ESTIMATION COSTING AND VALUATION

COURSE DESCRIPTION AND OBJECTIVE

By the end of the course students will be in a position to estimate quantities of various items of a residential building. He will also be in a position to estimate the earth work required in roads and canals. He will be able to calculate rates of various items of work. He will learn the methods of building valuation and rent fixation

COURSE OUTCOMES:

Prepare quantity estimates for buildings

Roads, rails and canal works

Calculate the quantity of materials required for civil engineering works as per specifications

Evaluate contracts and tenders in construction practices

UNIT – I

Procedure of Estimating : Methods of estimating; Main items of work; Deduction for openings; Degree of accuracy; Units of measurement.

Methods of Building Estimates : Individual wall method; Centre line method; Arch masonry calculation; Estimate of steps.

UNIT – II

Estimate of Buildings : Centre line method - Estimate of residential building ;Estimate of a building from line plan.

Estimate of Buildings : Individual Wall Method - Estimate of residential building; Estimate of a building from line plan.

UNIT – III

Estimate of RCC works : Standard hooks and cranks; Estimate of RCC slab; RCC beam; RCC T– beam slab and RCC column with foundation.

Road Estimate : Estimate of earthwork; Estimate of pitching of slopes; Estimate of earthwork of road from longitudinal sections; Estimate of earthwork in hill roads.

Canal Estimate : Earthwork in canals–different cases; Estimate of earthwork in irrigation channels.

UNIT – IV

Specifications : Purpose and method of writing specifications; General specifications. Detailed Specifications for Brick work; R.C.C; Plastering; Mosaic Flooring; R.R.Stone Masonary.

Analysis of Rates : Task or out – turn work; Labour and materials required for different works; Rates of materials and labour; Preparing analysis of rates for the following items of work:

i) Concrete ii) RCC Works iii) Brick work in foundation and super structure iv) Plastering v) CC flooring vi) White washing.

UNIT – V

PWD Accounts and Procedure ofWorks : Organization of Engineering department; Work charged establishment; Contract; Tender; Tender notice; Tender Schedule; Earnest money; Security money; Measurement book; Administrative approval; Technical sanction; Plinth area; Floor Area; Carpet area; Approximate Estimate; Plinth area estimate; Revised Estimate; Supplementary estimate.

Valuation : Cost; Price & value; Methods of valuation; Out goings; Depreciation; Methods for estimating cost depreciation; Valuation of building.

Miscellaneous Topics : Gross income; Net income; Scrap value; Salvage value; Obsolescence; Annuity; Capitalized value; Years purchase; Life of structures; Sinking fund; Standard rent; Process of fixing standard rent; Mortgage.

TEXT BOOK :

1. B.N. Dutta, “Estimating & Costing in Civil Engineering”, 22nd ed., U.B.S. Publishers & Distributors, New Delhi, 2001.

REFERENCE BOOK :

1. S. C. Rangwala, “Valuation of Real properties”, 12th ed., Charotar Publishing House, Anand, 2002.

ESTIMATION & CONSTRUCTION PLANNING

UNIT - I

INTRODUCTION

"What is the purpose and necessity of studying this subject?" This is the first question which arises in mind. The answer lies in the following questions:-

(a) Has one got enough money to spend on the construction?

(b) Has one got ample time that one can wait for the completion of the construction?

(c) Has one got resources that one can arrange any amount of desired material to be used in construction?

If the answer is *YES*, then the study of this subject is useless. But if the answer is *NO*, then the question arises, "which are the factors necessitating the study of this subject." Any person indulged in the Civil Engineering profession can clearly think of these factors i.e. set amount of funds, costly labour (skilled and unskilled), difficulty in getting good building materials, particularly cement and day to day rising cost of steel, bricks, timber etc. Also *economy* and *standard* of the construction are two important things required. Standard of construction can be achieved by careful supervision and selecting proper specifications whereas for Economy, planning is a must. The total quantity of various materials used in construction, if known before hand, can help the planning towards economy.

TYPES OF ESTIMATES

The estimates may be divided in to the following catagories:-

(1) Preliminary or Approximate estimate.

(2) Rough cost estimate based on plinth area.

(3) Rough cost estimate based on cubic contents.

(4) Detailed estimate.

(5) Annual repair estimate.

(6) Special repair estimate.

(7) Revised estimate

(8) Supplementary estimate.

1. Preliminary or Approximate estimate

This estimate is prepared to decide *financial aspect, policy* and to give idea of the cost of the proposal to the competent sanctioning authority. It should clearly show the necessity of the proposal and how the cost has been arrived at

The calculations for approximate estimate can be done with the following data. The data can be had from a similar construction already complete in the nearby area, excuted by the department.

For example: To calculate approximate estimate for a Hospital, per bed cost is calculated from the recent completed hospital and is multiplied with the number of beds required. Similarly for a house, per square meter plinth area is calculated and is multiplied with the proposed covered area. The specifications should also be same. For a road, expenditure of per kilometer length is taken, width also plays the role.

The following documents should be attached with it.

(a) Detailed report

(b) Site plan of the proposal

(c) It should also clearly mention about the acquisition of land, Provision of electric and water supply etc.

2. Plinth area Estimate (Based on Rough Cost)

Plinth area of a building means Length x Breadth (roofed portion only) excluding plinth offsets. The estimates are prepared on the basis of plinth areas of the various buildings proposed to be constructed. The **rates** are being arrived at the dividing the total cost of construction with its plinth area. For example if total cost of a building is Rs. 2 lakhs and its plinth area is 50 sq. m. then plinth area rate =2,00,000 / 50 = Rs.4000/- per sq.m. Using this rate as basis of the next construction, approximate or rough cost of the proposal can be arrived at by multiplying the plinth area of the proposed building with this plinth area rate.

The following documents are attached with the estimate.

(a) Line plan with brief specifications.

(b) Cost of various services added i.e. electric and water supply etc.

(c) North line should be shown clearly on line plan.

3. Cubic Contents Estimate (Based on Rough Cost)

The cubic contents of a building means plinth area x height of the building. The height is taken from floor level to top of roof.

The cubic contents of the proposed building are multiplied with cubic rates arrived at for the similar construction i.e. total cost of construction divided by cubic contents = cost per cubic metre.
Documents attached are as in No. 2
(Administrative approval is granted on rough cost estimate)

4. Detailed Estimate

After getting Administrative approval on rough cost estimate, detailed estimates are prepared.
In this, the estimate is divided in to sub-heads and quantities of various items are calculated individually. In the end of the detailed quantities, an *abstract* of *cost* giving quantities of each item and rate of every item according to the sanctioned schedule of rates shall be attached. In case of non-schedule rates i.e. rates which are not given in the sanctioned schedule of rates, proper analysis of rates shall be attached. If however the work proposed to be constructed is located in a remote place, the provision for the carriage of the material shall be added in the estimate to avoid any excess over the administratively approved estimate later on. Detailed specifications & report should also be attached with the estimate. Technical sanction is given on detailed estimate.
The detailed estimate shall also provide for the cost of approach road, water supply, electric installations and acquisition of land etc, so as to call it a comprehensive estimate.

5. Annual repair estimate

In order to keep building and roads in perfect condition, annual repairs should be carried out as follow:-
(i) In case of a building-white washing, oiling and painting of doors and windows, cement plaster repairs (inside & outside), repairs of floors etc. In no case this annual repair amount should increase more that 1/2% to 2% of the capital cost of the building.
(ii) In case of a road-filling patches, maintenance of berms etc.

6. Special repair estimate

If the work cannot be carried out of the annual repair funds due to certain reasons resulting in the genuine increase in cost, then special repairs estimate is to be prepared.
The reason of increase may be:-
(i) In case of a building-opening of new doors, change of floors, replastering walls etc.
(ii) In case of roads-if the whole surface is full of corrugation & patches, then the total surface is to be scarified. The old metal is taken out, consolidation by adding more metal is done and top surface is repainted.

7. Revised estimate

When the sanctioned estimate exceeds by 5% either due to the rate being found insufficient or due to some other reasons, a fresh estimate is prepared which is called a Revised Estimate. A comparative statement on the last page of the estimate is attached giving there in the reasons of the increase of cost in case of each item.

8. Supplementary Estimate

This is fresh detailed estimate in addition to the original sanctioned estimate prepared when additional works are deemed necessary during the progress of a work to supplement the original works. The abstract of cost should show the amount of the original sanctioned estimate as well as the supplementary amount for which sanction is required.

METHODS OF TAKING OUT ESTIMATES

The calculations of quantities of materials can be done using various methods of estimates. The application of an individual method depends upon the design and shape of the building. The different methods are as under:

1. Centre line method.
2. Crossing method.
3. Out to out and in to in method.
4. Bay method.
5. Service unit method.

1. Centre line method

This method is suitable only if the offsets are symmetrical and the building is more or less rectangular in shape. The centre line of the building is determined carefully after doing deductions for repeated measurements (as explained in the next problem). This centre line acts as length for the complete calculations of the estimate. If the deduction is not cared for the results of estimates may be wrong. All the walls should have the same section.

2. Crossing Method

In this method, lengths and breadths of the masonry walls at plinth level are taken (internal dimension of the room + thickness of the walls) for calculating quantities. The symmetrical offsets are a must as in the case of centerline method.

3. Out to out & in to in Method

This method is most practicable under all circumstances and is generally followed in the P.W.D. for computing the quantities of various items. The estimation in this book has been done using this method.

4. Bay Method

This method is useful and is generally followed in case of building having several bays. The cost of the one class room is worked out and then multiplied by the number of bays in that building. The extra cost of the end walls and difference in framing. If there is any, should be made, so as to arrive at the correct cost.

5. Service Unit Method.

This method is followed in cases such as school building where there are so many class rooms. The cost of one class room us worked out and then multiplied by the number of class rooms to be constrused. In case of Hospitals, the service unit is a bed, in case of Water Tank, it is a litre and in case of Cinema Hall, the service unit is a seat.

DETAILED ESTIMATES

WINDOW IN AN EXISTING WALL

We have learnt from the previous chapter, the methods of calculating various quantities. In this chapter, estimates of buildings have dealt in details, complete with Report, Specifications, Abstract of cost and Material statement. The rates applied for calculating the abstract of cost are the approved ones, as are in schedule or rates of Punjab & Haryana. The current premium above C.S.R. has also been incorporated in the rate. Before starting with Detailing, the few important points about estimating which should be known are as under: these points are common for any type of civil engineering structure.

IMPORTANT POINTS ABOUT ESTIMATING

(a) Before starting any estimate of building, road and bridge, it should be seen that the plans are fully dimensioned, inner and outer dimensions should be checked before starting the estimate to avoid complications later on.

(b) The estimate should be drawn sub-head-wise, to avoid omission of any item.

(c) The nomenclature of every item should be according to the sanctioned schedule of rates to avoid claims of the contractors later on.

(d) All items should be calculated in units, according to which the payment is to to be made (chapter on, units)

(e) A detailed report according to the sub-heads should be attached. This should be self explanatory giving complete information.

(f) Detailed drawings should be attached with every detailed estimate, with north line on the plan.

(g) Detailed specifications of every item should be attached so that the work should be carried out accordingly & the specifications should be according to the latest edition of the P.W.D. specifications.

(h) In order to make the estimate a comprehensive one, provision of electric & water supply should be made.

(i) In the end of estimate, an abstract of cost giving cost of every sub-head and total cost should be attached. A provision of contingencies & petty establishment @ 5% should be added in the end of abstract of cost.

(j) The rate per sq. metre should be worked out & it should be given in the end of abstract of the building estimate. This helps in future reference.

(k) In case of Road estimate, rate per Km. should also be worked out.

(l) The road estimate should mention the special features of the alignment so followed & also whether the soling is of bricks or of stone, should be mentioned in the report of estimate.

(m) In case of bridges & culverts, rate per metre (width) to be worked out.

(n) Current applicable premium above C.S.R. should be added before finding out the unit rate i.e., plinth or per km rate.

UNIT – II

GENERAL SPECIFICATIONS

General specifications give the idea and class of work in general terms and are generally attached with the rough cost and detailed estimates.

1. GENERAL SPECIFICATIONS OF FIRST CLASS BUILDINGS

Foundation and Pliath :- Shall be of first class burnt bricks in lime or cement mortar(1:6)over a bed of cement concrete. (1:6:12 or 1:8:16)

Superstructure:- Shall be of first class burnt brick work in lime or cement mortar (1:6)

Damp Proof Course:- Shall be of a cm thick cement concrete (1:2:4) with on-layer of bitumen laid hot or any other specified water proof material.

Roofing:- Shall be of R.C.C. slabs (1:2:4) covered with two coats of bitumen lalid hot and a layer of lime or cement concrete 8 cm. thick over it with a tile flooring with cement flush with cement flush pointed on the top.

Flooring:- Shall be of TERRAZO in drawing, dining, bath and W.C., 4 cm thick plain conglomerate polished floors in bed rooms and in other rooms.

Doors and Windows:- Doors and windows shall be of teak wood, paneled or paneled and glazed with gauze shutters to outer doors and fixed wire gauze to windows and ventilators Fittings shall preferably of brass or good quality metal.

Finishing:- The inside and outside walls shall have 1.25 cm. thick cement plaster. Drawing, dining and bed rooms inside of walls shall have 2 coats of distemper and other rooms shall have three coats of white washing. The outside of the wall shall have two coats of colour washing over one coat of white washing.

Painting:- Doors and windows shall be given three coats of white lead where exposed and white zinc or cream or grey silicate paint elsewhere.

Miscellaneous:-

First class buildings shall be provided with first class sanitary and water supply fittings and electrical installations. A plinth protection 1.50 m. wide of bricks sloped away from the building shall be provided all round the building.

Plinth Area Rate

Rs. 4500.00 to Rs. 5,500 per sq. meter. (Rates variable)

2. GENERAL SPECIFICATIONS OF SECOND CLASS BUILDINGS

Foundation and Plinth:- All walls shall be built of first class burnt bricks laid in mud mortar over a bed of lime concrete or cement concrete. Top course of the plinth shall be laid in cement motar(1:6)

Superstructure: - All walls shall be built of first class burnt bricks laid in mud mortar.

The Following portions to be built in cement mortar (1:6.)

(a) Shills of windows, C. windows and almirahs.

(b) Back of almirahs.

(c) Top course of parapet.

(d) Jambs of doors, windows, C. windows and almirahs.

(e) Drip course, cornice and weather course etc.

(f) Two courses below the R.C.C. slab and roof battens.

Damp proof Course: - Damp proof course 4 cm thick shall be of Portland cement concrete (1:2:4) with one coat of bitumen laid hot.

Roofing:- All main rooms shall have R.B. roof or R.C. roof and first class or second class mud roofs over other rooms.

Floors:- the main rooms shall have conglomerate floors and verandahs shall have flat or brick on edge floors over cement concrete and sand.

Doors and Windows:- Interior and exterior surface of wall shall be cement plastered 1.25 cm thick, covered with three coats of white washing.

Painting: - Doors and windows shall be painted with three coats of chocolate paint or any other approved paint.

Miscellaneous:- Roof drainage shall be carried by means of Gargolyes and khassi parnalas. Plinth protection1.50 m. wide of bricks shall be provided all round the building.

Plinth Area Rate: Rs. 2500 to Rs.3000 per sq.m

3. GENERAL SPECIFICATION SOR THIRD CLASS BUILDINGS

Foundations and Plinth: - All walls shall be built of second class burnt laid in mud mortar over bed on lime concrete.

Superstructure: - All walls shall be built of second‟s class burnt bricks laid in mud mortar.

Roofing:- All rooms shall have second class mud roof and the verandahs shall have G.I. sheet roof.

Floors:- Floors everywhere shall be of brick over mid concrete and cement pointed.

Doors and Windows: - Doors and windows shall be of kail, Chir, Mango or any other soft wood, ledged, battened and braced type.

Finishing: - Interior surface of walls shall be mud plastered and covered with three coats of white washing. The outside surface shall be flush lime pointed.

Painting: - Doors and windows shall be give two coats of ordinary chocolate paint.

Plinth Area Rate: - Rs. 1500.00 to Rs. 1800.00 per sq.m.

4. GENERAL SPECIFICTIONS OF FOURTH CLASS BUILDINGS

Foundation and Plinth:- All walls shall be built of se3cond class brick work laid in mud mortar.

Superstructure: - All walls shall be built of sand molded sun dried bricks laid in mud mortar with the exception of the following which shall be built in second class brick work in mud.

1. Two courses underneath the roof battens.
2. Jambs of doors and windows.
3. Pillars under the roof beams.
4. Sills of windows, C. windows and almirahs.

Roofing:- Third class mud roof.

Floors: - Mud floors(2.5cm) mud plaster over the rammed earth and gobri leeped.

Doors and Windows:- Doors and windows shall be of kail, chir or any other soft wood battend doors.

Finishing:- mud and mud plaster inside and outside.

Painting: Two coats of ordinary paint.

Plint Area Rate:- Rs. 800.00 to Rs. 1000.00 per sq.m.

DETAILED SPECIFICATIONS

Detailed specifications give the method of constructions and specify the nature of work.

***1.* EXCAVATION OF FOUNDATIONS**

Equality of pressure should be aimed at in designing foundations. The foundation

Trenches shall be taken down to the exact width of the widest part of the foundation. The trenches where possible shall always be taken down to a few cms into good hard soil. In order to ascertain the nature of the soil, it is essential to dig trial pits at each of the four corners of the proposed site of a building before starting the construction.

The bottoms of all trenches shall be well watered and rammed. The soft and defective place shall be filled with concrete or with any other hard material as directed by the Engineer-in-charge.

If, however, rocky surface is met, it shall be made as leveled as possible and any small in equalities shall be filed with concrete.

Foundation in bad soil

Where great depihs of bad soil are met with, such as black cotton soil, it may be necessary to resort to piles which may be of wood, steel or reinforced concrete. Where the depth of the bad soil is not excessive, the foundations may consist of beams or concrete arches of concrete pillars.

The pillars being taken down into good soil. In some cases the structure may be built on a raft of concrete reinforced with a grillage of R.s Beams.

2. **EARTH FILLING**

Earth used for filling shall be free from saltpeter and white ants and only foamy and clayey soil free from clods shall be used. It shall be laid in 15 cm layers and each layer shall be well watered and rammed with iron rammers. In case of high embankments, the layers shall not exceed 30 cm depth and the settlement allowances shall be made @ 10% of the height of uncomapacted fills.

3. **Concrete in foundations**

Lime concrete or cement concrete shall be used in foundations to be a base for the super structure.

3.1. LIME CONCRETE

Ingredients

Lime, Surkhi, Sand, Brick ballast or stone ballast and water.

3.1.1. Lime

Lime is always used as putty lime of class „B‟ [semi – hydraulic or quick lime form] and

Class „C‟ [Non- hydraulic in hydrated or quick lime form], shall be used as directed by the Executive Engineer.

The hydrated lime used should be thoroughly mixed with water in suitable container. It shall then be stirred into thick consistency and left undistributed for not less than 36 hours. Extra water should be drained out and putty should be bused. Similarly quick lime should be converted into putty. The volume of lime putty shall be taken as equal to the volume of dry slaked lime.

3.1.2 surkhi

Surkhi shall be obtained by pounding fully bricks or bats. It shall be free from admixture of claly, dust or foreign matter. No un burnt bricks or bats shall, be used for grinding in to surkhi.

3.1.3 Aggregate

The brick aggregate shall be broken from first class or second class bricks or their bats, or from dense over burnt bricks. The gauge of the ballast shall be 2 cm to 4 cm.

The stone aggregate shall consist of good hard tough broken stone, gravel or shingle of the gauge specified. It shall free from dirt, leaves or any other organic, or admixture of soft or decayed stone.

3.1.4 Water

Water used in construction shall be clean, free earthly, vegetable or organic impurities, like alkalis, salts etc. which cause efflorescence and affect setting time of mortar.

4. Mixing And Laying

The aggregate previously well soaked, shall be measured and laid on a clean platform of brickscyut 555 or wood. The platform shall be sufficient size to give ample room for mixing 23 to 28 cub.m. of concrete. Lime and surkhi shall be measured and laid on the aggregate. The whole dry and wet mix is then turned over three or four times so that it shall be thoroughly mixed concrete shall be laid slowly and gently in layer of 15 cm (not thrown from a height) and thoroughly consolidated with 5.5 kg. Rammers shall be used for consolidating the edges.

5. Tests

The consolidation of a concrete is said to be complete if (a) a stick end ways from a height of I m rebounds with ringing sound. (b) The second test is by digging a hole in the concrete and pouring water in the hole. If the consolidation in complete, the water shall not be absorbed in the.

6. Curing

The concrete shall be kept wet for a period of at least ten days no brick work masonry shall be laid on the concrete for at least seven days after laying.

PERMISSIBLE SAFE LOADS OF FOUNDATIONS.

SOIL	Lonnes per sq.m.
Ordinary earth	5.46 5.46
Make up ground, well consolidated	5.46 to 10.93 8.20 to 16.40
Soft clay	16.40 to 21.86 21.86
Loamy soils and sand mixed clay	32.80 to 43.70
Ordinary clay	
Solid clay	
Very hard clay	

***7.* USE OF COARSE AAGAGREGATE FOR DIFFERENT TYPES OF CONCRETE**

(I) 65mm, Nominal size:

For unreinforced mass concrete word on ordinary work.

(ii) 40mm, Nominal size:

For unreinforced mass work of cement concrete on small jobs over 15 cm minimum dimensions. For reinforced works, it shall be used where the dimension of members exceed 45cm. (iii) 20mm Nominal size:

Unless otherwise mentioned, if will be used as under-

(a) Unreinforced cement concrete work between 5cm minimum size.

(b) Conglomerate floor.

(c) R.C.C. works exceeding 12cm but not exceeding 45cm in minimum dimension.

(iv) 15mm Nominal size.

Unless otherwise mentioned and specified, this aggregate shall be used in cement concrete works of the following description.

(a) R.C.C. lintels and slabs under12cm and more than 5cm.

(b) R.C.C. posts and battens less than 40cm sectional area.

7. CEMENT CONCRETE

8.1 Ingredients

Cement, sand, brick or stone aggregate, gravel or shingle and water

8.1.1 Cement

Cement shall be Portland cement of the Indian standard Specifications as perIS: 269. All cement shall be brought to the site of work in bags with the seals in tack. Fresh and from moisture. All cement shall be gauged by weight and shall be added at the mixture in whole 50kg.bags.

8.1.2 Fine Aggregate (Sand)

It shall consist of clean, hard, uncoated grains of natural sand or crushed stone sand rushed gravel sand or combination of any of these free clay, loam, silt, organic or other deleterious substances. The sand shall be washed before using Fig.8.1 shous the trough for washing sand.

8.1.3. COURSE AGGREGATE

Coarse aggregate (bajri or grit) shall consist of good hard tough and clear water worn bajri obtained from natural streams. The girl shall be free from dirt, clay, leaves or other organic matter and soft or decayed stone and shall be of the gauge specified according to the nature of the work.

8.1.4 WATER

Water used in construction shall be clean, free from earthly, vegetable or organic impurities: like alkalis, salts etc. which cause efflorescence and affect setting time of mortar.

8. MIXING (CEMENT CONCRETE 1:6:12 ETC)

In all proportions of cement concrete except 1:1 ½:3, 1:2:4 and 1:3:6, the measured quantity of cement is to be placed on top of the measured quantity of the aggregate (fine and coarse) and the whole mass mixed three or four times so that it shall be thoroughly incorporated. The required quantity of water (clean, rather drinking water) shall then be added and the entire wet mass shall be turned over unto the homogeneous mixture of the required consistency is obtained.

9. LAYING AND CONNSOLIDATION OF CEMENT CONCRETE IN FOUNDATIONS

Concrete shall be handed from the mixing platform to the place of final deposit as rapidly as possible. It shall be laid slowly and gently in layers of 15cm (not thrown from a height) and thoroughly consolidated with 5.5 kg. Rammers.

10. FARMA OR BATCH BOX

The design of the farma (Fig. 8.2) is given below

15” x 15” x 9 x 5”/8 = 1.25 cft.

Or 38cm x 38 cm x 25cm = .036m

11. REINFORCED CEMENT CONCRETE

The standard mix for reinforced cement concrete is (1:2:4).

In addition to this, round steel bars are embedded to make the structure strong to take up all the tensile stresses.

12. MIXING

The two ingredients i.e. cement and sand shall be hand mixed dry, three or more times until the mix comes to a uniform colour. The measured quantity of coarse aggregate shall then be added to the mixture and whole mixed dry thoroughly. The required quantity of water shall then be added with a

13. Reinforcement

Round steel bars as far as possible shall be used in preference to square bars. The bars shall be thoroughly cleaned of rust, scale and of coatings that might destroy or reduce bond. The ends of all bars shall be properly hooked and bends shall be made as per drawing and design supplied. In case of joints in reinforcement an overlay of not less than 40 diameters shall be given for tension member. Figs.8.3,8.4 and 8.5 show the method of bending and overlapping the steel bars.

14. MIXING CEMENT CONCRETE (1:2:4 OR 1:3:6)

The two ingredients i.e. cement and sand shall be mixed dry, three or more times until the mix comes to a uniform colour. The measured quantity of coarse aggregate shall than be added to the mixture and whole mixed dry thoroughly. The required quantity of water shall then be added with a rose.

15. PLACING AND HANDLING THE CONCRETE

Concrete shall be handled from the mixing platform to the final deposit as rapidly as possible. After depositing, the concrete is to be ridded, vibrated, tamped or worked to ensure that no hollow places are left.

16. FORMS AND CENTRING

Forms wherever required shall be sufficiently rigid and strong to withstand the weight placing and putting of concrete and the movement of labor, material and plant. Forms shall be sufficiently water right to prevent leakage of mortar. Forms shall be supported or fixed by wedges of the load being eased and the forms removed without sock to the work and without hammering.

17. LAYING

Before depositing the concrete, the reinforcement shall be correctly laid in position and secured against displacement by tying with soft iron wire. The bars shall remain in position 20 mm. above the surface of centering.

18. CURING

The concrete when laid shall be carefully protected from the extremes of weather and temperature and from unequal or too repaid drying. It shall be thoroughly kept wet for at least 15 days.

19. EXPASION JOINTS

In every long lengths of slab work, expansion joints shall be provided at intervals of about 9 m. to 12m.

20. BEARING

The bearing of slabs not be less than the thickness of the slab with a minimum of 12cm.

21. DAMP PROOF COURSE

In order to prevent water absorption form the soil and thus causing dampness in the walls, a continuous layer of an impervious material is provided. Such a material is known as a horizontal damp proof course. It consists of cement concrete 1:2:4, I part cement washed sand and 4 parts shingle (gauge 6mm to 20mm,) Unless and otherwise specified, the damp proof course shall consist of 4 cm, thickness of cement concrete with one coat of bitumen laid hot @ 1 kg. per square meter of Damp proof course and be sanded immediately.

The Damp proof course shall extend to the full width of the superstructure walls except in the case of outer walls where it shall not be carried across doorways and verandah openings and similar openings.

Vertical D.P.C. shall consist of 12mm or 18mm thick 1:3 cement plaster with two layer of bitumen laid hot. Bitumen shall be blown bitumen grade 85/25, having application temperature 177 to 204 c.

BRICK WORK

Brick work consists of first class bricks laid in the mortar specified.

22. BRICK WORK IN MUD MORTAR.

23.1 Bricks

Shall be first class made from good brick free from saline deposits and shall be sand molded thoroughly burnt without being vitrified, of good colour, shall be regular

and uniform in shape & size with sharp and square arises and parallel faces. Emits a clear ringing sound when struck, shall be free from flaws, cracks etc. should not absorb more than 20% of water by weight after being soaked in water for 24 hours.

23.2 Mud mortar

Mud mortar shall be prepared from stiff clay, broken up into powder and free grass, stones, kankar, roots and other matter. The clay shall then be worked up with water by mens‟ feet and PHOWRATHS on a clean platform.

23.3 Joints

The thickness of the joints shall be 6mm and in no case exceeds 10mm. All brick work shall be taken truly plumb, laid in English bond.

23. BRICK WORK IN LILME MORTAR

24.1 Bricks

Same specifications as per para 23.

24.2 Lime mortar

Ingredients-Lime, Surkhi sand or cinder and water. The proportions upon the ingredients available at site. General one part of lime and 2 parts of surkhi are suitable.

2.4.2.1 **Lime:** Same specification as perpara 3.1.1.

24.2.2 **Surkhi:** same specification as per para 3.1.2.

24.2.3. **Mixing:** the mortar shall be mixed by measure on a clean platform close to the mill. The measuring wooden boxes may be used. The ingredients shall be mixed twice dry and then ground with sufficiency of water in a mill continuously for three hours.

For big works a bullock mortar mill (see Fig.2.6) is used and shall be constructed of first class bricks in lime mortar. Class shall be taken that fresh mortar shall be made daily and used as fresh as

24.3 lying:- Bricks should be laid in proper bond.

24.4 Soaking:- All bricks shall be soaked in clean water before use for at least one hour.

24.5 joints:- Joints shall be of uniform thickness, not exceeding 6mm. 10mm and 13mm for 1st class brick work respectively. The vertical joints must be quite symmetrical and truly plump in case of Ist class brick work.

The joints in faces which are to be plastered or pointed shall be raked out while the mortar is green.

The brick work shall be kept moist for a period of ten days.

24. BRICK WORK IN CEMENT MORTAR

25.1 **Bricks:** (same specifications as per in Para 23)

25.2 **Cement mortar**: cement mortar shall consist of mixture of 1:3, 1:5,or1:6 according to the nature of work.

25.3 **Mixing**: cement and sand shall be thoroughly mixed dry and then water is added with a fine rose to make the mortar workable. Mortar to which the water has been added shall be used within 30 minutes of the addition of water.

25.4 **Joints**: (Same as per in item 24.5)

The thickness of joints shall be regulated so that height of 10 courses when laid with Horizontal joints shall measure one meter in height.

The joints in faces which are to be plastered or pointed should be racked out while the mortar is green i.e not later than 24 hours after the work is done.

25.5 **Watering**:- Walls as they progress shall be kept thoroughly well watered on their faces and tops.

BRICK OR TILE FLOORING

Consists of first class burnt bricks or tiles laid flat or on edge over a bed of 10cm, thick lime concrete or cement (1:6:18) and 10cm. thick sand.

34.1 Laying: All bricks or tiles or tiles shall be laid in lime or cement mortar with bed and vertical joints full of mortaar1:4 simple "lipping" at the edge shall not be permitted. The laying shall be in plain, diagonal, herring bone or other pattern as desired by the Engineer-in-charge. The work shall be protected from the effect of sun, frost and rain during construction.

34.2 Soaking: Before use, all bricks or tiles shall be soaked in clean water in tanks for at least one hour.

34.3 Joints: The joints shall not exceed 6mm in thickness. The mortar in the joints shall be struck off flush with s trowel. Care shall be taken that no mortar shall spreed over the edge of the bricks or tiles.

34.4 Curing: The floor must be kept wet for seven days after laying. If cement pointing is done, it shall be kept moist for at least 15days after the pointing has been done.

35. TERRAZO FLOORING

A rough foundation of ordinary cement concrete 1:2:4 to within 29mm below the required finish grade shall first be provide. The material of the terrazo consisting of 1 x ½ parts of very small marble chips machine crushed and free from marble dust and foreign matter, 6 to 13 mm, to one part cement shall then be laid and floated over the rough surface, so that flat sides of the chips lay evenly at the top if the marble chips do not show up sufficiently, the defective parts may be filled up by hand. After the terrazzo concrete has hardened enough to prevent dislodgement of aggregate, it shall be ground down with an approved type of grinding machine shod with free rapid cutting carborundum stones to expose the coarse aggregate. The floor to be kept wet during grinding process. After this the finish shall be scrubbed with warm water and soft soap and mopped dry.

36. MARBLE FLOORS

The marble flooring shall consists of marble tiles laid on 12mm thick mortar bed over the usual base courses of 10cm base concrete 1:8:16 and 10cm said or stone filling in case of ground floor or over R.C.C slabs. In case of upper floors the mortar bed shall be of 1:3 cement sand mortar.

The marble slabs should be of approved quality and thickness 20mm to 25mm with truly plane surface. The size of marble slab shall be slightly oversize to permit cutting to actual size of tiles at the site of work.

36.1 Curing: During the progress of work and for 10days after laying, each section of floor shall be kept flooded. Three clear days shall be allowed for setting before the pavement is walked over and no weight should be rested upon the surface, until 7days after laying is completed, Polishing is done, as in case of Terrzo flooring and no first cutting is usually needed.

37. ROOFING

First class mud roofing consists of two layers of tiles 30 x 15 x 4 cms. Resting on wooden or reinforced cement concrete battens spaced 30 cm centre to centre. The top of tiles shall have 13mm thick cement plaster (1:4) covered with two coats of

bitumen laid hot and 10 cm. thick earth, another 2.5 cm. layer of mud plaster to be given and finished with gobri leeping. (45 tiles are required for one sq.m. of roof area).

DOORS & WINDOWS

Doors and windows may range from the humble ledged and braced doors and windows which are usually, fitted to out houses, to the multiple, paneled and paneled and fitted fitted with ornate molding and paneled, and which are usually associated with the entrances to important buildings. In all cases the construction shall be such as to ensure that the door shall be satisfactory in service.

46.1 Timber

All doors, windows, clerestory windows and all almirahs with their chowkats shall be made of well seasoned deodar wood or any other food timber free from sapwood, large knots, shakes cracks and other serious defects.

46.2 Panels

In case of paneled doors, the panels shall not be less than 13 mm thick.

46.3 Sash Bars

In case of glazed doors, Sash Bars shall be of the full thickness of the leaf and 38 mm. in width and shall be molded and mitered on the outside and rebated from inside. The width of the rebate shall be 13 mm.

47. WHITE WASHING

The surface to be white washed must be clean and smooth and perfectly dry before applying white wash. Each coat be allowed to dry before nest is applied. New plastered surface tone white washed, shall not be trowel led to a glaxed surface otherwise white wash will not adhere.

The white wash shall be made from pure fat lime, brought to the work in an unsa0laked condition and termed as class „C" lime. Water shall ne added to this lime in a tub, until the mixture is of a consistency of cream and allowed to rest for 24 to 48 hours. The mixture shall then be strained through coarse cloth, suitable quantity of gum shall be added, dissolved in hot water. This hot water shall be added at the rare of about 5 liters per kg. to produce kilky solution.

47.1 Colour washing

The colour wash shall be made from pure slaked fat lime and mixed with the necessary pigment to give the required shade. The pigment shall be such as to be unaffected by lime.

The surface to be colour washed shall be given one coat of white wash and then one or two coats of colour washing. Each coat of site or colour wash is to be allowed to dry and passed by the Engineer- in-Charge before the next is applied.

48. PAINTING

48.1 Wood work (New)

Before commencing any painting, the surface should be rubbed down with sand paper and make it smooth with grade 2 1/2 paper and then with 1 1/2 grade. The sand papering must be finished with the grain.

Before applying paint, all knouts must be killed or covered with two coats of patents knotting or with a preparation of red lead glued size, laid on hot. When the wood work is thoroughly dry, the priming coat shall be applied.

DETAILED SPECIFICATIONS OF ROADS

1. Earth filling (Embankment)

1. Before any earth work is commenced, the ground be cleaned of all trees jungle and roots of every description. The embankment shall be made from borrow pits on either side of the road.

The earth work should be laid in layers of 15 cm. to 23 cm. and consolidated by rollers, preferably sheep"s foot rollers. The final compaction may be ordinary power roller.

All large clods should be broken as the work proceeds and allowance made for settlement which so equal to 10% of the height of the embankment.

The side slopes of the formation should preferably be about 4 to 1 except in high embankments with goods soil where the slope be increased to 2 to 1.

II. Soling coat

2. Soling shall always be provided under the wearing coat except when the road is founded on a very hard natural surface such as on rock.

3. Width

The width of the soling shall always be 30 cms. More than the proposed width of the carriage way. For instance, if the carriageway is 3.60 m., the width of soling shall be 3.90 m. In case where bricj on end edging is provided the width of soling shall be same as that of the width of carriageway.

III. Collection of soling

Where soling coat of bricks is to be provided, all bricks shall be fully burnt or over burnt. The bats which are less than half a brick in size shall not be used.

4. Stacking

The bricks or stones collected shall be stacked parallel to the centre line of the road and clear from the formation width. Gaps at least 1.5 m. wide must be left in every line of the bricks, for drainage etc.

5. Stone

The stone shall be hard, durable and tough in texture and be obtained from an approved quarry.

6. Kankar

The kankar shall be tough and heavy, with a bluish fracture. After digging, it must be spread out for at least a month before being brought to the road side.

7. Laying

The soling shall be laid at a stretch, the depth of which be equal to the depth of soling. The trench shall be filled and the camber should be the same as that o the finished surface.

The soling shall be laid carefully, hand packed with interstices filled with smaller pieces of the same material. Before laying the soling coat the sub-grade shall be thoroughly leveled and care shall be taken to see that the sub-

grade is hard and well consolidated and there are no soft pots and depressions.

8. Kankar

After lying the soling, earth or sand shall be spread over it to a thickness of 2.5 cm. so that joiners of the soling may be filled up by sand or earth.

9. Measurement

In case of soling of stone boulders, stacks shall be measured 35 cm. high but paid as 30cm. to allow for loose stacking, in case of kankar, the stacks shall be measured 32.5 cm. high but shall be paid as 30cm.

V. wearing coat (consolidation).

10. The metal shall be broken from hard durable tough stone of uniform texture from an approved quarry. Where metal has been broken from water worn boulders, no individual boulder shall weigh less than 3.6 kg. a piece.

11. Measurement

In order to allow for loose stacking, shall be 32.5 cm. high but shall be paid as 30 cm.

Stacking

(Same as per item 4)

VI. Wearing coat (consolidation)

12. Preparation of surface

The surface of the soling shall be thoroughly cleaned of all dirt and brought to the camber that the finished road is to have. Two parallel bunds of clay puddle, 23 cm. wide and 15cm. deep shall be made along the other edges of the medaling.

The bunds shall be strong enough to prevent the new metal from spreading as well as to retain the water used in consolidation.

13. Spreading of metal

The stone metal shall then be spread over the surface true to the template Fig. 8.9. The metal shall be carefully packed, the bigger pieces being placed below and the smaller pieces on the interstices of the bigger pieces. The templates shall be used at a distance of approximately 7.5 m. from one another.

14. Rolling and consolidation

The metal shall then be rolled with a road roller commencing at the edges and working towards the centre. The metal is to be rolled dry until well compacted and there is no appreciable wave in front of an advancing roller.

The whole medaling shall then be thoroughly water and kept saturated rolling continued until the consolidation is finished to the satisfaction of the engineer-in charge.

15. Bajri binding

After the consolidation is practically complete, the binding material such as fine bajri obtained from screening or from a quarry shall be spread and the rolling and watering continued to such an extent that the binding material is formed into slurry and is grouted into interstices.

17. Camber

The camber of the template shall be 1 in 60 if the road is intended to be painted, 1 in 72 if a cement concrete surface is to be provided and 1 in 48 if it is to

remain water bound. For example in case of camber 1 in 72 the height at the centre above the outer edges shall be 1 cm. for each 1.44 meters of road width.

17. Progress

A power roller should be able to consolidate amount 34 cubic ketres of stone metal or 56 m2 of kankar in a day.

18. Test of good consolidation

Rough tests are as below:

(a) A loaded cart should not leave indentation when passing over the finished work.

(b) A piece of metal about the size of a wall nut of put on the surface and a roller passed over it, it should be crushed or driven into surface.

UNIT - III

Qualifications of contractor

There are no fixed norms of qualifications of a contractor. There are some essentials which a contractor is expected to have. Such as:

1. He should be financially sound
2. He should have sufficient knowledge to read the drawings
3. He should be well versed with the procedure or the department to carry out the work, submission of boils and experidhce
4. Good reputation and experience
5. Should have ability to handle labor and material efficiently and properly.
6. Should be capable of arranging men and material as per requirement.

Quotation

The rates quoted by a contractor in response to tender call are called “quotations” ,

Tenders

It is defined as an offer in writing to execute a specified work or supply. In this offer, some specific articles are required by the department mentioning approximate rate, under certain conditions of contract. An agreement between the contractor and the department is executed, fixation of is the main clause, for the completion of the job.

Earnest money

It is a guarantee is the shape of money, gives by the contractor along with their tenders, confirming their willingness to work for the department. Mode of money to be is informed by the department 2% of the total estimate.

In case, if the tender of the contractor is not accepted. The money is refunded immediately.

Security money

This is the money which the contractor has to deposit with the department when the contract is allotted to him. It is 10% of the total estimate. This money also includes earnest money already deposited by the contractor. This deposit is kept as a check so that the conditions of the contract agreed upon are fulfilled and the work is the progress and quality of the work is not satisfactory.

Classification of contracts

The contracts can be classified as under:

(a) Scheduled contract or item rate contract

(b) Lump sum contract

(c) Combination of both

Notice Inviting Tenders (N.I.T.)

It is prepared by the administrative wing after all the above mentioned formalities are complete including administrative approval, technical sanction,funds,land acquisition etc. sealed tenders are invited by giving advertisement in leading newspapers, by sending letters to reputed contractors and displaying notice on notice board of the department.

The date of issue of the notice should 4 weeks before the receipt of tenders. Mode to send the earnest money should be mentioned clearly.

Time, date and place where the drawings can be seen, should also be mentioned in the advertisement. Cost of tender from and its availability should be mentioned. Incomplete tender forms are likely to be rejected as per conditions mentioned.

Opening of tenders

The tenders are opened at the place mentioned in the tender form i.e. in the office of executive engineer, on the due date and time mentioned. Executive engineer, divisional accountant and office superintendent represent the department on one side and contractors or their representatives are on the other side. The lock of the box in which sealed tenders are dropped by the contractors is opened in the presence of all. After checking the seals of the tender covers, these are opened and are signed by both the parties. Comparative statement is prepared item wise and the worm is allotted to the lowest bidder. The competent authority has powers to reject the tender of the lowest bidder, but he has to give reasons and confidential remarks, financial position and reputation of the contractor is also considered. Earnest money to the bidders of rejected tenders is retuned. Signature of each contractor is taken as a token of certificate that tenders were opened in their presence and the allotment has been done to the right bidder.

Contract agreement

It is a contact deed between the government and the contractor. Divisional engineer signs on behalf of government. He is responsible for correct preparation and execution of the agreement.

The condition of the different departments varies for the preparation of the contract agreement. Preferably these be between the framework of manual of order.

Copy of letter from S,E,to contractor

Office of superintending engineer

North circle, P.W.D. Patiala date _____

To

Sh.ABC

Contractor

Patiala

Subject: reference No._____, construction of panchayat bhawah at Patiala
Reference your tender No._____. Dated _____
Dear Sir,
On behalf of governor of Punjab, I am accepting your tender for the above mentioned work.
Please attend „divisional‟ office (south) immediately, for instructions regarding taking over the site and commencement of the work.
Please attend this office on_____to complete your contract agreement

The number allotted to this contract is SE-N /PTA-4/2003. This number should be quoted for future correspondence.

A copy of each of the following is forwarded here with:

(i) Schedule I and II

(ii) Particular specifications

(iii)Complete set of drawings (duly signed by both the parties)

You are requested to return the copy of this letter duly signed as a token of acceptance.

Yours faithfully,

UNIT IV

Introduction, necessity of valuation of building, definition of terms used, valuation of a building, calculation of standard rent, concept of capitalized value and year's purchase, typical problems.

Valuation means fixation of cost or return expected of a building, engineering structure project (Govt. or private), at present days rates. The value of a structure may be more or less depending upon the present utility of a structure. For example, a house having a number of rooms but smaller in size will fetch less value than a house, may be smaller in area but having well planned and proper sized of rooms.

Necessity of Valuation

The following reasons necessitates the valuation of property:-

(i) Rent fixation. It is generally taken as 6% of the valuation of the property.

(ii) For buying and selling.

(iii) Acquisition of property by Govt.

(iv) To be mortgaged with bank or any other society to raise loan.

(v) For various taxes to be given and fixed, by the Municipal Committee.

(vi) Insurance: For taking out on insurance policies.

Roll of an Engineer

The roll of an Engineer in valuation is felt when an Engineering structure is to be valued, if and when it is:-

(a) To e acquired

(b) To be divide

(c) To be allotted to a claim holder.

The following factors require consideration for valuation:-

(i) Locality:-

In case a building is located in such an area, where there is easy access to market, schools and is located on road side. The Orientation of the building is according to Engineering rules. It will fetch more cost than a building which is in a neglected condition and is locate at unhealthy site.

(ii) Structure:-

The structure of a building is also an important consideration while evaluating a building. Workmanship I attractive and the building is properly maintained, it will fetch more cost than the building in a neglected form with poor quality of material used.

According to specifications a building is divided in four classes:-

First Class

Second Class For Details, see chapter on specifications

Third Class

Fourth Class

Value: Present day cost of a Engineering structure (Saleable value)

Cost: Original cost of construction. It is used to find out the loss of value of property due to various reasons.

Net Income: Total amount of the income received from a property during the year, without deducting outgoing.

Gross Income : Total amount of the income received form a property during the year, without deducting outgoing.

Net income: An amount left at the end of the year after deducting all usual outgoings.

Out goings:- These are expenses which are incurred on a building so that it may give back revenue. The following are-various outgoings.

(i) **Taxes:-** These are annual taxes paid by the owner, such as wealth tax, property tax and municipal taxes (varies from 10% to 25% of net income).

(ii) **Management:-** Upto 10% of the gross revenue is kept aside for this expenses. This includes, chowkidar sweeper etc. this is applicable only for big buildings or apartments

(iii) **Repairs:-** For this 1 ½ % of the total construction is set aside for annual repairs of the building. These repairs are must to maintain the building. It is also calculated as 10% of the gross income.

(iv) **Sinking fund:-** This is also taken as outgoings (For details see definition)

(v) **Miscellaneous:-** This is again suitable for big buildings. Lighting of common place, expenditure of liftman etc. are to be paid by the owner.

(vi) **Loss of Rent:-** This is also an outgoing in case a building in not fully occupied by the tenants. This has to be deducted from gross income.

(vii) **Insurance:-** Premium given against fire or for theft policy.

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

Free hold Property:- Any property which is in complete possession f the owner is known as free hold property. The owner can use the property in an way he likes. But he will have to follow constraints fixed by town planners or Municipality before doing any construction.

Lease hold:- If a property is given to some person on yearly payment basis by the free holder, then the property is called „lease hold property‟ and the person who take s the property is called Lease-holder. In case of building, the lease is for 99 years to 9 years.

Easement:- An owner getting over the property of another person, the following faculties is known as easements.

(i) Facility of running water and sewer pipes through other‟s land.

(ii) Facility of air and light.

(iii) Facility of drainage of rain water.

(iv) Facility of access.

The owner who gives facilities is known as Servant owner and who enjoys facilities is called

Dominant owner.

Scrap Value:- If a building is to be dismantled after the period of its utility is over, some amount can be fetched from the sale of old materials. The amount is known as Scrap Value of a building. If varies from 8% to 10% of the cost of construction according to the availability of the material.

In case where Wood & Steel are available, the scrap value is more than as R.C.C structure, as in the latter case, the material has less reuse value.

Salvage Value:- If property after being discarded at the end of the utility period is sold without being broken into pieces, the amount thus realized by sale is known as its Salvage Value.

For example, railway sleepers can be re-used as posts and even old iron rails taken out can be used as beams in a roof or sheds of a building.

Building Cost Index:

A building cost index indicates the increase and decrease of the cost above the cost above the cost at a certain base year and is expressed by a percentage rise & fall. For instance taking 1960 as abase year, the present 1980 as Building Cost Index may be taken 1.25% to 150% above the cost during the year 1960 This index depends upon cost of material, labour, transport etc.

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

Sinking Fund:- A fund which is gradually accumulated and aside to reconstruct the property after the expiry of the period of utility is known as

sinking Fund. The sinking funds may be found out by taking a sinking fund policy with any insurance company or depositing some amount in the bank. Generally while calculating the sinking fund, life of the building is considered. 90% of cost of construction is used for calculations & 10% is left out as scrap value.

$$The\ forumula\ used\ to\ find\ out\ the\ annual\ \text{sin}king\ fund\ is\ I\frac{Si}{(1+i)^n-1}$$

Where

I = Annual instalment required

N = Number of years required to creat sinking fund.

I = Rate of interest expressed in decimal i.e.5% as.05.

S = Amount of sinking fund.

Example:

A printing machine is to be installed at a cost of 30000/- in a press. Assuming the life of the machine as 20 years. Calculate the amount of annual installment of sinking fund to be deposited to accumulate the whole amount of 5% compound interest.

$$I=\frac{Si}{(1+i)^n-1}=\frac{30000x.05}{(1+.05)^{20}-1}=Rs.906.30$$

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

The owner will have to deposit Rs. 906.30 per year in 5% compound interest for 20 years to accumulate Rs. 30,000/-.

Note: In certain cases, old buildings are purchased and in that case scrap value into be deducted from the amount spent so as to calculate the amount of Sinking fund.

Example: **An old shop in the main market has been purchased by a person as a cost of Rs. 20000/-. Work out the amount of annual sinking fund at 3% interest assuming future life of the building as 15 years and scrap value of the building as 10% of the cost of purchase.**

Solution:

Cost of the shop = Rs. 20000/-

Less crape value = Rs. 2000/-

Net Rs. 18000/-

Amount of sinking found to be accumulated after 15 years = Rs. 18000/-

Annual instalment of sinking fund.

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

$$= \frac{18000x.03}{(1+.03)^{15} - 1} = Rs.971.20$$

UNIT – V

INTRODUCTION

It is the primary task of an Executive Engineer and S.D.E. to a supervise the accounts of their department as strictly as they supervise the works. They must follow the rules as mentioned in Departmental Financial Rules (D.F.R) manual in case of any fault on the part the officers, there is no rule to absolve them of their responsibility to apply the rules. In a department the principle account record book is "Cash Book"

Cash includes all legal tender coins, currency notes, recognized by Reserve Bank of India, demand drafts, cheques, payable on demand, revenue stamps etc.

Postal stamps, national saving certificates, government securities, bonds etc. are not treated as cash.

Cash Book

It is a very important book maintained in a division and sub-division. This book has record of all transactions i.e. all receipts and payments of the department. It is maintained on P.W.A. Form I. The pages of the register are machine numbered. Such page has receipt side on the left and payment side on the right.

Maintenance of Cash Book

All transactions of cash receipts and payment of a division or sub-division taking place, day by day, are recorded in register P.W.A.I. Its pages are machine

numbered. Each page has receipt side on the left having 5 columns and payment side on the right having 7 columns. The points to be kept in mind are as under:

1. All transactions should be maintained in the cash book by Divisional Engineer or S.D.E. as a regular arrangement.
2. All entries in the cash book must be made day by day in the concise and clear manner and transactions invariably recorded at the time and on the date on which they actually occur and strictly in order of their occurrence.
3. Interpolation of entries should be avoided but when it becomes necessary to make an entry between two ruled lines or make any addition or alterations, these entries should be duly attested with signatures.
4. Incorrect entries should be crossed and correct entries written should be duly attested with dated initials of the disbursing officer.
5. The S.D.E. should see that no line is left blank and also between two entries. The same blank space should be cancelled with diagonal lines.

6. On payment side, there are two money columns, column 9 is meant for cast payment while columns 10 and 11 for payment by cheques.

7. The cash in chest must be kept as low as possible.

8. The cash book must be checked by S.D.E. daily or whenever he is available at his sub-division, with reference to vouchers and receipts (P.W.A. 3). After checking both sides accounts, dated initials should be put under last entry.

9. When a cheque is issued to add cash in the chest, its amount and number are recorded on payment side. The account is simultaneously entered on receipt side as cash from treasury.

10. When a new cheque is issued against a Time barred or lost cheque, the entry in red ink is made in column 8 only. The amount of the cheque is not to be shown in column 11. A certificated of "Non-payment" from the bank is necessary before issuing a new cheque.

11. When a cheque previously issued is to be cancelled, a minus entry in column 11 should be shown. A cross reference against original entry is necessary. Reason of cancellation should also be given.

12. If an officer issues a cheque on tour he should enter the payment as soon as he reaches the head quarters, in column 1, the entry is made as date of entry of cheque/date of issue of cheque.

13. Temporary advance or Imprest given should be entered in column 8, in red ink. The amount is not entered in column 9 as it still forms the part of cash. In the column of money, only increase or decrease of imprest is recorded.

14. Balancing: The cash book should be balanced on the date prescribed for closing of cash book accounts of the month. It is advisable to have weekly balancing if entries are numbered.

15. The details of actual cash found at the monthly counting should be recorded in form P.W.A. 2 and a certificate of the reconciliation of book balance with the actual one recorded below the closing entries of the month.

16. Whenever it is found that cash in the chest is not as per balance of the cash book, it should unless the error can be detected, be set right at once, be rectified forthwith by making the necessary receipts or payment entry. "To cash found surplus" under public works deposit or "Under miscellaneous P.W. Advances". As the case may be.

17. The actual balance of cash in each chest should be counted on the last working day of each month.

18. The details of actual balance should be recorded and a certificate of the count of cash specifying both in the words and figures, the actual cash balance (excluding imprest an temporary advance) and

reconciliation of the balance so counted with the book balance should be recorded below the entry of each month.

19. The cash book should always be kept under lock and key.

Subsidiary Cash Book

The cash transaction relating to salaries of regular establishment is maintained in "Subsidiary cash book". The cash related to this cash book is kept separate from that of main cash book.

Debit & Credit

Any amount which the government owes to other agencies is known as Debit and any amount which the government receives from others is called „Credit".

Common Irregularities In Writing A Cash Book Common Irregularities In Writing A Cash Book

When any construction made for maintaining a particular book e.g. Cash book is not follows. It becomes an irregularity, although these irregularities may be of minor nature, but their impact may nor be that minor. The common irregularities are as under:

(a) Blank space left between two consecutive lines

(b) Corrections not initialed with date

(c) Entries not done as per their date of occurrence

(d) Overwriting and interpolation done but not properly attested.

(e) Cash book not checked by Executive Engineer

(f) Detail of balance not correct

(g) Other instructions as given in manual of order of PWD not followed.

Imprest

It is maintained on form P.W.A. 3 It is a fixed sum if money given to a subordinate to enable him to make patty payments for the work done for department. The power to gave imprest to an individual is given by a competent authority, with the understanding that no prior sanction is necessary for making payment.

Mainterance of Imprest Account

1. The fixed amount of imprest is entered in red ink in column 5. If additional amount is taken during the month, it is also entered in the same way.

2. Entry for payment should be done strictly in accordance with their occurrence.

3. Vouchers for payments should be kept as a proof of payment and a certificate on it, "paid by me", should also be given.

4. For keeping record of imprest, no other advance should be mixed with the imprest amount.

5. The column 3 of the form is meant for full description of the work done or supplies made and name of the work for which purchase has been done.

6. Account of imprest should be closed at least 2 days before the closing of cash book.

Imprest Cash Accounts Imprest Cash Accounts Imprest Cash Accounts Imprest Cash Accounts Imprest Cash AccountsImprest Cash Accounts Imprest Cash Accounts Imprest Cash Accounts

Impreset cash book of Sh…….

Month & Date 1	Voucher No. 2	Transactions 3	Amount of Cash Payment 4	Total 5	Head of Account 6

Temporary Advance

This is an advance given to a subordinate by the disbursing officer to enable him to make certain specific payments, such as payment to labour engaged on muster roll, pay-bill of work-charged establishment or any other payment for which passing orders have already been give.

The account of temporary advance is entered in form P.W.A.3. The balance after disbursing the amount should be deposited back, as early as possible.

Treasury ChallansTreasury Challans Treasury Challans Treasury ChallansTreasury Challans Treasury Challans Treasury Challans

Any payment to be made to any govt. department is deposited in Government treasury or sub treasury, in the specific head allotted to that department. For this purpose, challan form 32-A is filled in triplicate. The form shows name and address of the depositor, full particulars for which the deposit is done, Head of account and orders to the bank. One cop duly signed by Treasury officer, is returned to the depositor as a proof of his deposit. This copy is presented to officer incharge, who makes an entry in receipt side in his cash book.

The second copy is required in the treasury. The third one is sent to the concerned department for information and record.

MISCELLANEOUS

Cash Balance Reports

As soon as the cash book of the month has been closed, the S.D.E. should sent the following balance report or Divisional Engineer. The points to be sent are:

i) That there is no large cash balance

ii) That temporary advances are cleared before the close of the month

iii) That the amount of interest with officers or subordinates is not excess of requirement.

Cancellation of Cheques

The following reasons result in cancellation of a cheque

i) Time barred cheques

ii) If the receiver wants money in cash and not by cheque

iii) Wrong issuance of cheque.

iv) Writing mistake detected after issuance of cheque

When a new cheques is issued in place of a cancelled cheque. A red ink entry

on the payment sid of the cash book is done. It is also very important to write this fact on the counter foil of the original cancelled cheque issued.

INTRODUCTION TO THE SUBJECT

1.1 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 requirement 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.

1.2 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 arrange contract.
4. Estimate is also required to control the expenditure during the execution of work.
5. Estimate decides whether the proposed plan matches the funds available or not.

1.3 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

1.4 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 preparation of estimation become very difficult. So, It is very essential before preparing an estimate.

1.4.2. 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 various items of work laying down the Quantities and qualities of materials, their proportions, the method of preparation workmanship and execution of work.

1.4.3. RATES:

For preparing the estimate the unit rates of each item of work are required.

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.,

1.5 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. The Complete Estimate Cost of land P.s.and contingencies at 5% Legal expenses between owner and contractor Cost of Structure Actual cost of

Land Cost of Surveying Cost of Verification of deeds and execution of deeds Brochorage if any Cost of labour Permit fees for constrution water, electricity from concerned authorities cost of materials Consulting Engineers fees cost for preparation of plan, estimate and design Cost of supervision

3 ***Estimation and Costing***

1.6 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 tems or simply L.S.Items. The following are some of L.S. Terms in the estimate.

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

Ingeneral, certain percentage on the cost of estimation is alloted 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.

1.7 WORK CHARGED ESTABLISHMENT:

During the construction of a project considerable number of skilled supervisors, 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.

2.1 UNITS OF MEASUREMENTS:

The units of measurements are mainly categorized 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 (m2)
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]
Particulas of item

Earth work:

1. Earth work in Excavation
2. Earthwork in fillingin foundation trenches

3. Earth work in filling in plinth

Concrete:

1. Lime concretre in foundation
2. Cement concrete in Lintels
3. R.C.C.in slab
4. C.C. or R.C.C. Chujja, Sunshade
5. L.C. in roof terracing

(thickness specified)

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

	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.

2.2 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.

2.3 METHODS OF TAKING OUT QUANTITIES:

The quantities like earth work, foundation concrete, brickwork in plinth and super structure etc., can be 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

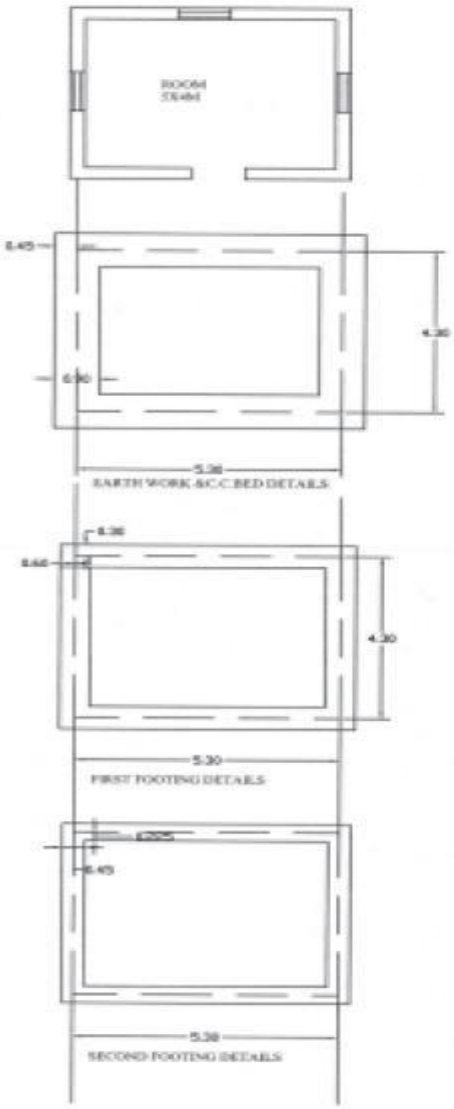
wall-short wall method is used to internal walls. This method suits for different thicknesses walls and different level of foundations. Because of this reason, all Engineering departments are practicing this method.

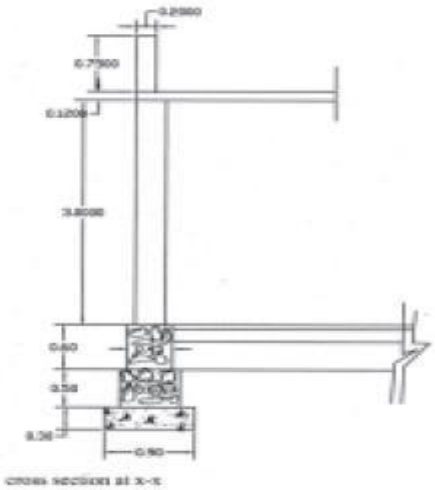
From the Drawing given below determine

(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).**

Single Roomed Building (Load Bearing type structure)





Note: All Dimensions are in 'M'

D=1X2.1M

W=1.5X1.2M

Measurement of Materials and Works

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 super structure						
	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
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** with CM(1:6) for superstructure	1	19.2	0.3	0.3	17.28	**m^3**

TYPES OF ESTIMATES

Chapter **3**

3.1 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 measurements are taken from drawings and entered in respective columns of prescribed proforma. the quantities are calculated by multiplying the values that are in numbers column to Depth column as shown below:

Details of measurements form

***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.

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

ABSTRACT OF ESTIMATE FORM

The detailed estimate should accompanied 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 Estimate:

i) **Quantity and transportation of materials:** For bigger project, the requirement of materials is more. such bulk volume of mateials will be purchased 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.

3.2 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 equipment, 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.

3.3 METHODS OF PREPARATION OF APPROXIMATE ESTIMATE:
Preliminary or approximate estimate is required for studies of various aspects 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 knowledge 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 methods 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 2.0m2, lifts, air-conditioning 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 sun breakers.

b) Cubical Contents Method: This method is generally used for multistoried 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.

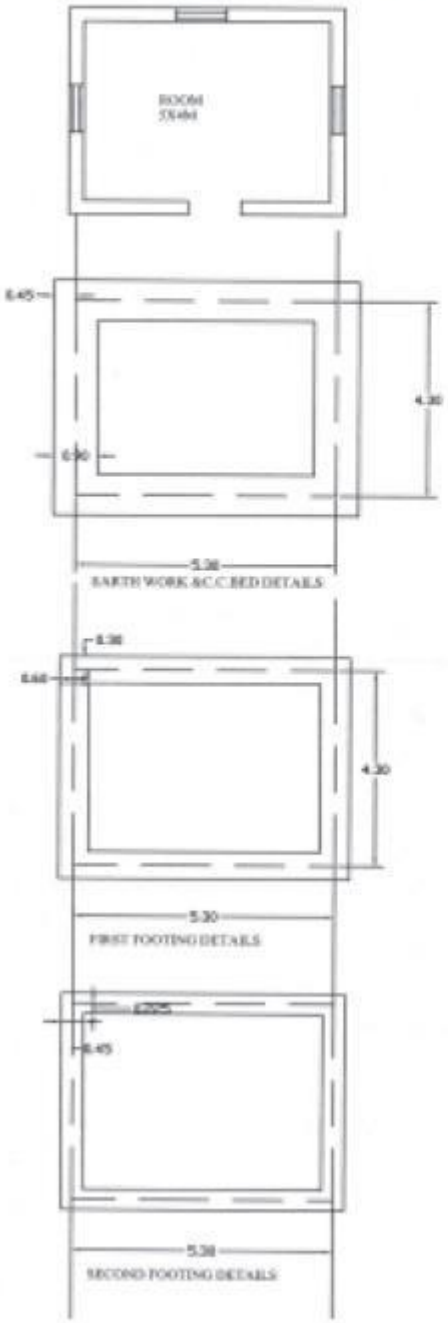
c) Unit Base Method: According to this method the cost of structure is determined by multiplying the total number of units with unit rate of each item. In case schools and colleges, the unit considered to be as 'one student' and in case of hospital, the unit is 'one bed'. the unit rate is calculated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

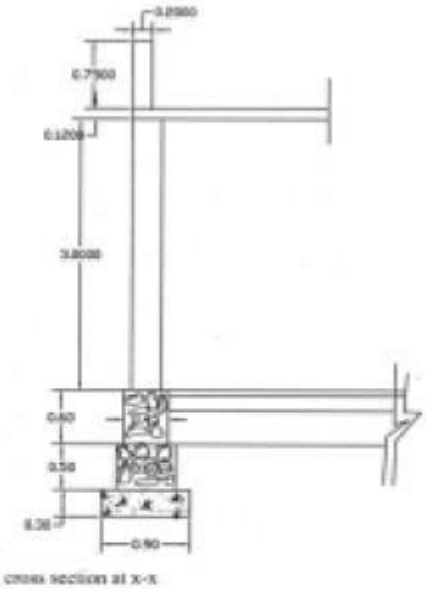
DETAIL & ABSTRACT ESTIMATES OF BUILDINGS

Chapter **4**

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'

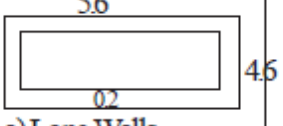
D=1X2.1M

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**

S.No.	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**						
	Inside						
	For walls	1	18.0	--	3.0	54.0	L=2(5.0+4.0)=18.0
	Out side						
	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 (upto parapet wall)
	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	
	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 ceiling					151.18	(=131.18+20=151.18)
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						

Detail & Abstract Estimates of Buildings 26

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**
	53 / 43						L=2(5.3+4.3)=19.2
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 super structure	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

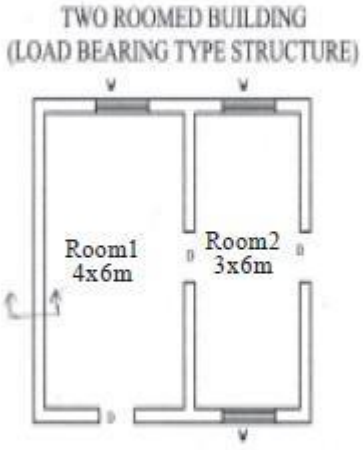
8.	**flooring with Mosaic tiles**	1	5.0	4.0	--	20.0	
9	**Plastering with CM (1:6)for super structure**						
	Inside						
	For walls	1	18.0	--	3.0	54.0	
	Out side						
	For walls	1	20.4	--	3.87	61.2	
	Basement outside	1	21.6	--	0.6	12.96	
	Parapet wall						
	a) Inside	1	18.8	--	0.75	14.1	
	b) top	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.	

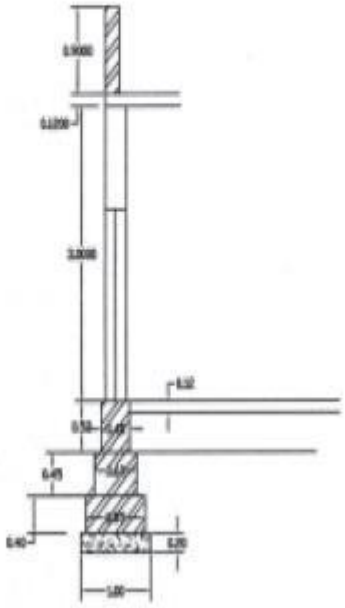
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
14	Painting with ready mixed synthetic enamil paints with two coats over primary coat for new wood for						
	a) Doors	2¼x1	1.0	---	2.1	4.725	
	b) Windows	2¼x3	1.5	---	1.2	12.15	
					Total	**16.875**	m^2
15	Petty supervision and contingencies at 4%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

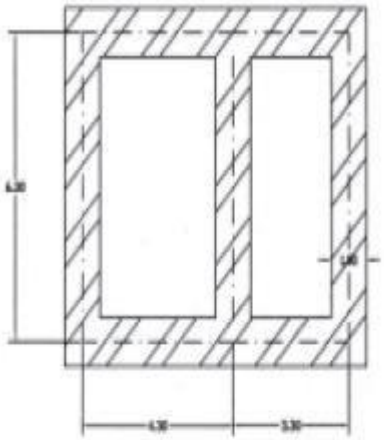
Example :2 :-From the given figure below calculate the details and abstract estimate for the double roomed building (Load bearing type structure) by a) long wall & short wall method (b) Centre Line Method



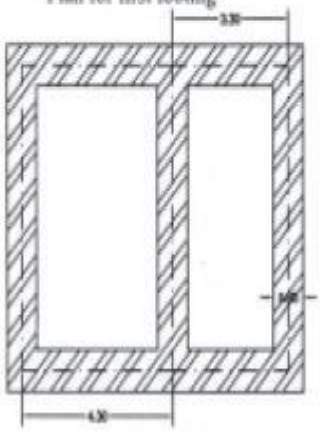


D=1x2.1
W=1.5x1.2

Note: All Dimensions are in 'M'



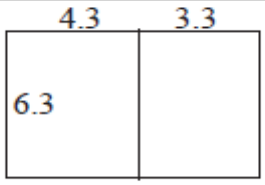
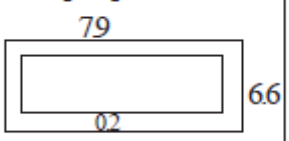
Plan for first footing



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=8.6
	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) Long walls	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 super structure	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.						

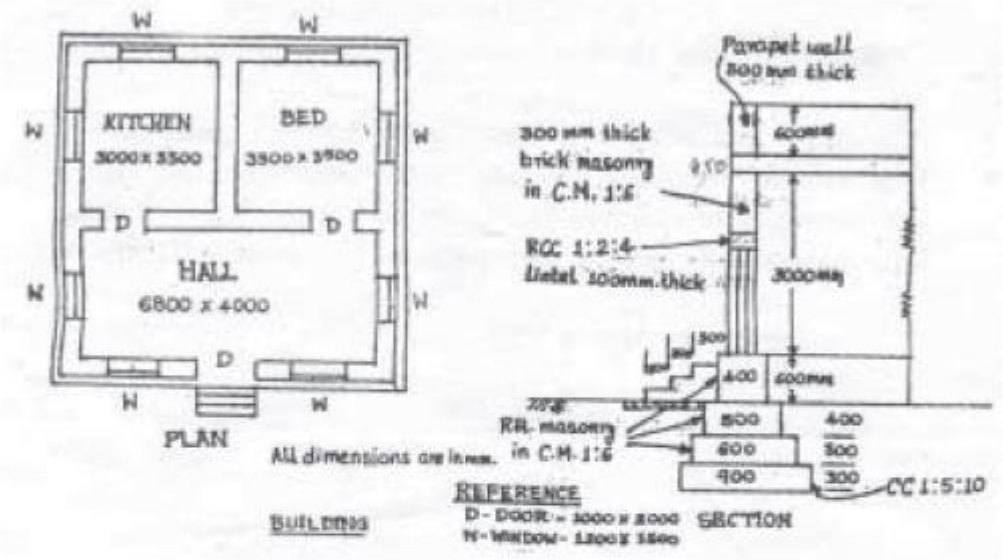
b) Centre Line Method

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=34.1-0.6x2/2
	b) for basement	1	33.7	0.40	0.40	5.392	L=34.1-0.4x2/2
	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.						

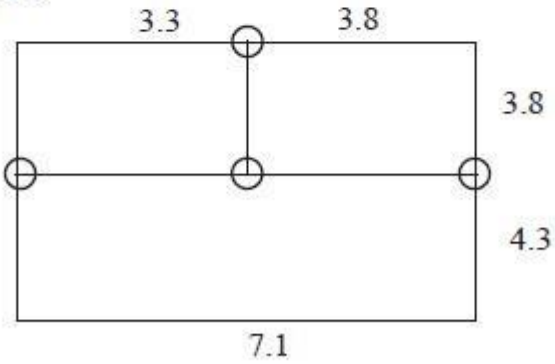
Abstract estimate of two roomed building (Load bearing type structure)

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 abstract estimate for the single Storeyed residential building with no of rooms (Load bearing type structure) by Centre Line Method

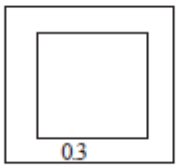


Centre line diagram



Total centre line length =(3.3+3.8)3+3.8×3+4.3×2=41.3m

no of T Junctions = 4

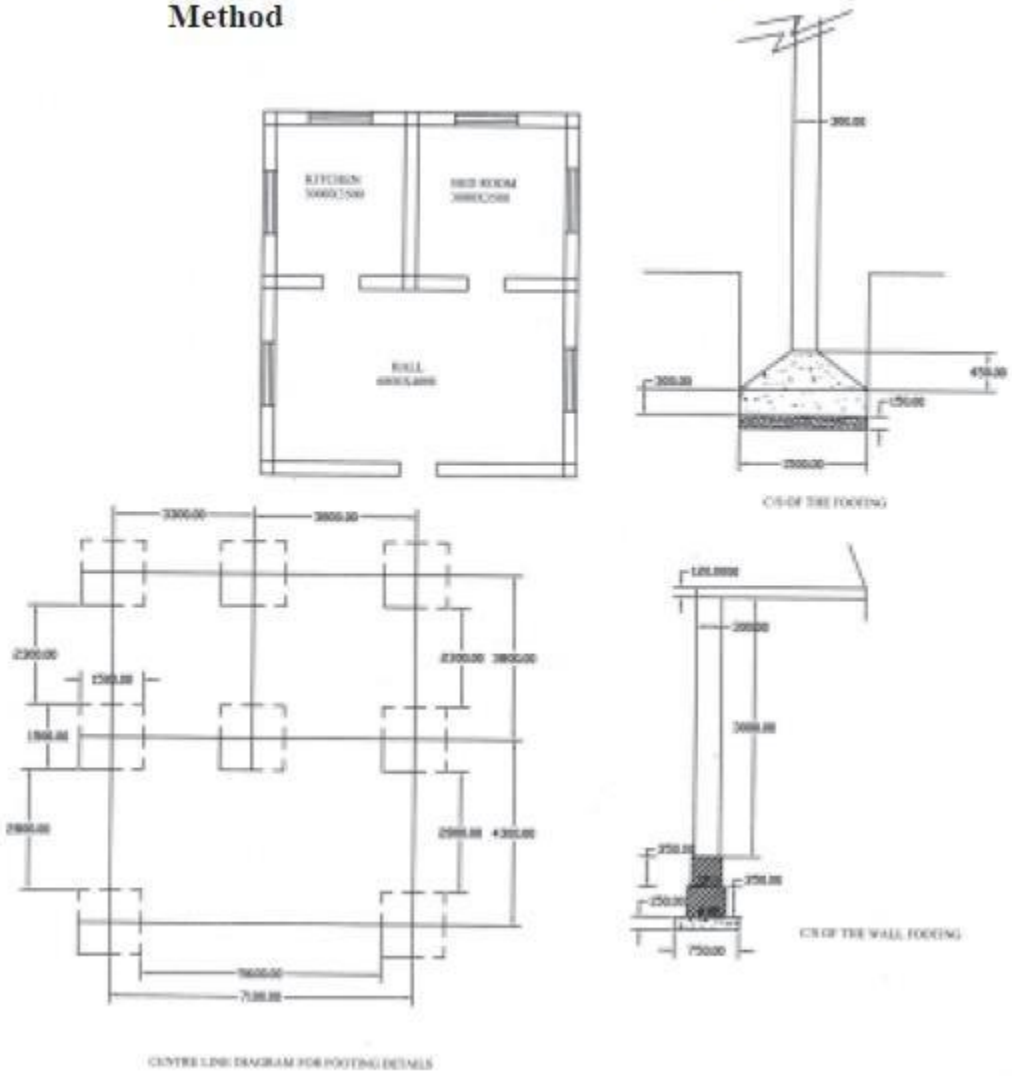
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	Earth work Excavation	1	39.5	0.9	1.0	35.55	41.3-4x0.9/2=39.5
2.	C.C. bed (1:5:10)	1	39.5	0.9	0.3	10.665	m^3
3.	R.R. Masonary in CM 1:6						
	1st Footing	1	40.1	0.6	0.3	7.218	41.3-4x0.6/2=40.1
	IInd Footing	1	40.3	0.5	0.4	8.06	41.3-4x0.5/2=40.3
	Basement	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 CM1:6	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 CM1:5	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 25mm th 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	
					Total	**50.85**	m^2
8.	Ceiling = Same as 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 abstract estimate for the single storeid residential building with no.of rooms (Framed Structured type) by Centre Line Method



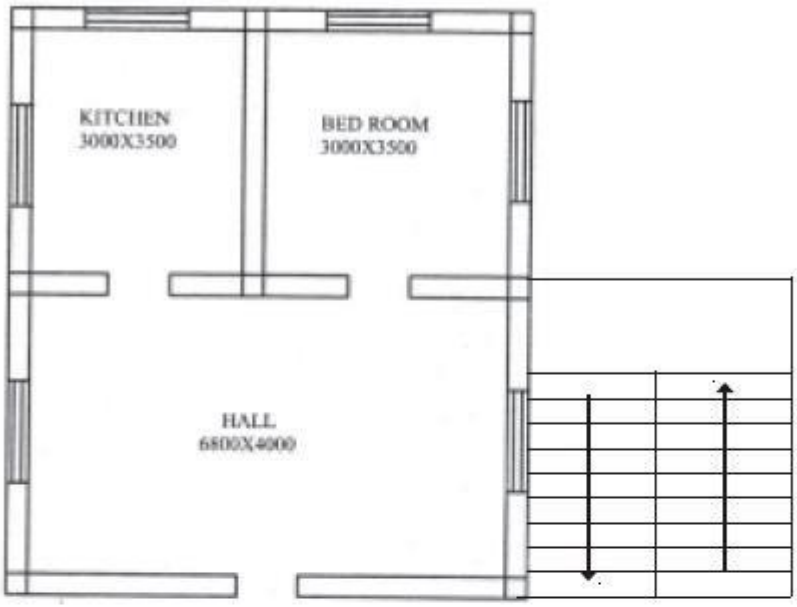
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	Earth work excavation for foundation for						
	a) pillars	8	1.5	1.5	1.80	32.4	
	b) around the building and cross walls	1	26.3	0.75	0.85	27.9	L= 5.6+2.8x2+ 2.3x3+(1.8+2.3)2
					Total	**60.3**	m^3
2.	C.C. (1:4:8) for						
	a) pillars	8	1.5	1.5	0.15	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 / 7.8 / 0.3 / 7.1 / 8.1						
	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				Total	**50.85**	m^2
	Flooring					50.85	
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.						

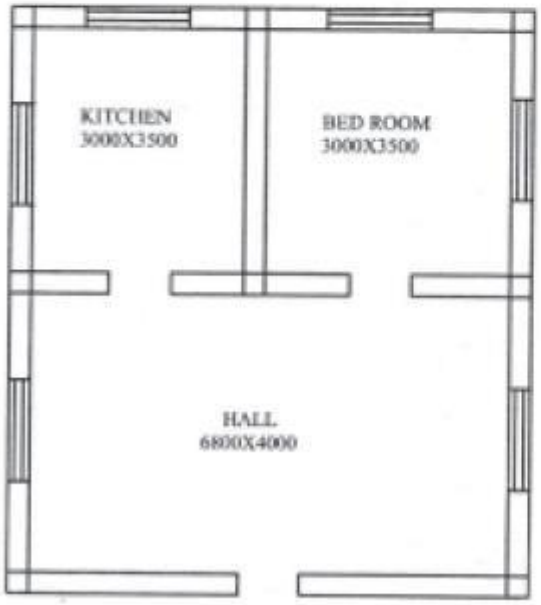
Abstract estimate of single storeyed residential building (framed structure type)

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

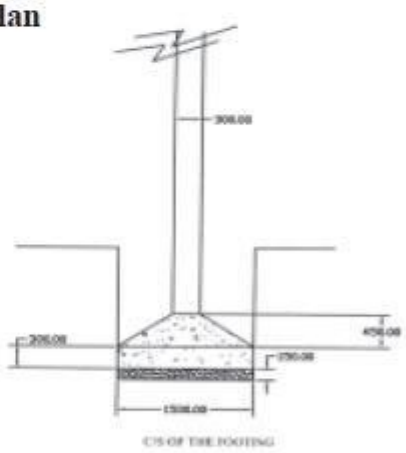
Example 5 :- From the given figure below calculate the details and ab stract estimate for the two storeoied residential building wit no.of rooms (Framed Structured type) by Centre Lin Method



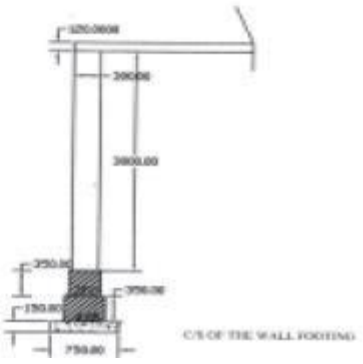
Ground Floor Plan



First Floor Plan



C/S OF THE FOOTING



C/S OF THE WALL FOOTING

S.No.	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 parapet wall 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 separately in the next problem						

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

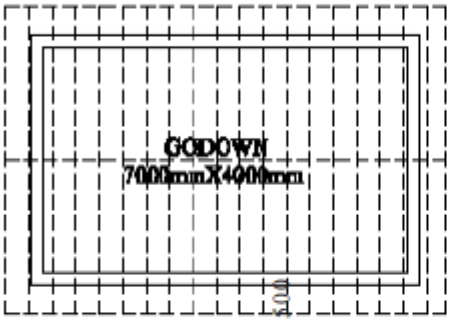
a) Size of common rafter = 80x40mm

b) Size of ridege piece = 120x 200mm

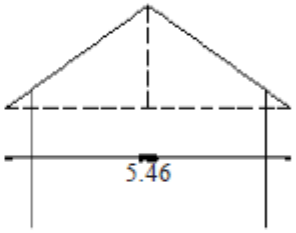
c) Size of eaves board = 20 x 300mm

230mm thick brick wall

Common rafters at 450mm c/c



Rise = 1/3Span



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

= 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 m²
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.

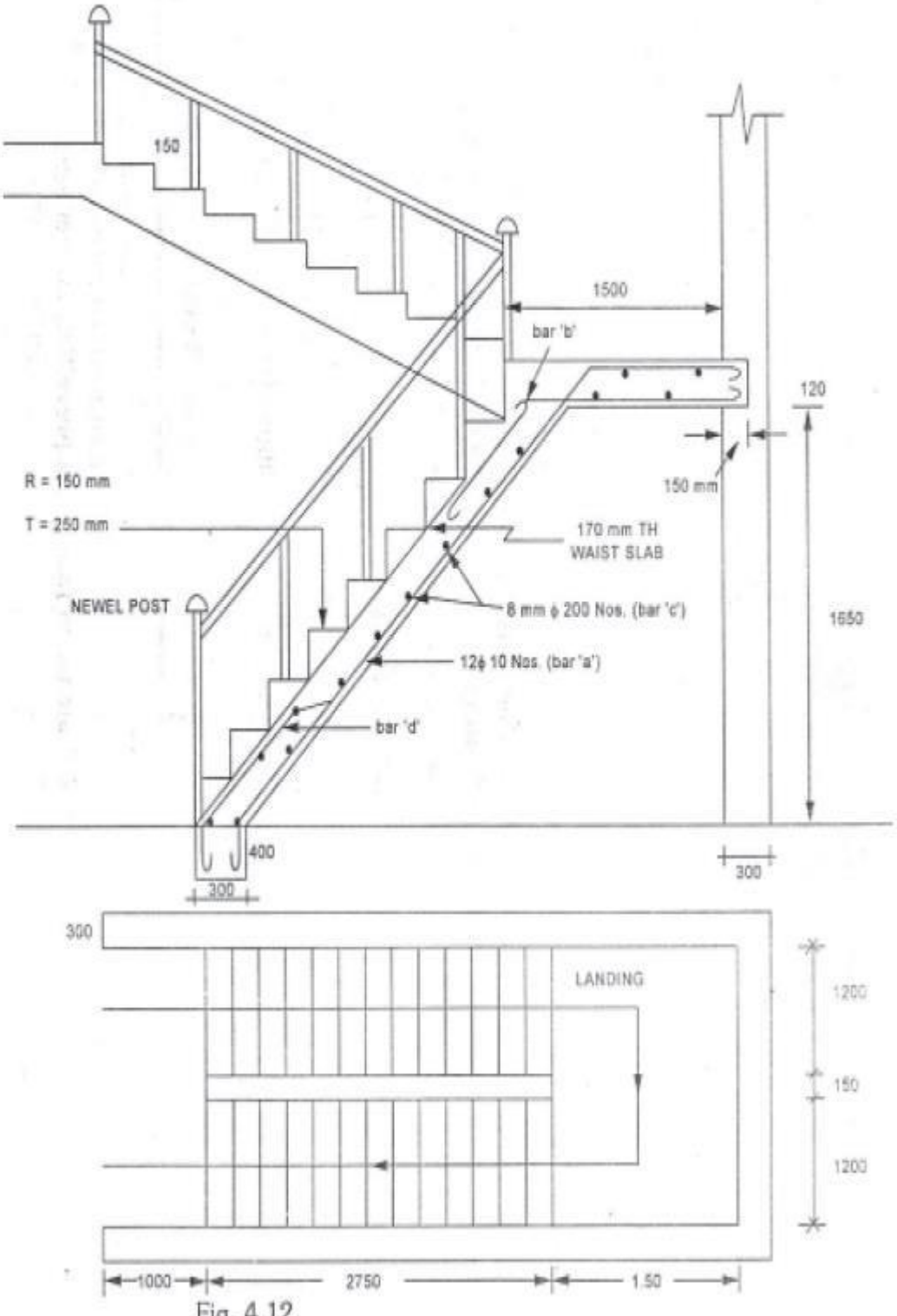
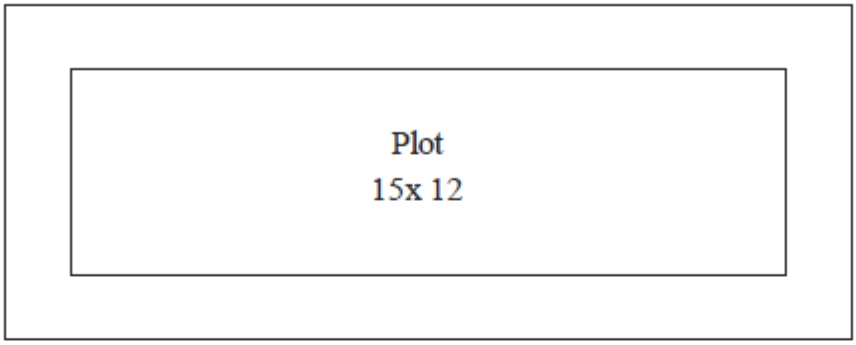


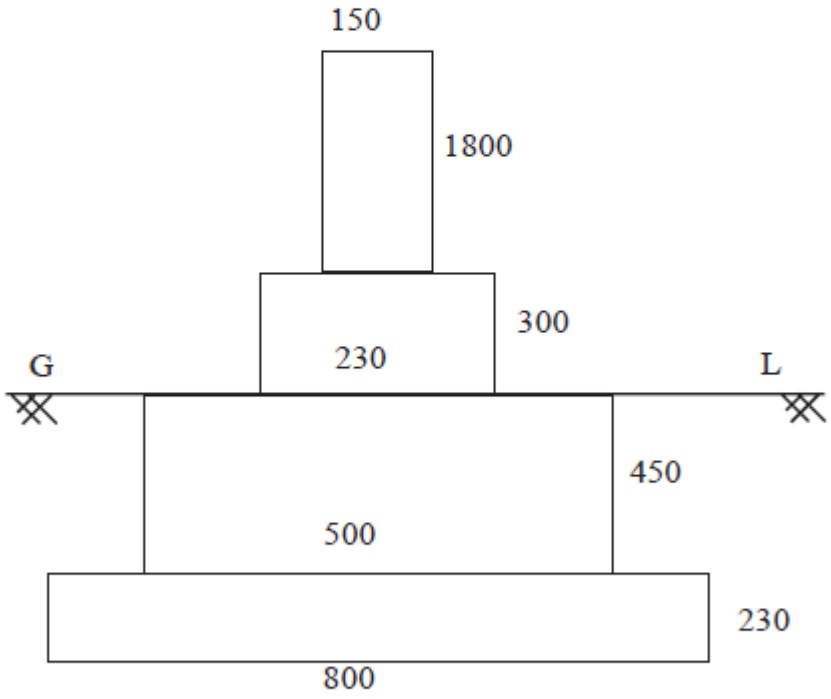
Fig. 4.12

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 shuttering 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 I 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 estimate for the Compound Wall



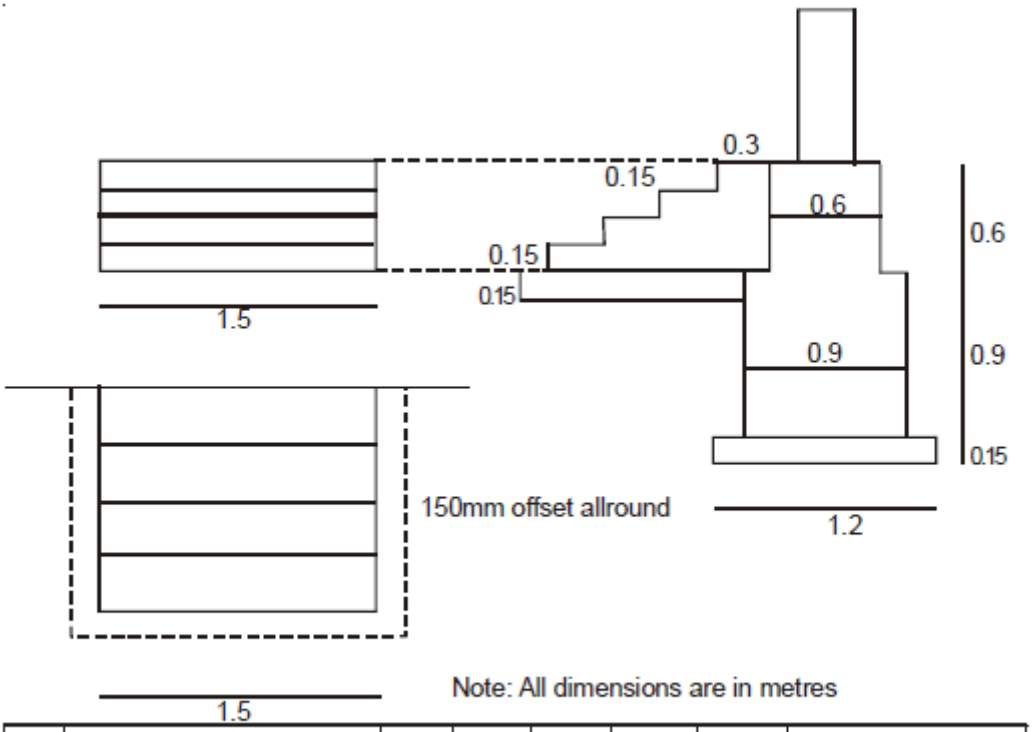


Cross Section of the compound wall

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	Earth work 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) 25mm th	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**	m^2
5.	white washing/colour washing = Same as item (4)					3.60	m^2

ANALYSIS OF RATES

Chapter 5

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 decided 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 constructional 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, remaining 70% as II class. The rates of materials for Government works are fixed by 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 includes 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 1m3 wet concrete = 1.52m3 dry concrete approximately
SP.Wt of concrete= 1440 kg/m3 (or) 1.44 t/m3

1 bag of cement = 50 Kg

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**

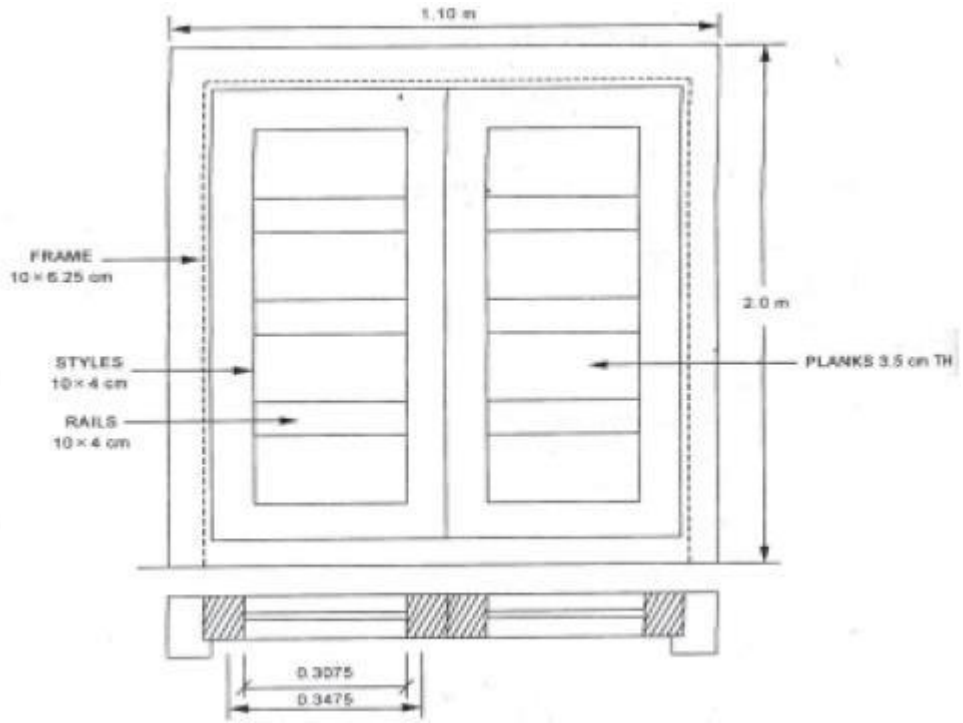
3. Pointing to R.R.Masonary in CM(1:4) mix using cost & conveyance of Cement, sand and all materials from approved sources to site and labour charges for point neatly etc.

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



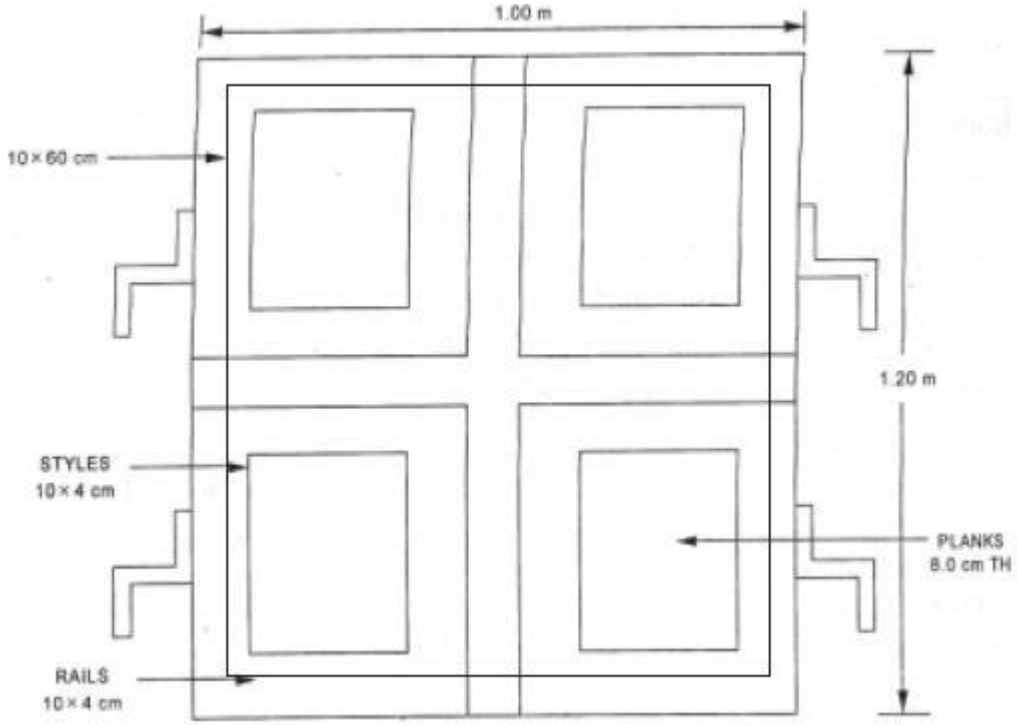
Requirements :

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
		0.0090m³

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

0.0076m3

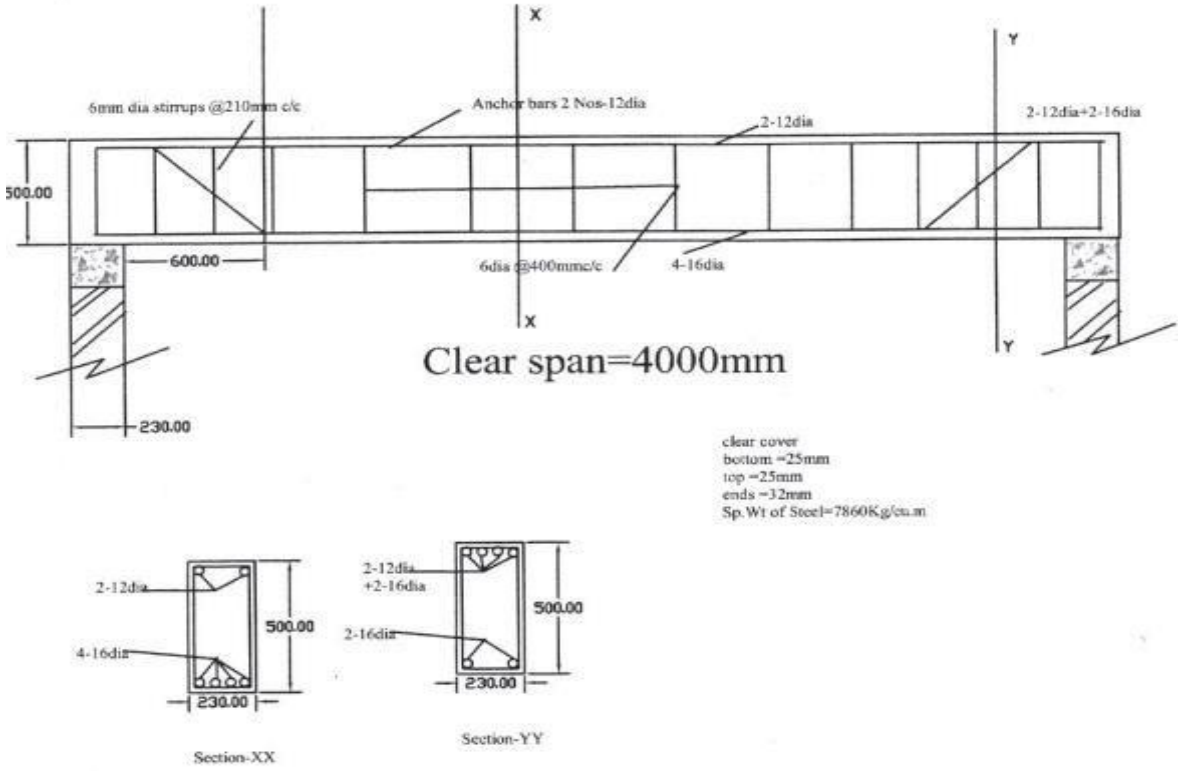
S.No.	Description of Item	Quantity	Unit	Rate	Per	Amount
1.	wood Cost	0.0076	Cum	25000	cum	1900.00
2.	Butt Hinges	6	Nos	20	each	120.00
3.	Z-hold fasts	4	Nos	10	each	40.00
4.	Cost of labour	1.2	sqm	1000	sqm	1200.00
					Total	**3260.00**

Cost of door per 1m2 = 3260/ 1.2 = 2716.67 say Rs.2720/-

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

Chapter 6

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

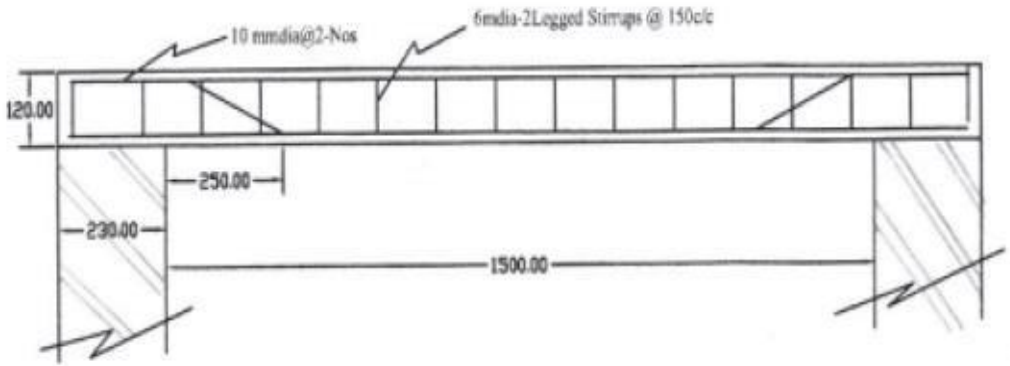


beam.

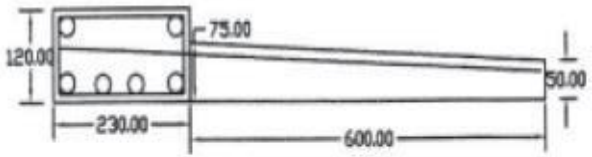
Name.	Shape	Dia.	No.	Length in m	Total Length in m	Self weight in kg /m	Total Weight in Kg
B E A M	main bars 4000+2x230-2x32=4396	16	2	4396+2x(9x16) =4684mm =4.684m	4.684 x 2 =9.368m	$\frac{\pi}{4}\times\left(\frac{16}{1000}\right)^2\times 7860$ = 1.58	1.58x 9.368 = 14.8
	Anchor bars 4000+2x230-2x32=4396	12	2	4396+2x(9x12) =4612mm =4.612m	4.612 x 2 =9.224m	$\frac{\pi}{4}\times\left(\frac{12}{1000}\right)^2\times 7860$ = 0.89	0.89x 9.224 = 8.2
	Cranked bars 500-2x25-16= 434 798 2800 798	16	2	4396+2x(9x16)+ 2(0.414x434) =5043mm =5.043m Additional length for each crank = 0.414d	5.04 x 2 = 10.08	$\frac{\pi}{4}\times\left(\frac{16}{1000}\right)^2\times 7860$ = 1.58	1.58x 10.08 = 15.92
	450 180 Height = 500-2x25=450 Width =230-2x25 =180	6	17	2(450+180) + 2x9x6 =1368mm =1.368m	1.368x17 = 23.256	$\frac{\pi}{4}\times\left(\frac{6}{1000}\right)^2\times 7860$ = 0.22	0.22x23.256 = 5.16
				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

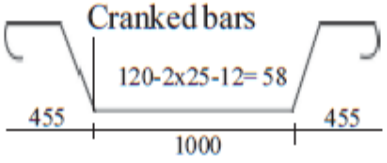
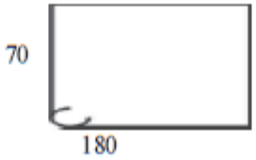
R.C.C.LINTEL



LONGITUDINAL SECTION OF R.C.C.LINTEL



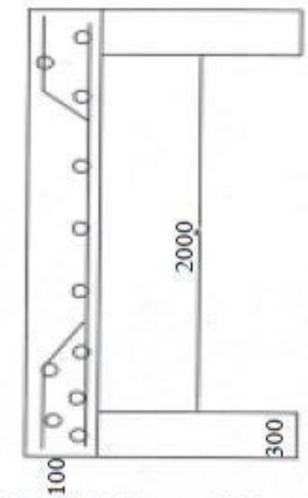
C/S OF LINTEL CUM SUNSHADE

Name.	Shape	Dia.	No.	Length in m	Total Length in m	Self weight in kg/m	Total Weight in Kg
LINTEL	main bars  1500+2x230-2x25=1910	12	2	1910+2x(9x12) =2126mm =2.1264m	2.126 x 2 =4.252m	$\frac{\pi}{4}\times\left(\frac{12}{1000}\right)^2\times 7860$ =0.89	0.89x 4.252 =3.78
	Anchor bars  1500+2x230-2x25=1910	10	2	1910+2x(9x10) =2090mm =2.090m	2.09 x 2 =4.18m	$\frac{\pi}{4}\times\left(\frac{10}{1000}\right)^2\times 7860$ =0.62	0.62x 4.18 =2.59
	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	$\frac{\pi}{4}\times\left(\frac{12}{1000}\right)^2\times 7860$ =0.89	0.89x 4.348 =1.87
	 Height=120-2x25=70 Width=230-2x25=180	6	14	2(70+180)+ 2x9x6 =608mm =0.608m	0.608x14 =8.512	$\frac{\pi}{4}\times\left(\frac{6}{1000}\right)^2\times 7860$ =0.22	0.22x8.512 =1.87
				No. of stirups=((1910/150)+1)=14 Nos			

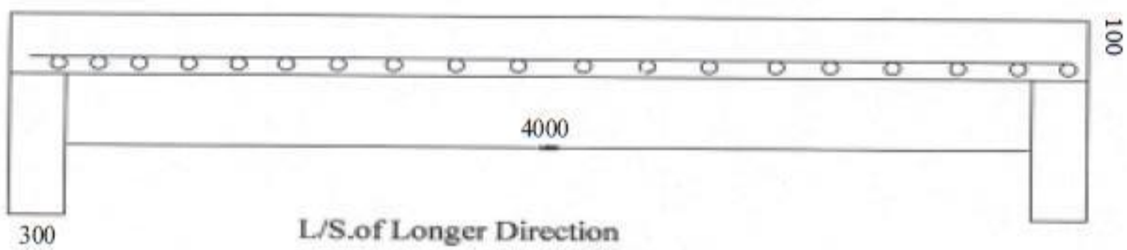
Example 3: Prepare the bar bending schedule of the given figure for R.C.C. Lintel

Internal room dimension = 4000x 2000

Plan of R.C.C.Slab



Slab Thickness=100mm

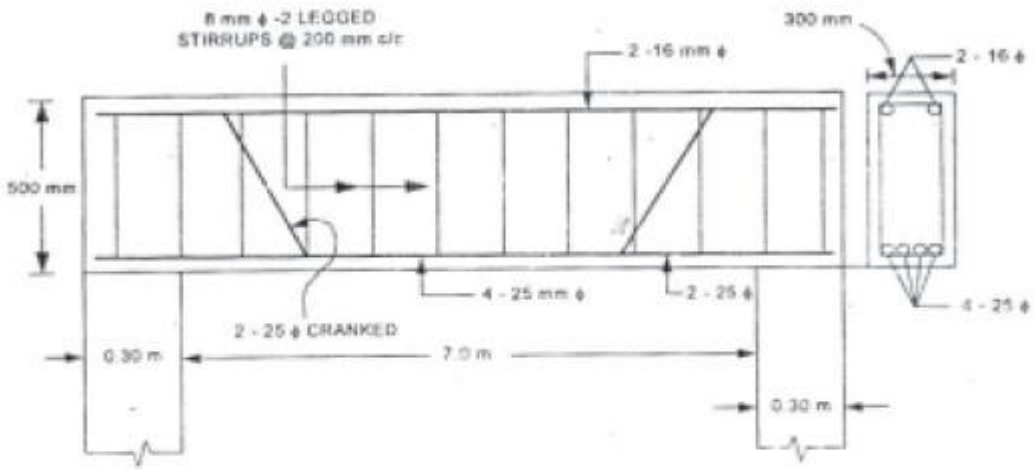


L/S.of Longer Direction

Name.	Shape	Dia.	No.	Length in m	Total Length in m	Self weight in kg/m	Total Weight in Kg
S L A B	Cranked bars 100-2x13-8= 66 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	$\frac{\pi}{4}\times\left(\frac{8}{1000}\right)^2\times 7860$ = 0.39	0.39x 69.7 = 27.53
	4000+2x230-2x25=4410	6	$\frac{2410}{180}+1$ =15	4.41m	4.41x15 = 66.15	$\frac{\pi}{4}\times\left(\frac{6}{1000}\right)^2\times 7860$ = 0.22	0.22x66.15 = 14.553

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

7.1 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 sometimes 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.

7.2 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.

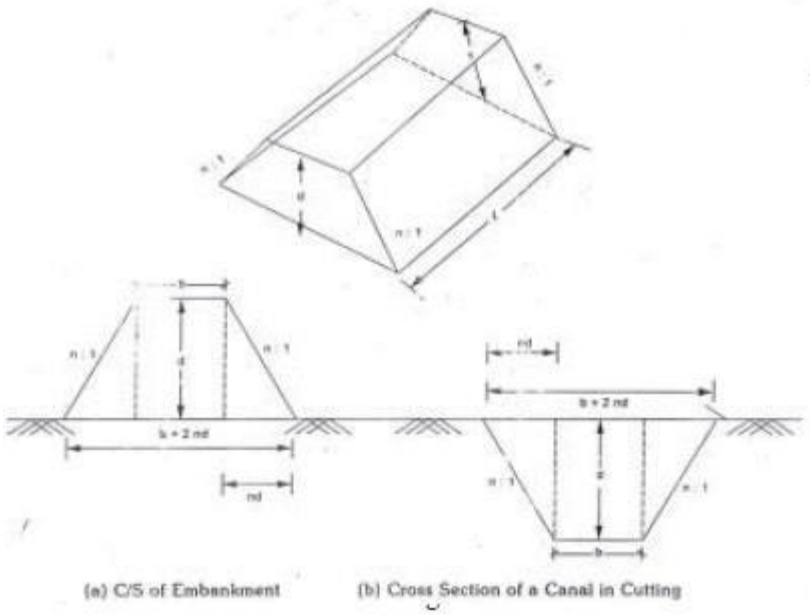
Lift :

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
0.5 - 1 lift
} Total 04 lifts

7.3 Calculation of earth work for Roads:

1) volume of earth work in banking or in cutting having "no longitudinal slope". Volume = Correctional area x length



(a) C/S of Embankment (b) Cross Section of a Canal in Cutting

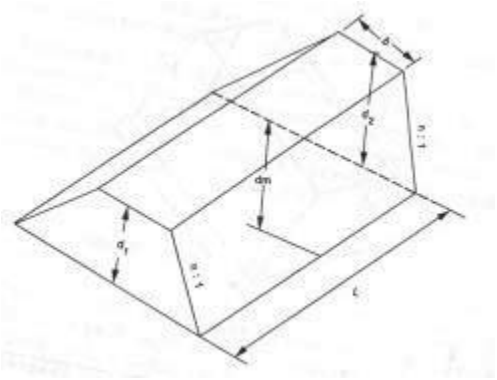
$V = (bd+2x1/2x\,ndx\,d)L$

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

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 d1, d2 = depth of banks at two ends

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

$$\text{Area of mid section (Am)} = (bd_m + nd_m^2)$$

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

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.

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

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

$$\text{Volume of earth work (v)} = Am \times L$$

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

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

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

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

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

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

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

Earth work Calculations 84

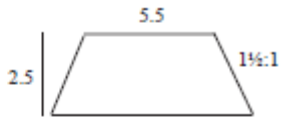
Example 7.1 : Find the volume of earth work in embankment of length 12m. Top width is 5.5m and depth is 2.5m the side slopes ara 1½:1

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	1.175	14.51	50	725.56
50	1.10	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

$A = bd + nd^2$

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

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

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

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

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

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

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

Volume of earth work by Trepezoidal rule

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

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

$$= 4137.50\ m^3$$

c) By Prismoidal rule

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

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

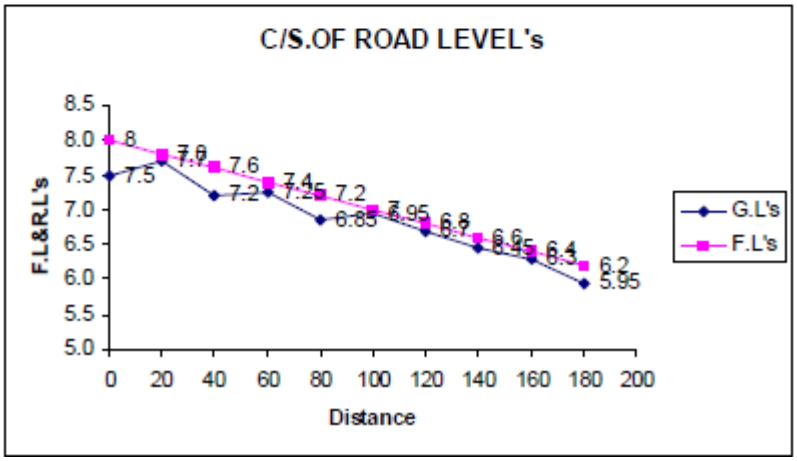
$$= \frac{50}{3}[(15.625 + 14.145) + 4(13.42 + 14.88 + 13.42) + 2(14.145 + 12)]$$

$$= 4149 \text{ m}^3$$

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 :

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

$$=20\left[\left(\frac{6.375+3.09}{2}\right)+(1.215+1.215+1.837+4.38+0.63+1.215+1.837+1.215\right]$$

$$=365.53m^3$$

Prismoidal formula :

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

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

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

$$2(1.215+4.38+1.815+1.215)]$$

$$=317.27\ m^3$$

Earth work Calculations 88

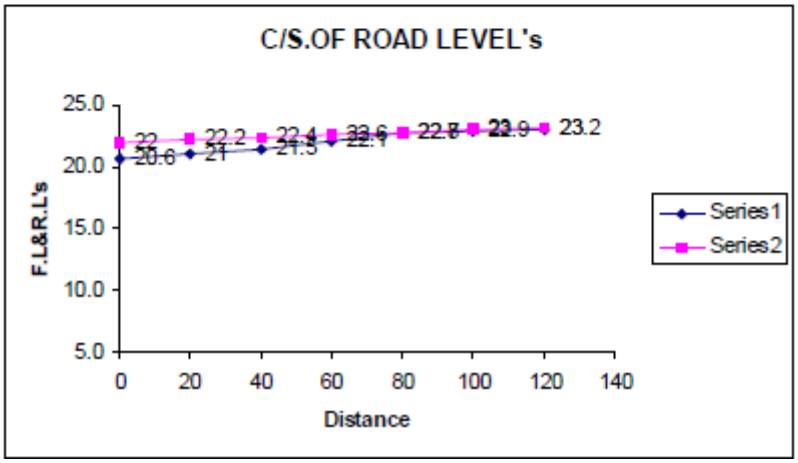
Example 7.5:- The road has the following data

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	
			Embank-ment	Cut-ting	Embank-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

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

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

$$= 969.5\ m^3$$

b) Prismoidal formula

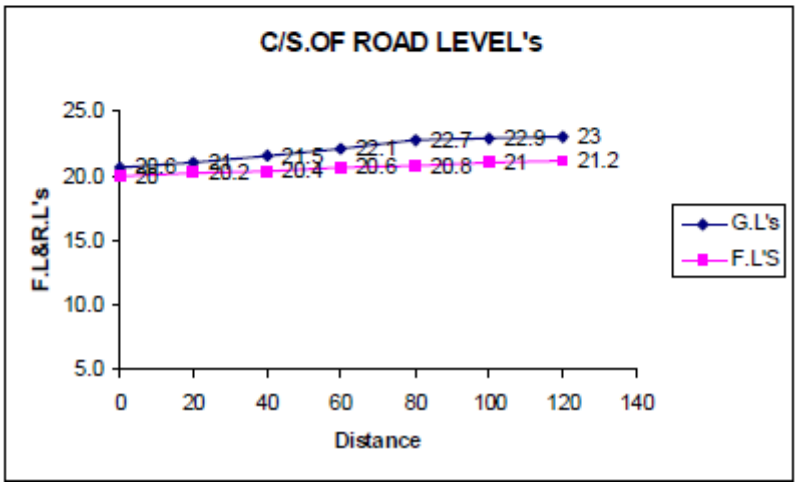
$$V = \frac{L}{3}[(A_1 + A_n) + 4(\text{even Areas}) + 2(\text{Odd Areas})]$$

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

$$= 968.33\ m^3$$

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

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

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

$= 2409.6\ m^3$

b) Prismoidal formulae :

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

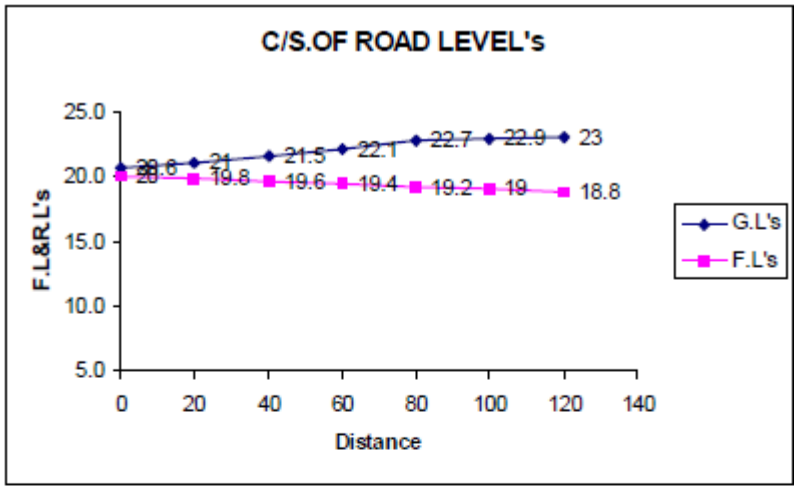
$$= \frac{L}{3}[(A_1 + A_7) + 4(A_2 + A_4 + A_6) + 2(A_3 + A_5)]$$

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

$= 2408.4\ m^3$

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		Area of	
			Embank-ment	Cut-ting	Embank-ment	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

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

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

$$= 5208\ m^3$$

b) Prismoidal formulae :

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

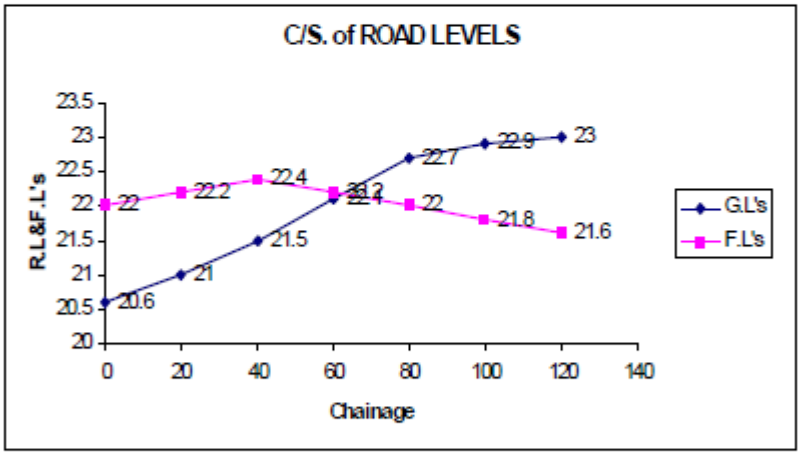
$$= \frac{L}{3}[(A_1 + A_7) + 4(A_2 + A_4 + A_6) + 2(A_3 + A_5)]$$

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

$$= 5198.8\ m^3$$

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	Embank ment $bd+nd^2$	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

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

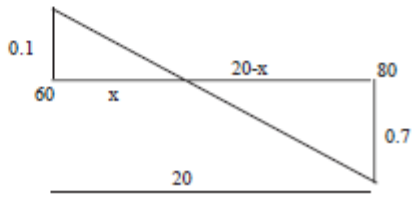
$0.7x=(20-x)0.1$

$0.7x=2-0.1x$

$0.7x+0.1x=2$

$0.8x=2$

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



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)

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

$= 782.46 m^3$

By Prismoidal

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

$= 742.44\ m^3$

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

$$V = 17.5\left[\frac{0+9.135}{2}\right]+20\left[\left(\frac{9.135+19.74}{2}\right)+15.015\right]$$

$= 668.98 m^3$

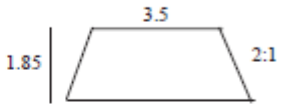
By Prismoidal

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

$= 646.18\ m^3$

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.

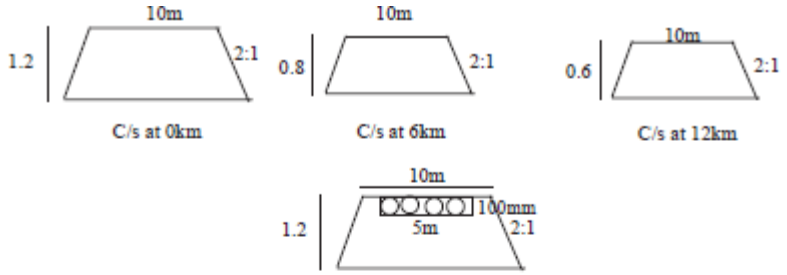
Chainage	0	1	2	3	4	5	6
R L of ground	8.0	7.8	7.6	7.3	6.9	6.2	6.5

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 = $600\left[\left(\frac{14.88+6.72}{2}\right)+9.28\right]$ = 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	

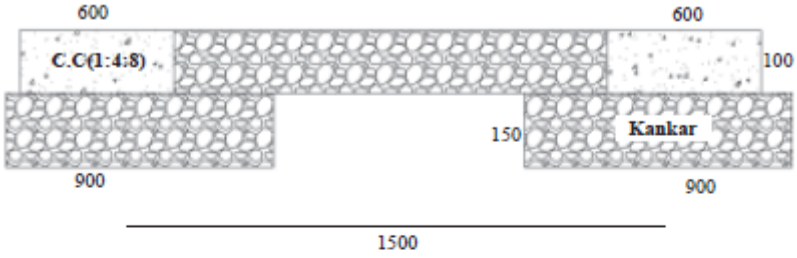
Cement concrete road

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 convey-ance of all materials at site machine mixing, laying cur-ing etc.	1	100	3.5	0.1	35. cum	
2	C.C.(1:2:4) for pavement	1	100	3.5	0.1	35cum	
3	Provision for mastic pads					L.S.	
4	Unforcean items @2%					L.S.	
5	Petty supervision @4%					L.S	

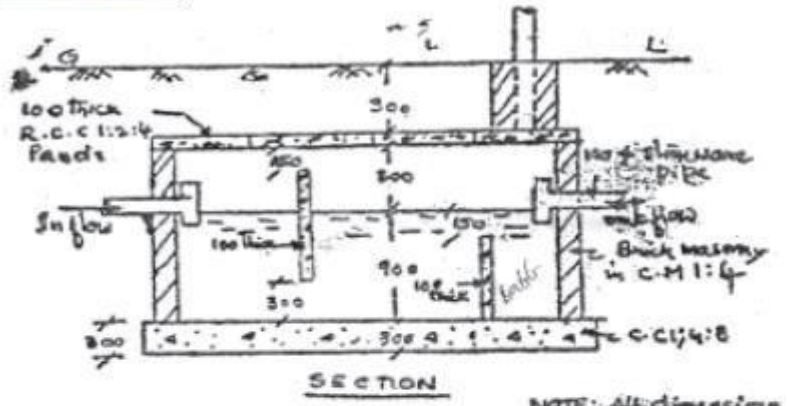
Example 8.3 :- Prepare an estimate for 1 Km length of C.C. track or the fig shown below.

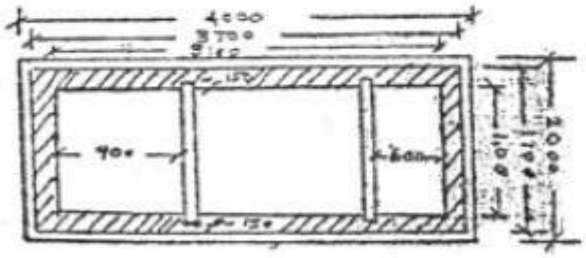


S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	C.C.(1:2:4) in tracks including laying	2	1000	0.6	0.1	120m³	
2.	laying of kankar (for loose thickness increase with 33 $\frac{1}{3}$ %)						
	a) in between C.C tracks	1	1000	0.9	0.133	120	
	b) under C.C. tracks	2	1000	0.9	0.20	360	
						480 m³	

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

SEPTIC TANK



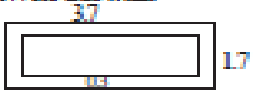
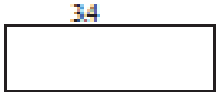


PLAN

SEPTIC TANK

+-

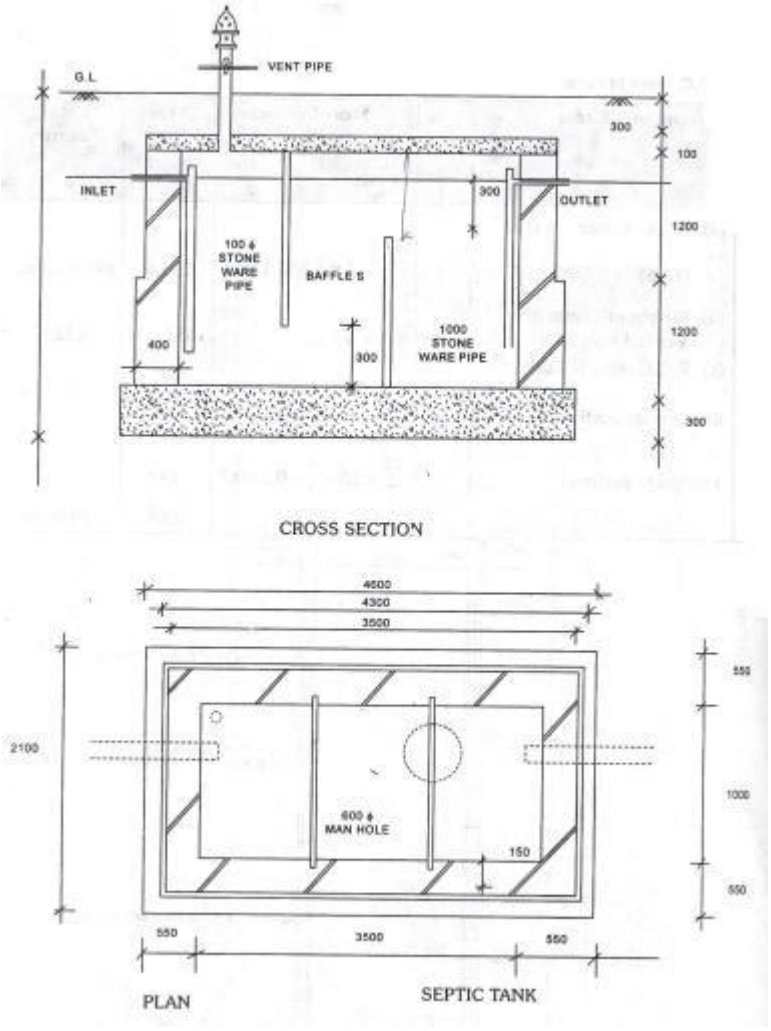
Detailed Estimates 100

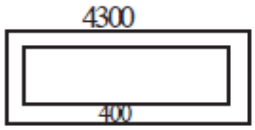
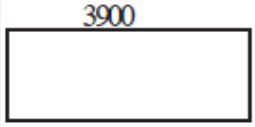
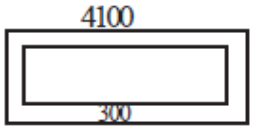
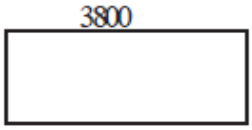
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	Earth work excation upto G.L.	1	4.0	2.0	1.9	15.2m³	
2.	C.C. (1:4:8)bed	1	4.0	2.0	0.3	2.4m³	
3.	Brick masonary in CM 1:4 for side walls						
							
	Long wall short wall method						
	Long wall	2	3.7	0.3	1.2	2.664	
	Short walls	2	1.1	0.3	1.2	0.792	
	(or)				Total	**3.456**	
	centre line method						
							
	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
1	Earth work excation upto GL.	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	
	Short walls	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 (neglecting the space for vent pipe footing)	1	3.70	1.70	0.30 Total	1.1887 4.11	
7	supply fixing of steel grills including labour for fabrication @ 750N/m²	1	0.839	x750=	629.2N	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 item @2%				L.S	L.S	
12	PS & contingencies @4%				L.S	L.S	

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

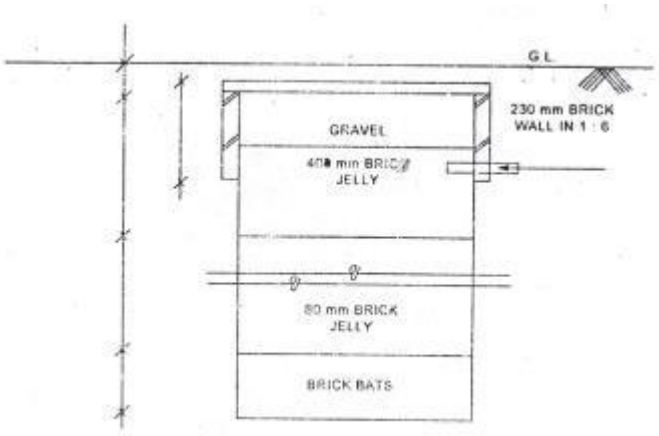


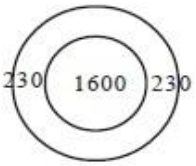
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	Earth work excavation upto GL.	1	4.60	2.10	3.1	29.95	
2.	C.C.(1:4:8) bed for foundation	1	4.6	2.10	0.30	2.898	
3.	Brick masonary in CM 1:4 for side walls						
	a) Upto first step (400th)						
							
	centre line method	1	10.60	0.40	1.20	5.088	
							
	total centre line length =(3900+1400)2=10600						
	b) from Ist to II step (300th)						
							
	Centre line method						
							
	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	$\frac{\pi}{4}\times(0.1)^2$			-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	12.40	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



S.No.	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	$\frac{\pi}{4}$ x1.6^2		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)40mm 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 GL.	1	$\frac{\pi}{4}\times 2.06^2$		0.16	0.53	

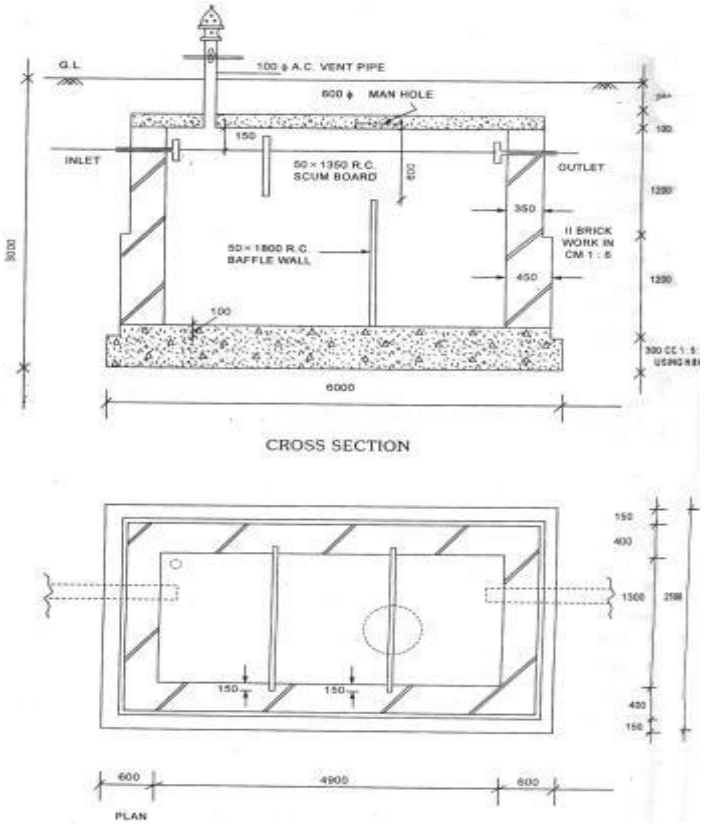
$\frac{\pi}{4}\times 1.6^2$

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

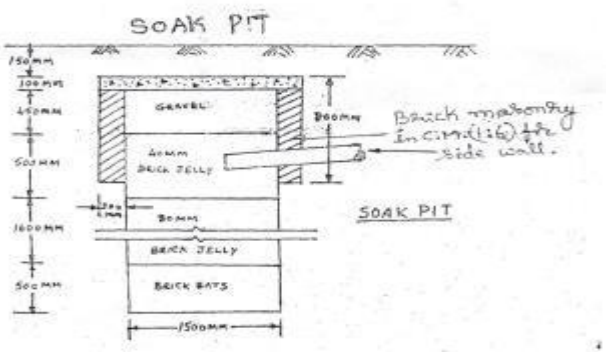
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
7.	Laying of joining 100mm popies including earth work Encavation, sand filling packing joints etc complets						
	L=12+0.23+1.6/2	1	13.03		---	13.03	RM
8	Unforcean items of work@2%	1	--		--	LS	
9	Petty supervision and contingencies @4%	1	---		---	LS	

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 includes 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 estimated 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 superintending 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.**Quantities of Materials and their Costs:**

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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 estimated cost is provided in the estimate.

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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 according 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, towards purchase of certain tools and other pretty items which cannot be accounted 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

10.0Sqm/mason

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 allowed (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 amenities 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.

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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 materials 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, graveled 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 EXCAVATION 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 excavation 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 corresponding 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.

Preamble

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 remaining 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 writing 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.