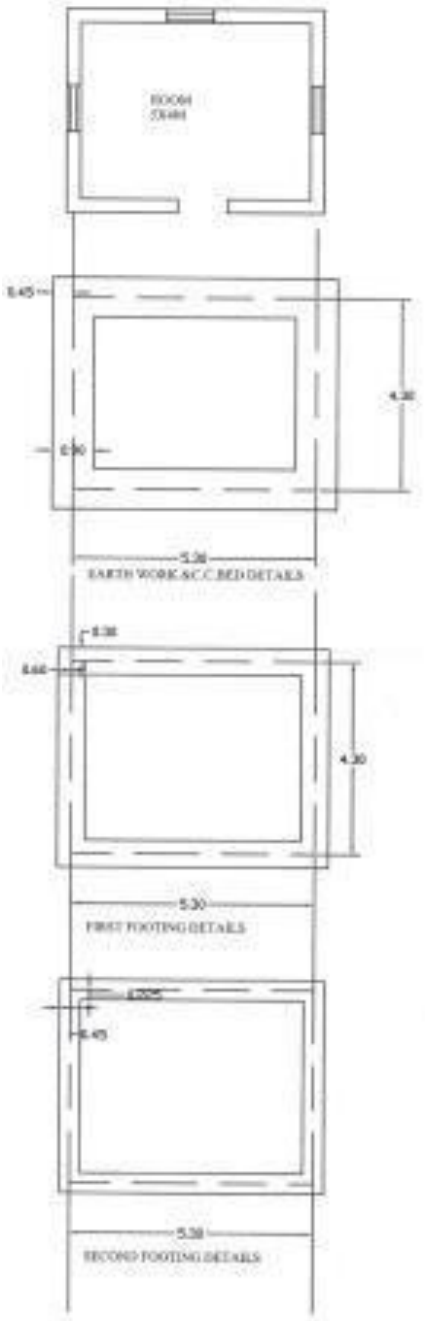
This method is suitable for walls of similar cross sections. Here the total centre line length is multiplied by breadth and depth of respective item to get the total quantity at a time. When cross walls or partitions or verandah walls join with mainall, the centre line length gets reduced by half of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

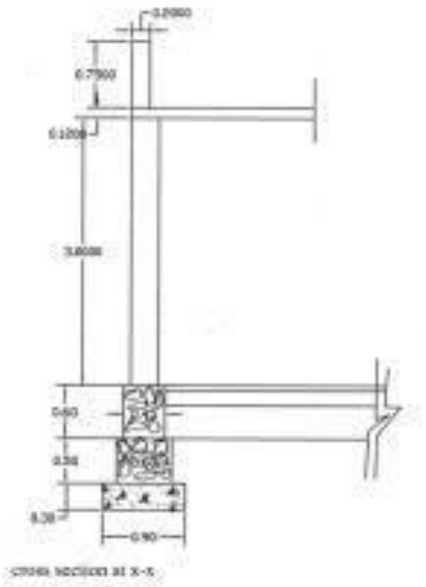
c) Partly centre line and partly cross wall method:

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

P.B.-1: From the Drawing given below determine (a) Earth work exca-vation (b) CC (1:5:10) Bed (c) R.R.Masonry in C.M. (1:6) (d) Brick Work in C.M.(1:6).

Single Roomed Building (Load Bearing type structure)





Note: All Dimensions are in 'M'

D=1X2.1M

W=1.5X1.2M

Long wall - Short wall Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation for foundation**						
	a) Long walls	2	6.2	0.9	1.4	15.264	L=5.3+.45+.45 =6.2 D= 0.3+0.5+0.6 = 1.4
	b) Short walls	2	3.4	0.9	1.4	8.568	L= 4.3-0.45-0.45= 3.4
					Total	**24.192**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	6.2	0.9	0.3	3.348	
	b) Short walls	2	3.4	0.9	0.3	1.836	
					Total	**5.184**	**m^3**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings						
	i) Long walls	2	5.9	0.6	0.5	3.54	L= 5.3+0.3+0.3=5.9
	ii) Short walls	2	3.7	0.6	0.5	2.22	L=4.3-0.3-0.3 = 3.7
					Total	**5.76**	**m^3**
	b) Basement						
	i) Long walls	2	5.75	0.45	0.6	3.105	L= 5.3+0.225+0.225= 5.75
	ii) Short walls	2	3.85	0.45	0.6	2.079	L= 4.3-0.225-0.225 =3.85
					Total	**5.184**	**m^3**
	Total R.R. Masonry for footings and Basement						
			=	**5.76+5.184 = 10.94**			**m^3**
4.	**Brick masonary** with CM (1:6) for superstructure						
	a) Long Wall	2	5.6	0.30	3.00	10.08	L=5.3+0.15+0.15=5.6
	b) Short walls	2	4.0	0.30	3.00	7.20	L=4.3-0.15-0.15=4.0
					Total	**17.28**	**m^3**

Centre Line Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation	1	19.2	0.9	1.4	24.192 **m^3**	L=2(5.3+4.3)=19.2
	5.3 / 4.3						
2.	**C.C.(1:4:8) bed for** foundation	1	19.2	0.9	0.3	5.184 **m^3**	
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings	1	19.2	0.6	0.5	5.76	
	b) Basement	1	19.2	0.45	0.6	5.184	
					Total	**10.944 m^3**	
4.	**Brick masany** wit h CM (1:6) for super	structure1	19.2	0.3	0.3	17.28 **m^3**	

EXERCISE

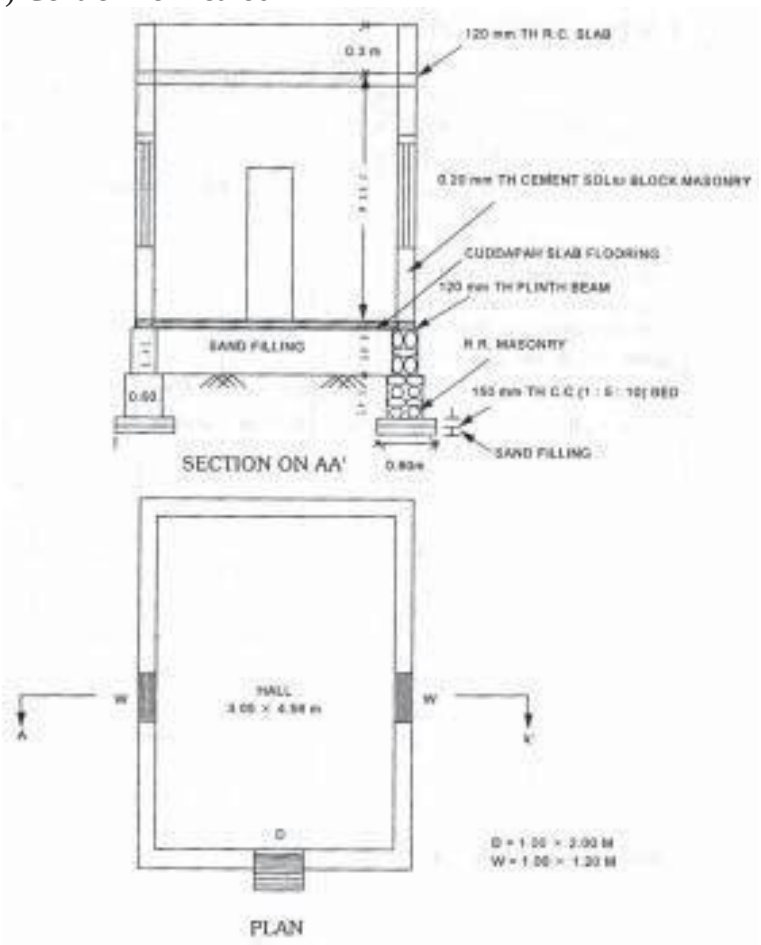
I. Short Answer Questions

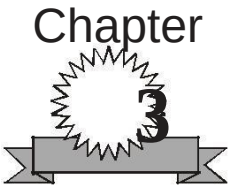
1. List the difference between centre line method and long wall-short wall method of taking out measurements.
2. What are the rules to be followed while taking the mesurements?
3. Mension the units for the following items.

   a) flooring b) R.R.Masonry c) Plastering for pointing d) Damp proof course e) R.C. sunshade (Sepcified width and thickness)

II. Essay type questions

1. From the Drawing given below determine (a) Earth work excavation (b) CC (1:5:10) Bed (c) R.R.Masonry in C.M. (1:6) (d) Brick Work in C.M.(1:6). by
   (a) longwall - short wall method
   (b) Centre line Method





TYPES OF ESTIMATES

DETAILED ESTIMATE:

The preparation of detailed estimate consists of working out quantities of various items of work and then determine the cost of each item. This is prepared in two stages.

i) Details of measurements and calculation of quantities:

The complete work is divided into various items of work such as earth work concreting, brick work, R.C.C. Plastering etc., The details of measure-ments are taken from drawings and entered in respective columns of prescribed proforma. the quantities are calculated by multiplying the values that are in num-bers column to Depth column as shown below:

Details of measurements form

S.No.	Description of Item	No	Length (L) m	Breadth (B) m	Depth/ Height (D/H)m	Quantity	Explanatory Notes

***ii)* Abstract of Estimated Cost :**

The cost of each item of work is worked out from the quantities that already computed in the detals measurement form at workable rate. But the total cost is worked out in the prescribed form is known as abstract of estimated form. 4%of estimated Cost is allowed for Petty Supervision, contingencies and Unforeseen items.

ABSTRACT OF ESTIMATE FORM

Item No.	Description/ Particulars	Quantity	Unit	Rate	Per (Unit)	Amount

The detailed estimate should accompained with

i) Report

ii) Specification

iii) Drawings (plans, elevation, sections)

iv) Design charts and calculations

v) Standard schedule of rates.

3.1.1.Factors to be consisdered While Preparing Detailed Esti-mate:

i) **Quantity and transportation of materials:** For bigger project, the re-quirement of materials is more. such bulk volume of mateials will be pur-chased and transported definitely at cheaper rate.

ii) ***Location of site:*** The site of work is selected, such that it should reduce damage or in transit during loading, unloading, stocking of mateirals.

iii) ***Local labour charges:*** The skill, suitability and wages of local laboures are consideed while preparing the detailed estimate.

DATA:

The process of working out the cost or rate per unit of each item is called as Data. In preparation of Data, the rates of materials and labour are obtained from current standard scheduled of rates and while the quantities of materials and labour required for one unit of item are taken from Standard Data Book (S.D.B)

3.2.1 Fixing of Rate per Unit of an Item:

The rate per unit of an item includes the following:

1) ***Quantity of materials & cost:*** The requirement of mateials are taken strictly in accordance with standard data book(S.D.B). The cost of these includes first cost, freight, insurance and transportation charges.

ii) ***Cost of labour:*** The exact number of labourers required for unit of work and the multiplied by the wages/ day to get of labour for unit item work.

iii) ***Cost of equipment (T&P):*** Some works need special type of equip-ment, tools and plant. In such case, an amount of 1 to 2% of estimated cost is provided.

iv) ***Overhead charges:*** To meet expenses of office rent, depreciation of equipment salaries of staff postage, lighting an amount of 4% of estimate cost is allocated.

METHODS OF PREPARATION OF APPROXIMATE ESTIMATE:

Preliminary or approximate estimate is required for studies of various as-pects of work of project and for its administrative approval. It can decide, in case of commercial projects, whether the net income earned justifies the amount invested or not. The approximate estimate is prepared from the practical knowl-edge and cost of similar works. The estimate is accompanied by a report duely explaining necessity and utility of the project and with a site or layout plan. A percentage 5 to 10% is allowed for contingencies. The following are the meth-ods used for preparation of approximate estimates.

a) Plinth area method

b) Cubical contents methods

c) Unit base method.

a) Plinth area method: The cost of construction is determined by multiplying plinth area with plinth area rate. The area is obtained by multiplying length and breadth (outer dimensions of building). In fixing the plinth area rate, carefull observation and necessary enquiries are made in respect of quality and quantity aspect of materials and labour, type of foundation, hight of building, roof, wood work, fixtures, number of storeys etc.,

As per IS 3861-1966, the following areas include while calculating the plinth area of building.

a) Area of walls at floor level.

b) Internal shafts of sanitary installations not exceeding 2.0m^2, lifts, airconditionsing ducts etc.,

c) Area of barsati at terrace level:

Barsati means any covered space open on one side constructed on one side constructed on terraced roof which is used as shelter during rainy season.

d) Porches of non cantilever type.

Areas which are not to include

a) Area of lofts.

b) Unenclosed balconies.

c) Architectural bands, cornices etc.,

d) Domes, towers projecting above terrace level.

e) Box louvers and vertical sunbreakers.

b) Cubical Contents Method: This method is generally used for multistoreyed buildings. It is more accurate that the other two methods viz., plinth area method and unit base method. The cost of a structure is calculated approximately as the total cubical contents (Volume of buildings) multiplied by Local Cubic Rate. The volume of building is obtained by Length x breadth x depth or height. The length and breadth are measured out to out of walls excluding the plinth off set.

The cost of string course, cornice, carbelling etc., is neglected.

The cost of building= volume of buildings x rate/ unit volume.

c) Unit Base Method: According to this method the cost of structure is deter-mined by multiplying the total number of units with unit rate of each item. In case schools and colleges, the unit considered to be as 'one student' and in case of hospital, the unit is 'one bed'. the unit rate is calculated by dividing the actual expenditure incured or cost of similar building in the nearby locality by the num-ber of units.

Problems on Plinth Area Method

Example 3.1: Prepare an approximate estimate of building project with total plinth area of all building is 800 sqm. and from following data.

i) Plinth area rate Rs. 4500 per sqm
ii) Cost of water supply @7½%of cost of building.
iii) Cost of Sanitary andElectrical installations each @ 7½% of cost of building.
iv) Cost of architectural features @1% of building cost.
v) Cost of roads and lawns @5% of building cost.
vi) Cost of P.S. and contingencies @4% of building cost. Determine the total cost of building project.

Solution :

Data given:

Plinth area = 800m^2.

Plinth area rate = Rs. 4500 per Sqm.

∴ Cost of building = 800 x 4500 = Rs. 36,00,000=00

Add the cost of the water supply charges @7½%

$$= \frac{36,00,000 \times 7.5}{100} = 2,70,000 = 00$$

Add the Cost of Sanitary and electrical installation @ 15%

$$= \frac{36,00,000 \times 15}{100} = 5,40,000 = 00$$

Add the cost of archetectural features @1%

$$= \frac{36,00,000 \times 1}{100} = 36,000 = 00$$

Add the cost of Roads Lawns @ 5%= $\frac{36,00,000 \times 5}{100}$ =1,80,000 =00

Add the Cost of P.S. and contingencies @ 4%

$$= \frac{36,00,000 \times 4}{100} = 1,44,000 = 00$$

Total Rs. 47,70,000=00

Assume Add supervision charges 8% on overall cost

$$= 47,70,000 \times \frac{8}{100} = 3,81,600 = 00$$

Grand Total Rs. 51,51,600=00

Example 3.2 : The plinth area of an appartment is 500 sqm. Detemine the total cost of building from the following data:

a) Rate of construction = Rs.1230/--per m^3.

b) The height of appartment = 16.25 m

c) Water Supply, Sanitary and Electrical installations each at 6% of building cost.

d) Architectural appearance @ 1% of building cost.

e) Unforeseen item @2% of Building cost.

f) P.S. and contingencies @4% of building.

Solution :

a) The Cost of building = cubic content x cubic rate

$= 500 \times 16.25 \times 1230$ = Rs. 99,93,750/-

b) Provision for water supply, sanitary and

Electrical installations water supply and sanitation each @ 6%

$= \frac{99,93,750 \times 18}{100}$ =Rs.17,98,875/−

i.e total percent = 3×6 = 18% building cost

c) Architectural appearance @1%= $\frac{99,93,750 \times 1}{100}$ = Rs. 99,937/-

d) Unforeseen items @2% = Rs. 1,99,875/-

e) P.S. and contingenies @4% = Rs. 3,99,750/-

Total = Rs.1,24,92,187/-

Sundries 7,813/-

Total cost of the building project = Grand Total = Rs.1,25,00,000/-

Example 3.3: The plinth area and plinth area rate of a residential building are 100 sqm and Rs. 5000/- respectively. Determine the total cost of building as-suming suitable provisions.

Solution :

Cost of building = 100 x 5000 = Rs.5,00,000

Cost of water supply and

sanitary fittings @15% = $\frac{5,00,000\times15}{100}$ = Rs. 75,000

Cost of Electrification @7½% = $\frac{5,00,000\times7.5}{100}$ = Rs. 37,500

Cost of Roads & Lawns @5%= $\frac{5,00,000\times5}{100}$ = Rs. 25,000

Cost of P.S.& contingencies@4%= $\frac{5,00,000\times4}{100}$ = Rs. 20,000

Total Cost Rs. 6,57,500/-

Example 3.4 : Prepare an approximate Extimate of a proposed building from the follwoing?

Plinth area of the building = 226 sqm.

Cost of the structure = 2500 per sqm.

Water supply and sanitary arangements =

12½% Electrification =7%

Fluctuation of rates = 5% petty

supervision charges = 3%

sol: Cost of Building = 226x 2500 = Rs.5,65,000 Water supply &

Sanitory arrangements @ 12½ %

= $\frac{5,65,000\times12.5}{100}$ = Rs. 70,000

Electrification @7% = $\frac{5,65,000\times7}{100}$ = Rs. 39,550

Fluctuation of rates 5% = $\frac{5,65,000\times5}{100}$ = Rs. 28,250

Pettysupervision charges 3%= $\frac{5,65,000\times3}{100}$ = Rs.16,950

Total Cost Rs. = 7,19,750.00

Problem on Cubical content Method:

Example 3.5 : Prepare the rough estimate for a proposed commertial comples for a municipal corporation for the following data.

Plinth Area = 500m^2/floor

Ht of each storey = 3.5m

No.of storeys = G+2

Cubical content rate = Rs. 1000/m^3

Provided for a following as a pecentage of structured cost

a) water supply & Sanitary arrangement -8%
b) Electrification -6%
c) Fluctuation of rates - 5%
d) Contractors profit - 10%
e) Petty supervision & contingencies - 3%

Sol : Cubical content = No.of storeys (Plinth Area x height of each storey) = 3(500x3.5) = 5250m^3

Structural cost = Cubical content x cubical content rate
= 5250 x 1000 = 52.5 Lakhs

other provisons:-

a) Water supply and sanitation = 52.5x8/100 = Rs.4.2 Lakhs
b) Electrification = 52.5 x 6/100 = Rs.3.15 lakhs
c) fluctuation of rates = 52.5 x 5/100 = Rs.2.625

Total = Rs. 9.975 Lakhs
Structural cost = Rs. 52.500 Lakhs
Total = Rs.62.475 Lakhs

d) P.S./& contingencies = 62.475 x 3/100 = Rs.1.874 Lakhs
e) Contractors Profit = 62.475 x 10/100 = Rs.6.247 Lakhs

Total Cost = Rs.70.596 Lakhs

Problems on Unit Base Method:

Example 3.6: Prepare an approximate estimate or rough cost estimate of a hospital building for 50 beds. The cost of construction altogether for each bed is Rs. 60,000/-. Determine the total cost of hospital building.

Solution:

No. of beds = 50

Cost of construction = Rs. 60,000/-

Total Cost of Hospital building = 50x 60,000= **Rs. 30,00,000/-**

Example 3.7: To prepare the rough cost estimate of a hostel building which accommodate 150 students. The cost of construction including all provisions is Rs. 15,000/- per student. Determine total cost of building.

Solution :

No.of students= 150

Cost of construction including all L.S. provisions = Rs.

15,000/-Total Cost of hostel building =150 x 15000 = Rs.

22,50,000/-(Rupees twenty two lakhs, fifty thousands only)

EXERCISE

I. SHORT ANSWER QUESTIONS:

1. List the factors to be consider while preparing detailed estimate and explain breifly?
2. What are the differences between plinth area method and Unit base method?
3. List the requirements of data preparation.

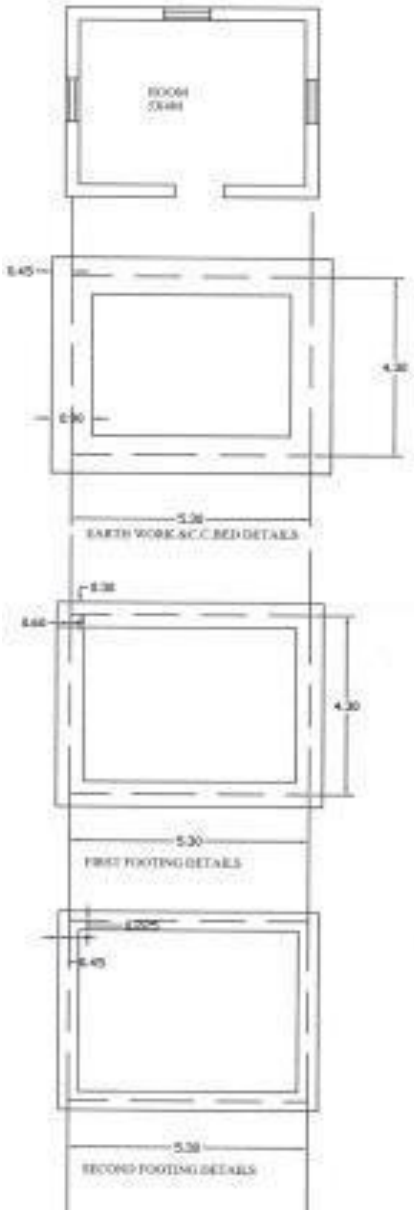
II ESSAY TYPE QUESTIONS :

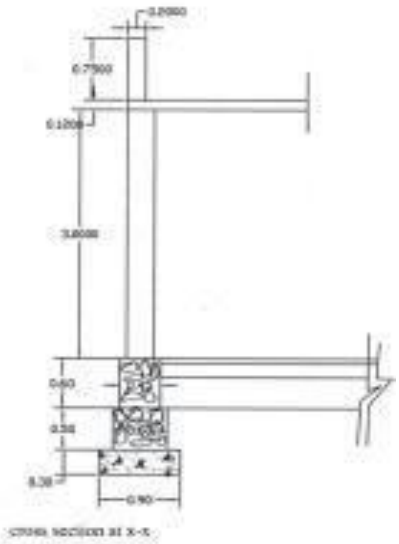
1. Prepare the approximate cost of building project (group HOuseing) i) No.of houses = 150
   ii) Plinth area of each dwelling = 600m^2
   iii) Plinth area rate = Rs. 5,000/-per m^2
   iv) Cost of water supply & sanitary arrangements @12½% v) Electrification at 7½% of cost of builing.
   vi Cost of roads & Lawns @5%
   vii) Cost of P.S.& contingencies @4%
2. Prepare a rough cost estimate of a cinema theatre which accommodate 1700 seats. The cost of construction including all provisions is Rs.6000/- per seat.
3. What are the methods of preparation of approximate estimates and explain briefly.

Chapter 4 DETAIL & ABSTRACT ESTIMATES OF BUILDINGS

Example 1: From the given figure below calculate the detailed and abstract estimate for the single roomed building (Load bearing type structure) by

a) long wall & short wall method (b) Centre Line Method





Note: All Dimensions are in 'M'

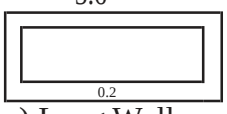
D=1X2.1M

W=1.5X1.2M

Single Roomed Building

(Load Bearing type structure)

a) Long wall - Short Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation						
	a) Long walls	2	6.2	0.9	1.4	15.264	L=5.3+.45+.45 =6.2 D= 0.3+0.5+0.6 = 1.4
	b) Short walls	2	3.4	0.9	1.4	8.568	L= 4.3-0.45-0.45= 3.4
					Total	**24.192**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	6.2	0.9	0.3	3.348	
	b) Short walls	2	3.4	0.9	0.3	1.836	
					Total	**5.184**	**m^3**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings						
	i) Long walls	2	5.9	0.6	0.5	3.54	L= 5.3+0.3+0.3=5.9
	ii) Short walls	2	3.7	0.6	0.5	2.22	L=4.3-0.3-0.3 = 3.7
					Total	**5.76**	**m^3**
	b) Basement						
	i) Long walls	2	5.75	0.45	0.6	3.105	L= 5.3+0.225+0.225= 5.75
	ii) Short walls	2	3.85	0.45	0.6	2.079	L= 4.3-0.225-0.225 =3.85
					Total	**5.184**	**m^3**
	Total R.R. Masonry for footings and Basement						
			=		**5.76+5.184=10.94**		**m_3**
4.	**Brick masonary** with CM (1:6) for super structure						
	a) Long Walls	2	5.6	0.30	3.00	10.08	L=5.3+0.15+0.15=5.6
	b) Short walls	2	4.0	0.30	3.00	7.20	L=4.3-0.15-0.15=4.0
	c) for parapetwall						
							
	a) Long Walls	2	5.6	0.2	0.75	**1.68**	
	b) Short walls	2	4.4	0.2	0.75	**1.32**	
					Total	**20.28**	**m^3**

o.	Particulars of Items	No.	L	B	H	Q	Explanation
	Deductions for openings						
	a)Doors	1	1.0	0.3	2.1	0.63	
	b) Windows	3	1.5	0.3	1.2	1.62	
					Total	**(-)2.25**	**m^3**
	Net Brick Masonry		**= 20.28 - 2.25 =**			**18.03m^3**	
5.	**R.C.C. (1:2:4) for**						
	a) Roof slab	1	5.6	4.6	0.12	3.090	
	b) Lintels over						
	i) Doors	1	1.2	0.3	0.15	0.054	
	ii) Windows	3	1.5	0.3	0.15	0.202	
	c) Beams						
	i) Long beams	2	5.6	0.3	0.3	1.008	
	ii) short beams	2	4.0	0.3	0.3	0.720	
					Total	**5.074**	**m^3**
6.	**Sandfilling for basement**	1	4.85	3.85	0.48	8.96	L=5.0-0.075-0.075=4.85
7	**C.C.(1:4:8) for flooring**	1	4.85	3.85	0.1	1.86	B= 4.0-0.075-0.075=3.85
8	**Flooring with Mosaic tiles**	1	5.0	4.0	--	20.0	**m^2**
9	**Plastering with CM (1:6)for super structure <u>Inside</u>**						
	For walls	1	18.0	--	3.0	54.0	L= 2(5.0+4.0) = 18.0
	<u>Out side</u>						
	For walls	1	20.4	--	3.87	61.2	L=2(5.6+4.6)=20.4
	Basement outside	1	21.6	--	0.6	12.96	H=3.0+0.12+0.75=3.87
	Parapet wall						(upto parapet wall)
	a) Inside	1	18.8	--	0.75	14.1	
	b) top	1	19.6	0.2	---	3.92	
	Deductions for opeinings				Total	**<u>146.18</u>**	**m^2**
	Doors	1x2	1.0	--	2.1	4.2	
	Windows	3x2	1.5	--	1.2	10.8	
						15.0	**m^2**
	Net Plastering	**= 146.18 - 15.0**				**= 131.18 m^2**	

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
10	Plastering for Ceiling with CM(1:5)	1	5.0	4.0	--	20.0	**m^2**
11	White Washing with two coats with Janatha cement						
	Same as quantity of plastering for walls and					151.18 (= 131.18+20= 151.18)	ceiling
12.	Colour washing with two coats						
	Same as quantity of plastering for walls and ceiling					151.18 (=131.18+20)151.18)	
13	Supply & Fixing of best country wood for						
	a) Doors	1				1 No.	
	b) Windows	3				3No.	
14	Painting with ready mixed synthetic enamil paits with two coats over primary coat for new wood for						
	a) Doors	2¼x1	1.0	---	2.1	4.725	
	b) Windows	2¼x3	1.5	---	1.2	12.15	
					Total	**16.875**	**m^2**
15	Petty supervision and contingencies at 4% and rounding off.						

b) Centre Line Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work exevation** for foundation	1	19.2	0.9	1.4	24.192	**m^3** L=2(5.3+4.3)=19.2
	5.3 / 4.3						
2.	**C.C.(1:4:8) bed for** foundation	1	19.2	0.9	0.3	5.184	**m^3**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings	1	19.2	0.6	0.5	5.76	
	b) Basement	1	19.2	0.45	0.6	5.184	
					Total	**10.944**	
4.	**Brick masonry** with CM(1:6) for superstructure	1	19.2	0.3	3.0	17.28	**m^3**
	For parapet wall	1	20.0	0.2	0.75	3.00	
	Deductions for openings						
	a)Doors	1	1.0	0.3	2.1	0.63	
	b) Windows	3	1.5	0.3	1.2	1.62	
					Total	**(-)2.25**	**m^3**
	Net Brick Masonry =		**17.28**	**+3.0-**	**2.25 =**	**18.03**	**m^3**
5.	**R.C.C. (1:2:4) for**						
	a) roof slab	1	5.6	4.6	0.12	3.090	
	b) Lintels over						
	i) Doors	1	1.2	0.3	0.15	0.054	
	ii) Windows	3	1.5	0.3	0.15	0.202	
	c) beams	1	19.2	1.3	0.3	1.728	
					Total	**5.074**	**m^3**
6.	**Sandfilling for basement**	1	4.85	3.85	0.48	8.96	L=5.0-0.075-0.075=4.85
7	**C.C.(1:4:8) for flooring**	1	4.85	3.85	0.1	1.86	B= 4.0-0.075-0.075=3.85

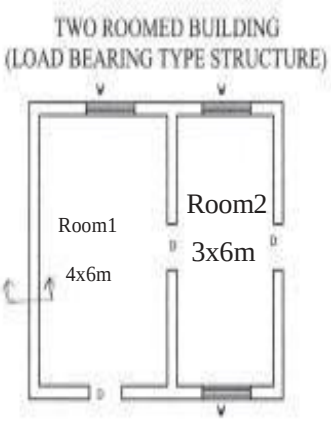
	8. **flooring with Mosaic tiles**	1	5.0	4.0	--	20.0		
	9 **Plastering with CM (1:6)for super structure**							
	Inside							
	For walls	1	18.0	--	3.0	54.0		
	Out side							
	For walls	1	20.4	--	3.87	61.2		
	Basement outside	1	21.6	--	0.6	12.96		
	Parapet wall							
	a) Inside	1	18.8	--	0.75	14.1		
	b) top	1	19.6	0.2	---	3.92		
	Deductions for opeinings				Total	**146.18**	m^2	
	Doors	1x2	1.0	--	2.1	4.2	L=5.0-0.075-0.075=4.85	
	Windows	3x2	1.5	--	1.2	10.8	B= 4.0-0.075-0.075=3.85	
						15.0	m^2	
	Net Plastering= 146.18-15 =					**131.18**	m^2	
	10 Plastering for Ceiling with CM(1:5)	1	5.0	4.0	--	20.0	m^2	
	11 White Washing with two coats with Janatha cement							
	Same as quantity of plastering for walls and ceiling					151.18 m^2	(131.18+20=151.18)	
	12. Colour washing with two coats							
	Same as quantity of plastering for walls and ceiling					151.18 m^2		
	13 Supply & Fixing of best country wood for							
	a) Doors	1				1 No.		
	b) Windows	3				3No.		

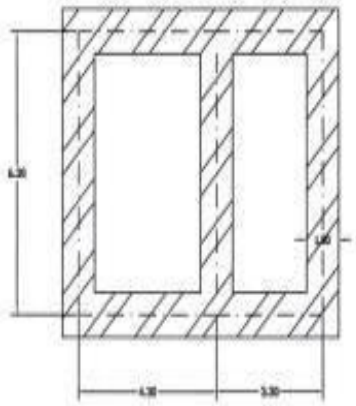
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
14	Painting with ready mixed synthetic enamil paints with two coats over primary coat for new wood for						
	a) Doors	2¼x1	1.0	---	2.1	4.725	
	b) Windows	2¼x3	1.5	---	1.2	12.15	
					Total	**16.875**	m^2
15	Petty supervision and contingencies at 4% and rounding off.						

Abstract estimate of single roomed building (load bearing structure)

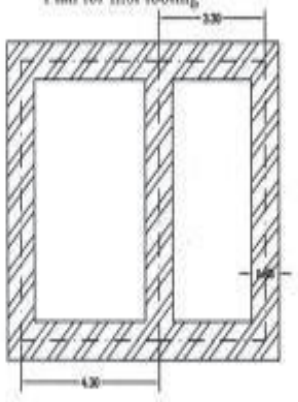
S.No.	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excaation	24.192	m^3	465	$10m^3$	1125.00
2.	Cement concrete(1:4:8)	5.184	m^3	4545	$1m^3$	8009.30
3.	RR.masonry in C.M.(1:5)	10.94	m^3	1391	m^3	15217.50
4.	Sand filling in basement	8.96	m^3	195.20	$10m^3$	175.00
5.	Brick masonry in country bricks of standard size in CM(1:8)	18.03	m^3	2291	m^3	41306.73
6.	R.C.C. (1:2:4) for lintels, beams etc.	1.984	m^3	6030	m^3	11963.52
7.	R.C.C.(1:2:4) for slabs,	3.09	m^3	6030	m^3	18633.00
8.	Cement concrete (1:5:10) for flooring	1.86	m^3	1452	m^3	2700.72
9.	Supplying and fixing of country wood for doors.	2.1	m^2	1650	m^2	3465.00
10.	Supplying and fixing of country wood for windows and ventilators.	5.4	m^2	2300	m^2	12420.00
11	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	151.18	m^2	582	$10m^2$	8798.70
12	White washing with best shell lime	151.18	m^2	116	$10m^2$	1753.68
13	Flooring with spartek tiles set in C.M (1:3)	20	m^2	4230	$10m^2$	8460.00
14	Painting with ready mixed enamel paint	16.875	m^2	335	$10m^2$	565.31
					Total	**134593.46**
15	Povision for water supply and sanitary arangements @12.5%					16824.18
16	Provision for electrification @7.5%					10094.50
17	Povision for architectural appearance @2%					2691.86
18	Provision for unforeseen items 2%					2691.86
19	Provision for P.s.and contingencies @4%					5383.73
					Grand Total Rs.	**172279.65**

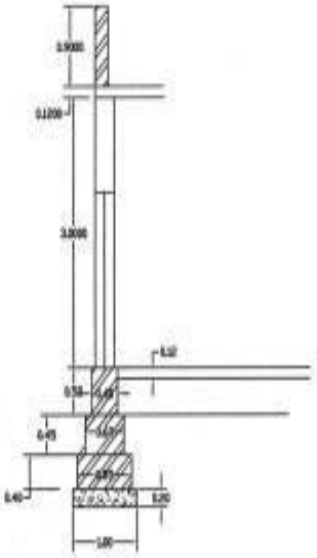
Example :2 :-From the given figure below calculate the details and abstract estimate for the double roomed building (Load bearing type structure) by a) long wall & short wall method (b) Centre Line Method





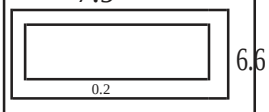
Plan for first footing





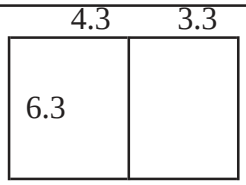
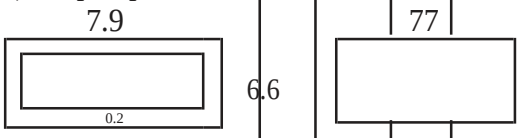
D=1x2.1
W=1.5x1.2

Note: All Dimensions are in 'M'

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation						
	a) Long walls	2	8.6	1.0	1.05	18.05	L=7.6+0.5+0.5=86
	b) Short walls	3	5.3	1.0	11.05	16.70	L=6.3-0.5-0.5=5.3
					Total	**34.75**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	8.6	1.0	0.2	3.44	
	b) Short walls	3	5.3	1.0	0.2	3.18	
					Total	**6.62**	**m^3**
3.	**Brick masanory for** footings with CM (1:4)						
	first footing						
	a) Longwalls	2	8.45	0.85	0.4	5.746	L=7.6+0.425+0.425=8.45
	b) Short walls	3	5.45	0.85	0.4	5.560	L=6.3-0.425-0.425=5.45
	2nd fooring						
	a) Long walls	2	8.20	0.6	0.45	4.428	L=7.6+0.3+0.3=8.2
	b) short walls	3	5.70	0.6	0.45	4.617	L=6.3-0.3-0.3=5.7
	ii) for base ment	2	8.00	0.4	0.4	2.560	L=7.6+0.2+0.0=8.0
	long walls	3	5.90	0.4	0.4	2.832	L=6.3-0.2-0.2= 5.9
	short walls						
	iii) for superstructure	2	7.90	0.3	3.0	14.22	L=7.6+0.15+0.15=7.9
	long walls	3	6.00	0.3	3.0	16.20	L=6.3-0.15-0.15=6.0
	short walls						
	iv) Parapet wall						
	7.9  6.6 0.2						
	a) long walls	2	7.90	0.2	0.70	2.212	
	b) Shot walls	2	6.20	0.2	0.70	1.736	
					Total	**60.11**	
	Deductions for openings						
	Doors	3	1.0	0.3	2.1	1.89	
	Windows	3	1.5	0.3	1.2	1.62	
	Lintels over doors	3	1.20	0.3	0.10	0.108	
	windows	3	1.70	0.3	0.10	0.153	
	Net B.M.=60.11-377=56. 34m^3				Total	**3.771**	

4	RCC(1:2:4)for						
	a) roof slab	1	7.9	6.6	0.12	6.256	
	b) for lintles over doors	3	1.2	0.3	0.1	0.108	
	Windows	3	1.7	0.3	0.1	0.153	
	c) beams	1	33.8	0.3	0.3	3.042	
					Total	**9.298**	m^3
5.	Plastering for walls	1	20.0	--	3.0	60.00	L=2(4.0+6.0)=20
	a) Inside room1	1	18.0	---	3.0	54.00	
	room2	1	29.0	---	3.0	87.00	L=2(7.9+6.6)=29
	b) out side	1×2	28.2	---	0.70	39.48	L=2(7.7+6.4)=28.2
	Parapet wall(Sides)	1×1	28.2	0.20	--	5.64	
					Total	**246.12**	m^2
	Deductions						
	a) doors	3×2	1.0	---	2.10	12.6	
	b) windows	3×2	1.5		1.20	10.8	
					Total	**23.4**	m^2
	Net Plastering		**= 246.12- 23.4 =**			**222.72**	**m^2**
6.	flooring with cuddapah slab in cm (1:3)						
	Room1	1	4.0	6.0	---	24	
	Room2	1	3.0	6.0	---	18	
					Total	**42**	**m^2**
7	Plastering for ceiling =same as flooring					42	
8	White washing = same as plastering for walls & Ceiling						
				=222.72 +42 = 264.72			**m^2**
9	Colour washing with two coats						
	Same as quantity of plastering for walls and ceiling					264.72	**m^2**
10	Supply & Fixing of best country wood for						
	a) Doors	3				3Nos.	
	b) Windows	3				3 Nos	
11	Painting with ready mixed synthetic enamil paints two coats over primary coat for new wood for						
	a) Doors	2¼x3	1.0	--		14.175	
	b) Windows	2¼x3	1.5	--		11.13	
						25.305	**m^2**
12	2% unforeseen items						
13	4% P.S& contingencies and round off.						

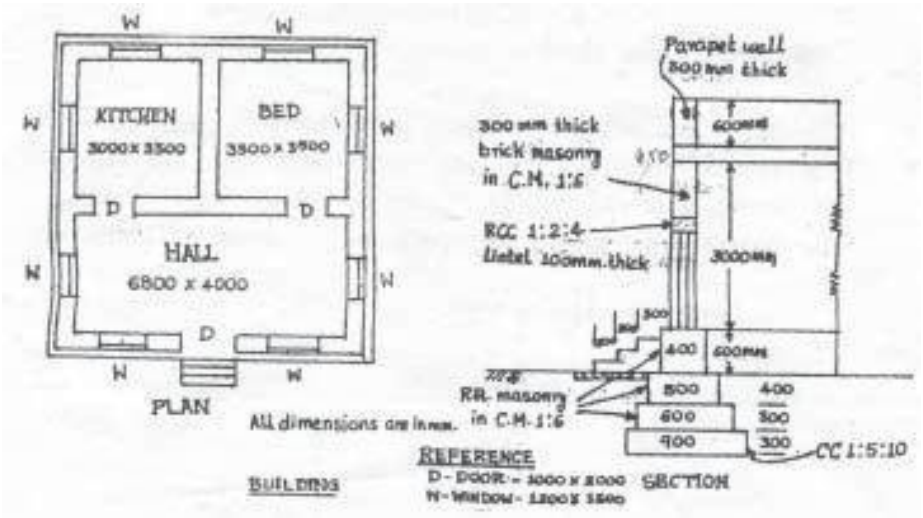
b) Centre Line Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
							
	Total centre line length =(4.3+3.3)2+6.3x3=34.1m						
1.	**Earth work excavation**	1	33.1	1.0	1.05	34.75	L=34.1-2x1/2=33.1
2.	**C.C.(1:4:8) bed for foundation**	1	33.1	1.0	0.20	6.62	**m^3**
3.	**Brick masonry with CM(1:4)**						
	a) for foundation						
	i) first footing	1	33.25	0.85	0.40	11.30	L=34.1-0.85 =33.25
	ii) 2nd footing	1	33.50	0.60	0.45	9.045	L=34.1-0.6 x2/2
	b) for basement	1	33.7	0.40	0.40	5.392	L=34.1-0.4 x2/2
	c) for super structure	1	33.80	0.30	3.0	30.42	L=34.1-0.3x2/2
	d) for parapet wall						
							
	Total centre line length = 2(7.7+6.4) =28.2	1	28.2	0.2	0.70	3.948	
					Total	**60.10**	**m^3**
	Deductions for						
	Openings Doors	3	1.0	0.3	2.1	1.89	
	windows	3	1.5	0.3	1.2	1.62	
	Lintels Doors	3	1.2	0.3	0.1	0.108	
	Windows	3	1.7	0.3	0.1	1.153	
					Total	**3.771**	**m^3**
	Net B.M.=60.11-3.771=56.34m^3						
4.	Quantity of R.C.C.Roof, Plastering for walls and cealing and flooring, White washing is same as Longwall &Short wall method.						

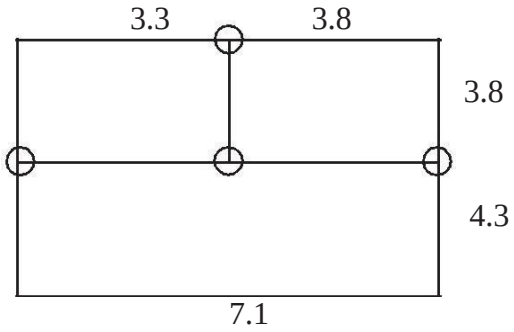
Abstract estimate of two roomed building (Load bearing type structure)

S.No.	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excavation	34.75	m^3	465	$10m^3$	1615.90
2.	Cement concrete(1:4:8)	6.62	m^3	1545	$1m^3$	10228.00
3.	Sand filling in basement	12.036	m^3	195.20	$10m^3$	235.00
4.	Brick masonry in country Bricks of standard size in CM(1:8)	56.34	m^3	2291	m^3	129075.00
5.	R.C.C. (1:2:4) for lintels, beams etc.	3.303	m^3	6030	m^3	19918.00
6.	R.C.C.(1:2:4) for slabs,	6.26	m^3	6030	m^3	37748.00
7.	Cement concrete (1:5:10) for flooring	4.2	m^3	1452	m^3	6098.40
8.	Supplying and fixing of country wood for doors.	6.3	m^3	1650	m^2	10395.00
9.	Supplying and fixing of country wood for windows and ventilators.	5.4	m^2	2300	m^2	12420.00
10.	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	222.72	m^2	582	$10m^2$	12962.30
11	White washing with best shell lime	264.72	m^2	116	$10m^2$	3070.75
12	Flooring with spartek tiles set in C.M (1:3)	42	m^2	4230	$10m^2$	17766.00
13	Painting with ready mixed enamel paint	25.305	m^2	335	$10m^2$	8477.17
						128090.00
14	Provision for water supply and sanitary arrangements @12.5%					16011.25
15	Provision for electrification @7.5%					9606.75
16	Provision for architectural appearance @2%					2561.80
17	Provision for unforeseen items 2%					2561.80
18	Provision for P.S.and contingencies @4%					5123.60
					Grand Total	**163955.23**

Example 3 :- From the given figure below calculate the details and ab-stract estimate for the single Storeyed residential building with no of rooms (Load bearing type structure) by Centre Line Method



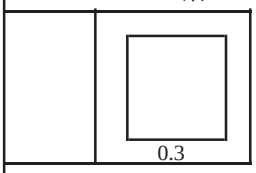
Centre line diagram



Total centre line length

=(3.3+3.8)3+3.8×3+4.3×2=41.3m no of T Junctions = 4

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	Earth work Excavation	1	39.5	0.9	1.0	35.55	41.3-4x0.9/2=39.5
2.	C.C. bed (1:5:10)	1	39.5	0.9	0.3	10.665	m^3
3.	R.R. Masornary in CM 1:6						
	1st Footing	1	40.1	0.6	0.3	7.218	41.3-4x0.6/2=40.1
	IInd Footing	1	40.3	0.5	0.4	8.06	41.3-4x0.5/2=40.3
	Basement	1	40.5	0.4	0.6	9.72	41.3-4x0.4/2=40.5
					Total	**25.00**	m^3
4.	Damp proof course over basement alround the building with CC (1:2:4)	1	40.5	0.6	---	16.2	m^2
	Deduct for Door sills	3	1.0	0.3		- 0.9	m^2
	Net Quantity =16.2-0.9=15.3sq.m				---		
5.	First class brick work in wall in						
	a) superstructure with CM 1:6	1	40.7	0.3	3.0	36.63	L =41.3-4x0.3/2
	b) Parapet wall	1	30.4	0.3	0.6	5.472	L=2(7.1+8.1)
					Total	**42.102**	m^3
	Deductions:						
	Doors	3	1.0	0.3	2.0	1.80	
	Windows	8	1.2	0.3	1.5	4.32	
	Lintel opening over						
	Doors	3	1.2	0.3	0.1	0.108	Asue 100mm
	Windows	8	1.4	0.3	0.1	0.336	projection on either
					Total	**6.564**	side
	Net Quantity of BM = 42.102-6.564 = 35.538m^3						
6.	Plastering with 12mmth in CM 1:5	1x2	40.1	---	3.0	240.6	L=41.3-4x0.3=40.1
	Deductions for openings						

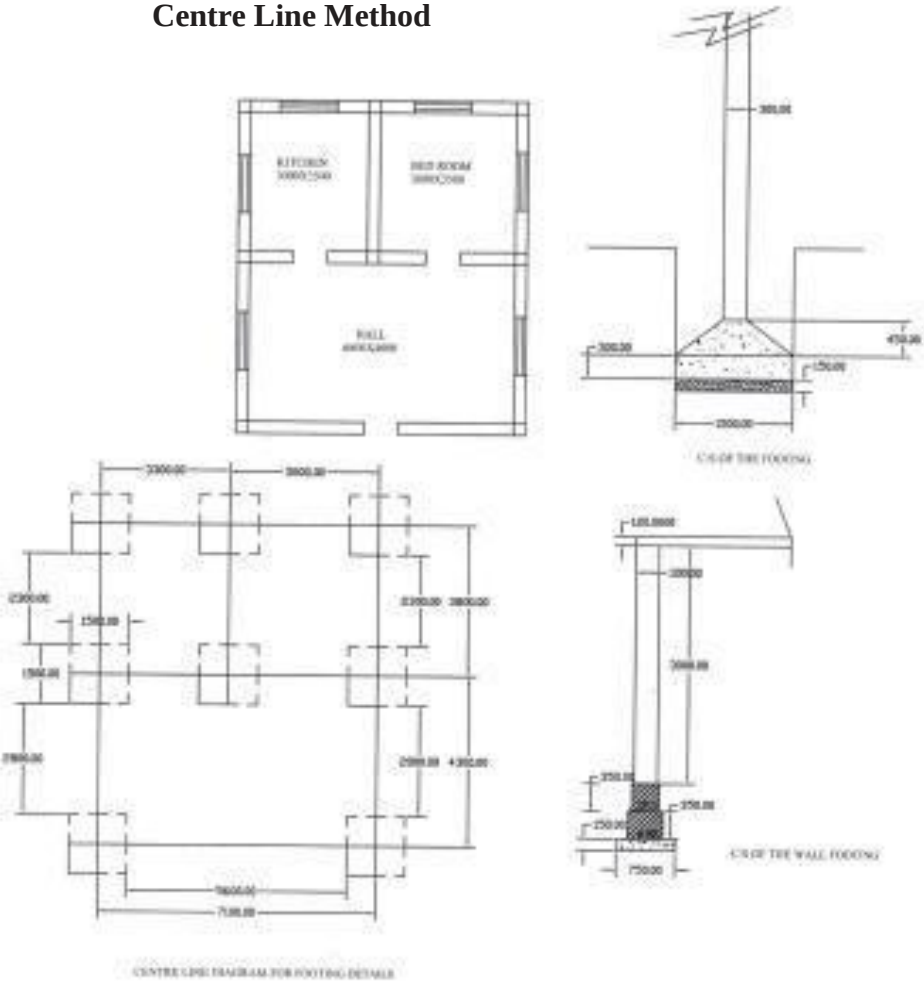


S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
	Doors	3x2	1.0	---	2.0	12.0	
	windows	8x2	1.2	---	1.5	28.8	
					Total	**40.8**	**m^2**
	Plastering for parapet wall (sides)	1x2	30.4	---	0.6	36.48	
	Top	1	30.4	0.3	---	9.12	
					Total	**45.60**	**m^2**
	Net Plastering = 240.6-40.8+45.6=245.4 m^2						
7.	Flooring with 25mmth CC(1:2:4)						
	Kitchen	1	3.0	3.5	--	10.5	
	Bed	1	3.5	3.5	--	12.25	
	Hall	1	6.8	4.0	--	27.20	
	Sills of Doors	3	1.0	0.3	--	0.90	
8.	Ceiling = Same as				Total	**50.85**	**m^2**
	Flooring					50.85	**m^2**
9.	white washing = Same as Plastering for walls and ceiling 245.4+50.85 = 296.25 m^2						
10.	RCC(1:2:4) for						
	a) Slab	1	7.40	8.40	1.5	9.324	
	b) lintels over Doors	3	1.2	0.3	0.1	0.108	
	Windows	8	1.4	0.3	0.1	0.336	
	c) beams	1	40.7	0.3	0.3	3.663	
					Total	**13.431**	**m^3**
11	Supply & Fixing of best country wood for						
	a) Doors	3				3Nos.	
	b) Windows	8				8 Nos	
12	Painting with ready mixed synthetic enamil paints two coats over primary coat for new wood for						
	a) Doors	2¼x3	1.0	--	2.0	13.50	
	b) Windows	2¼x8	1.2	--	1.5	32.40	
						45.90	**m^2**
13	2% unforeseen items						
14	4% P.S& contingencies and round off.						

Abstract estimate of single storeyed residential building with no of rooms (lead beary type)

S.No.	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excavation	35.55	m^3	465	$10m^3$	1653.00
2.	Cement concrete(1:4:8)	10.665	m^3	1545	$1m^3$	164.77.50
3.	RR.masonry in C.M.(1:5)	25.00	m^3	1391	m^3	34775.00
4.	Sand filling in basement	23.775	m^3	195.20	$10m^3$	464.00
5.	Brick masonry in country bricks of standard size in CM(1:8)	35.535	m^3	2291	m^3	81417.60
6.	R.C.C. (1:2:4) for lintels, beams etc.	4.107	m^3	6030	m^3	24765.20
7.	R.C.C.(1:2:4) for slabs,	9.324	m^3	6030	m^3	56223.70
8.	Cement concrete (1:5:10) for flooring	5.085	m^3	1452	m^3	7383.40
9.	Supplying and fixing of country wood for doors.	6.00	m^2	1650	m^2	9900.00
10.	Supplying and fixing of country wood for windows and ventilators.	14.40	m^2	2300	m^2	33120.00
11	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	245.40	m^2	582	$10m^2$	14282.30
12	White washing with best shell lime	296.25	m^2	116	$10m^2$	3436.50
13	Flooring with spartek tiles set in C.M (1:3)	50.85	m^2	4230	$10m^2$	21509.50
14	Painting with ready mixed enamel paint	45.90	m^2	335	$10m^2$	1537.65
						306945.35
15	Provision for water supply and sanitary arrangements @12.5%					38368.20
16	Provision for electrification @7.5%					23020.90
17	Provision for architectural appearance @2%					6138.90
18	Provision for unforeseen items 2%					6138.90
19	Provision for P.S.and contingencies @4%					12277.80
						392890.00

Example 4:- From the given figure below calculate the details and ab-stract estimate for the single storeid residential building with no.of rooms (Framed Structured type) by Centre Line Method



S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	Earth work excavation for foundation for						
	a) pillars	8	1.5	1.5	1.80	32.4	
	b) around the building and cross walls	1	26.3	0.75	0.85	27.9	L= 5.6+2.8x2+ 2.3x3+(1.8+2.3)2
					Total	**60.3**	
2.	C.C. (1:4:8) for						**m^3**
	a) pillars	8	1.5	1.5	0.15	2.7	
	b) around the building and cross walls	1	38.3	0.75	0.15	4.3	L= 3.5x3+3x2+ 3.5x2+4x2+6.8=38.3
					Total	**7.0**	m^3
3.	Brick Masonry with C.M. (1:6) for						
	a) first footing	1	38.3	0.45	0.35	6.03	
	b) Second Footing	1	38.3	0.35	0.30	4.69	
	c) Superstructure	1	38.3	0.3	3.0	4.02	
	d) Parapet wall	1	30.4	0.3	0.6	5.47	L=(7.1+8.1)x2=30.4
					Total	**20.21**	m^3
	6.8 / 7.1 / 7.8 / 8.1 / 0.3						
	Deduction for opening						
	a) Doors	3	1.0	0.3	2.0	1.8	
	b) Windows	8	1.2	0.3	1.5	4.32	
					Total	**6.12**	m^3
	Net Brick Masonry	=20.21-6.12			=	**14.09**	
4.	R.C.C.(1:1.5:3) for columns						
	a) Rectangular portion	8	1.5	1.5	0.3	5.40	
	b) Trepezoidal portion	8	0.9	0.9	0.45	2.92	
	c) Square portion upto GL	8	0.3	0.3	0.9	0.65	
	d) Squareporiton above GL	8	0.3	0.3	3.0	2.16	
					Total	**11.13**	m^3
5.	Plastering with 12mmth in CM 1:5	1x2	40.1	---	3.0	240.6	L=41.3-4x0.3=40.1
	Deductions for openings						

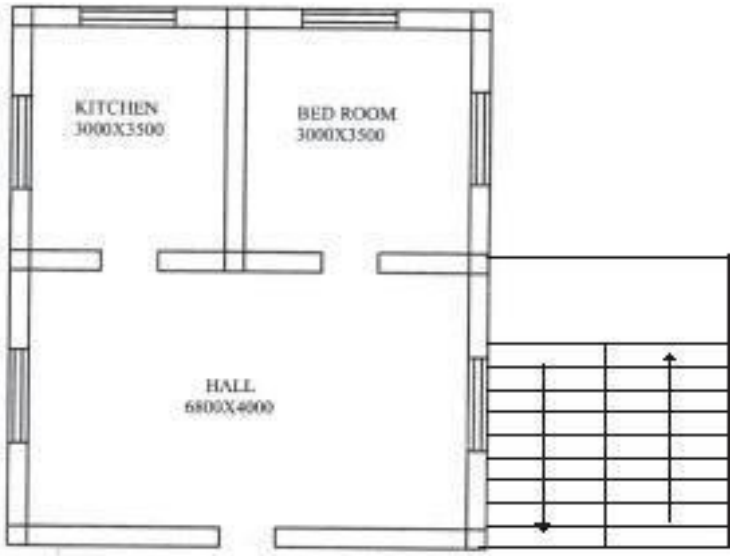
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
	Doors	3x2	1.0	---	2.0	12.0	
	windows	8x2	1.2	---	1.5	28.8	
					Total	**40.8**	**m^2**
	Plastering for parapet wall (sides)	1x2	30.4	---	0.6	36.48	
	Top	1	30.4	0.3	---	9.12	
					Total	**45.60**	**m^2**
	Net Plastring = 240.6-40.8+45.6 =245.4 m^2						
6.	Flooring with 25mmth CC(1:2:4)						
	Kitchen	1	3.0	3.5	--	10.5	
	Bed	1	3.5	3.5	--	12.25	
	Hall	1	6.8	4.0	--	27.20	
	Sills of Doors	3	1.0	0.3	--	0.90	
7.	Ceiling = Same as Flooring				Total	**50.85** 50.85	**m^2**
8.	white Washing = Same as Plastering for walls and ceiling 245.4+50.85 = 296.25 m^2						
9.	RCC(1:2:4) for						
	a) Slab	1	7.40	8.40	1.5	9.324	
	b) lintels over Doors	3	1.2	0.3	0.1	0.108	
	Windows	8	1.4	0.3	0.1	0.336	
	c) beams	1	40.7	0.3	0.3	3.663	
					Total	**13.431**	**m^3**
10	Supply & Fixing of best county wood for						
	a) Doors	3				3Nos.	
	b) Windows	8				8 Nos	
11	Painting with ready mixed synthetic enamil paints two coats over primary coat for new wood for						
	a) Doors	2¼x3	1.0	--	2.0	13.50	
	b) Windows	2¼x8	1.2	--	1.5	32.40	
						45.90	**m^2**
12	2% unforeseen items						
13	4% P.S& contingencies and round off.						

Abstract estimate of single storeyed residential building (framed structure type)

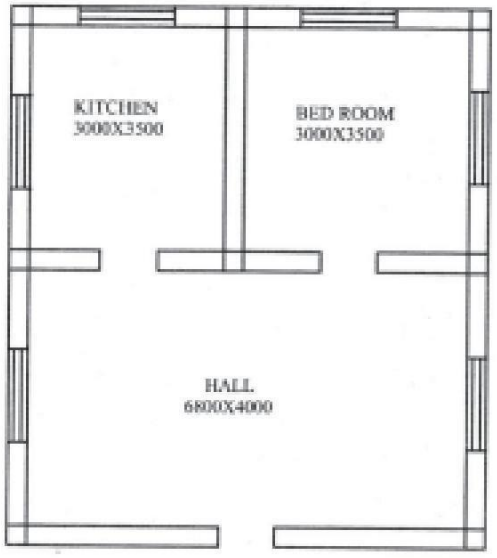
S.No.	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excavation	60.30	m^3	465	$10m^3$	2804.00
2.	Cement concrete(1:4:8)	7.00	m^3	1545	$1m^3$	10815.00
3.	Brick masonry in country bricks of standard size in CM(1:5) Reefs columns	14.09	m^3	2291	$10m^3$	32250.20
4.	R.C.C. (1:2:4) for lintels, beams, columns etc.	15.237	m^3	7405	m^3	112830.00
5.	R.C.C.(1:2:4) for slabs,	9.324	m^3	6030	m^3	56223.70
6.	Cement concrete (1:5:10) for flooring	5.085	m^3	1452	m^3	7383.40
7.	Supplying and fixing of country wood for doors.	6.00	m^3	1650	m^2	9900.00
8.	Supplying and fixing of country wood for windows and ventilators.	14.40	m^2	2300	m^2	33120.00
9.	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	245.40	m^2	582	$10m^2$	14282.30
10	White washing with best shell lime	296.25	m^2	116	$10m^2$	3436.50
11	Flooring with spartek tiles set in C.M (1:3)	50.85	m^2	4230	$10m^2$	21509.50
12	Painting with ready mixed enamel paint	51.00	m^2	335	$10m^2$	1708.50
13	Provision for staircase	LS	m^2			50000.00
14	Provision for water supply and sanitary arrangements @12.5%					354584.60 44323.00
15	Provision for electrification @7.5%					26593.80
16	Provision for architectural appearance @2%					7091.70
17	Provision for unforeseen items 2%					7091.70
18	Provision for P.s.and contingencies @4%					14183.40

Total Rs. 453868.00

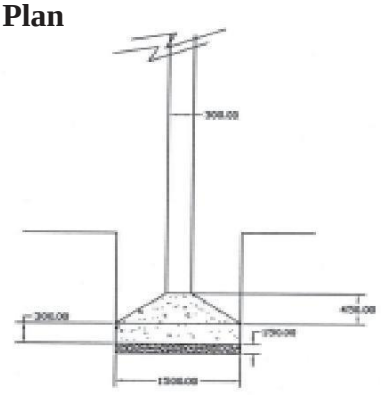
Example 5 :- From the given figure below calculate the details and ab-stract estimate for the two storeoied residential building with no.of rooms (Framed Structured type) by Centre Line Method



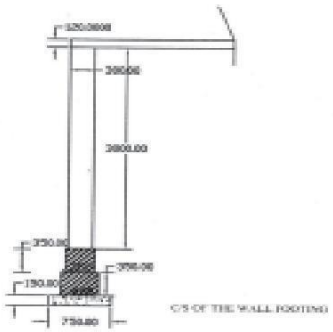
Ground Floor Plan



First Floor Plan



C/S OF THE FOOTING



C/S OF THE WALL FOOTING

o.	Particulars of Items	No.	L	B	H	Q	Explanation
	The quantities of various items of the building for the Ground floor is same as previous problem. Here the quantities of various items of the building for the First floor is mentioned here.						
	First Floor						
1	R.C.C. (1:1.5:3) for						
	a) Columns	8	0.3	0.30	3.0	2.16	
	b) Slabs	1	7.40	8.4	0.15	9.324	
	c) beams	1	40.7	0.3	0.3	3.663	
	d) lintels over doors	1	1.2	0.3	0.1	0.036	
	windows	6	1.4	0.3	0.1	0.252	
					Total	**15.435**	**m^3**
2.	B.M. with CM(1:8) in the first floor	1	28.6	0.3	3.0	25.74	
	Parapet wall	1	30.4	0.3	0.6	5.47	
	Deductions for openings						
	Doors	1	1.0	0.3	2.0	-0.6	
	Windows	6	1.2	0.3	1.5	-3.24	
	Net BM	**= 25.74+5.47-0.6-3.24 =**				**27.372**	**m^3**
3.	Plastering with CM (1:4)						
	for walls	1x2	30.4	--	3.0	182.4	
	for parapetwall sides	1x2	30.4	--	0.6	36.48	
	Parapet wall Top	1	30.4	0.3	--	9.12	
	Deductions						
	Doors	1	1.0	---	2.0	-2.0	
	Windows	6	1.2	--	1.5	-10.8	
					Total	**215.2**	**m^2**
4.	Flooring with CM(1:3)	1	6.8	7.8	---	53.04	**m^2**
5.	Plastering for ceiling with CM(1:3)= Same as Flooring					53.04	**m_2**
6.	White washing or colour washing = same as ceiling & BM = 53.04 + 215.2 = 268.24						**m^2**
7.	The estimation of a staircase is mentioned sepa-rately in the next problem						

Example 6: - Estimate the Quantities of the pictured roof shown in figure

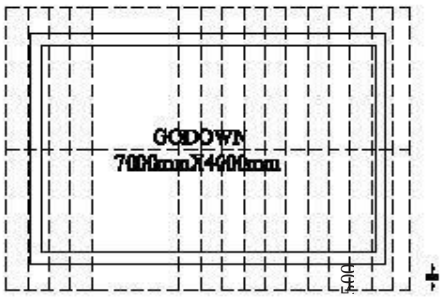
a) Size of common rafter = 80x40mm

b) Size of ridege piece = 120x 200mm

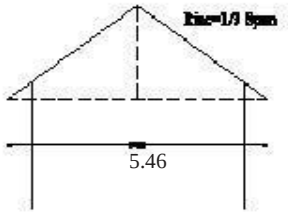
c) Size of eaves board = 20 x 300mm

230mm thick brick wall

Common rafters at 450mm c/c



Rise = 1/3Span



a) Length of Common rafter = $\frac{length}{2} + \frac{Span}{3} = \sqrt{2.73^2 + \left(\frac{5.46}{3}\right)^2}$

= 3.28m

b) Length of ridge piece = 7.0+0.23x2 +0.5x2 = 8.46 m

c) Length of Eaves board = 2(8.46+5.46) = 27.84m

S.No	Description	No	L	B	H	Qty	Remarks
1	Ridge piece	1	8.46	0.12	0.20	0.20	
2	Eaves Board	1	27.84	—	0.30	8.35	Unit of eaves Board in m^2
3	Common rafters	40	3.28	0.08	0.04	0.42	

Example- 7: - Calculate the quantities of items of the stair case of the figure shown in below.

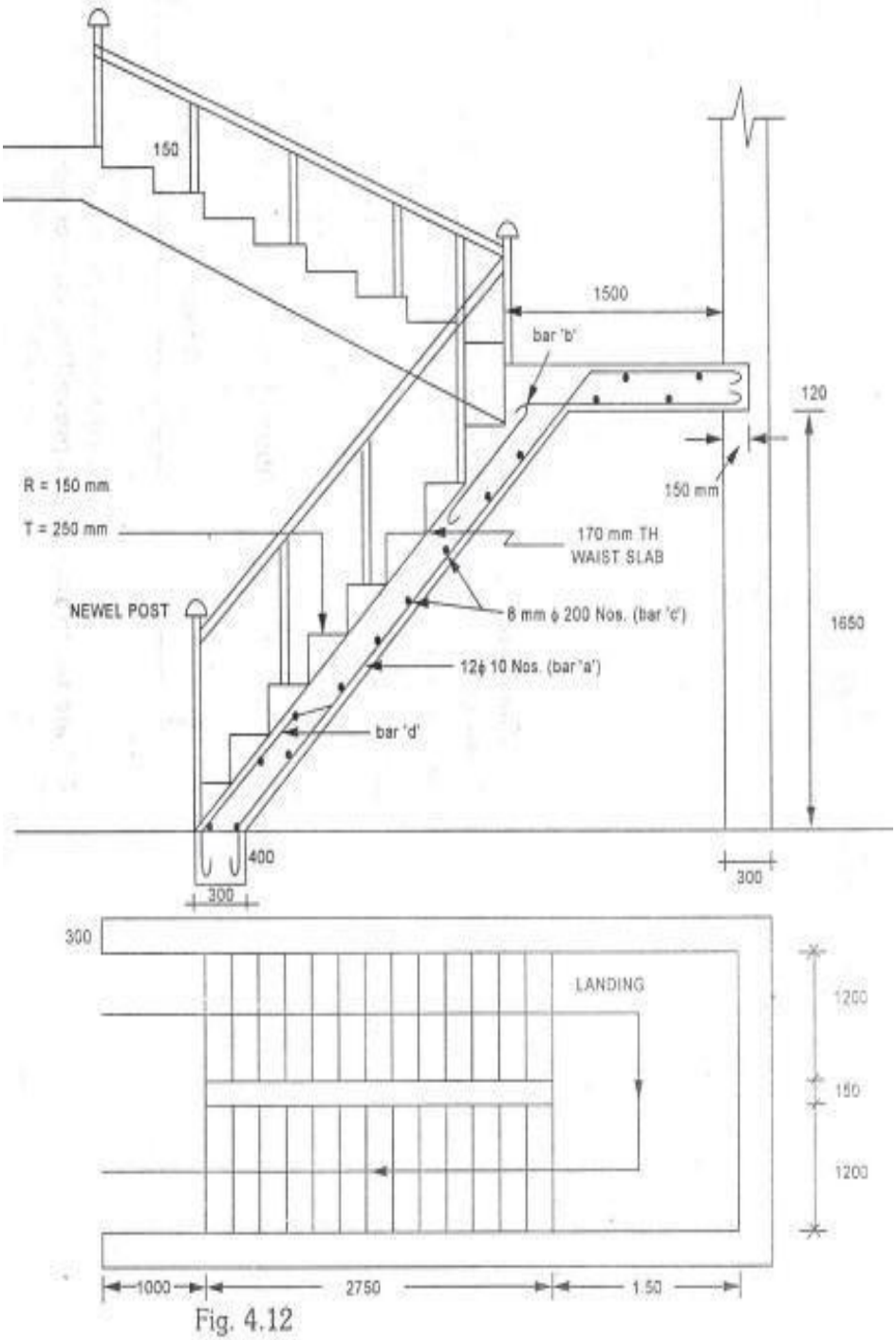
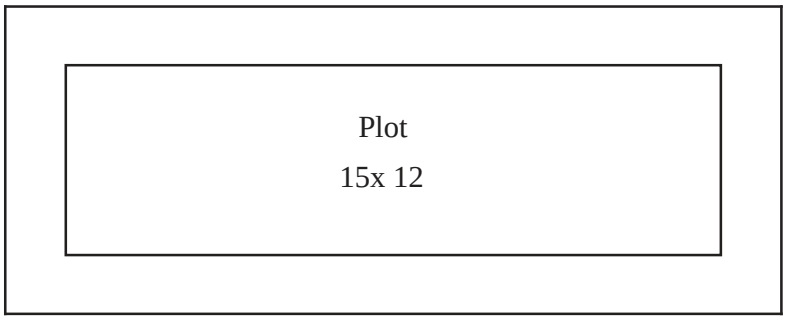


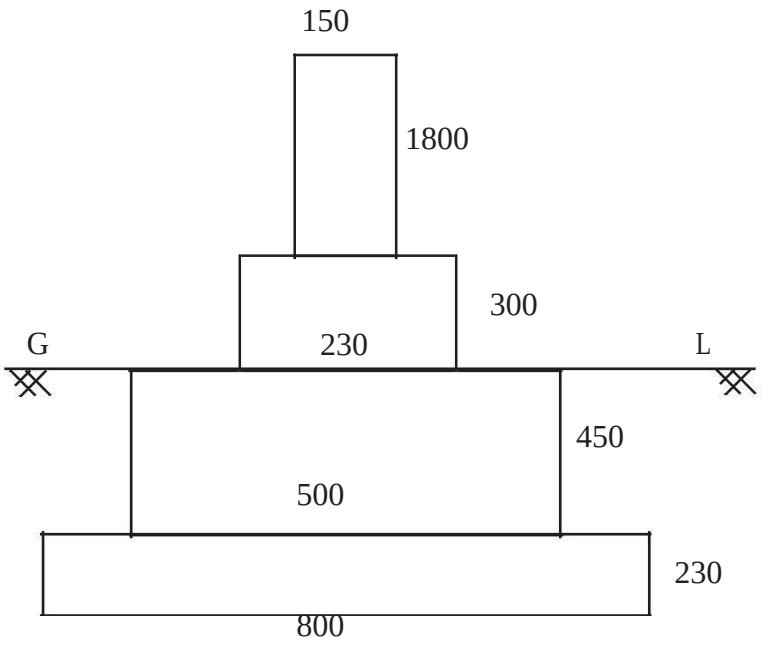
Fig. 4.12

R.C.C. Stair Case

S.No.	Particulars of Items	No.	L	B	H		Q	Explanation
1	R.C.C. (1:2:4) excluding steel and its fabrication but including centering and shultering and binding wire.							
	a) Toe wall	1x1	3.15	0	3	0.4	0.38 m^3	L= (1.2+0.15+1.2+2x0.3)
	b) Waist slab for 1 and II flights L=$\sqrt{2.75^2+1.65^2}$ = 3.21m	1x2	3.21	1.2		0.17	1.31	
	c) Landing Middle and first floor	1x2	2.85	1.65		0.17	1.60	L= (1.2+0.15+1.2+2x0.15)
						Total	**3.29** m^3	
2.	Ist class brick work in C.M. (1:4) for steps	2x11	1.2	½x(0		25+1.5)	0.495	
3.	20mm. thick cement plastering (1:5) for steps finished neat							
	a) Treads & Rises	2x11	1.2	x (0.25		+0.15)	10.56	
	b) ends of steps	2x11		½x(0.25+1.5)			0.41	
						Total	**10.97** m^2	
4.	2.5cm No sing in steps	2x12	1.2	--		--	28.8	RM
5.	2.5cm. C.C. flooring finished neat cement floating in middle and first floor landing.	1x2	2.55	1.2		--	6.12	m^2
6.	Supplying and fixing of best teak wood hand rail finished smooth	1x1	6.67	--		--	6.67	RM
7.	supply and fixing of best teak wood newel posts & finished smooth	1x2	1.0	0.1		0.1	0.02	m^3
8.	Cap of Newel post	1x2	---	--		---	2Nos.	

Example 8:- From the given figure below calculate the details esti-mate for the Compound Wall





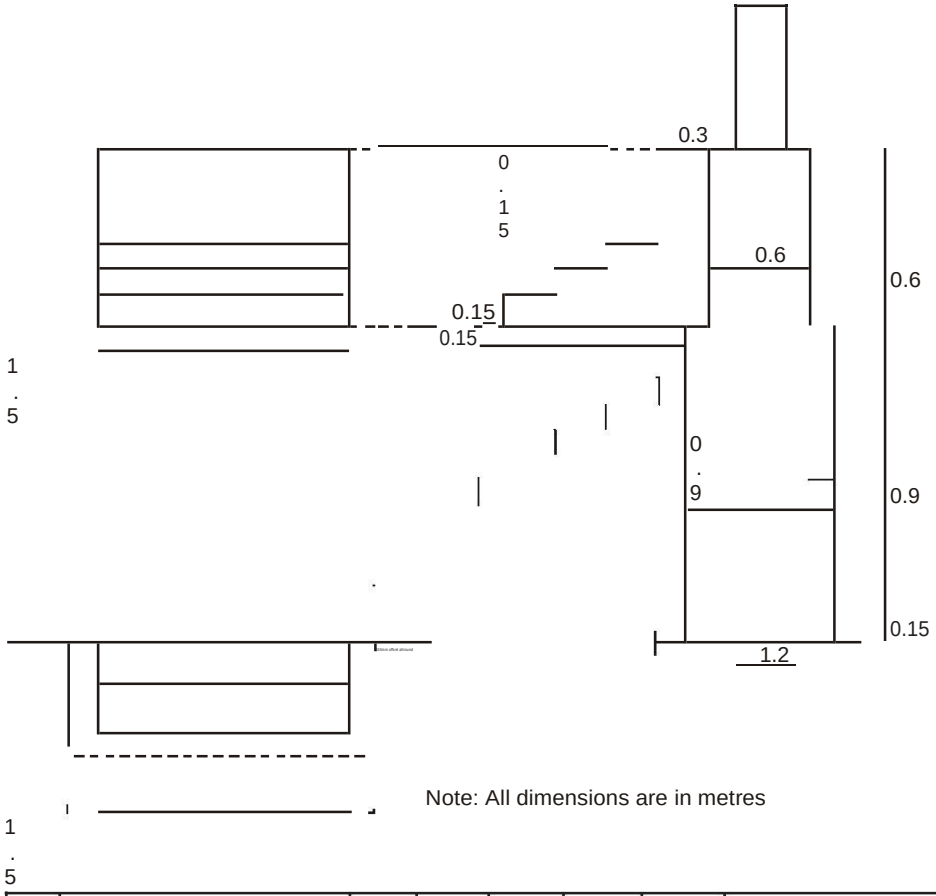
Cross Section of the compound wall

Note: 1) Brick Pillers of size 230x 230 size are built every 3 meters

2) The expansion joints are provided for every 6m length

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	Earthwork excavation for foundation 15.15 12.15 Total Centerline length = 2(15.15+12.15)= 54.6	1	54.6	0.80	0.68	29.7	m^3
2.	C.C.(1:4:8) for foundation	1	54.6	0.80	0.23	10.04	m^3
3.	First class brick work in CM (1:6) in foundation						
	a) footing	1	54.6	0.5	0.45	12.28	
	b) Basement	1	54.6	0.23	0.3	3.76	
					Total	**16.04**	m^3
4.	D.P.C.with C.C.(1:1½:3) 25mmth	1	54.6	0.23	---	12.56	m^2
5.	a) First Class B.M. in CM(1:6) for wall in super structure	1	54.6	0.15	1.8	14.74	
	b) Brick piller @3cm c/c	14	0.23	0.23	1.8	1.33	
	Deduction 150mm th wall	14	0.15	0.23	1.8	-0.87	
					Total	**15.2**	m^3
6.	Plastering with CM(1:5)						
	a) Outer surface & inner surface (0.3+0.04+1.8)	1x2	54.6	---	2.14	233.69	
	b) Top of wall	1x1	54.6	0.15	--	8.19	
	c) Piller Projection from the face of the wall	14x2	0.04	---	1.8	2.016	
					Total	**243.89**	m_2
7.	White washing/colour same as item(6)					243.89	m^2

Example 9:- Estimation of basement steps (one way)



Note: All dimensions are in metres

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	Earth work excavation for foundation	1	1.8	1.35	0.15	0.360	**m^3**
2.	C.C.(1:4:8) bed for foundation	1	1.8	1.35	0.15	0.360	**m^3**
3.	Ist class BM in CM (1:4)						
	a) 1st step	1	1.5	1.20	0.15	0.27	
	b) 2nd Step	1	1.5	0.90	0.15	0.27	
	c) 3rd Step	1	1.5	0.60	0.15	0.13	
	d) 4th step	1	1.5	0.30	0.15	0.06	
		Total				**0.73**	m^3
4.	Plastering with CM(1:3)						
	a) Threads	4	1.5	---	---	1.8	
	b) Risers	4	1.5	---	0.15	0.9	
	c)ends						
	a)Ist step						
	b) 2nd Step	2	1.2	---	0.15	0.36	
	c) 3rd Step	2	0.9	---	0.15	0.27	

d) 4th Step	2	0.6	---	0.15	0.18
	2	0.3	---	0.15	0.09
				Total	**3.60** $\mathbf{m^2}$
5. white washing /colour					
washing = Same as item (4)					3.60 $\mathbf{m^2}$

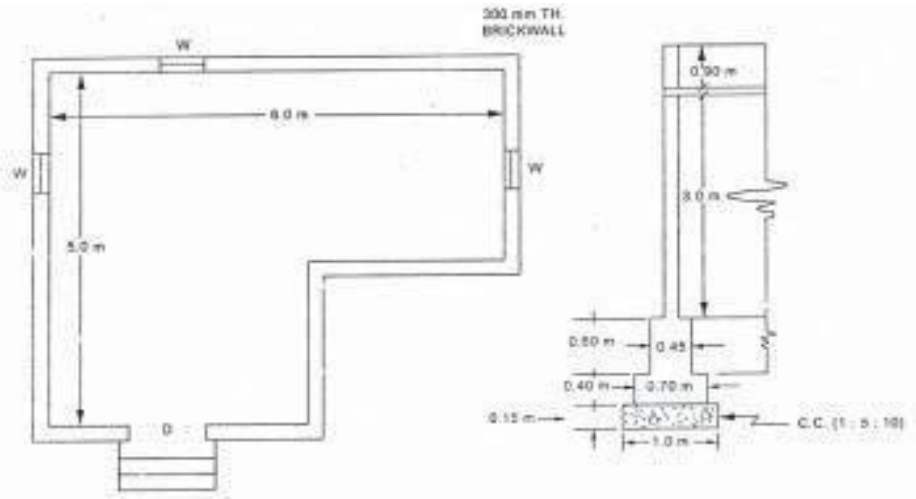
EXERCISE

Short Answer Questions

1. The internal dimensions of a single roomed building are 5.75x3.75m. Find the Centre line length of room and parapet. If the wall thickness of room and parapet are 300mm and 250mm respectively.
2. The internal dimensions of a room are 6.25 x 4.25m. find the quantity of sand filling in basemet. the height and thickness of basement are 750mm and 450mm respectively the wall thickness of room is 230mm.

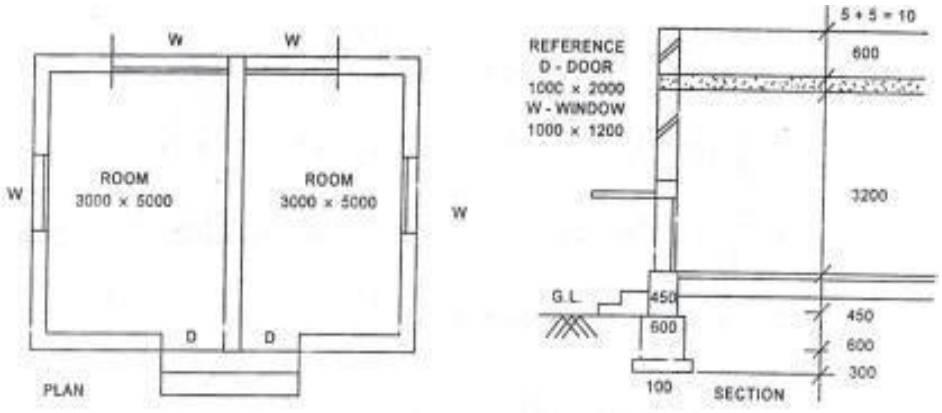
Essay Type Questions:

1. The plan and section of one roomed building

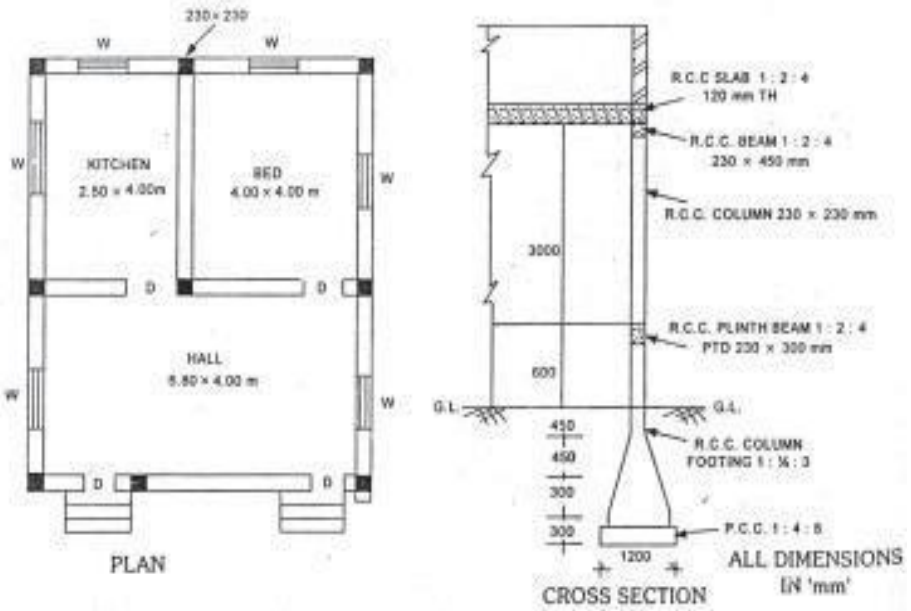


Calculate the following quantities by a) central line method b) Long wall & shortwall method.
i) Earth work excavation .
ii) Cement Concrete for foundation.
iii) Brick in CM 1:6 for footing.
iv) Brick in CM 1:6 for walls excluding openings

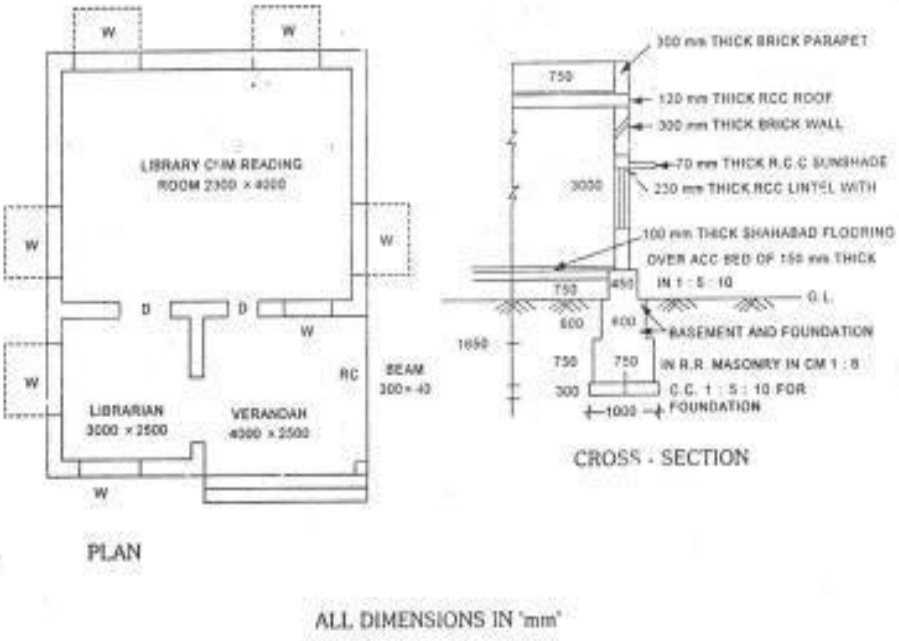
2) For a building drawing shown in figure calculate
   a) Brickwork in CM(1:6)in foundation footing.
   b) 12mm thick plastering the wall surfaces with CM (1:6) for all super structure walls by central line method.
   c) Earth work excavation for the foundation.



3) Repare the detailed estimate for the following items of work for the building shown in figure.
   a) R.C.C. (1:1.5:3) in columns upto ground level only.
   b) R.C.C. (1:2:4) in plinth Bleams
   c) R.C.C. (1:2:4) in slab.

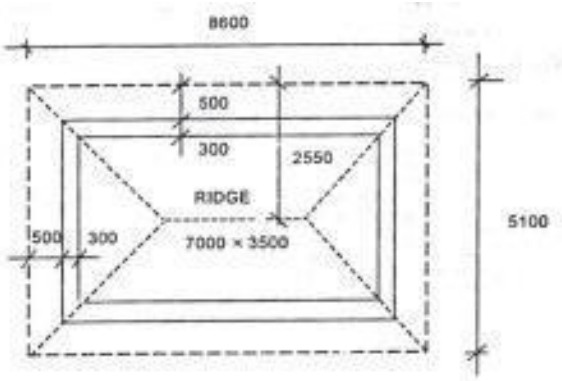


4) Prepare the detailed estimate for the following items of work for a building shown .
   a) R.R. masonry in CM 1:6 for footings and basement.
   b) Brick work in CM 1:6 for super structure.
   c) Plastering for ceiling with CM 1:3



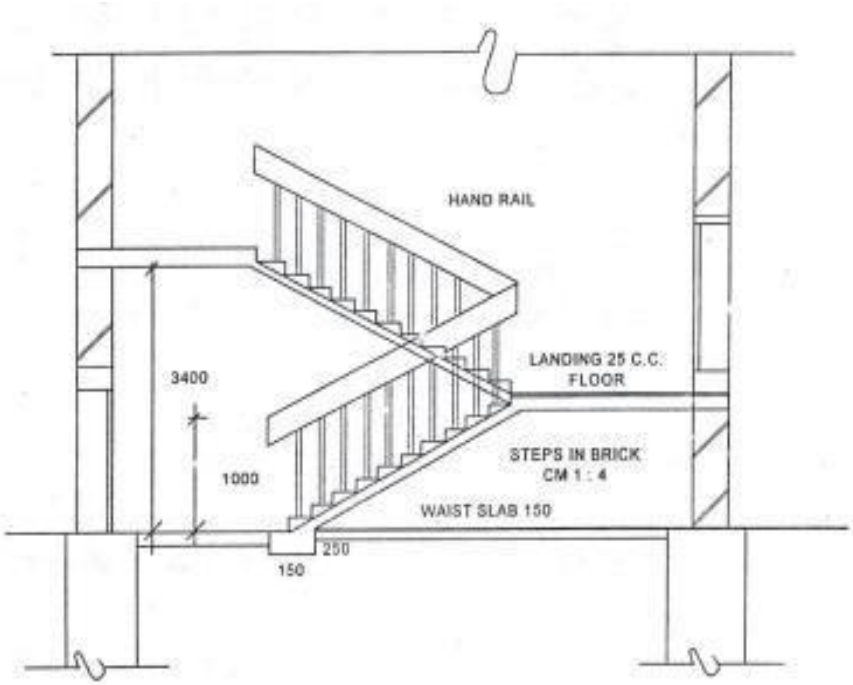
ALL DIMENSIONS IN 'mm'

5) From the Hipped roof shown in sketch, calculate
   a) Length of Hip rafter
   b) Ridge Piece

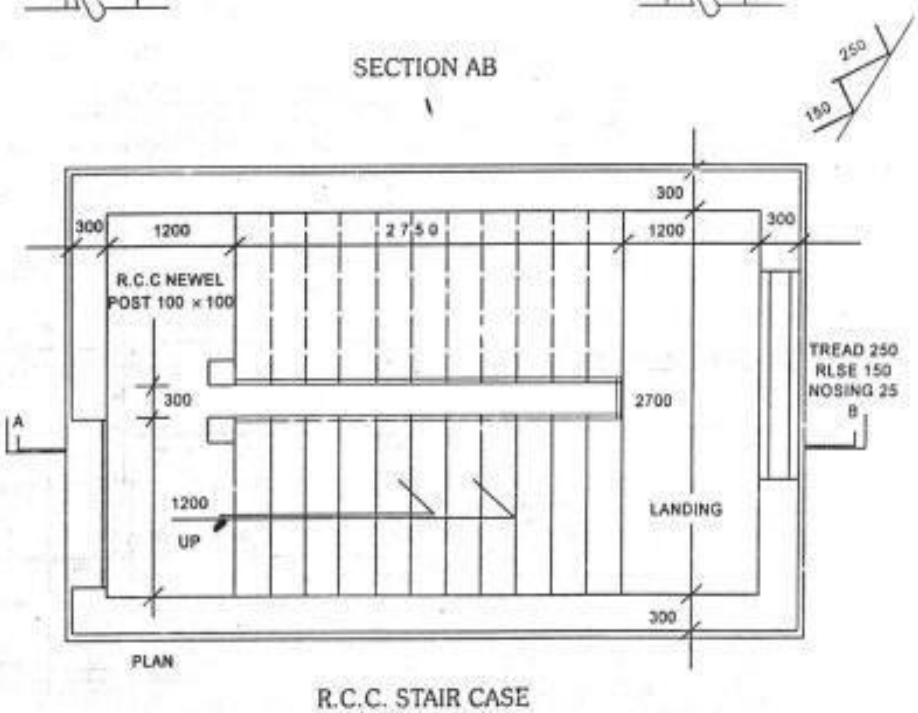


RISE OF ROOF 1/3 SPAN

6) For an R.C.C. Stair case shown in fig. Calculate the following contents.
   a) R.C.C. (1:2:4) for base beam, waist slab, Top and intermediate landings.
   b) Brick work in CM(1:4) for steps.

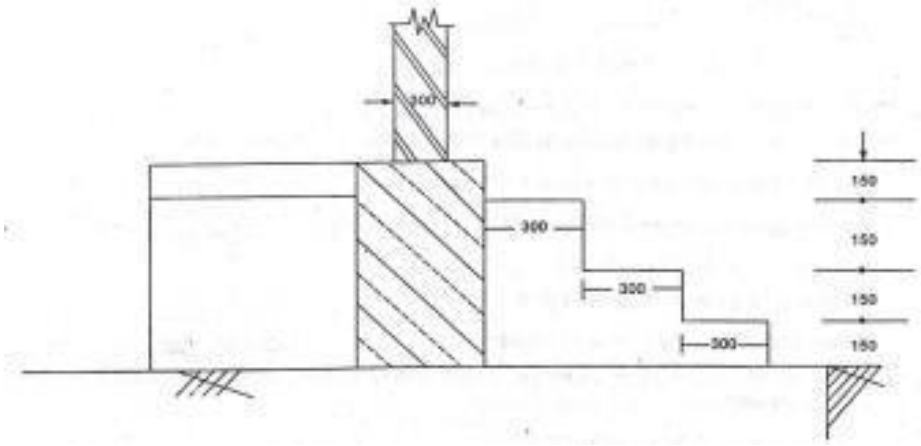


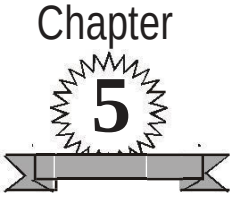
SECTION AB



R.C.C. STAIR CASE

7) The section of steps at the front of a residential building is shown in fig. Calculate
   a) Volume of BM in CM (1:5) for all three steps. the length of steps is 2.1m
   b) Plastering with CM (1:4) for all three steps.





ANALYSIS OF RATES

Definition : In order to determine the rate of a particular item, the factors affecting the rate of that item are studied carefully and then finally a rate is de-cided for that item. This process of determining the rates of an item is termed as analysis of rates or rate analysis.

The rates of particular item of work depends on the following.

1. Specifications of works and material about their quality, proportion and con-structional operation method.
2. Quantity of materials and their costs.
3. Cost of labours and their wages.
4. Location of site of work and the distances from source and conveyance charges.
5. Overhead and establishment charges
6. Profit

Cost of materials at source and at site of construction.

The costs of materials are taken as delivered at site inclusive of the transport local taxes and other charges.

Purpose of Analysis of rates:

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

Cost of labour -types of labour, standard schedule of rates

The labour can be classified in to

1) Skilled 1st class
2) Skilled IInd Class
3) un skilled

The labour charges can be obtained from the standard schedule of rates 30% of the skilled labour provided in the data may be taken as Ist class, remain-ing 70% as II class. The rates of materials for Government works are fixed by

57 ***Estimation and Costing*** the superintendent Engineer for his circle every year and approved by the Board of Chief Engineers. These rates are incorporated in the standard schedule of rates.

Lead statement: The distance between the source of availability of material and construction site is known as "Lead " and is expected in Km. The cost of convenayce of material depends on lead.

This statement will give the total cost of materials per unit item. It in-cludes first cost, convenayce loading, unloading stacking, charges etc.

The rate shown in the lead statement are for mettalled road and include loading and staking charges . The environment lead on the metalled roads are arrived by multiplying by a factor

a) for metal tracks - lead x 1.0
b) For cartze tracks - Lead x 1.1
c) For Sandy tracks - lead x 1.4

Note: For $1m^3$ wet concrete = $1.52\ m^3$ dry concrete approximately
SP. Wt of concrete= 1440 kg/m^3 (or) 1.44 t/m^3
1 bag of cement = 50 Kg

Example 1:- Calculate the Quantity of material for the following items.

a) R.C.C. (1:2:4) for $20m^3$ of work
b) R.C.C. (1:3:6) for $15m^3$ of work

a) Quantity of cement required = $\frac{1}{(1+2+4)} \times 1.52 \times 20 = 4.14m^3 \times \frac{1440}{50}$
=119.26 bags

Quantity of Sand required = $\frac{2}{(1+2+4)} \times 1.52x20 = 8.28m^3$

Quantity of cource aggreate = $\frac{4}{7} x1.52x20 = 16.56m^3$

b) Quantity of cement required = $\frac{1}{10} \times 1.52 \times 1.5 = 2.28m^3 \times \frac{1440}{50} = 65.66$ Bags

Quantity of sand required = $\frac{3}{10} \times 1.52x\ 15 = 6.84m^3$

Quantity of CA required = $\frac{6}{10} \times 1.52x15 = 13.68m^3$

Example 2:- Calculate the quantity of materials for the following items. a) C.M. (1:4) for $1m^3$ of work

b) CM (1:6) for $1m^3$ of work

Hint: Cement will go to fill up the volds in sand. So total volume was be 4 instead of 1+4=5

a) Quantity of Cement required $= \frac{1}{4} \times 1 = 0.25m^3 = 0.25 \times \frac{1440}{50} = 7.2$ bags

Quantity of Sand required $= \frac{4}{4} \times 1 = 1m^3$

b) Quantity of cement required $= \frac{1}{6} \times 1 = 0.16m^3 = 0.16 \times \frac{1440}{50} = 4.8$bags

Quantity of sand required $= \frac{6}{6} \times 1 = 1m^3$

Example 3:-Calculate the Quantity of Cement required in bags for the follow-ing items.

a) B.M. in CM(1:3) for 15 cum of work using $0.2m^3$ of CM required for $1m^3$ of Brick work

b) RCC (1:2:4) for $20m^3$ of work

Sol : a) $1m^3$ of Brick work - $0.2m^3$ of CM(1:3)

$15\ m^3$ of Brick work $= 15 \times 0.2 = 3m^3$

Quantity of cement required in bags $= \frac{1}{3} \times 3 \times \frac{1440}{50} = 28.8$bags

b) Quantity of Cement required in bags $= \frac{1}{7} \times 1.52 \times 20 \times \frac{1440}{50} = 125$ bags

Example 4:-Calculate the quantity of Cement required in bags for the following items of work.

a) C.C. (1:4:8) usy 40mm HBG metals for $30m^3$ of work

b) RR masanry in CM(1:5) very $0.34m^3$ of CM for $1m^3$ of masanry for 20m of work

sol : a) Quantity of Cement required $= \frac{1}{13} \times 1.52 \times 30 \times \frac{1440}{50} = 101$bags

b) $1m^3$ of RR masanry = $0.34m^3$ of CM (1:5)

$20\ m^3$ of RR masanry required = ? 20x 0.34=6.8m3

Quantity of cement required $= \frac{1}{5} \times 6.8 \times \frac{1440}{50} = 39.2$bags

Example 5:- Prepare the lead statement for the following materials

S.No.	Material	Rate at Source	Lead in KM			Conveyance
			MT	CT	ST	
1.	40mm HBG Metal	Rs.120/m^3	---	5	7	Rs.5.00/m
2.	River Sand	Rs.15/m^3	3	2	6	Rs.3.50/m
3.	Cement	Rs. 135/bags	2	---	4	Rs. 4.00 p

S.No.	Mateial	Rate of Source	Lead in KM			Equalant lead in km	Conveyance Charge	Total convey-ance Charge	
			MT	CT	ST				
1.	40mm HBG Metal	Rs.120/m^3	--	5	7	5×1.1+7×1.4=15.3	5.00/m3	15.3x5=76.5	1
2.	River Sand	Rs.15/m^3	3	2	6	3x1+2x1.1+6x1.4 =13.6	3.50/m3	13.6x3.5=47.6	1
3.	Cement	Rs. 135/bags	2	---	4	2x1+4x1.4=7.6	4.00per4km/bag	$\frac{7.6}{4.0}$ x 4.0=7.6	1

Cost of cement at site = 142.6/bag

1 bag of cement = 50kg

sp.wt of cement = 1440 kg/m^3 = 1.44t/m^3

Cost of Cement = $142.6 \times \frac{1440}{50}$ = 4106.88/m^3

Example 6:- Prepare the lead statement for the following materials

S.No.	Material	Rate of Source	Lead in KM			Conveyance Charge per km	Sein
			ST	CT	MT		Cha
1.	Cement	Rs.2100/10 KN (tonn)	5	2	3	Rs.1.5/m^3	--
2.	Bricks	Rs.850/100nos	5	--	3	Rs.30/1000Nos/Km	35
3.	Sand	Rs. 15/m^3	4	2	5	Rs.9.00 / km/cum	30
4.	40mm HBG Metal	Rs. 250/m^3	3	2	2	Rs.6.50/Km/m^3	35

S.No.	Material	Rate of Source	Lead in KM			Equalant lead in km	Conve-yance Charge Rs.	Total conveyance Charge Rs.	Seinerage Charge Rs.	Ces Char Rs
			ST	CT	MT					
1.	Cement	Rs.2100/10KN	5	2	3	5x1.4+2x1.1+3x1=11.2	1.50	16.80	--	--
2.	Bricks	Rs.850/1000nos	5	--	3	5x1.4+3x1=10	30	300.00	35	13
3.	Sand	Rs. 15m^3	1	2	2	1x1.4+2x1.1+2x1=5.6	9.00/m^3	50.40	30	12
4.	40mmHBG Metal	Rs. 250/m^3	3	2	2	3x1.4+2x1.1+2x1=8.4	6.5/m^3	54.6	35	15

Example 7:- Prepare a data sheet &calculate the cost of the following items of works:

a) Plastering with cement mortar (1:4), 20 mm thick unit-
$10m^2$ $0.21m^3$ C.M. (1:4)
0.66 Nos. Brick layer I class
1.54 Nos. Brick layer II Class
0.5 No.s Men Mazdoors
3.2 Nos. Women mazdoors
L.S. Sundries.

b) R.R. Masonry in C.M. (1:6) -$1m^3$
1.1 m^3 Rough stones
0.34 m^3 C.M. (1:6)
0.54 No.s Mason I Class
1.26 Nos. Mason II Class
1.40 Nos. Men mazdoors
1.40 Nos. Women mazdoors
LS. Sundries.

Lead Statement of materials:

S.No.	Materials	Cost at Source Rs. -- Ps.	Per	Lead in Km	Conveyance Charges per km
1	Rough stone	260=00	m^3	18	5=00/m3
2	Sand	12=00	m^3	25	4=00/m3
3	Cement	2100=00	10kn or 1tonne	Local	-

Labour Charges :

1. Mason / Brick layer I Class Rs.100=00 per day.
2. Mason /Brick layer II class Rs. 80=00 per day
3. Men mazdoor Rs. 60=00 per day
4. Women mazdoor Rs. 60=00 per day
5. Mixing charges of cement mortar Rs. 16=00perm^3

Lead Statement :

S.No.	Material	Cost at Source	Per	Lead in KM	Conveyance Charge Rs.	Total convenyance Charge Rs.	Total cost Rs.
1	Rough Stone	260.00	m^3	18	500/m^3	90.00	350.00
2	sand	12.00	m^3	25	4.00/m^3	100.00	112.00
3	Cement	2100	10KN or 1tonne	Local	---	---	2100/ tonne

a) Plaster with CM (1:4), 20mm thick, unit-10m^2

Cost of CM (1:4) for 0.21m3

cost of Cement = $\frac{1}{4} \times 0.21 \times 1.44 \times 2100 =$ 158.76

Cost of Sand = $\frac{4}{4} \times 0.21 \times 112 =$ 23.52

Total Cost Rs. 182.28

S.No.	Description	Quantity	Unit	Rate	per	Amount
1	CM(1:4)	0.21	m^3	182.28	0.21m^3	182.28
2	Brick layer I class	0.66	Nos	100	day	66.00
3	Brick layer II Class	1.54	Nos	80	day	123.20
4	Men mazdoors	0.5	Nos	60	day	30.00
5	Women mazdoors	3.2	Nos	60	day	192.00
6	Mixing Charges	0.21	m^3	16	m^3	28.16
7.	Sundrys	L.S.				3.36

Total Rs. 625.00

b) RR Masanry in CM (1:6) -1m^3

Cost of CM (1:6) for 0.34m^3

Cost of Cement = $\frac{1}{6} \times 0.34 \times 1.44 \times 2100 =$ 171.36

Cost of Sand = $\frac{6}{6} \times 0.34 \times 112 =$ 38.08

Total Cost Rs. 209.44

S.No.	Description	Quantity	Unit	Rate	per	Amount
1	Rough Stone	1.1	m^3	350	m^3	385.00
2	CM(1:6)	0.34	m^3	209.44	$0.34m^3$	209.44
3	Mason IClass	0.54	Nos	100.00	day	54.00
4	Mason II Class	1.26	Nos	8.00	day	10.08
5	Men Mazdoors	1.40	Nos	60.00	day	84.00
6	Women Mazdoors	1.40	Nos	60.00	day	84.00
7	Mixing Charges	0.34	m^3	16.00	m^3	5.44
8	Sundries	L.S.				18.04

Total Rs. **850.00/m^3**

Example 8:-Prepare a data sheet and calculate the cost of the items given below:

a) Brick masonry in C.M. (1:6) with country bricks-unit
Icum. 600Nos. country bricks.
$0.38m^3$ C.M.(1:6)
1.40Nos. Mason
0.7 Nos. Man Mazdoor
2.1 Nos. Woman
Mazdoor L.S. Sundries.

b) C.C.(1:5:10) using 40mm HBG metal unit 1cum.
$0.92m^3$..... 40mm size HBG metal
$0.46m^3$..... Sand
$0.092m^3$..... Cement
0.2 Nos ..... Mason
1.8 Nos ..... Man Mazdoor
1.4 Nos. ..... Woman Mazdoor
L.S. ..... Sundries.
Lead Statement of materials:

S.No.	Material	Cost at Source Rs. Ps.	Per	Lead in Km	Conveyance Charges per Km
1	40mmHBG metal	210=00	m^3	16	Rs.6=00/m^3
2	Sand	16=00	m^3	18	Rs.3=00/m^3
3	Bricks country	780=00	1000Nos	at site	--
4	Cement	2600=00	10KN or 1tonne	at site	--

Labour charges:

i) Mason- Rs. 90 per day.
ii) Man Mazdoor - Rs. 70 per day
iii) Woman Mazdoor - Rs. 70 per day.
iv) Mixing Charges of C.M. Rs. 20=00 per m^3.

Lead Statement :

Sl. No.	Material	Cost at Source	Per	Lead in KM	Conveyance Charge Rs.	Total conveyance Charge Rs.	Total cost Rs.
1	40mm HBG metal	210.00	m^3	16	Rs.6/m^3	96.00	306.00
2	sand	16.00	m^3	18	Rs.3/m^3	54.00	70.00
3	Country bricks	780.00	1000nos	at Site	---	---	780.00
4	Cement	2600	10kn or 1tonne	At site	---	---	2600/t

a) B.M. CM(1:6) with country bricks -

$1m^3$ CM (1:6) - $0.38m^3$

Cost of Cement = $\frac{1}{6} \times 0.38 \times 1.44 \times 2600 =$ 237.12

Cost of Sand = $\frac{6}{6} \times 0.38 \times 70 =$ 26.60

Total Cost Rs. 263.72

S.No.	Description	Quantity	Unit	Rate	per	Amount Rs.
1	Country Bricks	600	Nos	780	1000	769.23
2	CM (1:6)	0.38	m^3	263.72	$0.38m^3$	263.72
3	Mason	1.4	Nos	90	day	126.00
4	Man mazdoors	2.1	Nos	70	day	147.00
5	Mixing Charges	0.38	m^3	20	m^3	7.60
6	Sundries	L.S				86.44

Total Rs. 1400.00

b) CC (1:5:10) using 40mm HBG metal -1m^3

S.No.	Description	Quantity	Unit	Rate	per	Amount
1	40mm HBG metal	0.92	m^3	306	m^3	281.52
2	Sand	0.46	m^3	70	m^3	32.20
3	Cement	0.092	m^3	2600	t	344.45
4	Mason	0.2	Nos	90	Nos	18.00
5	Man mazdoor	1.80	Nos	70	Nos	126.00
6	women Mazdoor	1.4	Nos	70	Nos	98.00
7	Mixing charges	1.0	m^3	20	m^3	20.00
8	Sun dries	L.S				4.83

Total Rs. 925.00 /m^3

Lead Statement

Town data for Guntur Town Buildings as per 2004-05-"S.S.R.

Sl. No.	Description of Material	Source of supply	Unit	Lead in Km	Intial cost of material	Deduct Stacking charges	Convey-ance Charge	Blasting Charges	Seinorage Charges	C ch
1	Cement	Local	Mt	0.00	2700.00	0.00	0.00	0.00	0.00	
2	Sand for Mortar	Krishna River	Cum	34KM	71.00	-3.70	181.50	0.00	36.00	
3	Sand for Filling	T.lapalem Vagu	Cum	28km	28.00	-3.70	16.90	0.00	36.00	
4	Gravel	Perecherla	Cum	12km	38.50	-3.70	110.20	0.00	20.00	
5	40mm HBG metal	Lam	Cum	11km	269.00	-6.10	119.60	53.00	45.00	
6	20mm HBG Metal	Lam	Cum	11km	469.00	-6.10	119.60	53.00	45.00	
7	12mm HBG metal	lam	Cum	11km	375.00	-6.10	119.60	53.00	45.00	
8	10mm HBG metal	Lam	Cum	11km	313.00	-6.10	119.60	53.00	45.00	
9	6mm HBG metal	Lam	Cum	11km	237.00	-6.10	119.60	53.00	45.00	
10	R.T.Steel	Local	Mt	---	275.00	---	--	---	--	
11	Bricks	Kollur	1000	48km	1250.00	-5.90	424.70	---	---	
12	R.R.Stone for masonry works	Perecherla	Cums	11km	107.00	-6.10	119.60	51.50	45.00	

Preparation of Unit rates for finished items of words

I a) Cement Concrete in foundation (1:5:10)

S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
1.	40mm HBG Metal	0.92	Cum	547.75	Cum	503.93
2.	Sand	0.46	cum	284.80	Cum	131.00
3.	Cement	0.092	Cum	2700.00	MT	357.70
4.	Mason Ist Class	0.06	No	150.00	Nos	9.00
5.	Mason 2nd Class	0.14	No	131.00	Nos	18.34
6.	Man mazdoor	1.80	No	101.00	Nos	181.80
7.	Women Mazdoor	1.40	No	101.00	Nos	141.40
8.	Add Extra 15% on M.L					52.58
						1395.75
9	Add T.O.T. @4%					55.83
10	Sundries					0.42
					Total Rs.	1452.00

b). Cement Concrete in foundation (1:4:8)

S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
1.	40mm HBG Metal	0.92	Cum	547.75	Cum	503.93
2.	Sand	0.46	Cum	284.80	Cum	131.00
3.	Cement	0.115	Cum	2700.00	MT	447.12
4.	Mason Ist Class	0.06	No	150.00	Nos	9.00
5.	Mason 2nd Class	0.14	No	131.00	Nos	18.34
6.	Man mazdoor	1.80	No	101.00	Nos	181.80
7.	Women Mazdoor	1.40	No	101.00	Nos	141.40
8.	Add Extra 15% on M.L					52.58
						1485.17
9	Add T.O.T. @4%					59.40
10	Sundries					0.43
					Total Rs.	1545.00

2) R.C.C.Works

V.R.C.C.(1:2:4) Nominal mix using 20mm Normal size hard broken granite metal approved quarry with necessary reinforcement including casting, curing cost & conveyance of all materials.

2 a) P.C.C.(1:2:4)

S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
1.	20mm HBG Metal	0.92	Cum	797.75	Cum	733.93
2.	Sand	0.46	cum	284.80	Cum	131.00
3.	Cement	0.23	Cum	2700.00	MT	894.24
4.	Mason Ist Class	0.2	No	180.00	Nos	30.00
5.	Man mazdoor	1.8	No	131.00	Nos	235.80.
6.	Women Mazdoor	1.4	No	101.00	Nos	141.40
7.	Vibrating charges	1.0	Cum	101.00	Nos	101.00
8.	Machiny mixing concrete	1.0	Cum	28.80	cum	28.80
9	Add Extra 15% on M.L					76.23
				Total Rs.		2372.40

b) For steel reinforcement

S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
1.	cost of steel	1.00	MT	27500	MT	27500.00
2.	Fabrication charges	1.00	MT	5.00	Kg	5000.00
3.	Add 15% on M.L.					750.00
						33250.00
4.	Add T.O.T. @4%					1330.00
5.	Sundries					0.00
				Total Rs.		34580.00

c) V.R.C.C (1:2:4) for bed blocks, column footings including form work centering charges

S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
1.	V.P.C.C (1:2:4)	1.00	Cum	2372.40	Cum	2372.40
2.	Centering Charges	1.00	Cum	430.00	Cum	430.00
3.	Steel @0.5% = 0.5/ 100=0.005m^3					
	(0.005x7.85t/m3 = 0.04t	0.04	MT	34580.00	MT	1383.20
						4185.60
4.	Add T.O.T. @4%					167.40
	Sundries					0.00
				Total Rs.		**4353.00**

 d) V.R.C.C (1:2:4) for columns rectangular beams, pedastals including form work at centering charges.

S.No.	Descrtiption of Item	Quantity	Unit	Rate	Per	Amount
1.	V.P.C.C. (1:2:4)	1.00	Cum	2372.40	Cum	2372.40
2.	Centering Charges	1.00	Cum	675.00	Cum	675.00
3.	Steel for columns, beams @1.5% =1.5/ 100x7.85=0.117t	0.117	MT	34580.00	MT	4072.00
						7119.40
4.	Add T.O.T. @4%					284.77
5.	Sundries					0.83
				Total Rs.		**7405.00**

e) V.R.C.C (1:2:4) for slabs, lintels including form work at centering charges upto 100mm, thick

S.No.	Descrtiption of Item	Quantity	Unit	Rate	Per	Amount
1.	V.P.C.C (1:2:4)	1.00	Cum	2372.40	Cum	2372.40
2.	Centering Charges	10.00	Cum	710.00	Cum	710.00
3.	Steel for slabs @1% =1/100 x 7.85 = 0.0785 t	0.0785	MT	34580.00	MT	2714.53
						5796.63
	Add T.O.T. @4%					231.87
	Sundries					1.20
				Total Rs.		**6030.00**

3. Pointing to R.R.Masonary in CM(1:4) mix using cost & conveyance of Cement, sand and all materials from approved sources to site and labour charges for point neatly etc.

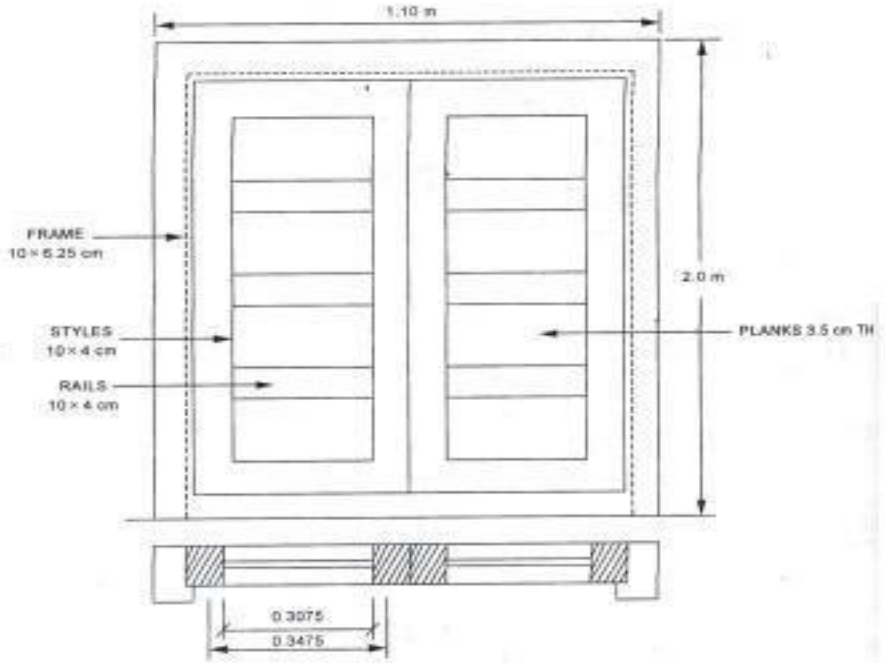
Analysis of Rates 70

S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
	Cost of CM(1:4)	0.09	Cum			
1.	Cement = $\frac{1}{4}$ ×1.44x0.09	0.032	t	2700.00	Mt	87.48
2.	Sand = $\frac{1}{4}$×0.09	0.09	Cum	284.80	Cum	25.63
3.	Mining	1.0	Cum	32.50	Cum	32.50
4.	Charges mason	0.48	Nos.	150.00	Nos	72.00
5.	Ist Class 2nd	1.12	Nos	131.00	Nos	146.72
6.	Class	0.50	Nos	101.00	Nos	55.00
7.	Man mazdoor	1.10	Nos	101.00	Nos	111.10
8.	Women Mazdoor					57.72
	Add 15% on ML					**588.15**
9.						23.53
10.	Add TOT @ 4%					0.32
			Total Rs.			**612.00**

4. Cement concrete flooring (1:2:4) using 12mm HBG machine crushed chips from approved quarry to site of work including curing cost and conveyance of all materials completed.

S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
1.	12mm HBG metal	0.92	Cum	680.25	cum	625.83
2.	crushed chips					
3.	Sand	0.46	cum	284.80	cum	131.00
4.	Cement	0.23	cum	2700	mt	894.24
	($0.23m^3$x1.44=0.33t	(or)0.331	MT			
5.	Mason ISt class	0.06	Nos	150.00	nos	9.00
6.	2nd Class	0.14	nos	131.00	nos	18.34
7.	Man mazdoor	1.80	nos	101.00	nos	181.80
8.	Women Mazdoor	1.40	nos	101.00	nos	141.40
9.	Add 15% Extra on ML					52.58
						2054.19
10	Add TOT @4%					82.17
11.	Sundries					0.64
				Total Rs.		**2137.00**

5 a) Supply and fixing teak wood fully panneled with 10x 4 cm styles, and 10x4cm rails and 3.5CM TH panels with teak wood fram of 6.25x 10cm 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 1.100 x 2.00 of area 2.2 sqm.



Requirements :

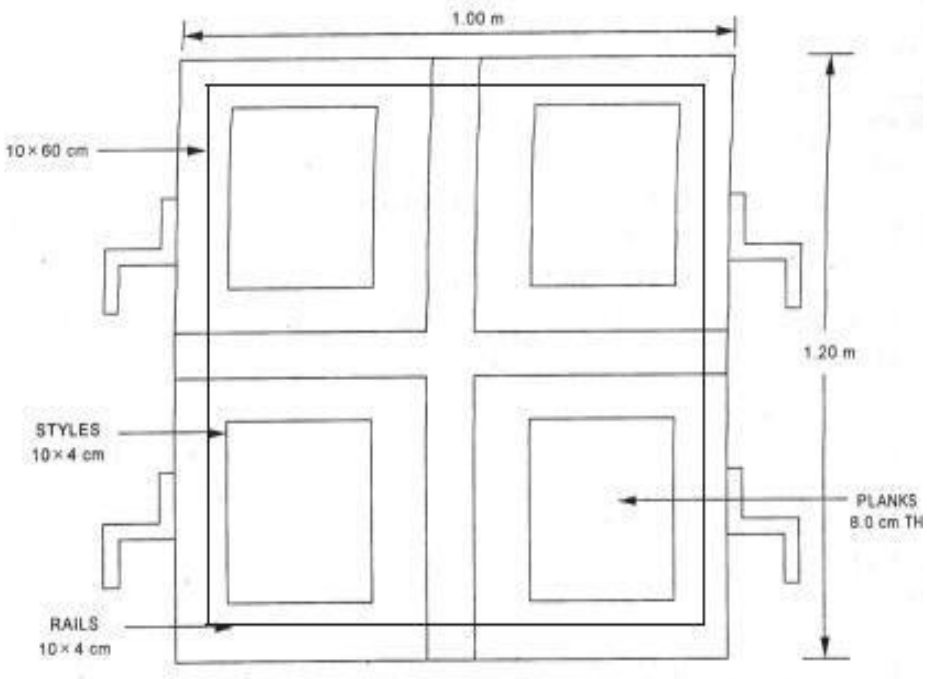
i) Verticals = 2x 2.0 x 0.10 x 0.0625 = 0.0250
ii) Horizontals = 1x 1.10 x 0.10 x 0.0625 = 0.0068
iii) Styles = 4x 1.937 x 0.10 x 0.04 = 0.0300
iv) Rails = 2x 5x 0.5075 x 0.10 x 0.04 = 0.0020
v) Planks = 2x 4x 0.364 x 0.3475 x .035= 0.0354

0.0090m^3

S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
1.	wood Cost	0.009	Cum	25000	cum	2470.00
2.	Butt Hinges	6	Nos	20	each	120.00
3.	Z-hold fasts	6	Nos	10	each	60.00
4.	Cost of labour	2.2	sqm	800	sqm	1760.00
					Total	**4410.00**

Cost of door per 1m^2 = 4410/ 2.2 = 2004.54 say Rs.2010/-

5 b) Supply and fixing teak wood fully panneled with 10x 4 cm styles, and 10x4cm rails and 3.5CM TH panels with teak wood fram of 6.25x 10cm size including cost of hold fasts, but hinges and labour charges for fixing window in position and fixing furniture etc., complete for one window of size 1.0x1.2 of area 1.2 sqm.



Requirements :

i) Verticals = 3x1.2 x 0.10 x 0.0625 = 0.0225
ii) Horizontals = 3x 1.00 x 0.10 x 0.0625 = 0.0188
iii) Styles = 4x 2 x 0.10 x 0.04 = 0.0160
iv) Rails = 4x 2x 0.4062 x 0.10 x 0.04 = 0.0012
v) Planks = 4x 0.3102x 0.2102 x0.03 = 0.0070

0.0076m^3

S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
1.	wood Cost	0.0076	Cum	25000	cum	1900.00
2.	Butt Hinges	6	Nos	20	each	120.00
3.	Z-hold fasts	4	Nos	10	each	40.00
4.	Cost of labour	1.2	sqm	1000	sqm	1200.00
					Total	**3260.00**

Cost of door per 1m^2 = 3260/ 1.2 = 2716.67 say Rs.2720/-

EXERCISE

Short Answer Questions

1. Calculate the Cement contents for the following
   a) C.C.(1:510) using 40mm H.B.G.Metal for 25m^3 work
   b) Brick work in CM (1:6) using country Bricks for 15m^3 of work if 0.38 m^3 of CM(1:6) is required for 1m^3 of Brick work.
2. Calculate the Rates of following materials by using the lead statement given below.

No.	Material	Rate of Source	Lead in KM			Conveyance Charge per
			ST	CT	MT	
1.	Cement	Rs.2100/10 KN (tonn)	3	2	3	Rs.2.5/m^3
2.	Bricks	Rs.850/100nos	1	1	5	Rs.40/1000Nos/Km
3.	Sand	Rs. 15/m^3	4	3	5	Rs.12.00 / km/cum
4.	40mm HBG Metal	Rs. 250/m^3	2	1	2	Rs.7.50/Km/m^3

Essay type Questions

1 Prepare a data sheet and calculate the cost of the items given below:

a) Brick masonry in C.M. (1:6) with country bricks-unit
Icum. 600Nos. country bricks.
0.38m^3 C.M.(1:6)
1.40Nos. Masons
0.7 Nos. Man Mazdoor
2.1 Nos. Woman
Mazdoor L.S. Sundries.

b) C.C.(1:5:10) using 40mm HBG metal unit 1cum.
0.92m^3..... 40mm size HBG metal
0.46m^3..... Sand
0.092m^3..... Cement
0.2 Nos ..... Mason
1.8 Nos ..... Man Mazdoor
1.4 Nos..... Woman Mazdoor
L.S. ..... Sundries.

Labour charges:
i) Mason- Rs. 90 per day.
ii)Man Mazdoor - Rs. 70 per day
iii)Woman Mazdoor - Rs. 70 per day.
iv)Mixing Charges of C.M. Rs. 20=00 per m^3.

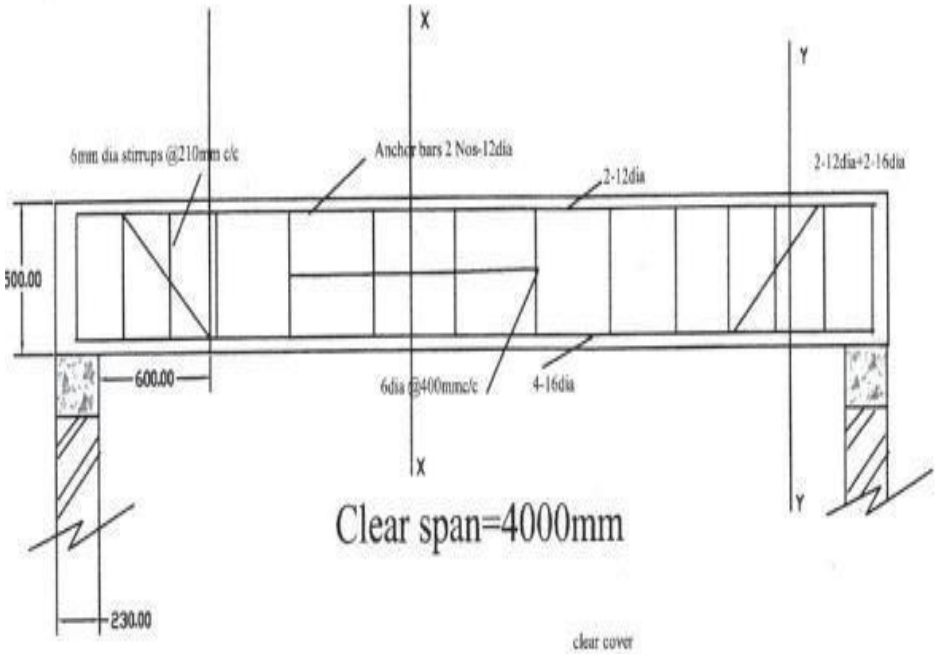
Lead Statement of materials:

S.No.	Material	Cost at Source Rs. Ps.	Per	Lead in Km	Conveyance Charges per Km
1	40mmHBG metal	210=00	m^3	16	Rs.6=00/m^3
2	Sand	16=00	m^3	18	Rs.3=00/m^3
3	Bricks country	780=00	1000Nos	at site	--
4	Cement	2600=00	10KN or 1tonne	at site	--

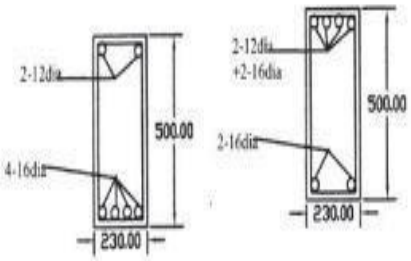
Chapter 6

ESTIMATION OF QUANTITIES OF STEEL & R.C.C. ELEMENTS

Example 1: Prepare the bar bending schedule of the given figure for R.C.C. beam.

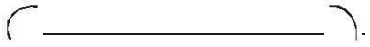
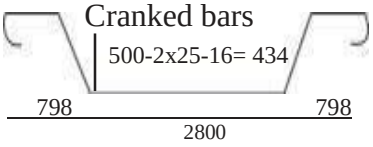
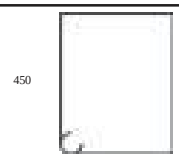


clear cover
bottom =25mm
top =25mm
ends =32mm
Sp.Wt of Steel=7860Kg/cu.m

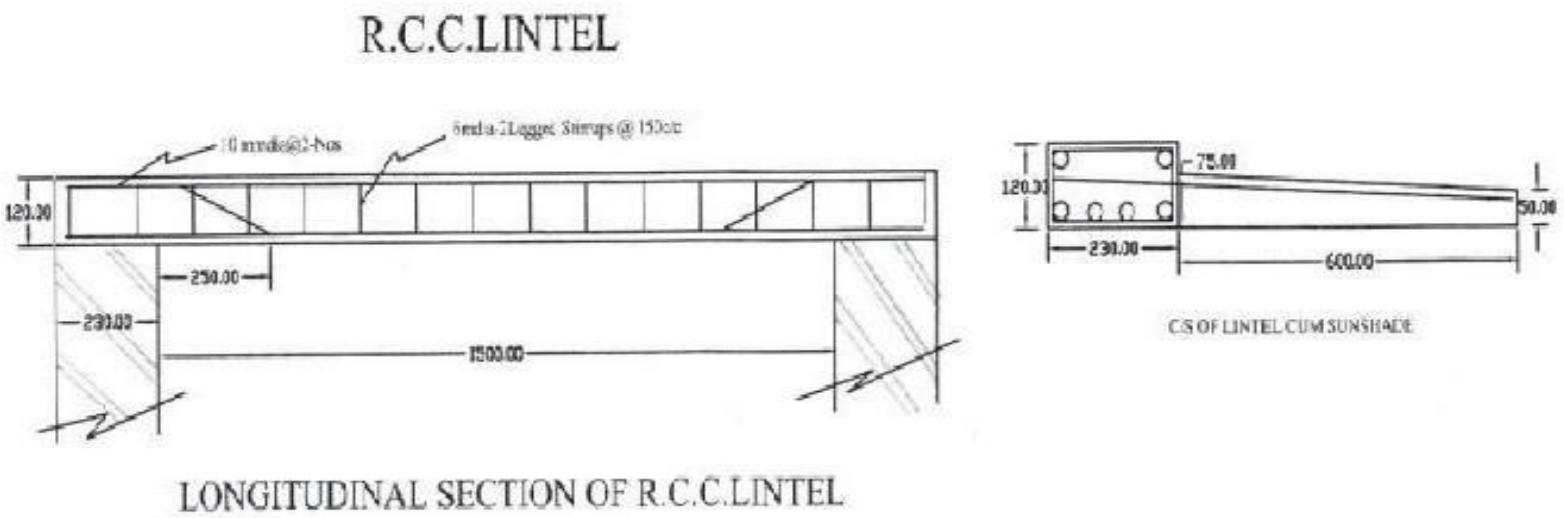


Section-XX

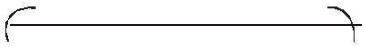
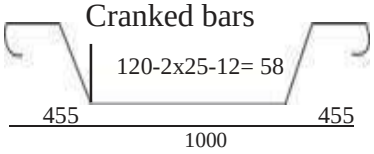
Section-YY

Name	Shape	Dia.	No.	Length in m	Total Length in m	Self weight in kg /m
B E A M	main bars  4000+2x230-2x32=4396	16	2	4396+2x(9x16) = 4684mm = 4.684m	4.684 x 2 = 9.368m	$\frac{\pi}{4} \times \frac{16}{1000}^2 \times 7860$ = 1.58
	Anchor bars  4000+2x230-2x32=4396	12	2	4396+2x(9x12) = 4612mm = 4.612m	4.612 x 2 = 9.224m	$\frac{\pi}{4} \times \frac{12}{1000}^2 \times 7860$ = 0.89
	Cranked bars 	16	2	4396+2x(9x16)+ 2(0.414x434) = 5043mm =5.043m Additional length for each crank = 0.414d	5.04 x 2 = 10.08	$\frac{\pi}{4} \times \frac{16}{1000}^2 \times 7860$ = 1.58
	 Height = 500-2x25=450 Width =230-2x25 =180	6	17	2(450+180) + 2x9x6 = 1368mm = 1.368m	1.368x17 = 23.256	$\frac{\pi}{4} \times \frac{6}{1000}^2 \times 7860$ = 0.22
				No. of stirups = ((798/210)+1)x2 +(2800/400) = 17 Nos		

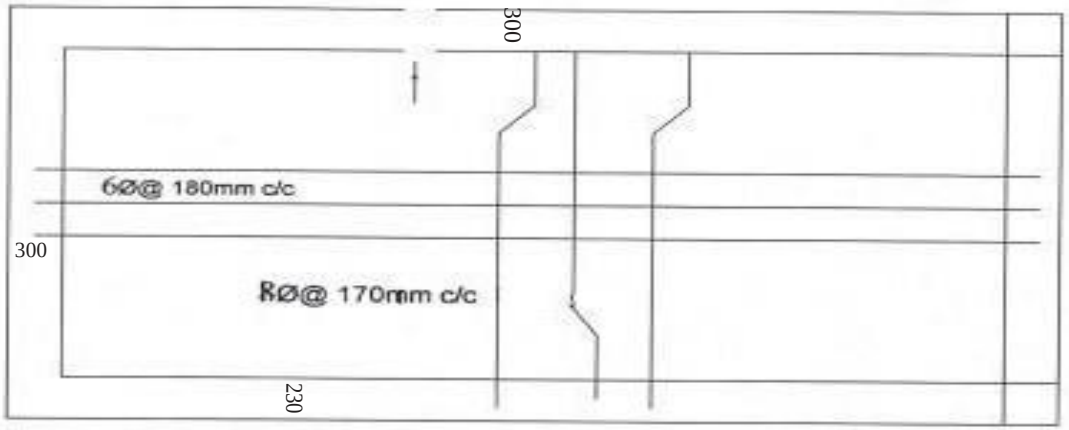
Example 2: Prepare the bar bending schedule of the given figure for R.C.C. Lintel



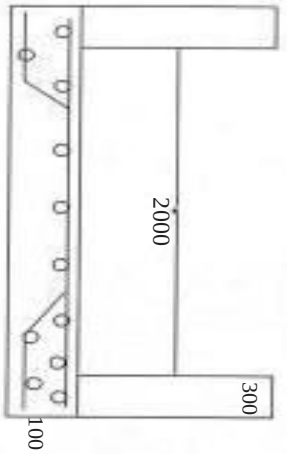
LONGITUDINAL SECTION OF R.C.C.LINTEL

Name	Shape	Dia.	No.	Length in m	Total Length in m	Self weight in kg /m
L I N T E L	main bars  1500+2x230-2x25=1910	12	2	1910+2x(9x12) = 2126mm = 2.1264m	2.126 x 2 = 4.252m	$\frac{\pi}{4} \times \frac{12}{1000}^2 \times 7860$ = 0.89
	Anchor bars  1500+2x230-2x25=1910	10	2	1910+2x(9x10) = 2090mm = 2.090m	2.09 x 2 = 4.18m	$\frac{\pi}{4} \times \frac{10}{1000}^2 \times 7860$ = 0.62
	Cranked bars 	12	2	1910+2x(9x12)+ 2(0.414x58) = 2174mm =2.174m Additional length for each crank = 0.414d	2.174 x 2 = 4.348	$\frac{\pi}{4} \times \frac{12}{1000}^2 \times 7860$ = 0.89
	 Height = 120-2x25=70 Width =230-2x25 =180	6	14	2(70+180) + 2x9x6 = 608mm = 0.608m	0.608x14 = 8.512	$\frac{\pi}{4} \times \frac{6}{1000}^2 \times 7860$ = 0.22
				No. of stirups = ((1910/150)+1) = 14 Nos		

Example 3: Prepare the bar bending schedule of the given figure for R.C.C. Lintel

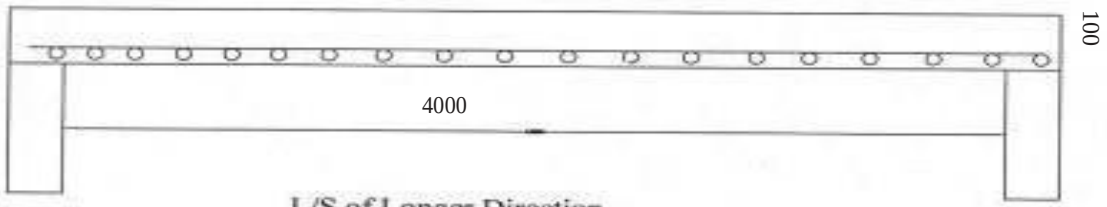


Plan of R.C.C.Slab



Slab Thickness=100mm

dimension=4000x
Internal room 2000

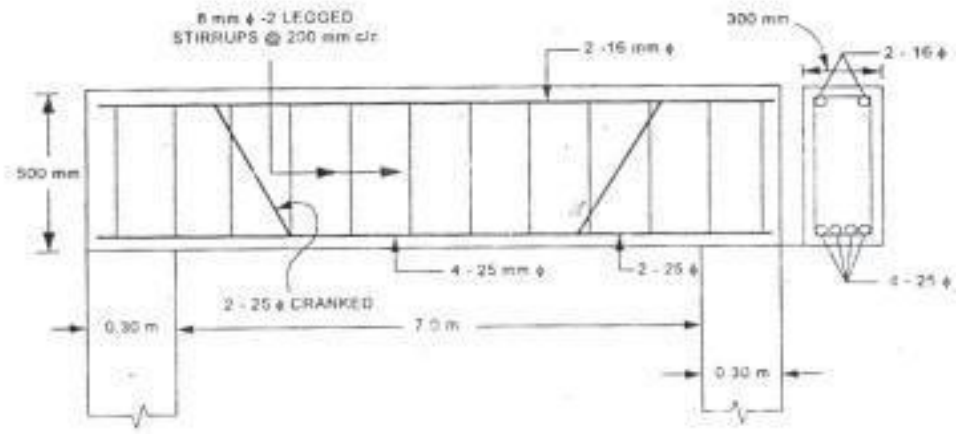


L/S.of Longer Direction

Name.	Shape	Dia.	No.	Length in m	Total Length in m	Self weight in kg /m
S L A B	Cranked bars  2000+2x230-2x25=2410	8	$\frac{4410}{170}+1$ =27	2410+2x(9x8)+ (0.414x66) = 2581.3mm =2.581m Additional length for each crank = 0.414d	2.581 x 27 = 69.7	$\frac{\pi}{4}\times\frac{8}{1000}^2 \times 7860$ = 0.39
	4000+2x230-2x25=4410	6	$\frac{2410}{180}+1$ =15	4.41m	4.41x15 = 66.15	$\frac{\pi}{4}\times\frac{6}{1000}^2 \times 7860$ = 0.22

EXERCISE

1) Prepare the Bar bending schedule for the beam shown below.



2) Prepare the Bar bending schedule of a simply supported R.C.C. Lintels from the following specification:
Size of lintel 300mm widex 200mm depth.Main bars in tension zone of Fe 250(grade I) 3 bars of 16mm dia., one bar is cranked through 45^0 at 170 mm from each end
2 No. anchor bars at top 8mm dia.
Two legged stirrups@150mm c/c of 6mm dia. through out. Clear span of the lintel is 1150mm.
Bearing on either side is 150mm.

Chapter 7

EARTH WORK CALCULATIONS

Introduction:-

Generally all the Civil Engineering projects like roads, railways, earth dams, canal bunds, buildings etc. involves the earth work.This earth work may be either earth excavation or earth filling or Some times both will get according to the desired shape and level. Basically the volume of earthwork is computed from length, breadth, and depth of excavation or filling.

In this chapter the various methods of calculating the earth work quantities shall be discussed.

Lead and

Lift: Lead:

It is the average horizontal distance between the centre of excavation to the centre of deposition. The unit of lead is 50m.

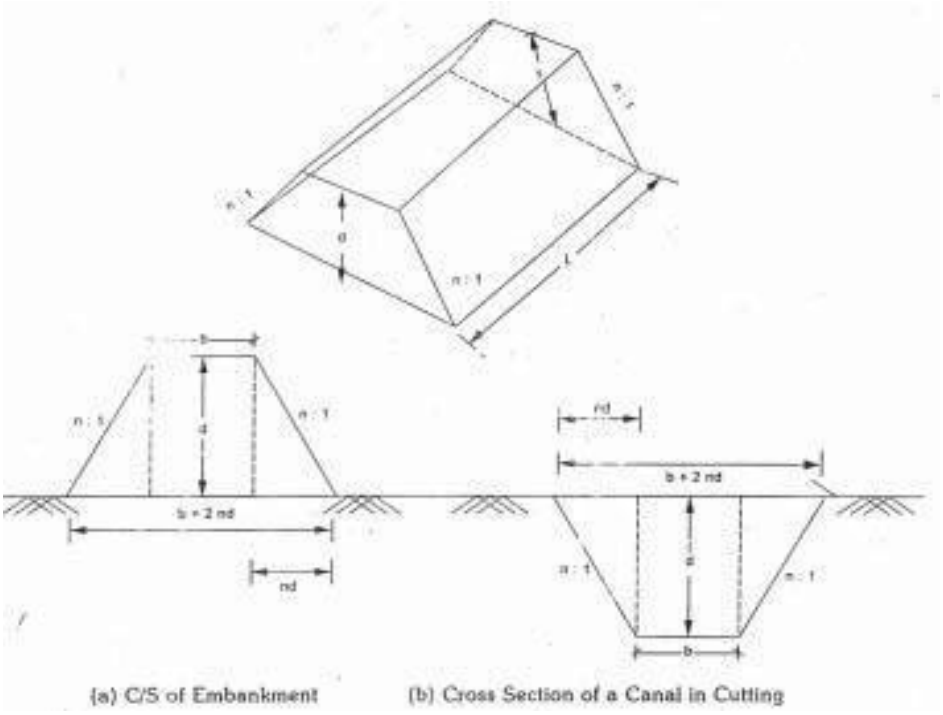
Lift :

It is the average height through which the earth has to be lifted from source to the place of spreading or heaping. The unit of lift is 2.00m for first lift and one extra lift for every 1.0m. for example when earth is to be lifted for 4.5m, Four lifts are to be paid to the contractor.

i.e. Upto2.0 - 1 lift
1.0 - 1 Lift
1.0 - 1 lift } Total 04 lifts
0.5 - 1 lift }

Calculation of earth work for Roads:

7.3.1 case 1) volume of earth work in banking or in cutting having "no longitudi-nal slope".



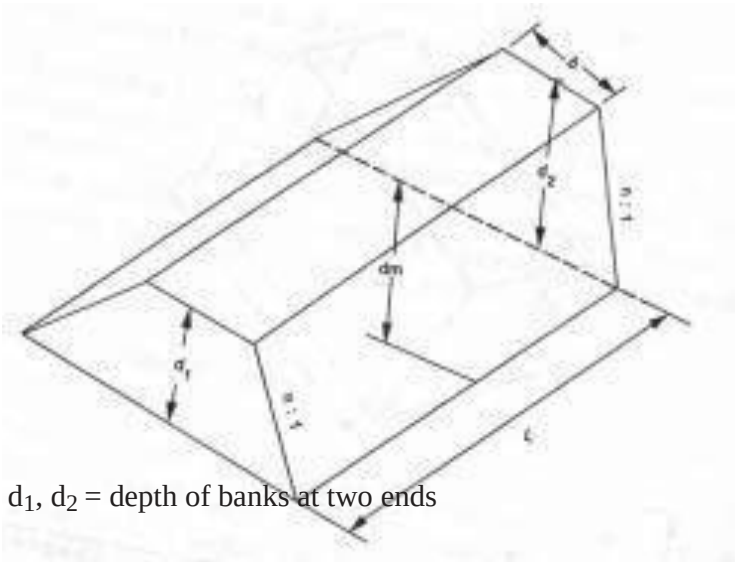
$V = (bd+2x1/2x\ ndx\ d)L$

$V = (bd+nd^2)L$

Case 2:

When the ground is in longitudinal slope or the formation has uniform gradient for a length the earth work may be calculated by the following methods.

1. By Mid Section or Mid ordinate method.



Where d_1, d_2 = depth of banks at two ends

Mid ordinate (or) Average depth $(d_m) = \frac{d_1 + d_2}{2}$

Area of mid section $(Am) = (bd_m + nd_m^2)$

volume of earth work $(v) = A_m \times L = (bd_m + nd_m^2) \times L$

ii) Trepezoidal formula: (for two sections)

In this method also called mean sectional area method

Let A_1 & A_2 be two areas at two ends.

$A = (bd_1 + nd_1^2)$, $A_2 = (bd_2 + nd_2^2)$

$A_m = \frac{A_1 + A_2}{2}$

Volume of earth work (v) = Am ×L

iii) Trepezoidal formula for a series of c/s areas at equal intervals.

Let $A_1, A_2, A_3 \ldots\ldots A_n$ are the cross sectional areas along L.S of Road 'L" is the distance between two cross sections

The volume of earth work

$$V = L\left[\frac{A_1 + A_n}{2} + (A_2 + A_3 + \ldots\ldots + A_{n-1})\right] \text{(or)}$$

$$= \frac{L}{2}\left[(A_1 + A_n) + 2(A_2 + A_3 + \ldots\ldots + A_{n-1})\right]$$

$$= \frac{\text{length}}{\quad}\ [\text{(sum of first and last areas)} + 2(\text{remaing Areas})]\ 2$$

iv) Prismoidal formula for a series of cross sectional areas at equal intervals.

Note : This method is adopted when there is odd number of cross sections. Volume of earth work

$$V = \frac{L}{3}\left[(A_1 + A_n) + 4(A_2 + A_4 + A_6 + \ldots\ldots + A_{n-1}) + 2(A_3 + A_5 + \ldots\ldots + A_{n-2})\right]$$

$$= \frac{\text{length}}{3}\text{(Sum of first and last areas)+4(even areas)+2(odd Areas)]}$$

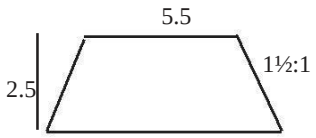
Example 7.1 : Find the volume of earth work in embankment of length 12m. Top width is 5.5m and depth is 2.5m the side slopes ara 1½:1

Sol : Top width b=5.5m

Depth d= 2.5m

side slopes =1½:1 i.e. n=1.5

length L=12m



Volume of earth work V $= (bd+nd^2)L$

$= (5.5 \times 2.5+1.5\times 2.5^2)12$

$= 77.5m^3$

Example 7.2 : The depths at two ends of an embankment of road of length 70m are 2m and 2.5m. The formation width and side slopes are 8m and 2:1 respectively. Estimate the Quantity of earth work by

a) Mid Sectional Area (ii)Mean sectional Area method. Sol: a) b=8m, d1=2m, d2=2.5m, l=70m, n=2

Mean depth $d_m = \frac{d_1+d_2}{2} = \frac{2+2.5}{2} = 2.25m$

Mid sectional Area = Am = $bdm+ndm^2 = (8x2.25+2x2.25^2)2=28.125m^2$

Volume of earth work (V)= AmxL = $28.125x70=1968.75m^3$.

b) Area of c/s at one end $A_1 = bd_1 +nd_1^2 = 8x2+2x2^2 =24m^2$ Area of C/s at other end $A2=bd_2+nd_2^2 =8\times 2.5+2\times 2.5^2 =32.5m^2$

Mean Sectional Area (Am) $= \frac{A_1+A_2}{2} = \frac{24+32.5}{2} = 28.25m^2$

Volume of earth work (V)= AmxL=$28.25x70=1977.5m^3$.

Example 7.3

The following width of road embank ment is 10m. The side slopes are 2:1 The depth along the centre line road at 50m intervals are 1.25, 1.10, 1.50, 1.20, 1.0,1.10, 1.15m calculate the Quantity of earth work by

a) Mid sectional rule
b) Trepezoidal rule
c) Prismoidal rule

a) Mid Sectional rule : b=10m, n=2.

Chainage	Depths	Mean depth (d_m)	Area of ($bd_m+nd_m^2$)	Length b/w Chainages	Quantity (m^3) $A_m \times L$
0	1.25				
50	1.10 }	1.175	14.51	50	725.56
		1.125	13.78	50	689.06
100	1.15				
		1.175	14.51	50	725.56
150	1.20				
		1.10	13.4	50	671.00
200	1.00				
		1.02	12.70	50	635.25
250	1.10				
		1.125	13.78	50	689.06
300	1.15				

Total $4135.49m^3$

b) Trepezoidal rule

$A = bd + nd^2$

$A_1 = bd1+nd_1^2 = 10x\ 1.25+2x\ 1.25^2 = 15.625 m^2$

$A_2 = bd2+nd_2^2 = 10x\ 1.10+2x\ 1.10^2 = 13.42m$

$A_3 = 10x\ 1.15+2.1.15^2 = 14.145m^2$

$A_4 = 10x\ 1.2+2x1.2^2 = 14.88m^2$

$A_5 = 10x\ 1.0+2x1^2 = 12.0m^2$,

$A_6 = 10\ x\ 1.1 +2x1.1^2 = 13.42m^2$

$A_7 = 10x1.15+2x1.15^2 = 14.145\ m^2$

Volume of earth work by Trepezoidal rule

$$V = L\left[\frac{A_1 + A_n}{2} + (A_2 + A_3 + \ldots A_{n-1})\right]$$

$$= 50\left[\frac{15.625 + 14.145}{2} + (13.42 + 14.145 + 14.818 + 12.0 + 13.42)\right]$$

$$= 4137.50\ m^3$$

c) By Prismoidal rule

$$v = \frac{L}{3}\left[(A_1 + A_n) + 4(\text{even Areas}) + 2(\text{Odd Areas})\right]$$

$$= \frac{L}{3}\left[(A_1 + A_7) + 4(A_2 + A_4 + A_6) + 2(A_3 + A_5)\right]$$

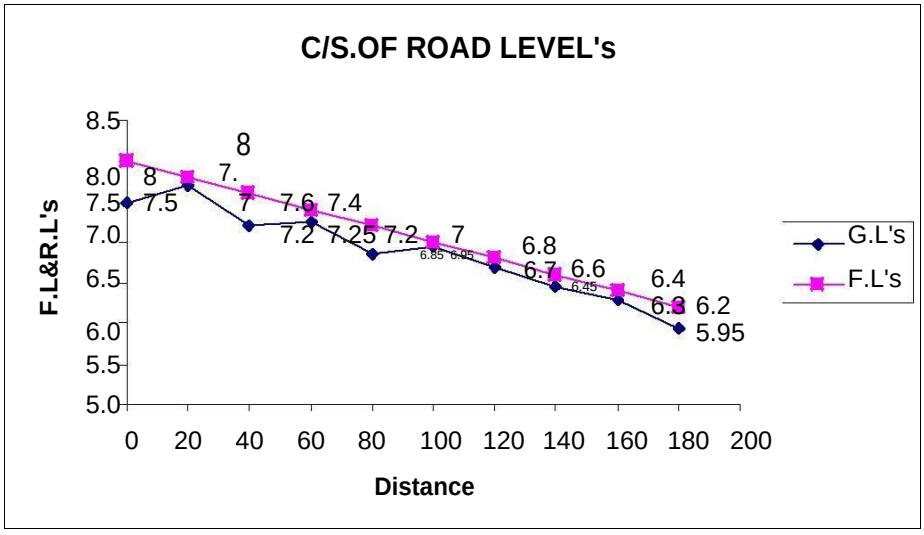
$$= \frac{50}{3}\left[(15.625 + 14.145) + 4(13.42 + 14.88 + 13.42) + 2(14.145 + 12)\right]$$

$$= 4149\ m^3$$

Example 7.4:- Estimate the Quantity of earth work for a portion of road from the following data

Chainage	0	1	2	3	4	5	6	7	8	9
RL	7.50	7.70	7.50	7.25	6.85	6.95	6.70	6.45	6.30	5.95

The formation level at Chainage 0 is 8.0 and having falling gradient of 1 in 100. The top width is 12m and side slopes 1½ horizontal to 1 vertical assuming the transverse direction is in level calculate the quantity of earth work Take 1 chain = 20m by using trepezoidol & Prismoidol formula.



Sol : -

b=12m n=5

Chainage	Distance	Reduced level	Formation Level	Depth(d) of		Area of	
				Embank-ment	Cutting	Embank-ment $bd+nd^2$	Cutting
0	0	7.50	8.0	0.50		6.375	
1	20	7.70	7.8	0.10		1.275	
2	40	7.50	7.6	0.10		1.215	
3	60	7.25	7.4	0.15		1.839	
4	80	6.85	7.2	0.35		4.38	
5	100	6.95	7.0	0.05		0.63	
6	120	6.70	6.8	0.10		1.215	
7	140	6.45	6.6	015		1.837	
8	160	6.30	6.4	0.10		1.215	
9	180	5.95	6.2	0.25		3.09	

Trepezoidal formula :

$$V = L\frac{A_1 + A_n}{2} + (A_2 + A_3 + ... + A_{n-1})$$

$$= 20\frac{6.375 + 3.09}{2} + (1.215 + 1.215 + 1.837 + 4.38 + 0.63 + 1.215 + 1.837 + 1.215$$

$$= 365.53 m^3$$

Prismoidal formula :

$$V = \frac{L}{3}\left[(A_1 + A_n) + 4(\text{even areas}) + 2(\text{Odd areas})\right]$$

$$= \frac{20}{3}\left[(A_1 + A_{10}) + 4(A_2 + A_4 + A_6 + A_8) + 2(A_3 + A_5 + A_7 + A_9)\right]$$

$$= \frac{20}{3}[(6.375+3.09+4(1.215+1.837+0.63+1.837) + 2(1.215+4.38+1.815+1.215)]$$

$$= 317.27 m^3$$

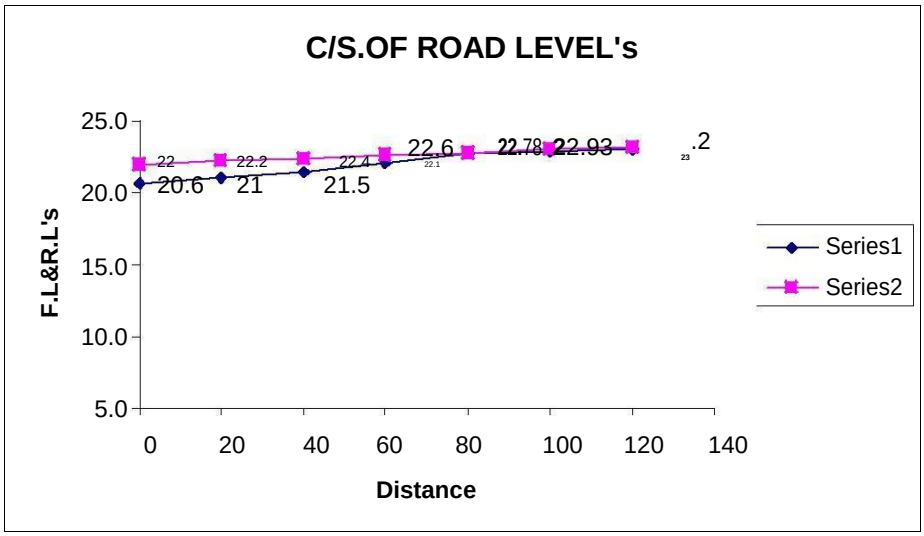
Example 7.5:- The road has the following data

Chainage	0	20	40	60	80	100	120
RL of Ground	20.6	21.0	21.5	22.1	22.7	22.9	23.0

The formation level at chainage zero is 22.0 and having a rising gradient of 1 in 100 the top width is 12.0m and side slopes are1½ :1 Assuming the transverse direction is in level. calculate the quantity of earth work by

a) Trepezoidal formula b) Prismoldal formula

Chainage Distance	Reduced level	Formation Level	Depth (d)of		Area of	
			Embark-ment	Cut-ting	Embark-ment	Cutting
0	20.6	22.0	1.40		19.74	
20	21.0	22.2	1.20		16.56	
40	21.5	22.4	0.90		12.01	
60	22.1	22.6	0.50		6.375	
80	22.7	22.8	0.10		1.215	
100	22.9	23.0	0.10		1.215	
120	23.0	23.2	0.20		2.460	



a) Trepezoidal formula:

Vol of earth work in embankment

$$V = L\left[\frac{A_1 + A_n}{2} + (A_2 + A_3 + \ldots\ldots + A_{n-1})\right]$$

$$= 20\left[\frac{19.74 + 2.46}{2} + (16.56 + 12.01 + 6.375 + 1.215 + 1.215)\right]$$

$= 969.5\ m^3$

b) Prismoidal formula

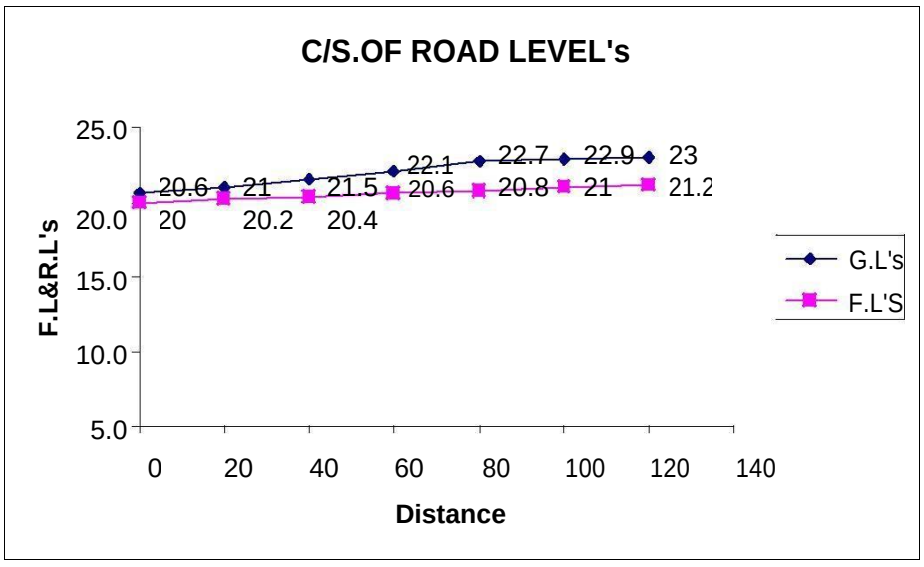
$$V = \frac{L}{3}[(A_1 + A_n) + 4(\text{even Areas}) + 2(\text{Odd Areas})]$$

$$20 = \frac{3}{3}[(19.74+2.46)+4(16.56+6.325+1.2+5)+2(12.01+1.215)]$$

$= 968.33 m^3$

Example 7.6:-From the above problem if the formation level at 0th chainage in 20m. Calculate the volume of earth work by using the formulas?

Chainage	Reduced level	Formation Level	Depth (d)of		Area of	
			Embank-ment	Cutting	Embank-ment	Cutting $bd+nd^2$
0	20.60	20.00	--	0.60	--	7.740
20	21.00	20.20	--	0.80	--	10.56
40	21.50	20.40	---	1.10	---	15.015
60	22.10	20.60	--	1.50	--	21.375
80	22.70	20.80	--	1.90	--	28.215
100	22.90	21.00	--	1.90	--	28.215
120	23.00	21.20	--	1.80	--	26.460



a) Trepezoidal formula:

Vol.of earth work in cutting

$$V = L\left[\frac{A_1 + A_n}{2} + (A_2 + A_3 + \ldots\ldots + A_{n-1})\right]$$

$$= 20\left[\frac{7.74+26.46}{2} + (10.56+15.015+21.375+28.215+28.215)\right]$$

$$= 2409.6 \text{ m}^3$$

b) Prismoidal formulae :

$$V = \frac{L}{3}\left[(A_1 + A_n) + 4(\textit{even areas}) + 2(\textit{Odd areas})\right]$$

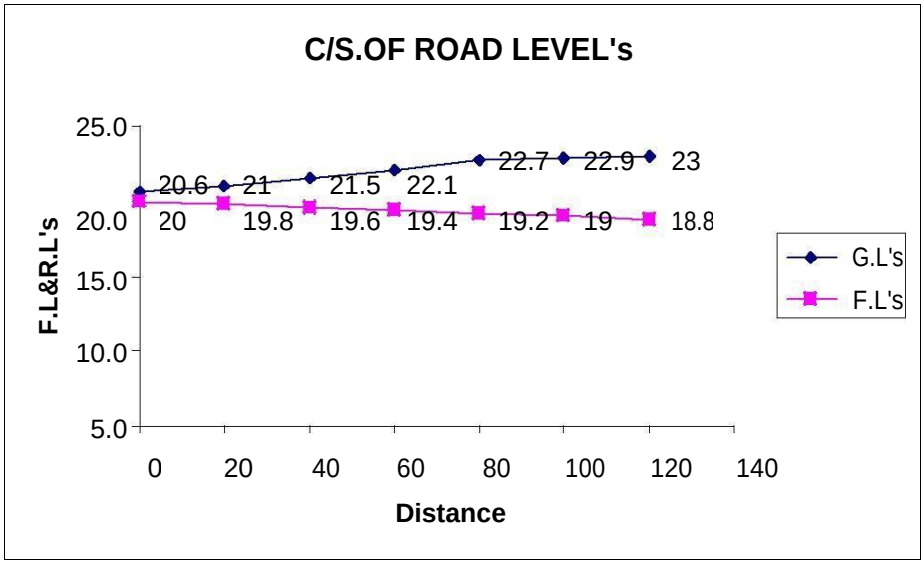
$$= \frac{L}{3}\left[(A_1 + A_7) + 4(A_2 + A_4 + A_6) + 2(A_3 + A_5)\right]$$

$$= \frac{20}{3}\left[(7.74+26.46) + 4(10.56+21.375+28.215) + 2(15.015+28.215)\right]$$

$$= 2408.4 \text{ m}^3$$

Example 7.7:-From the same above problem 7.6 if the gradient is in 100 falling calculate the quantity of earth work by using the formulas

Chainage	Reduced level	Formation Level	Depth (d)of Embank-ment	Depth (d)of Cut-ting	Area of Embank-ment	Area of Cutting
0	20.60	20.00	--	0.60	--	7.74
20	21.00	19.8	--	1.20	--	16.56
40	21.50	19.6	---	1.90	---	28.215
60	22.10	19.4	--	2.70	--	43.335
80	22.70	19.20	--	3.50	--	60.375
100	22.90	19.0	--	3.90	--	69.615
120	23.00	18.80	--	4.20	--	76.86



a) Trepezoidol formulae:

Vol.of earth work in cutting

$$V = L\left[\frac{A_1 + A_n}{2} + (A_2 + A_3 + \ldots\ldots + A_{n-1})\right]$$

$$= 20\left[\frac{7.74+76.86}{2} + (16.56+28.215+43.335+60.375+69.615)\right]$$

$$= 5208\ m^3$$

b) Prismoidal formulae :

$$V = \frac{L}{3}\left[(A1 + An) + 4(\text{even areas}) + 2(\text{Odd areas})\right]$$

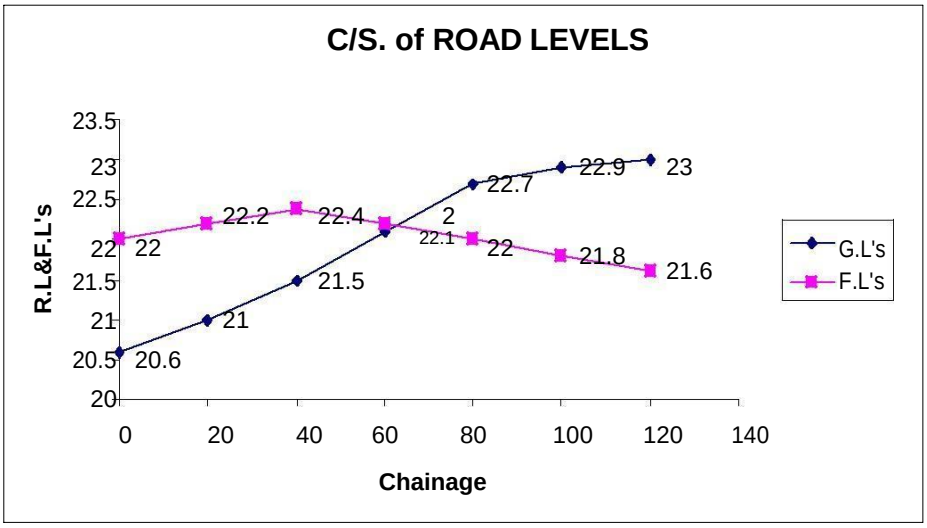
$$= \frac{L}{3}\left[(A_1 + A_7) + 4(A_2 + A_4 + A_6) + 2(A_3 + A_5)\right]$$

$$= \frac{20}{3}\left[(7.74+76.86) + 4(16.56+43.335+69.615) + 2(28.215+60.375)\right]$$

$$= 5198.8\ m^3$$

Example 7.8:- From the problem 7.5 if the gradient is 1 in 100 raising upto 40th chainage and 1 in 100 falling ragient from 40th Chainage to 120th chainage. Calculate the vol of earth work by using the formulas.

Chainage (m)	R.L.	F.L.	Depth (d)of .		Area of .	
			Embank-ment	Cutting	Embankment $bd+nd^2$	Cutting $bd+nd^2$
0	20.6	22.0	1.40		19.74	
20	21.0	22.20	1.20		16.56	
40	21.5	22.40	0.90		12.01	
60	22.1	22.20	0.10		1.215	
62.5			0.00	0.00	0.000	0.000
80	22.7	22.00		0.70		9.135
100	22.9	21.80		1.10		15.015
120	23.0	21.60		1.40		19.74



From similer triangel properties

$$\frac{x}{0.1} = \frac{20-x}{0.7}$$

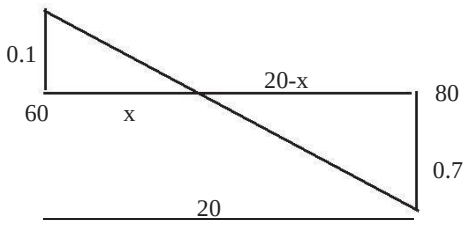
$0.7x = (20-x)0.1$

$0.7x = 2-0.1x$

$0.7x+0.1x = 2$

$0.8x = 2$

$$x = \frac{2}{0.8} = \frac{20}{8} = 2.5$$



Earth work Calculations 94

vol of earth work in embankment

Chainage	0	20	40	60	62.5
Area	19.74	16.56	12.01	1.215	0.00

here the intervals are not equal so we have to take the seperate volumes from oth chainage to 60th chainage and 60th chainage to 62.5 chainage

V = Vol (0 - 60) + vol(60 - 62.5)

$$= 20\frac{19.74+1.215}{2} + (16.56 + 12.01) + 2.5\frac{1.215+0.00}{2}$$

$$= 782.46 m^3$$

By Prismoidal

$$V = \frac{20}{3}\left[(19.74+1.215) + 4\times16.56 + 2\times12.01\right] + \frac{2.5}{3}\left[(1.215+0.00)\right]$$

$$= 742.44\ m^3$$

Vol of earth work in cutting

Chainage	62.5	80	100	120
Area	0.00	9.135	15.015	19.74

Volume (v) = vol (62.5-80)+Vol (80-120)

By Tripezoidal formula

$$V = 17.5\frac{0+9.135}{2} + 20\frac{9.135+19.74}{2} + 15.015$$

$$= 668.98 m^3$$

By Prismoidal

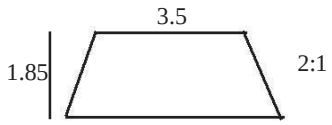
$$v = \frac{17.5}{3}\left[0.9+135\right] + \frac{20}{3}\left[(9.135+19.74)+4\times15.015\right]$$

$$= 646.18\ m^3$$

EXERCISE

Short Answer Questions

1. State the following formulae with usual notation
   a) Prismoidal formula
   b) Trepezoidal formula
2. For an embankment 90m long of uniform gradient when the height of bank is 2.4m at one end and 1.8m at the other end the width of embankment at top is 8m and its side slopes 2 vertical to 1 Horizontal calculate the quantity of earth work by a) Mid Sectional area method b) Mean sectional area method.
3. Find the earthwork in embankment between 5/2km to 5/5km of the proposed road whose c/s is given below.



Essay type questions

1. The road has the following data

Chainage in m	0	30	60	90	120
G.L. in m	25.8	26.5	27.2	28.1	28.5

The Formation level at chinage zero is 28 and having the rising gradient of 1 in 100 the top width is 10m and the side slopes are 1½ horizontal to 1 vertical Assuming transverse slope is level calculate the volume of earth work.

2. The reduced level of ground along the centre line of a proposed road from chaiage 0 to 6 are given below. The formation level at '0' chainage is 10.00 and the road is in down ward gradient of 1in 100 formation width of road is 10m and side slopes are 2:1 for both banking and cutting. Length of chain is 20m calculate the quantity of earth work required by a) Trepezoidal rule b) Prismoidal rule.

Chainage	0	1	2	3	4	5	6
R L of ground	8.0	7.8	7.6	7.3	6.9	6.2	6.5

Chapter 8

DETAILED ESTIMATES

A) Gravel Road

A gravel road comprising of a gravel of thickness 100mm compacted thickness and compacted by hand roller. A gravel is placed over an earthern formation which is compacted by a 2 tonne roller.

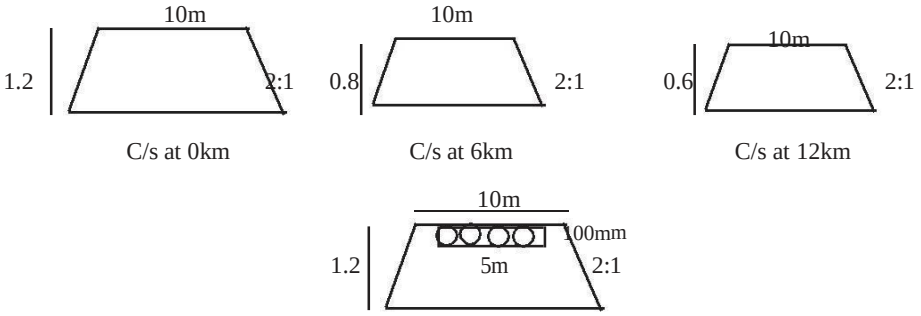
The estimate of gravel road consists of determining the folloiwng quantities.

i) Earth work excavation and depositing on bank and compaction

ii) collection of gravel

iii) spreading compacting gravel to OMC

Example 8.1:- Find the estamation of a gravel road for the fig shown below. for a proposed road from 0km to 12km.



S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	a) Earth work excavation and depositing on bark with an intial lead and lift of soil for formation and filing of pits, pot holes etc.						
	Area of C/s at O km (A) = $10x1.2+2x1.2^2 = 14.88m^2$						
	Area of C/s at 6 Km (A2) = $10x0.8+2x0.8^2 = 9.28m^2$						
	Area of C/s. at 12 km (A3) = $10x\ 0.6+2x0.6^2 = 6.72m^2$						
	Vol of earth work = $\frac{14.88+6.72}{2} + 9.28$ = 12048m3						
	b) Add extra for pits & pot holes LS = 52m3						
	Total = 12100 m3						
	Deduct for gravel = 1 x 1200 x 5 x 0.1 = $600\ m^3$						
	Net Earth work = 12100-600=11,500m^3						

2.	Collection of gravel including cost & conveyance etc complete 50% allowance is given for OMC compaction.	1	1200	5.00	0.15	900m^3	
3	Spreading of gravel and watering	1	1200	5.00	---	6000m^2	
4.	Un forcean items @2%					L.S.	
5.	Tools and plant @1%					L.S	
6.	P.S. and continsecis @ 4%					L.S	

Cement concrete road

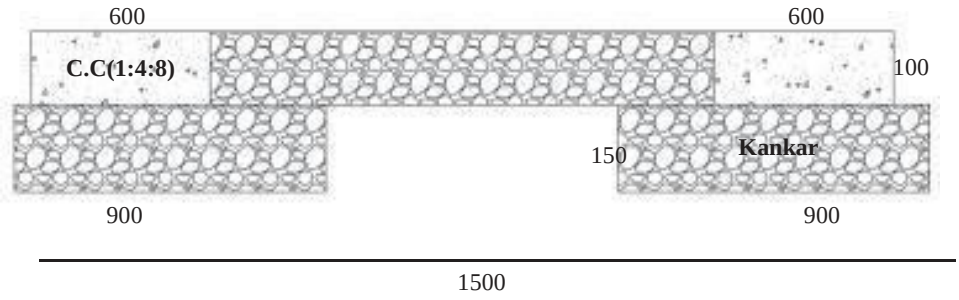
C.C. road is laid over an existing W.B.M road, In certain cases. It is laid over a prepared sub grade and a base course is provided. The concrete used for roads is M15 grade using 20mm H.B.G. metal while for base course a concrete of 1:4:8 using 40mm HBGmetal the stages of Estimations of a C.C.road is

a) Earth work excavation and deposting on the bank
b) Cement concrete (1:4:8) for base course
c) Cement concrete (1:2:8) for wearing course.

Example 8.2:- Calculation for the estimation of a C.C.road for a length of 100m and width of C.C.road is 3.50m with 100mm thickness of earh layer.

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	C.C.(1:4:8) for base course including cost and conveyance of all materials at site machine mixing, laying curing etc.	1	100	3.5	0.1	35. cum	
2	C.C.(1:2:4) for pavement	1	100	3.5	0.1	35cu m	
3	Provision for mastic pads					L.S.	
4	Unforcean items @2%					L.S.	
5	Petty supervision @4%					L.S	

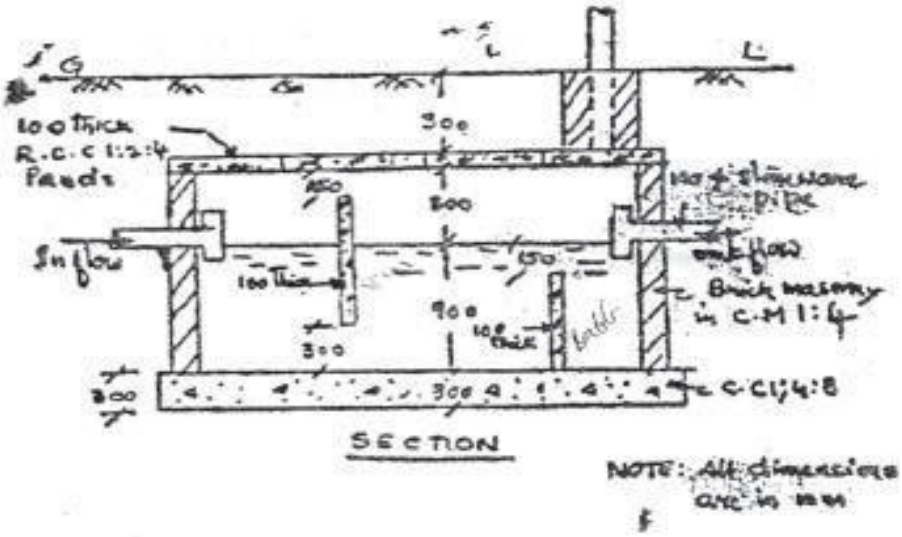
Example 8.3 :- Prepare an estimate for 1 Km length of C.C. track or the fig shown below.

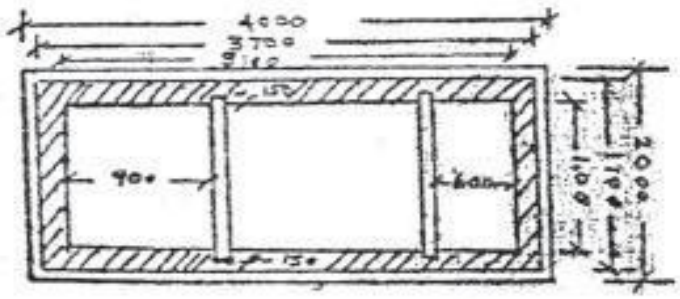


S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	C.C.(1:2:4) in tracks including laying	2	1000	0.6	0.1	120m^3	
2.	laying of kankar (for loose thickness increase with $33\frac{1}{3}$ %)						
	a) in between C.Ctracks	1	1000	0.9	0.133	120	
	b) under C.C.tracks	2	1000	0.9	0.20	360	
						480	m^3

Example 8.4:- Calculate the quantities of different items of the figure shown in below

SEPTIC TANK





PLAN

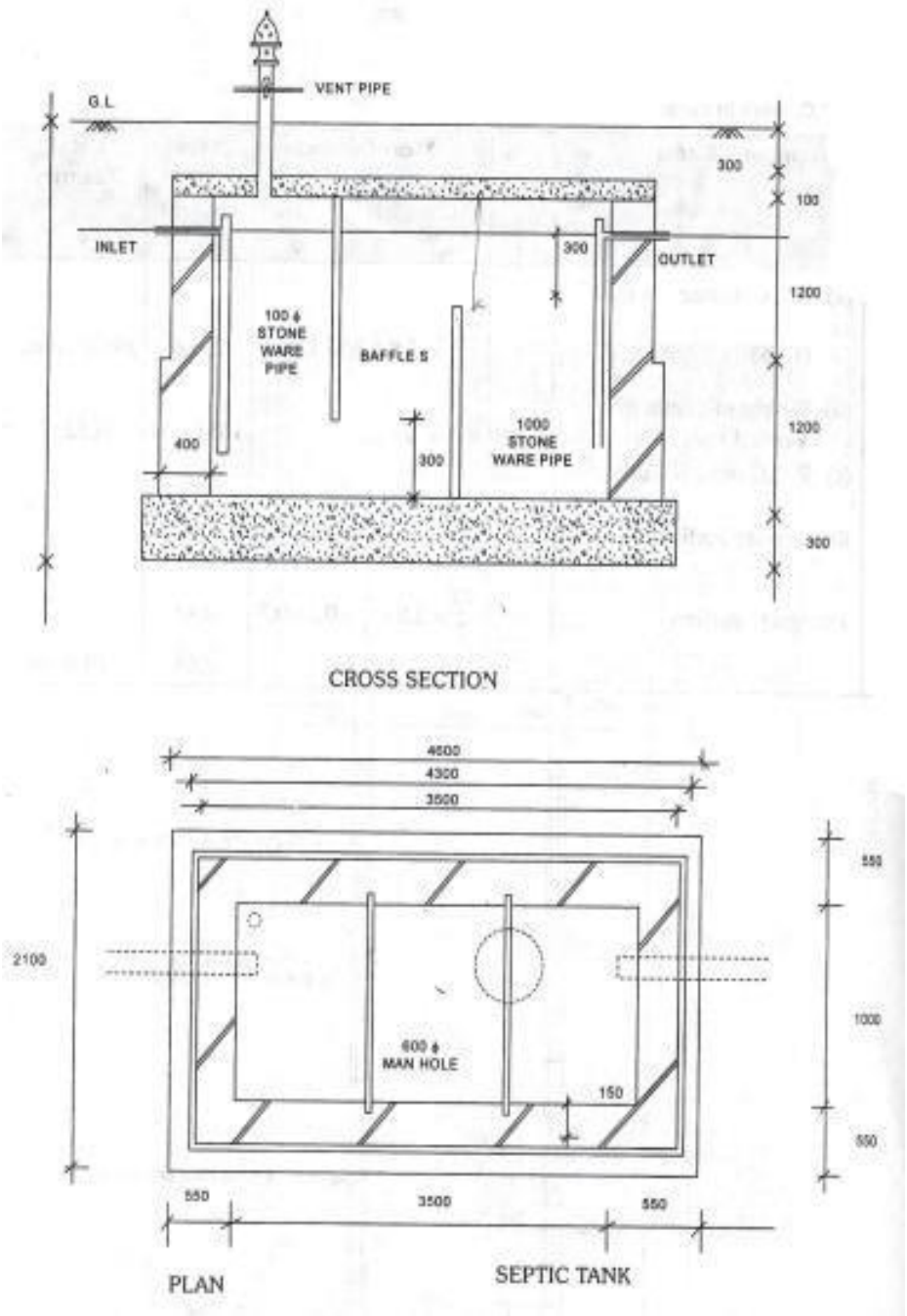
SEPTIC TANK

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	Earth work excation upto G.L.	1	4.0	2.0	1.9	$15.2m^3$	
2.	C.C. (1:4:8)bed	1	4.0	2.0	0.3	$2.4m^3$	
3.	Brick masonary in CM 1:4 for side walls						
	3.7 / 1.7 / 0.3						
	Long wall short wall method						
	Long wall	2	3.7	0.3	1.2	2.664	
	Shortwalls	2	1.1	0.3	1.2	0.792	
	(or)				Total	**3.456**	
	centre line method						
	3.4 / 1.4						
	total centre line length (3400+1400)2=9600	1	9.6	0.3	1.2	3.456	
4	R.C.C. (1:2:4) using 20mm HBG metal						
	a) R.C.C slab		3.70	1.70	0.1	0.629	
	b) Baffle wall		1.40	0.1	0.75	0.105	
	c) Scum board		1.40	0.1	0.75	0.105	
					Total	**0.839**	
5.	Plastering with CM(1:4) with 20mm th						
	a) Inner surface of septic tank		8.40	---	1.2	10.08	(3.1+1.1)2=8.4
	b) flooring		3.1	1.1	--	3.41	
	c) Sides of Scum board	1x2	1.1	--	0.75	1.65	
	d) Top and bottom	1x2	1.1	0.1	--	0.22	
	e) sides of baffle wall	1x2	1.0	--	0.75	1.65	
	f) top of baffle wall	1x1	1.0	0.1	---	0.1	
	Deduct for Pipe openings	2	$\frac{\pi}{4}\times(0.1)_2$			0.0157	
	Total (net) Plastering				Total	**17.10**	

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
6.	a) Earth filling with excavated soil around the brick wall						
	4.0						
	2.0						
	0.15						
	centre line method						
	3.85						
	1.85						
	Total Centre line length =						
	(1.85+3.85)2 = 11.4	1	11.4	0.15	1.30	2.223	
	b) over R.C.C. pannels	1	3.70	1.70	0.30	1.1887	
	(neglecting the space for				Total	**4.11**	
	venti pipe footing)						
7	supply fixing of steel grills						
	including labour for fabrication @ 750N/m^3	1	0.839	x750=	629.25 N	62.92 Kgs	
8	Provision of 100mm dia inlet and out let tees	1x2	---	--	--	2Nos	
9.	Provision of A.C.ventilating shaft 3m hight duly embedded in b/w at bottom	1x1			1 No	1 No	
10	Provision for A.C.cowl for ventilating pipe	1x1			1nos	1 No	
11	Unforcean itsm @2x				L.S	L.S	
12	P.S.& contingencies @4%				L.S	L.S	

Example 8.5:- Calculate the quantities of different items of the figure shown in below

SEPTIK TANK



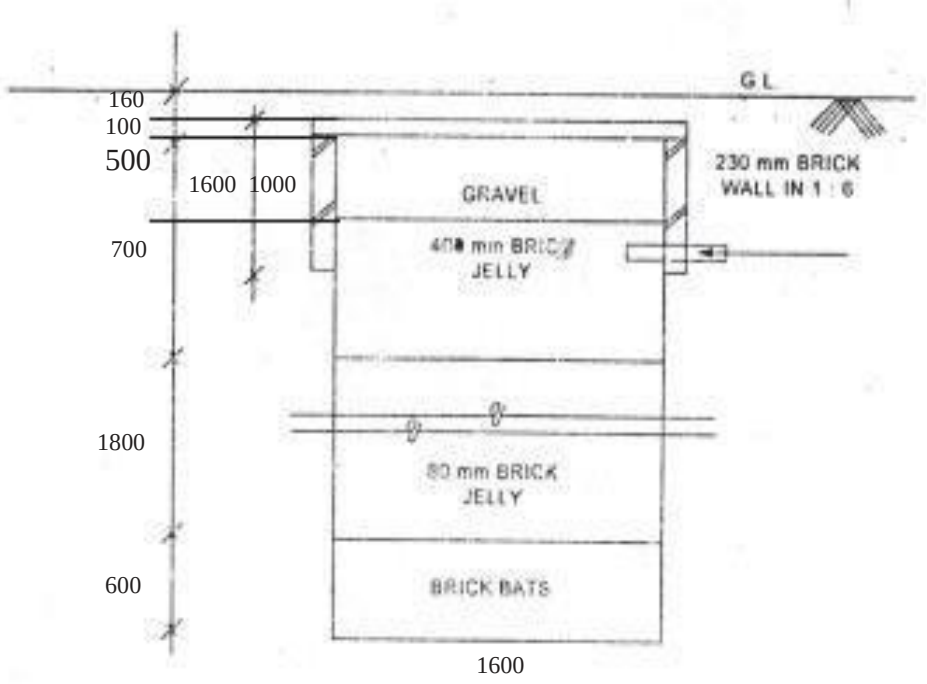
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	Earth work excavation upto G.L.	1	4.60	2.10	3.1	29.95	
2.	C.C.(1:4:8) bed for foundation	1	4.6	2.10	0.30	2.898	
3.	Brick masonary in CM 1:4 for side walls						
	a) Upto first step (400th)						
	4300 / 1800 / 400						
	centre line method	1	10.60	0.40	1.20	5.088	
	3900 / 1400						
	total centre line length = (3900+1400)2=10600						
	b) from Ist to II step (300th)						
	4100 / 1600 / 300						
	Centre line method						
	3800 / 1300						
	Total centre line length (3800+1300)2=10200	1	10.20	0.3	1.20	3.672	
	Total Brick Masonry		**= 5.088+3.672 =**			**8.76**	
4.	R.C.C. (1:2:4) using 20mm HBG metal						
	a) RCC roof slab	1	4.10	1.60	0.1	0.656	(Assure projection
	b) Baffle wall	1	1.20	0.10	1.80	0.216	100mm inside the
	c) 8cum ward	1	1.20	0.10	2.10	0.252	wall)
					Total	**1.124**	

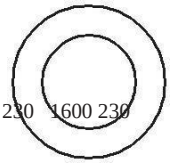
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
5.	Plastering with CM(1:4) with 20mm thick						
	a) Inner surface of septic tank	1	9.0	--	2.4	21.6	L =2(3.5+1.0)=9.0
	b) flooring	1	3.5	1.0	--	3.15	
	c) sides of scum board	1x2	1.0	--	2.1	4.2	
	d) Bottom of scum board	1	1.0	0.1	---	0.1	
	e) sides of baffle wall	1x2	1.0	---	1.8	3.6	
	f) Top of baffle wall	1	1.0	0.1	--	0.10	
	g) deduction for Pipe opening	2	$\frac{\pi}{4}(0.1)^2$			-0.015	
					Net Plastering =	**33.08** m^2	
6.	Earth filling with excavated soil around the brick work a) upto first step						
	4750 / 2250 / 150			1.60			
	4450 / 1950						
	Total length = (4.45+1.95)2						
	= 12.8 12.80 0.15 1.2 2.304 b) from 1st step to up to Ground Level						
	4600 / 2100 / 250			1x2			
	4350 / 1850			1x1			
				1x1			
	Total Centre Line length =2(4.35+1.85) = 12.4	1	12.4	0 0.25	1.60	4.96	

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
7	Supply & fixing of steel grills including labour for fabrication @750 N/m^3	1				L.S	
8	Provision of 100mm dia inlet & outlet Tees	1x2	---	----	---	2Nos	
9	Provision of A.C. cowl for ventilating shaft 3 mt height duly embeded below at bottom	1x1	--	--	--	1No	
10	Provision of A.C. cowl for ventilating pipe	1x1	--	--	--	1 No	
11	Unforceen items @2x					L.S	
12	R.S.& Contingeties @4%					L.S	

Example 8.6:- Calculate the quantities of different items of the figure shown in below

SOAK PIT



	o. Particulars of Items			No.	L	B	H	Q	Explanation
1.	Earth work excavation in non cohesive soils like sandy soils with an intial lead & lift								
	a) Soak pit	1	$\frac{\pi}{4}\times 1.6^2$		3.86	7.76			
	b) side brick wall	1	$\frac{\pi}{4}(2.06^2-1.6^2)$		1.16	1.53			
					Total	**9.29**			
2.	Brick work in CM (1:5) with country bricks including cost and conveyance etc complete alround the pit								
		1	$\frac{\pi}{4}(2.06^2-1.6^2)$		0.9	1.19			
	centre line method								
		1	$\pi(1.83)$	0.23	0.9	1.19			
3.	supply & packing including cost &con-veyance								
	a) Brick bats	1	$\frac{\pi}{4}\times 1.6^2$		0.6	1.2			
	b) 80mm brick jelly	1	$\frac{\pi}{4}\times 1.6^2$		1.8	3.62			
	c) 0mm brick jelly	1	$\frac{\pi}{4}\times 1.6^2$		0.7	1.4			
	d) gravel brick jelly	1	$\frac{\pi}{4}\times 1.6^2$		0.5	1.00			
					Total	**7.22**			
4.	R.C.C.(1:2:4) slab panels (precast) using 20mm HBG metal inlcuidng cost & conveyance	1	$\frac{\pi}{4}\times 2.06^2$		0.1	0.33			
5.	Filling with clay soil on top of pit upto G.L.	1	$\frac{\pi}{4}\times 2.06^2$		0.16	0.53			

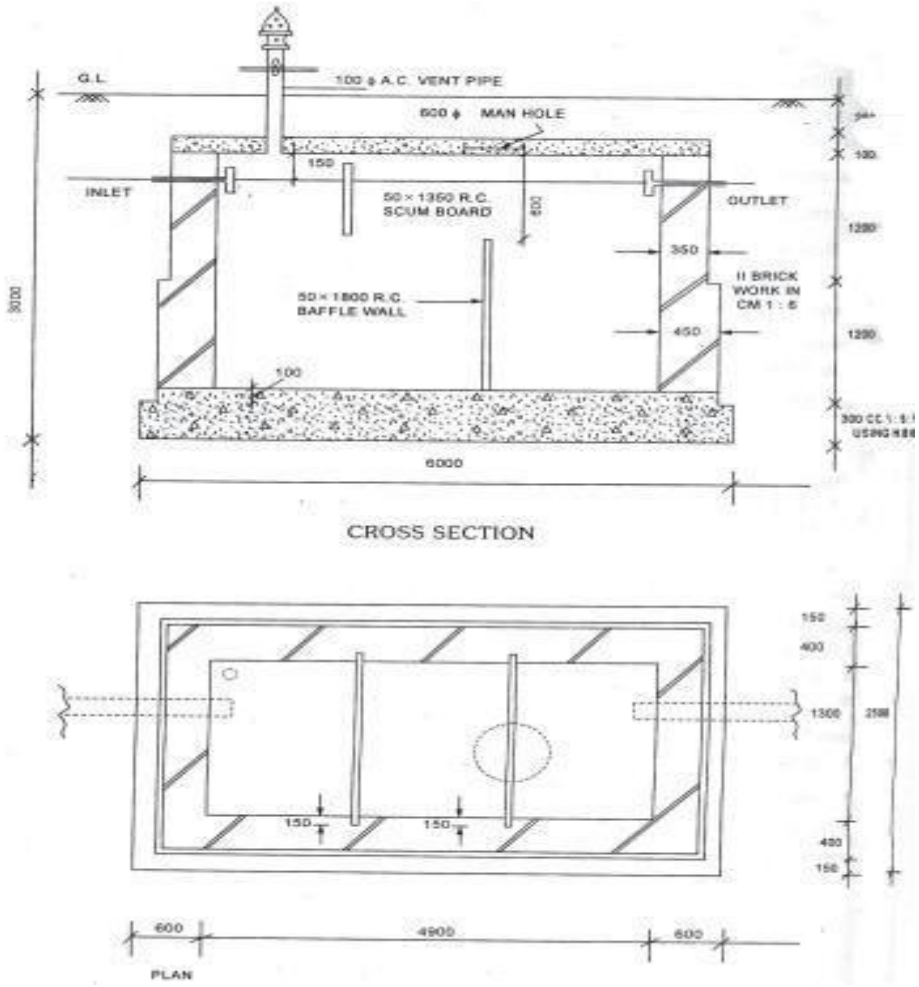
$\frac{\pi}{4}\times 1.6^2$

$\frac{\pi}{4}\times 1.6^2$

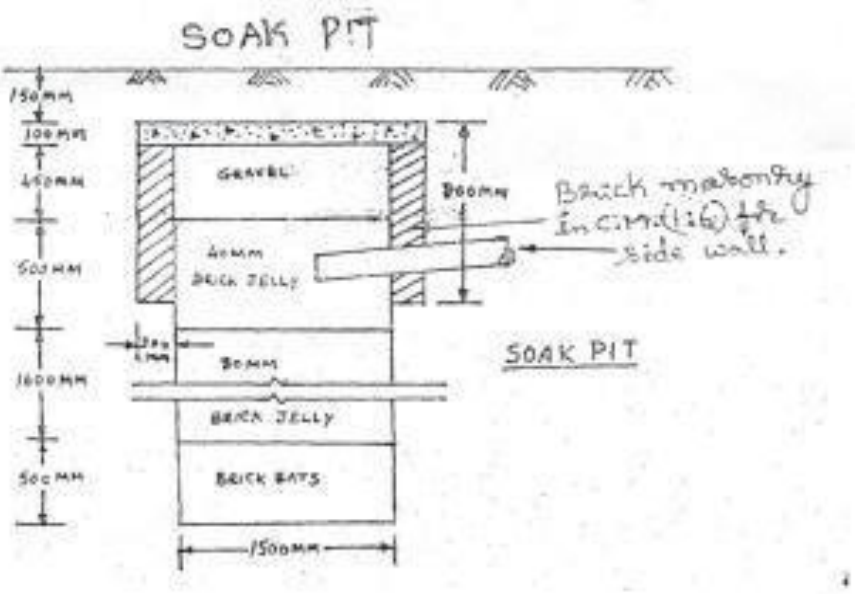
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
7.	Laying of joining 100mm popies including earth work Encavation, sand filling packing joints etc complets						
	L=12+0.23+1.6/2	1	13.03		---	13.03	RM
8	Unforcean items of work@2%	1	--		--	LS	
9	Petty supervision and contingencies @4%	1	---		---	LS	

EXERCISE

1. Calculate the quantities of various elements of the figure shown in below.



2. Prepare a detailed estimate for following items of work of "SOAKPIT" from the given figure
   a) 800mm size brick jelly.
   b) 40mm size brick jelly.
   c) Gravel,
   d) Brick masonry in C.M. (1:6):



APPENDEX

Quantities of Materials and their Costs:

The includes the quantities of various materials for unit quantity of an item followed by the specification and costs of various materilas. the cost in-cludes first cost, freight, transportation and insurance charges.

Labour and Cost:

This includes the number and wages of different categeries of labourers. Skilled, unskilled etc.,

Cost of Equipment:

For big projects it is necessary to use special type of tools and plants like special type of mixed concrete transport vehicle called triping wagons, cranes etc. in order to purchase such tools and plants and amount of 2 to 3% of esti-mated cost is provided in the estimate.

Over head Charges:

This includes office rent, depreciation of equipments, salaies of office staff, postage, lighting travelling allowances, telephone bills. the contractor may provide small tooks like ladders, trowels, ropes etc., fo his workmen.Here an amount of 5% of estimated cost is provided towards overhead charges.

Profit :

Generally 105 of estimated cost is considered for contractor's profit after allowing the charges of equipments and establishments. For small job s 15% and large works 8% profit is considered.

Standard Data Book:

This book gives the quantities of materials and labour required for unit item of work.

Standard scheduled of rates:

The rates of materials and wages of laboures are fixed by superintend-ing Engineer for this cicle for evey year.And these rates ae approved by board of enginees. The S.S.R. for 2002-2003 is presented in the last pages.

Water Charges:

For drinking and for work,s the arrangement of water is done either by sinking tube well or by giving connection to the work site from corporation by a pipe line. Centrally 1% of estimated.

Task or out-turn work:

This is the quantity of work which can be done by an atisan for trade working of 8 hours. Although the task is different from person to person ac-cording to their physical and mental abilities, the average task or out turn work is taken into consideration for preparing rate per unit item. Task does not mean that the quantity of work done by one oner labour. But other laboureso helpers also be engaged to complete the given task.

For example a manson can prepare 2.0m3 of cement concrete per day provided he is helped by two mazdoors to carry and mix the ingredients.

The following may be taken as approximate quantity of work out-turn work or task for an average artisan per day.

Sundries:

A lumpsum amount is generally provided in the analysis of rates, to-wards purchase of certain tools and other pretty items which cannot be ac-counted in detail. an amount of 2½ to 3% of labour cost is provided for this purpose.

TABLE

No.	Description of work	Quantity of work per day (8 hours of day)
1.	Earth work excavation in foundation, trenches in ordinary soils, lead 50m and lift up to 1.5m	2.75 m^3/Mazd
2.	Earth work in excavation in foundation trenches in hard soils, lead 50m and lift upto 1.5m	2.10m^3/ Mazd
3.	Earth work in soft or decomposed rock by blasting lead up to 50m and lift upto 1.5m	0.55m^3/ MaZd
4.	Sand filling in plinth, consolidation and dressend	4.0m^3/ Mazd
5.	Single layer brick flat soling including ramming, dresing etc.	9.0Sqm/ Mazd
6.	Lime concrete in foundation	10m^3/Mason
7.	C.C.	4.0m^3/ Mason
8.	R.C.C. (1:2:4)	3.25m^3/ Mason
9.	Brick work in foundation and plinth	1.40m^3/Mason
10	Brick work in super structure (G.F)	1.25m^3/Mason
11	Half brick work in partition wall	7.00Sqm/ Mason

12	Bricks in plain arches	1.0m^3/ Mason
13	Reinforced brick work in slabs	1.00m^3/ Mason
14	2.5 cm C.c.D. P.C.	12.5 m^2/Mason
15	2.0cm D.P.C. with C.M.	20Sqm/ Mason
16	R.R.Masonry foundation & Plinth	1.00cm/Mason
17	R.R.Masonry in superstructure	0.9m^3/ Mason
18	Ashlar masonry in superstructure	0.40m^2
19	C.R.S. Masonry in superstructure	0.67m^2
20	Brick on 1st floor with C.M.	1.0 Sqm/ Mason
21	7.5 cm floor with (1:4:8)	10.0Sqm/mason
22	Teraced flooring -7.5cm TH	20Sqn/mason
23	2.5cm THC.C. flooring	12.50 Sqm/mason
24	Terrazzo flooring 6mm TH mosaic work ove 2cm thick C.C.(1:2:4)	5.0 Sqm/m^2
25	Pre cast Terrazzo tiles 2mm TH, laying on bed of 25mm thick L.M.	5.0 Sq/m^2
26	Ranigang Tile roofing	6.7 Sqm
27	Mangaloe tile roofing including wooden battens, tiles set in C.M.	20 m^2
28	Corrugated G.I. sheet roofing	10Sqm
29	12mmTH current plaster on new brick work	10Sqm
30	Rule pointing on brick work	10Sqm
31	Single coat white washing over old white washing	133 Sqm
32	White washing over one coat printing	33.70 sqm
33	Lime pinning over interior surfaces(Plaster)	5.00sqm
34	Water proofing cement paint to new cement plaster	20.m^3/Paints
35	Snow cem washing on plaster surface two coats	20 m^3/sqm
36	Priming coat with ready mined primer on wood or steel	40m^3
37	Painting two coats with ready mined paint for wood work	18m^2
38	Breaking of over burnt brick to ballast 40mm down	0.75m^3/Mazd
39	Breaking of over burnt brick to ballast 25mm	0.55m^3

PREAMBLE

1. AREA ALLOWANCES:

A. MUNICIPALITIES

i) Allow 15% extra over basic rates on labour components works (upto a belt of 12k.m from the Municipal limits in all District Head Quarters for all special class, first class and the remaining Municipalities.

ii) For works at Tirumala Hills 30% extra over the S.S.Rates and 30% extra for Hoarsely Hills over the S.S.Rates of (R&B) circle, CHITTOOR is allowed on labour component works.

iii) For works located inside Tirumala Temple allow 20% extra over the rate for Tirumala Hills.

Note: For Items (i) above works within a belt of 12 Kilometers from all the Municipal limits shall be taken into account for purpose of allowing the extra percentage.

B. INDUSTRIAL AREA

10% extra over the basic rates on Labour component shall be al-lowed (upto a belt of 10km from the Municipal limits).

C. RURAL AREA

Allow 15% extra on skilled and semi skilled workmen in rural areas where no other allowances including importation of labour and ameni-ties are admissible

D. AGENCY/TRIBAL AREA

Not applicable to this circle.

E. GHAT ROADS

For the Ghat roads steeper than 1 in 20 gradient, the length of the road may be taken as 1.50 times of the existing length of the road for the purpose of leads only for the conveyance of materials based on the certificate for the Ghat Road given by the Superintending Engineer concerned.

NOTE : Under the compelling circumstances the concerned Chief Engineer can adopt the equivalent length of the road at 2.5 times of the actual length.

F.JAIL COMPOUNDS

15% extra is allowed over labour rates for the works in the Jails compounds, only equivalent number of men mazdoors shall be provided for works in jail Premises as no women and Children are allowed inside.

NOTE: If more than one area allowance such as those for (a) Municipalities (b) Industrial area (c) Ghat Roads are applicable for a particular situation only the maximum out of the allowable percentage is to be allowed.

II. IMPORTATION OF LABOUR AND LABOUR AMENITIES:

Maximum of 13% towards labour importation and amenities to labour butting etc., of the total labour component is allowed only in case of works where the labour component (i.e.,) excluding the cost of ma-terials such as cement and steel works out to more than Rs. 1.00 lakhs vide G.O. Ms. No. 270 T R&B(c-I0 Department dated: 20-5-1978 onthe basis of certificate of the Executive Engineer that the local labour available is not adequate and that labour has to be imported for executing the work subject to the approval of the Chief Engineer Concerned.

NOTE:

1. Extra percentage towards Labour importation and labour amenities where ever necessary is admissible in addition to other percentages allowable.
2. The above percentages may be allowed where ever necessary on the following item.
    1. Labour Rates.
    2. Materials like Sand, Metal Kankar, Quarry rubbish and clay for foundation or filling etc., bricks and tiles.
    3. Jungle Clearance.
    4. Dismantling
    5. Earth work including leads and lifts.
    6. Purely labour involving items like grinding, mixing, binding, steel and feeding ingredients into mixer etc.,
    7. Blasting, Drilling holes etc.,
    8. Stacking metal, Sand, Gravel, Stone, Picking, metalled, grav-elled surface spreading metal etc.,
    9. Loading and unloading materials excluding that parts of work in conveyance of materials by carts and lories.
    10. Labour components to be included in the data for items like masonry, mortar etc.,

III. WATER LEAD

The following labour is allowed for conveyance of water for every half kilometer lead or part there over the initial lead or part there of over the initial lead of half Kilometer.

a) Cement Concrete 1.50 Woman Mazdoor / cum.

b) Masonry 1.60 Woman Mazdoor /cum.

c) Plastering 0.50 Woman Mazdoor / 10sqm.

IV. EXCAVATION OF TRIAL TRENCHES, TRIAL PITS AND EXCA-VATION IN RESTRICTED PLACES.

a) Trial trenches not more than 2 Metres in width and depth not less than twice the Width -20% extra.

b) 1. Trial pits upto 2 M depth 125% extra
2. Over 2M depth and upto 4M depth 200% extra
3. Over 4M depth and upto 6M depth 300% extra
4. Over 6M depth and upto 8M depth 400% extra
5. Over 8M depth and upto 9M depth 400% extra
6. Over 9M depth 550% extra

c) Excavation in Restricted places:

i) Foundation of building, excavation of road boundary drains, model sections for canals, excavation of field channels excava-tion of narrow trenches of similar nature not more than 2M in width and depth not less than twice the width. 50% Extra

ii) For pipe lines where the depth is less than 1.5times 75% Extra the width

iii) For pipe lines where the depth is 1.5 times or more than the width 150%Extra

iv) Silt removal in restricted area such as channels of under tunnels, culverts and syphons. 150% Extra

NOTE :

i) The extra percentage allowed is over S.s., 301 rates for the cor-responding soil, it includes the charges of alllifts and initial lead but do not include dewatering charges if any in respect of all the items under (a) & (b) above.

ii) The above extra percentage in respect of excavation in restricted places are not to be allowed in respect of items involving blasting component which is to be taken as 1/3 of the cost.

V. PROVISIONS OF 1st CLASS AND 2nd CLASS WORK MEN UNDER SKILLED LABOUR

30% of the skilled labour provided in the data may be taken as 1st Class and emaining 70% as 2nd class.

Where the nature of work is same no distinction need be made in case or men and women workers.

VI. CEMENT CONCRETE PROPORTION AND REQUIREMENTS TO COARSE AGGREGATES ETC.,(UNIT=1cum)OF FINISHED WORK

i) For Cement Concrete proportions (1:4:8) (1:5:10) etc. 0.92 cum of coarse aggregate shall be adopted and the quantity of mortar required calculated proportionately in each case.

ii) For Cement concrete proportions (1:5:8) (1:6:10) etc., 0.90 cum of coarse aggregate shall be adopted and the quantity of mortar required calculated proportionately in each case.

VII. REQUIREMENTS OF CEMENT MORTAR FOR STONE MASONRY

Per unit (1cum) of finished work:

a) CR. Masonry first sort - 0.28 cum of Cement mortar
b) CR.Masonry second sort - 0.32 cum of Cement mortar
c) R.R.Masonry - 0.34 cum of Cement mortar

NOTE: In massive walls above 3M thick, 0.40cum of cement mortar shall be allowed.

VIII. REVETMENT AND APRON WORKS

i) The size of stone for the volume range 0.0515 to 0.030 cum shall not be less than 0.30 x 0.30 x 0.15M to 0.30x 0.225 x 0.225M.

ii) The rate of labour components as per the standard Data book is to be adopted for revetment work only. However for apron work Rs. 2.50 per cum should be deducted.

iii) Labour charges for rock to be adopt two thirds of the labour charges of revetment item.

IX. SEIGNIORAGE CHARGES

i) The seigniorage charges as existing actually may be added in the Data rates in the estimates subject to the conditions that the concerned Executive Engineer who prepare the estimates should certify in writ-ing the rates of seigniorage charges in all cases where the seigniorage charges are actually payable.

ii) The revised seigniorage charges as fixed by Government in G.O.M.S. No.154 (Industries and commerce(M-I) Department Dt. 23-07-96 may be adopted as follows.